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# CBSE EXAM PAPER 2025

## CLASS X

### SCIENCE (086)

Time: 3 Hours

Max. Marks: 80

#### General Instructions:

1. All questions would be compulsory. However, an internal choice of approximately 33% would be provided. 50% marks are to be allotted to competency-based questions.
2. Section A would have 16 simple/complex MCQs and 04 Assertion-Reasoning type questions carrying 1 mark each.
3. Section B would have 6 Short Answer (SA) type questions carrying 02 marks each.
4. Section C would have 7 Short Answer (SA) type questions carrying 03 marks each.
5. Section D would have 3 Long Answer (LA) type questions carrying 05 marks each.
6. Section E would have 3 source based/case based/passage based/integrated units of assessment (04 marks each) with sub-parts of the values of 1/2/3 marks.

## SECTION A

- 1 In which one of the following situations a chemical reaction does not occur?
- (a) Milk is left open at room temperature during summer.
  - (b) Grapes get fermented.
  - (c) An iron nail is left exposed to humid atmosphere.
  - (d) Melting of glaciers.

Ans :

(d) Melting of glaciers.

Melting of glaciers is a physical change, involving a change in state from solid to liquid. No new substance is formed and no chemical bonds are broken or created. It's simply a phase transition caused by temperature change, not a chemical reaction.

Thus (d) is the correct option.

- 2 In order to prepare dry hydrogen chloride gas in humid atmosphere the gas produced is passed through a guard tube (drying tube) which contains:
- (a) Calcium chloride
  - (b) Calcium oxide
  - (c) Calcium hydroxide
  - (d) Calcium carbonate

Ans :

(a) Calcium chloride

Calcium chloride is an effective drying agent. It absorbs moisture from hydrogen chloride gas, ensuring the gas remains dry in humid conditions. Other substances

listed are not commonly used for drying acidic gases like HCl due to reactivity or inefficiency.

Thus (a) is the correct option.

- 3 The property by virtue of which a solid material can be drawn into thin wires is called:
- (a) Malleability
  - (b) Ductility
  - (c) Rigidity
  - (d) Resistivity

Ans :

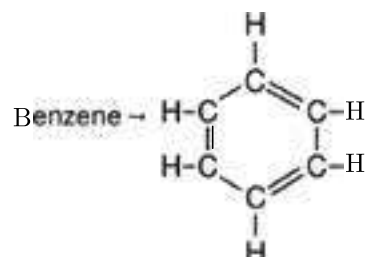
(b) Ductility

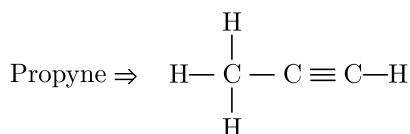
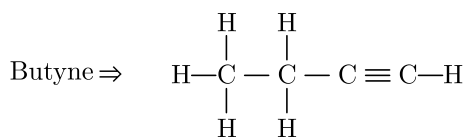
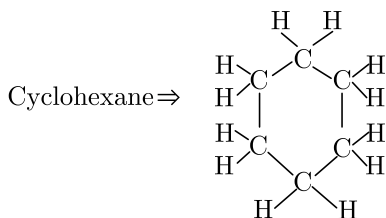
Ductility is the ability of a material, especially metals like copper or gold, to be stretched into thin wires without breaking. It is different from malleability, which is the ability to be hammered into thin sheets. Rigidity and resistivity are unrelated properties.

Thus (b) is the correct option.

- 4 Select from the following a hydrocarbon having one C–C bond and one C≡C bond:
- (a) Benzene
  - (b) Cyclohexane
  - (c) Butyne
  - (d) Propyne

Ans :





Propyne ( $\text{CH}_3\text{--C}\equiv\text{CH}$ ) has both a carbon-carbon single bond ( $\text{C--C}$ ) and a carbon-carbon triple bond ( $\text{C}\equiv\text{C}$ ). It belongs to the alkyne family. Benzene has delocalized double bonds, cyclohexane has only single bonds, and butyne may vary in bond positioning depending on its isomer.

Thus (d) is the correct option.

- 5 The essential element taken up from the soil by the plants to synthesize proteins is.
- Phosphorus
  - Nitrogen
  - Iron
  - Magnesium

Ans :

- (b) Nitrogen

Nitrogen is a vital nutrient for plants as it helps synthesize amino acids, the building blocks of proteins. Plants absorb nitrogen primarily in the form of nitrates from the soil. Without sufficient nitrogen, protein production and plant growth are significantly hindered.

Thus (b) is the correct option.

- 6 Select true statements about lymph from the following.
- Lymph vessels carry lymph through the body and finally open into larger arteries.
  - Lymph contains some amount of plasma, proteins and blood cells.
  - Lymph contains some amount of plasma, proteins and red blood cells.
  - Lymph vessels carry lymph through the body and finally open into larger veins.

The true statements are:

- A and B
- B and D
- A and C
- C and D

Ans :

- (b) Lymph contains some amount of plasma, proteins and blood cells.

Lymph contains plasma, proteins, and white blood cells, not red blood cells. It is transported through lymphatic vessels, which eventually drain into larger veins, not arteries. Hence, statements B and D are correct.

Thus (b) is the correct option.

- 7 Plants like rose and banana have lost the capacity to produce.
- Flowers
  - Buds
  - Seeds
  - Fruits

Ans :

- (c) Seeds

Rose and banana plants often reproduce through vegetative propagation and have lost the natural ability to produce viable seeds. These plants are commonly propagated via cuttings or suckers due to their seedless or sterile nature.

Thus (c) is the correct option.

- 8 In a bisexual flower the male gametes are present in the
- Anther
  - Ovary
  - Stigma
  - Filament

Ans :

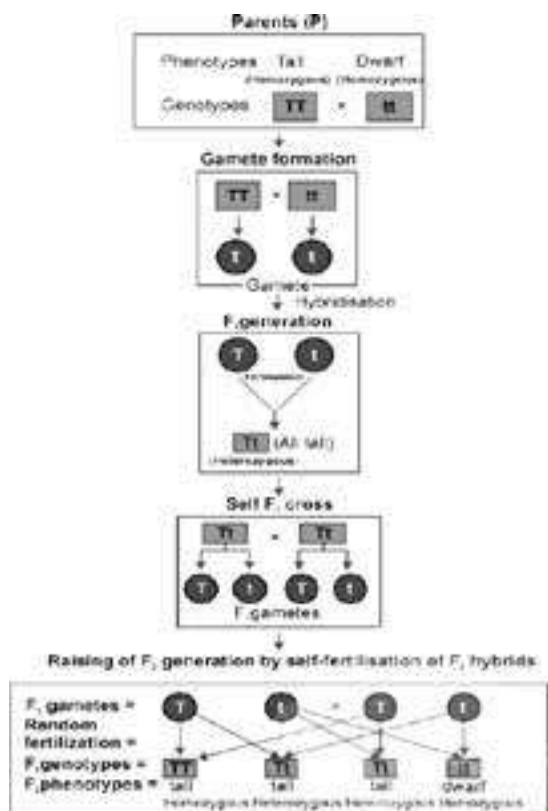
- (a) Anther

In a bisexual flower, both male and female reproductive organs are present. The male gametes are found in the anther, which is part of the stamen, the male reproductive structure of the flower.

Thus (a) is the correct option.

- 9 When a pure-tall pea plant is crossed with a pure-dwarf pea plant, the percentage of tall pea plants in  $F_1$  and  $F_2$  generation pea plants will be respectively.
- 100%; 25%
  - 100%; 50%
  - 100%; 75%
  - 100%; 100%

Ans :



In Mendelian genetics, a cross between pure tall (TT) and pure dwarf (tt) pea plants gives 100% tall plants in F<sub>1</sub> (Tt). In F<sub>2</sub> generation (Tt x Tt), the phenotypic ratio is 3 tall : 1 dwarf, so 75% tall plants appear.

Thus (c) is the correct option.

- 10 To get an image of magnification -1 on a screen using a lens of focal length 20 cm, the object distance must be:
- (a) Less than 20 cm (b) 30 cm  
(c) 40 cm (d) 80 cm

Ans :

(c) 40 cm

Given,

$$\text{Magnification} = -1$$

$$\text{Focal length lens } f = 20 \text{ cm}$$

$$m = \frac{f}{f + u}$$

$$-1 = \frac{20}{20 + u}$$

$$-20 - u = 20$$

$$u = -40 \text{ cm}$$

Thus (c) is the correct option.

- 11 An optical device 'X' is placed obliquely in the path of a narrow parallel beam of light. If the emergent beam gets displaced laterally, the device 'X' is:

- (a) Plane mirror  
(b) Convex lens  
(c) Glass slab  
(d) Glass prism

Ans :

A glass slab causes the light beam to emerge parallel to the incident ray but with lateral displacement. This happens due to refraction at both parallel surfaces. Unlike a prism, it doesn't deviate the ray, only shifts it sideways.

Thus (c) is the correct option.

- 12 A piece of wire of resistance 'R' is cut lengthwise into three identical parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R', then the value of R/R' is:

- (a) 1/9 (b) 1/3  
(c) 3 (d) 9

Ans :

When a wire is cut lengthwise into 3 parts, each has resistance (3R) due to increased length. In parallel,

$$\frac{1}{R'} = \frac{1}{3R} + \frac{1}{3R} + \frac{1}{3R} = \frac{1}{R}$$

$$R' = \frac{R}{9}$$

$$\frac{R}{R'} = 9$$

Thus (d) is the correct option.

- 13 An electric bulb is rated 220 V; 11 W. The resistance of its filament when it glows with a power supply of 220 V is:

- (a) 4400 Ω (b) 440 Ω  
(c) 20 Ω (d) 220 Ω

Ans :

Using the formula,

$$R = \frac{V^2}{P}$$

$$R = \frac{(220)^2}{11}$$

$$= \frac{48400}{11}$$

$$= 4400 \Omega$$

This is the resistance of the filament when the bulb operates at 220 V and consumes 11 W power.

Thus (a) is the correct option.



- 14 The minimum number of identical bulbs of rating 4 V; 6 W, that can work safely with desired brightness, when connected in series with a 240 V mains supply is:

(a) 20 (b) 40  
(c) 60 (d) 80

**Ans :**

Given,

$$\text{Voltage} = 4 \text{ V} \quad \text{Power} = 6 \text{ W}$$

$$R = \frac{V^2}{P} = \frac{4 \times 4}{6}$$

$$= \frac{8}{3} \Omega$$

$$I_{\max} = \frac{V}{R} = \frac{4 \times 3}{18}$$

$$= \frac{3}{2} \text{ A}$$

$$\text{Now, } I_{\max} = \frac{V}{nR}$$

$$I_{\max} = \frac{V}{nR}$$

$$\frac{3}{2} = \frac{240 \times 3}{n \times 8}$$

Each bulb operates safely at 4 V. To use 240 V supply, bulbs must be connected in series.

$$n = \frac{240}{4} = 60$$

So, 60 bulbs in series drop 240 V evenly (4 V per bulb), ensuring safe operation with proper brightness.

- 15 In the food chains given below. Select the most efficient food chain in terms of energy:
- (a) Grass → Grasshopper → Frog → Snake  
(b) Plants → Deer → Lion  
(c) Plants → Man  
(d) Phytoplankton → Zooplankton → Small Fish → Big Fish

**Ans :**

The food chain "Plants → Man" has only two trophic levels, resulting in minimal energy loss. Energy is lost at every step of the food chain, so shorter chains are more efficient in transferring energy to the final consumer. Thus (c) is the correct option.

- 16 Which one of the following gets biomagnified at different levels in a food chain?
- (a) Carbon monoxide  
(b) CFC's  
(c) DDT  
(d) Manure

**Ans :**

DDT is a pesticide that accumulates in organisms through the food chain, a process called biomagnification. As you go higher up the trophic levels, its concentration increases, causing harmful effects on predators and top consumers like birds and humans.

Thus (c) is the correct option.

**DIRECTION : Question Nos. 17 to 20 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option (a), (b), (c), and (d) as given below:**

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).  
(c) Assertion (A) is true but Reason (R) is false.  
(d) Assertion (A) is false but Reason (R) is true.

- 17 **Assertion (A) :** In large animals, oxygen can reach different parts of the animal's body easily.

**Reason (R) :** Respiratory pigments take up oxygen from the air and carry it to body tissues.

**Ans :**

Large animals need respiratory pigments like hemoglobin to transport oxygen effectively to distant tissues. These pigments bind oxygen in lungs and release it in cells. Both statements are true and Reason correctly explains Assertion.

Thus (a) is correct options.

- 18 **Assertion (A) :** Concentrated nitric acid is diluted by adding water slowly to acid with constant stirring.

**Reason (R) :** Concentrated nitric acid is easily soluble in water.

**Ans :**

Though nitric acid is soluble in water, adding water directly to acid is dangerous due to exothermic reactions that can cause splashing. Acid should always be added to water. Thus, Reason is true, but it doesn't support the Assertion.

Thus (d) is correct options.

- 19 **Assertion (A) :** In reptiles, the temperature at which the fertilized eggs are kept decides the sex of the offspring.

**Reason (R) :** Sex is not genetically determined in some animals.

Ans :

In some reptiles, environmental temperature influences whether eggs develop into males or females. This means sex isn't always genetically fixed. Both statements are true, and the Reason supports the Assertion.

Thus (a) is correct options.

- 20 **Assertion (A)** : When ciliary muscles contract, eye lens becomes thin.

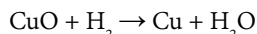
**Reason (R)** : Ciliary muscles control the power of the eye lens.

Ans :

When ciliary muscles contract, the eye lens becomes thicker (not thinner) to focus on nearby objects. So the Assertion is false. However, the Reason is true — ciliary muscles indeed control lens shape and focusing ability. Thus (d) is the correct option.

## SECTION B

- 21 Define oxidation. Identify and name the substance oxidised in the following reaction:



Ans :

Oxidation is the addition of oxygen or loss of hydrogen. In this reaction, hydrogen gains oxygen to form water, so  $\text{H}_2$  is oxidized.

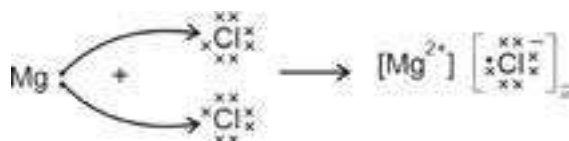
- 22 (A) Show the formation of magnesium chloride by electron transfer. Write the name of the cation and anion present in the compound formed. (Atomic Number of Mg = 12, Cl = 17)

or

- (B) How is zinc extracted from its ore? Name the processes involved in the extraction and write chemical equations for the reactions that occur during these processes.

Ans :

- (A) Magnesium loses 2 electrons to form  $\text{Mg}^{2+}$  and each chlorine gains 1 to form  $\text{Cl}^-$ .

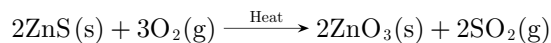


Cation:  $\text{Mg}^{2+}$ , Anion:  $\text{Cl}^-$ .

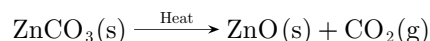
or

- (B) Zinc sulphide and zinc carbonate are the main ores of zinc. First, these ores are converted into zinc oxide, after that zinc oxide is heated with carbon where it is reduced to metallic zinc.

- Conversion of zinc sulphide into zinc oxide (Roasting)



- Conversion of zinc carbonate into zinc oxide (Calcination)



- Conversion of zinc oxide into metallic zinc (Reduction)



- 23 “Plants use a variety of techniques to get rid of waste material.” Justify this statement giving any four ways.

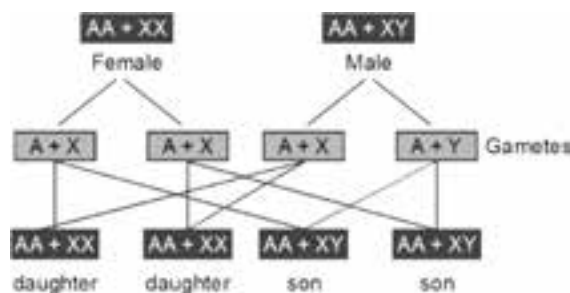
Ans :

Plants remove oxygen via photosynthesis, excess water via transpiration, store waste in leaves that fall off and secrete some waste into nearby soil. These are plant excretion methods unlike animals.

- 24 Explain with the help of a flow chart that in human beings father is responsible for the sex (male or female) of the child.

Ans :

Males produce two types of sperms (X and Y). Females produce only X-type ova. If sperm with X fertilizes the ovum, the child is female (XX); if Y, the child is male (XY). Thus, the father determines the sex.



Sex determination in human beings

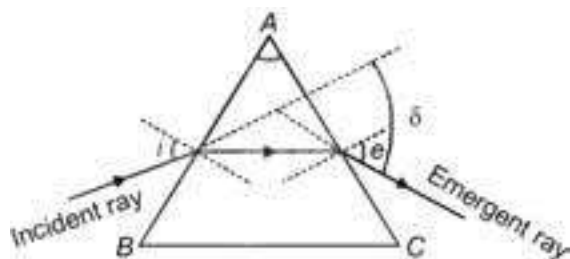
- 25 (A) Draw a ray diagram to show the refraction of a ray of light passing through an equilateral glass prism. Mark the angle through which the emergent ray bends from the direction of the incident ray and also name it.

or

- (B) Name the type of lenses required by the persons for the correction of their defect of vision called presbyopia (a) Write the structure of the lenses commonly used for the correction of this defect giving reason for such designs.

Ans :

- (A) The emergent ray bends due to refraction inside the prism and the angle between incident and emergent rays is the angle of deviation ( $\delta$ ). The diagram shows light bending toward the base of the prism and emerging at an angle.



or

- (B) Presbyopia is corrected using bifocal lenses. These have convex lenses for near vision (lower part) and concave lenses for distance vision (upper part), as presbyopia affects focusing on both nearby and distant objects due to aging.

- 26 What are magnetic field lines? List two important properties of magnetic field lines.

Ans :

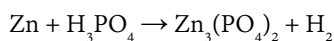
Magnetic field lines represent the direction of magnetic force. They are imaginary lines drawn from north to south outside a magnet.

Properties:

1. They are closed loops.
2. They never intersect each other.

## SECTION-C

- 27 (A) Why do we balance a chemical equation? Name and state the law that suggests the balancing of a chemical equation? Balance the following chemical equation:

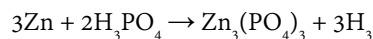


or

- (B) Define a precipitation reaction. Give its example and also express the reaction that occurs in the form of a balanced chemical equation.

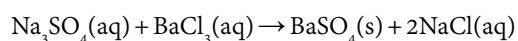
Ans :

- (A) We balance a chemical equation to equate the number of atoms or mass of reactants with products.  
Law: Law of Conservation of Mass – mass can neither be created nor destroyed in a chemical reaction.



or

- (B) Precipitation Reaction: A reaction where an insoluble solid (precipitate) is formed.  
Example: Sodium sulphate reacts with barium chloride to form barium sulphate (white precipitate).



- 28 Design an activity to show that metals are good conductors of heat and have high melting points.

Ans :

Activity to show that metals are good conductors of heat and have high melting point :

1. Take an aluminium or copper wire and clamp it on a stand.
2. Fix a pin at one end using wax.
3. Heat the other end with a candle.
4. The wax melts, dropping the pin—proving heat conduction. The wire remains solid—proving high melting point.

- 29 The digestion of food in human alimentary canal is a complex process. State the enzyme/salt present in the following and mention their function in the process of digestion:

- (i) Saliva
- (ii) Bile Juice
- (iii) Pancreatic Juice

Ans :

- (i) Saliva: Contains salivary amylase, which breaks down starch into sugar.
- (ii) Bile Juice: Contains salts (no enzymes), emulsifies fats for digestion.

- (iii) Pancreatic Juice Contains :

1. Trypsin : Digests proteins
2. Lipase : Digests fats
3. Pancreatic amylase : Acts on carbohydrates (Any one)

- 30 State two limitations of electrical impulses in multicellular organisms. Why is chemical communication better than electrical impulses as a means of communication between cells in multicellular organisms?

Ans :

Limitations of electrical impulses in multicellular organism are :

- Electrical impulses reach only cells connected by nervous tissue.
- After an impulse, cells need time to reset before generating another.

Chemical communication is better as hormones diffuse to various body regions, enabling cells to communicate without direct contact, unlike electrical impulses which require direct connection.

- 31 If we want to obtain a virtual and magnified image of an object by using a concave mirror of focal length 18 cm, where should the object be placed? Use mirror formula to determine the object distance for an image of magnification +2 produced by this mirror to justify your answer.

Ans :

To get a virtual, magnified image with a concave mirror ( $f = -18$  cm), place the object between the pole and the focus.

$$m = -\frac{v}{u} = +2$$

$$v = -2u$$

As,  $f = -18$  cm

Using mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-18} = \frac{1}{-2u} + \frac{1}{u}$$

$$\frac{1}{-18} = \frac{1}{2u}$$

$$u = -9 \text{ cm}$$

So, the object must be placed 9 cm in front of the mirror (between pole and focus). The magnification of image is +2.

- 32 The electrical resistivity of three materials A, B and C at 20°C is given below:

Material	Resistivity ( $\Omega$ m)
A	$10^{17}$
B	$44 \times 10^{-6}$
C	$1.62 \times 10$

- Classify these materials as conductor, alloy and insulator.
- Give one example of each of these materials and state one use of each material in the design of an electrical appliance such as an electric stove or an electric iron.

Ans :

(i)

Material	Resistivity	Type
A	$10^{17}$	Insulator
B	$44 \times 10^{-6} \Omega\text{m}$	Alloy
C	$1.62 \times 10 \Omega\text{m}$	Conductor

- A (Insulator) : Example – Rubber; used for insulating wires.

B (Alloy) : Example – Nichrome; used in heating elements of stoves.

C (Conductor) : Example – Copper; used in electric wiring.

- 33 What are decomposers? Give two examples. State how they maintain a balance in an ecosystem.

Ans :

Decomposers are microorganisms that feed on dead plant and animal remains and their waste products.

Examples: Bacteria and fungi.

They help maintain balance in the ecosystem by breaking down organic matter and replenishing the soil with nutrients essential for plant growth.

## SECTION-D

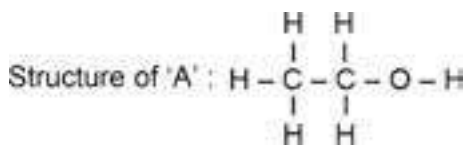
- 34 (A) A carbon compound 'A' on heating with excess conc.  $\text{H}_2\text{SO}_4$  forms a compound 'B', which on addition of one mole of hydrogen gas in the presence of nickel catalyst forms a compound 'C'. 'C' on combustion in air forms 2 moles of carbon dioxide and 3 moles of water. Identify 'A', 'B' and 'C' and write their structures. Give chemical equations of the reactions involved. Also state the role of concentrated sulphuric acid in the formation of 'B' from 'A'.

or

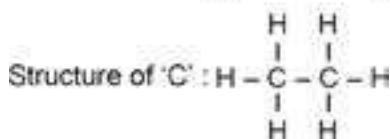
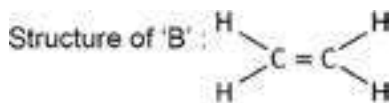
- (B) A carbon compound 'A' is widely used as a preservative in pickles and has a molecular formula  $\text{C}_3\text{H}_4\text{O}_3$ . This compound reacts with ethanol to form a sweet-smelling compound 'B'.
- Identify the compound 'A' and write its structure.
  - Write the chemical equation for the reaction of 'A' with ethanol to form compound 'B'. State the role of presence of an acid in the reaction.
  - How can we get compound 'A' back from 'B'?
  - How can 'A' be obtained from ethanol?
  - Name the gas produced when compound 'A' react with washing soda.

Ans :

(A)

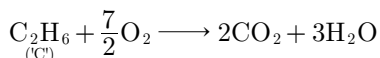
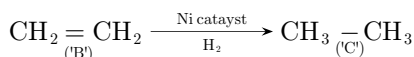
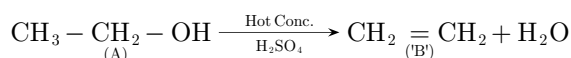


Ethanol



Ethanol

Reactions Involved :

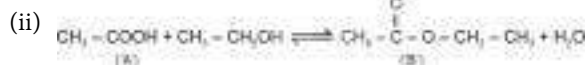
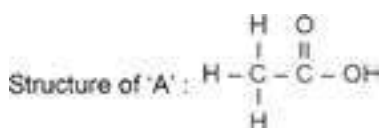


Role of concentrated Sulphuric acid :

The concentrated sulphuric acid can be regarded as a dehydrating agent which removes water from ethanol.

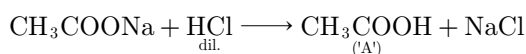
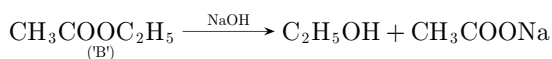
or

(B) (i) Compound 'A' is ethanoic acid

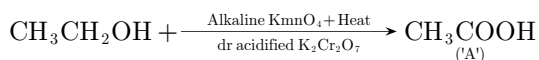


Here, acid catalyses the reaction.

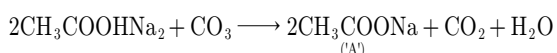
(iii) Conversion of compound 'B' to compound 'A' is done by treating it with sodium hydroxide followed by reaction with hydrochloric acid



(iv) Compound 'A' from ethanol can be obtained by oxidation. The reaction involved is



(v) The gas produced is carbon dioxide (CO<sub>2</sub>)



35 (A) (i) What is regeneration? Give one example of an organism that shows this process and one organism that does not. Why does regeneration not occur in the latter?

(ii) Water in a pond appears dark green and contains filamentous structures. Name these structures and the method by which they reproduce. Explain the process.

or

(B) (i) Name the part performing the following functions in the human male reproductive system:

- Carries sperm – Vas deferens
- Production of male gametes – Testes
- Whose secretion makes the transport of sperms easier – Prostate gland
- Provide suitable temperature for sperm formation – Scrotum

(ii) Write any two characteristics of sperms.

(iii) What are surgical contraceptive methods? Give the side effect caused by this procedure.

Ans :

(A) (i) Regeneration is the process by which some organisms regrow lost or damaged body parts.

Example that shows regeneration: Planaria

Example that does not : Human

Reason : Humans have complex body organization and specialized cells, making full regeneration impossible.

(ii) The filamentous structures are Spirogyra (algae). They reproduce by fragmentation.

In this method, the filament breaks into two or more fragments. Each fragment grows into a new organism, completing reproduction.

or

(B) (i)

- Vas deferens
- Testes
- Prostate gland and seminal vesicle
- Scrotum

(ii) Characteristics of sperms are as follows :

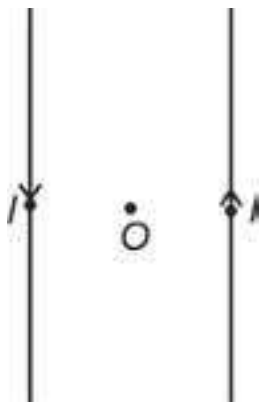
- Sperms are motile and have a tail for movement.
- Each sperm contains a haploid nucleus with 23 chromosomes.

(iii) Surgical contraceptive methods involve blocking gamete transport.

- In males : Vasectomy
- In females : Tubectomy

May cause infection, internal bleeding, or complications due to surgery.

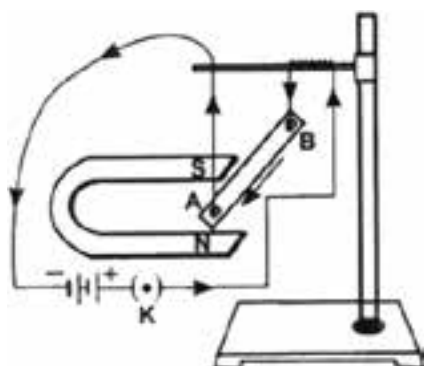
- 36 (A) (i) Draw the pattern of the magnetic field lines for the two parallel straight conductors carrying current of same magnitude 'I' in opposite directions. Show the direction of magnetic field at a point O which is equidistant from the two conductors.



- (ii) In our houses we receive (a)(c) electric power of 220 V. In electric iron or heater cables having three wires (red, black, green):
- What are these three wires called?
  - What is the potential difference between red and black wire?
  - What is the role of green wire in case of leakage?

or

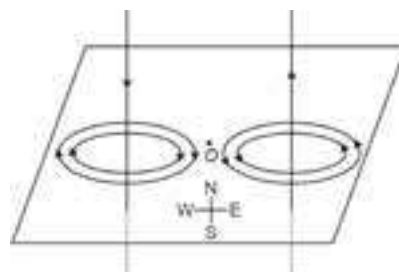
- (B) (i) Using the experimental setup shown: How can it be shown that:



- A force is exerted on conductor AB in magnetic field?
  - The direction of force can be reversed in two ways?
- (ii) When will the magnitude of force be highest?
- (iii) State Fleming's Left Hand Rule.

Ans :

- (A) (i) Magnetic field lines around each conductor form concentric circles. Since currents are in opposite directions, the magnetic fields



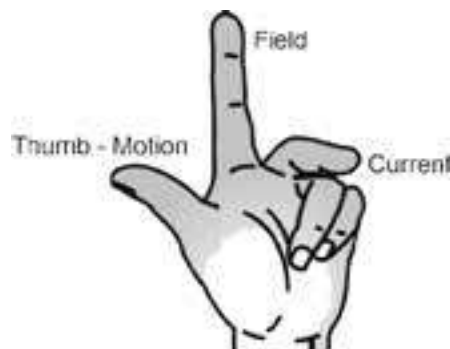
At point O, due to each wire are in the same direction and add up

The direction is determined using the Right-Hand Thumb Rule.

- Red Colour - Live wire  
Black Colour - Neutral wire  
Green: Colour - Earth wire
- 220 V
- The earth wire safely directs any leaked current to the ground, preventing electric shocks and protecting the appliance.

or

- (B) (i) When current flows through AB in a magnetic field, the conductor deflects—showing a magnetic force acts on it.
- (ii) Yes, by either:
- Reversing the current direction, or
  - Reversing the magnetic field direction.
- When the conductor is perpendicular to the magnetic field and current is maximum.
- (iii) If the thumb, forefinger, and middle finger of the left hand are held perpendicular to each other:
- Forefinger shows direction of magnetic field,  
Middle finger shows current direction,  
Thumb points in the direction of the force (motion).





## SECTION-E

**DIRECTION :** Question Nos. 37 to 39 are Source-based/ Case-based questions.

37 Common salt is a very important chemical compound for our daily life. Its chemical name is sodium chloride and it is used as a raw material in the manufacture of caustic soda, washing soda, baking soda etc. It is also used in the preservation of pickles, butter, meat etc.

- (i) Name the acid and the base from which common salt can be obtained (d)
- (ii) State the nature (acidic/basic/neutral) of sodium chloride. Give reason.
- (iii) (A) What happens when electric current is passed through an aqueous solution of sodium chloride? Name the products and their positions in the electrolytic cell.

or

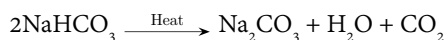
- (iii) (B) How is washing soda obtained from sodium chloride? Give chemical equations.

**Ans :**

- (i) Acid – Hydrochloric acid (HCl)  
Base – Sodium hydroxide (NaOH)
- (ii) Sodium chloride is neutral because it is formed from a strong acid (HCl) and a strong base (NaOH) via a neutralization reaction.
- (iii) (A) Electrolytic decomposition occurs.
  1. Cathode: Hydrogen gas is formed.
  2. Anode: Chlorine gas is released.
  3. Near Cathode: Sodium hydroxide is formed.

or

- (iii) (B) Step 1 : Solvay Process



38 In life there are certain changes in the environment called 'stimuli' to which we respond appropriately. Touching a flame suddenly is a dangerous situation for us. One way is to think consciously about the possibility of burning and then moving the hand. But our body has been designed in such a way that we save ourselves from such situations immediately

- (i) Name the action by which we protect ourselves when touching a hot object. Define it.
- (ii) Write the role of : (a) Motor neuron : Carries impulses from CNS to muscles. (b) Relay neuron : Connects sensory and motor neurons in spinal cord (d)

- (iii) (A) What are the two types of nervous system in human body? Name their components.

or

- (B) Which part of human brain is responsible for:
  - (a) Thinking – Cerebrum
  - (b) Picking up a pencil – Cerebellum
  - (c) Controlling blood pressure – Medulla
  - (d) Controlling hunger – Hypothalamus

**Ans :**

- (i) Reflex action– It is an automatic, quick response to a stimulus without conscious thought, controlled by the spinal cord.
- (ii) Motor neuron : it transmits impulses from the central nervous system towards the effectors i.e. muscles or glands.  
Relay neuron : it serves as a link between sensory and motor neurons.

- (iii) 1. Central Nervous System (CNS) – Brain and Spinal Cord  
2. Peripheral Nervous System (PNS) – Cranial nerves and Spinal nerves.

or

- (iii) (B) (a) Thinking - Cerebrum  
(b) Picking up a pencil - Cerebellum  
(c) Controlling blood pressure - Medulla oblongata  
(d) Controlling hunger - Fore-brain.

39 The students in a class took a thick sheet of cardboard and made a small hole in its centre. Sunlight was allowed to fall on this small hole and they obtained a narrow beam of white light. A glass prism was taken and this white light was allowed to fall on one of its faces. The prism was turned slowly until the light that comes out of the opposite face of the prism appeared on the nearby screen. They studied this beautiful band of light and concluded that it is a spectrum of white light.

- (i) Give any one more instance in which this type of spectrum is observed (d)
- (ii) What happens to white light in the above case?
- (iii) (A) List two conditions necessary to observe a rainbow.

or

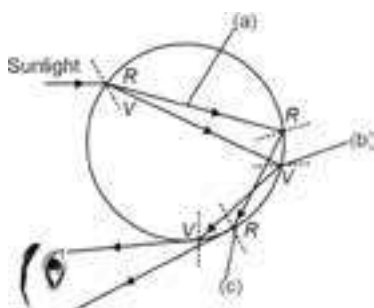
- (iii) (B) Draw a ray diagram to show the formation of a rainbow. Mark on it:
  - (a) Where dispersion of light occurs.
  - (b) Where light gets reflected internally.
  - (c) Where final refraction occurs.

Ans :

- (i) A rainbow in the sky is another instance where white light splits into its component colors, forming a spectrum.
- (ii) White light splits into its seven constituent colors (VIBGYOR) due to dispersion by the glass prism.
- (iii) (A)
  - 1. The source of light (sun) should be behind the observer.
  - 2. There should be sufficient water droplets in the atmosphere to disperse, reflect, and refract light.

or

- (iii) (B)



- (a) Dispersion occurs when sunlight enters a raindrop and splits into colors.
- (b) Internal reflection happens inside the raindrop on the rear surface.
- (c) Final refraction happens when light exits the raindrop and reaches our eyes.

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# CHAPTER 1

## Chemical Reactions and Equations

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### 1. INTRODUCTION

Chemistry is the branch of science in which we study the composition, properties and transformation of matter. We observe changes in matter all around us. These changes are of two types :

#### 1.1 Physical Change

A change in which there is a change in physical appearance of a substance but no change in its basic composition, is known as a physical change. For example, melting of butter and wax, boiling of water, dissolving of salt in water, breaking of glass, sublimation of a solid on heating, etc. No new chemical substance is formed in a physical change.

#### 1.2 Chemical Change

A change in which one or more new substances having properties and compositions different from the original substance are formed, is known as a chemical change. For example, burning of paper, wood, coal and magnesium ribbon, making of curd from milk, digestion of food, ripening of fruits, bursting of a cracker, boiling of egg, etc. Chemical changes are also called chemical reactions.

A chemical reaction is accompanied by changes in physical state, formation of a precipitate, change of colour, change in temperature or evolution of a gas.

Normally, a chemical change is permanent and cannot be reversed easily.

### 2. CHEMICAL EQUATION

#### 2.1 Word Equation

A word equation simply shows the change of reactants to products through an arrow placed between them. The reactants are written on the left-hand side (LHS) with a plus sign in case of two or more reactants and the products are written on the right-hand side (RHS) with a plus sign in case

of two or more products. The arrowhead shows the direction of the reaction pointing towards the products.

#### 2.2 Skeletal Chemical Equation

A chemical equation in which symbols and formulae are used instead of words to show a chemical reaction is called a skeletal chemical equation.

#### 2.3 Balanced Chemical Equation

A chemical equation in which the number of atoms of each element of reactants is equal to that of products, is called a balanced chemical equation.

#### 2.4 Balancing a Chemical Equation

Equalising the number of atoms of each element on reactants and products sides of a chemical equation is called balancing a chemical equation.

A chemical equation can be made more informative by adding physical states of reactants and products, reaction conditions, heat change during the reaction, i.e., heat released or absorbed, concentration of reactants and products, speed or rate of the reaction, i.e., slow or fast, and nature of the reaction, i.e., forward or backward to the equation.

#### 2.5 Characteristics of Chemical Equations

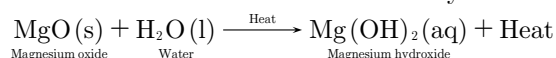
1. Chemical equation gives the names of different reactants and products of a chemical reaction.
2. It gives the number of atoms or molecules of reactants and products of a chemical reaction.
3. Chemical equation gives relative number of moles of reactants and products.
4. It gives the relative amount by mass or weight of reactants and products.
5. Chemical equation also gives relative volume of gaseous reactants and products.

### 3. TYPES OF CHEMICAL REACTIONS

#### 3.1 Combination Reaction

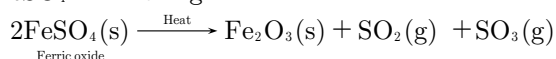
A reaction in which two or more substances combine together to form a single product is known as a combination reaction.

The combination reaction is often called synthesis.



#### 3.2 Decomposition Reaction

The reaction in which a single substance breaks down to form two or more substances, is called a decomposition reaction. For example, decomposition of  $\text{FeSO}_4$  on heating.



#### 3.3 Displacement Reaction

The reaction in which one atom or a group of atoms of a compound is replaced by another atom, is called a displacement reaction. Generally, a more reactive metal displaces a less reactive metal from its salt solution in displacement reaction.

The series in which metals are arranged in the decreasing order of their reactivity is called activity series of metals.

Potassium (K)	Most reactive
Sodium (Na)	
Calcium (Ca)	
Magnesium (Mg)	
Aluminium (Al)	
Zinc (Zn)	
Iron (Fe)	
Lead (Pb)	
Copper (Cu)	
Silver (Ag)	
Gold (Au)	
Platinum (Pt)	Least reactive

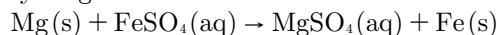
Decreasing reactivity

Activity series of some common metals

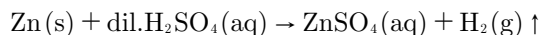
Few examples of displacement reactions are as follows:

1. Displacement of copper from a solution of copper sulphate by iron  
 $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$
2. Displacement of silver from silver nitrate solution by copper  
 $\text{Cu(s)} + 2\text{AgNO}_3\text{(aq)} \rightarrow 2\text{Ag(s)} + \text{Cu(NO}_3)_2\text{(aq)}$

3. Displacement of iron from iron sulphate solution by magnesium

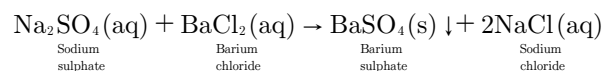


4. Zinc displaces hydrogen from dilute sulphuric acid.



#### 3.4 Double Displacement Reaction

The reaction in which anions and cations of two different molecules exchange places, forming two completely different compounds is called double displacement reaction. For example,

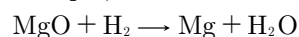


The common types of double displacement reactions are as follows:

1. **Precipitation Reaction :** It is a chemical reaction in which one of the products is precipitated as an insoluble solid. For example,  
 $\text{AgNO}_3\text{(aq)} + \text{NaCl(aq)} \rightarrow \underset{\text{(White ppt.)}}{\text{AgCl(s)}} \downarrow + \text{NaNO}_3\text{(aq)}$
2. **Neutralisation Reaction :** It is chemical reaction in which a strong acid and a strong base react with each other to form water and salt. For example,  
 $\text{NaOH(aq)} + \text{HCl(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$

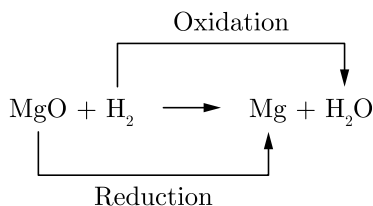
#### 3.5 Redox Reaction

1. **Oxidation :** If a substance gains oxygen or loses hydrogen in a reaction, the substance is said to be oxidised and the process is known as oxidation.
2. **Reduction :** If a substance loses oxygen and gains hydrogen in a reaction, the substance is said to be reduced and the process involved is known as reduction.  
 Reduction and oxidation take place simultaneously in few reactions. Such reactions are known as redox reactions.
3. **Oxidising Agent :** If a substance oxidises the other substance but itself gets reduced, then it is known as an oxidising agent.
4. **Reducing Agent :** If a substance reduces the other substance but itself gets oxidised, then it is known as a reducing agent.  
 For example,



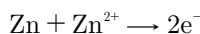
Here,  $\text{H}_2$  is the reducing agent as it reduces  $\text{MgO}$  to  $\text{Mg}$  and itself gets oxidised to  $\text{H}_2\text{O}$ . On the other hand, magnesium oxide is the oxidising agent which oxidises  $\text{H}_2$  to  $\text{H}_2\text{O}$  and itself gets reduced to  $\text{Mg}$ .

Thus, an oxidising agent gets reduced and a reducing agent gets oxidised in a redox reaction.

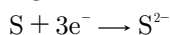
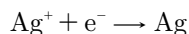


### 3.6 Electronic Concept of Oxidation and Reduction

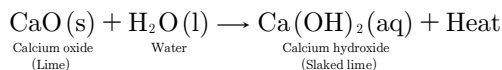
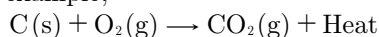
Oxidation is the loss of electrons by a species (an atom, a molecule or an ion).



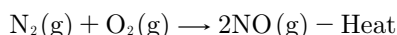
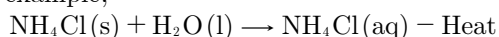
Reduction is the gain of electrons by a species (an atom, a molecule or an ion).



1. **Exothermic Reaction :** A chemical reaction in which heat is released along with the formation of product, is called exothermic reaction. For example,



2. **Endothermic Reaction :** A chemical reaction in which heat is absorbed along with the formation of product, is called endothermic reaction. For example,



### 3.7 Corrosion

It is the process of slow conversion of metals into their undesirable compounds by the attack of air (oxygen) and moisture.

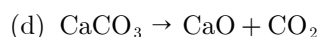
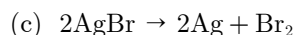
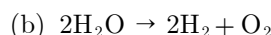
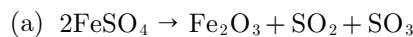
1. **Rusting :** When iron and iron articles are exposed to air and water, a reddish-brown layer is formed on the surface. This layer is called rust [hydrated iron(III) oxide,  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ ]. Hence, corrosion of iron is known as rusting.
2. **Rancidity :** When cooked food items containing oil and fat are kept exposed and unprotected, they become rancid and produce an unpleasant smell and taste. The phenomenon involved here is known as rancidity.
3. **Prevention of Rancidity :** Rancidity can be prevented by adding antioxidants, keeping food

items at low temperature, keeping food items in vacuum packing or airtight container and replacing air by nitrogen gas.

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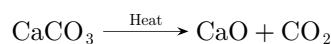
## OBJECTIVE QUESTIONS

1. Select from the following a decomposition reaction in which source of energy for decomposition is light:



Ans :

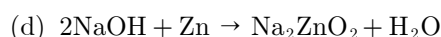
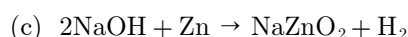
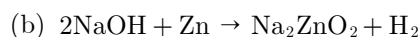
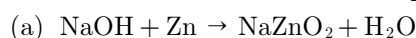
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The reaction in which a single substance breaks down to form two or more substances is called a decomposition reaction.

Thus (c) is correct option.

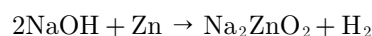
2. When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube and then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as:



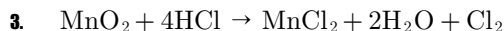
Ans :

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When zinc reacts with sodium hydroxide solution, sodium zincate and hydrogen gas are produced.



Thus (b) is correct option.

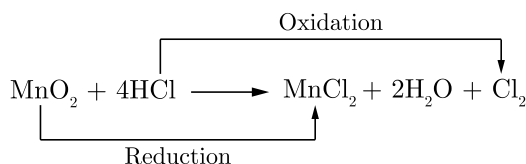


The reaction given above is a redox reaction because in this case :

- (a)  $\text{MnO}_2$  is oxidised and  $\text{HCl}$  is reduced
- (b)  $\text{HCl}$  is oxidised
- (c)  $\text{MnO}_2$  is reduced
- (d)  $\text{MnO}_2$  is reduced and  $\text{HCl}$  is oxidised

Ans :

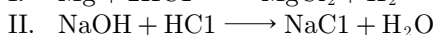
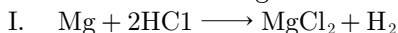
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In the above reaction  $\text{MnO}_2$  loses oxygen and  $\text{HCl}$  loses hydrogen.

Thus (d) is correct option.

4. Consider the following chemical equation. I and II.



The correct statement about these equations is:

- (a) 'I' is a displacement reaction and 'II' is a decomposition reaction.
- (b) 'I' is a displacement reaction and 'II' is double displacement reaction.
- (c) Both 'I' and 'II' are displacement reactions.
- (d) Both 'I' and 'II' are double-displacement reactions.

Ans :

OD 2023

The chemical equation I represents a displacement reaction. In this reaction  $\text{Mg}$  metal displaces hydrogen from  $\text{HCl}$ . The reaction in which one atom or a group of atom of a compound is replaced by another atom, is called a displacement reaction. Generally, a more reactive metal displaces a less reactive metal from its salt solution in displacement reaction.

The chemical equation II is an example of double displacement reaction because both the ions from each of the reactant ( $\text{NaOH}$  and  $\text{HCl}$ ) are displaced with another reactant. The reaction in which anions and cations of two different molecules exchange places, forming two completely different compounds is called double displacement reaction.

Thus option (b) is correct option.

5. Which of the statements about the reaction below are incorrect ?



- (a) Lead is getting reduced.
- (b) Carbon dioxide is getting oxidised.
- (c) Carbon is getting oxidised.
- (d) Lead oxide is getting reduced.
- (i) (a) and (b)
- (ii) (a) and (c)
- (iii) (a), (b) and (c)
- (iv) all

Ans :

In the given reaction  $\text{PbO}$  has lost oxygen to form  $\text{Pb}$ , therefore lead is getting reduced.

Carbon ( $\text{C}$ ) has gained oxygen to form  $\text{CO}_2$ , therefore carbon is getting oxidised.

Thus Option (i) correct.



The above reaction is an example of a :

- (a) combination reaction
- (b) double displacement reaction
- (c) decomposition reaction
- (d) displacement reaction.

Ans :

The given equation is a displacement reaction in which  $\text{Fe}$  of  $\text{Fe}_2\text{O}_3$  has been displaced by  $\text{Al}$ .

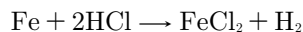
Thus Option (a) correct..

7. What happens when dilute hydrochloric acid is added to iron fillings? Tick the correct answer :

- (a) Hydrogen gas and iron chloride are produced.
- (b) Chlorine gas and iron hydroxide are produced.
- (c) No reaction takes place.
- (d) Iron salt and water are produced.

Ans :

The following reaction takes place :



Thus, hydrogen and iron chloride are produced.

Thus Option (a) correct.

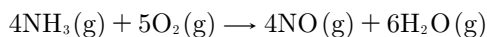
8. Which of the following is not a physical change ?

- (a) Boiling of water to give water vapour
- (b) Melting of ice to give water
- (c) Dissolution of salt in water
- (d) Combustion of liquefied petroleum gas (LPG)

Ans :

(d) Combustion of liquefied petroleum gas (LPG)

9. The following reaction is an example of a :



(i) displacement reaction

(ii) combination reaction

(iii) redox reaction

(iv) neutralization reaction

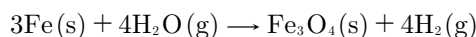
(a) (i) and (iv) (b) (ii) and (iii)

(c) (i) and (iii) (d) (iii) and (iv)

Ans :

(c) (i) and (iii)

10. Which of the following statements about the given reaction are correct ?



(i) Iron metal is getting oxidised

(ii) Water is getting reduced

(iii) Water is acting as reducing agent

(iv) Water is acting as oxidising agent.

(a) (i), (ii) and (iii) (b) (iii) and (iv)

(c) (i), (ii) and (iv) (d) (ii) and (iv)

Ans :

(c) (i), (ii) and (iv)

11. Three beakers labelled as A, B and C each containing 25 mL of water were taken. A small amount of NaOH, anhydrous  $\text{CuSO}_4$  and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statement(s) is(are) correct ?

(i) In beakers A and B, exothermic process has occurred.

(ii) In beakers A and B, endothermic process has occurred.

(iii) In beaker C exothermic process has occurred.

(iv) In beaker C endothermic process has occurred.

(a) (i) only (b) (ii) only

(c) (i) and (iv) (d) (ii) and (iii)

Ans :

(c) (i) and (iv)

12. Which of the following are exothermic processes ?

(i) Reaction of water with quicklime

(ii) Dilution of an acid

(iii) Evaporation of water

(iv) Sublimation of camphor (crystals)

(a) (i) and (ii) (b) (ii) and (iii)

(c) (i) and (iv) (d) (iii) and (iv)

Ans :

(a) (i) and (ii)

13. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation ?

(a)  $\text{KMnO}_4$  is an oxidising agent, it oxidises  $\text{FeSO}_4$

(b)  $\text{FeSO}_4$  acts as an oxidising agent and oxidises  $\text{KMnO}_4$

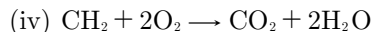
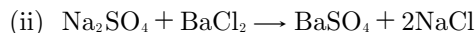
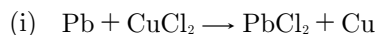
(c) The colour disappears due to dilution; no reaction is involved

(d)  $\text{KMnO}_4$  is an unstable compound and decomposes in presence of  $\text{FeSO}_4$  to a colourless compound.

Ans :

(a)  $\text{KMnO}_4$  is an oxidising agent, it oxidises  $\text{FeSO}_4$

14. Which among the following is(are) double displacement reaction(s) ?



(a) (i) and (iv) (b) (ii) only

(c) (i) and (ii) (d) (iii) and (iv)

Ans :

(b) (ii) only

15. Which among the following statement(s) is(are) true? Exposure of silver chloride to sunlight for a long duration turns grey due to :

(i) the formation of silver by decomposition of silver chloride

(ii) sublimation of silver chloride

(iii) decomposition of chlorine gas from silver chloride

(iv) oxidation of silver chloride

(a) (i) only (b) (i) and (iii)

(c) (ii) and (iii) (d) (iv) only

Ans :

(a) (i) only

16. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed ?

- (i) It is an endothermic reaction
  - (ii) It is an exothermic reaction
  - (iii) The pH of the resulting solution will be more than seven
  - (iv) The pH of the resulting solution will be less than seven
- (a) (i) and (ii)                      (b) (ii) and (iii)  
(c) (i) and (iv)                    (d) (iii) and (iv)

Ans :

- (b) (ii) and (iii)

17. Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved ?

- (i) Displacement reaction
  - (ii) Precipitation reaction
  - (iii) Combination reaction
  - (iv) Double displacement reaction
- (a) (i) only                      (b) (ii) only  
(c) (iv) only                    (d) (ii) and (iv)

Ans :

- (a) (ii) and (iv)

18. Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is :

- (a) 1 : 1                      (b) 2 : 1  
(c) 4 : 1                    (d) 1 : 2

Ans :

- (b) 2 : 1

19. Which of the following is(are) an endothermic process(es) ?

- (i) Dilution of sulphuric acid
  - (ii) Sublimation of dry ice
  - (iii) Condensation of water vapours
  - (iv) Evaporation of water
- (a) (i) only (iii)                      (b) (ii) only  
(c) (iii) only                    (d) (ii) and (iv)

Ans :

- (d) (ii) and (iv)

20. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate ?

- (a) Lead sulphate (insoluble)
- (b) Lead acetate
- (c) Ammonium nitrate
- (d) Potassium sulphate

Ans :

- (b) Lead acetate.

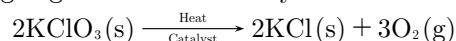
21. Which of the following gases can be used for storage of fresh sample of an oil for a long time ?

- (a) Carbon dioxide or oxygen
- (b) Nitrogen or oxygen
- (c) Carbon dioxide or helium
- (d) Helium or nitrogen

Ans :

- (d) Helium or nitrogen.

22. The following reaction is used for the preparation of oxygen gas in the laboratory



Which of the following statement(s) is(are) correct about the reaction?

- (a) It is a decomposition reaction and endothermic in nature.
- (b) It is a combination reaction.
- (c) It is a decomposition reaction accompanied by release of heat.
- (d) It is a photochemical decomposition reaction and exothermic in nature.

Ans :

- (a) It is a decomposition reaction and endothermic in nature.

23. Which one of the following processes involve chemical reactions ?

- (a) Storing of oxygen gas under pressure yiri a gas cylinder
- (b) Liquefaction of air
- (c) Keeping petrol in a china dish in the open



- (d) Heating copper wire in presence of air at high temperature

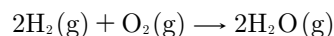
Ans :

- (d) Heating copper wire in presence of air-at high temperature

24. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature ?

- (a)  $2\text{H}_2(l) + \text{O}_2(l) \rightarrow 2\text{H}_2\text{O}(g)$   
 (b)  $2\text{H}_2(g) + \text{O}_2(l) \rightarrow 2\text{H}_2\text{O}(l)$   
 (c)  $2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(l)$   
 (d)  $2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(g)$

Ans :



25. Which of the following are combination reactions?

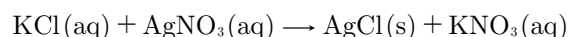
- (i)  $2\text{KClO}_3 \xrightarrow{\text{Heat}} 2\text{KCl} + 3\text{O}_2$   
 (ii)  $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2$   
 (iii)  $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$   
 (iv)  $\text{Zn} + \text{FeSO}_4 \rightarrow \text{ZnSO}_4 + \text{Fe}$   
 (a) (i) and (iii) (b) (iii) and (iv)  
 (c) (ii) and (iv) (d) (ii) and (iii)

Ans :

- (d) (ii) and (iii)

26. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction ?

Ans :



It is a double displacement and precipitation reaction

27. Ferrous sulphate decomposes with the evolution of a gas having a characteristic odour of burning sulphur. Write the chemical reaction involved and identify the type of reaction.

Ans :



It is a thermal decomposition reaction.

28. Why do fire flies glow at night ?

Ans :

Fire flies undergo a process known as bioluminescence. They have phosphorus compounds that give heat and light from their body.

29. Grapes hanging on the plant do not ferment but after being plucked from the plant can be fermented. Under what conditions do these grapes ferment ? Is it a chemical or a physical change ?

Ans :

The fermentation of grapes takes place in the presence of anaerobic conditions, i.e. in the absence of air. Since, new products are formed and it is an example of reversible reaction this is a chemical change.

30. Which among the following are physical or chemical changes ?

- (a) Evaporation of petrol  
 (b) Burning of Liquefied Petroleum Gas (LPG)  
 (c) Heating of an iron rod to red hot.  
 (d) Curdling of milk.  
 (e) Sublimation of solid ammonium chloride

Ans :

- (a); (c) and (e) are physical changes.  
 (b) and (d) are chemical changes.

31. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	$\text{C} + \text{O}_2 \rightarrow \text{CO}_2$	(p)	Displacement
(B)	$\text{AgBr} \xrightarrow{\text{light}} \text{Ag} + \text{Br}$	(q)	Combination
(C)	$\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$	(r)	Decomposition
(D)	$\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Cu}} \text{CH}_3\text{CHO} + \text{H}_2$	(s)	Oxidation

	A	B	C	D
(a)	q	r	p	s
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

- (a)A-q, B-r, C-p, D-s



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32. Column II gives type of reaction mention in column I, match them correctly.

	Column I		Column II
(A)	$\text{KClO}_3 \xrightarrow{\Delta}$	(p)	$\text{O}_2$
(B)	$\text{ZnCO}_3 \xrightarrow{\Delta}$	(q)	$\text{H}_2\text{O}$
(C)	$\text{H}_2\text{CO}_3 \xrightarrow{\Delta}$	(r)	$\text{CO}_2$
(D)	$\text{C}_2\text{H}_6 \xrightarrow{\Delta}$	(s)	$\text{ZnO}$

	A	B	C	D
(a)	p	s, r	q, r	q, r
(b)	p	q, r	s, r	r, p
(c)	q, r	s, p	p, s	r
(d)	r	q	s	p

Ans :

(a) A-p, B-s, r, C-q, r, D-q, r

33. **Assertion :** Corrosion of iron is a serious problem.

**Reason :** Every year an enormous amount of money is spent to replace damaged iron.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

Ans :

(a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.

Iron combines with oxygen in presence of air and moisture and forms a brown powder which gradually falls off. It is a wasteful reaction. Assertion and reason are true and reason explains assertion.

34. **Assertion :** Changing of colour of copper from reddish brown to black is an example of reduction.

**Reason :** Hydrogen is removed.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

Ans :

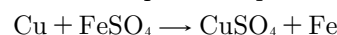
(d) Both Assertion and Reason are False.

When we heat copper, it combines with oxygen to form black coloured copper (II). oxide. Loss of Hydrogen is known as oxidation and in this reaction no Hydrogen

involved. So, both assertion and reason are false

35. **Assertion :** When iron nail is dipped in copper sulphate solution, the iron nail becomes brownish in colour and the blue colour of copper solution fade.

**Reason :** Equation representing this change is

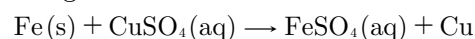


- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

Ans :

(c) Assertion is True but the Reason is False.

When iron nail is dipped in copper sulphate solution, iron being more reactive than copper displaces copper from its solution and so colour of copper sulphate fades. Equation representing this change is :



Hence assertion is true but reason is false.

36. **Assertion :** Silver chloride turns grey is sunlight.

**Reason :** Silver is one of the least reactive metals.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

Ans :

(b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.

In the presence of sunlight, silver chloride decomposes to silver and chlorine. Silver is one of the least reactive metals as it lies at the bottom of the metal reactivity series. Both assertion and reason are true but reason does not explain assertion.

37. **Assertion :** When water is added to calcium oxide, a large amount of heat is produced.

**Reason :** It is an endothermic reaction.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.
- (c) Assertion is True but the Reason is False.
- (d) Both Assertion and Reason are False.

**Ans :**

- (c) Assertion is True but the Reason is False.

When water is added to calcium oxide, it forms calcium hydroxide with release of large amount of heat. Chemical reaction in which heat is released are called exothermic reactions. Hence, assertion is true but reason is false.

**38. Assertion :** A chemical equation should be balanced.

**Reason :** Number of atoms of each element should be same on reactants as well as products side.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.
- (c) Assertion is True but the Reason is False.
- (d) Both Assertion and Reason are False.

**Ans :**

- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.

A chemical equation should be balanced to be in accordance with law of conservation, a mass which states that mass can neither be created nor be destroyed during a chemical reaction. In a balanced chemical equation, number of atoms of each element on both sides i.e. reactants and products are same. Hence, both assertion and reason are true but reason does not explain assertion.

**39. Assertion :** Chemical equations can be made more informative.

**Reason :** We can write physical state of reactants and products, temperature and pressure, name of catalyst used etc.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.
- (c) Assertion is True but the Reason is False.
- (d) Both Assertion and Reason are False.

**Ans :**

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.

Chemical equation can be made more informative by writing physical state of reactants and products. Conditions required can also be mentioned. Both assertion and reason are true and reason explains assertion.

**40. Assertion :** Equation

$C(s) + O_2(g) \rightarrow CO_2(g)$  is an example of combination reaction.

**Reason :** In the given above equation, carbon and oxygen react to give carbon dioxide.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.
- (c) Assertion is True but the Reason is False.
- (d) Both Assertion and Reason are False.

**Ans :**

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.

When two or more substance (elements or compounds) combine to form a single product, the reactions are called combination reactions. In the given equation, carbon and oxygen combine to form a single product is carbon dioxide. So, both assertion and reason are true and reason explains assertion.

**41. Assertion :** Chips manufacturers usually flush bags of chips with oxygen gas.

**Reason :** It adds taste to chips.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.
- (c) Assertion is True but the Reason is False.
- (d) Both Assertion and Reason are False.

**Ans :**

- (d) Both Assertion and Reason are False.

Chips manufactures usually flush bags of chips with inert gas such as nitrogen to prevent the chips from getting oxidised. Hence, both assertion and reason are false.

**42. Assertion :** Precipitation reactions produce insoluble salts.

**Reason :** Precipitation reaction is a double decomposition reaction.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.



- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.

Precipitation reactions produce insoluble salts. Precipitation reaction is a double decomposition reaction but all double decomposition reactions are not precipitation reaction but only these reactions which form insoluble substances form precipitate. Hence both assertion and reason are true but reason does not explain assertion.

- 43. Assertion :** During digestion, carbohydrates are broken down to form glucose.

**Reason :** Glucose is necessary for breathing.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(c) Assertion is True but the Reason is False.

We need energy to stay alive. We get this energy from the food we eat and during digestion the carbohydrates present in food are broken down into glucose. Hence, assertion is true but reason is false.

- 44. Assertion :** Decomposition reactions are similar to combination reactions.

**Reason :** Both reactions need a catalyst to occur.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(d) Both Assertion and Reason are False.

Decomposition reaction is opposite to combination reaction. Hence, both assertion and reason are false.

- 45. Assertion :** Corrosion of iron is commonly known as rusting.

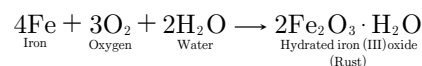
**Reason :** Corrosion of iron occurs in presence of water and air.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

When iron objects are exposed to humid air, a reddish brown mixture of iron oxide ( $\text{Fe}_2\text{O}_3$ ) and iron hydroxide  $[\text{Fe}(\text{OH})_3]$  formed. Rust is hydrated ferric hydroxide. It is soft and porous. Here, iron is oxidised to iron oxide.



This hydrated iron(III) oxide is commonly known as rust. If not controlled, rusting can corrode the entire iron present in an object. As rust is softer than iron, the strength of the object decreases when rusting takes place.

- 46. Assertion :** A reducing agent is a substance which can either accept electron.

**Reason :** A substance which helps in oxidation is known as reducing agent.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(d) Assertion (A) is false but reason (R) is true.

Any process which involves addition of hydrogen (or metallic element) or removal of oxygen (or non-metallic element) or gain of electrons(s) by atom or ion is called reduction reaction.

The substance which can bring about reduction of other substances is called a reducing agent.

- 47. Assertion :** The balancing of chemical equations is based on law of conservation of mass.

**Reason :** Total mass of reactants is equal to total mass of products.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.

- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

According to the law of conservation of mass, "Mass can neither be created nor destroyed in a chemical reaction". To obey this law the total mass of elements present in reactants must be equal to the total mass of elements present in the products. In other words, the number of atoms of each element remain the same, before and after a chemical reaction. Hence, we need to balance skeletal chemical equation.

**48. Assertion :** Carbon dioxide turns lime water milky.

**Reason :** Carbon dioxide sullies the water.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Carbon dioxide reacts with lime water (calcium hydroxide) to form milky precipitate of calcium carbonate.

**49. Assertion :** A chemical reaction becomes faster at higher temperatures.

**Reason :** At higher temperatures, molecular motion becomes more rapid.

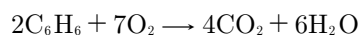
- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

A chemical reaction becomes faster at higher temperatures because at high temperature, the movement of particles are greater.

**50. Assertion :** The following chemical equation,



is a balanced chemical equation.

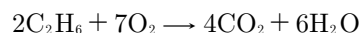
**Reason :** In a balanced chemical equation, the total number of atoms of each element may or may not equal on both side of the equation.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(c) Assertion is True but the Reason is False.

In a balanced chemical equation, the total number of atoms of each element are equal on both sides of the equation. Hence, the correct balanced chemical equation is,



**51. Assertion :**  $\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$

The above chemical equation is an example of displacement reaction.

**Reason :** Aluminium being more reactive than iron, displaces Fe from its oxide.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$  is a displacement reaction, Here, a highly reactive element (Al) displaces Fe from  $\text{Fe}_2\text{O}_3$ .

**52. Assertion :** Photosynthesis is considered as an endothermic reaction.

**Reason :** Energy gets released in the process of photosynthesis.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.  
 (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.  
 (c) Assertion is True but the Reason is False.  
 (d) Both Assertion and Reason are False.



Ans :

(c) Assertion (A) is true but reason (R) is false.

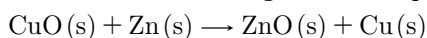
Photosynthesis is considered as an endothermic reaction because energy in the form of sunlight is absorbed by the green plants.

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**53. Assertion :** In the following chemical equation,



Zinc is getting oxidised and copper oxide is getting reduced.

**Reason :** The process in which oxygen is added to a substance is called oxidation whereas the process in which oxygen is removed from a substance is called reduction.

- (a) Both Assertion and Reason are True and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are True but Reason is not the Correct explanation of the Assertion.
- (c) Assertion is True but the Reason is False.
- (d) Both Assertion and Reason are False.

Ans :

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Because the reaction involves both oxidation and reduction in which, CuO is reduced to Cu and Zn is oxidised to ZnO.

**55.** Name the type of chemical reaction which takes place when quicklime is added to water.

Ans :

Comp 2021

It is exothermic and combination reaction.

**56.** Which one is a chemical change fermentation of fruit juice or diluting fruit juice ?

Ans :

Foreign 2010

Fermentation of fruit juice is the chemical change.

**57.** Which one is a chemical change rusting of iron or melting of iron ?

Ans :

Delhi 2017

Rusting of iron is the chemical change.

**58.** Hydrogen and oxygen combine with each other to form water. Name the reactants and products.

Ans :

Comp 2014

Hydrogen and oxygen are the reactants. Water is the product.

**59.** The molecular formula of chloride of cation  $X$  is  $\text{XCl}$ . What is the formula of nitrate of  $X$  ?

Ans :

OD 2011

$\text{XNO}_3$

**60.** Give the values of  $x, y, z$  for the equation :  
 $x\text{HCl} + \text{O}_2 \longrightarrow y\text{H}_2\text{O} + z\text{Cl}_2$

Ans :

Foreign 2009

$$x = 4, y = 2, z = 2$$

**61.** What is meant by skeletal equation ?

Ans :

OD 2018

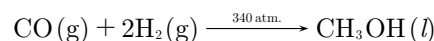
Unbalanced chemical equation is called as skeletal equation.

**62.** Write a balanced chemical equation to represent the following reaction :

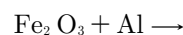
Carbon monoxide reacts with hydrogen gas at 340 atm. to form methyl alcohol.

Ans :

Foreign 2016

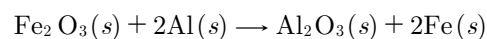


**63.** Complete and balance the following reaction :



Ans :

OD 2007



**54.** What is a balanced chemical equation ?

or

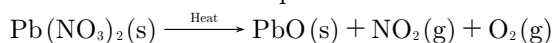
Define a balanced chemical equation.

Ans :

Comp 2021, 16

A chemical equation in which the number of atoms of each element involved is the same on the reactant and product sides is called a balanced chemical equation.

64. Balance the chemical equation:

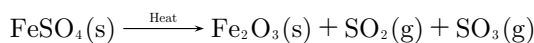


Ans :

Delhi 2010

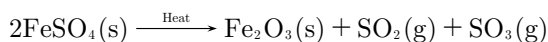


65. Balance the following chemical equation :



Ans :

Comp 2019



66. Name the type of the following reaction :



Ans :

Foreign 2006

Combination reaction.

67. Name the reaction in which two substances react to form a new substance.

Ans :

OD 2013

Combination reaction.

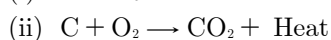
68. What type of reaction occurs in the digestion of food in our body ?

Ans :

Delhi 2009

Decomposition reaction.

69. Which of the following represents an exothermic reaction ?



Ans :

OD 2014

Second (ii) chemical reaction is an exothermic reaction.

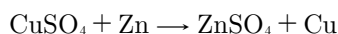
70. What is the reaction called in which an element, molecule or ion is removed by another ?

Ans :

Foreign 2017

Displacement reaction.

71. Name the type of reaction involved in the following :

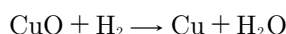


Ans :

OD 2006

Displacement reaction.

72. Identify the component oxidised in the following reaction :



Ans :

Delhi 2013

$\text{H}_2$  is oxidised into  $\text{H}_2\text{O}$ .

73. What is the reaction in which one substance is oxidised and the other is reduced called ?

Ans :

Foreign 2012

Redox reaction.

74. Name the reaction in which oxygen is removed from a substance.

Ans :

Comp 2020

Reduction.

75. Name the reaction in which oxygen is added to a substance.

Ans :

OD 2007

Oxidation.

76. Arrange iron, zinc and copper in the order of their increasing reactivity.

Ans :

Comp 2011

Copper < Iron < Zinc.

77. Give an example of an exothermic reaction.

Ans :

CBSE 2010

Burning of natural gas.



78. White silver chloride turns grey in sunlight. Why ?

Ans :

OD 2015

White silver chloride turns grey in sunlight due to decomposition of silver chloride into silver and chlorine by light.

79. Name the type of reaction in  $\text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3$ .

Ans :

Comp 2018

Combination reaction.

80. What changes do you observe in the iron nails and colour of copper sulphate solution if the iron nails are dipped in  $\text{CuSO}_4$  solution for 15 minutes ?

or

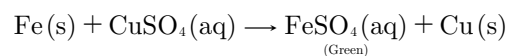
What happens when an iron nail is put inside copper sulphate solution ? Write reaction with observation.

Ans :

Delhi 2007

Iron nails turn brown in colour.

Copper sulphate solution turns light green.

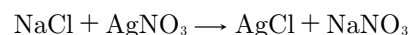


(Green)

81. Give an example of a double displacement reaction (only reaction with complete balanced equation).

Ans :

Comp 2009



82. What is the brown coloured gas evolved when lead nitrate crystals are heated in a dry test tube ?

**Ans :** Delhi 2013  
 $\text{NO}_2$  (Nitrogen dioxide).

83. Give an example of an endothermic reaction.

**Ans :** OD 2015  
Decomposition of  $\text{CaCO}_3$  on heating.  
 $\text{CaCO}_3(\text{s}) \xrightarrow{\text{Heat}} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

84. When magnesium ribbon burns in the air and forms a white ash, is magnesium oxidised or reduced ?

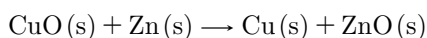
**Ans :** Foreign 2010  
Magnesium is oxidised.

85. In the following reaction identify which one is reduced and which one is oxidised ?



**Ans :** Delhi 2012  
 $\text{MnO}_2$  is reduced and  $\text{HCl}$  is oxidised.

86. Identify the substance that is oxidised and reduced in the reaction :



**Ans :** Comp 2017  
 $\text{CuO}$  is reduced and  $\text{Zn}$  is oxidised.

87. Name two effects of oxidation in daily life.

**Ans :** OD 2012  
The name of effects of oxidation in daily life are following :  
(i) Corrosion,  
(ii) Rancidity.

88. Why do iron articles become brown after some time?

**Ans :** Delhi 2006  
Due to corrosion iron articles become brown after some time.

89. Name two metals which are corroded.

**Ans :** OD 2009  
(i) Iron  
(ii) Copper

90. Why do the colour and taste of fats and oils change after sometimes ?

**Ans :** Comp 2012  
Due to rancidity the colour and taste of fats and oils change after sometimes.

91. Write two conditions of corrosion.

**Ans :** OD 2018  
(i) Presence of moisture.  
(ii) Presence of air (oxygen).

92. Why are bags of chips flushed with nitrogen gas ?

**or**  
Potato chips manufactures fill the packet of chips with nitrogen gas. Why ?

**Ans :** CBSE 2010, 16  
Nitrogen is an inert gas which prevents chips from rancidity or oxidation.

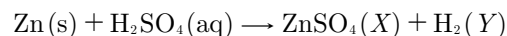
93. Why do silver ornaments lose their shine when kept for some time ?

**Ans :** Delhi 2019  
They get tarnished by reacting with atmospheric gases to become silver sulphide.

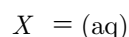
94. Name the gas that can be used for storage of fresh sample of chips for a long time.

**Ans :** Comp 2007  
Nitrogen.

95. Complete the missing component/variable given as  $X$  and  $Y$  in the following reaction :



**Ans :** Foreign 2012  
 $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$



and  $Y = (\text{g})$

96. Name the reducing agent in the following reaction :  
 $2\text{MnO}_2 + 4\text{Al} \rightarrow 3\text{Mn} + 2\text{Al}_2\text{O}_3$

**Ans :** Delhi 2014  
 $\text{Al}$  is a reducing agent in the above chemical reaction.

97. A silver spoon is kept immersed in an aqueous solution of copper sulphate. What change would be observed in the spoon as well as in the solution ?

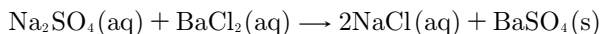
**Ans :** Comp 2012  
No change will be observed in the silver spoon and aqueous solution of copper sulphate because silver is less reactive than copper.

98. Balance the following chemical equation :



**Ans :** OD 2009  
 $3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$

99. Identify the type of reaction in the chemical equation given below :



Ans :

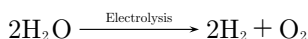
OD 2013

Double displacement reaction.

100. Give one example of the decomposition reaction. Write the balanced chemical equation which occurs on passing electric current. Write the balanced chemical equation.

Ans :

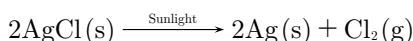
Delhi 2009



101. Write one equation for decomposition reaction which occurs in the presence of light.

Ans :

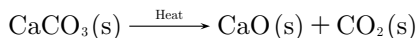
Foreign 2012



102. Write one equation for decomposition reaction which occurs in the presence of heat.

Ans :

SQP 2016



103. State one industrial application of reduction process.

Ans :

SQP 2008

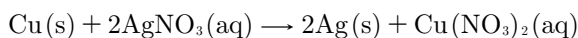
It is used in the metallurgical processes for the refining of metals.

104. What can be seen when a strip of copper metal is placed in a solution of silver nitrate ?

Ans :

OD 2006

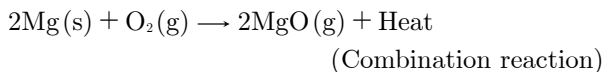
Metallic silver is precipitated and a blue solution containing copper nitrate is obtained.



105. State the type of chemical reaction with chemical equation which takes place in the following :  
Magnesium wire burnt in air.

Ans :

Foreign 2014



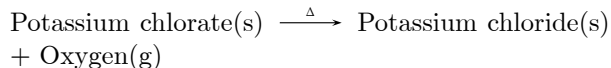
106. Define the term decomposition reaction.

Ans :

Delhi 2011

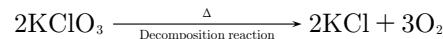
A chemical reaction in which a single compound decomposes into two or more simpler substances (elements or compounds) is called a decomposition reaction).

107. Write the balanced equation for the following reaction and identify the type of reaction :



Ans :

OD 2010



108. Tell whether respiration is exothermic reaction or endothermic reaction. Why ?

Ans :

Comp 2011

Respiration is exothermic because heat is evolved due to oxidation of glucose with oxygen that we inhale from the atmosphere.

109. What do you mean when we say that a substance has gone rancid ?

Ans :

SQP 2006

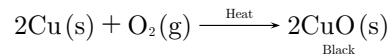
It means that the smell and taste of the substance have changed.

110. Identify the type of chemical reaction and write balanced chemical equation for the following :

On heating copper powder in a china dish, the surface of copper powder becomes black.

Ans :

Foreign 2010



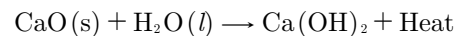
This is a oxidation-reduction reaction.

111. Identify the type of chemical reaction and write the balanced chemical equation for the following :

Quicklime reacts vigorously with water releasing a large amount of heat.

Ans :

OD 2012



This is a combination reaction

112. State reason for the following : Iron articles loose their shine gradually.

Ans :

Foreign 2015

When iron articles come in contact with air, moisture, acids etc., they loose their shine gradually and get coated with reddish brown powder. This is called rusting of iron.

113. What are antioxidants ? Why are they added to fat and oil containing foods ?

Ans :

Delhi 2013

Anti-oxidants are substances that are used to slow down or stop the process of the oxidation so that

the fats and oil containing food do not undergo rancidity.

114. Define redox reaction.

Ans :

SQP 2008

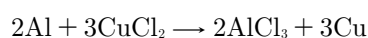
Those chemical reactions in which both oxidation and reduction occurs simultaneously are known as redox reactions.

115. Write the balanced chemical equation for the following reaction :

Aluminium + Copper chloride  $\longrightarrow$  Aluminium chloride + Copper.

Ans :

Comp 2009

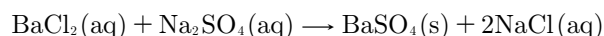


116. Express the following facts in the form of a balanced chemical equation :

Barium chloride solution reacts with sodium sulphate solution to give insoluble barium sulphate and a solution of chloride.

Ans :

Delhi 2008



## TWO MARKS QUESTIONS

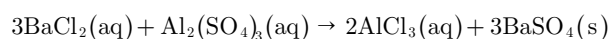
117. Translate the following statement into a balanced chemical equation.

“When barium chloride reacts with aluminium sulphate, aluminium chloride and barium sulphate are formed.”

State the type of this reaction giving reason to justify your answer.

Ans :

OD 2024

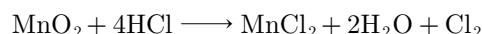


This reaction is an example of double displacement (precipitation) reaction.

Since exchange of ions takes place between both the reactants leading to the formation of a precipitate, it is an example of double displacement (precipitation) reaction.

118. State whether the given chemical reaction is a redox reaction or not.

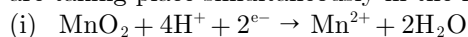
Justify: your answer



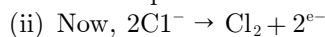
Ans :

OD 2023

The reaction given in the question is an example of a redox reaction because the oxidation and reduction are taking place simultaneously in the reaction.

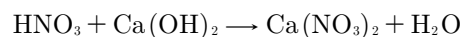


In the above reaction,  $\text{MnO}_2$  is converted to  $\text{Mn}^{2+}$  because addition of electrons takes place in this reaction, hence we can say that  $\text{MnO}_2$  is the compound which is reduced.



In the above reaction,  $\text{Cl}^-$  is oxidized to  $\text{Cl}_2$  because removal of electrons takes place. Hence, we can say that the compound which is oxidized is  $\text{HCl}$ .

119. Give the chemical name of the reactants as well as the products of the following chemical equation :



Ans :

Comp 2021

Reactants –  $\text{HNO}_3$  (nitric acid),  $\text{Ca}(\text{OH})_2$  (calcium hydroxide)

Product –  $\text{Ca}(\text{NO}_3)_2$  (calcium nitrate),  $\text{H}_2\text{O}$  (water).

120. What is a chemical equation ? Illustrate with an example.

Ans :

SQP 2018

The mode of communicating facts in chemical language about a chemical reaction is called a chemical equation. For example, the reaction of zinc with dilute sulphuric acid to produce zinc sulphate and hydrogen is given by the following chemical equation :



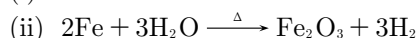
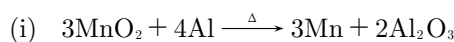
121. Change the following reactions into balanced chemical equations.

(i) Manganese dioxide is heated with aluminium powder.

(ii) Iron is treated with steam.

Ans :

OD 2015



122. What do you understand by skeletal and balanced chemical equation ?

Ans :

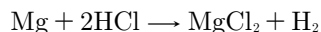
Foreign 2010

If the number of atoms of any element in a chemical equation is not equal on both sides, it is called a skeletal equation. For example,



In a balanced equation, the number of atoms

of different elements on both sides of a chemical equation are equal. For example,



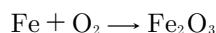
**123.** What are the essentials of a chemical equation?

**Ans :**

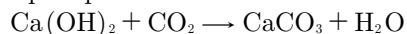
OD 2019

- It must refer to an actual chemical reaction.
- It should be molecular. For example, H, O, N should be written as  $\text{H}_2$ ,  $\text{O}_2$ ,  $\text{N}_2$ .
- It should be balanced and conform to the law of conservation of matter.

**124.** (i) Rewrite the following equation in a balanced form:



- (ii) Rewrite the following equation indicating that a solution of lime in water has been used and that a precipitate is formed in the reaction.



**Ans :**

Delhi 2006

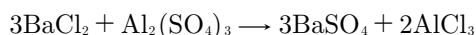
- $4\text{Fe} + 3\text{O}_2 \longrightarrow 2\text{Fe}_2\text{O}_3$
- $\text{Ca}(\text{OH})_2(aq) + \text{CO}_2(g) \longrightarrow \text{CaCO}_3(s) \downarrow + \text{H}_2\text{O}(l)$

**125.** Write the balanced chemical equation for the following reaction and write the name of the reaction :

Barium chloride + Aluminium sulphate  $\rightarrow$  Barium sulphate + Aluminium chloride

**Ans :**

SQP 2009



This is a double displacement reaction.

**126.** Write balanced chemical equations to represent the following statements :

- Carbon (coke) burns in air to form carbon dioxide gas.
- A piece of sodium metal on putting in water forms caustic soda and hydrogen gas.

**Ans :**

Comp 2020

- $\text{C}(s) + \text{O}_2(g) \xrightarrow{\uparrow} \text{CO}_2(g) \uparrow$
- $2\text{Na}(s) + 2\text{H}_2\text{O}(l) \longrightarrow 2\text{NaOH}(aq) + \text{H}_2(g) \uparrow$

**127.** Complete and balance the following ionic equations :

- $\text{Cu} + \text{Ag}^+ \longrightarrow \text{Cu}^{2+} + \text{Ag}$
- $\text{Na} + \text{H}^+ \longrightarrow \text{Na}^+ + \text{H}_2$
- $\text{Sn}^{2+} + \text{Hg}^{2+} \longrightarrow \text{Sn}^{4+} + \text{Hg}^+$
- $\text{Fe} + \text{H}^+ \longrightarrow \text{Fe}^{2+} + \text{H}_2$

**Ans :**

Foreign 2017

- $\text{Cu} + 2\text{Ag}^+ \longrightarrow \text{Cu}^{2+} + 2\text{Ag}$
- $\text{Na} + 2\text{H}^+ \longrightarrow \text{Na}^+ + \text{H}_2$   
 $2\text{Na} + 2\text{H}^+ \longrightarrow 2\text{Na}^+ + \text{H}_2$
- $\text{Sn}^{2+} + 2\text{Hg}^{2+} \longrightarrow \text{Sn}^{4+} + 2\text{Hg}^+$
- $\text{Fe} + 2\text{H}^+ \longrightarrow \text{Fe}^{2+} + \text{H}_2$

**128.** Translate the following statements into chemical equations and then balance them :

- Calcium disulphide burns in air to give carbon dioxide and sulphur dioxide.
- Sodium metal reacts with water to give sodium hydroxide and hydrogen gas.
- Aluminium metal replaces hydrogen from sulphuric acid and gives aluminium sulphate.
- Ferric oxide oxidises CO to  $\text{CO}_2$  and itself gets reduced to Fe.

**Ans :**

Comp 2013

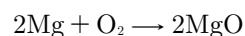
- $\text{CS}_2 + 3\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{SO}_2$
- $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2$
- $2\text{Al} + 3\text{H}_2\text{SO}_4 \longrightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2$
- $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$

**129.** A magnesium ribbon is burnt in oxygen to give a white compound 'X' accompanied by emission of light.

- Write the chemical formula of 'X'.
- Write a balanced chemical equation, when 'X' is dissolved in water.

**Ans :**

OD 2008



- X is MgO
- $\text{MgO} + \text{H}_2\text{O} \longrightarrow \text{Mg}(\text{OH})_2$

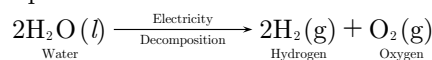
**130.** Explain electrolytic decomposition with suitable examples.

**Ans :**

Delhi 2013

When electricity is passed through a molten compound which is ionic nature, then the ions of the compound separate into components decomposing the compound.

Example :



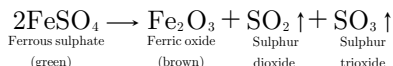
This is an example of electrolytic decomposition since a compound is decomposed by passing electricity through it.

**131.** When ferrous sulphate is heated, the green colour of ferrous sulphate changes to brown due to the formation of ferric oxide, with a smell of burning sulphur. Explain the reaction.

**Ans :**

Foreign 2015

The given reaction can be represented as :



Since ferrous sulphate is decomposed, on heating, into ferric oxide, sulphur dioxide and sulphur trioxide, this is a thermal decomposition reaction.

**132.** Consider the following displacement reactions :

- (i)  $\text{CuSO}_4(\text{aq}) + \text{Fe}(\text{s}) \longrightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$   
 (ii)  $\text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe}(\text{s})$

State which is the most reactive and which is the least reactive metal out of zinc, copper and iron.

**Ans :**

Delhi 2007

- (i) In the first reaction, iron displaces Cu from  $\text{CuSO}_4$  solution, so iron is more reactive than copper.  
 (ii) In the second reaction, zinc displaces iron from its sulphate solution, so zinc is more reactive than iron.

Thus, zinc is more reactive than iron which is more reactive than copper. Thus, zinc is the most reactive and copper is the least reactive metal.

**133.** Below are given two chemical reactions. Which one is a combination reaction and which is a displacement reaction ?

- (i)  $2\text{KBr}(\text{aq}) + \text{Cl}_2(\text{aq}) \longrightarrow 2\text{KCl}(\text{aq}) + \text{Br}_2(\text{aq})$   
 (ii)  $\text{Fe}(\text{s}) + \text{S}(\text{s}) \longrightarrow \text{FeS}(\text{s})$

**Ans :**

SQP 2009

- (i) Displacement reaction.  
 (ii) Combination reaction.

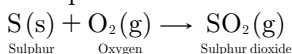
**134.** What are oxidation reactions ?

**Ans :**

Foreign 2011

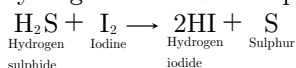
It is a process in which (a) oxygen or any electronegative element is added up, or (b) hydrogen or any electro positive element is removed, or (c) electrons are released. Examples are :

- (a) Sulphur burns in air with a blue flame to form sulphur dioxide. We see that oxygen is added up to sulphur.



(Addition of oxygen to sulphur)

- (b) Hydrogen sulphide combines with iodine to give hydrogen iodide and sulphur.



(Removal of hydrogen from  $\text{H}_2\text{S}$ )

- (c) Sodium atom ionises to give  $\text{Na}^+$  ions.



**135.** Classify the following on the basis of type of chemical change :

- (i)  $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$   
 (ii)  $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$   
 (iii)  $\text{H}_2\text{S} + \text{Cl}_2 \longrightarrow 2\text{HCl} + \text{S}$   
 (iv)  $\text{NaBr} + \text{AgNO}_3 \longrightarrow \text{AgBr} + \text{NaNO}_3$

**Ans :**

SQP 2015

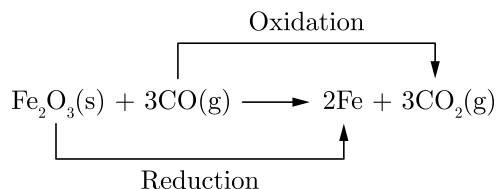
- (i) Combination reaction.  
 (ii) Decomposition reaction.  
 (iii) Displacement reaction.  
 (iv) Double decomposition reaction.

**136.** "Oxidation and reduction processes occur simultaneously." Justify this statement with the help of an example.

**Ans :**

OD 2012

In the following reaction one substance gets oxidised and the other gets reduced. So, oxidation and reduction occur simultaneously.



**137.** "Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate."

- (i) Translate the above statement into a chemical equation.  
 (ii) State two types in which this reaction can be classified.

**Ans :**

Delhi 2014

- (i)  $3\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \longrightarrow 2\text{AlCl}_3 + 3\text{BaSO}_4$   
 (ii) (a) Double displacement reaction.  
 (b) Precipitation reaction.

**138.** Why do we store silver chloride in dark coloured bottles ? Explain in brief.

**Ans :**

OD 2016

Silver chloride on exposure to sunlight may decompose as per the following reaction :



Therefore, it is stored in dark coloured bottles.



139. (i) Define photochemical reaction.  
 (ii) Write the balanced equation for the following reaction and identify the type of reaction :  
 Potassium bromide + Barium iodide → Potassium iodide + Barium bromide.

Ans :

Comp 2010

- (i) A decomposition reaction which takes place in presence of sunlight is called photochemical reaction.  
 (ii)  $2\text{KBr} + \text{BaI}_2 \rightarrow 2\text{KI} + \text{BaBr}_2$   
 Double displacement reaction.
140. "A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed."  
 (i) Translate the above statement into a chemical equation.  
 (ii) State two types for this reaction.

or

A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction.

Ans :

Foreign 2008

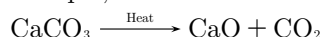
- (i)  $\text{KCl(aq)} + \text{AgNO}_3\text{(aq)} \rightarrow \text{AgCl(s)} + \text{KNO}_3\text{(aq)}$   
 (ii) (a) Double displacement reaction.  
 (b) Precipitation reaction.
141. What is meant by thermal decomposition reaction ? Explain with an example.

Ans :

OD 2013

Decomposition reaction carried out by heating is called thermal decomposition reaction.

For example,



142. An aluminium can is used to store ferrous sulphate solution. It is observed that in few days holes appeared in the can. Explain the observation and write chemical equation to support your answer.

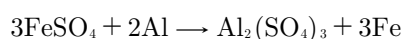
Ans :

Comp 2015

Displacement reaction occurs.

**Reason :** Aluminium is more reactive than iron. Aluminium sulphate is formed and iron is precipitated out.

Equation :

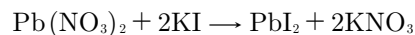


143. Aqueous solutions of lead nitrate and potassium iodide are mixed together. What change in colour will you observe? Write a balanced equation for the reaction and the type of reaction.

Ans :

OD 2010

Yellow colour forms.



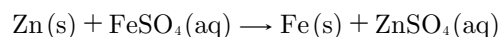
Double displacement reaction.

144. What would you observe when zinc is added to a solution of iron (II) sulphate. Name the type of reaction and write the chemical equation.

Ans :

Delhi 2007

Green coloured solution turns colourless and iron metal is deposited.



145. A small amount of ferrous sulphate is heated in a hard glass test tube.  
 (i) Write the equations involved in the above reaction.  
 (ii) What type of reaction is taking place ?

Ans :

Delhi 2013

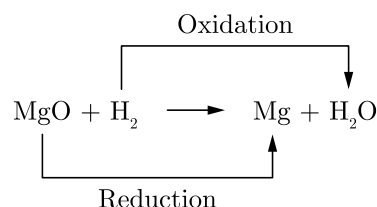
- (i)  $2\text{FeSO}_4 \xrightarrow{\Delta} \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$   
 (ii) Thermal decomposition.

146. What is a redox reaction ? Write down a chemical equation representing it.

Ans :

Comp 2016

The reaction in which one reactant get oxidised while the other, get reduced is called redox reaction.

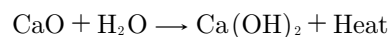


147. Define combination reaction. Give one example of a combination reaction which is also exothermic.

Ans :

SQP 2009, 12

When two or more than two substances combine and form a single substance, it is called combination reaction.

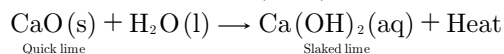


148. A white solid when dropped in water produces a hissing sound. What the solid may be ? Give the chemical reaction for above. Name the product formed.

**Ans :**

Foreign 2013, 11

White solid is quick lime (CaO).

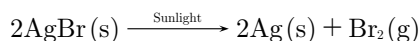
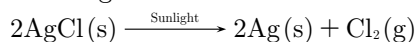


- 149.** Name two salts that are used in black and white photography. Give reactions when they are exposed to light.

**Ans :**

Delhi 2006

AgCl and AgBr



- 150.** When the powder of a common metal is heated in an open china dish, its colour turns black. However, when hydrogen is passed over the hot black substance so formed, it regains its original colour. Based on the above information answer the following questions :

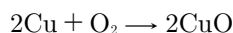
- What type of chemical reaction takes place in each of the two given steps ?
- Name the metal initially taken in the powder form. Write balanced chemical equations for both the reactions.

**Ans :**

Comp 2009

- Oxidation and Reduction.
- Metal : Copper.

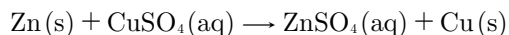
Reaction :



- 151.** What happens when a strip of zinc is dipped into copper sulphate solution ? Write the balanced chemical equation of the reaction.

**Ans :**

OD 2010

Zn displaces Cu from CuSO<sub>4</sub> solution.CuSO<sub>4</sub> solution becomes colourless.

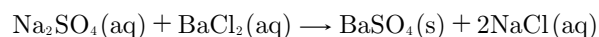
- 152.** Define double displacement reaction with the help of an example.

**Ans :**

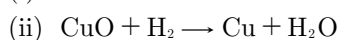
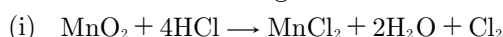
Delhi 2008

A reaction in which there is an exchange of ions between the reactants is called double displacement reaction.

Example :



- 153.** Identify the substance oxidised and the substance reduced in the following reactions :

**Ans :**

SQP 2012

Oxidised : HCl, H<sub>2</sub>Reduced : MnO<sub>2</sub>, CuO

- 154.** In the electrolysis of water;

- Name the gases collected at the cathode and the anode.
- Why is a few drops of dil. H<sub>2</sub>SO<sub>4</sub> added to the water ?

**Ans :**

Foreign 2014

- Cathode : Hydrogen  
Anode : Oxygen
- To make water a better conductor of electricity.

- 155.** (a) Why is combustion reaction an oxidation reaction?  
(b) How will you test whether the gas evolved in a reaction is hydrogen?

**Ans :**

Comp 2017

- (a) Combustion reaction is an oxidation reaction because it is always carried in the presence of air or oxygen.



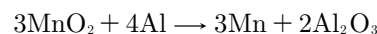
- (b) Bring a burning match stick close to the mouth of the tube from which hydrogen gas escapes. The gas will immediately catch fire and this will be accomplished by pop sound.

- 156.** Name the reducing agent in the following reaction :  

$$3\text{MnO}_2 + 4\text{Al} \longrightarrow 3\text{Mn} + 2\text{Al}_2\text{O}_3$$
  
 State which is more reactive, Mn or Al and why ?

**Ans :**

Delhi 2013



In the above reaction, aluminium is being oxidised. The element which is oxidised is a reducing agent. So, Al in the above case is a reducing agent.

Al is more reactive as it is placed higher in the activity series.

- 157.** Classify the following as exothermic and endothermic reactions :

- Photosynthesis
- Respiration
- Burning of natural gas
- Electrolysis of water

**Ans :**

OD 2011

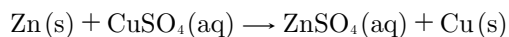
- Photosynthesis : Endothermic reaction.
- Respiration : Exothermic reaction.
- Burning of natural gas : Exothermic reaction.
- Electrolysis of water : Endothermic reaction.

- 158.** A thin zinc plate was kept in a glass container having  $\text{CuSO}_4$  solution. On examining it was found that the blue colour of the solution is getting lighter and lighter. After a few days when the zinc plate was taken out of the solution, a number of small holes were noticed in it. State the reason and write chemical equation of the reaction.

**Ans :**

SQP 2016

Zn metal from zinc plate was dissolved in solution which replaced copper from  $\text{CuSO}_4$  solution as zinc is more reactive than copper. As a result, a number of holes were noticed in zinc plate and blue colour of the  $\text{CuSO}_4$  solution becomes lighter.

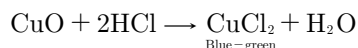


- 159.** On adding dilute  $\text{HCl}$  to copper oxide powder, the solution formed is blue-green. Predict the new compound which imparts a blue-green colour to the solution.

**Ans :**

Delhi 2011, 07

The new compound formed is copper (II) chloride  $\text{CuCl}_2$ , which imparts blue-green colour to the solution.



- 160.** Identify the substance oxidised, substance reduced, oxidising agent and reducing agent.



**Ans :**

Foreign 2014, OD 2012

Substance oxidised :  $\text{HCl}$

Substance reduced :  $\text{MnO}_2$

Oxidising agent :  $\text{MnO}_2$

Reducing agent :  $\text{HCl}$

- 161.** Aluminium is a reactive metal but is still used for packing food articles. Why ?

**Ans :**

Delhi 2015

Aluminium is quite reactive, when it is kept in air or oxygen for sometime, the upper surface gets converted into its oxide called aluminium oxide ( $\text{Al}_2\text{O}_3$ ), which gets deposited as a thin coating on the surface of the metal. This aluminium oxide is passive. Therefore, the metal is used for packing food articles which do not get spoiled in the foil.

- 162.** When a green iron salt is heated strongly, the colour finally changes to black and odour of burning sulphur is given out.

(a) Name the iron salt.

(b) Name the type of reaction that takes place during the heating of iron salt.

**Ans :**

OD 2010

(a) Ferrous sulphate.

(b) Decomposition reaction.

- 163.** State the kind of chemical reactions in the following samples :

(a) Digestion of food in stomach.

(b) Combination of coal in air.

**Ans :**

Comp 2007

(a) Decomposition reaction.

(b) Combination reaction.

- 164.** When hydrogen gas burns in presence of oxygen, water is formed and when water is electrolysed then hydrogen and oxygen gases are produced. State the kind of reaction that takes place.

(a) in the first case

(b) in the second case.

**Ans :**

Delhi 2009

(a) Combination reaction.

(b) Decomposition reaction.

- 165.** Give one example of a redox reaction which is also a displacement reaction.

**Ans :**

Delhi 2017



The reaction of zinc oxide with carbon is a redox reaction as well as a displacement reaction. This is a redox reaction because zinc oxide is reduced to zinc (by losing oxygen) whereas carbon is oxidised to carbon monoxide (by gaining oxygen). This is a displacement reaction because carbon is displacing zinc from zinc oxide to form zinc metal and  $\text{CO}$ .

- 166.** Which two observations will be made when quicklime is added to water ?

**Ans :**

Comp 2006

(i) Reaction takes place vigorously.

(ii) A large amount of heat is produced.

- 167.** What is observed when carbon dioxide gas is passed through lime water :

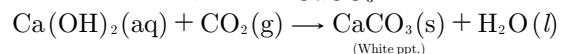
(i) For a short duration.

(ii) For a long duration.

**Ans :**

Foreign 2016

(i) For short duration : Lime water turns milky due to the formation of  $\text{CaCO}_3$ .



(ii) For long duration : A clear solution is obtained due to formation of calcium bicarbonate which is soluble in water.



- 168.** State what happens when zinc granules heated with sodium hydroxide solution. Write the balanced chemical equation for the reaction. Name the main product formed in this reduction.

**Ans :**

OD 2011

When zinc granules are heated with NaOH solution, sodium zincate is formed with the evolution of hydrogen gas.



The main product formed in this reaction is  $\text{H}_2$  gas.

- 169.** When potassium iodide solution is added to a solution of lead(II) nitrate in a test tube, a precipitate is formed.

- State the colour of this precipitate.
- Name the compound precipitated.
- Write the balanced chemical equation for this reaction.

**Ans :**

SCP 2015, Comp 2013

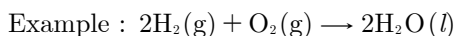
- Yellow
- Lead(II) oxide.
- $\text{Pb(NO}_3)_2\text{(aq)} + 2\text{KI(aq)} \longrightarrow \text{PbI}_2\text{(s)} + 2\text{KNO}_3\text{(aq)}$   
yellow

- 170.** What is a combination reaction? State one example giving balanced chemical equation for the reaction.

**Ans :**

Foreign 2016, 09

A chemical reaction in which two or more substances (elements or compounds) combine to form a single substance is called combination reaction.



- 171.** Select (i) Combination reaction and (ii) decomposition reaction from the following chemical equations :

- $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
- $\text{NaBr} + \text{AgNO}_3 \longrightarrow \text{AgBr} + \text{NaNO}_3$
- $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$
- $\text{H}_2\text{S} + \text{Cl}_2 \longrightarrow 2\text{HCl} + \text{S}$

**Ans :**

Comp 2011

- Reaction (a) is combination reaction.
- Reaction (c) is decomposition reaction.

- 172.** Complete and balance the following:

- $\text{P} + \text{O}_2 \longrightarrow$
- $\text{MnSO}_4 + \text{H}_2\text{S} \longrightarrow$

**Ans :**

OD 2006

- $\text{P}_4 + 5\text{O}_2 \longrightarrow 2\text{P}_2\text{O}_5$
- $\text{MnSO}_4 + \text{H}_2\text{S} \longrightarrow \text{MnS} + \text{H}_2\text{SO}_4$

- 173.** Write balanced equation for each of the following :

- Chlorine gas burns in hydrogen gas to give hydrogen chloride.
- Hydrogen sulphide burns in air to give water and sulphur dioxide.

**Ans :**

Delhi 2017

- $\text{Cl}_2 + \text{H}_2 \longrightarrow 2\text{HCl}$
- $2\text{H}_2\text{S} + 3\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + 2\text{SO}_2$

- 174.** List four observations that help us to determine whether a chemical reaction has taken place.

**Ans :**

OD 2013

- Evolution of a gas.
- Change in temperature.
- Change in state.
- Change in colour.

- 175.** Identify the type of each of the following reactions. Also write balanced chemical equation for each.

- The reaction mixture becomes warm.
- An insoluble substance is formed.

**Ans :**

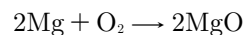
Delhi 2012

- It is a combination reaction.  
 $\text{CaO(s)} + \text{H}_2\text{O(l)} \longrightarrow \text{Ca(OH)}_2\text{(aq)} + \text{Heat}$
- It is a double displacement reaction.  
 $\text{Na}_2\text{SO}_4\text{(aq)} + \text{BaCl}_2\text{(aq)} \longrightarrow \text{BaSO}_4\text{(s)} + 2\text{NaCl(aq)}$

- 176.** Write a balanced chemical equation to show the chemical change that occurs when magnesium ribbon is burnt in air. Name the product formed and mention the characteristics of the flame produced.

**Ans :**

Delhi 2016



The product formed is magnesium oxide.

Magnesium burns producing a brilliant white light tour.

- 177.** Express the following facts in the form of a balanced chemical equation :

- When a strip of copper metal is placed in a solution of silver nitrate, metallic silver is precipitated and a solution containing copper nitrate is formed.
- Barium chloride solution reacts with sodium sulphate solution to give insoluble barium sulphate and a solution of sodium chloride.

**Ans :**

OD 2010

- $\text{Cu(s)} + 2\text{AgNO}_3\text{(aq)} \longrightarrow 2\text{Ag} + \text{Cu(NO}_3)_2\text{(aq)}$
- $\text{BaCl}_2\text{(aq)} + \text{Na}_2\text{SO}_4\text{(aq)} \longrightarrow \text{BaSO}_4\text{(s)} + 2\text{NaCl(aq)}$

- 178.** Define a chemical equation. What is an unbalanced equation called? What law covers the balancing of a chemical equation? State it.

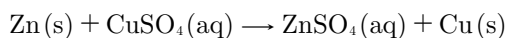
**Ans :**

Comp 2013

A chemical equation is a shorthand representation of a chemical reaction using the symbols and formulae of substances involved in the reaction. An unbalanced chemical equation is called skeletal chemical equation. The law of conservation of mass governs the balancing of a chemical equation.

States that, "mass can neither be created nor destroyed in a chemical reaction."

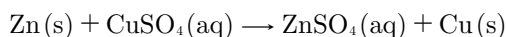
- 179.** Reverse of the following chemical reaction is not possible :



Justify this statement with reason.

**Ans :**

Foreign 2011



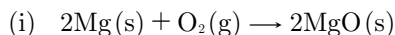
The reverse of the above reaction is not possible because Cu is less reactive than Zn. So, it cannot displace Zn from its salt solution.

- 180.** State the type of chemical reactions with chemical equations that take place in the following :

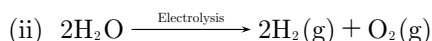
- Magnesium wire is burnt in air.
- Electric current is passed through water.

**Ans :**

Delhi 2014



This is a combination reaction.

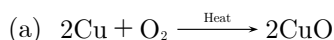


- 181.** Giving chemical equation answer the following:

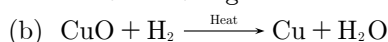
- What happens when copper is heated in air?
- What happens when the product obtained in above reaction is heated in hydrogen?

**Ans :**

OD 2007



A black coating is formed.



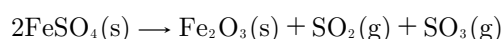
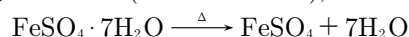
Black coating turns brown.

- 182.** What is the colour of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  crystals? How does this colour change upon heating? Give balanced chemical equation for the change.

**Ans :**

Delhi 2010

$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  is given in colour and loses water of crystallisation when it is heated. It is then decomposed to give  $\text{Fe}_2\text{O}_3$  (brown coloured),  $\text{SO}_2$  and  $\text{SO}_3$ .



- 183.** (a) Why is combustion reaction an oxidation reaction?

- (b) How will you test whether the gas evolved in a reaction is hydrogen?

**Ans :**

Comp 2006

- (a) Combustion reaction is an oxidation reaction because it is always carried in presence of air or oxygen.

- (b) Bring a burning match stick closed to the mouth of the tube from which hydrogen gas escapes. The gas will immediately catch fire and will be accompanied by pop sound.

- 184.** You must have tasted or smelt the containing food materials left for a long time. Such foods taste and smell bad. What is the reason for this, and the name given to the phenomenon? List two measures taken at home to prevent it.

**Ans :**

Foreign 2009

It happens due to oxidation of fatty matters contained in the food and this phenomenon is known as rancidity.

Measures of prevention :

- Keeping such food materials in air tight containers.
- Refrigeration of such food materials.

- 185.** Write two examples of every day life, where redox reactions are taking place.

**Ans :**

Delhi 2017

- (i) Silver jewellery tarnishes due to reaction of  $\text{H}_2\text{S}$  gas of the air and silver is oxidised to silver sulphide.

- (ii) In rusting of iron, iron is oxidised to iron oxide.

- 186.** Food items can be preserved for longer time when kept in a refrigerator. What is the reason behind this fact?

**Ans :**

Comp 2011

At lower temperature, the oxidation process of the food items gets slowed down. Hence, these food items can be preserved for longer time.

- 187.** A student has been collecting silver coins and copper coins. One day she observed a black coating on copper coins. Which chemical phenomenon is responsible for these coatings? Write the chemical name of black and green coatings.

**Ans :**

Foreign 2009

The phenomenon responsible for these coatings is corrosion. Silver gets black coating of silver sulphide

when it reacts with hydrogen sulphur in the air.

Copper gives a green coating of copper carbonate when it reacts with moist carbon dioxide in the air.

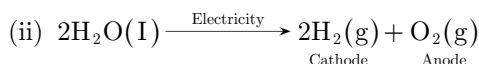
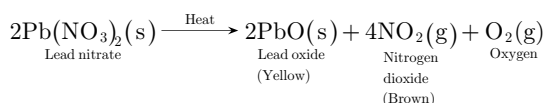
### THREE MARKS QUESTIONS

188. (i) Define a decomposition reaction. Write chemical equation for the reaction that occurs when lead nitrate is heated strongly in a boiling tube.  
 (ii) In electrolytic decomposition of water two gases are liberated at the electrodes. Give the mass ratio of the gas liberated at the cathode and at the anode.

Ans :

OD 2024

- (i) The reactions in which a single reactant breaks down to form two or more substances in presence of heat, light or electricity are known as decomposition reactions.



Mass of  $\text{H}_2$  evolved at cathode =  $2 \times 2 = 4 \text{ g}$

Mass of  $\text{O}_2$  evolved at anode =  $1 \times 32 = 32 \text{ g}$

Mass of  $\text{H}_2$  : Mass of  $\text{O}_2 = 4 : 32 = 1 : 8$

189. Identify the type of each of the following reactions stating reason for your answers :

- (a)  $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe} + \text{heat}$   
 (b)  $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$   
 (c)  $\text{ZnCO}_3 \xrightarrow{\text{heat}} \text{ZnO} + \text{CO}_2$

Ans :

Comp 2021

- (a) Chemical reaction (A) is a single displacement reaction. Aluminium (Al) being more reactive than iron (Fe) displaces less reactive metal Fe from its compound  $\text{Fe}_2\text{O}_3$ . This displacement is highly exothermic and releases a lot of heat.  
 (b) Double displacement reaction in this double displacement reaction, two compounds  $\text{Pb}(\text{NO}_3)_2$  and  $\text{KI}$  react by exchange of ions to form two new compounds, lead iodide and potassium nitrate. For example  $\text{Pb}^{2+}$  of  $\text{Pb}(\text{NO}_3)_2$  react with  $2\text{I}^-$  of  $2\text{KI}$  to form  $\text{PbI}_2$ . Similarly  $2\text{K}^+$  of  $2\text{KI}$  react with  $2(\text{NO}_3^-)$  of  $\text{Pb}(\text{NO}_3)_2$  to form  $2\text{KNO}_3$ . In this reaction  $\text{PbI}_2$  is formed as a precipitate (an insoluble solid) which separates out from the solution so this reaction is also precipitation reaction.

- (c) Thermal decomposition reaction in this reaction a single compound zinc carbonate ( $\text{ZnCO}_3$ ) when heat breaks down into two compounds zinc oxide ( $\text{ZnO}$ ) and carbon dioxide ( $\text{CO}_2$ ). When a decomposition reaction is carried out by heating, it is called. Thermal decomposition reaction.

190. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, the colour of the solution fades and a black precipitate is obtained.

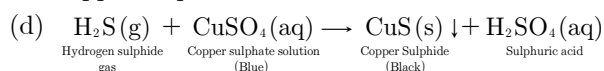
- (a) Name the type of reaction mentioned above.  
 (b) Why does the colour of the solution fade away ?  
 (c) Write the chemical name of the black precipitate formed.  
 (d) Give the balanced chemical equation for the reaction involved.

Ans :

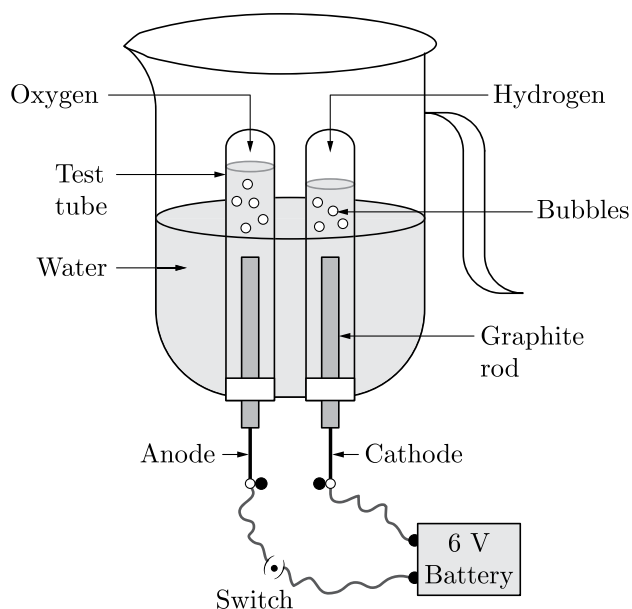
SQP 2021

When hydrogen sulphide gas is passed a blue solution of copper sulphate, the blue colour of the solution fades and a black precipitate of copper sulphide is formed alongwith sulphuric acid.

- (a) The type of the reaction mentioned above is double displacement reaction.  
 (b) The blue colour of copper sulphate fades due to its reaction with hydrogen sulphide gas and results into the formation of colourless solution of sulphuric acid.  
 (c) The chemical name of black precipitate is copper sulphide.



191. Study the figure given below and answer the following questions :





- Name the process depicted in the diagram.
- Write the composition of the anode and the cathode.
- Write the balanced chemical equation of the reaction taking place in this case.
- The reaction does not take place if a few drops of dilute sulphuric acid are not added to water. Why?

Ans :

SQP 2018

- Electrolytic decomposition of water/electrolysis of water.
- The gas collected at cathode is hydrogen and it is double the volume of than that of oxygen.  
The gas collected at anode is oxygen which has volume half than that of hydrogen.  
The deficiency of iodine in the diet of a person produces less thyroxine hormone and causes goitre.  
The deficiency of insulin hormone in the body causes a disease known as diabetes.
- $2\text{H}_2\text{O}(l) \xrightarrow[\text{Current}]{\text{Electric}} 2\text{H}_2(g) + \text{O}_2(g)$
- The reaction does not take place if a few drops of dilute sulphuric acid are not added to water. Water is not a good conductor of electricity sulphuric acid is added in the water to make, it a good conductor of electricity.

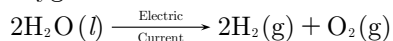
192. In the electrolysis of water :

- Name the gases liberated at anode and cathode.
- Why is it that the volume of gas collected on one electrode is two times that on the other electrode?
- What would happen if dil.  $\text{H}_2\text{SO}_4$  is not added to water ?

Ans :

SQP 2020

- Gas liberated at anode – Oxygen
- On electrolysis water decomposes into hydrogen and oxygen :



Water decomposes to hydrogen and oxygen in the ratio of 2 : 1 by volume. The double volume collected is hydrogen.

- If dilutes sulphuric acid is not added to water, electrolysis will not take place as water is not a good conductor, if distilled water is used. Otherwise otherwise also conductivity will be very low if tap water is used. Sulphuric acid is added to water to make it a good conductor.

193. Lead nitrate solution is added to a test tube containing potassium iodide solution.

- Write the name and colour of the compound precipitated.
- Write the balanced chemical equaiton for the reaction involved.
- Name the type of this reaction justifying your answer.

Ans :

Comp 2019

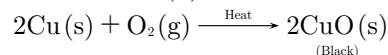
- When lead nitrate solution is added to a test tube containing potassium iodide solution, a yellow precipitate of lead iodide is produced along with potassium nitrate solution.
- $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \longrightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3$   
Lead iodide (yellow ppt.)      Lead iodide      Potassium nitrate
- The reaction is double displacement. In this double displacement reaction, two compounds, lead nitrate solution, two compounds, lead nitrate solution and potassium iodide solution react to form two new compounds, lead iodide and potassium nitrate. An exchange of ions takes place in this reaction.  
For example, the lead ions ( $\text{Pb}^{2+}$ ) of lead nitrate react with iodide ( $\text{I}^-$ ) of potassium iodide to form a new compound lead iodide ( $\text{Pb}^{2+}\text{I}^-$  or  $\text{PbI}_2$ ). Similarly, the potassium ions ( $\text{K}^+$ ) of Potassium iodide react with the nitrate ions ( $\text{NO}_3^-$ ) of lead nitrate to form new compound, potassium nitrate ( $\text{K}^+\text{NO}_3^-$  or  $\text{KNO}_3$ ). Lead iodide ( $\text{PbI}_2$ ) is formed as an insoluble yellow precipitate so it is also called precipitation reaction.

194. 1 g of copper powder was taken in a China dish and heated. What change takes place on heating ? When hydrogen gas is passed over this heated substance, a visible change is seen in it, Give the chemical equations of reactions, the name and the color of the products formed in each case.

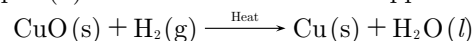
Ans :

Delhi 2019

When 1 g of copper powder was heated in a China dish, a black coating is formed on the surface of copper of copper (ii) oxide or cupric oxide.



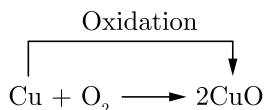
The name of product is copper (ii) oxide and it is black in colour. When hydrogen gas is passed over copper (ii) oxide.  $\text{CuO}$  reduced to copper.



The product formed is Cu and its colour is reddish brown.

Explanation : In the first reaction

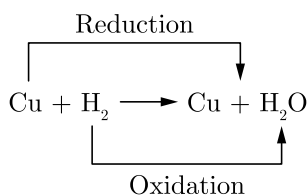




Copper has been oxidised to CuO. Since oxygen is added, it is an oxidation reaction and oxygen is the oxidising agent.

In the second reaction CuO has reacted with H<sub>2</sub> since, oxygen has been removed, it is a reduction reaction and hydrogen is the reducing agent.

Reduction



195. What does a balanced chemical equation convey ?

Ans :

Delhi 2018

A balanced chemical equation conveys the following informations :

- Formulae of substances taking part in chemical reaction, i.e., reactants.
- Formulae of substances produced in the reaction, i.e., products.
- The relative number of molecules of reactants and products.
- The relative masses of reactants and products.
- The relative volumes of gaseous substances involved in the reaction.

196. What is a thermochemical equation ? Give two examples.

Ans :

OD 2009

An equation in which information about heat change is included is called a thermochemical equation. In such an equation, it is very important to indicate the physical state of the various species involved.

Examples :

- $\text{C(s)} + \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)} \Delta H = -393.5 \text{ kJ}$
- $\text{C} \text{ (graphite)} + 2\text{H}_2\text{(g)} \longrightarrow \text{CH}_4\text{(g)} \Delta H = +74.25 \text{ kJ}$

197. Write and balance the following questions presented to you as written statements :

- Magnesium carbonate plus hydrochloric acid produces magnesium chloride plus water plus carbon dioxide gas.

(ii) Aluminium plus chlorine gas produces aluminium trichloride..

(iii) Nitrogen plus hydrogen produces ammonia.

Ans :

Delhi 2016

- $\text{MgCO}_3 + \text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2\text{O} + \text{CO}_2$   
 $\text{MgCO}_3 + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- $\text{Al} + \text{Cl}_2\text{(g)} \longrightarrow \text{AlCl}_3$   
 $2\text{Al} + 3\text{Cl}_2 \longrightarrow 2\text{AlCl}_3$
- $\text{N}_2 + \text{H}_2 \longrightarrow \text{NH}_3$   
 $\text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3$

198. In an experiment 20 g of zinc (A) was reacted with 20 g of iodine (B) in a 250 ml beaker containing 50 ml water. Reaction proceeded with evolution of heat and at the end, reaction mixture did not give any colour on adding starch solution, but some zinc was found settling at the bottom.



- Is the reaction endothermic or exothermic ?
- Out of the two reactants, Zn(s) and I<sub>2</sub>(s), which one is left unreacted ? Why?
- How much of (A) and (B) should be taken so that no reactant is left out at the end of the reaction ?

Ans :

Comp 2019

- Exothermic.
- Zinc is left unreacted because zinc was found settling at the bottom and also no iodine is left behind as the resulting mixture gives no colour on adding starch solution. It is so because 20 g of iodine does not provide requisite number of atoms for complete consumption of atoms given by 20 g of zinc.
- Weight of (A) and (B) should be taken so that both provide equal moles. For 65.4 g of Zn (At. wt. of Zn = 65.4, 254 g I<sub>2</sub> needs to be taken (At. wt. of I<sub>2</sub> = 127).

199. Give chemical explanation for evolution and absorption of heat in a chemical reaction.

Ans :

Foreign 2017

We know that atoms in the molecule of an element or a compound are held together by chemical bonds. During a chemical reaction, bonds between atoms of reactants are broken and then new bonds are formed between the atoms of the products. When bonds are broken, energy is absorbed and when new bonds are formed, energy is released.

- If the energy released during the formation of new bonds is more than the energy used up during breaking the old bonds, the overall

reaction will be exothermic.

- (ii) If the energy released during the formation of new bonds is less than the energy required to break the bonds, the overall reaction will be endothermic.

- 200.** Name three chemical reactions in which heat is evolved and three chemical reactions in which heat is absorbed.

**Ans :**

Delhi 2013

**Exothermic reactions :**

- (i) Oxidation of methane in the presence of air.  
 $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 890.0 \text{ kJ}$
- (ii) Formation of sulphur trioxide.  
 $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3 + 46.9 \text{ kcal}$
- (iii) Oxidation of ammonia.  
 $4\text{NH}_3 + 5\text{O}_2 \xrightarrow{\text{Pt}} 4\text{NO} + 6\text{H}_2\text{O} + 21.5 \text{ kcal}$

**Endothermic reactions :**

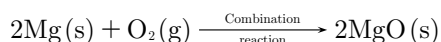
- (i) Formation of hydrogen iodide  
 $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightarrow 2\text{HI}(\text{g}) - 51.9 \text{ kJ}$
- (ii) Decomposition of calcium carbonate  
 $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g}) - 177.8 \text{ kJ}$
- (iii) Formation of carbon disulphide  
 $\text{C}(\text{s}) + 2\text{S}(\text{s}) \rightarrow \text{CS}_2(\text{l}) - 92 \text{ kJ}$

- 201.** Illustrate an experiment in support of a combination reaction.

**Ans :**

OD 2010

A piece of clean magnesium wire is held with a pair of tongs. It is heated over a Bunsen burner. It will be seen that the wire burns with a dazzling light and forms a white powder. The white powder is magnesium oxide, which is formed by the combination of magnesium with oxygen present in the air.

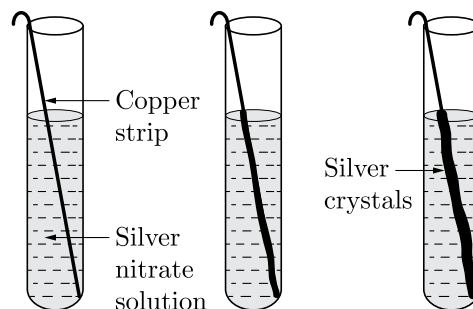
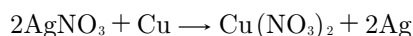


- 202.** Illustrate an experiment to support a displacement reaction.

**Ans :**

Delhi 2007

Some silver nitrate solution is taken in a test tube. The solution is colourless. A strip of copper is added into it (see Fig.). After some time it is observed that some shining crystals have deposited on the strip and the solution becomes bluish. This is due to the fact that copper replaces silver in the solution and forms bluish copper nitrate solution. In turn, shining crystals of silver deposit on the copper strip.



- 203.** Design an activity to show a decomposition reaction in which light is used to decompose a reactant. Write chemical equation for the reaction and state its one use.

**Ans :**

Comp 2010

**Activity :**

- Take about 2 g silver chloride in a china dish.
- Note down its colour.
- Place this china dish in sunlight for some time.
- Observe the colour of the silver chloride after some time.
- You will see that white chloride turns grey in sunlight. This is due to decomposition of silver chloride into silver and chlorine by light.

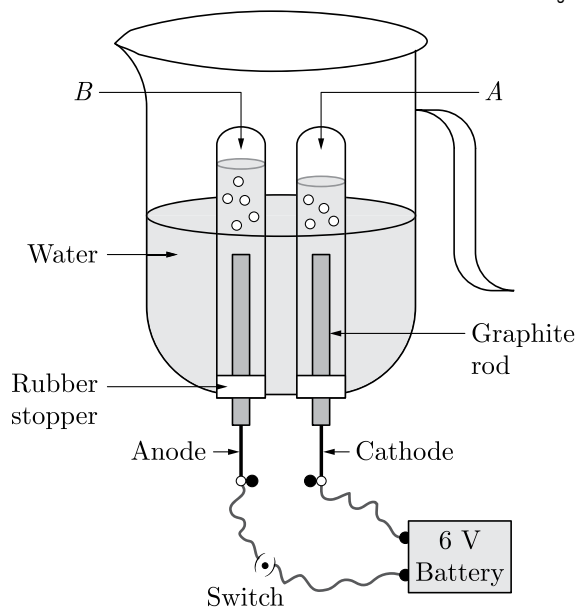


This reaction is used in black and white photography.

- 204.** Draw a labelled schematic diagram to show the electrolysis of water. Why is the amount of gas collected in one of the test tubes in this activity is double of the amount collected in the other ?

**Ans :**

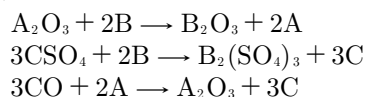
Foreign 2013



**Figure :** Electrolysis of water

Composition of water is  $\text{H}_2\text{O}$ , i.e., it has 2 hydrogen atoms and 1 oxygen atom. Therefore, ratio of volumes of the two is 2 : 1.

- 205.** A, B and C are three elements which undergo chemical reactions according to the following equations :



Answer the following questions with reasons :

- Which element is the most reactive ?
- Which element is the least reactive ?
- What is the type of reactions listed above ?

**Ans :**

OD 2014

- B as it displaces both A and C from their solution.
- C as it is displaced by both A and B.
- displacement reactions

- 206.** Take 2 g silver chloride in a china dish and place it in sunlight.

- Observe the colour of silver chloride after some time.
- What type of reaction does take place ?
- Write the chemical reaction for above observation.

**or**

What change will you observe if white silver chloride is placed in sunlight ? Write an equation for the reaction and the type of the reaction.

**Ans :**

Delhi 2012

- Initially silver chloride was white and after the exposure to sunlight it turned grey.
- Decomposition reaction.
- $2\text{AgCl} \xrightarrow{\text{Sunlight}} 2\text{Ag} + \text{Cl}_2$

- 207.** Take a small amount of calcium oxide or quick lime in a beaker and slowly add water to this.

- Is there any change in temperature ?
- What type of reaction is taking place ?
- Write chemical equation for above reaction.

**Ans :**

Comp 2010

- Yes, there is a change in temperature.
- Exothermic reaction.
- $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2 + \text{Heat}$

- 208.** Name the type of chemical reaction represented by the following equations :

- $\text{CaCO}_3(\text{s}) \xrightarrow{\text{Heat}} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{Ca}(\text{OH})_2(\text{aq})$
- $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$

**Ans :**

Delhi 2008

- Decomposition reaction/endothermic.
- Combination reaction/endothermic.
- Displacement reaction.

- 209.** Identify the substances that are oxidised and that are reduced in the following reactions :

- $\text{ZnO} + \text{C} \longrightarrow \text{Zn} + \text{CO}$
- $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$
- $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$

**Ans :**

Foreign 2006

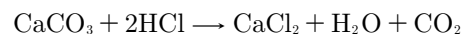
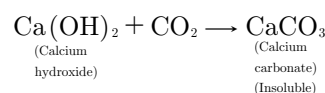
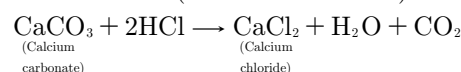
	Substances oxidised	Substances reduced
(i)	C	ZnO
(ii)	$\text{H}_2$	CuO
(iii)	HCl	$\text{MnO}_2$

- 210.** When a water insoluble substance X is added to dilute hydrochloric acid, a colourless and odourless gas is evolved. When the gas is passed through lime water, it turns milky. Write the chemical formula of X and the chemical equations involved.

**Ans :**

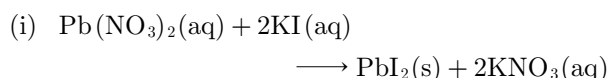
Comp 2011, 07

X is  $\text{CaCO}_3$  (calcium carbonate)



- 211.** (i) Write the balanced chemical equation for the reaction. Name the reaction.  
(ii) What is the colour of the precipitate formed and name the products formed in the reaction?

**Ans :**



The reaction is called precipitation reaction as solid  $\text{PbI}_2$  is formed.

- (ii) Yellow colour precipitate of  $\text{PbI}_2$  is formed.  
 $\text{PbI}_2$ -lead iodide,  $\text{KNO}_3$ -Potassium nitrate.

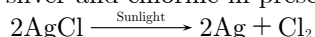
**212.** Account for the following :

- (a) White silver chloride turns grey in sunlight.  
 (b) Brown coloured copper powder on heating in air turns into black coloured substance.

**Ans :**

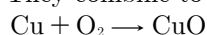
OD 2013

- (a) Due to decomposition of silver chloride into silver and chlorine in presence of sunlight.



- (b) Due to the oxidation of copper powder to copper oxide.

They combine to form a new substance



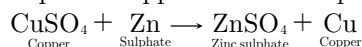
**213.** Explain the following chemical changes, giving one example in each case :

- (i) Displacement or substitution,  
 (ii) Dissociation,  
 (iii) Isomerisation reaction.

**Ans :**

Delhi 2015

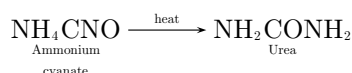
- (i) **Displacement or substitution reaction :** The reaction in which an atom or a group of atoms in the molecule is replaced by another atom or a group of atoms is called displacement or substitution reaction. For example, zinc displaces copper from its sulphate solution.



- (ii) **Dissociation reaction :** When a substance breaks up into positive and negative ions in water, it is called dissociation reaction. For example, acetic acid in water dissociates into  $\text{CH}_3\text{COO}^-$  and  $\text{H}^+$  ions.



- (iii) **Isomerisation reaction :** When a compound changes into another compound by simple rearrangement of atoms, it is called an isomerisation reaction. For example,



**214.** Give one example each of the following decomposition reactions. Write balanced equation in each case :

- (i) The reaction which occurs on passing electric current.  
 (ii) The reaction which occurs in the presence of sunlight.  
 (iii) The reaction which occurs on heating of a substance.

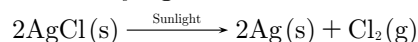
**Ans :**

Comp 2012

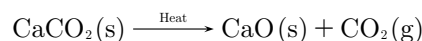
- (i) On passing electricity through water with few drop of dil.  $\text{H}_2\text{SO}_4$  and using two carbon electrodes, water decomposes into two gases-oxygen and hydrogen.



- (ii) Silver chloride turns grey in sunlight due to the decomposition of silver chloride into silver and chlorine by light.



- (iii) On heating decomposition of calcium carbonate into calcium oxide and carbon-dioxide occurs. This is called thermal decomposition.



**215.** (a) List two observations which will show that a chemical reaction has taken place.

- (b) A solution  $X$  is used for white washing :

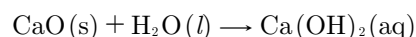
- (i) Write the chemical name and formula of  $X$   
 (ii) How is  $X$  obtained from compound  $Y$  which reacts with dil.  $\text{HCl}$  to give brisk effervescence due to colourless, odourless gas which is soluble in water and non-supporter of combustion ? Write chemical equation for the reactions involved in the preparation of  $X$  from  $Y$ .

**Ans :**

Comp 2011

- (a) (i) Change in state  
 (ii) Change in colour.

- (b) (i)  $X$  is slaked lime,  $\text{Ca(OH)}_2(\text{aq})$



**216.** (a) Give an example for a combination reaction which is exothermic.

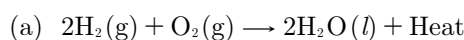
- (b) Identify oxidising agent, reducing agent in the following reaction :



- (c) Name the phenomenon due to which the taste and smell of oily food changes when kept for a long time in open. Suggest one method to prevent it.

**Ans :**

OD 2009



- (b) Oxidising agent  $\text{Cl}_2$   
 Reducing agent  $\text{H}_2\text{S}$

- (c) Rancidity, keeping food in air tight containers.

**217.** Take 3g of barium hydroxide in a test tube, now add about 2 g of ammonium chloride and mix the contents with the help of a glass rod. Now touch the test tube from outside.

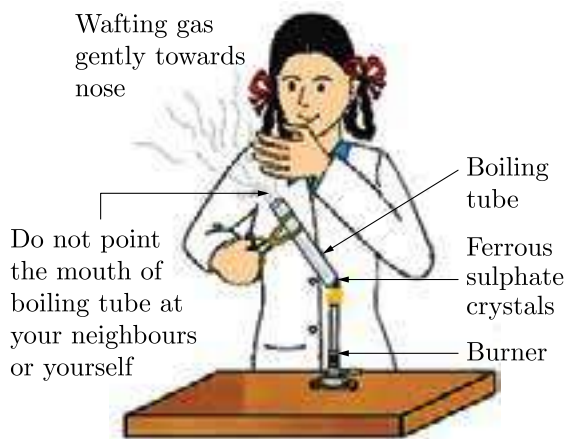
- What do you feel on touching the test tube ?
- State the inference about the type of reaction occurred.
- Write the balanced chemical equation of the reaction involved.

**Ans :**

CBSE 2016

- On touching the test tube, coldness is felt.
- It means that the reaction is endothermic. It is a double displacement reaction.
- $\text{Ba}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightarrow 2\text{NH}_4\text{OH} + \text{BaCl}_2$

**218.** Look at the figure given below and answer the following questions :



- What is the colour of ferrous sulphate crystals before and after heating.
- How do you identify the gases evolved on heating.
- Write the balanced chemical equation. What kind of reaction does it represent ?

**Ans :**

Foreign 2007

- Before heating the crystals are green in colour. After heating they turn white.
- The gas evolved can be identified by the characteristics smell of burning sulphur.
- $2\text{FeSO}_4(\text{s}) \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3(\text{s}) + \text{SO}_2(\text{g}) + \text{SO}_3(\text{g})$   
(Ferric oxide)

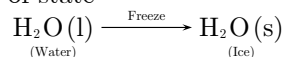
**219.** State one example each characterized by the following along with the chemical equation :

- Change in state
- Evolution of gas
- Change in temperature.

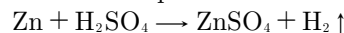
**Ans :**

OD 2014

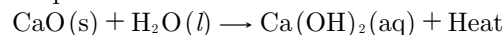
- Change of water into ice is an example of change of state



- By placing zinc granules in  $\text{H}_2\text{SO}_4$  solution, Hydrogen gas is evolved and zinc salt is formed. This is example of evolution of gas.



- Calcium oxide reacts vigorously with water to produce slaked lime releasing a large amount of heat. This is an example of change in temperature.



**220.** On heating blue coloured powder of copper(II) nitrate in a boiling tube, copper oxide (black), oxygen gas and a brown gas  $X$  is formed.

- Write a balanced chemical equation of the reaction.
- Identify the brown gas  $X$  evolved.
- Identify the type of reaction.

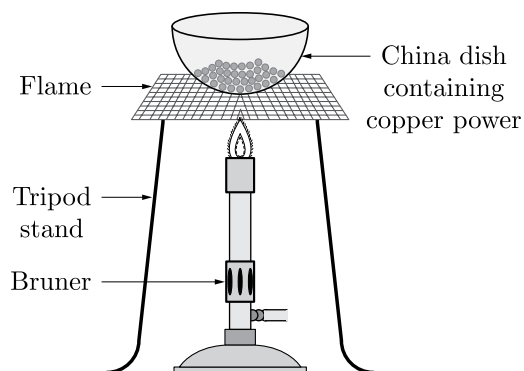
**Ans :**

OD 2006

- $\text{Cu}(\text{NO}_3)_2(\text{s}) \xrightarrow{\text{Heat}} \text{CuO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$   
(Black)

- Brown gas  $X$  is nitrogen dioxide.
- It is an example of decomposition reaction.

**221.** Look at the figure given below and answer the following questions :



- Write the chemical reaction involved.
- What are the colours of Cu and  $\text{CuO}$  ?
- Can we reconvert  $\text{CuO}$  into Cu ? Write the reaction involved.

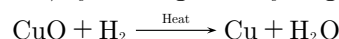
**Ans :**

Delhi 2011

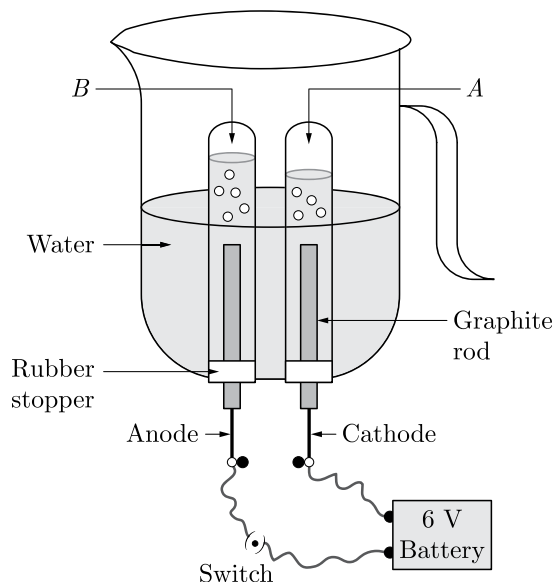
- $2\text{Cu} + \text{O}_2 \xrightarrow{\text{Heat}} 2\text{CuO}$

- Cu powder is shiny brown while  $\text{CuO}$  is black.

- Yes, by heating with hydrogen gas



- 222.** Look at the figure given below and answer the following questions :



- Which tube contains hydrogen gas ?
- If the volume of hydrogen gas collected is 10 mL, what will be the volume of oxygen collected ?
- Why do we add a few drops of dil. sulphuric acid?

**Ans :**

Delhi 2007

- Hydrogen gas is collected in the test tube B placed over cathode.
- Volume of  $O_2$  gas collected will be half of the volume of  $H_2$  gas i.e., 5 mL.
- Pure water is a non-conductor of electricity. A few drops of dilute  $SO_4$  are added to conduct electricity through it.

- 223.** During the reaction of some metals with dilute hydrochloric acid, following observations were made:

- The temperature of the reaction mixture rises when aluminium (Al) is added.
- The reaction of sodium metal is found to be highly explosive.
- Some bubbles of a gas are seen when lead (Pb) is reacted with the acid.

Explain these observations giving suitable reasons.

**Ans :**

OD 2009

- The temperature of the reaction mixture gives rise when aluminium is added because it is an exothermic reaction.
- Reaction of sodium metal is found to be highly explosive because it is an exothermic reaction.

- When lead is treated with hydrochloric acid, bubbles of hydrogen gas are evolved.  

$$Pb + 2HCl \rightarrow PbCl_2 + H_2$$

- 224.** State which of the following chemical reactions will take place or not, giving suitable reason for each :

- $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$
- $Fe(s) + ZnSO_4(aq) \rightarrow FeSO_4(aq) + Zn(s)$
- $Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$

**Ans :**

Foreign 2011

- $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$   
This reaction will take place as zinc is more reactive than copper and therefore, can displace copper from its aqueous solution.
- $Fe(s) + ZnSO_4(aq) \rightarrow FeSO_4(aq) + Zn(s)$   
This reaction will not take place since iron is less reactive than zinc, therefore, it will not be able to displace.
- $Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$   
This reaction will take place as zinc is more reactive than iron and therefore, can displace iron from its aqueous solution.

- 225.** Anhydrous copper sulphate ( $CuSO_4$ ) was dissolved in one beaker and hydrated copper sulphate ( $CuSO_4 \cdot 5H_2O$ ) was dissolved in another beaker. What heat changes do you expect in these beakers and why ?

**Ans :**

Comp 2013

Dissolution of anhydrous copper sulphate is an endothermic process. Hence, temperature of the solution falls in this beaker. Dissolution of hydrated copper sulphate is an exothermic process. Hence, temperature of the solution will rise in this beaker.

- 226.** Tanya added magnesium into a test tube containing dil. HCl acid. She saw some gas coming out of it. She took a burning match stick near the mouth of the test tube and heard a popping sound while the match stick extinguished. Tanya concluded that the gas evolved is hydrogen and it is not combustible. Find the error in her conclusion and support your answer with reason.

**Ans :**

SQP 2016

The conclusion that hydrogen gas is not combustible is wrong, because hydrogen gas is highly combustible and burns very fast to produce large amount of heat.

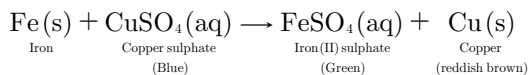
- 227.** Justify with the help of an example that displacement reaction is also a redox reaction.

**Ans :**

OD 2013

Consider the following displacement reaction :



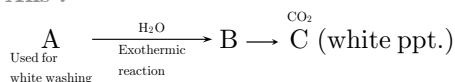


In the above reaction Fe is converted to  $\text{Fe}^{2+}$  by loss of electrons. Hence Fe is oxidised.  $\text{Cu}^{2+}$  is converted to Cu by gain of electrons. Hence  $\text{Cu}^{2+}$  is reduced. Thus, the above reaction is a displacement reaction as well as a redox reaction.

- 228.** Compound *A* when dissolved in water gives compound *B* and liberates heat. Compound *A* is used in white washing. Compound *B* reacts with  $\text{CO}_2$  to form a white precipitate of compound *C*. Identify compounds *A*, *B* and *C* and also write the equations involved.

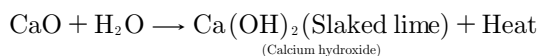
**Ans :**

Delhi 2011

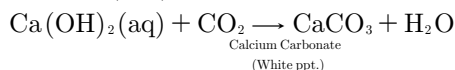


Quicklime ( $\text{CaO}$ ) is used for whitewashing.

So *A* is  $\text{CaO}$ .



*B* is  $\text{Ca(OH)}_2$ .



Calcium Carbonate (White ppt.)

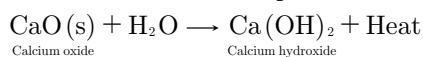
*C* is  $\text{CaCO}_3$ .

- 229.** When  $\text{CaO}$  is added to water taken in a beaker, rise in temperature is observed. However, when  $\text{Ba(OH)}_2$  is mixed with  $\text{NH}_4\text{Cl}$ , a fall in temperature is observed. Why?

**Ans :**

Foreign 2013

Reaction of  $\text{CaO}$  and water is an exothermic reaction. So rise in temperature is observed.



Reaction of  $\text{Ba(OH)}_2$  and  $\text{NH}_4\text{Cl}$  is an endothermic reaction and hence fall in temperature is observed.



- 230.** Give reasons for the following :

- Keeping food in air tight containers help in preventing rancidity.
- Moist air and acidic gases are not good for some metals.
- Chips manufacturers usually flush bags of chips with nitrogen gas.

**Ans :**

Comp 2015

- It does not allow air (oxygen) to come in contact with the food and this prevents oxidation of

food. Thus, the food never become rancid and its smell and taste remains the same.

- Moist air causes corrosion of iron while acidic gases causes corrosion of copper and silver.
- Nitrogen being inert prevents oxidation of food.

## FIVE MARKS QUESTIONS

- 231.** With the help of an appropriate example, justify that some of the chemical reactions are determined by

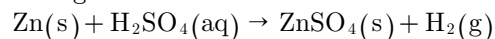
- Change in temperature,
- Evolution of a gas, and
- Change in colour

Give chemical equation for the reaction involved in each case.

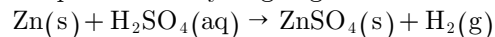
**Ans :**

OD 2023

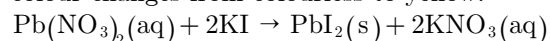
- When zinc reacts with sulphuric acid, the test tube in which the reaction is taking place will be hot, indicating that the temperature is rising during the reaction.



- The chemical reaction between zinc and dilute sulphuric acid is characterized by the evolution of hydrogen gas. On bring a burning matchstick near the gas jar if it burns with a pop sound, the presence of hydrogen gas is confirmed.



- The reaction between lead nitrate solution and potassium iodide solution. In this reaction colour changes from colourless to yellow.



- 232.** (a) Design an activity to demonstrate the decomposition reaction of lead nitrate.
- (b) Draw labelled diagram of the experimental set-up. List two main observations.
- (c) Write balanced chemical equation for the reaction stating the physical state of the reaction and the products.

**Ans :**

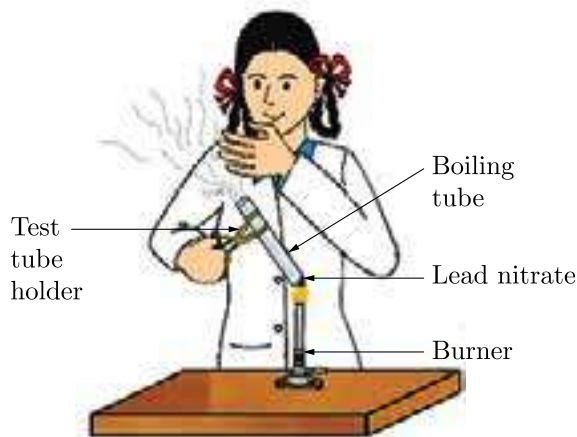
Delhi 2019

- Take a small amount of lead nitrate powder in a boiling tube.

Hold the boiling tube with a pair of tongs and heat it over the flame first gently and then strongly.

- Labeled diagram of the experimental setup :

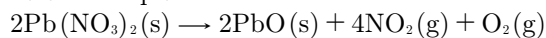




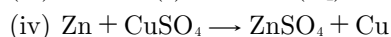
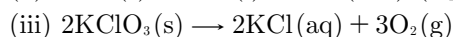
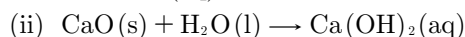
Two main observations :

- (i) We observe emission of brown fumes of a gas which is nitrogen dioxide.
- (ii) The white colour of lead nitrate changes to yellow colour as lead oxide is formed.

(c) Balanced equation :



**233.** (a) Classify the following reactions into different types :



(b) Translate the following statement into a balanced chemical equation :

“Barium chloride reacts with aluminium sulphate to give aluminium chloride and barium sulphate.”

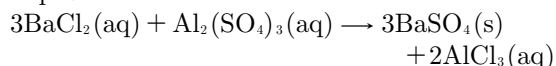
**Ans :**

OD 2019

(a) Type of reactions are :

- (i) Double displacement reaction
- (ii) Combination reaction
- (iii) Decomposition reaction
- (iv) Displacement reaction

(b) The balanced chemical equation for the reaction between barium chloride and aluminium sulphate to give aluminium chloride and barium sulphate.



**234.** What is observed after about 1 hour of adding the strips of copper and aluminium separately to ferrous

sulphate solution filled in two beakers ?

Name the reaction if any change in colour is noticed. Also, write chemical equation for the reaction.

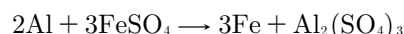
**Ans :**

Foreign 2019

When strip of copper is added to ferrous sulphate solution taken in a beaker, no change is observed.

On adding a strip of aluminium to ferrous sulphate solution taken in another beaker, we observe that the greenish colour of ferrous sulphate solution starts fading and it becomes colourless after about an hour.

Reaction taking place is Displacement reaction. Equation of the reaction taking place is :



**235.** A student wants to study a decomposition reaction by taking ferrous sulphate crystals. Write two precautions he must observe while performing the experiment.

**Ans :**

Delhi 2019

Precautions to be observed for studying decomposition reaction :

- (a) Use only hard boiling test tube.
- (b) Hold the test tube in an inclined position away from your body and do not point the mouth of the boiling tube at your neighbours or yourself.
- (c) Use a pair of tongs for holding the boiling tube while heating and don't touch the boiling tube with your bare hands.
- (d) Do not inhale the gases emitted directly, it should be inhaled by wafting gently towards your nose.

**236.** How is a chemical equation written ? Illustrate with an example.

**Ans :**

OD 2016

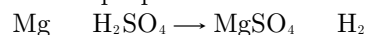
Let it be required to write a chemical equation that describes the reaction between magnesium and sulphuric acid to produce magnesium sulphate and hydrogen.

- (i) Write the symbols of all the substances involved in the reaction – first the reactants and then the products – one after the other, on the same line.

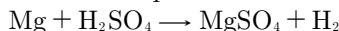
Reactants                      Products



- (ii) Separate the reacting substances from the products by a symbol meaning “produce”. The sign  $\longrightarrow$  (an arrow) or sometimes sign = is used for this purpose.



- (iii) Then put a + sign between the reactants indicating that these 'react' and a + sign between the products which signifies and'.



**237.** Describe the method of balancing a chemical equation.

**Ans :**

Delhi 2012

The following sequential steps should be taken to obtain a balanced chemical equation :

- (i) First the skeleton equation is written. For example,  

$$\text{H}_2 + \text{O}_2 \longrightarrow \text{H}_2\text{O}$$
- (ii) The same total of charges should appear on the left and right side of the equation.
- (iii) Now one of the atoms is made equal on both sides by multiplying a molecule or compound with an integral number so that the desired element is balanced. It is convenient to start with the molecule or compound that contains the maximum number of atoms. Here,  $\text{H}_2\text{O}$  contains maximum number of atoms. It contains one short of oxygen atom and so it is multiplied by 2 as shown.  

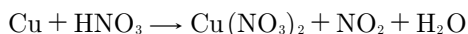
$$\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$$
- (iv) Next, the effect of multiplication of the molecule on the balance of other atoms is examined. As is seen, the number of oxygen atom on both sides balances but now the number of hydrogen atom on the left is 2 less. So, multiply  $\text{H}_2$  on the left by 2.  

$$2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$$
- (v) Further, count the number of atoms of each type on both sides. In the above equation :

Atom	On right	On left
H	4	4
O	2	2

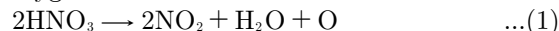
Now, the equation is balanced. If the number of atoms on both sides do not agree, the above steps should be continued till a balanced equation is obtained. This is called hit and trial method.

If the reaction is complicated, i.e., it involves large number of reactants and products, it is preferred to write the equation in steps (the actual reaction may or may not take place in these steps). For example, when copper reacts with conc. nitric acid, products are copper nitrate, nitrogen dioxide and water.



We can write this reaction in three steps and balance each step separately.

- (i) First,  $\text{HNO}_3$  is decomposed to give nitrogen dioxide ( $\text{NO}_2$ ), water ( $\text{H}_2\text{O}$ ) and atomic oxygen.



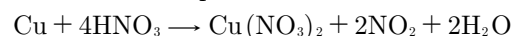
- (ii) In the next step, copper is oxidised to copper (II) oxide ( $\text{CuO}$ ).



- (iii) Copper oxide so formed then reacts with nitric acid to form copper nitrate,  $\text{Cu}(\text{NO}_3)_2$  and water.



Next, eq. (1), (2), (3) are multiplied by an integer so that on adding (1), (2) and (3), intermediate products (which do not appear in the final reaction) cancel out. Now, in this case, we find that the integer is one. So (1), (2) and (3) are added and the final balanced equation is written as below :



This method is known as partial equation method.

**238.** Balance the following skeleton equations :

- (i)  $\text{KClO}_3 \longrightarrow \text{KCl} + \text{O}_2$
- (ii)  $\text{Na}_2\text{CO}_3 + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- (iii)  $\text{CH}_4 + \text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O}$
- (iv)  $\text{NaCl} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + \text{HCl}$
- (v)  $\text{Fe} + \text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$
- (vi)  $\text{H}_2\text{S} + \text{O}_2 \longrightarrow \text{H}_2\text{O} + \text{S}$
- (vii)  $\text{H}_2 + \text{N}_2 \longrightarrow \text{NH}_3$

**Ans :**

Comp 2012

- (i)  $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$
- (ii)  $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- (iii)  $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
- (iv)  $2\text{NaCl} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{HCl}$
- (v)  $3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
- (vi)  $2\text{H}_2\text{S} + \text{O}_2 \longrightarrow 2\text{H}_2\text{O} + 2\text{S}$
- (vii)  $\text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3$

**239.** What are the drawbacks of a chemical equation? Illustrate with an example.

**Ans :**

OD 2017

A balanced chemical equation does not give the following information :

- (i) The physical state of the reactants and products—whether these are solids, liquids or gaseous, etc.
- (ii) Concentration of reactants and products.
- (iii) Conditions of reaction such as temperature, pressure, catalyst and light.
- (iv) The rate of reaction – whether it is slow or fast.
- (v) Time taken for completion of the reaction.

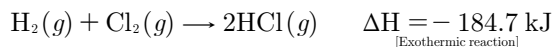
- (vi) Heat changes – whether heat is evolved or absorbed.  
 (vii) Whether reaction is reversible or irreversible.

**240.** How can a chemical reaction be made more informative?

**Ans :**

Delhi 2010

- (i) The physical condition of the various species may be indicated by signs (*s*), (*l*) and (*g*) for solid, liquid and gas respectively after the formula of a substance, e.g.,  
 $2P(s) + 3Cl_2(g) \rightarrow 2PCl_3(l)$
- (ii) The precipitate formed in the reaction is shown by an arrow pointing downward ( $\downarrow$ ), e.g.,  
 $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 \downarrow + 2HCl$
- (iii) ( $\uparrow$ ) sign is used for gas evolved.  
 $Zn + HCl \rightarrow ZnCl_2 + H_2 \uparrow$
- (iv) If a substance dissolved in water is used or produced, sign (aq) is used.  
 $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O$
- (v) Heat changes occurring during a chemical reaction may also be indicated, such as  
 $2H_2(g) + O_2(g) \rightarrow 2H_2O(l) \quad \Delta H = + 571.6 \text{ kJ}$   
[Endothermic reaction]



**241.** Name the type of following reactions :

- (i)  $Fe(s) + CuSO_4(aq) \rightarrow Cu(s) + FeSO_4(aq)$   
 (ii)  $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$   
 (iii)  $NH_4Cl(s) \rightarrow NH_3(g) + HCl(g)$   
 (iv)  $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$   
 (v)  $CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$   
 (vi)  $NH_4NO_2(s) \rightarrow 2H_2O(g) + N_2(g)$   
 (vii)  $Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$   
 (viii)  $2NH_3(g) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq)$

**Ans :**

Foreign 2016

- (i) Displacement reaction.  
 (ii) Decomposition reaction.  
 (iii) Decomposition reaction.  
 (iv) Combination reaction.  
 (v) Displacement reaction.  
 (vi) Decomposition reaction.  
 (vii) Displacement reaction.  
 (viii) Combination reaction.

**242.** Define the terms :

- (i) Oxidising agent and  
 (ii) Reducing agent.

**Ans :**

Delhi 2018

- (i) Oxidising agent : It is the substance which in a reaction (a) gives up oxygen or any electronegative element, or (b) accepts hydrogen or any electropositive element, or (c) accepts electrons.
- (ii) Reducing agent : It is the substance which in a reaction (a) gives up hydrogen or any electropositive element, or (b) accepts oxygen or any electronegative element, or (c) releases electrons.

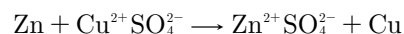
In the following reaction :



Chlorine accepts hydrogen from  $H_2S$ , thus oxidising it, and is called oxidising agent.

In a chemical reaction, oxidising agent is reduced and the reducing agent is oxidised.

In the reaction between zinc and copper sulphate solution :



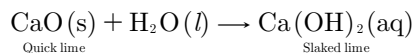
Zn reduces  $Cu^{2+}$  to Cu, itself being oxidised to  $Zn^{2+}$ , so Zn acts as a reducing agent.

- 243.** (a) What happens chemically when quick lime is added to water ?  
 (b) Balance the following chemical equation :  
 $MnO_2 + HCl \rightarrow MnCl_2 + Cl_2 + H_2O$   
 (c) What is decomposition reaction? Explain it with suitable example.

**Ans :**

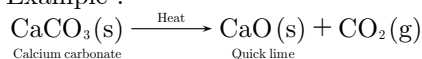
Foreign 2010

- (a) Quick lime reacts with water vigorously to produce slaked lime releasing a large amount of heat.



- (b)  $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$   
 (c) A reaction in which a single reactant breaks down to give simpler products is known as decomposition reaction.

Example :



- 244.** (a) Balance the chemical equation :  
 $Fe(s) + H_2O(g) \rightarrow Fe_3O_4(s) + H_2(g)$   
 (b) Identify the type of reaction in the equation given below :  
 $Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$   
 (c) You could have noted that when copper powder is heated in a china dish, the surface of copper powder becomes coated with black colour substance.

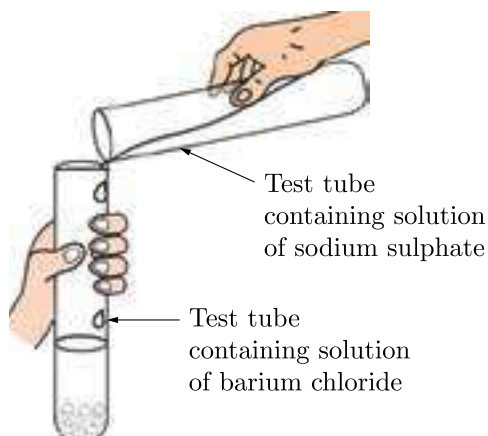
- Why has this black coloured substance formed?
- What is that black substance ?
- Write the chemical equation of the reaction that takes place.

Ans :

OD 2013

- $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
- Double displacement reaction.
- Because oxygen is added to copper and copper (II) oxide is formed.
  - Copper (II) oxide ( $\text{CuO}$ )
  - $2\text{Cu} + \text{O}_2 \xrightarrow{\text{Heat}} 2\text{CuO}$

245. Observe the given figure and answer the following questions :



- Write the complete balanced reaction for the above.
- Type of reaction involved.
- Is there any precipitate formed?
- If any precipitate formed, write the colour of the precipitate.

Ans :

Comp 2008

- $\text{Na}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{BaSO}_4(\text{aq})$
- Double displacement.
- Yes, precipitate is formed.
- Colour of precipitate is white.

246. When a green salt is heated strongly, its colour finally changes to brown and odour of burning sulphur is given out :

- Name the iron salt and write its formula.
- Name the brown substance obtained and write its formula.
- Which product gives the odour of burning sulphur? Write the formula.

- Write the chemical equation of the reaction involved.
- Name the type of chemical reaction which takes place during the heating of iron salt.

Ans :

OD 2006

- Ferrous sulphate,  $\text{FeSO}_4$
- Ferric oxide,  $\text{Fe}_2\text{O}_3$
- Sulphur dioxide,  $\text{SO}_2$
- $2\text{FeSO}_4(\text{s}) \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3(\text{s}) + \text{SO}_2(\text{g}) + \text{SO}_3(\text{g})$   
Ferrous sulphate      Ferric oxide      Sulphur dioxide      Sulphur trioxide
- Decomposition reaction.

247.
  - Define corrosion.
  - What is the name given to the corrosion of iron?
  - What is the colour of coating formed on silver and copper ?
  - What damage is caused by corrosion?
  - How can we prevent corrosion ?

Ans :

Delhi 2011

- Surface of a metal reacts with atmospheric oxygen, moisture and carbon dioxide to form a coating on the surface. This phenomenon is called corrosion.
- When the metal involved in iron, the phenomenon of corrosion may be called rusting.
- Silver forms a black coating and copper forms a green coating on the surface when exposed to the atmosphere for a long time.
- Corrosion weakens the metal. A great deal of damage is caused to car bodies, bridges, iron railings and ships.
- Corrosion can be prevented by coating metal surface with paint.

248.
  - Name two effects of oxidation in daily life.
  - Why do iron articles become brown after sometime?
  - Define the term corrosion. Give an example of corrosion.
  - Give the conditions of corrosion.
  - What is rancidity ?

Ans :

Delhi 2014

- Corrosion, Rancidity.
- Due to corrosion.
- The process in which metals are eaten up gradually by the action of air, moisture or a chemical (such as an acid) on their surface, is called corrosion.

- (iv) (a) Presence of moisture.  
 (b) Presence of air (oxygen).  
 (v) Rancidity : When fats and oils are oxidised (or kept in open for some days), then smell and taste changes. We say that they have gone rancid. The condition produced by aerial oxidation of fats and oils in foods marked by unpleasant smell and taste is called rancidity. Rancidity spoils the food materials prepared in fats and oils which have been kept for a considerable time and make them unfit for eating.

**249.** Identify the type of chemical reaction and write balanced chemical equation for each of the following:

- (a) Barium chloride solution is mixed with copper sulphate solution and a white precipitate is observed.  
 (b) On heating copper powder in a china dish, the surface of copper powder becomes black.  
 (c) On heating green ferrous sulphate crystals, a reddish brown solid is left and gases having smell of burning sulphur are noticed.  
 (d) Iron nails when left dipped in blue copper sulphate solution become brownish in colour and blue colour of copper sulphate solution turns to light green.  
 (e) Quicklime reacts vigorously with water releasing a large amount of heat.

**Ans :**

Comp 2012

- (a)  $\text{BaCl}_2(\text{aq}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + \text{CuCl}_2(\text{aq})$   
White ppt.  
 Double displacement reaction.  
 (b)  $2\text{Cu}(\text{s}) + \text{O}_2(\text{g}) \xrightarrow{\text{Heat}} 2\text{CuO}(\text{s})$   
 Oxidation-reduction reaction.  
 (c)  $2\text{FeSO}_4(\text{s}) \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3(\text{s}) + \text{SO}_2(\text{g}) + \text{SO}_3(\text{g})$   
 Decomposition reaction.  
 (d)  $\text{Fe}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$   
(Blue solution) (Light green)  
 Displacement reaction.  
 (e)  $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2 + \text{Heat}$   
 Combination reaction.

- 250.** (a) Write a balanced chemical equation for the process of photo synthesis and the conditions of the reaction giving physical states of all the substances.  
 (b) Classify the following chemical reactions as exothermic or endothermic :  
 (i) Electrolysis of water.  
 (ii) Burning of natural gas.  
 (iii) Decomposition of calcium carbonate.  
 (iv) Burning of magnesium ribbon in air.

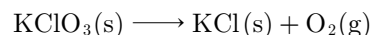
**Ans :**

Comp 2008

- (a)  $6\text{CO}_2(\text{aq}) + 12\text{H}_2\text{O}(\text{l}) \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{aq}) + 6\text{H}_2\text{O}(\text{l})$   
 (b) (i) Endothermic reaction.  
 (ii) Exothermic reaction.  
 (iii) Endothermic reaction  
 (iv) Exothermic reaction.

## CASE BASED QUESTIONS

- 251.** A student prepared oxygen in a lab by catalytic decomposition of potassium chlorate ( $\text{KClO}_3$ ) as shown in the figure. Decomposition of potassium chlorate gives potassium chloride ( $\text{KCl}$ ) and oxygen ( $\text{O}_2$ ). The following reaction takes place :



- (i) How many moles of  $\text{KClO}_3$  are required to produce 2.4 moles of  $\text{O}_2$ ?  
 (ii) Name the element which is reduced in the given reaction.  
 (iii) How many moles of  $\text{KClO}_3$  give 3 moles of oxygen?  
 (iv) What is the oxidation state of chlorine in potassium chlorate?

**Ans :**

- (i) 3 moles of  $\text{O}_2$  are formed by 2 moles of  $\text{KClO}_3$   
 2.4 moles of  $\text{O}_2$  will be formed by  
 $\frac{2}{3} \times 2.4 = 1.6$  moles of  $\text{KClO}_3$   
 (ii) Chlorine  
 (iii) 2 moles of  $\text{KClO}_3 \equiv 3$  moles of  $\text{O}_2$   
 (iv) Oxidation state chlorine is +5.

- 252.** When two or more substances react and form some new substance, it is called a chemical reaction. Chemical equation is represented in terms of symbols, molecular formulas, moles, states, etc. As we know, all chemical reaction obeys law of chemical combination. Therefore, chemical reactions need to be balanced. It is done by hit and trial method. The chemical reactions can be classified into different types such as combination reaction, decomposition reaction, displacement reaction, double displacement reaction. The reactions take place in solution is precipitation reactions and neutralisation reactions.





- (i) Define a chemical equation.
- (ii) Which law is followed by all chemical reactions?
- (iii) Name four types of chemical reactions.
- (iv) Give example of precipitation reactions.

**Ans :**

- (i) A chemical reaction is defined as the reaction in which two or more substances react to form new substance.
- (ii) The law of chemical combination is followed by all chemical reactions.
- (iii) Combination reactions, displacement reactions, double displacement reactions and decomposition reactions are four types of chemical reactions.
- (iv) The reaction between silver nitrate and sodium chloride that forms precipitate of silver chloride and sodium nitrate and sodium nitrate is an example of precipitation reactions.

**253.** Corrosion is the phenomenon of deterioration of surface of metal in presence of air and moisture. It is a natural process and in the presence of a moist atmosphere, chemically active metals get corroded. This is oxidation reaction. Rusting is the process where iron corrodes due to exposure to the atmosphere. The main circumstance of corrosion occurs with iron because it is a structural material in construction, bridges, buildings, rail transport, ships, etc. Aluminium is also an important structural metal, but even aluminium undergoes oxidation reactions. However, aluminium doesn't corrode or oxidize as rapidly as its reactivity suggests. An alloy of aluminium or any other metal like magnesium

can make aluminium stronger and harder.

Copper (Cu) corrodes and forms a basic green carbonate and lead corrodes to form a white lead oxide or carbonate.

- (i) What is rusting?
- (ii) Which two metals do not corrode easily?
- (iii) List two properties of alloys.
- (iv) What is the effect of corrosion on electrical conductivity ?

**Ans :**

- (i) The deterioration of surface of iron in presence of air and moisture is called rusting.
- (ii) Gold and platinum
- (iii) (a) Alloys are more resistant to corrosion.  
(b) The melting point of alloys are less than pure metals.
- (iv) Corrosion increases the electrical conductivity of metals.

**254.** Oxidation is the process of gaining of oxygen or losing of hydrogen. Reduction is the process of losing of oxygen or gaining of hydrogen. The substance which undergoes oxidation is the reducing agent while the substance which undergoes reduction is known as the oxidising agent. Oxidation and reduction always take place together and these type of reactions are known as redox reactions. Some of the examples of redox reactions are given below :

- a.  $\text{Pb}_3\text{O}_4 + 8\text{HCl} \longrightarrow 3\text{PbCl}_2 + \text{Cl}_2 + 4\text{H}_2\text{O}$
- b.  $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$
- c.  $\text{CuSO}_4 + \text{Zn} \longrightarrow \text{Cu} + \text{ZnSO}_4$
- d.  $\text{V}_2\text{O}_5 + 5\text{Ca} \longrightarrow 2\text{V} + 5\text{CaO}$
- e.  $3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
- f.  $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$

- (i) Give two examples of oxidation reaction from your everyday life.
- (ii) Write the oxidising agent in the reaction a and b.
- (iii) Out of oxidation and reduction, which reaction takes place at anode?

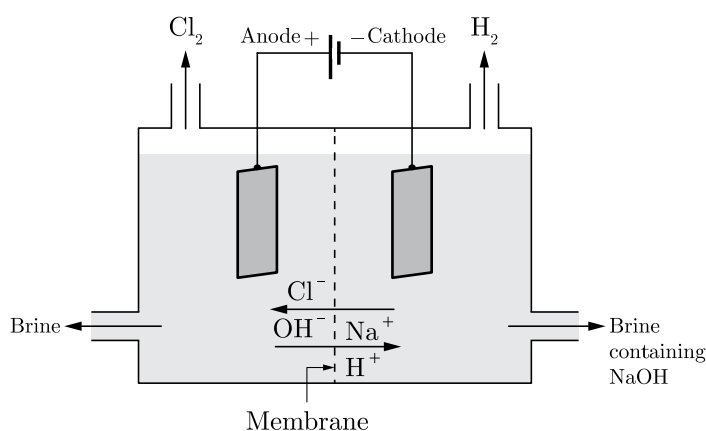
**Ans :**

- (i) (a) Corrosion  
(b) Rancidity
- (ii)  $\text{CuSO}_4$  and  $\text{CuO}$
- (iii) Oxidation takes place at anode.

**255.** 'Salts' refer to the compound formed when an acid reacts with a base. These reactions are known as

neutralisation reactions. These reactions are often used in the laboratories to calculate the exact concentration of an acid or an alkali when the other is known. The familiar example of salt is sodium chloride (NaCl), which we use in our food on daily basis and is known as rock salt.

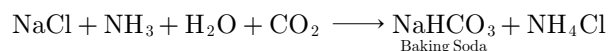
It is prepared by the reaction of hydrochloric acid and sodium hydroxide solution. This salt is used to prepare various compounds. When electricity is pass through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. The process is called the chlor-alkali process because of the products formed-chlor and alkali for sodium hydroxide.



- Write the chemical reaction of chlor-alkali process.
- Name the gases formed at the anode and the cathode.
- Write one use each of chlorine and hydrogen gas.
- How will you prepare baking soda from sodium chloride?

Ans :

- $2\text{NaCl} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{Cl}_2 + \text{H}_2$
- Anode : Chlorine gas, Cathode : Hydrogen gas
- Chlorine is used to purify water. Hydrogen gas is used as a fuel.
- When a cold and concentrated solution of sodium chloride reacts with ammonia and carbon-di-oxide, sodium hydrogencarbonate (baking soda) and ammonium chloride is formed.



**256.** There are different types of chemical reactions occurring around us or being carried out for the benefit of mankind, e.g. combination reactions,

decomposition reactions, displacement reactions, precipitation reactions, reduction-oxidation (redox) reactions, photochemical reactions etc.

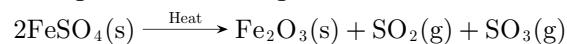
Now, answer the following questions :

- Combustion of coke is a combination reaction.  $\text{CO}_2$  is not a pollutant. Then, why is combustion of coke harmful?
- Which reaction followed by two combination reactions are involved in white wash of walls?
- Give one use of tin plating in daily life.
- How photochemical reactions have played an important in photography?

Ans :

- $\text{CO}_2$  is not a pollutant when present in the atmosphere upto a certain percent. Rather, it helps to maintain the temperature of the Earth. Combustion of coke is harmful as it increases the concentration of  $\text{CO}_2$  in the atmosphere which causes global warming (greenhouse effect).
- Reaction of calcium with oxygen gives quicklime ( $\text{CaO}$ ) which combines with water to form  $\text{CaCO}_3$
- Tiffin boxes made up of steel are either tin plated or nickel plated to protect them from rusting. However, tin-plating is preferred because tin is non-poisonous and hence, does not contaminate the food kept in them.
- A photographic film used in black and white photography is a celluloid film coated with silver chloride. Its working is based on the decomposition of silver chloride in the presence of sunlight.

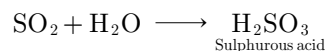
**257.** Ferrous sulphate crystals on heating in a dry boiling tube gives the following reaction:



- What is the colour change in this reaction ?
- Name the type of reaction.
- Which gas has a smell of burning sulphur?
- What happens where  $\text{SO}_2$  gas is passed through water?

Ans :

- The colour changes from green to brown.
- The reaction is called decomposition reaction.
- Sulphur dioxide.
- If forms sulphurous acid.





**258.** While performing experiment in the chemistry lab, a student took lead nitrate solution in a test tube. To this solution, he added potassium iodide solution.

- Write balanced chemical equation for this reaction.
- What are the different names given to this reaction?
- What is the colour of the precipitate formed?
- Name the compound precipitated.

**Ans :**

- $$\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \longrightarrow \text{PbI}_2(\text{s}) \downarrow + 2\text{KNO}_3(\text{aq})$$
- The reaction is called double displacement reaction as well as precipitation reaction as one of the products is an insoluble substance.
- The colour of the precipitate is yellow.
- Lead iodide.

**259.** In a redox reaction, if a substance gains oxygen, it is said to be oxidized. If a substance loses oxygen during a reaction, it is said to be reduced.

In reaction:



- Which substance gets oxidized and which substance gets reduced?
- What is the colour change in the above reaction?
- What other name is given to this redox reaction?
- Is this reaction,  $\text{ZnO} + \text{H}_2 \xrightarrow{\text{Heat}} \text{Zn} + \text{H}_2\text{O}$  feasible? If not, then why?

**Ans :**

- $\text{H}_2$  gets oxidized to  $\text{H}_2\text{O}$  and  $\text{CuO}$  gets reduced to  $\text{Cu}$ .
- $\text{CuO}$  is a black solid whereas  $\text{Cu}$  is reddish brown.
- Displacement reaction.
- The reaction is not possible.  $\text{H}_2$  is less reactive than zinc. So, hydrogen cannot displace zinc from zinc oxide.

**260.** When a metal is attacked by substances around it such as moisture, acids, etc., it is said to corrode, and this process is called corrosion. The black coating on silver, green coating on copper and reddish-brown powder on iron surface are some examples of corrosion.

- What is the name given to the corrosion of iron?
- What is the formula of green colour coating on copper?

- Name two methods to prevent corrosion of iron.
- Is corrosion a redox reaction?

**Ans :**

- Rusting
- $\text{CuCO}_3 - \text{Cu}(\text{OH})_2$  Basic copper carbonate.
- (a) Painting of an iron object.  
(b) Applying oil/grease on iron object.
- Yes

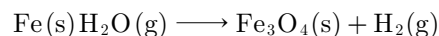
**261.** Magnesium ribbon burns in air with a dazzling white flame. This is due to the formation of a white solid. This white solid dissolves in water and gives a solution which turns red litmus blue.

- Write the equation for the reaction of magnesium ribbon in air.
- Name the type of reaction.
- Why does the white dazzling flame appear ?
- What happens when white solid is dissolved in water?

**Ans :**

- $$2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$$
- The reaction is called combination reaction.
- This is due to the formation of magnesium oxide.
- $$\text{MgO} + \text{H}_2\text{O} \longrightarrow \text{Mg}(\text{OH})_2$$
  
White solid

**262.** You are given the following unbalanced equations:

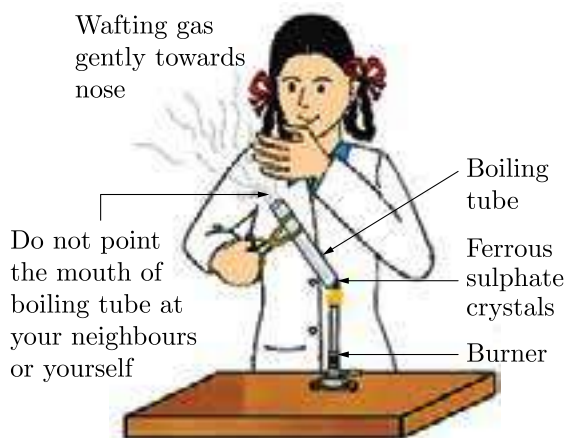


- Write balanced chemical equations.
- Write which substance gets oxidized and which substances gets reduced.
- What name can be given to this reaction other than redox reactions?
- How will you test the gas evolved?
- Identifying the oxidizing agent and reducing agent.

**Ans :**

- $$3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \longrightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$$
- $\text{Fe}$  gets oxidized to  $\text{Fe}_3\text{O}_4$  and  $\text{H}_2\text{O}$  gets reduced to form  $\text{H}_2$  gas.
- Displacement reaction.
- $\text{H}_2$  gas gives a pop sound when a match stick brought near the gas.
- Oxidizing agent:  $\text{H}_2\text{O}(\text{gas})$ , Reducing agent:  $\text{Fe}(\text{s})$ .

263.



After seeing the above image answer the following questions.

- What was the colour of the crystals before heating and after heating?
- Write the chemical equation for the reaction.
- Name the reaction.
- Which pungent smelling gas is evolved during the reaction? What is the nature of this gas?
- Write the name of the solid substance formed.

**Ans :**

- Before heating: Pale green colour.  
After heating: Reddish brown.
- $$2\text{FeSO}_4(\text{s}) \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3(\text{s}) + \text{SO}_2(\text{g}) + \text{SO}_3(\text{g})$$
- Thermal decomposition.
- Pungent smelling gas is sulphur dioxide,  $\text{SO}_2$ . It is a non-metallic oxide, hence acidic in nature.
- Ferric oxide or iron (III) oxide.

[www.nodia.in](http://www.nodia.in)

# CHAPTER 2

## Acids, Bases and Salts

### 1. ACIDS

Acids are chemical compounds which have sour taste, consist of hydrogen (H) and turn blue litmus solution red. On the basis of their sources, acids can be classified as:

#### 1.1 Organic Acids

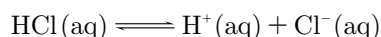
They are derived from living organisms, i.e., plants and animals. For example, tomatoes contain oxalic acid and ants contain formic acid.

#### 1.2 Mineral Acids

They are obtained from mineral sources, e.g., sulphuric acid, nitric acid and hydrochloric acid. They are inorganic acids. Many mineral acids find extensive use and application.

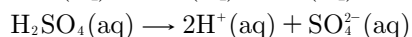
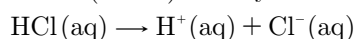
#### 1.3 Arrhenius Theory of Acids

According to this theory, acids are substances that ionise to give  $H^+$  ions when dissolved in water, e.g.,



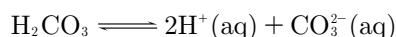
#### 1.4 Strong Acids

These acids ionise more or less completely when dissolved in water, e.g., sulphuric acid ( $H_2SO_4$ ), nitric acid ( $HNO_3$ ) and hydrochloric acid ( $HCl$ ).



#### 1.5 Weak Acids

These acids ionise to a small extent when dissolved in water, e.g., acetic acid ( $CH_3COOH$ ), formic acid ( $HCOOH$ ) and carbonic acid ( $H_2CO_3$ ).



#### 1.6 Reactions of Acids with Metals

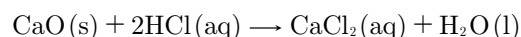
Dilute acids react with metals to evolve hydrogen.



$H_2$  gas is not evolved when a metal reacts with nitric acid ( $HNO_3$ ).

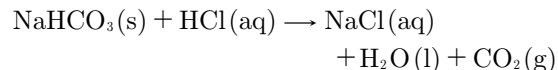
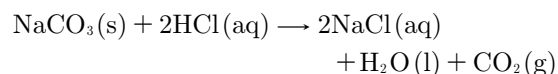
#### 1.7 Reactions of Acids with Metal Oxides

Metal oxides, being basic in nature, react with acids to form salt and water.



#### 1.8 Reactions of Acids with Metal Carbonates and Metal Hydrogen carbonates

Acids break up metal carbonates and metal hydrogen carbonates to evolve carbon dioxide gas with brisk effervescence.

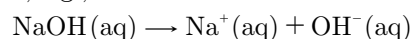


### 2. BASES

Bases are chemical compounds which have bitter taste, are soapy and slippery to touch and turn red litmus solution blue, e.g., sodium hydroxide, potassium hydroxide, aluminium hydroxide, etc. Those bases which are soluble in water are called alkalis.

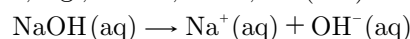
#### 2.1 Arrhenius Theory of Bases

According to this theory, bases are substances that ionise to give hydroxyl ion ( $OH^-$ ) when dissolved in water, e.g.,



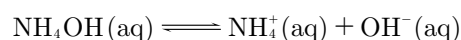
#### 2.2 Strong Bases

They ionise more or less completely on dissolving in water, e.g.,  $NaOH$ ,  $KOH$ ,  $Ca(OH)_2$  etc.



#### 2.3 Weak Bases

They ionise to a small extent on dissolving in water, e.g., ammonium hydroxide ( $NH_4OH$ ), copper hydroxide [ $Cu(OH)_2$ ], etc.



## 2.4 Indicators

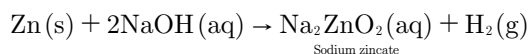
Acid-base indicators are natural or synthetic dyes which show a change of colour depending upon the acidity or alkalinity of a solution.

The indicator like litmus is red in acidic and blue in basic medium. Methyl orange is red in acidic and yellow in basic medium. Phenolphthalein is colourless in acidic and pinkish-red in basic medium.

1. **Olfactory Indicators :** Those substances whose odour changes in acidic or basic medium are called olfactory indicators, e.g., the smell of onion diminishes in a base but remains as such in an acid.

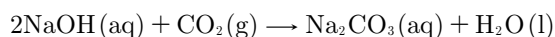
## 2.5 Reactions of Bases with Metals

Metals like Zn and Al react with strong alkalis to evolve  $H_2$  gas.



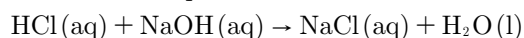
## 2.6 Reactions of Bases with Non-metallic Oxides

Bases react with acidic oxides to form salt and water.



## 2.7 Neutralization

When an acid reacts with a base, it gives salt and water, it is called neutralization reaction, and also it is an exothermic process.



## 2.8 Potential of Hydrogen (pH)

The negative exponent of 10 to which it must be raised in order to express the hydrogen ion concentration of the solution in mole per litre. Mathematically,  $[H^+(aq)] = 10^{-pH}$

Higher the  $H^+(aq)$  concentration, lower is the pH value.

## 2.9 pH Scale

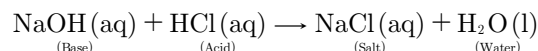
In neutral solution and pure water,  $pH = 7$ , acidic solutions,  $pH < 7$  and alkaline solutions,  $pH > 7$ .

## 2.10 Universal Indicator

It is a pH indicator composed of several compounds that exhibit colour changes over a pH value range from 0 to 14. It not only shows acidic or basic nature of solution but also shows approximate pH by giving a particular colour for a specific value of pH.

## 3. SALTS

They are ionic compounds formed by the combination of cation from base and anion from acid.



### 3.1 pH of Salt Solutions

1. The salt of a strong acid and a weak base gives acidic solution ( $pH$  less than 7).

$NH_4Cl(s) + H_2O(l) \rightleftharpoons NH_4OH(aq) + HCl(aq)$   
Here, hydrochloric acid (strong acid) ionises to give  $H^+(aq)$  ions which is greater than ammonium hydroxide (weak base) ionises to give  $OH^-(aq)$  ions, so, the solution is acidic.

2. The salt of a strong base ( $NaOH$ ) and a weak acid  $H_2CO_3$  gives basic solution ( $pH$  more than 7).

$NH_2CO_3(s) + H_2O(l) \rightleftharpoons 2NaOH(aq) + H_2CO_3(aq)$   
Here,  $NaOH$  releases  $OH^-(aq)$  ion more and  $H_2CO_3$  releases  $H^+(aq)$  ion less, so, the solution is basic.

3. The salt of a weak acid ( $HA$ ) and a weak base ( $BOH$ ) gives slightly acidic or slightly basic or neutral solution ( $BA$ ).



If acid is stronger than base, the solution is acidic ( $pH < 7$ ). If acid is weaker than the base, the solution is basic ( $pH > 7$ ). If acid and base formed are of equal strength, the solution is neutral ( $pH = 7$ ).

4. The salt of a strong acid and a strong base gives neutral solution ( $pH = 7$ ). Salts of strong acids and bases, e.g.,  $NaCl$ ,  $Na_2SO_4$ , etc., on dissolving in water do not hydrolyse, so, not disturb the  $pH = 7$ .

### 3.2 Sodium Chloride ( $NaCl$ )

It is common salt. It is obtained from sea water by the process of evaporation.

Uses of Sodium Chloride

1. Sodium chloride ( $NaCl$ ) helps in proper functioning of the human body, i.e., in muscle contraction, etc. It helps the body to prepare hydrochloric acid in gastric juice.
2. It is used in cooking food and it improves the flavour of food.
3. It is used to prepare  $NaOH$ ,  $Na_2CO_3$ , etc.

### 3.3 Sodium Hydroxide ( $NaOH$ )

It is prepared on a large scale by electrolysis of a conc. solution of sodium chloride. This solution is called brine.

Ans :

OD 2016, 10

(a)  $\text{pH} = -\log [\text{H}^+]$

or  $\text{pH} \propto \frac{1}{[\text{H}^+]}$ . If the pH solution is less than 7, is acidic, if more than 7, it is basic and if is 7, it is neutral.

(b) Neutral.

(c) 1 M NaOH solution.

(d) The best way to prevent tooth decay is to clean the mouth after eating food using tooth paste which are generally basic in nature and neutralise the excess acid formed in the mouth.

(e) Water acts as carrier of  $[\text{H}^+]$  ion and exists as  $[\text{H}_3\text{O}^+]$  hydronium ion.

172. (a) A liquid has a pH less than 7 which represents an acidic solution.

(i) State the nature of solution, if its pH increases from 7 to 14.

(ii) Mention the ion whose concentration increases with the increase in pH value.

(iii) Suggest a method that is generally used for measuring pH value.

(b) Give reason for the following :

(i) Tooth decay starts when the pH of the mouth is lower than 5.5.

(ii) Antacids are used for treatment of indigestion.

Ans :

Delhi 2013

(a) (i) If the pH of the solution increases from 7 to 14, the solution becomes basic.

(ii) It is the concentration of  $\text{OH}^-$  (hydroxyl) ions which increases when the pH increases from 7 to 14.

(iii) A paper impregnated with universal indicator is used to measure the pH of a solution.

(b) (i) Tooth enamel is corroded when the pH of the mouth is below 5.5. This is because the bacteria present in the mouth produces acid by the degradation of sugar (food particles).

(ii) Antacids contain a base like magnesium hydroxide. During indigestion, the stomach produces acid by the degradation of food. Antacid neutralises the acid and provides relief to the affected person.

173. What is plaster of paris? How is plaster of paris prepared ? Write equation of the reaction involved. What happens when water is added to plaster

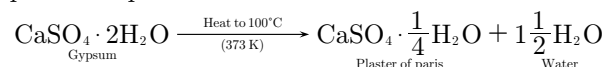
of paris? Write an equation to show the reaction between plaster of paris and water.

Ans :

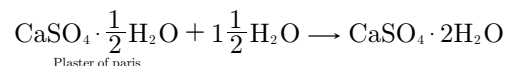
Foreign 2011

Plaster of paris is calcium sulphate hemihydrate.

The formula of plaster of paris is  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ . Plaster of paris is prepared by heating gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) to a temperature of  $100^\circ\text{C}$  (373 K) in a kiln. At this temperature, gypsum loses three-fourths of its water of crystallisation and forms plaster of paris.



When water is added to plaster of paris, it sets into a hard mass in about half an hour. The setting of plaster of paris is due to its hydration to form crystals of gypsum which set to form a hard solid mass.



174. Give suitable reasons for the following statements :

(a) Rain water conducts electricity but distilled water does not.

(b) We feel burning sensation in the stomach when we overeat.

(c) A tarnished copper vessel regains its shine when rubbed with lemon.

(d) The crystals of washing soda change to white powder on exposure to air.

(e) An aqueous solution of sodium chloride is neutral but an aqueous solution of sodium is basic.

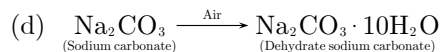
Ans :

OD 2016, 08

(a) Rain water is acidic in nature due to the presence of acidic oxides but not distilled water.

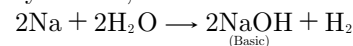
(b) When we overeat, we suffer from acidity due to excess acid produced in the stomach. This produces a burning sensation.

(c) A copper vessel gets tarnished due to the formation of basic copper carbonate on vessel, which is basic in nature. When rubbed with lemon, which is acidic, neutralisation takes place and copper vessel regains its shine.



(e) Aqueous solution of sodium chloride is neutral because it formed from strong acid (HCl) and strong base (NaOH).

Aqueous solution of sodium form sodium hydroxide, which is basic in nature.



or completely, are called efflorescent salts and the phenomenon is called efflorescence, e.g., washing soda, epsom salt, etc.

## OBJECTIVE QUESTIONS

1. Consider the following compounds :

$\text{FeSO}_4$ ;  $\text{CuSO}_4$ ;  $\text{CaSO}_4$ ;  $\text{Na}_2\text{CO}_3$

The compound having maximum number of water of crystallisation in its crystalline form in one molecule is :

- (a)  $\text{FeSO}_4$  (b)  $\text{CuSO}_4$   
(c)  $\text{CaSO}_4$  (d)  $\text{Na}_2\text{CO}_3$

Ans :

OD 2024

Compound	Crystalline form
$\text{FeSO}_4$	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (Green vitriol)
$\text{CuSO}_4$	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (Blue vitriol)
$\text{CaSO}_4$	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (Gypsum)
$\text{Na}_2\text{CO}_3$	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ (Washing soda)

Thus (d) is correct option.

2. Oxides of aluminium and zinc are:

- (a) acidic (b) basic  
(c) amphoteric (d) neutral

Ans :

OD 2024

$\text{Al}_2\text{O}_3$  and  $\text{ZnO}$  are amphoteric in nature because they show both acidic and basic character.

Thus (c) is correct option.

3. Metal oxides generally react with acids, but few oxides of metal also react with bases. Such metallic oxides are :

- I.  $\text{MgO}$   
II.  $\text{ZnO}$   
III.  $\text{Al}_2\text{O}_3$   
IV.  $\text{CaO}$   
V.  $\text{CaO}$

- (a) I and II (b) II and III  
(c) III and IV (d) I and IV

Ans :

OD 2023

Oxides which show acidic as well as basic behaviour are called as amphoteric oxides.

Examples - Aluminium oxide,  $\text{Al}_2\text{O}_3$  and zinc oxide,  $\text{ZnO}$ .

Thus option (b) is correct option.

4. Few drops of aqueous solution of ammonium chloride are put on a universal indicator paper. The paper turns pink. Study the following table and choose the correct option.

Nature	Ammonium chloride is a salt of...	Range of pH
(a) acidic	weak acid and strong base	less than 7
(b) basic	weak acid and strong base	more than 7
(c) acidic	strong acid and weak base	less than 7
(d) basic	strong acid and strong base	7

Ans :

OD 2023

Ammonium chloride is a salt of strong acid like (hydrochloric acid) and a weak base (like ammonium hydroxide). It is acidic in nature and pH less than 7. Universal indicator paper gives pink solution in acidic medium.

Thus option (c) is correct option.

5. Two salts X and Y are dissolved in water separately. When phenolphthalein is added to these two solutions the solution X turns pink and the solution Y does not show any change in colour, therefore X and Y are:

	(X)	(Y)
(a)	$\text{Na}_2\text{CO}_3$	$\text{NH}_4\text{Cl}$
(b)	$\text{Na}_2\text{SO}_4$	$\text{NaHCO}_3$
(c)	$\text{NH}_4\text{Cl}$	$\text{Na}_2\text{SO}_4$
(d)	$\text{NaNO}_3$	$\text{Na}_2\text{SO}_4$

Ans :

OD 2023

Phenolphthalein gives pink colour in a basic pH range from 8.2 to 10. When phenolphthalein is added to  $\text{Na}_2\text{CO}_3$  solution, which is a basic solution, the solution will turn pink in colour. However, when phenolphthalein is added to  $\text{NH}_4\text{Cl}$ , which is acidic solution, the solution will remain colourless.

Thus option (a) is correct option.

6. A solution turns red litmus blue, its pH is likely to be

- (a) 1 (b) 4  
(c) 5 (d) 10



a large amount of heat is evolved at once. This heat changes some of the water to steam explosively which can splash the acid on our face or clothes and cause acid burns.

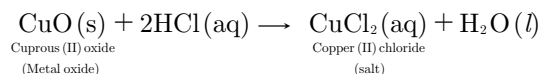
- 140.** What happens when an acid reacts with a metal oxide? Explain with the help of an example.

**Ans :**

Delhi 2013

An acid reacts with a metal oxide to form salt and water.

Example :



The solution turns blue-green due to the formation of copper (II) chloride.

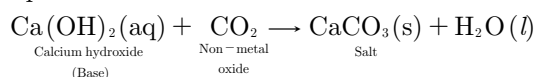
- 141.** What happens when a base reacts with a non-metal oxide? Explain with the help of an example.

**Ans :**

Foreign 2017

A base reacts with a non-metal oxide to form salt and water.

Example :



- 142.** Why do acids not show acidic behaviour in the absence of water?

**Ans :**

OD 2010

The acidic behaviour of acids is due to the presence of  $\text{H}^+$  (aq) ions. The acids produce hydrogen ions only on dissolving in water. In the absence of water, acids do not produce hydrogen ions and hence do not show acidic behaviour.

### THREE MARKS QUESTIONS

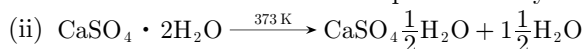
- 143.** A compound which is prepared from gypsum has the property of hardening when water is mixed in right quantity with it:

- Write common name and the chemical name of this compound.
- Give chemical equation for its preparation.
- List its two uses.

**Ans :**

OD 2024

- Common name – Plaster of Paris  
Chemical name – Calcium sulphate hemihydrate



- (1) It is used for immobilising the affected fractured part of bone leading to quick recovery.

- (2) It is also used for making decorative pieces such as toys, statues, etc.

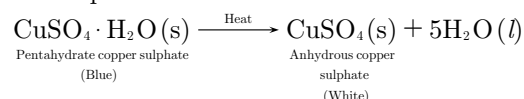
- 144.** Give reasons for the following :

- Only one half of water molecule is shown in the formula of Plaster of Paris.
- Sodium hydrogen carbonates is used as an antacid.
- On strong heating, blue coloured copper sulphate crystals turn white.

**Ans :**

Comp 2020

- Only one half of water molecule is shown in the formula of plaster of paris because two formula units of  $\text{CaSO}_4$  share one molecule of water.
- Sodium hydrogen carbonate is used as an antacid because it is alkaline in nature and neutralises excess acid in stomach and provides relief.
- Blue coloured copper sulphate crystals on strong heating loses molecules of water of crystallisation and changes to anhydrous copper sulphate which is white in colour.



- 145.** List the important products of the Chlor-alkali process. Write one important use of each.

**Ans :**

Comp 2020

When electricity is passed through brine (an aqueous solution of sodium chloride), it decomposes

$$2\text{NaCl (aq)} + 2\text{H}_2\text{O (l)} \xrightarrow[\text{Current}]{\text{Electric}} 2\text{NaOH (aq)} + \text{H}_2 \text{ (g)} + \text{Cl}_2 \text{ (g)}$$

The process of breakdown of brine solution is called Chlor-alkali process because of products 'chlor' for chlorine and 'alkali' for sodium hydroxide.

Chlorine gas is formed at the cathode, hydrogen gas at the cathode whereas sodium hydroxide solution is formed near the cathode.

**Use of Products formed :**

- Uses of NaOH (sodium hydroxide) :** It is used for:
  - de-greasing metals.
  - Manufacture of soaps, paper, a large number of chemicals and artificial fibres. (Any one)
- Uses of Chlorine :** It is used in :
  - Water treatment, swimming pool.
  - Preparation of bleaching powder, PVC, disinfectants, CFC's Pesticides etc.

16. A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue ?

(a) Lemon juice                      (b) Vinegar  
(c) Common salt                    (d) An antacid

Ans :

(d) An antacid

17. Which of the following gives the correct increasing order of acidic strength ?

(a) Water < Acetic acid < Hydrochloric acid  
(b) Water < Hydrochloric acid < Acetic acid  
(c) Acetic acid < Water < Hydrochloric acid  
(d) Hydrochloric acid < Water < Acetic acid

Ans :

(a) Water < Acetic acid < Hydrochloric acid

18. If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done ?

(a) Wash the hand with saline solution  
(b) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate  
(c) After washing with plenty of water apply solution of sodium hydroxide on the hand  
(d) Neutralise the acid with a strong alkali

Ans :

(b) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate.

19. Sodium hydrogen carbonate when added to acetic acid evolves a gas. Which of the following statements are true about the gas evolved ?

(i) It turns lime water milky.  
(ii) It extinguishes a burning splinter  
(iii) It dissolves in a solution of sodium hydroxide  
(iv) It has a pungent odour  
(a) (i) and (ii)                      (b) (i), (ii) and (iii)  
(c) (ii), (iii) and (iv)            (d) (i) and (iv)

Ans :

(b) (i), (ii) and (iii)

20. Common salt besides being used in kitchen can also be used as the raw material for making

(i) washing soda

(ii) bleaching powder

(iii) baking soda

(iv) slaked lime

(a) (i) and (ii)                      (b) (i), (ii) and (iii)

(c) (i) and (iii)                    (d) (i), (iii) and (iv)

Ans :

(c) (i) and (iii)

21. One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is

(a) hydrochloric acid              (b) tartaric acid  
(c) acetic acid                      (d) sulphuric acid

Ans :

(b) tartaric acid

22. To protect tooth decay we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is

(a) acidic                              (b) neutral  
(c) basic                                (d) corrosive

Ans :

(c) basic

23. Which of the following statements is correct about an aqueous solution of an acid and of a base ?

(i) Higher the pH, stronger the acid  
(ii) Higher the pH, weaker the acid  
(iii) Lower the pH, stronger the base  
(iv) Lower the pH, weaker the base  
(a) (i) and (iii)                      (b) (ii) and (iii)  
(c) (i) and (iv)                      (d) (ii) and (iv)

Ans :

(d) (ii) and (iv)

24. The pH of the gastric juices released during digestion is

(a) less than 7                      (b) more than 7  
(c) equal to 7                        (d) equal to 0

Ans :

(a) less than 7

25. Which of the following phenomena occur, when a small amount of acid is added to water ?

(i) Ionisation  
(ii) Neutralisation  
(iii) Dilution

- (iii) The pH paper is changed from blue to red in colour.
- (iv) Turns red litmus to blue in colour.

**179.** Acids, bases and salts are three main categories of chemical compounds. These have certain definite properties which distinguish one class from the other.

The acids are sour in taste while bases are bitter in taste. Tasting a substance is not a good way of finding out if it is an acid or a base! Acids and bases can be better distinguished with the help of indicators. Indicators are substances that undergo a change of colour with a change of acidic, neutral or basic medium. Many of these indicators are derived from natural substances such as extracts from flower petals and barrier. Litmus, a purple dye is extracted from the lichen plant. Some indicators are prepared artificially. For example, methyl orange and phenolphthalein. Given below is a table of indicators and their colour change in acidic and basic medium.

Indicator	Colour in Acid	Colour in Alkali
Litmus	Red	Blue
Methyl	Pinkish red	Yellow
Phenolphthalein	Colourless	Pink

- (i) Give two examples each of natural and artificial indicators.
- (ii) An aqueous solution turns red litmus solution blue. Excess addition of which solution would reverse the change-ammonium hydroxide solution or hydrochloric acid?
- (iii) What will be the change in colour when a few drops of phenolphthalein is added to a solution having pH 8.5
- (iv) What is universal indicator?

**Ans :**

- (i) Natural Indicators : Turmeric and red cabbage, Artificial Indicators : Methyl red and methyl orange
- (ii) Hydrochloric acid because adding excess acid to the base would turn blue litmus solution red.
- (iii) It changes into pink.
- (iv) Universal indicator is a mixture of dyes that changes colour gradually over a range of pH and is used in testing for acids and alkalis.

**180.** The pH scale can be used to determine the strength of acid solutions as well as basic solutions by making use of hydrogen ion concentrations in them. Consider two solutions *A* and *B* having pH values 3 and 9.5, respectively.

- (i) Which solution will turn blue litmus red ?
- (ii) Which solution will turn phenolphthalein from colourless to pink ?
- (iii) Water is a neutral substance. What colour will you get when you add a few drops of universal indicator to a test tube containing distilled water?

**Ans :**

- (i) Solution *A* will turn blue litmus to red as its value of pH is 3.
- (ii) Solution *B* will turn phenolphthalein from colourless to pink as it is basic in nature.
- (iii) It turns the universal indicator solution green as its pH value is 7.

**181.** A metal carbonate *X* on heating with an acid gives a gas which when passed through a solution *Y* gives the carbonate back. On the other hand, a gas *G* that is obtained at anode during electrolysis of brine is passed on dry *Y*, it gives a compound *Z*, used for disinfecting drinking water.

- (i) Identify *X*, *Y*, *G* and *Z*.
- (ii) What is the nature of the gas evolved when *X* is heated ?
- (iii) Write the reaction involved in the formation of *G* ?
- (iv) Write the reaction involved when *G* reacts with *Y*.

**Ans :**

- (i) *X* is calcium carbonate ( $\text{CaCO}_3$ ).  
*Y* is slaked lime [ $\text{Ca}(\text{OH})_2$ ].  
*G* is chlorine ( $\text{Cl}_2$ ) gas.  
*Z* is bleaching powder ( $\text{CaOCl}_2$ ).
- (ii) 
$$\underset{(X)}{\text{CaCO}_{3(s)}} \xrightarrow{\Delta} \text{CaO}_{(s)} + \underset{(Acidic\ gas)}{\text{CO}_{2(g)}}$$
  
 The gas  $\text{CO}_2$  is acidic in nature.
- (iii) 
$$2\text{NaCl(aq)} + 2\text{H}_2\text{O(l)} \longrightarrow 2\text{NaOH(aq)} + \text{Cl}_2(\text{g}) + \text{H}_2(\text{g})$$
- (iv) 
$$\underset{(G)}{\text{Cl}_2(\text{g})} + \underset{(Dry)}{\text{Ca}(\text{OH})_2(\text{s})} \longrightarrow \underset{(Z)}{\text{CaOCl}_2(\text{s})} + \text{H}_2\text{O(l)}$$

34. Column II gives type of reaction mention in column I, match them correctly.

	Column I		Column II
(A)	$\text{NaHCO}_3$	(p)	Baking soda
(B)	$\text{NaOH}$	(q)	Alkaline
(C)	$\text{KHSO}_4$	(r)	Acidic salt
(D)	$\text{Ca}(\text{OH})_2$	(s)	Bitter taste

	A	B	C	D
(a)	p, q, r	q, s	q, r	q, s
(b)	p	q, s	s	r
(c)	q	s	p	r
(d)	r	q	s	p

Ans :

(a) A-p, q, r, B-q, s, C-q, r, D-q, s

35. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Solution of pH 5.5	(p)	Neutral
(B)	Solution of pH 5	(q)	Acidic
(C)	Solution of pH 4	(r)	$[\text{OH}^-] = 10^{-3}$
(D)	Solution of pH 7	(s)	Basic

	A	B	C	D
(a)	s	q, s	p	r
(b)	s, r	q, s	p	r
(c)	p, s	q	r, s	p
(d)	s	p	q	r, s

Ans :

(d) A-s, B-p, C-q, D-r, s

36. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Mono basic	(p)	$\text{KOH}$
(B)	Dibasic	(q)	$\text{Ca}(\text{OH})_2$
(C)	Diacidic	(r)	$\text{H}_2\text{SO}_4$
(D)	Mono acidic	(s)	$\text{HNO}_3$

	A	B	C	D
(a)	s	r	q	p
(b)	p	q	s	r
(c)	q	s	p	r
(d)	r	q	s	p

Ans :

(a) A-s, B-r, C-q, D-p

37. **Assertion (A)** : Hydrogen gas is not evolved when zinc reacts with nitric acid.

**Reason (R)** : Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
 (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).  
 (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

Ans :

OD 2024

Hydrogen gas is not evolved when zinc reacts with nitric acid as  $\text{HNO}_3$  being oxidising agent oxidises the hydrogen gas produced to water and itself gets reduced to any of the nitrogen oxides.

Thus (a) is correct option.

38. **Assertion (A)**: It is advised that while diluting an acid one should add water to acid and not acid to water keeping the solution continuously stirred.

**Reason (R)**: The process of dissolving an acid into water is highly exothermic.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation (A)  
 (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of (A).  
 (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

Ans :

OD 2023

The process of adding water to an acid is highly exothermic, therefore it is always recommended that acid should be added to water. If it is done the other way, then it might be possible that because of the large amount of heat generated, the mixture may splash out and cause burns. Hence, assertion is false but reason is true.

Thus option (d) is correct option.

Ans :

The solution which turns red litmus blue is basic. Hence, its pH should be greater than 7.

Thus option (d) is correct.

7. A solution reacts with crushed egg shells to give a gas that turns lime water milky. The solution contains

- (a) NaCl (b) HCl  
(c) LiCl (d) KCl

Ans :

The egg-shells are made of calcium carbonate and the gas which turns lime-water milky is carbon dioxide. Carbon dioxide gas can be formed by action of an acid solution on calcium carbonate (or egg-shells). So, the solution contains HCl.

Thus option (b) is correct.

8. 10 mL of solution of NaOH is found to be completely neutralized by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount HCl solution (the same solution as before) required to neutralise it will be

- (a) 4 mL (b) 8 mL  
(c) 12 mL (d) 16 mL

Ans :

10 mL of NaOH is neutralized by HCl = 8 mL

20 mL of NaOH will require HCl (for complete neutralization)

$$= \frac{8}{10} \times 20 = 16 \text{ mL}$$

Thus option (d) is correct.

9. Which one of the following types of medicines is used for treating indigestion ?

- (a) Antibiotic (b) Analgesic  
(c) Antacid (d) Antiseptic

Ans :

- (c) Antacid

10. What happens when a solution of an acid is mixed with a solution of a base in a test tube ?

- (i) The temperature of the solution increases  
(ii) The temperature of the solution decreases  
(iii) The temperature of the solution remains the same

(iv) Salt formation takes place

- (a) (i) only (b) (i) and (iii)  
(c) (ii) and (iii) (d) (i) and (iv)

Ans :

- (d) (i) and (iv)

11. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change ?

- (a) Baking powder  
(b) Lime  
(c) Ammonium hydroxide solution  
(d) Hydrochloric acid

Ans :

- (d) Hydrochloric acid

12. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

- (a) absorb the evolved gas  
(b) moisten the gas  
(c) absorb moisture from the gas  
(d) absorb  $\text{Cl}^-$  ions from the evolved gas

Ans :

- (c) absorb moisture from the gas

13. Which of the following salts does not contain water of crystallisation ?

- (a) Blue vitriol (b) Baking soda  
(c) Washing soda (d) Gypsum

Ans :

- (b) Baking soda

14. Sodium carbonate is a basic salt because it is a salt of

- (a) strong acid and strong base  
(b) weak acid and weak base  
(c) strong acid and weak base  
(d) weak acid and strong base

Ans :

- (d) weak acid and strong base

15. Calcium phosphate is present in tooth enamel. Its nature is

- (a) basic (b) acidic  
(c) neutral (d) amphoteric

Ans :

- (a) basic

When gypsum is heated at 373K, it loses water molecules and forms Plaster of Paris. Both assertion and reason are true and reason explains assertion.

45. **Assertion :** Salts of strong acids and weak bases are basic in nature.

**Reason :** pH value of such salt are more than 7.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

Salts obtained from strong acids and weak bases are acidic in nature and pH value of acidic salts is less than 7. Hence both assertion and reason are wrong.

46. **Assertion :** When acid rain flows into the river, it lowers the pH of the river water.

**Reason :** The survival of aquatic life in such river becomes difficult.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

Since pH value of acids is less than 7, so when acid rain flows into rivers, it lowers the pH of the rain water and survival of aquatic life in such river becomes difficult. Both assertion and reason are true but reason does not explain assertion.

47. **Assertion :** Limestone, chalk and marble react with acids to form salt, carbon dioxide and water.

**Reason :** Limestone, chalk and marble are different forms of calcium carbonate.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

Limestone, chalk, marble are different forms of calcium carbonate and calcium carbonate reacts with acid to form salt, carbon dioxide and water.

48. **Assertion :** In a neutralisation reaction, metal and non-metal react to form salt.

**Reason :** Metal contains  $H^+$  ions and non-metal  $OH^-$  ions.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

The reaction between an acid and a base to give a salt and water is known as neutralisation reaction. Acid contains  $H^+$  ion and base contains  $OH^-$  ion. Hence both assertion and reason are false.

49. **Assertion :** Non-metallic oxides are acidic in nature.

**Reason :** Non-metallic oxides react with base to form salt and water just like an acid reacts with a base.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

Non-metallic oxides react with base to form salt and water. Hence both assertion and reason are true and reason explains assertion.

50. **Assertion :** HCl produces hydronium ions ( $H_3O^+$ ) and chloride ions ( $Cl^-$ ) in aqueous solution.

**Reason :** In presence of water, base gives  $H^+$  ions.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.



(iv) Salt formation

- (a) (i) and (ii)                      (b) (i) and (iii)  
(c) (ii) and (iii)                    (d) (ii) and (iv)

**Ans :**

(b) (i) and (iii)

- 26.** Which one of the following can be used as an acid-base indicator by a visually impaired student ?

- (a) Litmus                              (b) Turmeric  
(c) Vanilla essence                (d) Penunia leaves

**Ans :**

(c) Vanilla essence

- 27.** Which of the following substance will not give carbon dioxide on treatment with dilute acid ?

- (a) Marble                              (b) Limestone  
(c) Baking soda                      (d) Lime

**Ans :**

(d) Lime

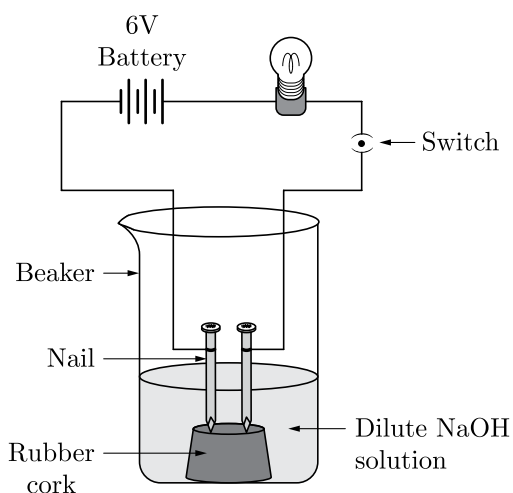
- 28.** Which of the following is acidic in nature ?

- (a) Lime juice                          (b) Human blood  
(c) Lime water                        (d) Antacid

**Ans :**

(a) Lime juice

- 29.** In an attempt to demonstrate electrical conductivity through an electrolyte, the following apparatus (Figure) was set up.



Which among the following statement(s) is(are) correct ?

- (i) Bulb will not glow because electrolyte is not acidic

(ii) Bulb will glow because NaOH is a strong base and furnishes ions for conduction.

(iii) Bulb will not glow because circuit is incomplete

(iv) Bulb will not glow because it depends upon the type of electrolytic solution

(a) (i) and (iii)                      (b) (ii) and (iv)

(c) (ii) only                          (d) (iv) only

**Ans :**

(c) (ii) only

- 30.** Which of the following is used for dissolution of gold?

- (a) Hydrochloric acid                (b) Sulphuric acid  
(c) Nitric acid                        (d) Aqua regia

**Ans :**

(d) Aqua regia

- 31.** Which of the following is not a mineral acid ?

- (a) Hydrochloric acid  
(b) Citric acid  
(c) Sulphuric acid  
(d) Nitric acid

**Ans :**

(b) Citric acid

- 32.** Which among the following is not a base ?

- (a) NaOH                                (b) KOH  
(c)  $\text{NH}_4\text{OH}$                             (d)  $\text{C}_2\text{H}_5\text{OH}$

**Ans :**

(d)  $\text{C}_2\text{H}_5\text{OH}$

- 33.** Which of the following statements is not correct ?

- (a) All metal carbonates react with acid to give a salt, water and carbon dioxide  
(b) All metal oxides react with water to give salt and acid  
(c) Some metals react with acids to give salt and hydrogen  
(d) Some non-metal oxides react with water to form an acid

**Ans :**

(b) All metal oxides react with water to give salt and acid

( $\text{NH}_3$ ) is a weak base because it does not contains hydroxide ions, but on reaction with water, it produces hydroxide ions but the reaction is almost reversible;



Moreover, the electro-negativity of nitrogen atoms makes it less basic, as nitrogen atoms take hold on its lone pair electrons to leave its vicinity. Hydrochloric acid is a strong mineral acid as it readily dissociates to produce hydrogen ions ( $\text{H}^+$ ) and chloride ions ( $\text{Cl}^-$ ). The reaction is  $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ . So, it is clear that ammonium chloride is made of weak base and strong acid. Ammonium chloride is considered as a neutral salt but actually its solution is slightly acidic because chloride ion ( $\text{Cl}^-$ ) is weak conjugate base of strong acid ( $\text{HCl}$ ) and ammonium ion ( $\text{NH}_4^+$ ) is a strong conjugate acid of a weak base ( $\text{NH}_3$ ). Thus, in the solution the conjugate acid is ( $\text{NH}_4^+$ ) stronger than the weak base ( $\text{Cl}^-$ ); so, the solution is slightly acidic.

- 56. Assertion :** Baking soda does not creates acidity in the stomach.

**Reason :** Baking soda is not alkaline.

- Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- Assertion is true but Reason is false.
- Assertion is true but Reason is false

**Ans :**

- Assertion is true but Reason is false.

Baking soda, being alkaline, neutralises the acidity in the stomach and removes it.

- 57. Assertion :** Plaster of Paris is used by doctors by setting fractured bones.

**Reason :** When Plaster of Paris is mixed with water and applied around the fractured limbs, it sets into a hard mass.

- Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- Assertion is true but Reason is false.
- Assertion is false but Reason is true.

**Ans :**

- Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Plaster of Paris when mixed with water and applied around the fractured limbs, it sets in to a hard mass and keeps the bone joints in a fixed position. So, it is commonly used for setting fractured bones.

- 58. Assertion :** Sodium hydroxide reacts with zinc to produce hydrogen gas.

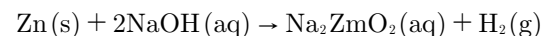
**Reason :** Acids reacts with active metals to produce hydrogen gas.

- Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- Assertion is true but Reason is false.
- Assertion is false but Reason is true.

**Ans :**

- Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Sodium hydroxide being an strong base, reacts with active metal (zinc) to product  $\text{H}_2$  gas. The reaction is given as follows:



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## ONE MARK QUESTIONS

- 59.** Which substance is present in sour tasting items ?

**Ans :**

OD 2018

Acids is present in sour tasting items.

- 60.** If someone in your family is suffering from acidity, which of the following would you suggest as a remedy: lemon juice, vinegar or baking soda solution ?

**Ans :**

Foreign 2015

Baking soda solution.

- 61.** Which factor is responsible for the working of baking soda as antacid ?

**Ans :**

Delhi 2011

The ability of acids and bases to nullify each other.

(d) Assertion is false but Reason is true.

**Ans :**

(c) Assertion is true but Reason is false.

HCl produces  $\text{H}^+$  ions in aqueous solution because in presence of water, acids give  $\text{H}^+$  ions. As  $\text{H}^+$  ions cannot exist alone so it combines with water molecules and form  $\text{H}_3\text{O}^+$ .

**51. Assertion :** If the pH inside the mouth decreases below 5.5, the decay of tooth enamel begins.

**Reason :** The bacteria present in mouth degrades the sugar and left over food particles and produce acids that remains in the mouth after eating.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Tooth decay starts when the pH of the mouth is lower than 5.5. Hence assertion is true but reason is false.

**52. Assertion :**  $\text{H}_2\text{CO}_3$  is a strong acid.

**Reason :** A strong acid dissociates completely or almost completely in water.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

Acid which partially dissociate into in aqueous solutions is known as weak acid. Example:  $\text{H}_2\text{CO}_3$  (carbonic acid),  $\text{HCOOH}$  (formic acid) and acid which completely dissociate into ions in aqueous solutions is known as strong acid. Example: HCl (Hydrochloric acid),  $\text{H}_2\text{SO}_4$  (Sulphuric acid) etc.

**53. Assertion :** Salts are the products of an acid-base reaction.

**Reason :** Salt may be acidic or basic.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

**Ans :**

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Salts are formed by the combination of acid and base through neutralisation reaction. Salt are ionic compound consisting two parts, one part carrying positive charge and the other part carrying a negative charge. The number of positive and negative ions present in such that total positive charge is equal to total negative charge so that the salt as a whole is the electrically neutral.

**54. Assertion :** On adding  $\text{H}_2\text{SO}_4$  to water the resulting aqueous solution get corrosive.

**Reason :** Hydronium ions are responsible for corrosive action.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

$\text{H}_2\text{SO}_4$  is a strong acid, it readily forms hydronium ions when dissolved in water which are responsible for its corrosive action.

**55. Assertion :** pH of ammonium chloride solution is in acidic range.

**Reason :** Solution of a salt of weak base and strong acid is acidic.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Ammonium chloride is made up of ammonia ( $\text{NH}_3$ ) and hydrochloric acid (HCl), the reaction is  $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$ . We know that ammonia

79. Dry HCl gas does not change the colour of dry blue litmus. Give reason.

Ans : OD 2008

H<sup>+</sup> ion from HCl cannot ionize to give H<sup>+</sup> ions in absence of water. Acidic property like change in colour of litmus depends on production of H<sup>+</sup> ion, hence there is no colour change.

80. What do you mean by acid rain ?

Ans : Foreign 2014

When pH of rain water is below 5.6, it is called acid rain.

81. Which acid is produced in stomach ?

Ans : Comp 2018

Hydrochloric acid is produced in stomach.

82. Name a natural antidote of nettle.

Ans : Comp 2013

Dock plant.

83. Name the acid present in tamarind.

Ans : SQP 2019

Tartaric acid.

84. Why is HCl a stronger acid than acetic acid ?

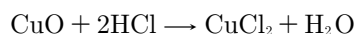
Ans : Delhi 2011

On dissociation HCl yields larger [H<sup>+</sup>] for the same concentration compared to acetic acid.

85. What will you observe when dilute hydrochloric acid is added to a small amount of copper oxide in a beaker?

Ans : Foreign 2014

The colour of the solution becomes blue green and the copper oxide



86. Name a salt which does not contain water of crystallisation.

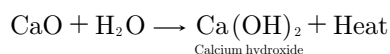
Ans : Delhi 2008

Baking soda.

87. What happens when water is added to quick lime ?

Ans : OD 2006

When quick lime reacts with water, slaked lime is formed.



88. A compound which is formed due to recrystallisation of sodium carbonate. Identify the compound and write its chemical formula.

Ans : Comp 2013

Compound : Washing soda;

Chemical formula : Na<sub>2</sub>CO<sub>3</sub> · 10H<sub>2</sub>O

89. What are the products formed when an acid reacts with a base ?

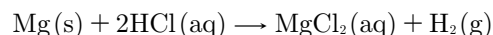
Ans : Delhi 2017

Acid reacts with a base to form salt and water.

90. Explain the action of dilute hydrochloric acid on magnesium ribbon.

Ans : Foreign 2010

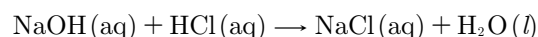
Dil. Hydrochloric acid reacts with magnesium to form magnesium chloride and hydrogen gas is liberated.



91. Explain the action of dilute hydrochloric acid on sodium hydroxide.

Ans : Comp 2007

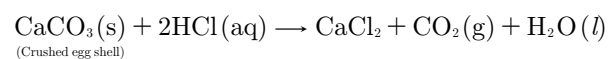
Reaction between dil. hydrochloric acid and sodium hydroxide is a neutralisation reaction. Sodium chloride salt and water are formed.



92. Explain the action of dilute hydrochloric acid on crushed egg shells.

Ans : OD 2017

Egg shells are made of calcium carbonate (CaCO<sub>3</sub>). Dilute hydrochloric acid dissolves the CaCO<sub>3</sub> and makes the shell soft.



93. What is neutralisation reaction ?

Ans : Foreign 2013

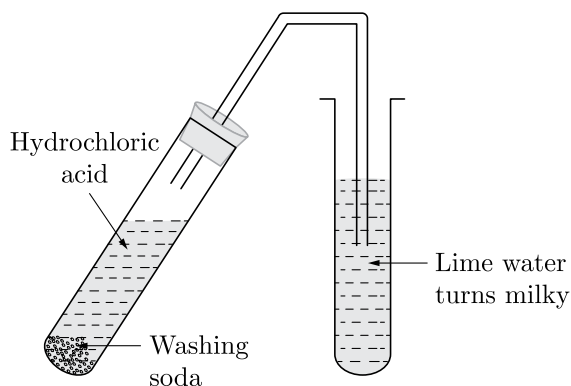
The reaction between an acid and base to form salt and water is called neutralisation reaction.

94. Two solutions A and B have pH values of 3.0 and 10.5 respectively. Which of these will turn blue litmus solution to red.

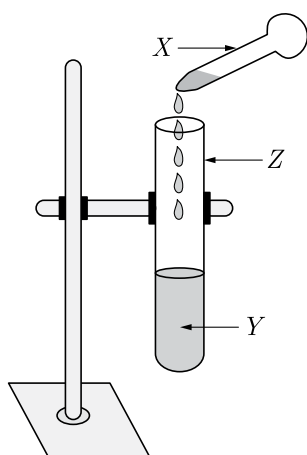
Ans : Delhi 2017

A solution which have pH between 1 to 7 is called an acid. So here, pH of A is 3.0, so A is an acid. Also, we know acid turn blue litmus to red.

The gas evolved in the reaction turns lime water milky. Therefore, the evolved gas is carbon dioxide. Thus, this experiment shows that acids decompose sodium carbonate to produce carbon dioxide.



163. Complete the labelling in the figure given alongside.



Ans :

Delhi 2007

X is the dropper containing dilute HCl.

Y is the dilute solution of NaOH + phenolphthalein.

Z is a test tube.

164. What is meant by 'water of crystallisation' of a substance? Describe an activity to show that blue copper sulphate crystals contain water of crystallisation.

Ans :

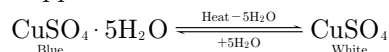
Delhi 2014

Crystals of some compounds seem to be dry (or anhydrous), but actually contain some water molecules attached to them. This water is called water of crystallisation and such salts are called hydrated salts.

The following activity shows that blue copper sulphate crystals contain water of crystallisation.

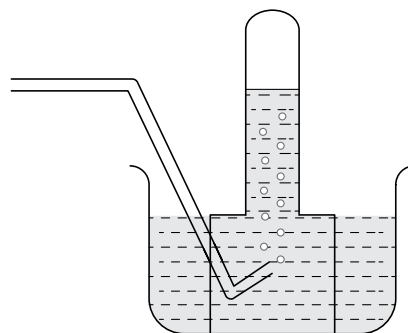
**Activity :** Heat a few copper sulphate crystals in a dry boiling tube. After sometime, the blue colour of the crystals disappears and white powder or anhydrous copper sulphate is formed.

A few drops of water also appear on the inner walls of the boiling tube. When some water is added to the boiling tube after heating, the blue colour reappears.



165. A metal is treated with dilute sulphuric acid. The gas evolved is collected by the method shown in the figure. Answer the following :

- Name the gas.
- Name the method of collection of the gas.



- Is the gas soluble or insoluble in water?
- Is the gas lighter or heavier than air?

Ans :

OD 2006

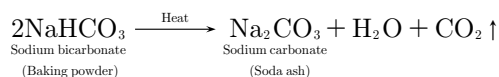
- Hydrogen gas.
- The gas is collected by the downward displacement of water.
- Since the gas is collected over water, this suggests that the gas is insoluble in water.
- The gas is lighter than air because the collecting gas jar is inverted.

166. A housewife found that the cake prepared by her is hard and small in size. Which ingredient has she forgotten to add that would have made the cake fluffy? Give reason.

Ans :

Delhi 2019

She has forgotten to add baking powder during the preparation of cake. Baking powder contains sodium bicarbonate and tartaric acid. On heating, sodium bicarbonate reacts with acid to produce carbon dioxide gas which causes the cake to rise and become fluffy.



112. The pH of soil *A* is 7.5 while that of soil *B* is 4.5. Which of the two soils *A* or *B* should be treated with powdered chalk to adjust its pH and why ?

Ans : OD 2012

Soil *B* with pH 4.5 should be treated with powdered chalk to adjust the pH of soil to neutral i.e., nearly 7 as acidic soil is not good for plant growth.

113. Explain how the pH change in the river water can endanger the lives of aquatic animal like fish.

Ans : Delhi 2011

When the acid rain which has pH less than 5.6, flows into the rivers, it lowers pH of the river water. As a result, the survival of aquatic life in such rivers become difficult.

## TWO MARKS QUESTIONS

114. Out of the two—hydrochloric acid and acetic acid, which one is considered a strong acid and why ? Write the name/molecular formula of one more strong acid.

Ans : Comp 2021

Hydrochloric acid (HCl) is a stronger acid than acetic acid (CH<sub>3</sub>COOH) because it releases H<sup>+</sup> ions in aqueous solution more easily. In order to verify this, add a few drops of universal indicator solution in the test tubes containing the acids. It acquires red colour in hydrochloric acid (pH = 2) and yellow in acetic acid (pH = 4) which confirms that hydrochloric acid is stronger acid.

115. Write equations for
- Dissociation of HCl in water.
  - Formation of hydronium ion.
  - NaOH is dissolved in water.
  - KOH is dissolved in water.

Ans : Delhi 2017

- $\text{HCl} + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
- $\text{H}^+ + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{O}^+$
- $\text{NaOH(s)} \xrightarrow{\text{H}_2\text{O}} \text{Na}^+(\text{aq}) + \text{OH}^-(\text{aq})$
- $\text{KOH(s)} \xrightarrow{\text{H}_2\text{O}} \text{K}^+(\text{aq}) + \text{OH}^-(\text{aq})$

116. What is dilution ?

Ans : OD 2015

Mixing an acid or base with water results in decrease in the concentration of ions (H<sub>3</sub>O<sup>+</sup>/OH<sup>-</sup>) per unit

volume. Such a process is called dilution and the acid or the base is said to be diluted.

117. Name some naturally occurring acids and their source.

Ans : Delhi 2011

Acid	Natural source
Acetic acid	Vinegar
Lactic acid	Sour milk (Curds)
Citric acid	Oranges
Citric acid	Lemons

118. Tooth enamel is one of the hardest substances in our body. How does it undergo damage due to eating chocolates and sweets ? How do tooth pastes prevent this damage ?

Ans : Foreign 2012

Tooth enamel is made up of calcium phosphate, the hardest substance in the body. When we eat chocolates, sweets etc., some particles remain in the mouth. The bacteria presents in the mouth act on these left over food particles to produce acid which corrodes the tooth enamel and causes tooth decay. As tooth pastes are generally basic, they help in neutralizing this acid and prevent tooth decay.

119. Name the gas which is usually produced when dil. sulphuric acid reacts with a metal. Illustrate it with an example. How will you test the evolution of this gas.

Ans : SQP 2016

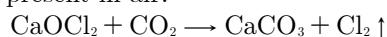
When dilute H<sub>2</sub>SO<sub>4</sub> reacts with metal, hydrogen gas is produced. For example, when H<sub>2</sub>SO<sub>4</sub> reacts with aluminium metal, aluminium sulphate and hydrogen gas are produced.

$2\text{Al(s)} + 3\text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{Al}_2(\text{SO}_4)_3(\text{s}) + 3\text{H}_2(\text{g})$   
when a burning match stick is taken near the mouth of the container in which hydrogen gas is producing, it burns with pop sound.

120. A calcium compound which is a yellowish white powder is used as a disinfectant and also in textile industry. Name the compound. Which gas is released when this compound is left exposed to air ?

Ans : Delhi 2019

- Bleaching powder or calcium oxychloride.
- When exposed to air, it releases Cl<sub>2</sub> gas according to the following reaction with CO<sub>2</sub> present in air.





62. How does colour of litmus change in acidic and basic media ?

Ans :

Comp 2010

In acidic media, colour of litmus is red and in basic media, colour of litmus is blue.

63. What is the source of litmus ?

Ans :

SQP 2019

Lichen is the source of litmus.

64. Write the name some natural indicators.

Ans :

Delhi 2014

Red cabbage leaves, turmeric, coloured petals of some flowers like Hydrangea, Petainia and Geranium.

65. Write the name of some synthetic indicators.

Ans :

OD 2009

Phenolphthalein, methyl orange, etc.

66. Why the colour of stain of curry on cloth becomes reddish brown when soap is scrubbed on it ?

Ans :

Comp 2017

The soap is a basic substance. Turmeric used in spice is an indicator and turns reddish brown when comes in contact with basic substances.

67. Which of these vanilla, onion and clove can be used as olfactory indicator ?

Ans :

OD 2012

All three are used as the olfactory indicator.

68. What happens when acids react with metals ?

Ans :

OD 2009

Acids react with metals to give salt and hydrogen gas.

Acid + Metal  $\rightarrow$  Salt + Hydrogen

69. Write equation for reaction between zinc and sulphuric acid.

Ans :

SQP 2007

$\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$

70. Write the equation for reaction between sodium hydroxide and zinc.

Ans :

Foreign 2018

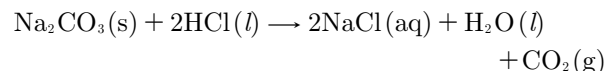
$2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$

71. What happens when dilute hydrochloric acid is added to sodium carbonate ?

Ans :

Delhi 2013

Carbon dioxide gas is evolved along with formation of sodium chloride and water.

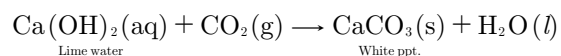


72. Write the reaction between carbon dioxide and lime water.

Ans :

OD 2010

On passing carbon dioxide, lime water turns milky due to formation of calcium carbonate.



73. What happens when metal carbonates/metal hydrogen carbonates react with acids ?

Ans :

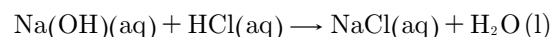
Foreign 2007

Metal carbonate/Metal hydrogen carbonate + Acid  $\rightarrow$  Salt + Carbon dioxide + Water.

74. Write the equation for reaction between sodium hydroxide and hydrochloric acid.

Ans :

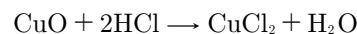
SQP 2010



75. Write and balance the reaction between copper oxide and hydrochloric acid.

Ans :

OD 2019

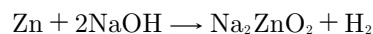


76. Most metals do not react with bases, but zinc metal does. Suggest a reason. Write an equation for the reaction between Zn and NaOH.

Ans :

SQP 2010

Zinc is amphoteric in nature.



77. Aqueous solution of acids conduct electricity while alcohol does not. Explain.

Ans :

Delhi 2016

Aqueous solutions of acids contains ions to conduct electricity. Alcohol does not produce ions. Thus, no dissociation occurs.

78. What do you mean by olfactory indicators ?

Ans :

OD 2013

There are some substances whose odour changes in acidic or basic media. These are called olfactory indicators.

- 130.** A compound of sodium  $X$  is used in kitchen to make the 'pakoras' crispy. It is also used to remove acid in the stomach.

- (a) Identify the compound  $X$  and write its chemical formula.  
 (b) What chemical reaction occurs on heating it during the cooking of food ?

**Ans :**

Delhi 2011

- (a) The compound  $X$  is sodium hydrogen carbonate. Its chemical formula is  $\text{NaHCO}_3$ .  
 (b) The following chemical reaction takes place while heating it during cooking food :

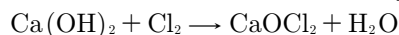


- 131.** Write the chemical formula of bleaching powder. How is bleaching powder prepared ? For what purpose is it used in drinking water ?

**Ans :**

OD 2014

The chemical formula of bleaching powder is  $\text{CaOCl}_2$ . Bleaching powder is produced by the action of chlorine on dry slaked lime  $[\text{Ca}(\text{OH})_2]$ .



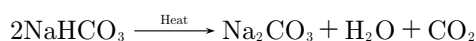
Bleaching powder is used in drinking water to make it germ-free.

- 132.** Effervescences are formed when the baking soda is heated. What substance is present in baking soda ? Name the gas evolved. Write the chemical equation involved.

**Ans :**

Foreign 2017

The substance present is baking soda ( $\text{NaHCO}_3$ ). Gas evolved is  $\text{CO}_2$ .



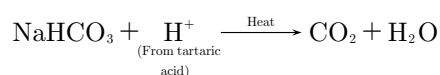
- 133.** What is 'baking powder'. How does it make the cake soft and spongy ?

**Ans :**

Comp 2018

Baking soda is a mixture of baking soda ( $\text{NaHCO}_3$ ) and edible acid like tartaric acid.

Baking powder on heating produces carbon dioxide gas which causes bread or cake to rise making it soft and spongy.



+ Sodium salt of tartaric acid.

- 134.** Explain why plaster of paris should be stored in a moisture proof container.

**Ans :**

OD 2009

Plaster of paris should be stored in a moisture proof container because the presence of moisture

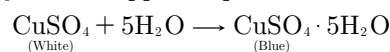
can cause its slow setting by bringing about its hydration. This will make the plaster of paris useless after sometime.

- 135.** What happens when a few drops of water are added to anhydrous copper sulphate ? Explain with the help of an equation.

**Ans :**

OD 2007

Anhydrous copper sulphate ( $\text{CuSO}_4$ ) is white. When water is added to anhydrous copper sulphate, it gets hydrated and turns blue due to the formation of hydrated copper sulphate.

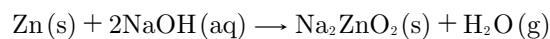


- 136.** State what happens when zinc granules are heated with sodium hydroxide solution. Write the balanced equation for this reaction. Name the main product formed in this reaction.

**Ans :**

Delhi 2015

When zinc granules are heated with sodium hydroxide solution, then sodium zincate salt and hydrogen gas are formed :



Main product formed is sodium zincate.

- 137.** A substance  $X$  is used as building material and insoluble in water. When reacts with dil.  $\text{HCl}$  it produces a gas which turns lime water milky. Predict the substance and write the chemical equation involved.

**Ans :**

Comp 2017

The substance  $X$  is  $\text{CaCO}_3$ , used as a building material and insoluble in water.

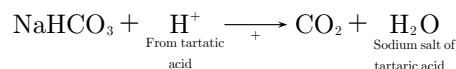


- 138.** Why is tartaric acid added into baking soda to get baking powder ?

**Ans :**

Comp 2019

Tartaric acid is added to neutralise the sodium carbonate formed on heating by the decomposition of  $\text{NaHCO}_3$ . If it is not added, the cake would taste bitter due to the presence of sodium carbonate in it.

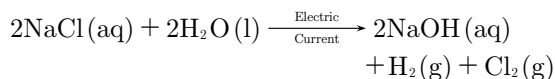


- 139.** Explain why, diluting an acid, the acid should be added to water and not water to the acid.

**Ans :**

OD 2011

- (i) When the concentrated acid is added to water, then the heat is evolved gradually and easily absorbed by the large amount of water.  
 (ii) If water is added to concentrated acid, then



Hydrogen gas is obtained at cathode and chlorine gas at anode. NaOH remains in solution. The solution on evaporation gives solid NaOH. This process is called chlor-alkali process.

1. Sodium Hydroxide is used in manufacturing soaps, detergents, paper, artificial silk (rayon) and dyes. It is used in manufacturing chemicals, i.e., Sodium hypochlorite, sodium chlorate, etc.

### 3.4 Uses of Hydrogen Gas

It is used in manufacturing of ammonia and methyl alcohol and to prepare hydrochloric acid. It is used for hydrogenating oils to give fats. Vegetable oils on hydrogenation give margarine.

Vegetable oil +  $\text{H}_2 \rightarrow$  Margarine (vegetable ghee)

### 3.5 Uses of Chlorine Gas

It is used as a bleaching agent in textile industry and used for sterilising water.

### 3.6 Washing Soda ( $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ )

It is obtained from sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) through ammonia-soda or Solvay process. Its chemical name is sodium carbonate decahydrate.

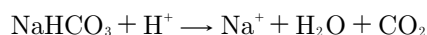
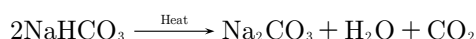
**Uses of Washing Soda :** It is used for washing clothes and in manufacturing glass, caustic soda, borax, etc.

### 3.7 Baking Soda ( $\text{NaHCO}_3$ )

It is prepared by passing carbon dioxide through an aqueous solution of sodium carbonate. Its chemical name is sodium hydrogen carbonate or sodium bicarbonate.



It is a white crystalline solid, sparingly soluble in water and its aqueous solution is mildly alkaline. It decomposes on heating to give  $\text{Na}_2\text{CO}_3$  and release  $\text{CO}_2$ . It reacts with acids ( $\text{H}^+$ ) to evolve  $\text{CO}_2$ .



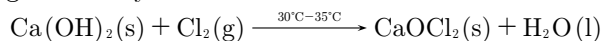
### 3.8 Uses of Baking Soda

It is used in cooking and as an antacid to correct the acidity of stomach. It is used in making

effervescent drinks and in fire extinguishers, and also in preparing baking powder.

### 3.9 Bleaching Powder

The chemical name of bleaching powder is calcium oxychloride ( $\text{CaOCl}_2$ ). It is obtained by passing  $\text{Cl}_2$  gas over dry slaked lime.

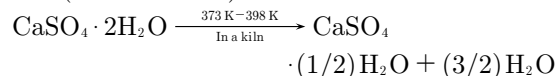


### 3.10 Uses of Bleaching Powder

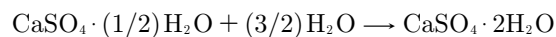
It is used for bleaching of wood pulp, cotton, and as a disinfectant.

### 3.11 Plaster of Paris

Its chemical name is calcium sulphate hemihydrate [ $\text{CaSO}_4 \cdot (1/2)\text{H}_2\text{O}$ ]. It is obtained by heating gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ).



Plaster of Paris on mixing with an adequate quantity of water, it forms a gypsum again.



### 3.12 Uses of Plaster of Paris

It is used for immobilising the affected fractured part of bone leading to quick recovery. It is also used for making decorative pieces such as toys, statues, etc.

Plaster of Paris should be stored in moisture-proof container.

### 3.13 Water of Crystallization

1. **Hydrated Salts :** A crystalline salt molecule that is loosely attached to a certain number of water molecules is called hydrated salt. These water molecules are water of crystallization.
2. **Hygroscopy :** Those substances which absorb moisture from atmosphere at ordinary temperature, are called hygroscopic substances, and the property is known as hygroscopy, e.g., conc.  $\text{H}_2\text{SO}_4$ , etc.
3. **Deliquescence :** Those substances which absorb moisture from atmosphere at ordinary temperature and ultimately dissolve in the absorbed water to form a solution are called deliquescent substances and the phenomenon is called deliquescence, e.g., NaOH, KOH, etc.
4. **Efflorescence :** Certain hydrated salts when exposed to air at ordinary temperature lose their water of crystallization either partially

(iii) **Uses of Hydrogen** : It is used:

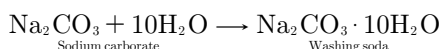
- (a) In manufacture of ammonia for fertilizers as rocket fuel.  
(Any one)

- 146.** How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it ?

**Ans :**

Comp 2020

Preparation of washing soda from sodium carbonate  
Anhydrous sodium carbonate is dissolved in water i.e. soda  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$



It is a basic salt.

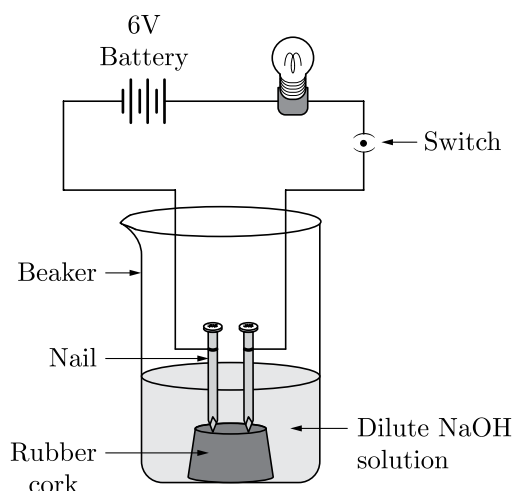
Permanent hardness can be removed by washing soda.

- 147.** How will you show that acids conduct electricity ?

**Ans :**

OD 2013

The arrangement is made as shown in the figure. Dilute sulphuric acid is added and the switch is made 'on'. The bulb glows. This shows that acids conduct electricity.

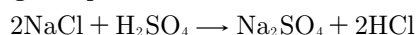


- 148.** A gas is produced when conc.  $\text{H}_2\text{SO}_4$  is added to solid sodium chloride taken in a test tube. The gas coming out through the delivery tube is passed over a dry blue litmus paper and then over a moist blue litmus paper. Record your observations and explain reason with the help of chemical equation.

**Ans :**

Delhi 2010

$\text{HCl}$  gas is produced.



When the gas passed through dry litmus paper,

there is no change in colour because it cannot show acidic properties as  $\text{H}^+$  ions are not present.

The gas when passed through moist litmus paper, colour is changed to red as it shows acidic properties. It happens so because  $\text{H}^+$  ions are produced when  $\text{HCl}$  dissolves in water.

- 149.** (i) What do you understand by the term pH of a solution ?  
(ii) What is the pH of distilled water and common salt solution ?

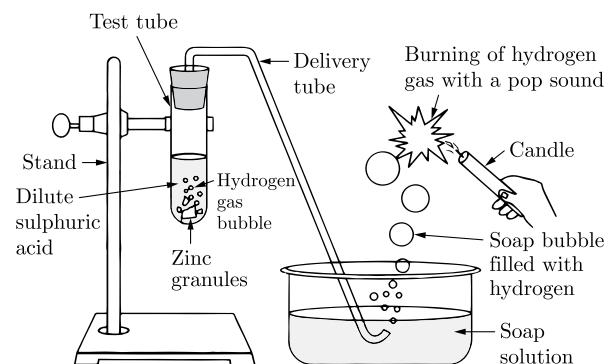
**Ans :**

Comp 2010

- (i) pH of a solution tells us about the concentration of  $\text{H}^+$  ion in a solution.  
(ii) pH of distilled water = 7  
pH of common salt solution = 7 [as common salt ( $\text{NaCl}$ ) is neutral]

- 150.** In the schematic diagram given below for the preparation of hydrogen gas what would happen if following changes are made ?

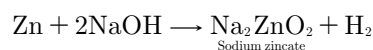
- (a) In place of zinc granules, same amount of zinc dust is taken in the test tube.  
(b) Instead of dilute sulphuric acid, dilute hydrochloric acid is taken.  
(c) Sodium hydroxide is taken in place of dilute sulphuric acid and the tube is heated.



**Ans :**

Foreign 2019

- (a) Hydrogen gas will evolve with greater speed.  
(b) Almost same amount of gas is evolved.  
(c) If sodium hydroxide is taken, hydrogen gas will be evolved only on heating :



- 151.** Why the medium becomes acidic in mouth ? What is the ill effect of the acidic medium ? How this can be prevented ?

- 95.** Two solutions *A* and *B* have pH values of 3.0 and 10.5 respectively. Which of these will turn phenolphthalein from colourless to pink ?  
**Ans :** SQP 2006  
Phenolphthalein turns pink to solution *B*.
- 96.** What is universal indicator ?  
**Ans :** OD 2010  
A universal indicator is a mixture of several indicators.
- 97.** State the purpose for which universal indicator is used.  
**Ans :** OD 2014  
This is used to identify whether the given solution is an acid or base and what is its concentration.
- 98.** Name the acid produced in our stomach.  
**Ans :** Foreign 2011  
Hydrochloric acid is produced by our stomach.
- 99.** Define an acid and a base.  
**Ans :** Delhi 2016, 09  
A substance which forms  $H^+$  ions in aqueous solution is called an acid and the one, which forms  $OH^-$  ions in aqueous solution is called a base.
- 100.** State what does pH of a solution signify ?  
**Ans :** Comp 2012  
pH is a scale, which measures hydrogen ion concentration in a solution.
- 101.** Tooth enamel is the hardest substance in our body. Name the compound of which it is made up of.  
**Ans :** Comp 2010  
Tooth enamel is made up of calcium phosphate  $[Ca_3(PO_4)_2]$ .
- 102.** Define olfactory indicators. Name two substances which can be used as olfactory indicators.  
**Ans :** Delhi 2011  
An olfactory indicator is a substance whose smell varies on depending whether it is mixed with an acidic or basic solution. Example: onion, clove oil.
- 103.** Choose strong acids from the following :  
 $CH_3COOH$ ,  $H_2SO_4$ ,  $H_2CO_3$ ,  $HNO_3$   
**Ans :** OD 2016  
Strong acids are  $H_2SO_4$  and  $HNO_3$ .
- 104.** Name two natural acid-base indicators.  
**Ans :** Delhi 2015  
(i) Beet root extract,  
(ii) Extracts of red cabbage leaves.
- 105.** List two examples of salts which do not contain metal ions.  
**Ans :** Foreign 2012  
 $NH_4Cl$ ,  $CH_3$ ,  $COONH_4$
- 106.** List two examples of salts which are obtained from weak acid and weak base.  
**Ans :** OD 2009  
 $CH_3COONH_4$ ,  $(NH_4)_2CO_3$
- 107.** List two examples of salts which are obtained from strong acid and strong base.  
**Ans :** SQP 2006  
 $NaCl$ ,  $K_2SO_4$ .
- 108.** How many molecules of water of crystallisation are there in  
(i) Plaster of Paris,  
(ii) Washing soda crystals.  
**Ans :** OD 2013  
(i)  $1/2$ ,  
(ii) 10
- 109.** A white chemical compound becomes hard on mixing proper quantity of water. It is used in surgery to maintain joints in a fixed position. Name the chemical compound and write its formula.  
**Ans :** Delhi 2010  
Plaster of Paris,  $CaSO_4 \cdot \frac{1}{2}H_2O$
- 110.** A woman found that the cake prepared by her is hard and small in size. Which ingredient has she forgotten to add that would have cause the cake rise and become light.  
**Ans :** Delhi 2007  
Baking powder.
- 111.** Explain the meaning of water of crystallisation with an example.  
**Ans :** OD 2016, 13  
Water of crystallisation is the fixed number of water molecules chemically attached to each formula unit of a salt in its crystalline form.  
Example :  $CaSO_4 \cdot 2H_2O$  (Gypsum).

(iii) Sulphuric acid ( $\text{H}_2\text{SO}_4$ )



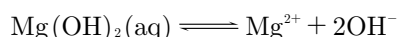
(iv) Sodium hydroxide ( $\text{NaOH}$ )



(v) Potassium hydroxide ( $\text{KOH}$ )



(vi) Magnesium hydroxide [ $\text{Mg}(\text{OH})_2$ ]



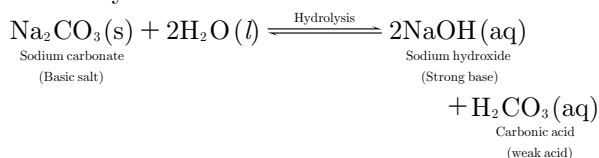
- 158.** A salt  $X$  when dissolved in distilled water gives a clear solution which turns red litmus blue. Explain this phenomenon.

**Ans :**

OD 2008

Basic solutions turn red litmus paper blue. The salt of a weak acid and a strong base gives a basic solution. So, the given salt  $X$  is the salt of a weak acid and a strong base.

Example : When sodium carbonate is dissolved in water, it gets hydrolysed to some extent and forms sodium hydroxide and carbonic acid.



Being a strong base, sodium hydroxide is fully ionised and gives a large amount of hydroxide ions ( $\text{OH}^-$ ). Carbonic acid is a weak acid which is only slightly ionized and hence, gives a small amount of hydrogen ions ( $\text{H}^+$ ). The  $\text{H}^+$  ions produced by carbonic acid neutralises only a small amount of  $\text{OH}^-$  ions produced by sodium hydroxide and the rest amount of  $\text{OH}^-$  ions are present in the solution. Hence, the  $\text{Na}_2\text{CO}_3$  solution is basic in nature. It turns red litmus blue.

- 159.** Describe an activity to show that reaction between bases and metals is different from reaction between acids and metals.

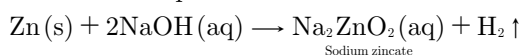
**Ans :**

Comp 2015

**Object :** To show the reaction between bases and metals.

**Method :** Put a few pieces of granulated zinc metal in sodium hydroxide solution. Warm the test tube and collect the gas formed.

**Observation :** On warming, zinc dissolves in sodium hydroxide and hydrogen gas is formed and following reaction takes place.



**Result :** With zinc metal strong bases form hydrogen gas and  $\text{OH}^-$  ion gives  $\text{ZnO}_2^{2-}$  (zincate ion) and hydrogen gas.

- 160.** Explain why :

- Common salt becomes sticky during the rainy season.
- Blue vitriol changes to white upon heating.
- Anhydrous calcium chloride is used in desiccator.

**Ans :**

Comp 2007

- Common salt contains the impurity of magnesium chloride ( $\text{MgCl}_2$ ) which is of deliquescent nature when exposed to atmosphere, it becomes moist. Therefore, common salt becomes sticky during the rainy season.
- Blue vitriol ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) upon heating changes to anhydrous copper sulphate ( $\text{CuSO}_4$ ) which is white in colour.
- Anhydrous calcium chloride ( $\text{CaCl}_2$ ) is highly hygroscopic in nature. In a desiccator, it readily absorbs moisture and is therefore, used as drying agent.

- 161.** State reasons for the following :

- A tarnished copper vessel begins to shine again when rubbed with lemon.
- All alkalies are bases but all bases are not alkalis.
- Use of a mild base like baking soda on the honey bee stung areas gives relief

**Ans :**

OD 2015, 10

- Copper is tarnished in presence of air, moisture, etc. and form copper oxide which is basic in nature. On rubbing it with lemon which contains citric acid, neutralisation reaction takes place and tarnished copper vessel begin to shine again.
- Bases which are soluble in water are called alkalis. So, all alkalis are bases but all bases are not alkalis.
- Honey bee stung area contains methanoic acid ( $\text{HCOOH}$ ). Hence, applying a mild base like baking soda ( $\text{NaHCO}_3$ ) on the area neutralises it and gives relief.

- 162.** Examine the figure given below and describe the experiment it illustrates.

**Ans :**

Foreign 2006

This figure illustrates the reaction of hydrochloric acid with washing soda.

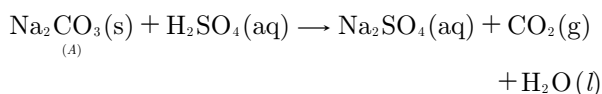


- 121.** A metal compound *A* reacts with dilute sulphuric acid to produce a gas which extinguishes a burning candle. Identify the compound *A* and the gas produced. Write a balanced chemical equation for the reaction if one of the compounds formed in the reaction is sodium sulphate.

**Ans :**

OD 2016

Compound *A* is sodium carbonate and the gas evolved is  $\text{CO}_2$ .



- 122.** Write one word/term for the following :

- Water soluble base
- A substance which dissociates on dissolving in water to produce hydrogen ions  $[\text{H}^+(\text{aq})]$  ions
- A reaction between an acid and a base to form salt and water.
- A substance which dissociates on dissolving in water to produce hydroxide ions  $[\text{OH}^- \text{ ions}]$

**Ans :**

Foreign 2013

- Alkali.
- Acid.
- Neutralisation reaction.
- Base.

- 123.** The soil in a field is highly acidic. List any two materials which can be added to this soil to reduce its acidity. Give the reason of your choice.

**Ans :**

OD 2016, 11

To reduce the acidity, lime, magnesium oxide and magnesium carbonate are used. These neutralise the acidity and thus reduce acidity of the soil.

- 124.** *P* and *Q* are aqueous solutions of sodium chloride and sodium hydroxide respectively. Which of these will turn :

- Blue litmus to red or
- Red litmus to blue ? Give justification for your answer.

**Ans :**

Delhi 2011

The solution *Q* will turn red litmus to blue because it is a basic solution. No effect of solution *P* will be observed either on blue litmus or red litmus because it is a neutral solution.

- 125.** Name the acid produced in our stomach. What happens if there is an excess of acid in the stomach ? How can it be cured ? Name the antacid.

**Ans :**

OD 2010

Hydrochloric acid is produced by our stomach which helps in digestion of food. When we over eat, a large amount of acid is produced which causes a burning sensation in the stomach.

Bases called antacids are used to nullify the acidity. Magnesium hydroxide (milk of magnesia) is often used for this purpose.

- 126.** Explain why an aqueous solution of sodium sulphate is neutral while an aqueous solution of sodium carbonate is basic in nature.

**Ans :**

Foreign 2016

- An aqueous solution of sodium sulphate is neutral because it is formed from a strong base ( $\text{H}_2\text{SO}_4$ ) and a strong base ( $\text{NaOH}$ ).
- Aqueous solution of sodium carbonate is basic in nature because it is formed from a strong base ( $\text{NaOH}$ ) and a weak acid ( $\text{H}_2\text{CO}_3$ ).

- 127.** Three solutions *A*, *B* and *C* have pH values of 6, 2 and 10 respectively. Which of the solutions is highly acidic ? Which solution will turn red litmus blue ?

**Ans :**

SQP 2019

Solution with pH value of 2 is highly acidic.

Solution with pH value of 10 will turn red litmus to blue.

- 128.** How does the enamel of the teeth undergo damage due to the eating of chocolates and sweets ? What should be done to prevent it.

**Ans :**

OD 2015

The best way to prevent tooth decay is to clean the mouth after eating food using tooth paste which is generally basic in nature and neutralise the excess acid formed in the mouth.

- 129.** A milkman adds very small amount of baking soda in fresh milk :

- Why does he shift the pH of fresh milk from 6 to slightly alkaline ?
- Why does this milk take a long time to set as curd?

**Ans :**

Delhi 2013

- It is because he can keep the milk for longer time as the milk is in alkaline condition, does not get soured easily.
- Due to the addition of baking soda, this milk becomes slightly basic which neutralise the acids produced in this milk. Hence, this takes longer time to set as curd.

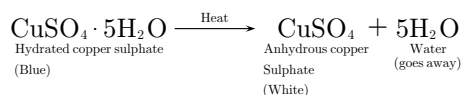
167. What is meant by water of crystallisation ? Explain that the crystalline salts contain water of crystallisation.

Ans :

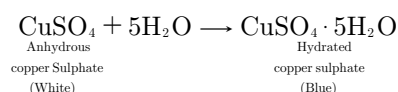
Foreign 2014

Water of crystallisation is a fixed number of water molecules present in one formula unit of a salt. One formula unit of copper sulphate contains five water molecules ( $5\text{H}_2\text{O}$ ). The water molecules which form part of the structure of a crystal are called water of crystallisation. When hydrated salts are heated strongly, they lose their water of crystallisation.

On strong heating, blue copper sulphate crystals turn white (due to loss of water of crystallisation).



Anhydrous copper sulphate turns blue on adding water.

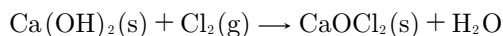
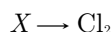
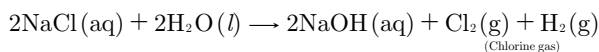


168. In one of the industrial processes used for manufacture of sodium hydroxide, a gas  $X$  is formed as by-product. The gas  $X$  reacts with lime water to give a compound  $Y$  which is used as a bleaching agent in chemical industry. Identify  $X$  and  $Y$  giving the chemical equation of the reactions involved.

Ans :

OD 2011

In the manufacture of sodium hydroxide, hydrogen gas and chlorine gas ( $X$ ) are formed as by-products. When chlorine gas ( $X$ ) reacts with lime water, it forms calcium oxychloride (bleaching powder). The reactions are :

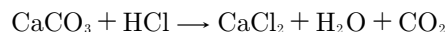


lime water ? Write balanced chemical equations for all the changes observed.

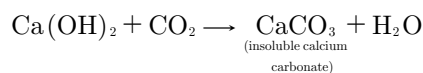
Ans :

OD 2010

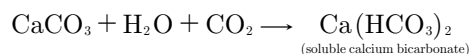
When pieces of marble are dropped in dil. hydrochloric acid, then calcium chloride, (salt), water and carbon dioxide are formed.



When evolved gas,  $\text{CO}_2$  is passed through lime water, then lime water turns milky. It happens due to formation of insoluble precipitate of calcium carbonate.



If excess carbon dioxide is passed through lime water, then the solution becomes colourless again, i.e., milky of the solution disappears due to the formation of soluble calcium bicarbonate.



170. (i) What are strong acids and weak acids? Give an example for each.
- (ii) A dry pellet of a common base  $B$  when kept in open absorbs moisture and turns sticky. The compound is also formed by chlor-alkali process. Identify  $B$ . What type of reaction occurs when  $B$  is treated with dilute hydrochloric acid ? Write the chemical equation.

Ans :

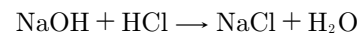
Delhi 2018

- (i) Acids of a particular concentration give rise more  $\text{H}^+$  ions are said to be strong acids and acids of a particular concentration give less  $\text{H}^+$  ions are said to be weak acids.

Example : Strong acid : Hydrochloric acid (or any other example)

Weak acid : Acetic acid (or any other example)

- (ii)  $B$  is sodium hydroxide ( $\text{NaOH}$ )



171. Account for the following

- (a) State the relation between hydrogen ion concentration of an aqueous solution and its pH.
- (b) An aqueous solution has a pH value of 7.0. Is this solution acidic, basic or neutral.
- (c) Which has a higher pH value, 1 M HCl or 1 M NaOH solution ?
- (d) Tooth enamel is one of the hardest substances in our body. How does it undergo damage due to eating chocolates and sweets ? What should we do to prevent it.
- (e) How does  $[\text{H}^+]$  ions exist in water ?

## FIVE MARKS QUESTIONS

169. A student dropped few pieces of marble in dilute hydrochloric acid, contained in a test tube. The evolved gas was then passed through lime water. What change would be observed in lime water ? What will happen if excess of gas is passed through

**39. Assertion :** Olfactory indicators are those whose colour changes in acidic and basic medium.

**Reason :** They react with acidic and basic solutions.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

Olfactory indicators are the substances whose colour changes in acidic and basic media. Hence both assertion and reason are false.

**40. Assertion :** Active metals react with acids to liberate hydrogen gas.

**Reason :** It is an example of displacement reaction.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

Metals which are more reactive than hydrogen can displace hydrogen from acids and thus products formed are salt and hydrogen gas. Hence both assertion and reason are true and reason explains assertion.

**41. Assertion :** Acids contain  $H^+$  ions.

**Reason :**  $H^+$  ions neutralise acids.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but the Reason is false.

Acids contain  $H^+$  ions which are responsible for acidic properties of acids. Hence assertion is true but reason is false.

**42. Assertion :** The process of dissolving an acid or a base in water is a highly exothermic one.

**Reason :** A large amount of heat is produced.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

When acid or base is dissolved in water, a large amount of heat is produced. Hence both assertion and reason are true and reason explains assertion.

**43. Assertion :** On heating, colour of hydrated copper sulphate changes from blue to white.

**Reason :** Copper sulphate is a crystalline salt.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

When hydrated copper sulphate is heated, the water which is present as water of crystallisation is removed and so colour changes from blue to white. Copper sulphate is a crystalline salt. Both assertion and reason are true but reason does not explain assertion.

**44. Assertion :** Plaster of Paris is obtained on heating gypsum at 373K.

**Reason :** On heating gypsum at 373K, it loses water molecules.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
- (c) Assertion is true but the Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion.

175. Answer the following :

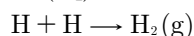
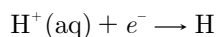
- Why is plaster of paris written as  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$  ? How is it possible to have half a water molecule attached to  $\text{CaSO}_4$  ?
- Why is sodium hydrogen carbonate an essential ingredient in antacids ?
- When electricity is passed through aqueous solution of sodium chloride, three products are obtained. Why is the process called chlor-alkali ?

Ans :

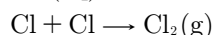
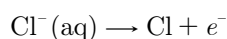
Comp 2017

- The actual formula of plaster of paris is  $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$  which means that one molecule of  $\text{H}_2\text{O}$  is associated with two molecules of  $\text{CaSO}_4$ . The formula is simplified and written as  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ .
- Sodium hydrogen carbonate is an essential constituent of antacids because it neutralises the effect of hydrochloric acid which is released in the stomach. That is why it is called antacid.  
 $\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- Upon passing electricity through an aqueous solution of  $\text{NaCl}$ , the following changes occur.  
 $\text{NaCl} \xrightarrow{\text{(aq)}} \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$   
 $\text{H}_2\text{O} \rightleftharpoons \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq})$

**At Cathode :**  $\text{H}^+$  ions are discharged in preference to  $\text{Na}^+$  ions which remain in solution. Hydrogen gas is evolved at cathode.



**At Anode :**  $\text{Cl}^-$  ions are discharged in preference to  $\text{OH}^-$  ions which remain in solution. Chlorine gas is evolved at anode.



Both  $\text{Na}^+$  ions and  $\text{OH}^-$  ions are present in solution as sodium hydroxide. Since an alkali ( $\text{NaOH}$ ) and chlorine are formed in the reaction, the process is called chlor-alkali.

## CASE BASED QUESTIONS

176. Study the table related to colour change with indicators and answer the questions that follow.

Solutions	Colour change with phenolphthalein indicator	Colour change with methyl orange indicator
<i>P</i>	Pink	Yellow
<i>Q</i>	Colourless	Orange
<i>R</i>	Colourless	Red

- Name the solution which is acidic.
- Arrange the given solutions in increasing order of their pH value.
- What is the name of solution *P* and *Q* ?
- When solution *P* added to the china rose indicator, what is the colour of solution *P* ?

Ans :

- Solution *R* is acidic because it changes to red on adding methyl orange indicator.
- $P < Q < R$
- Solution *P* and *Q* could be  $\text{NaOH}$  and  $\text{NaCl}$ .
- Green.

177. When the rain water contains large quantities of acids like nitric acid and sulphuric acid formed by dissolution of oxides of nitrogen and sulphur in water it is called as *P*. *Q* is formed of acidic water received on soil through rain, fog and snow. *R* is formed of wind-blown acidic gases and particles in the atmosphere which fall on ground with rain water.

- Identify the labelled parts as *P*, *Q* and *R* in this passage.
- Among *P*, *Q* and *R*, which part is mainly responsible for half of acidity in atmosphere that comes to earth ?

Ans :

- In the given passage, *P*, *Q* and *R* are acid rain, wet deposition and dry deposition respectively.
- About half of acidity in the atmosphere comes to earth through i.e., dry deposition (*R*).

178. Study the table and answer the following questions.

S. No.	Solution	pH limit
1.	Saliva	6.5-7.5
2.	Lemon juice	2.2-2.4
3.	Tomato juice	4.0-4.4
4.	Coffee	4.5-5.5

- What is the change on litmus paper when drops of tomato juice are dropped on it ?
- What is the nature of saliva given in table ?
- What is the effect of acid over pH paper ?
- What is the effect of base on litmus paper ?

Ans :

- The litmus paper will turn red.
- Saliva is neither acidic nor basic, it comes under neutral sense.

Ans :

Delhi 2013

- (i) Bacteria present in the mouth produce acids by degradation of food particles.
- (ii) Tooth enamel gets corroded and tooth decay occurs.
- (iii) By cleaning the teeth with tooth-paste which is basic in nature.
- 152.** The pH of the mouth of a person is lower than 5.5, what changes will occur in his mouth ? How these changes can be controlled ? Write any two measures.

Ans :

OD 2016

- (a) When the pH of mouth of a person is lower than 5.5, tooth decay starts.
- (b) Tooth which is made up of calcium phosphate is corroded.
- Measures :
- (i) Clean the mouth after eating food:
- (ii) Use of toothpaste (generally basic in nature).

- 153.** Account for the following :

- (a) Antacid tablets are used by a person suffering from stomach pain.
- (b) Toothpaste is used for cleaning teeth.

Ans :

SQP 2010

- (a) Antacids are mild bases. Antacid reacts with the hydrochloric acid formed in the stomach and neutralises its effect.
- (b) Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth after eating. The best way to prevent this is to clean the mouth by using toothpaste. Toothpastes, which are generally basic, can neutralise the excess acid and prevent tooth decay.
- 154.** Illustrate any three chemical properties of acids with examples.

Ans :

OD 2016, 10

- (i) Acids react with metals to produce salt and hydrogen gas.
- $$\text{Zn(s)} + 2\text{HCl(aq)} \longrightarrow \text{ZnCl}_2\text{(aq)} + \text{H}_2\text{(g)}$$
- (ii) Acids react with metal carbonates and metal hydrogen carbonates to give salt and  $\text{CO}_2$  gas.
- $$\text{Na}_2\text{CO}_3\text{(s)} + 2\text{HCl(aq)} \longrightarrow 2\text{NaCl(aq)} + \text{H}_2\text{O(l)} + \text{CO}_2\text{(g)}$$
- $$\text{NaHCO}_3\text{(s)} + \text{HCl(aq)} \longrightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)} + \text{CO}_2\text{(g)}$$

- (iii) Acid reacts with bases to produce salt and water. This is called neutralisation reaction.
- $$\text{HCl(aq)} + \text{NaOH(aq)} \longrightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$$

- 155.** (a) Given below are the pH values of four different liquids :
- 7.0, 14.0, 4.0, 2.0
- Which of these could be that of
- (i) lemon juice,
- (ii) distilled water.
- (iii) sodium-hydroxide solution and tomato juice.
- (b) When blue litmus solution is added to soda water, what change will be observed and why ?

Ans :

Foreign 2013

- (a) (i) 2.0 (ii) 7.0, (iii) 14.0, (iv) 4.0.
- (b) Soda water contains  $\text{CO}_2$  which is acidic. Therefore, blue litmus solution will change to red.

- 156.** You are provided with three test tubes *A*, *B* and *C* which contain distilled water, acidic solution and basic solution respectively. If you are given blue litmus paper only, how will you identify the contents to each test tube ?

Ans :

OD 2016

In each of the three test tubes, put blue litmus paper. In test tube *B* it will turn red but no change will occur in test tubes *A* and *C*. It means test tube *B* contains acidic solution. Now put this litmus in test tubes *A* and *C*, one by one. It will turn blue in *C* showing it contains basic solution but no change will occur in *A*. It means test tube *A* contains distilled water.

- 157.** How the following substances will dissociate to produce ions in their solutions?

- (i) Hydrochloric acid
- (ii) Nitric acid
- (iii) Sulphuric acid
- (iv) Sodium hydroxide
- (v) Potassium hydroxide
- (vi) Magnesium hydroxide

Ans :

Delhi 2014

Dissociation of various compounds in their solutions

- (i) Hydrochloric acid ( $\text{HCl}$ )
- $$\text{HCl(aq)} \rightleftharpoons \text{H}^+ + \text{Cl}^-$$
- (ii) Nitric acid ( $\text{HNO}_3$ )
- $$\text{HNO}_3\text{(aq)} \rightleftharpoons \text{H}^+ + \text{NO}_3^-$$

**182.** Baking soda is used in small amounts for making bread and cakes. It helps to make these soft and spongy. An aqueous solution of baking soda turns red litmus blue. It is also used in soda acid fire extinguisher. Use this information to answer the following questions.

- Write the equation for the reaction between baking soda and acid.
- How does it help in extinguishing fire?
- What is the reaction involved when it is heated?
- Is the pH value of baking soda solution lower than or higher than 7 ?

**Ans :**

- The equation for the reaction is  

$$2\text{NaHCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \xrightarrow{\text{(Baking soda)}} \text{Na}_2\text{SO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l}) + 2\text{CO}_2(\text{g})$$
- The  $\text{CO}_2$  gas produced by the reaction of baking soda and acid in the soda-acid fire extinguisher, helps in extinguishing fire.
- The reaction involved is  

$$2\text{NaHCO}_3(\text{s}) \xrightarrow{\Delta} \text{Na}_2\text{CO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) \uparrow$$
- The pH value of baking soda solution is higher than 7, i.e. it is alkaline.

**183.** A dry pellet of a common base *B* when kept in open absorbs moisture and turns sticky. The compound is also a by-product of chlor-alkali process.

- What is name of *B* ?
- What type of reaction occurs when *B* is treated with an acid?
- Write the balanced chemical equation for the reaction of *B* with  $\text{CO}_2$ .
- Which gas is evolved when *B* reacts with Zn.

**Ans :**

- B* is sodium hydroxide ( $\text{NaOH}$ ).
- Neutralisation reaction occurs when *B* is treated with an acid.
- The chemical reaction is



- The chemical reaction is



**184.** Study these table related to answer the questions that follow :

	Substance	pH	Colour shown by universal indicator
1.	<i>A</i>	6.5	Greenish yellow
2.	<i>B</i>	10.5	Navy blue
3.	<i>C</i>	0	Dard red
4.	<i>D</i>	8.5	Greenish blue
5.	<i>E</i>	4.0	Orange

Answer the questions giving examples in each case.

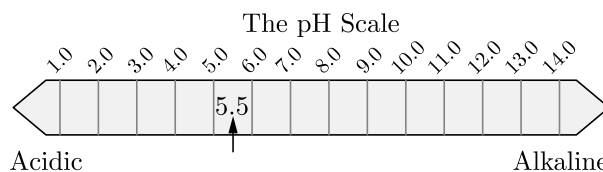
- Which substance may be used as a preservative?
- Which substance may be used in antacids?
- Which substance may be used in cakes to make them fluffy?
- Which substance is a strong acid?

**Ans :**

- Substance *E* may be used as a preservative, e.g. vinegar.
- Substance *B* may be used in antacids, e.g. milk of magnesia.
- Substance *D* may be used in cakes to make them fluffy, e.g. baking soda.
- Substance *C* is a strong acid, e.g. conc.HCl.

**185.** Children eat a lot of sugary foods such as cakes, pastries, chocolates etc. which can lead to tooth decay. Tooth decay is the gradual destruction of hard outer tissues of the tooth that leads to the formation of cavities or caries in tooth.

Whenever we eat any food, some of the food particles stick in-between our teeth. The bacteria present in our mouth break down the sugar present in the food to form acid. This acid changes the pH of the mouth which may be the main cause of tooth decay.



- What is meant by saying that pH change may be the main cause of tooth decay ?
- What is the critical pH at which tooth decay starts ?
- The nature of the toothpaste used for cleaning teeth is

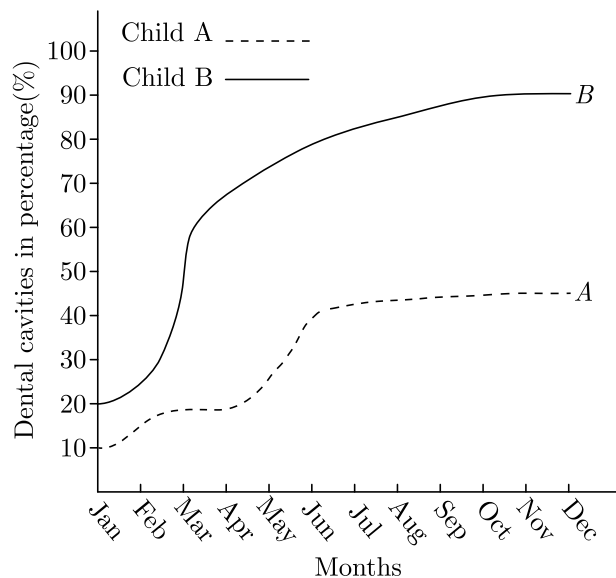
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- (iv) Based on the data shown in the graph below, which of the two children A and B, would have more teeth with cavities and why ?



Ans :

- (i) Tooth decay starts when the pH of the mouth falls below 5.5. Acid becomes strong enough to corrode hard enamel of tooth.
- (ii) 5.5
- (iii) basic
- (iv) Child B  
Eating lots of chocolates, chips or candies leads to tooth cavity.

# CHAPTER 3

## Metals and Non-metals

### 1. ELEMENTS

Till now, out of 118 elements known, only the first 98 elements occur naturally on the earth.

Elements are divided into metals, i.e., Fe, Cu, Hg, Pb, etc., and non-metals, i.e., C, O, H, N, etc.

Elements showing properties of both metals and non-metals like boron, silicon, germanium, arsenic, antimony and tellurium are called metalloid.

#### 1.1 Metals

Three-quarters of elements are metals. Coinage metals Au, Ag and Pt are used to make coins, etc.

1. Strategic metals titanium, chromium, manganese, zirconium, etc., are used for country's economy and defence. Co, Cu, Fe, Mg, K, Na and Zn are essential to human, plant and animal health.
2. Metals are solid at room temperature except mercury, i.e., liquid at room temp. They have metallic lustre. They are hard and cannot be easily cut with a sharp knife but metals Na and K are so soft that they can be easily cut with a knife. Chromium is the hardest and caesium the softest metal.
3. Metals like Au, Ag, Cu, Sn, Al, etc., are malleable, i.e., can be beaten with a hammer into thin sheets. They are ductile, i.e., drawn into fine wires. Gold is the most ductile and malleable metal.
4. Metals are good conductors of heat and electricity. Silver is the best conductor of heat and electricity. Lead is a poor conductor of heat and electricity.
5. Metals are crystalline in nature and densely packed, i.e., have high density. However, lithium (Li), sodium (Na) and potassium (K) have densities lesser than water.
6. Metals have high MP and BP because their constituent atoms are closely packed and strong forces of attraction exist between them. Gallium and caesium will melt if kept on the palm of

our hand due to having low MP. Metals are sonorous, i.e., give a ringing sound when struck.

#### 1.2 Non-metals

All living organisms are composed of non-metals, i.e., carbon, hydrogen, oxygen and nitrogen. Oxygen, the survival of living organisms, is the most abundant non-metal in the earth's crust.

1. Out of 22 non-metals, 10 are solids, 11 are gases and 1 (Br) is a liquid. Solid non-metals are brittle, i.e., when hammered, e.g., S and P. Non-metals are non-malleable and non-ductile.
2. Non-metals are bad conductors of heat and electricity except graphite. They have low density, and low MP and BP except diamond (3873 K) and graphite (3773 K) which have high MP.

#### 1.3 Chemical Properties of Metals

The metals when listed according to their electron-releasing tendency, the list is called activity series or reactivity series. It is shown in decreasing order as follows:

$K > Na > Ca > Mg > Al > Zn > Fe > CO > Ni > Su > Pb > [H]^* > Cu > Hg > Ag > Au$

1. Metals combine with  $O_2$  to give their oxides, e.g., metals like Na quickly burns with bright golden yellow flame, Mg burns with dazzling white light to give magnesium oxide (MgO) and Al burns in  $O_2$  to form aluminium oxide ( $Al_2O_3$ ).  
 $2Mg + O_2 \rightarrow 2MgO$   
 $4Al + 3O_2 \rightarrow 2Al_2O_3$
2. Iron slowly rusts in moist air to form a reddish-brown powder called rust  $[Fe_2O_3 \cdot xH_2O]$ .  
 $4Fe + 3O_2 \rightarrow 2Fe_2O_3$   
 $Fe_2O_3 + xH_2O \rightarrow Fe_2O_3 \cdot xH_2O$
3. Silver and gold do not react with oxygen even at high temperature.
4. Metals form basic oxides which react with  $H_2O$  to form basic solution, e.g.,  
 $Na_2O(s) + H_2O(l) \rightarrow 2NaOH(aq)$

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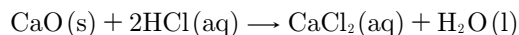
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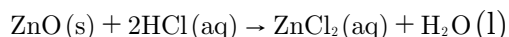
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2025-2005 (54 Papers)  
*Main, SQP and Comp*  
**BIOTECHNOLOGY**  
Class 9



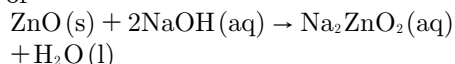
- Oxides of metals, insoluble in water, react with acids to form salt and water.



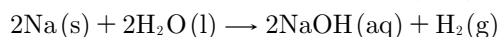
- Amphoteric oxides  $\text{ZnO}$ ,  $\text{Al}_2\text{O}_3$  and  $\text{PbO}_2$  react with acid and base to form salt and water, e.g.,



or

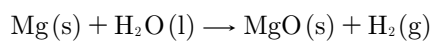
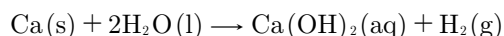


A metal placed above hydrogen is more reactive than a metal placed below hydrogen. Sodium violently reacts with water, i.e.,



Lithium, potassium and calcium react with cold water.

- Ca reacts with  $\text{H}_2\text{O}$  violently. The heat evolved is insufficient for hydrogen to catch fire. Ca, heavier than  $\text{H}_2\text{O}$ , however, floats on water because bubbles of  $\text{H}_2$  gas evolved during the reaction stick to the surface of Ca and make it float. Less reactive metals like Mg displace  $\text{H}_2$  from boiling water.

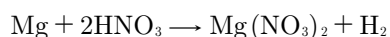
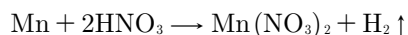


Fe, Al and Zn react on passing steam over hot metal. Pb, Cu, Ag and Au do not react with  $\text{H}_2\text{O}$ .

## 1.4 Reaction of Metals with Acids

Active metals react with dil. acids to evolve  $\text{H}_2$  and form salt.

- Metals placed above hydrogen in the activity series displace hydrogen from dil. hydrochloric acid or dil. sulphuric acid to evolve hydrogen gas and form the corresponding salt. Metals like Cu, Ag, Au placed below hydrogen in activity series do not evolve  $\text{H}_2$  from dil. acids.
- $\text{H}_2$  gas is not evolved when a metal reacts with  $\text{HNO}_3$ . Mg and Mn react with dil.  $\text{HNO}_3$  to evolve  $\text{H}_2$  gas, e.g.,



- The combining atom of metal loses one or more of its valence electrons to change into positive ion (cation) and atom of the non-metal gains these electrons to convert into negative ion (anion). Due to transfer of electrons between atoms of compounds, they are ionic compounds.

## 1.5 Physical Properties of Ionic Compounds

Ionic compounds (solids) have high Melting point and Boiling point. They are soluble in the water but are insoluble in solvents kerosene, benzene, etc. They do not conduct electricity in solid state due to the presence of ions.

## 1.6 Chemical Properties of Non-metals

Non-metals containing 4 or more than 4 electrons in their valence shell gain electrons to acquire its octet to form negative ions, thus, called electronegative elements.

- Non-metals, on heating in air, form their respective oxides, e.g.,  

$$\text{C(s)} + \text{O}_2\text{(g)} \xrightarrow{\text{Heat}} \text{CO}_2\text{(g)}$$
- Oxides of non-metals, being acidic in character, dissolve in water to form acids, i.e.,  

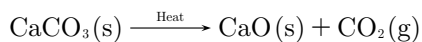
$$\text{CO}_2\text{(g)} + \text{H}_2\text{O(l)} \longrightarrow \text{H}_2\text{CO}_3\text{(aq)}$$
- Non-metals act as oxidising agents because they gain electrons and get reduced, e.g., fluorine (strongest oxidising agent). They also form covalent compounds.

## 1.7 Occurrence of Metals

The earth's crust is the major source of metals. Few metals (Au and Pt) occur in uncombined state due to its least reactivity but lots of metals are found in combined state as compounds. Ag and Cu occur both in uncombined and combined states. Alkali metals occur in combined state because of their maximum reactivity.

- Minerals (elements or compounds) occur naturally in the earth's crust, e.g., NaCl,  $\text{CaCO}_3$ ,  $\text{Ag}_2\text{S}$ , etc. They are the chief sources of metals. Those minerals from which the metal can be extracted profitably are called ores, e.g., bauxite ( $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ) from which aluminium is extracted. So, bauxite is an ore of aluminium. Thus, all ores are minerals but all minerals are not ores.
- Metallurgy is the entire chemical and technological process used for extracting metal from its ore. The steps involved in extracting metals are concentration of ore, extraction of metal from concentrated ore, and purification or refining of the metal so obtained.
- Unwanted impurities of rocky matter, sand, etc., in the ore are gangue or matrix. Concentration (benefication) is the process of removal of gangue from the ore.

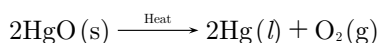
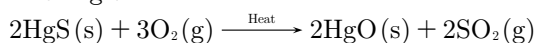
- Calcination is the process of converting carbonate ores into oxides by heating the ore below its fusion temperature in the absence of air.



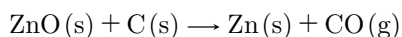
Roasting is the process of heating sulphide ores in excess of air (oxygen).

### 1.8 Reduction of Metal Oxide to Metal

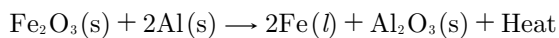
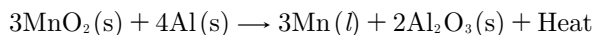
- Oxides of metals, low in the activity series, being unreactive can be reduced to metals by heating alone.



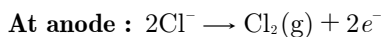
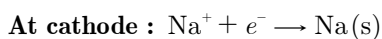
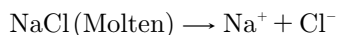
- The oxides of metals, i.e., Zn, Fe, Pb are reduced to the corresponding metal by using a suitable reducing agent like carbon.



Highly reactive metals like Na, Al, Ca, etc., displace metals of lower reactivity from their oxides, e.g.,



- In thermite process, metal oxides are reduced by Al powder in which large amount of heat is evolved. Metals placed up in the activity series cannot be obtained from their compounds by reduction with carbon as they are strong reducing agents. They are obtained by electrolysis of their molten chlorides, e.g., Na and Mg are obtained by electrolysis of their molten chlorides. Metals are deposited at cathode.



### 2. REFINING

Refining is the process by which impurities of metal after extracting from the one can be removed.

- **Electrolytic refining** is the process in which a block of impure metal is made anode and a thin strip of pure metal is made cathode. The electrolyte is a solution of a soluble salt of the same metal. On passing current, pure metal gets dissolved from anode and gets deposited on cathode.

### 3. CORROSION

It is the process of slow conversion of metals into their undesirable compounds by the action of oxygen, moisture and other gases like  $\text{SO}_2$ ,  $\text{NO}_2$ ,  $\text{CO}_2$  and  $\text{H}_2\text{S}$  and acids.

### 4. RUSTING

Rusting (corrosion of iron) is the process in which the surface of iron gets rusted with non-sticky reddish-brown substance when left exposed to moist air over a considerable interval of time.

- Rust or hydrated ferric oxide [ $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ ] is formed by action of air and moisture on iron.

Two conditions needed for rusting to occur are presence of (i) oxygen and (ii) moisture.

- Rusting is prevented by applying oil or grease on the surface of iron article, a coat of paint on iron, by electroplating with nickel and chromium, by tinning of iron and galvanisation.
- The addition of other elements to a metal is called alloying and the resulting material is an alloy. So, an alloy is a homogeneous mixture of a metal with other metal(s) or/and non-metal(s).
- Alloying is done to increase stability, hardness and tensile strength and to lower the MP.

## OBJECTIVE QUESTIONS

1. A metal and a non-metal that exists in liquid state at the room temperature are respectively:
  - (a) Bromine and Mercury
  - (b) Mercury and Iodine
  - (c) Mercury and Bromine
  - (d) Iodine and Mercury

Ans :

OD 2024

Mercury is a metal which exists in liquid state at the room temperature whereas bromine is a non-metal which exists in liquid state at the room temperature. Mercury offers higher resistance to the passage of electricity than copper.

Thus (c) is correct option.

2. Select the appropriate state symbols of the products given as X and Y in the following chemical equation by choosing the correct option from table given

- 112.** Name two metals that catch fire when put in water and why ?

**Ans :**

Delhi 2009

Sodium and potassium.

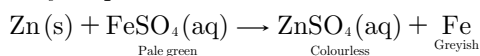
Sodium and potassium are highly negative metal which react vigorously with cold water to evolve hydrogen gas. The reaction is highly violent and exothermic and the evolved gas catches fire.

- 113.** What would you observe when zinc is added to a solution of iron(II) sulphate ? Write the chemical reaction that takes place.

**Ans :**

OD 2014

The pale green colour of iron(II) sulphate will fade and a colourless solution of  $\text{ZnSO}_4$  will be obtained. Greyish particles of Fe are also formed.



- 114.** Name two metals that start floating after sometime when immersed in water and why ?

**Ans :**

SQP 2018

Calcium and Magnesium.

Calcium and magnesium react with cold and hot water to evolve hydrogen gas. The bubbles of the gas evolved stick to the surface of the metal and thus being lighter floats on the surface.

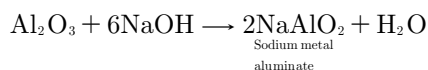
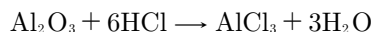
- 115.** Metal oxides are basic in nature. But some metal oxides show both acidic as well as basic behaviour. What are these oxides called ? Name one such oxide and write the reaction with an acid and a base.

**Ans :**

OD 2016, 11

Oxides which show acidic as well as basic behaviour are called as amphoteric oxides.

Examples :  $\text{Al}_2\text{O}_3$ .

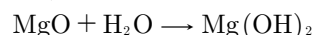
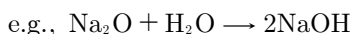


- 116.** An element reacts with air (oxygen) to form its oxide. When dissolved in water the solution turns red litmus blue. Is it a metal or a non-metal ? Justify your answer.

**Ans :**

Comp 2013

Basic oxide turns red litmus blue, so it is a metallic oxide. It is metal.



- 117.** List any two observations when a highly reactive metal is dropped in water.

**Ans :**

SQP 2016

- (i) Large amount of heat is evolved.
- (ii) Metal starts floating.

- 118.** Name a metal for each case :

- (a) It does not react with cold as well as hot water but reacts with steam.
- (b) When calcium metal is added to water the gas evolved does not catch fire but the same gas evolved on adding sodium metal to water catches fire. Why is it so ?

**Ans :**

Delhi 2019

- (a) (i) Aluminium,  
(ii) Copper.
- (b) In both cases, the gas evolved is  $\text{H}_2$ . When calcium reacts with water the heat evolved is not sufficient for hydrogen to catch fire. On the other hand, sodium metal reacts with water violently and in this case a lot of heat is evolved which is sufficient for hydrogen to catch fire.

- 119.** Give reasons for the following :

- (a) Sodium chloride has a high melting point.
- (b) Non-metals do not displace hydrogen from dilute acids.

**Ans :**

OD 2010

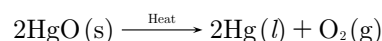
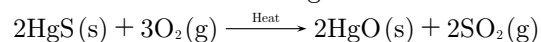
- (a) Sodium chloride does not exist as molecule but as aggregates of oppositely charged ions which are held tightly by strong electrostatic force. This is why we need high temperature to break this force of attraction between ions and hence it has high melting point.
- (b) Non-metals have less reactivity than hydrogen, so they cannot displace hydrogen from dilute acids.

- 120.** Explain how mercury is extracted from its sulphide ore (Cinnabar). Give equations of the reactions involved.

**Ans :**

OD 2019

When cinnabar is heated in air, it is first converted into mercuric oxide ( $\text{HgO}$ ). Mercuric oxide is then reduced on further heating.



- 121.** In one method of rust prevention, the iron is not coated with anything. Name the method and define it.

4. Which one of the following metals do not react with cold as well as hot water ?

(a) Na (b) Ca  
(c) Mg (d) Fe

Ans :

(d) Fe

5. Which of the following oxide(s) of iron would be obtained on prolonged reaction of iron with steam ?

(a) FeO (b) Fe<sub>2</sub>O<sub>3</sub>  
(c) Fe<sub>3</sub>O<sub>4</sub> (d) Fe<sub>2</sub>O<sub>3</sub> and Fe<sub>3</sub>O<sub>4</sub>

Ans :

(c) Fe<sub>3</sub>O<sub>4</sub>

6. What happens when calcium is treated with water ?

(i) It does not react with water  
(ii) It reacts violently with water  
(iii) It reacts less violently with water  
(iv) Bubbles of hydrogen gas formed stick to the surface of calcium

(a) (i) and (iv) (b) (ii) and (iii)  
(c) (i) and (ii) (d) (iii) and (iv)

Ans :

(d) (iii) and (iv)

7. Generally metals react with acids to give salt and hydrogen gas. Which of the following acids does not give hydrogen gas on reacting with metals (except Mn and Mg) ?

(a) H<sub>2</sub>SO<sub>4</sub> (b) HCl  
(c) HNO<sub>3</sub> (d) All of these

Ans :

(c) HNO<sub>3</sub>

8. The composition of aqua-regia is

(a) Dil. HCl	:	Conc. HNO <sub>3</sub>
3	:	1
(b) Conc. HCl	:	Dil. HNO <sub>3</sub>
3	:	1
(c) Conc. HCl	:	Conc. HNO <sub>3</sub>
3	:	1
(d) Dil. HCl	:	Dil. HNO <sub>3</sub>
3	:	1

Ans :

(c) Conc. HCl : Conc. HNO<sub>3</sub>  
3 : 1

9. Which of the following are not ionic compounds ?

(i) KCl (ii) HCl  
(iii) CCl<sub>4</sub> (iv) NaCl  
(a) (i) and (ii) (b) (ii) and (iii)  
(c) (iii) and (iv) (d) (i) and (iii)

Ans :

(b) (ii) and (iii)

10. Which one of the following properties is not generally exhibited by ionic compounds ?

(a) Solubility in water  
(b) Electrical conductivity in solid state  
(c) High melting and boiling points  
(d) Electrical conductivity in molten state

Ans :

(b) Electrical conductivity in solid state

11. Which of the following metals exist in their native state in nature ?

(i) Cu (ii) Au  
(iii) Zn (iv) Ag  
(a) (i) and (ii) (b) (ii) and (iii)  
(c) (ii) and (iv) (d) (iii) and (iv)

Ans :

(c) (ii) and (iv)

12. Metals are refined by using different methods. Which of the following metals are refined by electrolytic refining ?

(i) Au (ii) Cu  
(iii) Na (iv) K  
(a) (i) and (ii) (b) (i) and (iii)  
(c) (ii) and (iii) (d) (iii) and (iv)

Ans :

(a) (i) and (ii)

13. Silver articles become black on prolonged exposure to air. This is due to the formation of

(a) Ag<sub>3</sub>N (b) Ag<sub>3</sub>O  
(c) Ag<sub>3</sub>S (d) Ag<sub>3</sub>S and Ag<sub>3</sub>N

Ans :

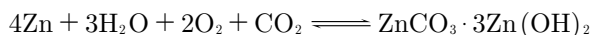
(c) Ag<sub>3</sub>S

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Zinc in presence of moist air is coated by the thin film of its basic carbonate on its surface and becomes dull.



**56. Assertion :** Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid

**Reason :** Carbon dioxide is given off in the reaction.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Gas bubbles are observed when sodium carbonate is added to dilute hydrochloric acid as  $\text{CO}_2$  gas is released.

## ONE MARK QUESTIONS

- 1.** Metals become dull when exposed to air. Why ?

**Ans :**

Delhi 2018

Metals become dull when exposed to air due to formation of a thin layer of oxide, carbonate or sulphide on their surfaces.

- 2.** What length of wire can be drawn from one gram of gold ?

**Ans :**

OD 2015

Two kilometres long wire can be drawn from one gram of gold.

- 3.** What is meant by thermal conductivity of metals ?

**Ans :**

Delhi 2013

Conductivity of heat in metals is known as thermal conductivity.

- 4.** Name the poorest conductors of heat among metals.

**Ans :**

Comp 2019

Lead is the poorest conductors of heat among metals.

- 5.** Arrange the following in decreasing order of their electrical conductivity : Mercury, Copper, Tungsten, Aluminium.

**Ans :**

Foreign 2017

Copper, Aluminium, Tungsten and Mercury.

- 6.** Explain the statement, "metals are sonorous".

**Ans :**

Delhi 2010

This means that metals produce a sound when struck by an object.

- 7.** Name a metal which offers higher resistance to the passage of electricity than copper.

**Ans :**

OD 2006

Mercury offers higher resistance to the passage of electricity than copper.

- 8.** Name two metals both of which are very ductile as well as very malleable.

**Ans :**

SQP 2009

Gold and silver.

- 9.** Name some non-metals which are solid at room temperature.

**Ans :**

Comp 2012

Carbon, sulphur, phosphorus, iodine, etc.

- 10.** Name the non-metal which is used in the hydrogenation of vegetable oils to make vegetable ghee.

**Ans :**

SQP 2020

Hydrogen.

- 11.** Name the most abundant element in the earth's crust.

**Ans :**

Foreign 2016

Oxygen.

- 12.** Name the second most abundant element in the earth's crust.

**Ans :**

Foreign 2019

Silicon.

- 13.** Name two metals which have very low melting point.

**Ans :**

OD 2010

Gallium and caesium have very low melting point.

Ans :

(a) deposited on cathode.

25. An element  $A$  is soft and can be cut with a knife. This is very reactive to air and cannot be kept open in air. It reacts vigorously with water. Identify the element from the following :

(a) Mg (b) Na  
(c) P (d) Ca

Ans :

(b) Na

26. Alloys are homogeneous mixtures of a metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents ?

(a) Brass (b) Bronze  
(c) Amalgam (d) Steel

Ans :

(d) Steel

27. Which among the following statements is incorrect for magnesium metal ?

(a) It burns in oxygen with a dazzling white flame  
(b) It reacts with cold water to form magnesium oxide and evolves hydrogen gas  
(c) It reacts with hot water to form magnesium hydroxide and evolves hydrogen gas  
(d) It reacts with steam to form magnesium hydroxide and evolves hydrogen gas

Ans :

(b) It reacts with cold water to form magnesium oxide and evolves hydrogen gas

28. Which among the following alloys contain mercury as one of its constituents ?

(a) Stainless steel (b) Alnico  
(c) Solder (d) Zinc amalgam

Ans :

(d) Zinc amalgam

29. Reaction between  $X$  and  $Y$ , forms compound  $Z$ .  $X$  loses electron and  $Y$  gains electron. Which of the following properties is not shown by  $Z$  ?

(a) Has high melting point  
(b) Has low melting point  
(c) Conducts electricity in molten state  
(d) Occurs as solid

Ans :

(b) Has low melting point

30. The electronic configurations of three elements  $X$ ,  $Y$  and  $Z$  are

$X - 2, 8$ ;  $Y - 2, 8, 7$  and  $Z - 2, 8, 2$ . Which of the following is correct ?

(a)  $X$  is a metal  
(b)  $Y$  is a metal  
(c)  $Z$  is a non-metal  
(d)  $Y$  is a non-metal and  $Z$  is a metal

Ans :

(d)  $Y$  is a non-metal and  $Z$  is a metal

31. Although metals form basic oxides, which of the following metals form an amphoteric oxide ?

(a) Na (b) Ca  
(c) Al (d) Cu

Ans :

(c) Al

32. Generally, non-metals are not conductors of electricity. Which of the following is a good conductor of electricity ?

(a) Diamond (b) Graphite  
(c) Sulphur (d) Fullerenes

Ans :

(b) Graphite

33. Electrical wires have a coating of an insulating material. The material, generally used is

(a) Sulphur (b) Graphite  
(c) PVC (d) All can be used

Ans :

(c) PVC

34. Which of the following can undergo chemical reaction?

(a)  $\text{MgSO}_4 + \text{Fe}$  (b)  $\text{ZnSO}_4 + \text{Fe}$   
(c)  $\text{MgSO}_4 + \text{Pb}$  (d)  $\text{CuSO}_4 + \text{Fe}$

Ans :

(d)  $\text{CuSO}_4 + \text{Fe}$

35. Which one of the following figures correctly describes the process of electrolytic refining ?



below:

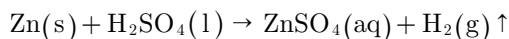


	(X)	(Y)
(a)	(s)	(l)
(b)	(aq)	(s)
(c)	(aq)	(g)
(d)	(g)	(aq)

Ans :

OD 2023

Zinc sulphate ( $\text{ZnSO}_4$ ) is acidic solution and hydrogen ( $\text{H}_2$ ) is a gas. The reaction of zinc with dilute sulphuric acid to produce zinc sulphate and hydrogen is given by the following chemical equation:



Thus option (b) is correct option.

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3. Bronze is an alloy of :

- (a) Copper and Zinc
- (b) Aluminium and Tin
- (c) Copper, Tin and Zinc
- (d) Copper and Tin

Ans :

OD 2023

Bronze is an alloy of copper and tin.

Uses of bronze :

- (i) Used for making coins.
- (ii) Used for making turbines and blades.

Thus option (d) is correct option.

4. Which of the following pairs will give displacement reactions ?

- (a) NaCl solution and copper metal.
- (b)  $\text{MgCl}_2$  solution and aluminium metal.
- (c)  $\text{FeSO}_4$  solution and silver metal.
- (d)  $\text{AgNO}_3$  solution and copper metal.

Ans :

(d)  $\text{AgNO}_3$  solution will have displacement reaction with copper (Cu) because copper is placed above silver in the activity series.

5. Which of the following methods is suitable for preventing an iron frying pan from rusting ?

- (a) Applying grease
- (b) Applying paint

(c) Applying a coating of zinc

(d) All of the above

Ans :

(d) All the methods are helpful in preventing iron pan from rusting.

6. An element reacts with oxygen to give a compound with a high melting point. This compound is also soluble in water. The element is likely to be

- (a) Calcium
- (b) Carbon
- (c) Silicon
- (d) Iron

Ans :

(a) Calcium

7. Food cans are coated with tin and not with zinc because

- (a) zinc is costlier than tin.
- (b) zinc has a higher melting point than tin.
- (c) zinc is more reactive than tin.
- (d) zinc is less reactive than tin.

Ans :

(c) Zinc is more reactive than tin.

1. Which of the following property is generally not shown by metals ?

- (a) Electrical conduction
- (b) Sonorous in nature
- (c) Dullness
- (d) Ductility

Ans :

(c) Dullness.

2. The ability of metals to be drawn into thin wire is known as

- (a) ductility
- (b) malleability
- (c) sonorosity
- (d) conductivity

Ans :

(a) ductility.

3. Aluminium is used for making cooking utensils. Which of the following properties of aluminium are responsible for the same ?

- (i) Good thermal conductivity
- (ii) Good electrical conductivity
- (iii) Ductility
- (iv) High melting point.
- (a) (i) and (ii)
- (b) (i) and (iii)
- (c) (ii) and (iii)
- (d) (i) and (iv)

Ans :

(d) (i) and (iv)

Ans :

(b) A-r, B-p, q; C-p, D-s

38. Match the column I to column II and select the correct answer using the codes given below:

	Column I Ore		Column II Elements
(A)	Chalcopyrite	(p)	Copper
(B)	Cuprite	(q)	Iron
(C)	Magnetite	(r)	Sulphur
(D)	Chalcocite	(s)	Oxygen

	A	B	C	D
(a)	p, q, r	p, s	q, s	p, r
(b)	p	q	s	p, r
(c)	r	s	p	q
(d)	s	q	r	p

Ans :

(a) A-p, q, r, B-p, s C-q, s D-p, r

39. **Assertion :** Nitrate ores are rarely available.

**Reason :** Bond dissociation energy of nitrogen is very high.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.  
 (c) Assertion is correct and Reason is false.  
 (d) Both Assertion and Reason are false.

Ans :

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The bond dissociation energy of  $N_2$  is very high due to presence of triple bond between two nitrogen atoms. That's why nitrate ores are rarely available.

40. **Assertion :** Metals possess metallic lustre.

**Reason :** Metals in their pure state, have a shining surface.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Both Assertion and Reason are false

Ans :

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Metals in their pure state have a shining surface which is called metallic lustre.

Hence both assertion and reason are true and reason explains assertion.

41. **Assertion :** Metals are said to be sonorous.

**Reason :** Metals conduct heat and electricity.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Both Assertion and Reason are false.

Ans :

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Metals are said to be sonorous because they produce a sound when they strike a hard surface. Metals are good conductors of heat and electricity. Both assertion and reason are true but reason does not explain assertion.

42. **Assertion :** Some metal oxides are amphoteric in nature.

**Reason :** Metallic oxides show acidic behaviour.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Both Assertion and Reason are false.

Ans :

(c) Assertion is true but Reason is false.

Some metal oxides are amphoteric in nature as they show both acidic and basic character. Hence assertion is true but reason is false.

43. **Assertion :** Sodium displaces copper from its salt solution.

**Reason :** Reactive metals can displace less reactive metals from their compounds in solution as molten form.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

63. Write one example of a metal which is poor conductor of electricity and a non-metal which is good conductor of electricity.

Ans :

Delhi 2012

Metal which is poor conductor of electricity.

Non-metal which is good conductor of electricity-  
Graphite.

64. Explain the term Malleability.

Ans :

Comp 2016

The property of metals by virtue of which they can be beaten into thin sheets is called malleability e.g. gold and silver.

65. Explain the term Ductility.

Ans :

SQP 2013

The ability of metals to be drawn into thin wires is called ductility. Gold is most ductile metal.

66. Give one most suitable word for the following statement :

- (a) Metal oxides which show basic as well as acidic behaviour  
(b) Iodine, a non-metal is shining.

Ans :

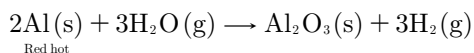
Delhi 2011

- (a) Amphoteric oxide  
(b) Lustrous.

67. Write the chemical equation for the reaction taking place when steam is passed over hot aluminium.

Ans :

OD 2008



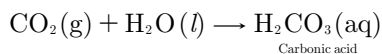
Red hot

68. What happens when carbon-dioxide is compressed in water at high pressure.

Ans :

Delhi 2015

Carbonic acid is formed.



Carbonic acid

69. Give reason why :

Electric wires are coated with plastic (PVC) ?

Ans :

Foreign 2017

The electric wires have a covering of PVC around them so that even if we happen to touch the current-carrying wire, the current will not pass through our body and hence we will not get an electric shock.

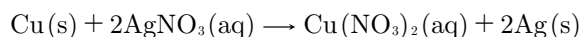
70. A copper plate was dipped into a solution of silver nitrate. After sometime, a black layer was observed

on the surface of copper plate. State the reason for it and write the chemical equation of the reaction involved.

Ans :

OD 2019

As copper metal is more active than silver so it displaces silver from the solution.



71. Classify the following into acidic oxides and basic oxides.

$\text{Na}_2\text{O}$ ,  $\text{SO}_2$ ,  $\text{MgO}$ ,  $\text{CO}_2$

Ans :

OD 2011

**Acidic oxide :**  $\text{SO}_2$ ,  $\text{CO}_2$

**Basic oxide :**  $\text{Na}_2\text{O}$ ,  $\text{MgO}$

72. Arrange metals Ca, Al, Cu and Au in decreasing order of reactivity.

Ans :

Delhi 2015

$\text{Cu} > \text{Al} > \text{Ca} > \text{Au}$

73. Give reason :

Generally no hydrogen gas is evolved when metals react with dilute nitric acid.

Ans :

OD 2013, 11

Nitric acid is a strong oxidising agent. It oxidises the produced hydrogen gas into water and itself gets reduced to any one of its oxides like  $\text{NO}$ ,  $\text{NO}_2$  or  $\text{N}_2\text{O}$ .

74. Give reason :

Ionic compounds are usually hard.

Ans :

Delhi 2009

They are solids and are somewhat hard because of the strong force of attraction between the positive and negative ions.

75. Why does calcium float in water ?

Ans :

Foreign 2014

Calcium reacts with water to form hydrogen gas. Due to the sticking of the  $\text{H}_2$  gas bubbles on calcium metal surface, it starts floating.

76. A green layer is gradually formed on a copper plate left exposed to air for a week in a bathroom. What could be this green substance be ?

Ans :

Comp 2018

The green substance is basic copper carbonate,  $\text{CuCO}_3$ ,  $\text{Cu(OH)}_2$ .

77. In nature metal A is found in free state while metal B is found in the form of its compound. Which of the two will be nearer to the top of the activity

**Ans :**

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Silver articles become black after sometime when exposed to air because it reacts with sulphur in the air to form silver sulphide. Hence both assertion and reason are true but reason does not explain assertion.

**50. Assertion :** Electrical wires can be made by copper.

**Reason :** Copper is a good conductor of electricity.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Electrical wires are made up of copper. Copper is very good conductor of electricity. Because it have more free electrons to conduct electricity.

**51. Assertion :** When zinc is added to a solution of iron (II) sulphate, no change is observed.

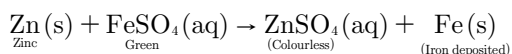
**Reason :** Zinc is less reactive than iron.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

When zinc is added to solution of iron(II), sulphate, the colour of iron sulphate solution changes. It is because zinc is more reactive than iron, therefore it displaces from iron(II) sulphate. Thus the green colour of the solution, fades and iron metal gets deposited.



**52. Assertion :** Food cans are coated with zinc and not with tin.

**Reason :** Zinc is more reactive than tin.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

Food cans are coated with tin not with zinc because zinc is more reactive than tin, it can react with organic acids present in food.

**53. Assertion :** Carbon reacts with oxygen to form carbon monoxide which is an acidic oxide.

**Reason :** Non-metals form acidic oxides.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

Carbon being a non-metal form acidic oxides, i.e., their aqueous solution turns blue litmus solution red.

**54. Assertion :** Different metals have different reactivities with water and dilute acids.

**Reason :** Reactivity of a metal depends on its position in the reactivity series.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

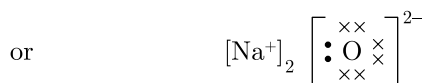
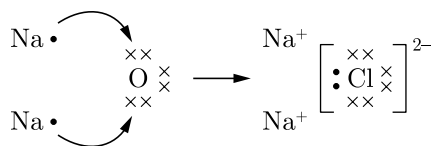
(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Metals can be arranged in the order of decreasing reactivity in a series. This series is called the activity or reactivity series of metals. Metals at the top of the series are very reactive and therefore they do not occurs free in nature. The metals at the bottom of the series are least reactive and therefore they normally occur free in nature.

**55. Assertion :** Zinc becomes dull in moist air.

**Reason :** Zinc is coated by a thin film of its basic carbonate in moist air.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.



- (b) Ionic compounds are usually hard because of strong electrostatic forces of attraction between the oppositely charged ions.
- (c) Ionic compound in the solid state do not conduct electricity because these compounds do not dissociate to produce free ions but in the molten state ionic compounds dissociate to produce free ions in the solution and hence they conduct electricity.

169. State which of the following reaction will take place or not and why ?

- (i)  $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu(s)}$
- (ii)  $\text{Fe(s)} + \text{ZnSO}_4(\text{aq}) \longrightarrow \text{FeSO}_4(\text{aq}) + \text{Zn(s)}$
- (iii)  $\text{Zn(s)} + \text{FeSO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe(s)}$

Ans :

Delhi 2013

- (i)  $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu(s)}$   
This reaction will take place as zinc is more reactive than copper and therefore can displace copper from its aqueous solution.
- (ii)  $\text{Fe(s)} + \text{ZnSO}_4(\text{aq}) \longrightarrow \text{FeSO}_4(\text{aq}) + \text{Zn(s)}$   
This reaction will not take place since iron is less reactive than zinc, therefore it will not be able to displace.
- (iii)  $\text{Zn(s)} + \text{FeSO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe(s)}$   
This reaction will take place as zinc is more reactive than iron and therefore can displace iron from its aqueous solution.

170. Give reasons for the following observations :

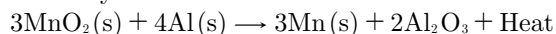
- (a) Prior to reduction of metal sulphides and metal carbonate must be converted into metal oxides.
- (b) For extracting some metals, displacement reactions are used in place of carbon to obtain metals from the oxides.

Ans :

OD 2016

- (a) It is easier to obtain a metal from its oxide, as compared to its sulphides and carbonates.
- (b) The highly reactive metals i.e., sodium, calcium, aluminium etc., are used as reducing agents because they can displace metals of lower

reactivity.



171. Give reasons for the following :

- (a) Ionic compounds in general have high melting and boiling points.
- (b) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.
- (c) Copper containers get a green coat when left exposed to air in the rainy season.

Ans :

Delhi 2015, 11

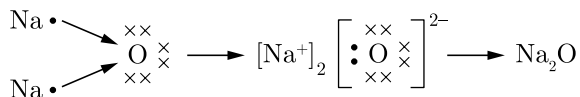
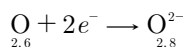
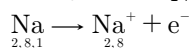
- (a) Ionic compounds have high melting and boiling points due to strong force of attraction between oppositely charged ions.
- (b) It is because these metals, themselves are strong reducing agents. Therefore, cannot be reduced by reducing agents like carbon.
- (c) Copper containers react with  $\text{CO}_2$ ,  $\text{O}_2$  and moisture to form green coloured basic copper carbonate  $[\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2]$

172. (a) Show the formation of  $\text{Na}_2\text{O}$  by the transfer of electrons between the combining atoms.
- (b) Why are ionic compounds usually hard ?
- (c) How is it that ionic compounds in the solid state do not conduct electricity and they do so when in molten state ?

Ans :

Delhi 2009

(a) Formation of  $\text{Na}_2\text{O}$  :



- (b) It is because of the strong force of attraction between the positive and negative ions.
- (c) Ionic compounds in the solid state do not conduct electricity because movement of ions in the solid is not possible due to their rigid structure. But ionic compounds conduct electricity in the molten state. This is possible in the molten state since the electrostatic forces of attraction between the oppositely charged ions are overcome due to the heat. Thus, the ions move freely and conduct electricity.

173. Explain the following statements :

- (a) Most metal oxides are insoluble in water but some of these dissolve in water. What are these oxides and their solutions in water called ?

14. Name two most malleable metals.

**Ans :** OD 2008, 06  
Gold and silver are the most malleable metals.

15. Name one metal and one non-metal which exists in liquid state at room temperature.

**Ans :** OD 2010  
Metal : Mercury; Non-metal : Bromine.

16. A non-metal  $X$  exists in two different forms  $Y$  and  $Z$ .  $Y$  is the hardest natural substance, whereas  $Z$  is a good conductor of electricity. Identify  $X$ ,  $Y$  and  $Z$ .

**Ans :** Delhi 2013  
 $X$  is carbon,  $Y$  is diamond and  $Z$  is graphite.

17. What is the general nature of metal oxides ?

**Ans :** Dehi 2017  
The metal oxides are generally basic in nature.

18. What are alkalis ? Give one example of alkalis.

**Ans :** Foreign 2006  
Those bases which are soluble in water are called alkalis. Sodium hydroxide ( $\text{NaOH}$ ) is an example of an alkali.

19. Name two amphoteric oxides.

**Ans :** OD 2011  
Aluminium oxide ( $\text{Al}_2\text{O}_3$ ) and zinc oxide ( $\text{ZnO}$ ).

20. What happens when magnesium is heated to its ignition temperature ?

**Ans :** OD 2018  
It burns with blinding white light to form magnesium oxide.

21. What happens when iron is heated to a high temperature ?

**Ans :** Delhi 2016  
Iron does not burn on heating but glows brightly.

22. What happens when copper is heated to a very high temperature ?

**Ans :** Delhi 2013  
Copper does not burn, but the hot metal is coated with a layer of black substance known as copper(II) oxide.

23. Name two metals which do not react with air even at high temperature.

**Ans :** SQP 2011  
Silver and gold not react with air even at high

temperature.

24. What happens when metals react with water ?

**Ans :** Delhi 2015  
Metals react with water to form metal oxides or metal hydroxides and hydrogen gas.

25. Name two metals that react violently with cold water.

**Ans :** OD 2009  
Potassium and sodium react violently with cold water.

26. Name the metal which does not react with dilute acids.

**Ans :** OD 2014  
Copper does not react with dilute acids.

27. Write the chemical equation for the reaction taking place When a piece of calcium metal is placed in water.

**Ans :** Comp 2007  
 $\text{Ca} + 2\text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2 + \text{H}_2$

28. Write the chemical equation for the reaction taking place when steam is passed Over red hot iron.

**Ans :** OD 2010  
 $3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$

29. Give reason for the following : Na, K and Ca metals form hydrides by combining with hydrogen gas, but most other metals do not.

**Ans :** Delhi 2013  
This is because Na, K and Ca are highly electro positive in nature.

30. An element M on reacting with oxygen forms an oxide  $\text{M}_2\text{O}$ . This oxide dissolves in water and turns red litmus blue. State whether the element M is a metal or a non-metal.

**Ans :** Delhi 2016  
M is a metal since metal oxides are generally basic in nature.

31. A metal  $X$  on heating in air does not burn, but acquires a black coating of the substance  $Y$  on its surface. Name the metal  $X$  and the substance  $Y$ .

**Ans :** OD 2018  
Metal  $X$  is copper and the substance  $Y$  is copper(II) oxide.



155. Differentiate between roasting and calcination process giving an example of each.

Ans :

Delhi 2010

	Roasting	Calcination
(i)	In roasting sulphide, ore is strongly heated in the presence of air into metal oxide.	In calcination, carbonate ore is strongly heated in absence of air into metal oxide.
(ii)	For example, $2\text{ZnS} + 3\text{O}_2 \xrightarrow{\text{Heat}} 2\text{ZnO} + 2\text{SO}_2 \uparrow$	For example, $\text{ZnCO}_3 \xrightarrow{\text{Heat}} \text{ZnO} + \text{CO}_2 \uparrow$

156. Write the equations for the following metals which are obtained from their compounds by reduction process.

- (a) Metal  $X$  which is low in reactivity series.  
 (b) Metal  $Y$  which is in middle of series.

Ans :

OD 2013

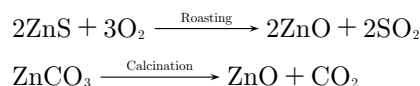
- (a)  $\text{XS} + \text{O}_2 \xrightarrow{\text{Heat}} \text{XO} + \text{SO}_2$   
 $\text{XO} \xrightarrow{\text{Heat}} \text{X} + \text{O}_2$   
 (b)  $\text{YO} + \text{C} \rightarrow \text{Y} + \text{CO}$

157. Write chemical equations for the reactions taking place when :

- (i) zinc sulphide is heated in air.  
 (ii) calcination of zinc carbonate is done.

Ans :

SQP 2017



158. Give the reaction involved during extraction of zinc from its ore by

- (a) roasting of zinc ore.  
 (b) calcination of zinc ore.  
 (c) reduction of zinc oxide.

Ans :

Delhi 2012

- (a)  $2\text{ZnS}(\text{s}) + 3\text{O}_2 \xrightarrow{\text{Heat}} 2\text{ZnO}(\text{s}) + 2\text{SO}_2(\text{g})$   
 (b)  $\text{ZnCO}_3(\text{s}) \xrightarrow{\text{Heat}} \text{ZnO}(\text{s}) + \text{CO}_2(\text{g})$   
 (c)  $\text{ZnO}(\text{s}) + \text{C}(\text{s}) \rightarrow \text{Zn}(\text{s}) + \text{CO}(\text{g})$

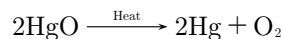
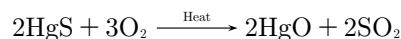
159. (a) Name the main ore of mercury. How mercury is obtained from its ore ? Give balanced chemical equations.

- (b) Name the method used to extract metals of high reactivity.

Ans :

OD 2016

- (a) Cinnabar ( $\text{HgS}$ ) is the main ore of mercury.



- (b) A highly reactive metal can be extracted from its ore by electrolytic reduction.

160. Give reason for the following :

- (i) Ionic compounds have usually high melting and boiling point.  
 (ii) Metals are good conductors of electricity whereas non-metals are not.

Ans :

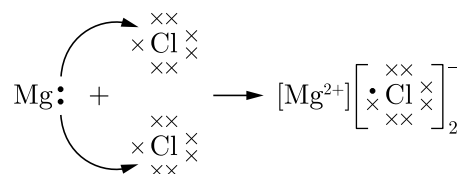
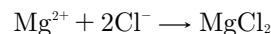
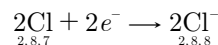
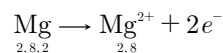
Delhi 2011

- (i) Because considerable amount of energy is required to break the strong inter-ionic attraction.  
 (ii) Metals have free electrons while non-metals (insulator) do not have any free electrons.

161. The atomic number of magnesium is 12 and of chlorine is 17. Show the formation of magnesium chloride by the transfer of electrons.

Ans :

Comp 2014



162. Ionic compounds conduct electricity only in molten state not in solid state. Why ?

Ans :

Delhi 2012

Ionic compounds conduct electricity only in molten state because the electrostatic forces of attraction between the oppositely charged ions are overcome due to heat. In solid state movement of ions is not possible due to their rigid structure.

163. How does rusting take place ? Write the conditions necessary for rusting to take place.

Ans :

OD 2009

- (i) **Rusting** : It is an oxidation process in which iron metal is slowly oxidised by the action of air in the presence of moisture.  
 Rust is a mixture of ferric oxide and ferric hydroxide. It is a brown, flaky substance.

48. Which metals are never found in free state in nature?

Ans :

Delhi 2017

The metals at the top of the activity series (K, Na, Ca, Mg and Al) are so reactive that they are never found in nature as free elements.

49. How are metals classified on the basis of reactivity ?

Ans :

Foreign 2008

On the basis of reactivity, we can group the metals into the following three categories :

- (i) Metals of low reactivity;
- (ii) Metals of medium reactivity;
- (iii) Metals of high reactivity.

50. Which metals are found as oxide, sulphides, etc. in earth's crust ?

Ans :

Delhi 2011

The metals in the middle of the activity series (Zn, Fe, Pb, etc.) are moderately reactive. They are found in the earth's crust mainly as oxides, sulphides or carbonates.

51. Write the equation when manganese dioxide is heated with aluminium powder.

Ans :

OD 2013



52. How are metals towards the top of the activity series extracted ?

Ans :

Foreign 2016

They are extracted by electrolysis.

53. In the refining of silver, the recovery of silver from silver nitrate solution involves displacement by copper metal. Give the reason for the same.

Ans :

Delhi 2010

Copper is more reactive than silver.

54. What chemical process is used for obtaining a metal from its oxide ?

Ans :

OD 2014

A metal is obtained from its oxide by the process of reduction.

55. What is corrosion of metals ?

Ans :

Foreign 2006

The eating away of upper layers of a metal due to the action of air and moisture is called corrosion.

56. Which metals do not corrode easily ?

Ans :

OD 2007, 09

(i) Gold,

(ii) Silver,  
(iii) Platinum.

57. Name one metal which corrodes on being kept in atmosphere ?

Ans :

Foreign 2018

Iron.

58. Silver becomes blackish (tarnished) after some time. Why ?

Ans :

OD 2016

A layer of silver sulphide (black in colour) is formed on the surface of silver-ware due to which it gets tarnished.

59. Why does a greenish layer appear on a copper vessel if it is left for a few days in humid atmosphere without being cleaned ?

or

Copper articles become green when kept in moist air. Why ?

or

A green layer is generally formed on a copper plate left exposed to air for a week in a bathroom. What could this green substance be ?

Ans :

OD 2017, 11, 06

The greenish layer on the copper articles (vessel or plate) is due to the coating of copper carbonate in moist air.

60. Give an advantage of corrosion of metals.

or

Give an example to support that corrosion of some metals is an advantage.

Ans :

Delhi 2009

Corrosion of metals like iron, copper, silver, etc. is an advantage because it prevents the metal underneath from further damage.

61. A vessel made of a metal  $M$  acquires a blackish tinge on exposure to air after a few days. Name the metal  $M$  and the black substance.

Ans :

Foreign 2017

The metal  $M$  is silver and the black substance is silver sulphide.

62. Write one example of a metal having low melting point and non-metal having high melting point.

Ans :

OD 2015

Low melting point metal-Gallium high melting point non-metal-diamond.

14. Galvanisation is a method of protecting iron from rusting by coating with a thin layer of
- (a) Galium (b) Aluminium  
(c) Zinc (d) Silver

Ans :

(c) Zinc

15. Stainless steel is very useful material for our life. In stainless steel, iron is mixed with
- (a) Ni and Cr (b) Cu and Cr  
(c) Ni and Cu (d) Cu and Au

Ans :

(a) Ni and Cr

16. If copper is kept open in air, it slowly loses its shining brown surface and gains a green coating. It is due to the formation of
- (a)  $\text{CuSO}_4$  (b)  $\text{CuCO}_3$   
(c)  $\text{Cu}(\text{NO}_3)_2$  (d)  $\text{CuO}$

Ans :

(b)  $\text{CuCO}_3$

17. Generally, metals are solid in nature. Which one of the following metals is found in liquid state at room temperature ?
- (a) Na (b) Fe  
(c) Cr (d) Hg

Ans :

(d) Hg

18. Which of the following metals are obtained by electrolysis of their chlorides in molten state ?
- (i) Na (ii) Ca  
(iii) Fe (iv) Cu
- (a) (i) and (iv) (b) (iii) and (iv)  
(c) (i) and (iii) (d) (i) and (ii)

Ans :

(d) (i) and (ii)

Ans :

(d) Iodine

20. Which one of the following four metals would be displaced from the solution of its salts by other three metals ?
- (a) Mg (b) Ag  
(c) Zn (d) Cu

Ans :

(b) Ag

21. 2 mL each of concentrated  $\text{HCl}$ ,  $\text{HNO}_3$  and a mixture of concentrated  $\text{HCl}$  and concentrated  $\text{HNO}_3$  in the ratio of 3 : 1 were taken in test tubes labelled as *A*, *B* and *C*. A small piece of metal was put in each test tube. No change occurred in test tubes *A* and *B* but the metal got dissolved in test tube *C* respectively. The metal could be
- (a) Al (b) Au  
(c) Cu (d) Pt

Ans :

(b) Au

22. An alloy is
- (a) an element  
(b) a compound  
(c) a homogeneous mixture  
(d) a heterogeneous mixture

Ans :

(c) a homogeneous mixture

23. An electrolytic cell consists of
- (i) positively charged cathode  
(ii) negatively charged anode  
(iii) positively charged anode  
(iv) negatively charged cathode
- (a) (i) and (ii) (b) (iii) and (iv)  
(c) (i) and (iii) (d) (i) and (ii)

Ans :

(b) (iii) and (iv)

24. During electrolytic refining of zinc, it gets
- (a) deposited on cathode  
(b) deposited on anode  
(c) deposited on cathode as well as anode  
(d) remains in the solution

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19. Generally, non-metals are not lustrous. Which of the following non-metal is lustrous ?
- (a) Sulphur (b) Oxygen  
(c) Nitrogen (d) Iodine

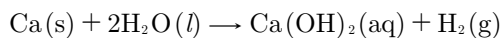
series of metals ? Why ?

**Ans :** OD 2016

Metal *B* will be nearer to the top of the activity series as it forms compounds in nature and not found in free state.

- 78.** Write the chemical equation for the following reaction: "A piece of calcium metal is dropped in water."

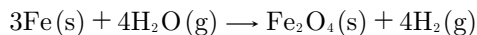
**Ans :** OD 2015



- 79.** Write the chemical equation for the following reaction:

"Steam is passed over red hot iron."

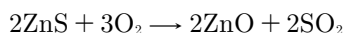
**Ans :** Comp 2019



- 80.** Write the chemical reaction for the following reaction:

"Zinc sulphide is heated in air."

**Ans :** Delhi 2009



- 81.** Give reason:

Carbonate and sulphide ores are usually converted into oxide during the extraction of metals.

**Ans :** OD 2014

It is easier to obtain metals from their oxides (by reduction) than from carbonates or sulphides.

- 82.** From amongst the metals sodium, calcium aluminium, copper and magnesium, name the metal:

- (i) Which reacts with water only on boiling and
- (ii) Another which does not react even with steam.

**Ans :** Foreign 2011

- (i) Magnesium,
- (ii) Copper.

- 83.** Name one metal and a non-metal found in liquid state of room temperature.

**Ans :** OD 2016

Metal — Mercury  
Non-metal — Bromine.

- 84.** Why do ionic compounds not conduct electricity in the solid state ?

**Ans :** Delhi 2012

Movement of ions in the solid state is not possible due to their rigid structure.

- 85.** An element *X* forms an oxide  $\text{X}_2\text{O}$  which is neither acidic nor basic, it is neutral. State whether element *X* is a metal or a non-metal.

**Ans :** OD 2018

Element *X* is a non-metal.

- 86.** A copper plate was dipped in a solution of silver nitrate. After sometime, silver from the solution was deposited on the copperplate. Which metal is more reactive-copper or silver ? Why ?

**Ans :** OD 2014

Copper is more reactive than silver because copper is able to displace silver from silver nitrate solution.

## TWO MARKS QUESTIONS

- 87.** Write some uses of metals which are based on the properties of malleability and ductility.

**Ans :** Delhi 2011

- (i) Silver foils are used for decorative purposes on sweets.
- (ii) Aluminium foils are used for wrapping chocolates, food stuff, etc.
- (iii) Thin copper wires are used in electric circuits.
- (iv) Gold and silver ornaments are made into different designs.

- 88.** Define the term 'electrical conductivity' of metals. Arrange the following metals in order of their decreasing electrical conductivity :

**or**

Give reason why metals conduct electricity.

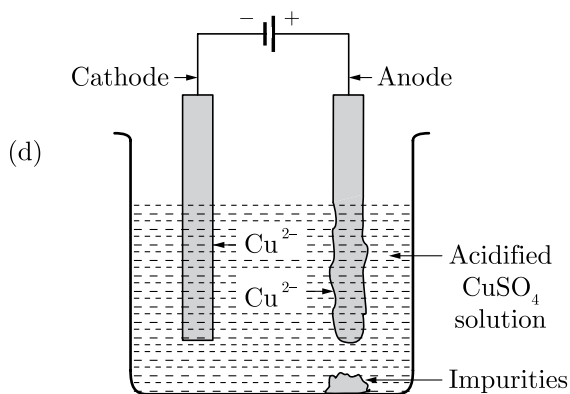
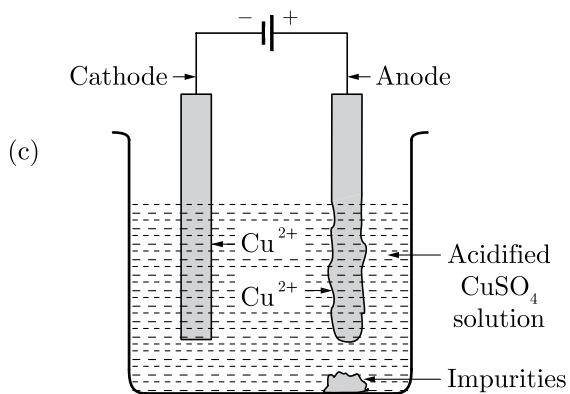
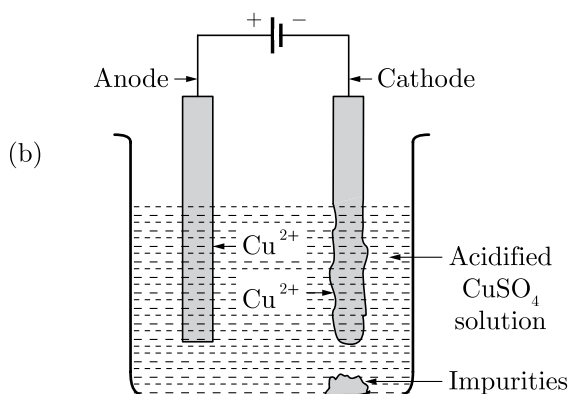
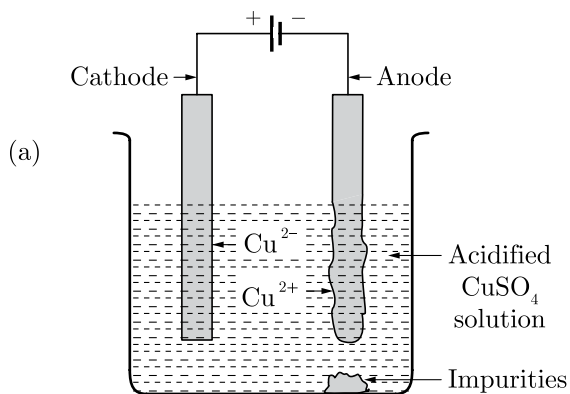
**Ans :** CBSE 2010, 06

- (i) The free flow of electrons in metals, i.e., the property of conductivity of electric current in metals is called electrical conductivity. These metals offer little resistance to the flow of current.
- (ii) Silver is the best conductor of electricity followed by gold. Mercury comes at last.

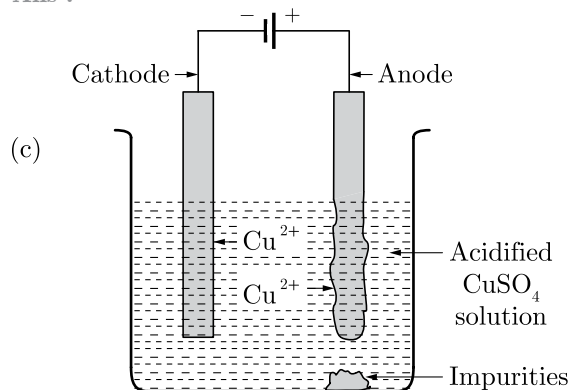
- 89.** Why are cooking vessels and water boilers generally made of copper and aluminium ?

**Ans :** SQP 2020

Cooking vessels and water boilers are generally made of copper and aluminium because they are good conductors of heat. Hence, the cooking vessels and boilers will get heated up quickly.



Ans :



36. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Good conductor of Electricity	(p)	Hydrogen
(B)	Food preservative	(q)	Copper
(C)	Allotrope of carbon	(r)	Nitrogen
(D)	Manufacture of ammonia	(s)	Graphite

	A	B	C	D
(a)	p	s, r	q, r	q, r
(b)	p	s	q	r
(c)	q	s	r	p
(d)	q, s	r	s	r, p

Ans :

(d) A-q, s B-r, C-s, D-r, p

37. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Steel	(p)	Copper
(B)	Brass	(q)	Zinc
(C)	Bronze	(r)	Iron
(D)	Magnalium	(s)	Aluminium

	A	B	C	D
(a)	p	s	q, r	q, r
(b)	r	p, q	p	s
(c)	q	s	p	r
(d)	s	q	r	p

**Ans :**

Comp 2013

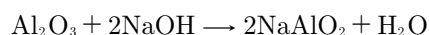
- (i) Hydrogen gas.  
 $(\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2 \uparrow)$   
 (ii) Downward displacement of water.  
 (iii) Insoluble in water.  
 (iv) Lighter than air.

- 102.** A metal  $A$ , which is used in thermit process, when heated with oxygen gives an oxide  $B$ , which is amphoteric in nature. Identify  $A$  and  $B$ . Write down the reactions of oxide  $B$  with  $\text{HCl}$  and  $\text{NaOH}$ .

**Ans :**

Delhi 2010

$A$  is aluminium ( $\text{Al}$ ) and  $B$  is aluminium oxide ( $\text{Al}_2\text{O}_3$ ).

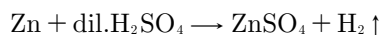


- 103.** Write observation with reaction for the following : Granulated zinc reacts with dil. sulphuric acid.

**Ans :**

OD 2015

When zinc reacts with dil. sulphuric acid bubbles of hydrogen are seen to come out.



- 104.** (a)  $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$   
 (b)  $\text{Cu} + \text{FeSO}_4 \rightarrow \text{CuSO}_4 + \text{Fe}$

Which of the above two reactions will take place and why ?

**Ans :**

Delhi 2017

Reaction (a) will take place. This is because  $\text{Fe}$  is more reactive than copper and so, it can displace  $\text{Cu}$  from its compound  $\text{CuSO}_4$ .

- 105.** Explain why most of the metals do not displace hydrogen from nitric acid.

**Ans :**

OD 2011

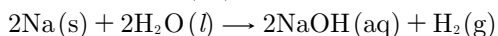
Nitric acid is a strong oxidising agent. It oxidises hydrogen produced to water and itself gets reduced to the nitrogen oxides.

- 106.** When a metal  $X$  is treated with cold water, it gives a base  $Y$  with molecular formula  $\text{XOH}$  (Molecular mass = 40) and liberates a gas  $Z$  which easily catches fire. Identify  $X$ ,  $Y$  and  $Z$  and also write the reaction involved.

**Ans :**

Comp 2016

$X$  is sodium ( $\text{Na}$ ),  $Y$  is sodium hydroxide ( $\text{NaOH}$ ),  $Z$  is hydrogen ( $\text{H}_2$ ).



+ Heat energy

- 107.** Why do the articles made of aluminium not corrode?

**Ans :**

Foreign 2009

The articles made of aluminium do not corrode because on exposure to air, the surface of aluminium is coated with a thin layer of aluminium oxide which is non-reactive. This protective layer protects the metal underneath from further damage.

- 108.** What are the constituents of solder alloy ? Which property of solder makes it suitable for welding electrical wires ?

**Ans :**

Delhi 2010

Solder is an alloy of lead and tin.

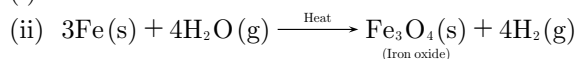
Low melting point of solder makes it suitable for welding electrical wires.

- 109.** (i) Select a metal out of the following which reacts with hot water but not with cold water : Iron, sodium, magnesium.  
 (ii) Write the chemical equation of the reaction and name the main product formed during this reaction.

**Ans :**

OD 2016, 10

(i) Metal is iron.



- 110.** Why do ionic compounds conduct electricity in molten state ?

**Ans :**

Comp 2008

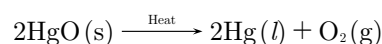
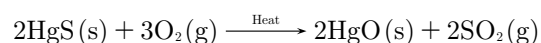
In solid state, ionic compounds do not conduct electric current because the ions are held together in fixed positions by strong electrostatic forces and cannot move freely. When ionic solid is dissolved in water or melted, the crystal structure is broken down and ions become free to move and conduct electricity.

- 111.** How are the less reactive metals extracted ? Explain with the help of an example.

**Ans :**

SQP 2006

Metals low in the reactivity series are very less reactive. The oxides of these metals can be reduced to metals by heating alone. For example, cinnabar ( $\text{HgS}$ ) is an ore of mercury. When it is heated in air (roasted) it is first converted into mercuric oxide ( $\text{HgO}$ ). Mercuric oxide is then reduced to mercury on further heating.





- (c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Sodium is more reactive than copper. Hence both assertion and reason are true and reason explains assertion.

**44. Assertion :** Ionic compounds are soft solids.

**Reason :** There is weak molecular forces between particles of ionic compounds.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

**Ans :**

(d) Both Assertion and Reason are false.

Ionic compounds are hard solids because there is strong force of attraction between positive and negative ions. Hence both assertion and reason are false.

**45. Assertion :** An arrangement of metals in decreasing order of their reactivity is called activity series.

**Reason :** Metals can be differentiated from non metals.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

**Ans :**

(c) Assertion is true but Reason is false.

Activity series in arrangement of metals in decreasing order of their reactivity, Assertion is true but reason is wrong.

**46. Assertion :** Alloying is a good method of improving the properties of a metal.

**Reason :** We can be differentiated from non metals.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

- (c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

We can get the desired properties by alloying. Hence both assertion and reason are true and reason explains assertion.

**47. Assertion :** Solder is an alloy of lead and copper.

**Reason :** It has a high melting point.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

**Ans :**

(d) Both Assertion and Reason are false.

Solder is an alloy of lead and tin with low melting point. Hence, both assertion and reason are false.

**48. Assertion :** Sodium metal is obtained by electrolytic reduction.

**Reason :** Sodium is a highly reactive metal.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Sodium is a highly reactive metal to its compound cannot be reduced by common reducing agents, hence it is obtained by electrolytic reduction.

**49. Assertion :** Silver articles become black after sometime when exposed to air.

**Reason :** Silver is very less reactive.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
(c) Assertion is true but Reason is false.  
(d) Both Assertion and Reason are false.

Ans :

Foreign 2012

**Electrical protection :** The method is used for protecting iron articles which are in contact with each other, i.e., underground pipes. The iron particle is reacted with more reactive metals, i.e., magnesium and zinc. Therefore, Mg will be corroded and it will protect iron from being rusted.

122. State reasons for the following :

- Silver chloride becomes black after sometime when exposed to air.
- Although aluminium is a highly reactive metal, yet its articles do not corrode.

Ans :

OD 2013

- Silver chloride becomes black after sometime when exposed to air as it reacts with sulphur in air to form a black coating of silver sulphide.
- Although aluminium is highly reactive metal, yet its articles do not corrode due to the formation of protective layer of oxide,  $\text{Al}_2\text{O}_3$  on its surface which prevents it from further corrosion.

123. Name the constituents of bronze and write its two uses.

Ans :

Delhi 2008

Constituents of bronze are : Copper + Zinc.

Uses of bronze :

- Used for making coins.
- Used for making turbines and blades.

124. Explain how the properties of an alloy are different from those of constituent metals.

Ans :

Foreign 2017

Properties of alloys are different from those of constituent metals in respect of hardness, strongness, resistant to corrosion, which is increased while melting point, malleable and conductivity decreased.

125. Why is sodium kept immersed in kerosene oil ?

Ans :

OD 2019

Sodium reacts so vigorously with the oxygen of air that it catches fire if kept in the open. Sodium is kept immersed in kerosene oil to protect it from the action of air and moisture and to prevent accidental fires.

126. Give reason :

- Why do aluminium sheets not corrode easily.
- Why is copper vessel covered with a green

coating in rainy season.

Ans :

Foreign 2015

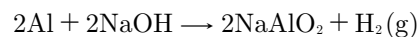
- Aluminium does not corrode easily because on exposure to air, its surface is coated with a thin layer of aluminium oxide which is protective and non-reactive.
- It is because copper reacts with moist carbon dioxide in the air and slowly loses its shiny brown surface and gains green coat.

127. Explain why sodium hydroxide solution cannot be kept in aluminium containers ? Write equation for the reaction that may take for the same.

Ans :

OD 2013

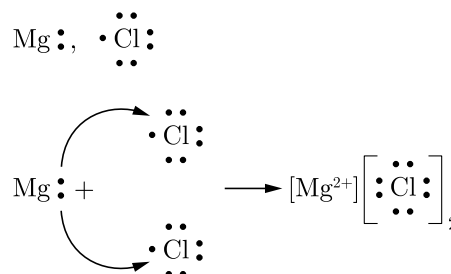
Aluminium is an amphoteric metal. It reacts with NaOH to form  $\text{NaAlO}_2$ . So, NaOH cannot be stored in an aluminium container.



128. What is electron dot structures of magnesium and chlorine and show the formation of magnesium chloride by the transfer of electrons.

Ans :

OD 2012



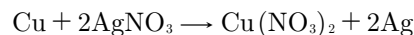
129. Give reasons for the following :

- We can store copper sulphate solution in silver vessel but not silver nitrate solution in a copper vessel.
- Food cans are coated with tin rather than zinc.

Ans :

Delhi 2015

- We can store copper sulphate solution in silver vessel, because silver is less reactive than copper. So, displacement reaction does not occur. But we cannot store silver nitrate in copper container because copper is more reactive than silver. So, it displaces silver from its salt.



- Tin is less reactive metal than zinc. So, it is not easily attacked by components of food items.

177. Discuss the physical properties of non-metals.

Ans :

SQP 2018

Physical properties of non-metals are following :

- (i) Non-metals are brittle : They break into pieces when hammered or stretched, i.e., they are not malleable.
- (ii) Non-metals are non-ductile: These cannot be drawn into wires.
- (iii) Non-metals are bad conductors of heat and electricity : Non-metals do not have free electrons. There is one exception graphite, which is a good conductor of heat and electricity.
- (iv) Non-metals are non-lustrous and cannot be polished : The exceptions are graphite and iodine which are lustrous.
- (v) Non-metals are generally soft : Except diamond (allotropic form of carbon) which is the hardest substance known, non-metals are soft.
- (vi) Non-metals generally have low melting and boiling points : Except graphite which has high melting point, non-metals have weak intra-molecular force.
- (vii) Non-metals have low densities : Most non-metals are light.

178. Discuss the exceptions in the properties of metals and non-metals.

Ans :

Delhi 2016

- (i) All metals except mercury exist as solids at room temperature. Metals have high melting points but gallium and caesium have very low melting points. These two metals will melt if they are kept on palm.
- (ii) Iodine is a non-metal but it is lustrous.
- (iii) Carbon is a non-metal that can exist in different forms. Each form is called an allotrope. Diamond, an allotrope of carbon, is the hardest natural substance known and has a very high melting and boiling points. Graphite, another allotrope of carbon, is a conductor of electricity.
- (iv) Alkali metals (lithium, sodium, potassium) are so soft that they can be cut with a knife. They have low densities and low melting points.

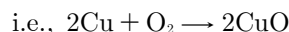
179. In what forms are metal found in nature ? With the help of examples explain how metals react with oxygen, water and dilute acids. Also write chemical equations for the reaction.

Ans :

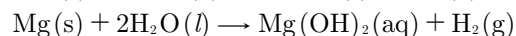
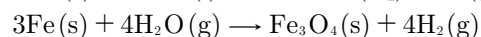
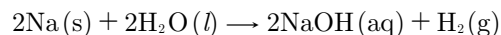
OD 2010

- (i) Metals are found in the form of both free and combined state.

- (ii) **Reaction of metal with oxygen** : All metals combine with oxygen and form metal oxides. For example, when copper is heated in air it combines with oxygen and forms copper oxide.



**Reaction of metals with water** : Metals like sodium react with cold water, magnesium reacts with hot water and iron react with steam.



**Reaction of metal with acids** : Metals react with acids and form salt and hydrogen gas.

For example, magnesium reacts with dilute hydrochloric acid and form magnesium chloride and hydrogen.



180. Give reason for the following:

- (i) Gold and platinum are used in jewellery.
- (ii) Copper cannot displace hydrogen from dilute acids.
- (iii) Stainless steel does not rust easily.
- (iv) Metals can be given different shapes according to our needs.
- (v) Zinc does not give hydrogen gas on reacting with  $\text{HNO}_3$ .

Ans :

SQP 2019

- (i) Gold and silver are shiny and tinreactive, so they are used in jewellery.
- (ii) Copper is lesser reactive than hydrogen, so it cannot displace hydrogen from acids.
- (iii) Stainless steel is an alloy. So, it does not rust easily.
- (iv) Metals are malleable and ductile, so it can take different shapes as we wish.
- (v) Since  $\text{HNO}_3$  is a strong oxidising agent and oxidises  $\text{H}_2$  to  $\text{H}_2\text{O}$  and it self get reduced to any of the oxide of nitrogen.

181. (a) Describe the steps associated with extraction of copper from its sulphide ore.
- (b) How impure copper is purified by electrolytic refining ?

or

- (a) How copper is obtained from its sulphide ore? Write balanced chemical equations.
- (b) Give the electrolytic refining of impure copper with diagram.



32. In nature, metal P is found in the form of its compounds and metal Q is found in the free state. Which of the two will be nearer to the top of the activity series of metals ?

Ans :

Comp 2014

Metal P.

33. An element A forms two oxides AO and AO<sub>2</sub>. The oxide AO is neutral whereas the oxide AO<sub>2</sub> is acidic in nature. Would you call element A a metal or a non-metal ?

Ans :

Comp 2010

Element A is a non-metal as. Only non-metals form neutral and acidic oxides.

34. Name the compounds formed by metals when they react with hydrogen.

Ans :

Foreign 2017

Hydrides.

35. If copper metal is heated over a flame, it develops a coating. What is the colour and composition of this coating ?

Ans :

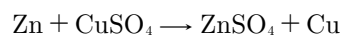
Foreign 2010

A black colour coat is developed on the copper metal due to formation of CuO or copper oxide.

36. Write the chemical equation for the reaction taking place when a piece of zinc is placed in a solution of copper(II) sulphate.

Ans :

Foreign 2008



37. If P, Q, R, S, T represent metals in the decreasing order of their reactivity, which one of them is most likely to occur in the free state in nature ?

Ans :

OD 2019

Metal T.

38. Which one of the metals in the following group are (a) most reactive, (b) least reactive ?

Au, Na, Cu, Ca.

Ans :

SQP 2007

(a) Sodium (Na) is the most reactive in the above group.

(b) Gold (Au) is the least reactive in the above group.

39. Name one metal which reacts with very dilute HNO<sub>3</sub> to evolve hydrogen gas.

Ans :

OD 2014

Magnesium (Mg)/Manganese (Mn) reacts with very

dilute HNO<sub>3</sub> to evolve H<sub>2</sub> gas.

40. Why does copper not evolve hydrogen on reacting with dilute sulphuric acid ?

Ans :

Delhi 2018

It happens so because copper is less reactive metal, it occupies a place below hydrogen in the reactivity series.

41. What are electrovalent compounds ?

Ans :

Delhi 2013

The compounds formed by the transfer of electrons from a metal to a non-metal are known as ionic compounds or electrovalent compounds.

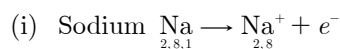
42. Show the ion formation in

(i) Sodium

(ii) Chlorine.

Ans :

OD 2011



43. What can you say about the solubility of electrovalent compounds?

Ans :

Delhi 2015

Electrovalent compounds are generally soluble in water and insoluble in solvents such as kerosene, petrol, etc.

44. Write electronic configuration of an element having atomic number 11.

Ans :

OD 2017

2, 8, 1.

45. Write electronic configuration of an element having atomic number 13.

Ans :

SQP 2010

2, 8, 3.

46. Ionic compounds are hard crystalline solids. Why ?

Ans :

OD 2019

Ionic compounds are very hard solids due to strong force of attraction between positive and negative ions.

47. Which metals are found in free state in nature ?

Ans :

Comp 2013

The metals at the bottom of the activity series are the least reactive. They are often found in a free state.

the strip becomes brownish. What is the reason for this ? Write the balanced chemical equation for the reaction.

Ans :

Foreign 2010

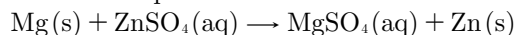
- (a) Metals are reactive atoms as they are highly electropositive. They readily react with other atoms during their formation in earth and become compounds.
- (b) Displacement reaction takes place as aluminium is more reactive than copper. The copper displaced will stick on the aluminium rod making it brownish.
- $$2\text{Al(s)} + 3\text{CuSO}_4\text{(aq)} \longrightarrow \text{Al}_2(\text{SO}_4)_3\text{(aq)} + 3\text{Cu(s)}$$

148. (a) Using a simple experiment, how can you prove that magnesium is placed above zinc in the reactivity series ?
- (b) Why copper metal cannot liberate hydrogen when reacting with dil. HCl ?

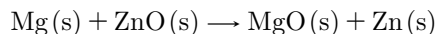
Ans :

SQP 2015

- (a) When a magnesium rod is dipped in  $\text{ZnSO}_4$  solution or magnesium powder heated with zinc oxide powder. Magnesium displaces the zinc from its compound.



or



This shows that magnesium is placed above zinc in the reactivity series.

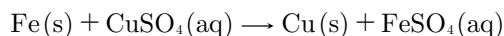
- (b) Copper is less reactive and thus it is placed below hydrogen in the reactivity series of metals. Hence, it does not react with dil. HCl.
149. (a) An element  $X$  on reacting with oxygen forms an oxide  $X_2O$ . The oxide dissolves in water and turns blue litmus red. Predict the nature of the element whether metal or non-metal.

- (b) A solution of copper sulphate was kept in an iron pot. After few days, the pot developed some holes in it. How will you account for this ?

Ans :

Delhi 2017

- (a) Element  $X$  is non-metal.
- (b) Iron lies above copper in the activity series. Therefore, a chemical reaction had taken place between iron pot and copper sulphate solution, i.e., iron displaces copper from copper sulphate solution.

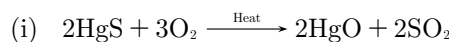


150. Write equations when

- (i) cinnabar is heated.
- (ii)  $\text{Cu}_2\text{S}$  is heated.

Ans :

SQP 2019



151. Which method can be used in place of reduction by carbon?

Ans :

Delhi 2011

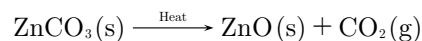
Besides using carbon (coke) to reduce metal oxides to metals, sometimes displacement reactions can also be used. The highly reactive metals such as sodium, calcium, aluminium, etc., are used as reducing agents because they can displace metals of lower reactivity from their compounds.

152. Describe the calcination of zinc ore.

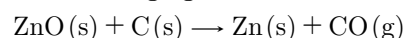
Ans :

Foreign 2013

The chemical reaction that takes place during calcination of zinc ores like  $\text{ZnCO}_3$  by heating strongly in limited supply of air which can be shown as follows :



Zinc oxide is then reduced to zinc metal by using suitable reducing agents such as carbon.

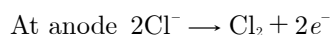


153. What happens when molten NaCl is electrolysed ?

Ans :

SQP 2018

Sodium metal is deposited at the cathode (the negatively charged electrode), whereas chlorine is liberated at the anode (the positively charged electrode). The reactions are :



154. Write the balanced chemical equation for the chemical reaction between manganese dioxide and aluminium powder. What happens if manganese powder is heated with aluminium oxide ?

Ans :

SQP 2015



No reaction takes place, because Mn is less reactive than Al and hence no displacement occurs.



90. How does a metal conduct heat ?

Ans :

OD 2017

Atoms of a metal gain energy when heated and vibrate more vigorously. This energy is transferred to the electrons which move through the metal. They in turn transfer their energy to other electrons and atoms, and thus heat is conducted.

91. What properties do you think of while categorizing elements as metals and non-metals.

Ans :

OD 2019

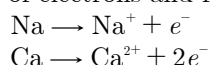
We consider various physical properties like lustre, sonority, malleability, ductility, etc. We also consider chemical properties like reaction with oxygen, water, etc.

92. Why metals are said to be electro-positive ?

Ans :

Delhi 2014

Metals are electro-positive because they ionise by loss of electrons and form positive ions.



93. Some metals do not get oxidised. Why ?

Ans :

Delhi 2011

The surface of metals like Mg, Al, Zn, Pb, etc. gets covered with a thin layer of oxide. This layer prevents the metal from further oxidation.

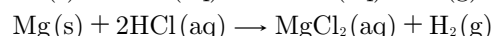
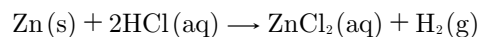
94. What happens when a metal reacts with dilute acid?

Ans :

Delhi 2016

Metal salt is formed and hydrogen gas is evolved.

Metal + dilute acid  $\longrightarrow$  Metal salt + Hydrogen e.g.,



95. Why do metals generally not form compounds with hydrogen ?

Ans :

OD 2009

This is because metals form compounds by the loss of electrons, which are accepted by the other element. But hydrogen usually forms compounds with other elements either by the loss of electrons or by sharing of electrons. It does not accept electrons.

96. Sodium or potassium pieces should not be thrown into a sink the laboratory. Why ?

Ans :

Foreign 2007

Both sodium and potassium pieces vigorously with air and water. The reaction is highly exothermic and the evolved gas may even catch fire.

97. Hydrogen is a non-metal, still it is given a place in the reactivity series. Why ?

Ans :

SQP 2018

The reactivity of metals depends on how easily they can lose electrons. Like metals, hydrogen also loses electrons and forms positive ions. Hence, it is placed in the reactivity series.

98. Aluminium occurs in combined state whereas gold is found in free state. Why ?

Ans :

OD 2010

Aluminium is more reactive metal, it reacts with air, water and acid while gold is least reactive metal, it does not react with air, water or acid.

99. Why do surfaces of aluminium vessels acquire a dull appearance when exposed to air ?

Ans :

Delhi 2013

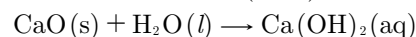
Surface of aluminium vessels becomes dull due to formation of layer of aluminium oxide ( $\text{Al}_2\text{O}_3$ ) when it is exposed to air.

100. A substance  $X$ , which is an oxide of a metal is used intensively in the cement industry. This element is present in bones also. On treatment with water it forms a solution which turns red litmus blue. Identify  $X$  and also write the chemical reactions involved.

Ans :

Foreign 2011

$X$  is calcium oxide ( $\text{CaO}$ ).



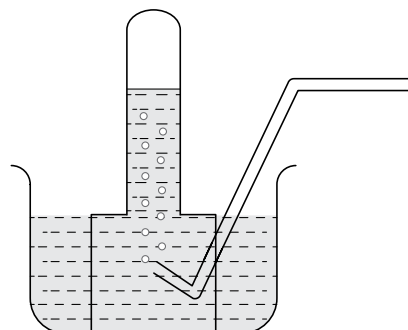
101. A metal is treated with dil  $\text{H}_2\text{SO}_4$ , the gas evolved is collected by the method shown in the figure. Answer the following :

(i) Name the gas.

(ii) Name the method of collection of the gas.

(iii) Is the gas soluble or insoluble in water ?

(iv) Is the gas lighter or heavier than air ?



(ii) **Conditions necessary for rusting :**

- (a) Presence of air (or oxygen).
- (b) Presence of moisture.

**164.** Describe ways to prevent rusting.

**Ans :**

Comp 2017

The rusting of iron can be prevented by the following methods :

- (a) by coating the metal surface with a thin layer of paint, varnish or grease.
- (b) by coating iron with a thin layer of another metal which is more reactive than iron, e.g., by galvanization. Galvanization is the process of covering iron with zinc.
- (c) It can also be prevented by the use of anti-rust solutions.

**165.** Give reasons for the following :

- (i) Shining surfaces of metals become dull on exposure to air and moisture.
- (ii) Aluminium is extracted from its ore by electrolysis of molten ore.
- (iii) Gold is available in the native state.

**Ans :**

OD 2010

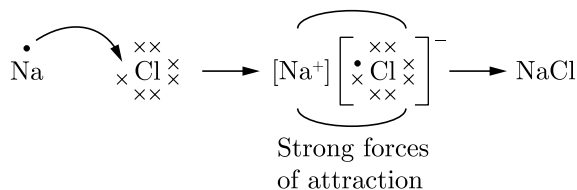
- (i) Metal surfaces corrode to form metal compounds.
- (ii) Aluminium is a very reactive metal so, it can be extracted only by electrolysis.
- (iii) Gold is a very unreactive element, so it is found in native state.

- 166.** (a) Show the formation of NaCl from sodium and chlorine atoms by the transfer of electron(s).  
 (b) Why has sodium chloride a high melting point?  
 (c) Name the anode and the cathode used in electrolytic refining of impure copper metal.

**Ans :**

OD 2016

(a)



- (b) Because of strong electrostatic forces of attraction between oppositely charged ions.
- (c) Anode is of impure copper while cathode is of pure copper.

**167.** What is meant by refining of metals? Describe the electrolytic refining of copper with a neat labelled diagram.

**Ans :**

Delhi 2011

In electrolytic refining process, the impure metal is made as anode and a thin strip of pure metal is made as cathode. A solution of the metal salt is made as an electrolyte (See Figure). On passing the current through the electrolyte, the pure metal from the anode dissolves into the electrolyte. An equivalent amount of pure metal from the electrolyte is deposited on the cathode. The soluble impurities go into the solution, whereas, the insoluble impurities settle down at the bottom of the anode and are known as anode mud.

At anode :  $\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-$

At cathode :  $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$

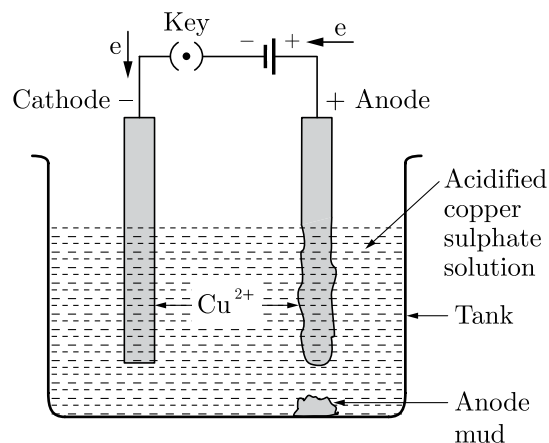


Figure: Electrolytic refining of copper.

- 168.** (a) Show the formation of  $\text{Na}_2\text{O}$  by the transfer of electrons between the combining atoms.  
 (b) Why are ionic compounds usually hard ?  
 (c) How is it that ionic compounds in the solid state do not conduct electricity and they do so when in molten state ?

**Ans :**

OD 2019

- (a) Sodium has one electron in the outermost shell and oxygen has six electrons in its outermost shell. To complete their octets, magnesium loses two electrons and oxygen accepts them. The formation of  $\text{MgO}$  is shown below :

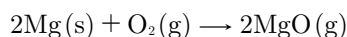
### THREE MARKS QUESTIONS

- 130.** What happens when magnesium ribbon is burnt in air? What is the state of the metal oxide in the product formed ?

**Ans :**

OD 2017

When magnesium ribbon is burnt in air, it produces dazzling light and a white coloured magnesium oxide is formed



- 131.** A metal  $X$  combines with a non-metal  $Y$  by the transfer of electrons to form a compound  $Z$ .

- State the type of bond in compound  $Z$ .
- What can you say about the melting and boiling point of compound  $Z$ .
- Will this compound dissolve in kerosene or petrol?
- Will this compound be a good conductor of electricity ?

**Ans :**

OD 2010

- Ionic bond in compound  $Z$ .
- It has high melting and boiling point due to stronger inter-ionic attraction.
- No, as electrovalent compounds are soluble in water but insoluble in kerosene or petrol.
- No, as its solution in water contains ions but in solid state do not conduct electricity as movement of ions is not possible due to its rigid structure.

- 132.** What prevents the metals such as magnesium, aluminium, zinc and lead from oxidation at ordinary temperature ?

**Ans :**

SQP 2013

At ordinary temperature, the surface of metals such as magnesium, aluminium, zinc and lead, etc., are covered with a thin layer of oxide. The protective oxide layer prevents the metals from further oxidation.

- 133.** What is meant by galvanisation ? Why is it done ?

**Ans :**

OD 2011

The process of depositing a thin layer of zinc metal on iron objects is called galvanisation. Galvanisation is done to protect the iron objects from rusting. This is because zinc metal does not corrode on exposure to damp air (due to the presence of a thin zinc oxide layer on its surface).

- 134.** A metal ' $M$ ' on reacting with dilute acid liberates a gas ' $G$ '. The same metal also liberates gas ' $G$ ' when reacts with a base.

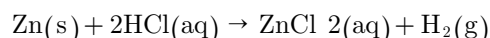
- Write the name of gas ' $G$ '.
- How will you test the presence of this gas?
- Write chemical equations for the reactions of the metal with (1) an acid and (2) a base.

**Ans :**

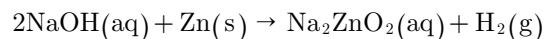
OD 2023

- Hydrogen gas
- On bringing a burning match stick near the mouth of the test tube, again a pop sound occurs.
- Chemical equations

**Reaction with acid :**



**Reaction with base :**



- 135.** A shining metal  $M$ , of burning gives a dazzling white flame and changes to a white powder  $N$ .

- Identify  $M$  and  $N$ .
- Represent the above reaction in the form of a balanced chemical equation.
- Does  $M$  undergo oxidation or reduction in this reaction ? Justify.

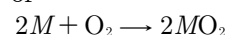
**Ans :**

Comp 2020

- $M$  – Magnesium  
 $N$  – Magnesium oxide.
- $2\text{Mg(s)} + \text{O}_2(\text{g}) \longrightarrow 2\text{MgO(s)}$   

magnesium
oxygen
magnesium oxide

or



- $M$  metal will undergo oxidation reaction as oxygen is added to metal  $M$  and  $MO_2$  (metal oxide) is formed.

When a piece of shining metal  $M$  is burnt in air, a white powder of metal oxide is formed. Shining metal is magnesium ribbon which burns with a dazzling white flame and white powder is formed which is magnesium oxide.

- 136.** Compare in tabular form the reactivities of the following metals with cold and hot water :

- Sodium
- Calcium
- Magnesium

- (b) At ordinary temperature the surface of metals such as magnesium, aluminium, zinc etc., is covered with a thin layer. What is the composition of this layer? State its importance.
- (c) Some alkali metals can be cut with a knife.

Ans :

OD 2016

- (a) Solution of metal oxides in water is called alkali (soluble base), e.g., sodium hydroxide (NaOH), potassium hydroxide (KOH).
- (b) This layer is oxide layer. It makes the metal less reactive (passive) and makes it more useful because it cannot get corroded and remains as it is.
- (c) It is because these metals are very soft, e.g., sodium metal can be cut with knife.

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174. What kind of impurities are generally found in ores? What name is given to such impurities and state the basis of removing the impurities from the ore?

Ans :

Foreign 2013

Ores mixed from the earth are usually contaminated with large amounts of impurities such as soil, sand etc. These impurities are called gangue. The processes used for removing the gangue from the ore are based on the differences between the physical or chemical properties of the gangue and the ore.

175. (a) A non-metal  $X$  exists in two different forms  $Y$  and  $Z$ .  $Y$  is the hardest natural substance whereas  $Z$  is a good conductor of electricity. Identify  $X$ ,  $Y$ ,  $Z$ .
- (b) An element  $X$  on reaction with oxygen forms an oxide  $XO_2$ . The oxide when dissolved in water turns blue litmus red. State whether element  $X$  is a metal or non-metal.
- (c) Name the metal which is alloyed with copper to make bronze.

Ans :

OD 2011

- (a)  $X$  is carbon.  
 $Y$  and  $Z$  are allotropes of carbon.  
 $Y$  (hardest natural substance)—Diamond.  
 $Z$  (Good conductor of electricity)—Graphite.
- (b)  $X$  is non-metal.  
 $X + O_2 \rightarrow XO_2$   
 e.g.,  $C + O_2 \rightarrow CO_2$   
 It turns blue litmus red.
- (c) Tin.

## FIVE MARKS QUESTIONS

176. On the basis of reactivity metals are grouped into three categories:

- Mls of low reactivity
- Metal of medium reactivity
- Metals of high reactivity

Therefore metals are extracted in pure form from their ores on the basis of their chemical properties.

Metals of high reactivity are extracted from their ores by electrolysis of the molten ore.

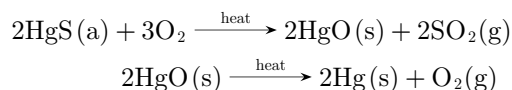
Metals of low reactivity are extracted from their sulphide ores, which are converted into their oxides. The oxides of these metals are reduced to metals by simple heating.

- (a) Name the process of reduction used for a metal that gives vigorous reaction with air and water both
- (b) Carbon cannot be used as a reducing agent to obtain aluminium from its oxide? Why?
- (c) Describe briefly the method to obtain mercury from cinnabar. Write the chemical equation for the reactions involved in the process.
- (d) Differentiate between roasting and calcination giving chemical equation for each.

Ans :

OD 2023

- (a) Electrolytic reduction  
 The metal is likely to be Sodium (Na). It has very much affinity to oxygen. So, reducing agents like carbon and aluminum can't be used.
- (b) Because aluminium has greater affinity for oxygen than for carbon, therefore carbon cannot reduce alumina ( $Al_2O_3$ ) to aluminium.
- (c) Cinnabar (HgS-mercury (II) sulphide or mercury sulphide) is an ore of mercury. It is heated in air to give mercuric oxide (HgO). Mercuric oxide is further heated to get mercury. The reactions involved are,



- (d) Calcination is defined as the process of converting ore into an oxide by heating it strongly. The ore is heated below its melting point either in absence of air or in limited supply.  
 e.g.,  $ZnCO_3 \rightarrow ZnO + CO_2$   
 Roasting is a process of metallurgy where ore is converted into its oxide by heating it below its melting point in the presence of excess air.  
 An example of roasting is when Zinc sulphide is converted into zinc oxide.  
 $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

- 141.** Write an experiment to show that copper does not react with dilute HCl.

**Ans :**

OD 2019

Take small pieces of magnesium, zinc, aluminium, iron and copper. Clean their surfaces by rubbing with a sand paper. Place these metals in separate test tubes. Add about 10 mL dilute hydrochloric acid to each of these test tubes. Observe Carefully the rate of formation of bubbles.

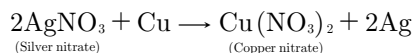
We will find that the rate of formation of bubbles was the fastest in the case of magnesium. It decreases in the order  $Mg > Al > Zn > Fe$ . In the case of copper, no bubbles were evolved. This shows that copper does not react with dilute HCl and  $H_2SO_4$ .

- 142.** A copper plate was dipped into a solution of  $AgNO_3$ . After some time, a black layer was deposited on the copper plate. State the reason for it. Write the chemical equation of the reaction involved.

**Ans :**

Delhi 2012

A black layer was deposited on the copper plate because copper being more reactive than silver, displaces silver from silver nitrate and forms copper nitrate.

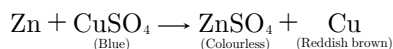


- 143.** (a) Arrange the metals Zn, Mg, Al, Cu and Fe in decreasing order of reactivity.  
 (b) What would you observe when you put  
 (i) Some zinc pieces into blue copper sulphate solution ?  
 (ii) Some copper pieces into green ferrous sulphate solution.  
 (c) Name a metal which combines with hydrogen gas. Name the compound formed.

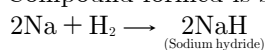
**Ans :**

OD 2011

- (a) Decreasing order of reactivity  
 $Mg > Al > Zn > Fe > Cu$ .  
 (b) (i) Zinc being more reactive than copper, will displace copper from copper sulphate. The blue colour of the copper sulphate solution will fade and a colourless solution will be obtained. Reddish brown particles of copper will settle at the bottom of the container.



- (ii) No change in the colour of the solution as copper is less reactive than iron metal.  
 (c) Sodium can be combined with hydrogen gas. Compound formed is sodium hydride.



- 144.** (i) Which metals can displace hydrogen ?  
 (ii) Which metals cannot displace hydrogen ?

**Ans :**

Delhi 2014

- (i) Metals placed above hydrogen in the reactivity series are more reactive than hydrogen and can displace hydrogen from its compounds like acids.  
 e.g., Sodium, calcium, etc.  
 (ii) Metals placed below hydrogen in the reactivity series are less reactive than hydrogen and cannot displace hydrogen from its compounds like acids.  
 e.g., Silver, gold, etc.

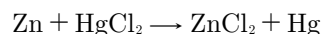
- 145.** State the reason for the following behaviour of zinc metal :

On placing a piece of zinc metal in a solution of mercuric chloride, it acquires a shining silvery surface, but when it is placed in a solution of magnesium sulphate, no change is observed.

**Ans :**

Foreign 2016

On placing a piece of zinc metal in a solution of mercuric chloride, it acquires a shining silvery surface because zinc being more reactive than mercury, displaces mercury from mercuric chloride and forms zinc chloride.



When zinc is placed in magnesium sulphate solution, no reaction takes place because zinc is less reactive than magnesium and hence it cannot displace magnesium from magnesium sulphate.

- 146.** How does the activity series of metals help us in predicting the relative reactivity of metals ?

**Ans :**

OD 2017

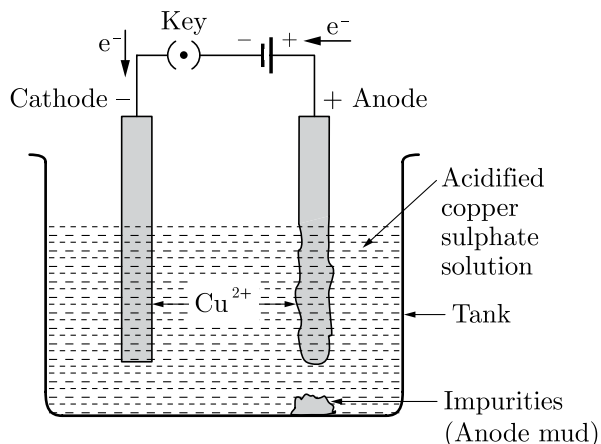
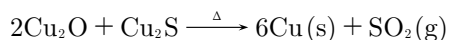
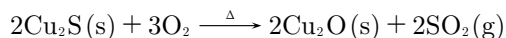
- (i) In the reactivity series, the most reactive metal is placed at the top. It does not occur in free state and is more electro-positive.  
 (ii) The least reactive metal is placed at the bottom. It generally occurs in free state and is less electro-positive.  
 (iii) A metal displaces any of the metals below it in the reactivity series from their solutions.  
 (iv) Metals above hydrogen in the reactivity series displace hydrogen from acids.

- 147.** (a) Why metals are not found in their free state generally ?  
 (b) If a strip of aluminium with scratched clean surface is dipped into an aqueous solution of copper sulphate for little time, the surface of

Ans :

Foreign 2011

- (a) Copper is obtained from its sulphide ore  $\text{Cu}_2\text{S}$  by heating in air strongly.



- 182.** A metal  $E$  is stored under kerosene. When a small piece of it is left open in the air, it catches fire. When the product formed is dissolved in water it turns red litmus to blue.

- Name the metal  $E$ .
- Write the chemical equation for the reaction when it is exposed to air and when the product is dissolved in water.
- Explain the process by which the metal is obtained from its molten chloride.

Ans :

Comp 2017

- Metal  $E$  is sodium.
- $$4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$$

$$4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$$
- Electrolysis of molten metal chloride ( $\text{NaCl}$ ) gives pure metal ( $\text{Na}$ ). In this process,  $\text{Na}$  is deposited at cathode.
 
$$\text{Na}^+ + e^- \rightarrow \text{Na}$$

$$\text{Cl}_2 \text{ is liberated at anode.}$$

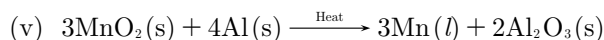
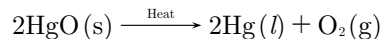
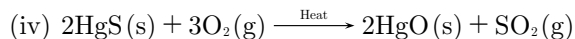
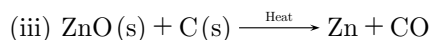
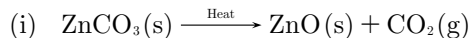
$$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^-$$

- 183.** Write balanced chemical equation for the reactions taking place when :

- Zinc carbonate is calcinated.
- Zinc sulphide is roasted.
- Zinc oxide is reduced to zinc.
- Cinnabar is heated in the air.
- Manganese dioxide is heated with aluminium powder.

Ans :

OD 2013



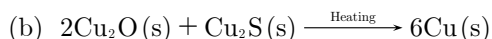
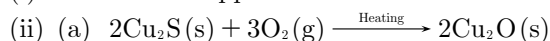
- 184.** A metal  $M$  found in nature as sulphide ore ( $\text{M}_2\text{S}$ ) is one of the good conductor of heat and electricity and used in making electric wires :

- Identify the metal  $M$ .
- Write the balanced chemical equations involved in the process of extraction of the metal.
- Draw a labelled diagram of electrolytic refining of the metal.

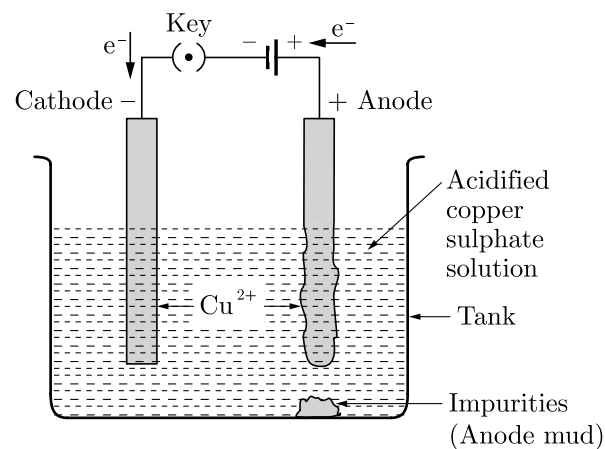
Ans :

Delhi 2010

- (i) Metal  $M$  is copper.



- (iii)



- 185.** Write the names and symbols of two most reactive metals. Explain by drawing electronic structure how any one of the two metals react with a halogen. State any two physical properties of the compound formed.



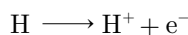
- (iii) What is native of Halide ore ?  
 (iv) Which is the most abundant metal on the earth's crust ?

Ans :

- (i) Ag  
 (ii) Galena  
 (iii) Horn silver  
 (iv) Aluminium

**198.** The arrangement of metals in a vertical column in the decreasing order of their re-activities is called the reactivity series or activity series of metals. The most reactive metal is at the top position of the reactivity series. The least reactive metal is at the bottom of the reactivity series.

Hydrogen, though a non-metal, has been included in the activity series of metals only for comparison. Apart from it, the hydrogen atom also has tendency to lose its valence electron and form cation like the behaviour shown by metals. Thus,




- (i) Which metal can be displaced by copper from its salt solution ?  
 (ii) An element 'X' after reacting with acids liberate hydrogen gas and can displace lead and tin from their salt solution. Write down the Name of X metal.  
 (iii) Write down the name of most reactive metal  
 (iv) Which metal does not liberate hydrogen gas after reacting with acid ?

Ans :

- (i) Copper can displace  $\text{AgNO}_3$  because Copper is more reactive than silver.  
 (ii) Nickel  
 (iii) Potassium  
 (iv) Gold

**199.** Activity series : Relative reactivities of metals

Potassium		Most reactive
Sodium		
Calcium		
Magnesium		
Aluminium		
Zinc		Reactivity decreases
Iron		
Lead		
Hydrogen		
Copper		
Mercury		
Silver		
Gold		Least reactive

- (i) What happens when iron nail is added to copper sulphate solution? What is the colour change ?  
 (ii) Identify the metal which reacts with very dilute nitric acid to evolve hydrogen gas. Name one more metal not given in the above series which reacts in the same way with dilute nitric acid.  
 (iii) Name one important ore of copper with its chemical formula.  
 (iv) Which method is used to extract sodium from molten sodium chloride ?  
 (v) Which metal is used in the galvanization of iron?

Ans :

- (i) The colour changes from blue to green.  
 (ii) Magnesium and manganese.  
 (iii) Copper glance,  $\text{Cu}_2\text{S}$ .  
 (iv) Electrolytic reduction is used for the extraction of sodium.  
 (v) Zinc.

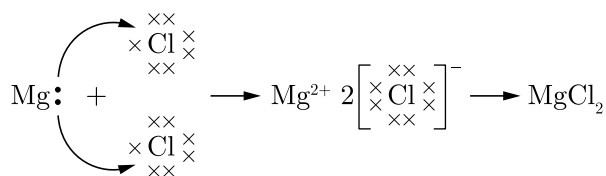
**200.** Electronic configuration of some of the elements are given:

Type of element	Element	Atomic number	Number of electrons in shell
Metals	Sodium (Na)	11	2 8 1
	Magnesium (Mg)	12	2 8 2
	Aluminium (Al)	13	2 8 3
Non-metals	Oxygen (O)	8	2 6
	Sulphur (S)	16	2 8 6
	Chlorine (Cl)	17	2 8 7

- (i) State one physical property to distinguish between metals and non-metals.  
 (ii) What is the nature of the bond formed when magnesium reacts with chlorine? Write the formula of the compound.  
 (iii) What is common between oxygen and sulphur ?  
 (iv) Draw the electron dot structure of  $\text{O}_2$  molecule.  
 (v) Name the important ore of aluminium.

Ans :

- (i) Metals are malleable and ductile while non-metals are brittle.  
 (ii) Ionic bond formed transfer of electrons from magnesium to chloride.



189. (a) Define corrosion.  
 (b) What is corrosion of iron called ?  
 (c) How will you recognise the corrosion of silver ?  
 (d) Why corrosion of iron is a serious problem ?  
 (e) How can we prevent corrosion of iron ?

Ans :

OD 2016

- (a) It is a process in which a metal reacts with substances present in air to form surface compounds.  
 (b) Rusting.  
 (c) Black layer on its surface due to formation of  $\text{Ag}_2\text{S}$ .  
 (d) It makes the metal weak and brittle, which is serious problem.  
 (e) Oiling, painting, greasing, galvanisation, alloying can prevent iron from corrosion.

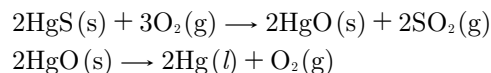
190. Explain the following :

- (i) Metals at the top of the reactivity series do not occur in the free state in nature.  
 (ii) Finely powdered ore is mixed with a suitable oil and water in the concentration of a sulphide ore.  
 (iii) Sulphide ores need to be roasted after concentration.  
 (iv) Mercury can be obtained just by roasting the ore.  
 (v) Highly reactive metals are obtained by electrolytic reduction of their compounds.

Ans :

Delhi 2012

- (i) Metals at the top of the reactivity series are very reactive metals. They react with air, water and carbon dioxide to form their oxides, hydroxides and carbonates. Hence, they do not occur in the free state in nature.  
 (ii) The sulphide ore is wetted by pine oil and not by water. When finely powdered ore mixed with the oil is agitated with water, the foam of the pine oil picks up the ore particles which are thus separated from the impurities.  
 (iii) It is very difficult to extract a metal from its sulphide ore. On roasting, the sulphide ore is transformed into the oxide of the metal. This oxide can easily be reduced to the metal by heating it with coke or carbon monoxide.  
 (iv) Mercury is very low in the reactivity series. Hence, it is very inactive. When cinnabar ( $\text{HgS}$ ), an ore of mercury, is heated in air, it is first converted into mercuric oxide ( $\text{HgO}$ ) which is then reduced to mercury.



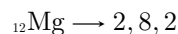
- (v) Highly reactive metals cannot be obtained from their compounds by heating with carbon. This is because these metals have a greater affinity for oxygen than carbon. However, in electrolytic reduction, a large amount of energy produced breaks up the bonds in the metal oxides.

191. (a) What is an ionic bond ?  
 (b) How is an ionic bond formed ?  
 (c) Write the formation of magnesium chloride.

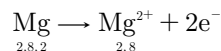
Ans :

Comp 2017

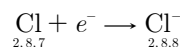
- (a) The chemical bond formed by the transfer of electrons from one atom to another is known as an ionic bond.  
 (b) An ionic bond is formed when one of the atoms can donate electrons to achieve the inert gas electronic configuration and other atom needs electrons to achieve the inert gas electronic configuration.  
 When a metal (usually 1, 2 or 3 electrons in outermost shell) reacts with a non-metal (usually 5, 6 or 7 electron in outermost shell), transfer of electrons takes place from metal atoms to the non-metal atoms and an ionic bond is formed. There is a strong force of electrostatic attraction between metallic cation and non-metallic anion which is responsible for the formation of ionic bond.  
 (c) Formation of magnesium chloride ( $\text{MgCl}_2$ ) :  
 The atomic number of magnesium is 12. It has two electrons in its valence shell as shown below :



Magnesium, therefore, has a tendency to lose the 2 valence electrons and in the process attains the electronic configuration of neon.



Chlorine (atomic number 17) has 7 electrons in the valence shell. It has a tendency to gain one electron to complete its octet.

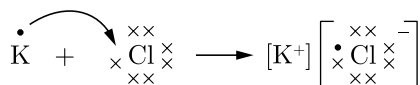
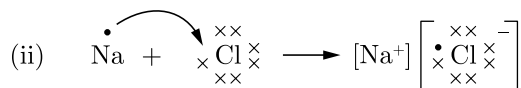


Thus, when magnesium and chlorine are brought together, the magnesium atom transfers its two valence electrons to two chlorine atoms. In the process, both the atoms acquire the stable electronic configuration of nearest inert gases. The positively charged magnesium ion  $\text{Mg}^{2+}$  and negatively charged chloride ions ( $\text{Cl}^{-}$ ) are now held together by the electronic force of

Ans :

SQP 2014

- (i) Two most reactive metals are sodium (Na) and potassium (K).



- (iii) Properties of the compound NaCl or KCl :
- It has high melting and boiling point.
  - It conducts electricity in molten/solution soluble in water.

186. (i) Design an activity to show the conditions needed for iron nails to rust.  
(ii) Why do we apply paint on iron articles ?

Ans :

OD 2011

- (i) Take three test tubes and place clean iron nails in each of them. Label these test tubes A, B and C. Pour some water in test tube A and cork it. Pour boiled distilled water in test tube B. Then pour about 1 mL oil and cork it. The oil will float on water and prevent the air from entering. Put some anhydrous calcium chloride in test tube C and cork it. Anhydrous calcium chloride will absorb the moisture, if any, from the air. Leave these test tubes for a few days and then observe.

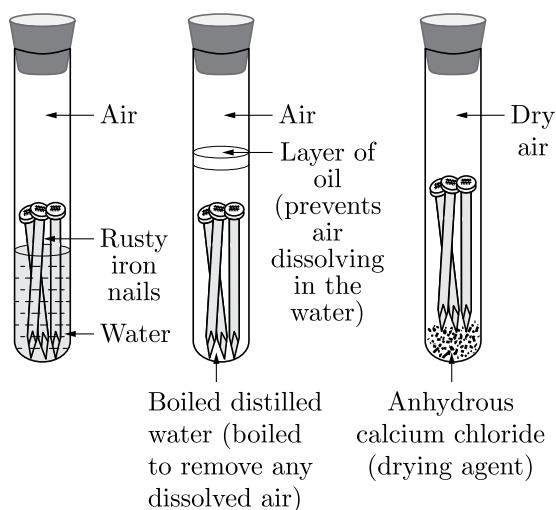


Figure: Investigating the conditions under which iron rusts. In tube A, both air and water are present. The nails become rusty. In tube B, there

is no air in the water. The nails do not rust. In tube C, the air is dry and the nails do not rust.

We will observe that the nails rust in test tube A, but they do not rust in test tubes B and C. In test tube A, the nails are exposed to both air and water. In test tube B, the nails are exposed to only water, whereas in test tube C, the nails are exposed to only dry air. This shows that both air and water are necessary for iron to rust.

- (ii) Rusting of iron can be prevented by painting the surface of iron object as a result oxygen and moisture of the atmosphere do not come in direct contact with the surface of iron.

187. (a) All ores are minerals but all minerals are not ores. Justify the statement.  
(b) What is galvanisation ?  
(c) Explain roasting with the help of a reaction.  
(d) What do you mean by amalgam ?

Ans :

Comp 2016

- (a) Ore is the mineral from which a metal can be profitably or economically extracted. From each mineral metals cannot be extracted-profitably so all minerals are not ores.  
(b) Galvanisation is a process of coating a thin layer of zinc over iron sheets.  
(c) Roasting is the process of heating sulphide ore at high temperature in excess of oxygen.

Example :



- (d) If one of the metals is mercury, then the alloy is known as amalgam.

188. What are alloys ? How are they made ? Name the constituents and uses of brass, bronze and solder.

Ans :

OD 2019

Homogeneous mixture of two or more metals or a metal and a non-metal is known as an alloy.

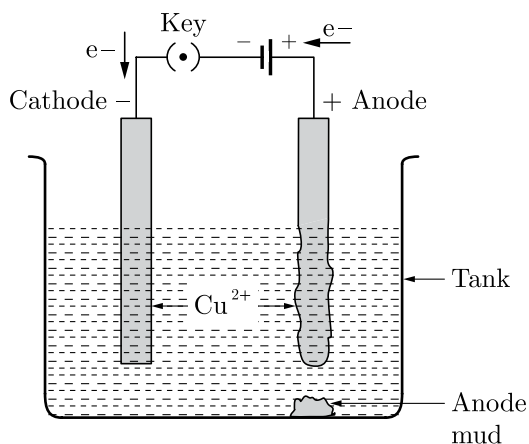
An alloy is prepared by :

- melting the primary metal.
- dissolving the other elements in a definite proportion and cooled to room temperature.

Alloy	Constituent	Uses
Brass	Cu and Zn	in making utensils
Bronze	Cu and Sn	marking statue/medal
Solder	Pb and Sn	in soldering

**195.** Refining is the process of purification of metals. One of the important method of refining is electrolysis. In electrolysis, electrical energy is used to bring about a non-spontaneous redox reaction. This is done by passing an electric current through a liquid containing ions, known as an electrolyte. In contrast to metals, the current in electrolytes is carried by the movement of ions rather than the movement of electrons. The solid conductors inserted into the liquid are called electrodes, the one with a positive charge is called the anode (because it attracts anions) and the one with the negative charge is called the cathode.

A diagrammatic representation of electrolysis of copper is shown below :



(i) Name the electrolyte used in refining of copper.

(ii) a.  $\text{Cu} \longrightarrow \text{Cu}^{2+} + 2\text{e}^-$

b.  $\text{Cu}^{2+} + 2\text{e}^- \longrightarrow \text{Cu}$

Which of these two reactions occur at cathode and anode?

(iii) What is anode mud?

(iv) Name two metals which can be refined by electrolytic method.

**Ans :**

(i) Acidified copper sulphate

(ii) (a) Reaction a. occurs at anode.

(b) Reaction b. occurs at cathode.

(iii) The impurities which settle at the bottom of anode as a result of electrolysis is called anode mud.

(iv) Nickel and Zinc

**196.** The reactivity series is a list of metals arranged in the order of their decreasing activities. The metal at the top of the reactivity series is the most reactive and metal at the bottom is the least reactive. The more reactive metal displaces less reactive metal from its salt solution.

K	Potassium	More reactive
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	Reactivity decreases.
Fe	Iron	
Pb	Lead	
[H]	[Hydrogen]	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	Least reactive

(i) Name the metals which react with steam but not with hot water.

(ii) What happen when calcium react with nitric acid?

(iii) Which method is used to extract metal present at the top of the reactivity series?

(iv) Which of the following metals exist in their native states in nature?

I. Cu

II. Au

III. Zn

IV. Ag

**Ans :**

(i) Aluminium, iron and zinc

(ii) Calcium reacts with nitric acid to form calcium nitrate, dinitrogen monoxide and water.

(iii) Electrolytic reduction

(iv) II and IV

**197.** Metals occur in nature in the free as well as in the combined state. The less reactive metals are generally found in the free state. Most of the metals, however are found in the combined form as minerals. The minerals from which metals can be obtained on a commercial scale are called ores. In other words, the minerals from which metals can be extracted profitably are called ores. Thus, bauxite ( $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ) and clay ( $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ ) are minerals of aluminium. However, it is bauxite that is chiefly used to obtain aluminium commercially. So, bauxite, and not clay, is an ore of aluminium.

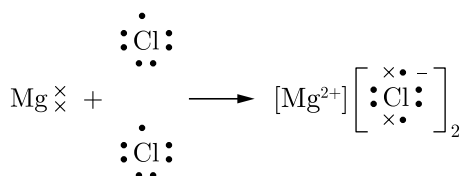
(i) Which metal occurs in native state ?

(ii) Write the name of the sulphide ore ?

attraction and form ionic bond.



This process can also be shown as below :



## CASE BASED QUESTIONS

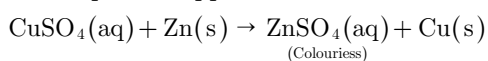
**192.** The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining.

- What is the cathode and anode made of in the refining of copper by this process?
- Name the solution used in the above process and write its formula.
- How copper gets refined when electric current is passed in the electrolytic cell?
- You have two beakers 'A' and 'B' containing copper sulphate solution. What would you observe after about 2 hours if you dip a strip of zinc in beaker 'A' and a strip of silver in beaker 'B'? Give reason for your observations in each case.

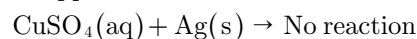
**Ans :**

OD 2024

- In the refining of copper anode is made of impure copper whereas, cathode is made of the thin strip of pure copper.
- The solution used is acidified copper sulphate having chemical formula  $\text{CuSO}_4$ .
- When electric current is passed through the electrolyte, copper sulphate solution, the pure metal from the anode dissolves into the solution. An equivalent amount of pure metal from the electrolyte is deposited on the cathode. The soluble impurities go into the solution and the insoluble impurities settle down at the bottom of the anode as anode mud.
- When the zinc strip is dipped in copper sulphate solution (beaker 'A') the blue colour of solution becomes colourless because zinc being more reactive displaces copper from its salt solution.



When silver strip is dipped in copper sulphate solution (beaker 'B') no reaction takes place as silver is less reactive than copper.



**193.** Study the following table :

Metal	Iron (II) Sulphate	Copper (II) Sulphate	Zinc Sulphate	Silver Nitrate
A	No reaction	Displacement	---	---
B	Displacement	---	No reaction	---
C	No reaction	No reaction	No reaction	Displacement
D	No reaction	No reaction	No reaction	No reaction

- Name the most active metal.
- Name the least reactive metal.
- Arrange the metals A, B, C and D in order of increasing reactivity.
- Container of which metal can be used to store both zinc sulphate solution and silver nitrate solution?

**Ans :**

- B is most reactive metal. B can displace iron whereas no other metal can do.
- D is least reactive metal.
- $D < C < A < B$
- Container of D can be used to store both zinc sulphate solution and silver nitrate solution.

**194.** A metal M reacts vigorously with water to form a solution S and a gas G. The solution S turns red litmus to blue whereas gas G, which is lighter than air, burns with a pop sound. Metal M has a low melting point and is used as a coolant in nuclear reactors.

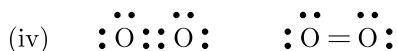
- What is metal M ?
- What is solution S ?
- What is gas G ?

**Ans :**

- The metal M is sodium.
- The solution S is NaOH (sodium hydroxide).
- The gas G which burns with a pop sound is hydrogen.

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- (iii) Both have same number of valence electron.  
Both belongs to the same group (Group 16) of the periodic table.



- (v) Bauxite:  $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ .

**201.** The earth's crust is the major source of metals-seawater contains some soluble salts such as sodium chloride, magnesium chloride, etc. The elements or compounds, which occur naturally in the earth's crust are known as minerals. At some places, minerals contain a very high percentage of a particular metal and the metal can be profitably extracted from it. These minerals are called ores.

- Name the chief ore of mercury and zinc.
- Write equations for the extraction of copper from its sulphide ore.
- Define the process used to convert carbonate ores into metal oxide.
- Name two metals which exists in their native state.

**Ans :**

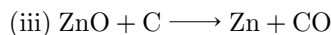
- Mercury  $\rightarrow$  Cinnabar,  $\text{HgS}$   
Zinc  $\rightarrow$  zinc blende,  $\text{ZnS}$ .
- $2\text{Cu}_2\text{O}(\text{s}) + \text{Cu}_2\text{S}(\text{s}) \xrightarrow{\text{Heat}} 6\text{Cu}(\text{s}) + \text{SO}_2(\text{g})$
- The process is called calcination. It is defined as heating the carbonate ore strongly in the limited supply of air to form metal oxide.
- Silver and gold.

**202.** The metals high up in the reactivity series are very reactive. They cannot be obtained from their compounds by heating with carbon. There metals are obtained by electrolytic reduction.

- Why can't we reduce oxide of sodium by using carbon ?
- Write the steps involved in the extraction of sodium from molten sodium chloride.
- Write one reaction where carbon is used as a reducing agent.
- Why we use molten sodium chloride and not aqueous sodium chloride for the extraction of sodium.

**Ans :**

- Carbon cannot reduce sodium oxide to sodium because sodium has more affinity for oxygen than carbon.
- At Cathode:  $\text{Na}^+ + \text{e}^- \longrightarrow \text{Na}$  (reduction)  
At Anode:  $2\text{Cl}^- \longrightarrow \text{Cl}_2 + 2\text{e}^-$  (oxidation)



- (iv) Electrolysis of aqueous sodium chloride liberates  $\text{H}_2$  gas at cathode and not sodium because hydrogen is low than sodium in the reactivity series.

**203.** Besides using carbon to reduce metal oxides to metals, sometimes displacement reactions can also be used. The highly reactive metals oxide as sodium, calcium, aluminium, etc., are used as reducing agents.

- What happens when manganese dioxide is heated with aluminium powder ?
- Identify the substances that are getting oxidized and reduced in the above reaction.
- Complete the following equation:  
 $\text{Fe}_2\text{O}_3(\text{s}) + 2\text{Al}(\text{s}) \longrightarrow$
- What is this reactions of  $\text{Fe}_2\text{O}_3$  with Al known as?

**Ans :**

- $3\text{MnO}_2(\text{s}) + 4\text{Al}(\text{s}) \longrightarrow 3\text{Mn}(\text{l}) + 2\text{Al}_2\text{O}_3(\text{s}) + \text{Heat}$
- Substance oxidized = Al  
Substance reduced =  $\text{MnO}_2$
- $\text{Fe}_2\text{O}_3(\text{s}) + 2\text{Al}(\text{s}) \longrightarrow 2\text{Fe}(\text{l}) + \text{Al}_2\text{O}_3(\text{s}) + \text{Heat}$
- The reaction is known as thermite reaction.

**204.** Alloying is a very good method of improving the properties of metal. Galvanization is a method of protecting steel and iron from rusting.

- What is the chemical formula and chemical name of rust ?
- Define galvanization.
- Define alloy.
- Name two important alloys containing copper.

**Ans :**

- Chemical formula:  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$   
Chemical name : Hydrated formic acid.
- Galvanization is a method of protecting steel or iron from rusting by coating them with a thin layer of zinc.
- An alloy is a homogeneous mixture of two or more metals, or a metal or a non-metal.
- Two alloys containing copper are:  
Bronze ( $\text{Cu} + \text{Sn}$ )  
Brass ( $\text{Cu} + \text{Zn}$ )



**205.** According to octet rule, an atom with 8 electrons in its outermost shell is stable. The noble gases have complete outer electron shells and this makes them very stable. These gases are least reactive as they have stable electronic configuration. Now, the other elements would also seek stability and hence either transfer the electrons, or gain the electrons, or share the electrons. This rule is very important to understand the chemical bonding. The atoms of elements combine to have 8 electrons in their valence shell in order to attain stable electronic configuration like their nearest noble gases. This rule was proposed by G.N. Lewis and is also known as the Rule of Eight.

- (i) What is the number of valence electron in neon gas?
- (ii) How many electrons present in helium ?

**Ans :**

- (i) 0
- (ii) 2

**206.** Sample of four metals P, Q, R and S were taken and added to the following solution one by one. The results obtained have been tabulated as follows.

Metal	$\text{FeSO}_4$	$\text{CuSO}_4$	$\text{ZnSO}_4$	$\text{AgNO}_3$
P	No reaction	Displacement	.....	.....
Q	Displacement		No reaction	Displacement
R	No reaction	No reaction	No reaction	
S	No reaction	No reaction	No reaction	No reaction

- (i) Which is the most reactive metal ?
- (ii) What would you observe if Q is added to a solution of  $\text{CuSO}_4$ . Also, what is the colour change when Q is added to  $\text{FeSO}_4$ .

**Ans :**

- (i) Metal Q is the most reactive metal.
- (ii) Metal Q will displace copper from  $\text{CuSO}_4$  solution and brown colour copper is deposited. The green colour of  $\text{FeSO}_4$  solution fades away.

# CHAPTER 4

## Carbon and Its Compounds

### 1. INTRODUCTION

Carbon is a very important element in elemental and combined forms. There are a large number of carbon compounds. In organic chemistry, we study structure, composition, properties and synthesis of carbon compounds.

### 2. ALLOTROPES OF CARBON

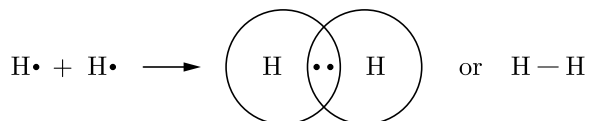
Allotropy is the property of an element which exists in two or more different forms (allotropes). Allotropes have same chemical properties but different physical properties. The important allotropes of carbon are diamond, graphite and fullerenes (Buckminster fullerenes).

Buckminsterfullerene ( $C_{60}$ ) is a football-shaped spherical molecule in which sixty carbon atoms are linked in interlocking hexagonal and pentagonal rings of carbon atoms.

### 3. COVALENT BOND

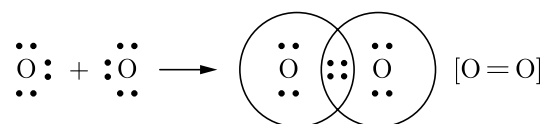
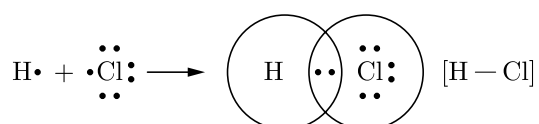
Two atoms of hydrogen molecule have same tendency to gain or lose electrons but do not acquire the nearest inert gas configuration i.e., helium by simultaneous loss and gain of one electron.

According to Lewis, both hydrogen atoms share their one valence electron to acquire the nearest inert gas (helium) configuration.



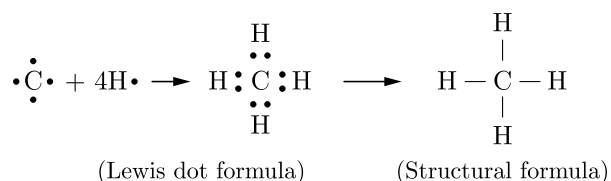
The bond formed between atoms by sharing of mutual and equal electrons is called covalent bond.

#### 3.1 Electronic Dot Structures of HCl and $O_2$ :



### 4. BONDING IN CARBON COMPOUNDS (ORGANIC COMPOUNDS)

Carbon acquires octet configuration by sharing its outermost electrons with other combining atom. Thus, organic compounds involve covalent bonds, e.g., formation of methane ( $CH_4$ ) :



Here, carbon shares its four valence electrons with one electron each of four hydrogen atoms.

Formation of ethene ( $C_2H_4$ ) and ethyne ( $C_2H_2$ ) also involves covalent bonds.

### 5. CHARACTERISTICS OF ORGANIC COMPOUNDS

#### 5.1 Physical State

Organic compounds exist as a gas, liquid or solid, e.g., methane (gas), ethanol (liquid) and urea (solid).

#### 5.2 Melting and Boiling Points

They have lower Melting point and Boiling point.

#### 5.3 Solubility

Organic compounds, being non-polar, are soluble in solvents like benzene carbon tetra chloride etc. Polar covalent organic compounds are soluble in polar solvents such as alcohol and water.

## 5.4 Electrical Conductivity

They do not conduct electricity in solid or molten state or in solution.

## 5.5 Reactions

Organic compounds are less reactive than ionic compounds.

# 6. VERSATILE NATURE OF CARBON

## 6.1 Catenation

It is linking of identical atoms together to form long chains. In catenation, carbon-carbon bond, being stable, forms a large number of compounds in straight and branched chains.

## 6.2 Tetravalency of Carbon

Since carbon has a valency of four, it is capable of bonding with four other atoms of carbon or atoms of other elements, e.g., carbon with hydrogen, etc.

## 6.3 Isomerism

Two or more different compounds having same molecular formula but different structural formula are called isomers and the phenomenon is called isomerism.

# 7. HYDROCARBONS

They are made of carbon and hydrogen, e.g., methane, ethyne, butyne, benzene, etc. Based on structure and properties, hydrocarbons are classified as:

## 7.1 Open Chain (Acyclic) Hydrocarbons

They contain open chain of carbon atoms in their molecules, i.e., in either straight or branched form. They are of two types:

### 1. Saturated Hydrocarbons

In them, saturated hydrocarbons carbon atoms are bonded to each other by single (–) bond with general formula of alkenes  $C_nH_{2n}$ , where  $n$  = number of carbon atoms in molecules, e.g., ethane ( $C_2H_6$ ), propane ( $C_3H_8$ ), etc.

### 2. Unsaturated Hydrocarbons

In unsaturated hydrocarbons (alkenes and alkynes), two carbon atoms are bonded to each other by a double bond (=, alkenes) or triple bond ( $\equiv$ , alkynes).

The general formula of alkenes is  $C_nH_{2n}$ , e.g., ethene ( $C_2H_4$ ), propene ( $C_3H_6$ ), etc., and alkynes is  $C_nH_{2n-2}$ , e.g., ethyne ( $C_2H_2$ ), etc.

e.g., ethyne ( $C_2H_2$ ), etc. . . . as of carbon atoms. They are of following two

## 7.2 Closed Chain Hydrocarbons

They contain closed chains or rings of carbon atoms. They are of following two kinds.

### 1. Aliphatic Cyclic Hydrocarbons

They contain a ring of 3 or more C atoms and have properties similar to aliphatic hydrocarbons, e.g., cyclobutane ( $C_4H_8$ ), cyclopentane ( $C_5H_{10}$ ), etc.

### 2. Aromatic Hydrocarbons

They contain one or more six membered ring of carbon atoms with alternate single and double bonds, e.g., benzene ( $C_6H_6$ ), toluene ( $C_6H_5CH_3$ ), naphthalene ( $C_{10}H_8$ ), etc.

## 7.3 Alkyl Groups

The removal of one hydrogen atom from an alkane gives the corresponding alkyl group having general formula  $C_nH_{2n+1}$  (–R), e.g., methyl (– $CH_3$ ) of methane ( $CH_4$ ), etc.

## 7.4 Functional Group

It is an atom or a group of atoms which determines the chemical properties of an organic compound.

Functional groups like halo (–Cl, –Br, –I), alcoholic (–OH), aldehydic (–CHO), ketonic (–CO), carboxylic (–COOH), amino (– $NH_2$ ) are attached to carbon compounds. Their general names are halides, alcohols, aldehydes, ketones, carboxylic acids, amines, etc.

## 7.5 Homologous Series

This series contains structurally same organic compounds with similar functional group in which successive members differ by  $CH_2$ . The important members (homologues) are alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids, etc.

1. All the members of a homologous series can be represented by  $C_nH_{2n+2}$ .
2. Each successive member differs in formula by a common difference of  $CH_2$ .
3. The molecular mass of two successive members of a homologous series differs by 14.
4. Homologues show same chemical properties but different physical properties with increase in molecular mass.

5. The members of a particular homologous series can be prepared by same general methods.

## 8. NOMENCLATURE OF ORGANIC COMPOUNDS

Nomenclature is the system of naming organic compounds (a systematic method) which was adopted by International Union of Pure and Applied Chemistry (IUPAC) system of nomenclature consisting of four parts, i.e., Prefix... Word root... Primary suffix... Secondary suffix.

### 8.1 Word Root or Root Name

It denotes the number of carbon atoms in the longest selected chain, e.g., one C → Meth, Two C → Eth, Three C → Prop, Four C → But, Five C → Pent, Six C → Hex, Seven C → Hept, Eight C → Oct, Nine C → Non, Ten C → Dec, etc.

### 8.2 Suffix

It is written after word root. It is of two types as follows:

#### 1. Primary Suffix

It denotes the type of carbon to carbon bond in the organic compounds. For C – C bond, primary suffix 'ane', for C = C bond, 'ene' and for C ≡ C bond 'yne' are used.

#### 2. Secondary Suffix

It is functional group in molecules attached to primary suffix to write the IUPAC name. Secondary suffixes -ol for alcohols (–OH), -al for aldehydes (–CHO), -one for ketones (–CO), -oic acid for carboxylic acids (–COOH) and -amine for amines (–NH<sub>2</sub>) are used.

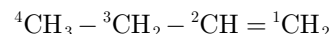
To write secondary suffix, 'e' of primary suffix is replaced by IUPAC name of functional group, e.g., Alcohols (monohydric) called alkanols have general formula C<sub>n</sub>H<sub>2n+1</sub>OH (ROH). The terminal 'e' of primary suffix is replaced by 'ol', e.g., IUPAC name of methyl alcohol is methanol.

### 8.3 Prefix

It denotes substituent groups, e.g., prefixes chloro, bromo, nitro, methyl, ethyl and propyl are used for substituents (–Cl), (–Br), (–NO<sub>2</sub>), (–CH<sub>3</sub>), (–C<sub>2</sub>H<sub>5</sub>) and (–C<sub>3</sub>H<sub>7</sub>).

## 9. WRITING IUPAC NAME OF AN ORGANIC COMPOUND

1. Select the longest continuous chain of carbon atoms (parent chain) of double bond C = C, triple bond C ≡ C and also those involved in the functional group.
2. Number the chain from one end to the other in order to give the lowest number in this order:  
Functional group > double bond or triple bond > prefix
3. The position (indicated by Arabic numerals) and name are separated by a hyphen, e.g.,



There are 4 C-atoms in the longest chain that includes double bond. So, the word root is 'but'.

The primary suffix is 'ene' for double bond. The chain should be numbered from right to left so as to give the lowest number to double bond. Hence, its correct IUPAC name is 'But-1-ene'.

## 10. CHEMICAL PROPERTIES OF CARBON COMPOUNDS

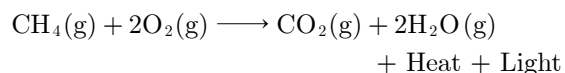
### 10.1 Combustion

It is an act of burning of a substance or rapid chemical reaction or oxidation reaction releasing heat and light. Fuels are combustible substances used to produce heat on burning. All solid, liquid or gaseous fuels are made of carbon compounds, e.g.,

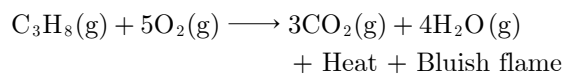
1. Carbon burns in air to give CO<sub>2</sub> with release of heat and light.



2. Methane burns to give CO<sub>2</sub> and H<sub>2</sub>O.



3. LPG is a mixture of propane and butane or butane and isobutane. It burns with a bluish flame to produce a large amount of heat.



Saturated hydrocarbons give a clean bluish flame and unsaturated hydrocarbons give a yellow flame with a black smoke due to higher percentage of carbon in them.

### 10.2 Substitution Reaction

In this reaction, an atom or a functional group of a molecule is replaced by another equivalent atom or a functional group. Halogenation, e.g., chlorination of alkanes in sunlight is a substitution reaction.

$X = \text{CH}_3\text{CH}_2\text{OH}$  (ethanol)

$Y = \text{CH}_2 = \text{CH}_2$  (ethene)

$\text{CH}_3\text{CH}_2\text{OH} + \text{Na} \rightarrow \text{CH}_3\text{CH}_2\text{ONa} + \text{H}_2$

$Z = \text{Hydrogen gas.}$

Here, concentrated sulphuric acid acts as a dehydrating agent, it removes water molecule from ethanol.

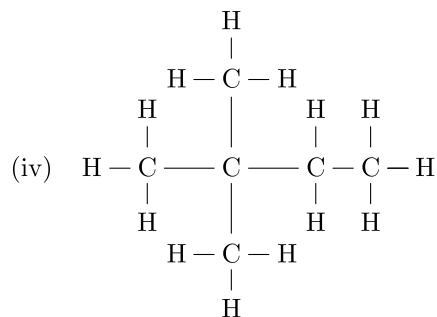
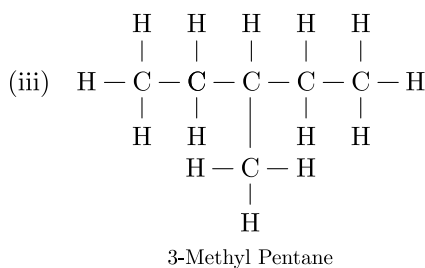
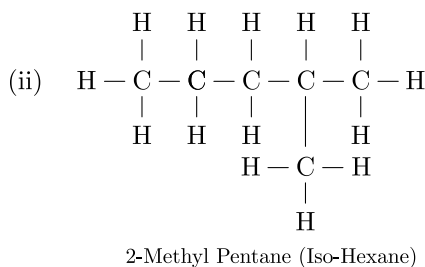
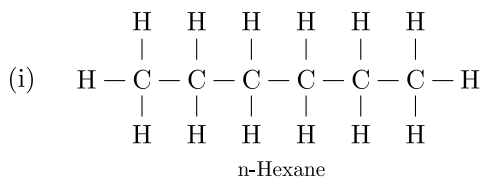
- 221.** You are given balls and stick model of six carbon atoms and fourteen hydrogen atoms and sufficient number of sticks. In how many ways one can join the models of six carbon atoms and fourteen hydrogen atoms to form different molecules of  $\text{C}_6\text{H}_{14}$ .

**Ans :**

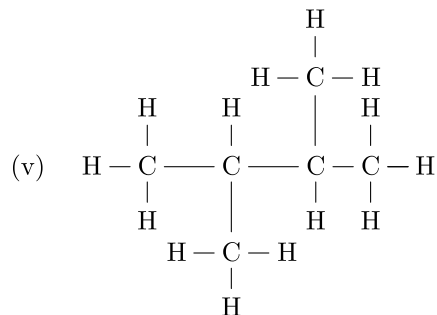
SQP 2018, Delhi 2012

We can, make five types of molecules of  $\text{C}_6\text{H}_{14}$  with these balls and sticks as  $\text{C}_6\text{H}_{14}$  (Hexane) has five isomers.

These five isomers (five types of molecules) are :



2, 2-dimethyl Butane (Neo-Hexane)



2, 3-dimethyl Butane

- 228.** Draw the structural formulae of all the possible isomers of the compound with the molecular formula  $\text{C}_3\text{H}_6\text{O}$  and also give their electron dot structures.

**Ans :**

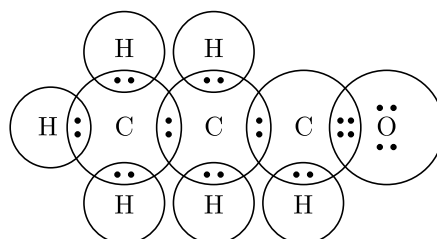
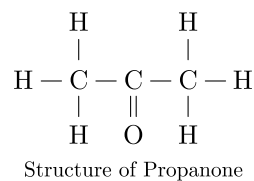
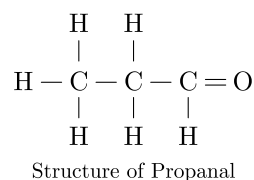
OD 2018, Delhi 2015

There are two possible isomers of  $\text{C}_3\text{H}_6\text{O}$ .

These are :

(i) Propanal  $\text{C}_2\text{H}_5\text{CHO}$  and

(ii) Propanone  $\text{CH}_3\text{COCH}_3$



Electron dot structures of Propanal

added to alcohol.

### 12.3 Harmful Effects of Drinking Alcohol

When consumed in large quantities, it slows metabolic process and depresses the central nervous system resulting lack of coordination, mental confusion and drowsiness. So, drunken driving leads to increased road accidents. Heavy drinking over a long period of time causes cirrhosis.

### 12.4 Denaturation of Ethyl Alcohol

It is made unfit for drinking by adding poisonous substances like methanol pyridine and copper sulphate to it. This is made blue by adding a blue dye so that it can be easily identified. This is called denatured alcohol.

## 13. ETHANOIC ACID (CH<sub>3</sub>COOH, ACETIC ACID)

It belongs to carboxylic acids. A dilute aqueous solution containing 5 to 8 per cent of ethanoic acid is called vinegar. Ethanoic acid is a colourless liquid having sour taste and smell of vinegar. The MP of pure ethanoic acid is 290 K. It often freezes during winter in cold countries into an icy mass. So, pure ethanoic acid is called glacial ethanoic (acetic) acid. Ethanoic acid is miscible with water.

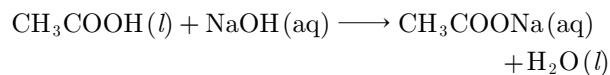
### 13.1 Chemical Properties of Ethanoic Acid

#### 1. Acidic Character

Ethanoic acid, being acidic in nature, turns blue litmus solution red.

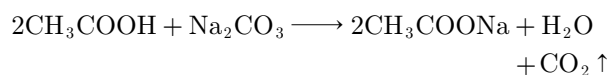
#### 2. Reaction with a Base

Like mineral acids, it reacts with NaOH to form salt and water.

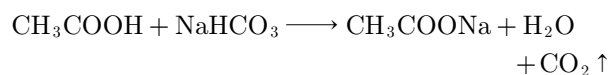


#### 3. Reaction with Metal Carbonates and Hydrogen Carbonates

It decomposes sodium carbonate to evolve carbon dioxide.



Ethanoic acid decomposes carbonates or hydrogen carbonates to form carbon dioxide and salt.

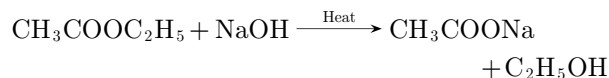


### 4. Reaction with Alcohols (Esterification)



### 13.2 Hydrolysis of Esters

Ethyl ethanoate is boiled with NaOH to form sodium ethanoate and ethanol.



Alkaline hydrolysis of esters is called saponification as it is basic reaction in producing soaps.

### 13.3 Uses of Ethanoic Acid

1. Acetic acid (vinegar) is used as food and salad dressing and for killing most molds, bacteria and germs. It is used as a preservative of sauces and pickles.
2. It is used in manufacturing acetone and esters to make perfumes.

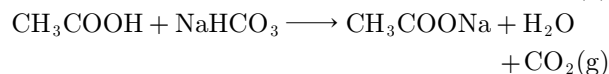
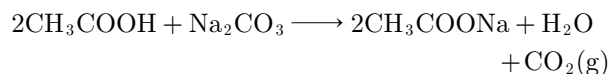
### 13.4 Tests for Ethanoic Acid

#### 1. Litmus Test

All acids turn blue litmus solution or paper in to red.

#### 2. Decomposition of Carbonates and Bicarbonates:

Acids decompose carbonates and hydrogen carbonates to evolve carbon dioxide which turns lime water milky, e.g.,



## 14. SOAPS

It is water-soluble sodium or potassium salt of a long chain carboxylic acid which has cleansing properties in water, e.g., sodium stearate (C<sub>17</sub>H<sub>35</sub>COONa) and sodium palmitate (C<sub>15</sub>H<sub>31</sub>COONa), etc. As a soap is a salt of weak acid (carboxylic acid) and a strong base (NaOH), it dissolves in water and solution is basic in nature. So, a soap solution turns red litmus blue.

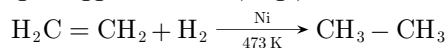
### 14.1 Cleansing Action of a Soap

On dissolving in water, soap molecules ionise to give long chain carboxylate anion and sodium or potassium cation to remove greasy and oily substances present in our body, e.g.



### 10.3 Addition Reaction

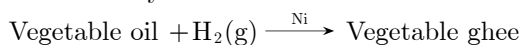
It is a class of chemical reaction in which an atom or a group of atoms is added to a molecule to form a single bigger molecule, e.g.,



The addition of hydrogen to an unsaturated compound is called hydrogenation.

### 10.4 Hydrogenation of Oils

Vegetable oils (liquids) are used as cooking purpose. To make unpalatable oils out of oils (esters of unsaturated higher fatty acids, i.e.,  $-\text{C} = \text{C}-$ ) palatable, they are converted into semi-solid mass (vegetable ghee) by hydrogenating these oils. Hydrogen is passed in hot vegetable oil in the presence of finely divided nickel.



## 11. ETHANOL (C<sub>2</sub>H<sub>5</sub>OH, ETHYL ALCOHOL)

Ethanol [grain (drinking) alcohol] is just called alcohol or spirit.

### 11.1 Physical Properties of Ethanol

It is a colourless liquid with a characteristic alcoholic smell and burning taste. It is lighter than water. It is miscible with water in all proportions. 100% of pure ethanol is absolute alcohol.

Ethanol containing 5% water is rectified spirit.

Consumption of smaller quantities of ethyl alcohol (good solvent) causes intoxication and drunkenness.

## 12. CHEMICAL PROPERTIES OF ETHANOL

### 1. Nature

Ethanol, being neutral in nature, does not affect litmus solution.

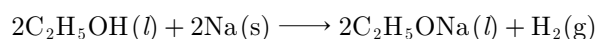
### 2. Combustion

Ethanol (C<sub>2</sub>H<sub>5</sub>OH), being highly volatile and combustible liquid, burns with smokeless blue flame.

$$\text{C}_2\text{H}_5\text{OH}(\text{l}) + 3\text{O}_2(\text{g}) \longrightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l}) + \text{Heat}$$

### 3. Reaction with Sodium

It reacts with sodium to form sodium ethoxide.



### 4. Oxidation

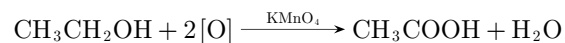
(a) **Partial Oxidation** : On oxidation with mild

oxidising agents, i.e., chromic anhydride (CrO<sub>3</sub>) dissolved in acetic acid (CH<sub>3</sub>COOH), the product of oxidation is ethanol (CH<sub>3</sub>CHO).



### (b) Complete Oxidation :

(i) Ethanol (C<sub>2</sub>H<sub>5</sub>OH) when warmed with dil. alkaline potassium permanganate (KMnO<sub>4</sub>) solution, it gets oxidised into ethanoic acid (C<sub>2</sub>H<sub>5</sub>COOH).

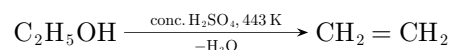


(ii) Likewise, acidified potassium dichromate solution oxidises ethanol to ethanoic acid.



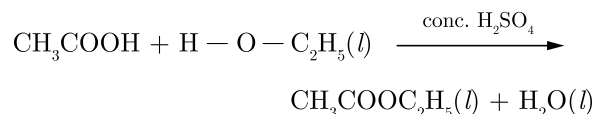
### 5. Dehydration to give Unsaturated Hydrocarbons

When ethyl alcohol is heated with excess of conc. H<sub>2</sub>SO<sub>4</sub>, it undergoes dehydration to give unsaturated hydrocarbon, i.e., ethene (C<sub>2</sub>H<sub>4</sub>).



### 6. Reaction with Ethanoic Acid (Esterification)

Ethanol (C<sub>2</sub>H<sub>5</sub>OH) reacts with ethanoic acid in the presence of a little conc. H<sub>2</sub>SO<sub>4</sub> to form an ester called ethyl ethanoate (CH<sub>3</sub>COOC<sub>2</sub>H<sub>5</sub>).



The reaction of a carboxylic acid with an alcohol to form an ester is called esterification.

### 12.1 Uses of Ethanol

1. It is used as motorcar fuel and fuel additive. It gives CO<sub>2</sub> and H<sub>2</sub>O on burning in excess O<sub>2</sub>.
2. It is used in alcoholic drinks, and in hospitals to sterilise wounds and syringes.
3. It is used in many healthcare products, and used in spirit lamp, spirit level and thermometers.

### 12.2 Test for an Alcohol

#### 1. Sodium Metal Test

When small dry piece of sodium is added to ethanol, hydrogen bubbles are produced.

#### 2. Ester Formation Test

Formation of fruity smell of ester when glacial ethanoic acid and few drops of conc. H<sub>2</sub>SO<sub>4</sub> are

3. A molecule of ammonia ( $\text{NH}_3$ ) has  
 (a) only single bonds  
 (b) only double bonds  
 (c) only triple bonds  
 (d) two double bonds and one single bond

Ans :

(a) only single bonds

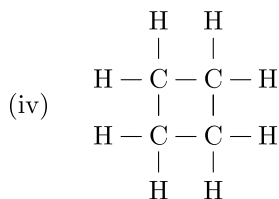
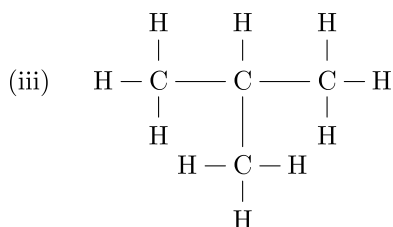
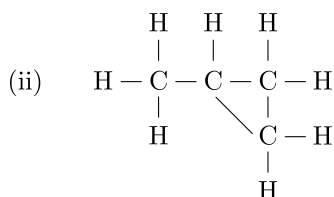
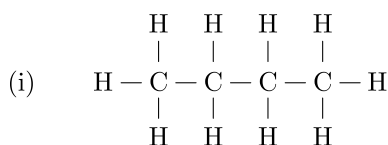
4. Buckminsterfullerenes is an allotropic form of  
 (a) phosphorus (b) sulphur  
 (c) carbon (d) tin

Ans :

(c) carbon

Foreign 2015

5. Which of the following are correct structural isomers of butane ?



- (a) (i) and (iii) (b) (i) and (ii)  
 (c) (ii) and (iv) (d) (iii) and (iv)

Ans :

(a) (i) and (iii)



In the above given reaction, alkaline  $\text{KMnO}_4$  acts as

- (a) reducing agent (b) oxidising agent

- (c) catalyst (d) dehydrating agent

Ans :

(b) oxidising agent

7. Oils on treating with hydrogen in the presence of palladium or nickel catalyst form fats. This is an example of  
 (a) Addition reaction  
 (b) Substitution reaction  
 (c) Displacement reaction  
 (d) Oxidation reaction

Ans :

(a) Addition reaction

8. In which of the following compounds,  $-\text{OH}$  is the functional group ?

- (a) Butanone (b) Butanol  
 (c) Butanoic acid (d) Butanal

Ans :

(b) Butanol

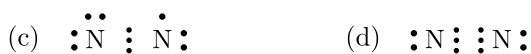
9. The soap molecule has a  
 (a) hydrophilic head and a hydrophobic tail  
 (b) hydrophobic head and a hydrophilic tail  
 (c) hydrophobic head and a hydrophobic tail  
 (d) hydrophilic head and a hydrophilic tail

Ans :

Delhi 2012

(a) hydrophilic head and a hydrophobic tail

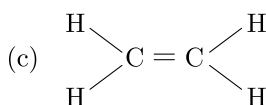
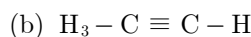
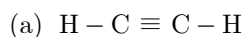
10. Which of the following is the correct representation of electron dot structure of nitrogen ?



Ans :

(d)  $\begin{array}{c} \cdot \\ :\ddot{\text{N}} \\ \cdot \end{array}$   $\begin{array}{c} \cdot \\ :\ddot{\text{N}} \\ \cdot \end{array}$

11. Structural formula of ethyne is



53. Name the different forms of carbon present in nature?

Ans : OD 2015

Carbon is present in nature in combined as well as free states.

The different forms of carbon are—

1. In combined state as carbonates and bicarbonates of metals.
2. In free state as coal, petroleum and natural gas.
3. In bio-molecules such as sugar, protein fat.

54. Write the molecular formula of the 2nd and 3rd members of the homologous series whose first member is methane.

Ans : OD 2016

Propane ( $C_3H_8$ ) and butane ( $C_4H_{10}$ )

55. Write the molecular formula of the 2nd and 3rd member of the homologous series whose first member is ethene.

Ans : Delhi 2017, Delhi 2015

Propene ( $C_3H_6$ ) and butene ( $C_4H_8$ ).

56. What is hydrocarbon ?

Ans : Delhi 2016

Compounds of hydrogen and carbon are called hydrocarbons.

Example -  $CH_4$ ,  $C_5H_{12}$  etc.

57. What is saturated hydrocarbon? Write its general formula.

Ans : OD 2017

The hydrocarbon having only C—C single bond is called saturated hydrocarbon or alkanes. The general formula of alkanes is  $C_nH_{2n+2}$

where,  $n = 1, 2, 3, 4, \dots$

58. Write the molecular formula of the 2nd and 3rd member of the homologous series where the first member is ethyne.

Ans : Foreign 2016

Propyne ( $C_3H_4$ ) and butyne ( $C_4H_6$ ).

59. What is a homologous series of carbon compounds.

Ans : Comp 2017

A homologous series is the family of organic compounds having the same functional group, and the adjacent members of which differ by  $CH_2$  unit or 14 mass unit.

60. During the process of fermentation, why does the liquid appear as boiling ?

Ans : Delhi 2017, Comp 2016

The liquid appears as boiling during fermentation due to the liberation of carbon dioxide gas.

61. Name the compound  $CH_3 - CH_2 - OH$  and identify its functional group.

Ans : Foreign 2017, OD 2016

The compound  $CH_3 - CH_2 - OH$  is ethanol.

The functional group present in ethanol is alcohol.

62. Write the next homologous of each of the following :  
(i)  $C_2H_4$ , (ii)  $C_4H_6$

Ans : OD 2016

(i)  $C_3H_6$  (ii)  $C_5H_8$

63. Name the hydrocarbons having general formula  $C_nH_{2n}$ .

Ans : Delhi 2017

Alkenes.

64. Name the following compounds :

(i)  $CH_3 - CH_2 - OH$

(ii)  $CH_3 - \overset{\overset{H}{|}}{C} = O$

Ans : Delhi 2016, Delhi 2012

(i) Ethanol,

(ii) Ethanal.

65. Which element exhibits the property of catenation to maximum extent and why ?

Ans : Foreign 2017

Carbon, due to strong C—C bond.

66. Write the name and molecular formula of the fourth member of alkane series.

Ans : Foreign 2016

Butane,  $C_4H_{10}$ .

67. Select saturated hydro-carbons from the following :

Ans : OD 2015

$C_3H_6$ ,  $C_5H_{10}$ ,  $C_4H_{10}$ ,  $C_6H_{14}$ ,  $C_2H_4$

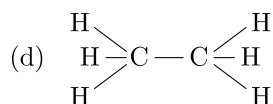
$C_4H_{10}$ ,  $C_6H_{14}$

68. Why is air not allowed to enter the vessel during fermentation of sugar to prepare ethanol ?

Ans : Foreign 2013

This is because air present in the vessel might oxidize ethanol formed to vinegar.





Ans :

Delhi 2011

(a)  $\text{H} - \text{C} \equiv \text{C} - \text{H}$

12. Identify the unsaturated compounds from the following :

- (i) Propane
- (ii) Propene
- (iii) Propyne
- (iv) Chloropropane

- (a) (i) and (ii)
- (b) (ii) and (iv)
- (c) (iii) and (iv)
- (d) (ii) and (iii)

Ans :

(d) (ii) and (iii)

13. Chlorine reacts with saturated hydro-carbons at room temperature in the

- (a) absence of sunlight
- (b) presence of sunlight
- (c) presence of water
- (d) presence of hydrochloric acid

Ans :

(b) presence of sunlight

14. In the soap micelles

- (a) The ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster.
- (b) Ionic end of soap is in the interior of the cluster and carbon chain is out of the cluster.
- (c) Both ionic end and carbon chain are in the interior of the cluster.
- (d) Both ionic end and carbon chain are on the exterior of the cluster.

Ans :

(a) The ionic end of soap is on the surface of the cluster while the carbon chain is in the interior of the cluster.

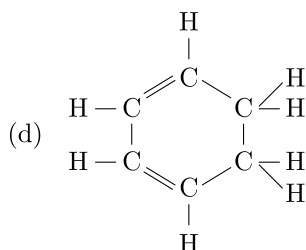
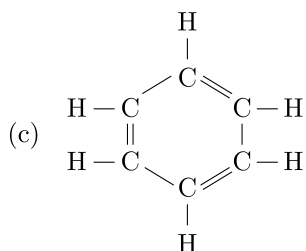
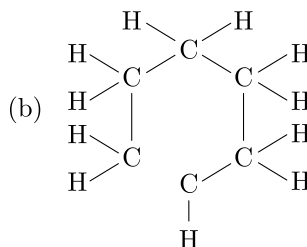
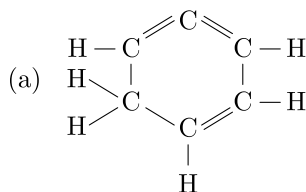
15. Pentane has the molecular formula  $\text{C}_5\text{H}_{12}$ . It has

- (a) 5 covalent bonds
- (b) 12 covalent bonds
- (c) 16 covalent bonds
- (d) 17 covalent bonds

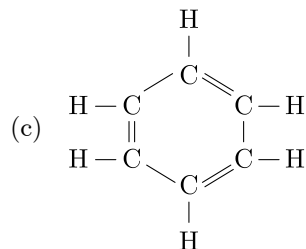
Ans :

(c) 16 covalent bonds.

16. Structural formula of benzene is



Ans :



17. Ethanol reacts with sodium and forms two products. These are

- (a) sodium ethanoate and hydrogen
- (b) sodium ethanoate and oxygen
- (c) sodium ethoxide and hydrogen
- (d) sodium ethoxide and oxygen

of (A).

- (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

**Ans :**

OD 2023

The melting point and boiling point of ethanol are indeed lower than that of sodium chloride. This is because ethanol is a covalent compound, while sodium chloride is an ionic compound. Covalent compounds have weaker intermolecular forces than ionic compounds, which mean less energy is required to break the bonds holding the molecules together. Therefore, covalent compounds tend to have lower melting and boiling points than ionic compounds.

Thus option (a) is correct option.

- 33. Assertion :** Carbon shows maximum catenation property in the periodic table.

**Reason :** Carbon has small size and thus, forms strong C – C bond.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Catenation is the bonding of atoms of the same element into a series, called as Chain. Catenation occurs more readily with carbon, which forms strong covalent bond with other C-atoms to form long chains and structures.

- 34. Assertion :** Graphite is slippery to touch.

**Reason :** The various layers of carbon atoms in graphite are held together by weak vander Waals forces.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

A graphite crystal consists of various layers of carbon atoms in which each carbon atom is joined to three other atoms by strong covalent bonds. The various layers of carbon atoms in graphite are held together by weak vander Wall's forces making it slippery to touch.

- 35. Assertion :** Propene reacts with HBr to give isopropyl bromide.

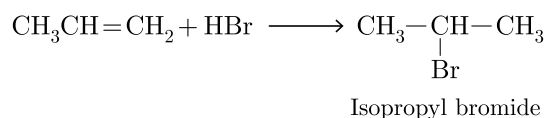
**Reason :** Addition of Br<sub>2</sub> to alkene place faster in presence of ionising substance.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Addition of unsymmetrical addendum on unsymmetrical alkene takes place according to Markownikoff's rule. The negative part of the addendum goes on to less hydrogenated carbon atom.



- 36. Assertion :** C<sub>3</sub>H<sub>8</sub> and C<sub>4</sub>H<sub>10</sub> are the successive members of homologous series of methane.

**Reason :** Any two successive members in a homologous series differ in their molecular formula by α – CH<sub>3</sub> unit.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).



Ans :

(c) (ii) and (iv)

25. Which of the following does not belong to the same homologous series ?

(a)  $\text{CH}_4$  (b)  $\text{C}_2\text{H}_6$   
(c)  $\text{C}_3\text{H}_8$  (d)  $\text{C}_4\text{H}_8$

Ans :

OD 2015, Delhi 2015

(d)  $\text{C}_4\text{H}_8$ 

26. The name of the compound  $\text{CH}_3-\text{CH}_2-\text{CHO}$  is

(a) Propanal (b) Propanone  
(c) Ethanol (d) Ethanal

Ans :

(a) Propanal

27. The heteroatoms present in  $\text{CH}_3-\text{CH}_2-\text{O}-\text{CH}_2-\text{CH}_2\text{Cl}$  are

(i) oxygen (ii) carbon  
(iii) hydrogen (iv) chlorine  
(a) (i) and (ii) (b) (ii) and (iii)  
(c) (iii) and (iv) (d) (i) and (iv)

Ans :

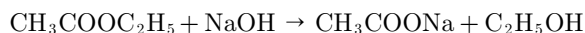
(d) (i) and (iv)

28. Which of the following represents saponification reaction ?

(a)  $\text{CH}_3\text{COONa} + \text{NaOH} \xrightarrow{\text{CaO}} \text{CH}_4 + \text{Na}_2\text{CO}_3$   
(b)  $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{H}_2\text{SO}_4} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$   
(c)  $2\text{CH}_3\text{COOH} + 2\text{Na} \longrightarrow 2\text{CH}_3\text{COONa} + \text{H}_2$   
(d)  $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$

Ans :

(d)



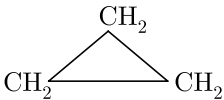
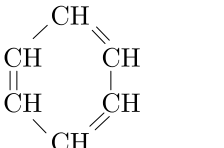
29. The first member of alkyne homologous series is

(a) ethyne (b) ethene  
(c) propyne (d) methane

Ans :

(a) ethyne

30. Match the column I to column II and select the correct answer using the codes given below:

Column I		Column II	
(A)	$\text{CH}_2=\text{CH}_2$	(p)	Saturated
(B)		(q)	Unsaturated
(C)	$\text{CH}_3-\text{CH}_2-\text{CH}_3$	(r)	Acyclic
(D)		(s)	Cyclic

	A	B	C	D
(a)	q, r	p, s	p, r	q, s
(b)	p, q	q, s	r, s	q, p
(c)	q, s	r, p	q, p	q, r
(d)	p, r	p, q	r, s	r, q

Ans :

(a) A-q, r, B-p, s, C-p, r, D-q, s

31. Match the column I to column II and select the correct answer using the codes given below:

Column I		Column II	
(A)	Halogenation	(p)	$\text{SO}_3 + \text{conc. H}_2\text{SO}_4$ Copper
(B)	Brass	(q)	$\text{HI} + \text{HIO}_3$
(C)	Bronze	(r)	$\text{Cl}_2 + \text{UV light}$
(D)	Magnalium	(s)	Fuming nitric acid

	A	B	C	D
(a)	q, r	s	p	q
(b)	q, s	p, r	q	r
(c)	r	p, s	q	s
(d)	p, q	r, s	p	r

Ans :

(a) A-q, r, B-s, C-p, D-q

32. **Assertion (A):** Melting point and boiling point of ethanol are lower than that of sodium chloride.

**Reason (R):** The forces of attraction between the molecules of ionic compounds are very strong

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation (A)  
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation

- 42. Assertion :** Acetic acid has six single bond and one double bond.

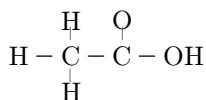
**Reason :** It is unsaturated organic compound.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Acetic acid has structure which has six single bond and only one double bond. It is an unsaturated organic compound.



- 43. Assertion :** Soap has good cleansing action.

**Reason :** Soap has short chain of hydrocarbon. Which acts as hydrophobic and long ionic part which acts as hydrophilic.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

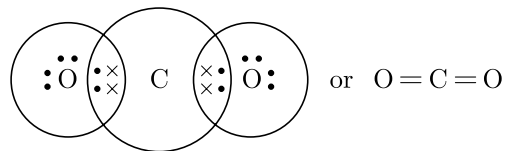
- (c) Assertion (A) is true but reason (R) is false.

Soap has long chain of hydrocarbon and short chain of ionic part.

## ONE MARK QUESTIONS

- 44.** Draw electron dot structure of carbon dioxide and write the nature of bonding between carbon and oxygen in its molecule.

**Ans :**



Covalent bond (double bond) is present in between C and O.

- 45.** Write the molecular formula of first two members of homologous series having functional group-Cl.

**Ans :**

OD 2017

$\text{CH}_3\text{Cl}$  (chloromethane) and  $\text{C}_2\text{H}_5\text{Cl}$  (chloroethane).

- 46.** Hydrogen has one valence electron. Name the inert gas nearest to hydrogen to acquire the stable configuration by hydrogen.

**Ans :**

OD 2016, Foreign 2015

Helium.

- 47.** Predict the nature of bond formed between two atoms having electronic configuration of 2, 8, 6.

**Ans :**

Delhi 2017

Covalent bond by sharing of two electrons from each atoms.

- 48.** Write the molecular formula of first two members of homologous series having functional group-Br.

**Ans :**

OD 2017

$\text{CH}_3\text{Br}$  (Bromo methane) and  $\text{C}_2\text{H}_5\text{Br}$  (Bromo ethane).

- 49.** What is the percentage of carbon in the atmosphere ?

**Ans :**

Delhi 2017

The percentage of carbon in the atmosphere is 0.03.

- 50.** What is the percentage of carbon in the earth's crust?

**Ans :**

Foreign 2016

There is 0.02% of carbon in the earth's crust.

- 51.** Write the molecular formula of first two members of homologous series-having functional group -OH.

**Ans :**

Comp 2017

$\text{CH}_3\text{OH}$  (Methanol) and  $\text{CH}_3\text{CH}_2\text{OH}$  (Ethanol).

- 52.** Name the period and group of carbon in the periodic table.

**Ans :**

SQP 2016

Carbon lies in group 14 and period number two of periodic table.

**Example :** Alkanes with general formula  $C_nH_{2n+2}$ .

**Characteristics :**

- All the members of a homologous series can be represented by the same general formula and they have same functional group.
- Any two adjacent homologues differ by 1 carbon atom and 2 hydrogen atoms in their molecular formulae.
- The difference in the molecular masses of any two adjacent homologues is 14u.

- 144.** List two properties of carbon which lead to the huge number of carbon compounds we see around us, giving reason for each.

**Ans :**

Delhi 2019, Delhi 2015

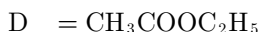
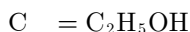
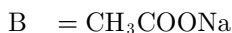
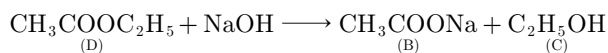
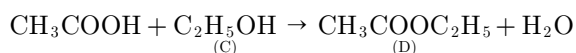
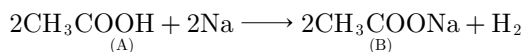
Two properties of carbon which lead to the huge number of carbon compounds are :

- Catenation :** It is the ability of carbon to form bonds with other atoms of carbon.
- Tetravalency :** With the valency of four, carbon is capable of bonding with 4 other atoms. This forms huge number of compounds.

- 145.** A compound  $A$  ( $C_2H_4O_2$ ) reacts with Na metal to form a compound ' $B$ ' and evolves a gas which burns with a pop sound. Compound ' $A$ ' on treatment with an alcohol ' $C$ ' in presence of an acid forms a sweet smelling compound ( $C_4H_8O_2$ ). On addition of NaOH to ' $D$ ' gives back  $B$  and  $C$ . Identify  $A$ ,  $B$ ,  $C$  and  $D$ . Write the reactions involved.

**Ans :**

OD 2019, Delhi 2017



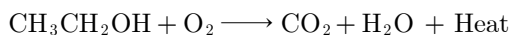
- 146.** What happens (write the chemical equation in each case)

- ethanol is burnt in air.
- a piece of sodium is dropped into ethanol?

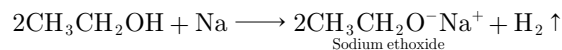
**Ans :**

OD 2017

- When ethanol is burnt in air, forms carbon-dioxide gas and water vapour.



- When a piece of sodium is dropped into ethanol, forms sodium ethoxide and hydrogen.

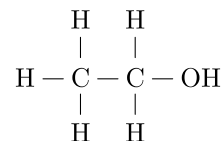


- 147.** Write the structural formula of ethanol. What happens when it is heated with excess of conc.  $H_2SO_4$  at 443 K Write the chemical equation for the reaction stating the role of conc.  $H_2SO_4$  in this reaction.

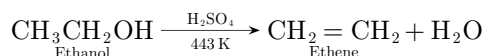
**Ans :**

Foreign 2016, OD 2016

Structural formula of ethane



When it is heated with excess of conc.  $H_2SO_4$  at 443 K, it undergoes dehydration to form alkene.



- 148.** Write characteristics of covalent compounds.

**Ans :**

Delhi 2017

The properties of covalent compounds are :

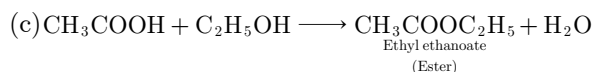
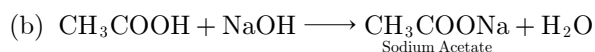
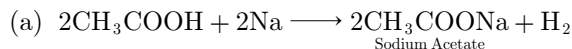
- They have low melting and boiling points.
- They are generally gaseous or liquid substances.
- They are bad conductors of electricity and heat.
- They are of two types—polar and non-polar covalent compounds.

- 149.** Write chemical equation of the reaction of ethanoic acid with the following: (a) Sodium, (b) Sodium hydroxide, (c) Ethanol.

Write the name of one main product of each reaction.

**Ans :**

Delhi 2016



- 150.** Two carbon compounds  $X$  and  $Y$  have the molecular formula  $C_4H_8$  and  $C_5H_{12}$  respectively. Which one of them is most likely to show addition reaction ? Justify your answer.

**Ans :**

Foreign 2017

Saturated compound—( $C_5H_{12}$ ) (compound  $Y$ ) undergoes substitution reaction.

Unsaturated compound — $C_4H_8$  (compound  $X$ ) undergoes addition reaction at the multiple bonds.

69. A compound with molecular formula  $C_2H_6O$  is used as a fuel. Identify the compound.

Ans :

Delhi 2014

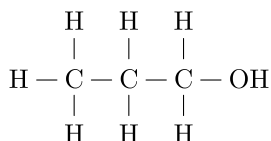
Ethanol ( $CH_3CH_2OH$ ).

70. Write the name and structure of an alcohol with three carbon atoms in its molecule.

Ans :

SQP 2017, OD 2014

Propanol.



71. Write the molecular formula of the compound formed by the reaction of ethanoic acid with ethanol in the presence of an acid catalyst.

Ans :

Delhi 2015

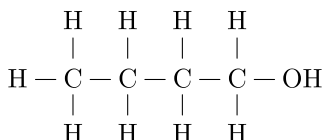
Ethyl ethanoate ( $CH_3COOC_2H_5$ ).

72. Write the name and structure of an alcohol with four carbon atoms in its molecule.

Ans :

SQP 2015, Foreign 2014

Butanol.

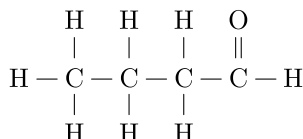


73. Write the name and structure of an aldehyde with four carbon atoms in its molecule.

Ans :

SQP 2015

Butanal.



74. Name the process of converting vegetable oil to vegetable ghee.

Ans :

SQP 2014, Delhi 2011

Hydrogenation.

75. Unsaturated hydrocarbon gives a yellow flame with lots of black smoke when burnt in oxygen. Give reason.

Ans :

OD 2015

Due to incomplete combustion of carbon contents.

76. Is combustion always accompanied by a flame ?

Ans :

OD 2014

No.

77. What is nature of combustion reaction ?

Ans :

Delhi 2015

It is an exothermic reaction.

78. Identify the functional group in the following compounds :

(i)  $CH_3COCH_3$ , (ii)  $HCOOH$

Ans :

Delhi 2014, Delhi 2011

(i)  $\begin{array}{c} \text{O} \\ || \\ -C- \end{array}$  Ketone

(ii)  $\begin{array}{c} \text{O} \\ || \\ -C- \end{array} OH$  carboxylic acid

79. Write the molecular formula of alcohol which can be derived from butane.

Ans :

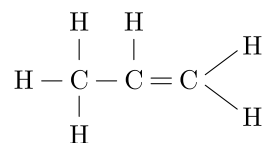
Foreign 2015

$CH_3 - CH_2 - CH_2 - CH_2 - OH$  (Butanol)

80. Give the structural formula of alkene with three carbon atom.

Ans :

Foreign 2014



81. What is the dilute solution (in 5-8% water) of acetic acid known as ?

Ans :

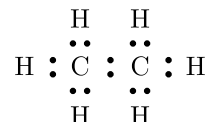
Comp 2015

The dilute solution (in 5-8% water) of acetic acid is known as vinegar.

82. Write the electron - dot structure of ethane ( $C_2H_6$ ).

Ans :

Comp 2014



83. Write the number of covalent bonds in the molecule of ethane.

Ans :

OD 2015, Delhi 2011

Seven covalent bonds.

- (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.  
 Assertion is correct but reason is false. Any two successive members in a homologous series differ in their molecular formula by  $-\text{CH}_2-$  unit.

**37. Assertion :** When ethanol is heated at 443 K with excess conc.  $\text{H}_2\text{SO}_4$ , ethene is obtained.

**Reason :** Conc.  $\text{H}_2\text{SO}_4$  acts as a dehydrating agent.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

When ethanol is heated with conc. sulphuric acid [ $\text{H}_2\text{SO}_4$ ] at 443 K, dehydration takes place and ethene is obtained. In this, conc.  $\text{H}_2\text{SO}_4$  acts as a dehydrating agent.

**38. Assertion :** Third member of alkane is propane ( $\text{C}_3\text{H}_8$ ).

**Reason :** It is obtained from general formula  $\text{C}_n\text{H}_{2n+2}$ .

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

$\text{C}_3\text{H}_8$  can be obtained from general formula,  $\text{C}_n\text{H}_{2n+2}$

**39. Assertion (A) :** Iso-butane is the isomer of  $\text{C}_4\text{H}_{10}$ .

**Reason (R) :** Iso-butane has four C and ten-H atom.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \end{array}$  is the structural isomer of butane.

**40. Assertion :**  $\text{CH}_3\text{Cl}$  is obtained from  $\text{CH}_4$  by the action of  $\text{Cl}_2$  in the presence of sunlight.

**Reason :** It is obtained by addition reaction.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

$\text{CH}_3\text{Cl}$  is obtained from  $\text{CH}_4$  by substitution reaction by the action of  $\text{Cl}_2$  in the presence of sunlight.

**41. Assertion :** The most of carbon compounds are good conductors of electricity.

**Reason :** They do not dissociate to form ions and remain as molecules.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(d) Assertion (A) is false but reason (R) is true.

Carbon compounds are mainly poor conductors of electricity.

is noticed.

100. Name the substances in which ethanol is an important constituent.

Ans :

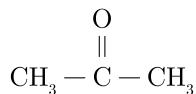
Delhi 2014, Delhi 2012

Ethanol is an important constituent of beer, wine, whiskey. some cough syrups, digestive syrups etc.

101. Draw the structure of the simplest ketone.

Ans :

Foreign 2013



102. Name the constituents which participate in the esterification.

Ans :

Foreign 2012, Delhi 2007

Alcohol, organic acid and sulphuric acid.

103. What are soaps ?

Ans :

OD 2010

Soaps are sodium salts of higher fatty acids. Soap is biodegradable and shows cleansing action by removing dirt.

104. Which gas is evolved in the fermentation process ?

Ans :

Comp 2012

CO<sub>2</sub> is evolved in the fermentation process.

105. Write the next higher homologues of the following :

(a) C<sub>3</sub>H<sub>6</sub>

(b) C<sub>5</sub>H<sub>8</sub>.

Ans :

OD 2013

(a) C<sub>4</sub>H<sub>8</sub>

(b) C<sub>6</sub>H<sub>10</sub>

106. What is alcohol content in rectified spirit ?

Ans :

OD 2012

95% alcohol.

107. Why should both sodium and ethyl alcohol be dry when these are made to react ?

Ans :

Delhi 2011

Because sodium catches fire in water.

108. Name the fourth (4th) member of alkene series.

Ans :

Delhi 2012

Fourth member of alkene series is pentene (C<sub>5</sub>H<sub>10</sub>).

109. Name the functional group present in propanone (CH<sub>3</sub>COCH<sub>3</sub>).

Ans :

Foreign 2013

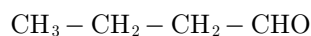
Ketone.

110. Write the name and structure of an aldehyde with four carbon atoms.

Ans :

Foreign 2012, SQP 2009

Butanal



111. What are enzymes ?

Ans :

OD 2011

The catalysts which bring about bio-chemical changes are called enzymes.

112. Name the enzyme present in milk.

Ans :

SQP 2013, OD 2010

Lactase.

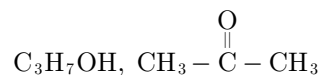
113. Describe the chemical change that takes place during souring of milk ?

Ans :

Delhi 2011

In hot weather, the enzyme (lactase) present in milk turns milk sugar lactose into lactic acid. Since acid is sour in taste, the presence of lactic acid in milk makes it sour.

114. Name the functional group present in each of the following compounds :



Ans :

Delhi 2010

Alcohol and ketone groups.

115. Name the enzyme that converts sugar to glucose and fructose.

Ans :

OD 2011

Invertase.

116. Write the name of the sugar which is obtained from sugarcane.

Ans :

Foreign 2010

Sucrose.

117. What is the function of yeast in fermentation ?

Ans :

SQP 2011

Yeast contains the enzymes invertase and zymase which act as catalysts during fermentation.



84. Write the number of covalent bonds in the molecule of propane,  $C_3H_8$ .

Ans :

OD 2014

Ten covalent bonds.

85. Write the name of each of the following functional groups :

(a)  $-OH$

(b)  $-C(=O)-$

Ans :

Delhi 2015, Foreign 2010

(a) Alcohol, (b) Ketone.

86. Write the number of covalent bonds in the molecules of butane  $C_4H_{10}$ .

Ans :

Delhi 2014

Thirteen covalent bonds.

87. Why do the atoms take part in bonding ?

Ans :

Foreign 2015

Atoms take part in bonding to acquire the electronic configuration of nearest inert gas to acquire stability.

88. Name the bond present in the atoms of  $N_2$ .

Ans :

Foreign 2014

Triple covalent bond.

89. Why are covalent compounds generally poor conductors of electricity ?

Ans :

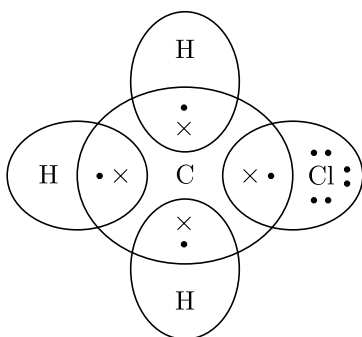
OD 2012

This is because covalent compounds do not produce ions in solution or on melting.

90. Draw the electron dot structure of  $CH_3Cl$ .

Ans :

Delhi 2013



91. Name the hydrocarbons which have general formula  $C_nH_{2n-2}$ .

Ans :

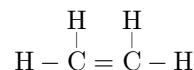
OD 2012, Delhi 2008

Alkynes.

92. Draw the structure of ethene molecule ( $C_2H_4$ ).

Ans :

Foreign 2013



93. Does alcohol give litmus test ?

Ans :

Delhi 2012

No, alcohol does not change the colour of blue or red litmus. It is neutral in nature.

94. Name the bond present between the atoms of  $O_2$ .

Ans :

OD 2013

Double covalent bond.

95. Name the process by which alcohol is produced in the industries.

Ans :

SQP 2013

In the industries, alcohol is produced by the fermentation of sugar.

96. Draw structure of ethyne ( $C_2H_2$ ).

Ans :

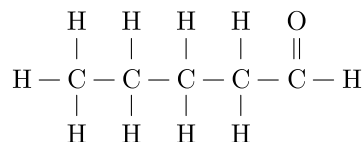
Comp 2013

Ethyne :  $H - C \equiv C - H$

97. Draw the structure of pentanal ( $C_4H_9CHO$ ).

Ans :

OD 2013



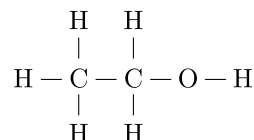
98. Draw the structure of ethyl alcohol ( $C_2H_5OH$ ).

or

Draw the structure of ethanol ( $C_2H_5OH$ ).

Ans :

OD 2012



99. What happens when a small amount of  $NaHCO_3$  is added to the acetic acid solution ?

Ans :

Delhi 2013

A brisk effervescence due to evolution of  $CO_2$  (g),

136. Apart from the basic raw materials, what extra things are added during the manufacture of soap in the soap industry ?

Ans :

SQP 2011, Delhi 2008

Apart from the basic raw materials, perfumes, disinfectants and medicines are added during the commercial manufacture of soap.

Ans :

Foreign 2009

Detergents do not form precipitate with  $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$  ions which are responsible for hardness of water and hence can be used even in hard water.

137. Write the byproduct obtained during the commercial manufacture of soap.

or

Name the product formed beside soap that is obtained during saponification process.

Ans :

SQP 2010, Foreign 2008

Glycerol.

138. Fermentation of sugar solution with enzymes is being carried out in a vessel at  $20^\circ\text{C}$  to  $30^\circ\text{C}$  in the presence of air. Which organic compound will be produced in this process ?

Ans :

SQP 2009

Acetic acid (Ethanoic acid).

139. Why is common salt added during the preparation of soap from oil ?

Ans :

SQP 2008

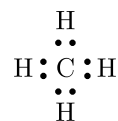
Common salt is added to precipitate out the soap completely from the solution.

140. Which organic acid is present in vinegar ? Write its chemical formula also.

Ans :

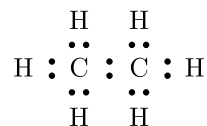
OD 2009

Acetic acid,  $\text{CH}_3 - \text{COOH}$ .



For ethane:

Electron dot formula :

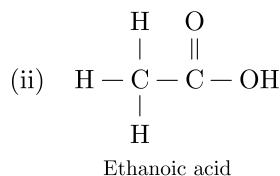
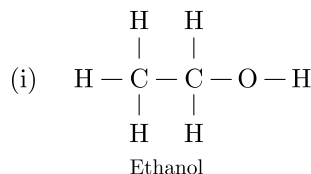


142. (a) Draw the structures for (i) ethanol, (ii) ethanoic acid.  
(b) Why is the conversion of ethanol to ethanoic acid considered an oxidation reaction? Write the oxidising agent used in the reaction involved.

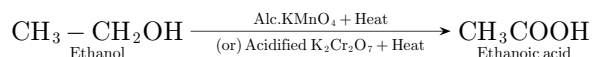
Ans :

SQP 2020, Delhi 2013

- (a) Structures for ethanol and ethanoic acid are as follows:



- (b) Conversion of ethanol to ethanoic acid is considered as an oxidation reaction because oxygen is added to ethanol to convert it to ethanoic acid.



In the above reaction alkaline  $\text{KMnO}_4$  or acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  adds oxygen to ethanol hence they are the oxidising agent used in the reaction involved.

143. What is a homologous series of carbon compounds? Give an example and list its three characteristics.

Ans :

OD 2019

A homologous series is a group of organic compounds having similar structures and similar chemical properties in which the successive compounds differ by  $\text{CH}_2$  group.

141. Write the electron dot structure of methane ( $\text{CH}_4$ ) and ethane ( $\text{C}_2\text{H}_6$ ).

Ans :

SQP 2021

For methane :

Electron dot formula :

## TWO MARKS QUESTIONS

- (iii) Name the process used to prepare soap commercially.  
 (iv) What is the advantage of soaps over detergents?

Ans :

- (i) Soaps molecules react with magnesium/calcium ions present in hard water to form insoluble substance called scum.  
 (ii) Micelles  
 (iii) Saponification on heating with sodium hydroxide, which is an alkali, the vegetable oil or fat (which are ester) converts base to alcohol and sodium salt of carboxylic acids (called soaps).  
 (iv) Soaps are 100% biodegradable means they can be decomposed completely by the bacteria present in water. Hence, soaps do not cause any water pollution.

309. Some organic compound and its chemical formula is shown in the table :

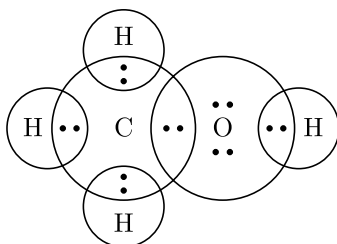
Organic compound	Chemical formula
Methanol	CH <sub>3</sub> OH
Ethanol	C <sub>2</sub> H <sub>5</sub> OH
Methanoic acid	HCOOH
Ethanoic acid	CH <sub>3</sub> COOH
Methanal	HCHO

Answer the following question which is based on the above table.

- (i) Draw the electron dot structure of methanol.  
 (ii) Which of the above compound does not liberate hydrogen gas on reaction with sodium metal?  
 (iii) Name the compound which gives brisk effervescence on reaction with baking soda.  
 (iv) Which chemical from the above list is added to ethanol to make it unfit for drinking purposes ?

Ans :

(i)



- (ii) Methanal, HCHO  
 (iii) Methanoic acid, HCOOH and Ethanoic acid, CH<sub>3</sub>COOH  
 (iv) Methanol

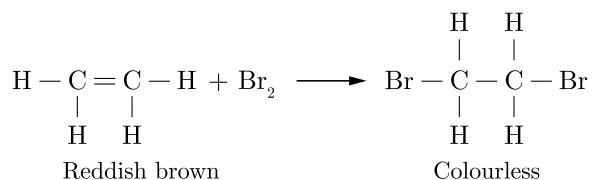
310. Read the following case based passage and answer the questions given after passage.

Organic compound	Bromine	Sodium	Sodium hydrogen carbonate
Ethene	Brown colour disappears	Negative	Negative
Ethanol	Negative	Positive	Negative
Ethanoic acid	Negative	Positive	Positive

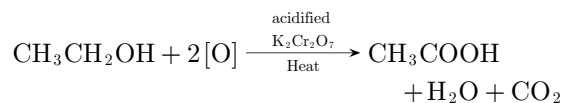
- (i) Why does ethene decolourizes bromine ?  
 (ii) Write the chemical equation for the reaction between ethanol and sodium.  
 (iii) Complete the equation:  
 $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \longrightarrow$   
 (iv) How do you convert ethanol into ethanoic acid ? What is this reaction called ?

Ans :

- (i) Ethene is unsaturated hydrocarbon. It decolorizes bromine due to addition of bromine to the double bond.



- (ii)  $2\text{CH}_3\text{CH}_2\text{OH} + 2\text{Na} \longrightarrow 2\text{CH}_3\text{CH}_2\text{ONa} + \text{H}_2$   
 (iii)  $\text{CH}_3\text{CH}_2\text{OH} + \text{NaHCO}_3 \longrightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O} + \text{CO}_2$   
 (iv) By oxidation of ethanol using acidified K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and heat.

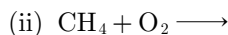
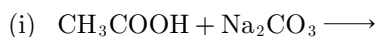


The reaction is called oxidation.

311. Study the following table and answer the questions given :

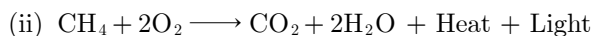
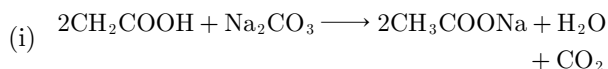
Compound	Homologous series
Methane, CH <sub>4</sub>	Alkane
Ethane, C <sub>2</sub> H <sub>6</sub>	Alkane

151. Complete the following chemical equations :

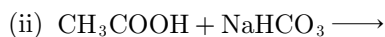


Ans :

Foreign 2016

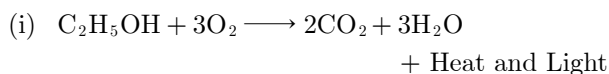


152. Complete the following chemical equations :



Ans :

SCP 2017



153. Why does carbon exhibit tetra covalency ?

Ans :

Comp. 2017

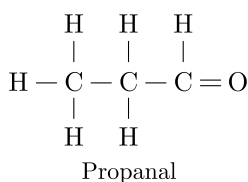
Carbon has four valence electrons. So, valency of carbon is four. Carbon cannot lose four electrons to form  $\text{C}^{+4}$  ions because it requires a large quantity of energy which is impossible to supply to the atoms. And neither carbon atoms have enough energy to gain 4 electrons to form  $\text{C}^{-4}$  ion. This is why carbon can only exhibit covalency with four valence electrons. So, carbon exhibits tetra covalency.

154. An aldehyde as well as a ketone can be represented by the same molecular formula say  $\text{C}_3\text{H}_6\text{O}$ . Write their structure and name them. State the relation between the two in the language of science.

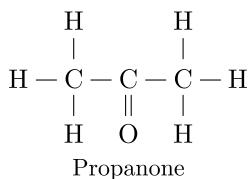
Ans :

OD 2017, Delhi 2014

Aldehyde :



Ketone :

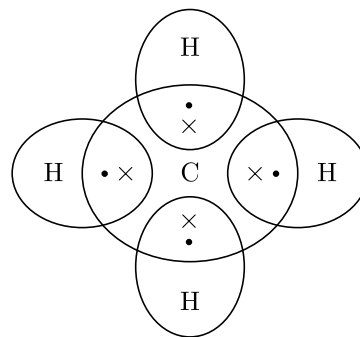


155. Explain with the help of tetravalency of carbon, the bond formation in the  $\text{CH}_4$  molecule.

Ans :

OD 2016

$\text{CH}_4$  molecule is formed by the sharing of one electron each of carbon atom with the electrons of H-atoms. Here H-atoms acquire stability by having two electrons in their outermost shell by sharing of one electron each from H-atom and C-atom. Due to formation of 4 C – H bonds, there are 8 electrons in the outermost shell of carbon and it becomes more stable.



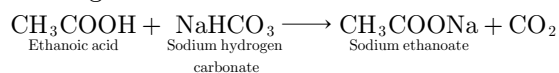
156. A student adds a spoon full of powdered sodium hydrogen carbonate to a flask containing ethanoic acid. List two main observations, he must note in his note book, about the reaction that takes places. Also write chemical equation for the reaction.

Ans :

Delhi 2017

**Observations :**

- A colourless and odourless gas evolves with a brisk effervescence.
- The gas extinguishes the burning splinter that is brought near it.



+  $\text{H}_2\text{O}$

**Relation :** These compounds show isomerism.

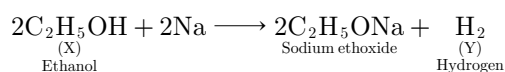
157. On dropping a small piece of sodium in a test tube containing carbon compounds  $X$  with molecular formula,  $\text{C}_2\text{H}_6\text{O}$ , a brisk effervescence is observed and a gas  $Y$  is produced. On burning a burning splinter at the mouth of the test tube the gas evolved burns with a pop sound. Identify  $X$  and  $Y$ . Also write the chemical equation for the reaction. Write the name and structure of the product formed when you heat  $X$  with excess conc. sulphuric acid.

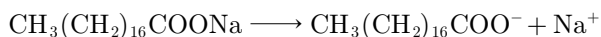
Ans :

Delhi 2016

$X$  is Ethanol ( $\text{C}_2\text{H}_5\text{OH}$ )

$Y$  is Hydrogen ( $\text{H}_2$ )

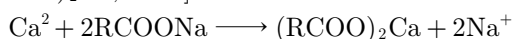




The carboxylate anion, active ion of soap molecule, has long hydrocarbon chain (tail) which is hydrophobic (water-hating) and charged  $-\text{COO}^-$  is head of the chain which is hydrophilic (water-loving) in nature. When a soap is dissolved in water, these chains form micelle. When a soap is applied to the wet cloth or body, the oily or greasy stains with embedded dirt get trapped into the interior of the micelle and are removed.

## 14.2 Soap and Hard Water

A soap ( $\text{RCOONa}$ ) does not form lather readily with hard water as the soap first reacts with  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions to form insoluble ppt. of Ca and Mg salts of fatty acids which float as white layer  $[(\text{RCOO})_2\text{Ca}, \text{scum}]$  over water.



## 14.3 Detergents

It is a cleansing substance that acts similarly to a soap but is. It made from chemical compounds other than oils and fats. A common detergent is sodium *n*-dodecyl sulphate [sodium lauryl sulphate (SLS)]. Since detergents do not form scum with hard water, they work well even in hard water to form lather readily.

## OBJECTIVE QUESTIONS

### 1. Carbon compounds :

- are good conductors of electricity.
- are bad conductors of electricity.
- have strong forces of attraction between their molecules.
- have weak forces of attraction between their molecules.

The correct statements are :

- (i) and (ii)
- (ii) and (iii)
- (ii) and (iv)
- (i) and (iii)

Ans :

OD 2024

Carbon compounds are bad conductors of electricity as they contain covalent bonds. Force of attraction between their molecules are not very strong and they do not conduct electricity in solid or molten state or in solution.

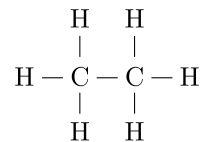
Thus (c) is correct option.

### 2. Ethane, with the molecular formula $\text{C}_2\text{H}_6$ has

- 6 covalent bonds
- 7 covalent bonds
- 8 covalent bonds
- 9 covalent bonds.

Ans :

Delhi 2013



(b) 7 covalent bonds

### 3. Butanone is a four-carbon compound with the functional group

- carboxylic acid
- aldehyde
- ketone
- alcohol

Ans :

Foreign 2013

(c) ketone

### 4. While cooking, if the bottom of the vessel is getting blackened on the outside, it means that

- the food is not cooked completely.
- the fuel is not burning completely
- the fuel is wet
- the fuel is burning completely.

Ans :

OD 2011

(b) the fuel is not burning completely

### 1. Carbon exists in the atmosphere in the form of

- Carbon monoxide only
- Carbon monoxide in traces and carbon dioxide
- Carbon dioxide only
- Coal

Ans :

OD 2017

(b) Carbon monoxide in traces and carbon dioxide

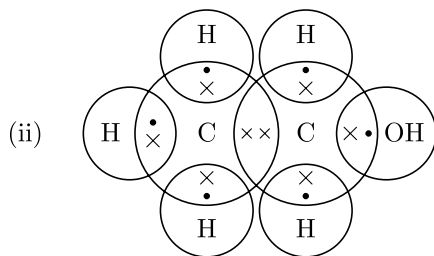
### 2. Which of the following statements are usually correct for carbon compounds? These

- are good conductors of electricity
- are poor conductors of electricity
- have strong forces of attraction between their molecules
- do not have strong forces of attraction between their molecules.

- (i) and (iii)
- (ii) and (iii)
- (i) and (iv)
- (ii) and (iv)

Ans :

(d) (ii) and (iv)

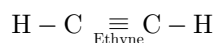


165. Explain the term alkynes with example.

Ans :

Delhi 2016, Foreign 2013

A compound having general formula  $C_nH_{2n-2}$  ( $n = 2, 3, 4, \dots$ ) is called alkyne. The first member of alkyne, ethyne, has triple bond between both atoms of carbon.



166. Give reasons for the following :

Carbon only forms covalent compounds.

Ans :

Foreign 2017

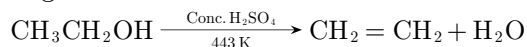
Carbon can neither lose four electrons as too much of energy is required, nor gain 4 electrons as 6 protons can't hold 10 electrons. Therefore, it can only share electrons. This is the reason why carbon forms covalent compounds only.

167. (a) List two medicinal uses of ethanol.  
 (b) What happens when ethanol is heated with excess of conc.  $H_2SO_4$  at 443 K (Give chemical equation)? What role does conc.  $H_2SO_4$  play in this reaction ?

Ans :

Delhi 2016, Foreign 2014

- (a) (i) In tincture of iodine, and  
 (ii) In cough syrup.  
 (b) When ethanol is heated with excess of conc.  $H_2SO_4$  at 443 K, dehydration of ethanol occurs to give ethene.



In this reaction, conc.  $H_2SO_4$  acts as a dehydrating agent.

168. Why are alkanes called paraffins ?

Ans :

OD 2015

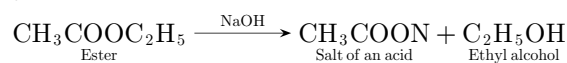
Alkanes are the compounds having general formula  $C_nH_{2n+2}$ . There is no double or triple bond between any two carbon atoms. All valency of carbon is satisfied by single covalent bond. So, it is less reactive. This is why alkanes are called paraffins.

169. (a) What is saponification ?  
 (b) Write differences between soaps and detergents under the following heads :  
 (i) Chemical composition.  
 (ii) Action with hard water.

Ans :

OD 2013

- (a) In the saponification reaction, an ester reacts with an alkali to form salt of an acid and alcohol.



- (b) Differences between soap and detergent :  
 (i) Chemical composition : Soaps are sodium or potassium salts of long chain carboxylic acid.  
 Detergents are ammonium or sulphonate salts.  
 (ii) Action with hard water :  
 Soaps form insoluble substances called scum with hard water.  
 Detergents are effective in hard water because they do not form insoluble precipitate.

170. Give the IUPAC names of

- (a)  $CH_3 - CH_2 - Br$   
 (a)  $CH_3 - CH_2 - CH_2 - CH_2 - C \equiv CH$

Ans :

Delhi 2016, Delhi 2013

- (a) The IUPAC name of  $CH_3 - CH_2 - Br$  is Bromo ethane.  
 (a) The IUPAC name of  $CH_3 - CH_2 - CH_2 - CH_2 - C \equiv CH$  is Hexa-1-yne.

171. Write the properties of ethanoic acid.

Ans :

Delhi 2014, Delhi 2013

- (a) Ethanoic acid is a colourless, pungent smelling liquid.  
 (b) Its boiling point is 391 K.  
 (c) It is miscible in water in all proportions.

172. What are isomers ? Draw the structures of two isomers of butane ( $C_4H_{10}$ ).

Ans :

Foreign 2015

Isomers : Organic compounds having same molecular formula but different structural arrangement of atoms in their molecules are called as isomers.

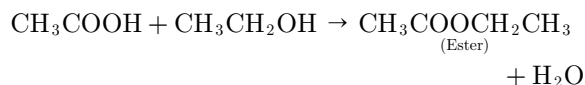
Two isomers of butane are :



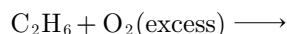
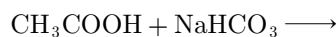
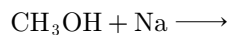
with each other by covalent bonds to form as chain, is called catenation.

No other element except carbon possesses self-linking property to form large compounds as chains. So, they do not exhibit the properties of catenation to the extent seen in carbon compounds.

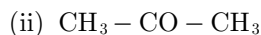
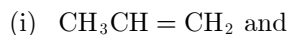
- (b) Ester is formed by the reaction of an organic acid and an alcohol.



278. (a) Write balanced equations for the following reactions :

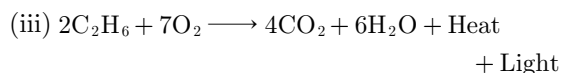
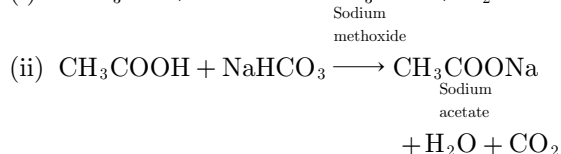


- (b) Write the formula and name of the next homologue of :

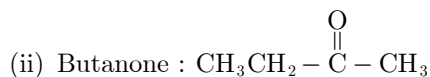


Ans :

OD 2014

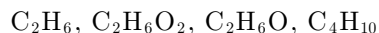


- (b) (i) Butene :  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$



279. (a) What is a catalyst ? Write the chemical equation to represent the hydrogenation of ethene.

- (b) Which of the following compounds belong to the same homologous series ?

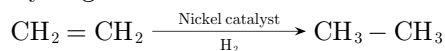


Ans :

Delhi 2015, Foreign 2011

- (a) Catalyst is a substance that causes a reaction to occur or proceed at a different rate without the catalyst itself being affected.

Hydrogenation of ethene :



- (b)  $\text{C}_2\text{H}_6$  and  $\text{C}_4\text{H}_{10}$ .

280. (a) Write chemical equations for the following :

(i) Conversion of ethanol to ethene.

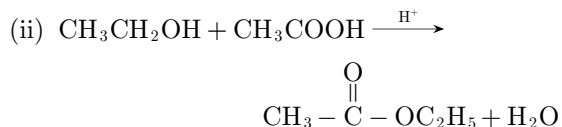
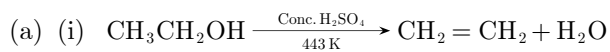
(ii) Reaction of ethanol with ethanoic acid in presence of conc. sulphuric acid.

(iii) Reaction of ethanol with sodium metal.

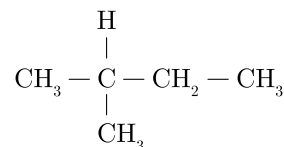
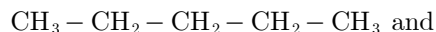
- (b) What are isomers? Write any two possible structures for the formula  $\text{C}_5\text{H}_{12}$ .

Ans :

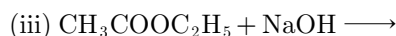
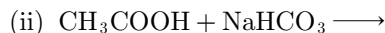
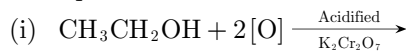
Delhi 2014



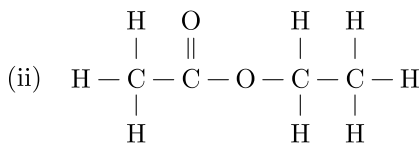
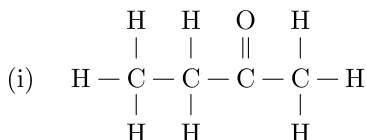
- (b) Different compounds that are represented by same molecular formula but exhibit different structural formulae, are called isomers.



281. (a) Complete the following reactions and name the main product formed in each case :



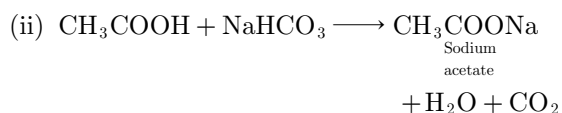
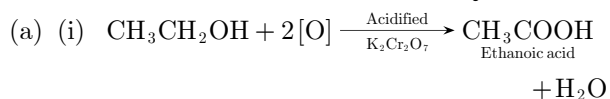
- (b) Write the names of the following compounds :



State the functional group present in each compound.

Ans :

Foreign 2015, Delhi 2012



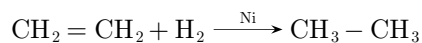
**Ans :**

Foreign 2015, Delhi 2013

- (a) Replacement of an atom or group from an organic compound under suitable condition is called as substitution reaction.



- (b) Addition of simple molecules to unsaturated compounds to get saturated compounds is called as addition reaction.



- (c) Reaction in which oxygen is added or hydrogen is removed from an organic compound using suitable oxidizing agent is called as oxidation' reaction.



- 181.** (a) On dropping a small piece of sodium into an organic compound *A* with molecular formula  $\text{C}_2\text{H}_6\text{O}$  in a test tube a brisk effervescence is observed. On bringing a burning splinter near the mouth of the test tube, the gas evolved burns with a pop sound. Identify *A* and write the chemical equation.
- (b) What will happen when you heat the organic compound *A* at 443 K with excess of concentrated sulphuric acid ?

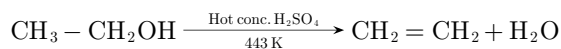
**Ans :**

Foreign 2014, Delhi 2013

- (a) *A* is ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ).



- (b) When ethanol is heated at 443 K with excess of conc.  $\text{H}_2\text{SO}_4$ , it gives ethene and water.



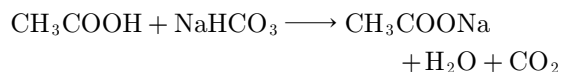
- 182.** Name the main product formed when :

- (a) Ethanoic acid is treated with sodium bicarbonate.
- (b) Ethanol is heated with alkaline  $\text{KMnO}_4$  solution.
- (c) Ethyl ethanoate is treated with  $\text{NaOH}$  solution.
- Also write the chemical equations for each of the above reactions.

**Ans :**

Foreign 2015

- (a) When ethanoic acid is treated with sodium bicarbonate, evolution of  $\text{CO}_2$  takes place.



- (b) When ethanol is heated with alkaline  $\text{KMnO}_4$  solution, it gets oxidized to form ethanoic acid.

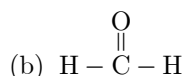


- (c) When ethyl ethanoate is treated with  $\text{NaOH}$  solution, it undergoes saponification.



- 183.** Define the term 'functional group'. Identify the functional groups present in the following compounds

- (a)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$

**Ans :**

Comp 2014

Functional group : It may be defined as an atom or  $+\text{CO}_2 \uparrow + \text{H}_2\text{O}$

- (b)  $2\text{C}_2\text{H}_5\text{OH} + 2\text{Na} \longrightarrow 2\text{C}_2\text{H}_5\text{ONa} + \text{H}_2 \uparrow$

- (c)  $\text{CH}_4\text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl}$

- 184.** What is meant by fermentation? How is vinegar prepared ?

**Ans :**

OD 2015

Vinegar is prepared by the oxidation of ethanol in air, in the presence of acetobacter enzyme.

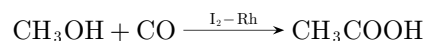


- 185.** How is ethanoic acid prepared commercially ?

**Ans :**

OD 2014

Ethanoic acid is prepared by the reaction between methanol and carbon monoxide in the presence of iodine-rhodium as catalysts.



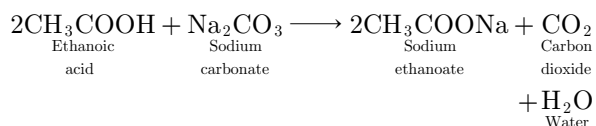
- 186.** What happens when ethanoic acid reacts with

- (a) Sodium carbonate,
- (b) Sodium hydroxide ?

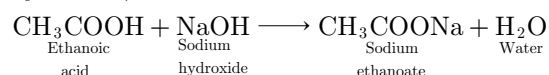
**Ans :**

Delhi 2015

- (a) When ethanoic acid reacts with sodium carbonate, it forms sodium ethanoate, water and carbon dioxide.



- (b) When ethanoic acid reacts with sodium hydroxide, it forms sodium ethanoate and water.



118. Name the enzyme which converts glucose into ethanol.

Ans :

Comp. 2011

Zymase.

119. Name the functional group present in propanal ( $C_3H_6O$ ).

Ans :

OD 2011

Aldehyde group.

120. Name the enzymes present in yeast.

Ans :

OD 2010

Invertase and zymase.

121. Name the products obtained on complete combustion of ethanol.

Ans :

Delhi 2013, Comp 2010

The products obtained on complete combustion of ethanol are carbon dioxide and water along with the release of heat and light.

122. "Saturated hydrocarbons burn with a blue flame while unsaturated hydrocarbons burn with a sooty flame." Why ?

Ans :

Delhi 2010

Unsaturated hydrocarbons burn with a sooty flame because of incomplete combustion of carbon particles. When saturated hydrocarbons are burnt in the sufficient supply of  $O_2$  then they burn completely producing a clean blue flame.

123. Which product is formed when ethanol is heated with dilute solution of alkaline  $KMnO_4$  ?

Ans :

Foreign 2011

Ethanoic acid.

124. Write one use of vinegar.

Ans :

Delhi 2010

Vinegar is used for preserving foods like sausages, pickles etc.

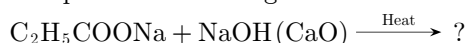
125. What is soda lime ?

Ans :

OD 2011, Delhi 2008

A mixture containing 3 parts of  $NaOH$  and 1 part of  $CaO$  is called soda lime.

126. Complete the following reaction :



Ans :

Comp 2010

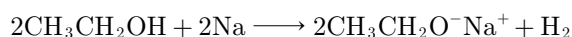


127. Complete the following chemical reaction :



Ans :

OD 2011



128. A compound has molecular formula  $C_2H_6O$ . It is usable as a fuel. Identify the compound.

Ans :

SQP 2008

Compound with molecular formula  $C_2H_6O$  which can be used as fuel is ethanol.

129. Name the gas evolved when a piece of sodium is dropped into ethanol.

Ans :

Delhi 2011

Hydrogen.

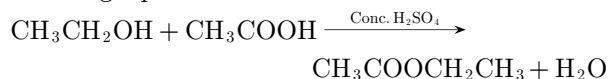
130. What happens when soap solution in a test tube is shaken with (i) soft water, (ii) hard water ?

Ans :

Foreign 2010

When soap solution is shaken with hard water, no lather is formed whereas, a lot of lather is formed with soft water.

131. Name the type of reaction represented by the following equation :



Ans :

Foreign 2011

Esterification reaction.

132. How ethanoic acid got its name as glacial acetic acid ?

Ans :

Comp. 2010

The melting point of ethanoic acid is 290 K. Hence, it often freezes during winter and forms ice like flakes.

133. Which type of synthetic detergents are biodegradable?

Ans :

OD 2009

Synthetic detergents having linear alkyl chains are biodegradable.

134. Name two fatty acids that are present in soap.

Ans :

SQP 2012, OD 2008

Stearic acid and palmitic acid.

135. Name the raw materials required for making soap.

Ans :

Delhi 2009

Vegetable oil, sodium hydroxide and common salt.

**Ans :**

Foreign 2013

Synthetic detergents made with linear hydrocarbons are easily degraded by the microorganisms present in water bodies like lakes, rivers etc. This prevents water pollution and hence are more acceptable environmentally.

- 195.** Write chemical equations for the two steps involved in preparing ethanol by the fermentation of molasses.

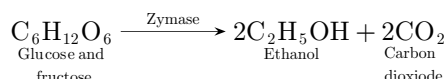
**Ans :**

Delhi 2012, OD 2011

- (a) The slow decomposition of organic matter into simpler substances in the presence of enzymes is known as fermentation.
- (b) In this process, the sugar from molasses is first converted to glucose and fructose in the presence of an enzyme, invertase.



Glucose and fructose are both converted to ethanol and carbon dioxide in the presence of another enzyme, zymase.

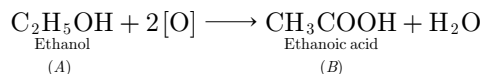


- 196.** An organic compound *A* is a constituent of an antifreeze. This compound on heating with oxygen forms another compound *B* which has a molecular formula  $\text{C}_2\text{H}_4\text{O}_2$ . Identify the compounds *A* and *B*. Write the chemical equation of the reaction that takes place to form the compound *B*.

**Ans :**

SQP 2013

Compound *A* can be ethanol which is used as an antifreeze. It will give ethanoic acid on oxidation which has molecular formula  $\text{C}_2\text{H}_4\text{O}_2$ . The reaction involved in oxidation is written as follows :

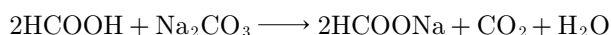


- 197.** An organic compound *A* of molecular formula  $\text{CH}_2\text{O}_2$  turns blue litmus red and gives brisk effervescence with  $\text{Na}_2\text{CO}_3$ . Identify *A* and give the chemical reaction.

**Ans :**

Comp. 2013

Since compound *A* turns blue litmus red, it means it is an acid. The possible acid with the formula  $\text{CH}_2\text{O}_2$  is methanoic acid. It gives brisk effervescence on reaction with  $\text{Na}_2\text{CO}_3$  due to evolution of carbon dioxide.



- 198.** Differentiate between an alcohol and carboxylic acid chemically.

**Ans :**

OD 2013

Test	Alcohol	Carboxylic acid
(a) Litmus test	No change in colour of litmus solution.	Turns blue litmus red.
(b) Sodium bicarbonate	No brisk effervescence	Brisk effervescence due to the formation of $\text{CO}_2$

- 199.** What happens when an ester is treated with an alkali solution ?

**Ans :**

SQP 2012, OD 2010

When an ester is treated with an alkali solution like sodium hydroxide, the ester breaks down to form the sodium salt of carboxylic acid and the parent alcohol. For example,



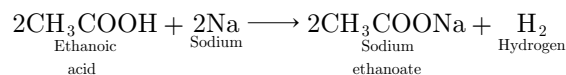
This reaction is called hydrolysis of ester.

- 200.** Write two tests to demonstrate that acetic acid ( $\text{CH}_3\text{COOH}$ ) is acidic in nature.

**Ans :**

Delhi 2013

- (a) Acetic acid turns blue litmus red.
- (b) Acetic acid reacts with metals (Na, Mg, Al) to form metal ethanoates and hydrogen.



- 201.** Detergents have many advantages over soaps but are still quite harmful. Explain.

**Ans :**

OD 2012, Delhi 2009

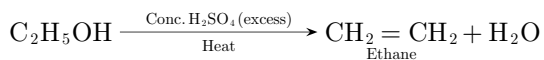
Synthetic detergent is a better cleansing agent than soap. There is one major disadvantage that synthetic detergent is non-biodegradable. The use of detergents causes pollution of water.

- 202.** What happens when an aqueous solution of potassium permanganate in NaOH solution is added to warm ethanol ?

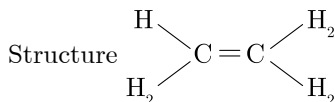
**Ans :**

Foreign 2013

When an aqueous solution of potassium permanganate in NaOH solution is added to warm ethanol, the purple colour due to permanganate gets de-colourized. When all the alcohol gets consumed, the reaction stops and the purple colour persists.



Name of the product is ethene

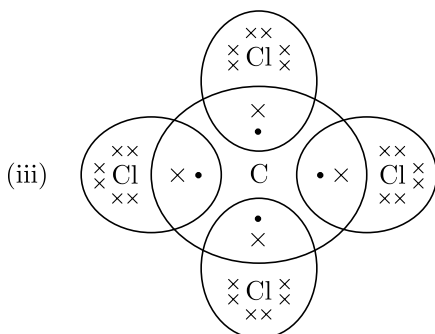
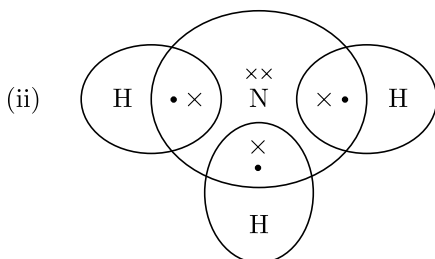
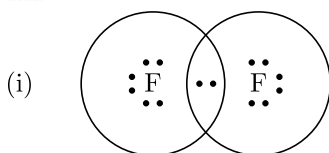


158. Write electronic dot structures of

- (a)  $\text{F}_2$   
(b)  $\text{NH}_3$   
(c)  $\text{CCl}_4$

Ans :

Foreign 2017, SQP 2014

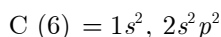


159. Mention the position of carbon on the basis of its electronic configuration and comment on the nature of compound formed by carbon :

Ans :

Foreign 2016

C has atomic no. 6.



As it has four valence electrons, as element of group 14 and period 2, it can form only covalent compounds.

To gain or lose 4 electrons is impossible for an element on the basis of concept of energy change during bond formation. So, carbon always forms covalent compound by sharing its valence electrons.

160. Write the names of following compounds :

- (a)  $\text{CH}_3\text{CH}_2 - \text{C} \equiv \text{CH}$   
(b)  $\text{CH}_3\text{CH}_2\text{OH}$   
(c)  $\text{CH}_3\text{COCH}_3$

Ans :

Comp 2017

- (a) Butyne,  
(b) Ethanol,  
(c) Propanone.

161. What are soaps chemically ? How do they differ from synthetic detergents ?

Ans :

Delhi 2016, Comp 2015

Chemically soap is sodium or potassium salt of fatty acid.

Detergents are ammonium or sulphonate salts of long chain carboxylic acids.

162. Give reasons for the following : Unsaturated hydrocarbons show addition reaction but not saturated hydrocarbons.

Ans :

OD 2017

Unsaturated hydrocarbons have either double or triple bonds, one or two of which break easily. It is weak to form single covalent bonds. In comparison, saturated hydrocarbons have only single bonds which are strong. This is why unsaturated hydrocarbons show addition reaction but not saturated hydrocarbons.

163. How is it that we can use detergents for washing clothes even when the water is hard, but not soaps? What change has been made in the composition of detergents to make them biodegradable ?

Ans :

OD 2016

Detergents are sodium salts of sulphonic acids. They can be used for washing clothes even when water is hard because their calcium and magnesium salts are soluble in water.

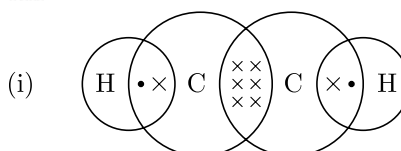
Soaps are sodium salts of fatty acids. They react with  $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$  ions to form salts which are insoluble in water and form scum.

164. Draw the electron dot structures of :

- (a)  $\text{C}_2\text{H}_2$ ,  
(b)  $\text{C}_2\text{H}_5\text{OH}$

Ans :

Delhi 2017



beaker. Add to it 100 mL of 20% solution of sodium hydroxide. Heat it for about 45 minutes with constant stirring. The mixture becomes thick and the oil and water layers merge into each other. Then add about 20 g of common salt and stir the mixture. A pale yellow solid floats on the surface. It is separated and cooled. It forms a cake, which is soap.

- 213.** What is the disadvantage of synthetic detergent over soap ?

Ans :

OD 2010

The disadvantage of synthetic detergent over soap is that some of the synthetic detergents are non-biodegradable. Hence, the microorganisms present in water bodies cannot decompose them. This results in the water pollution in rivers, lakes etc.

- 214.** In washing powders certain chemicals are added to impart the undermentioned properties. Name the chemicals used for each property :

- keeps the dirt suspended in water.
- removes dirt particles.
- keeps the washing powder dry.
- imparts whiteness.

Ans :

Delhi 2011, OD 2009

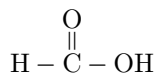
- Carboxy Methyl Cellulose is added to washing powder to keep the dirt suspended in water.
- Sodium carbonate is added to remove the dirt particles.
- Sodium sulphate and sodium silicate are added to keep the washing powder dry.
- Sodium perborate is added to impart whiteness.

- 215.** Write the name and structural formula of simplest organic acid.

Ans :

Delhi 2010, OD 2010, Foreign 2010

Structural formula of the simplest organic acid is



Common name : Formic acid.

IUPAC name : Methanoic acid.

- 216.** An organic compound *P* is a constituent of wine. *P* on reacting with acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  forms another compound *Q*. When a piece of sodium is added to *Q*, a gas *R* evolves which burns with a pop sound. Identify *P*, *Q* and *R* and write the chemical equations of the reactions involved.

Ans :

Foreign 2011

*P*—Ethanol, *Q*—Ethanoic acid, *R*—Hydrogen.



- 217.** What will you observe on adding a 5% alkaline potassium permanganate solution drop by drop to some warm ethanol taken in a test tube? Write the name of the compound formed during the above chemical reaction.

Ans :

Delhi 2010, OD 2008

On adding  $\text{KMnO}_4$ , the pink colour of  $\text{KMnO}_4$  disappears initially because it oxidizes ethanol to ethanoic acid.

Name of the substance formed : Ethanoic acid.

### THREE MARKS QUESTIONS

- 218.** A substance X is used as a building material and is insoluble in water. When it reacts with dil.  $\text{HCl}$ , it produces a gas which turns lime water milky.

- Write the chemical name and formula of 'X'.
- Write chemical equations for the chemical reactions involved in the above statements.

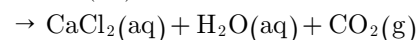
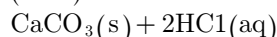
Ans :

OD 2023

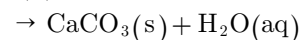
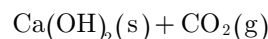
- Substance X is calcium carbonate.

Chemical formula:  $\text{CaCO}_3$

- In the reaction between calcium carbonate and dilute hydrochloric acid ( $\text{HCl}$ ), calcium chloride ( $\text{CaCl}_2$ ), carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ) are produced.

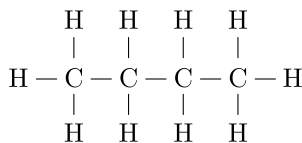


The carbon dioxide evolved reacts with lime water ( $\text{Ca}(\text{OH})_2$ ) to form calcium carbonate and water.

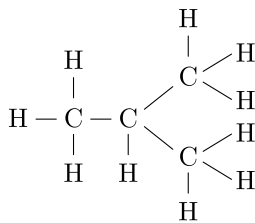


The production of calcium carbonate is responsible for the milky white colour.

- 219.** (i) A compound 'A' with a molecular formula of  $\text{C}_2\text{H}_6\text{O}$  reacts with a base to give salt and water. Identify 'A', state its nature and the name of the functional group it possesses. Write chemical equation for the reaction involved.
- (ii) When the above stated compound 'A' reacts with another compound 'B' having molecular formula  $\text{C}_2\text{H}_6\text{O}$  in the presence of an acid, a



Normal butane



ISO butane

173. (a) Soaps cannot be used with hard water. Why ?  
 (b) Give the chemical composition of detergents.  
 (c) Give one advantage of detergents over soaps.

Ans :

SQP 2014

- (a) Hard water contains calcium and magnesium salts, which react with soap and forms scum (insoluble substance).  
 (b) Detergents are ammonium or sulphonate salts.  
 (c) Detergents do not form insoluble precipitate with calcium and magnesium ions in hard water. Thus they remain effective in hard water.

174. What happens when ethene reacts with water in the presence of sulphuric acid ? Give appropriate chemical equation and name the compound so obtained.

or

How is ethanol prepared from ethene ?

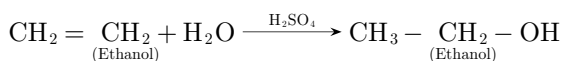
or

Write the chemical equation representing the preparation reaction of ethanol from ethene.

Ans :

Delhi 2013, SQP 2011

Ethanol is obtained when ethene reacts with water in presence of sulphuric acid.



175. What are the advantages of synthetic detergent over soap ?

or

For cleansing action when is a detergent preferred to a soap ?

Ans :

Comp 2014

- (a) Synthetic detergents can be used for cleaning purpose even in hard water.  
 (b) They have a strong cleansing action.

176. Explain the formation of scum when hard water is treated with soap.

Ans :

OD 2015

Hard water contains calcium and magnesium ions.

These ions combine with soap molecules to form curdy white precipitate of calcium and magnesium salts of soaps which is called scum.

177. (a) Give a chemical test to distinguish between saturated and unsaturated hydrocarbons.  
 (b) Name the products formed when ethanol burns in air.  
 (c) Why is the reaction between methane and chlorine considered a substitution reaction ?

Ans :

Delhi 2014

- (a) For this, few drops of bromine water is added into the sample. If brown colour of bromine disappears quickly then it is unsaturated hydrocarbon, otherwise it is saturated hydrocarbon.  
 (b) Carbon dioxide, water.  
 (c)  $\text{CH}_4 + \text{Cl}_2 \longrightarrow \text{CH}_3\text{Cl} + \text{HCl}$

In the presence of sunlight, chlorine replaces the hydrogen atoms one by one. So, it is called substitution reaction.

178. (a) Write the names of :  
 (i)  $\text{CH}_3 - \text{CH}_2 - \text{CHO}$   
 (ii)  $\text{CH}_3 - \text{CH}_2 - \text{OH}$   
 (b) Name the gas evolved when an alcohol reacts with sodium. Give chemical equation for the reaction involved.  
 (c) Which two of the following compounds belong to same homologous series ?  
 $\text{C}_2\text{H}_6\text{O}$ ,  $\text{C}_2\text{H}_6\text{O}_2$ ,  $\text{C}_2\text{H}_6$ ,  $\text{CH}_4\text{O}$

Ans :

Foreing 2013

- (a) (i) Propanal  
 (ii) Ethanol  
 (b) Hydrogen gas :  
 $2\text{CH}_3\text{CH}_2\text{OH} + 2\text{Na} \longrightarrow 2\text{CH}_3\text{CH}_2\text{ONa} + \text{H}_2$   
 (c)  $\text{C}_2\text{H}_6\text{O}$ ,  $\text{CH}_4\text{O}$ .

179. Complete and balance the following reactions :

- (a)  $\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \longrightarrow \dots + \dots + \dots$   
 (b)  $\text{C}_2\text{H}_5\text{OH} + \text{Na} \longrightarrow \dots + \dots$   
 (c)  $\text{CH}_4\text{Cl}_2 \xrightarrow{\text{Sunlight}} \dots + \dots$

Ans :

Delhi 2014

- (a)  $2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{CH}_3\text{COONa}$

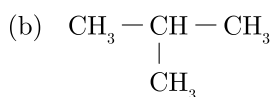
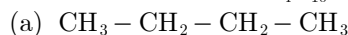
180. Illustrate the following reactions with example :

- (a) Substitution reaction  
 (b) Addition reaction  
 (c) Oxidation reaction



$C_4H_{10}$  belongs to alkane.

Structural Isomers of  $C_4H_{10}$  :



**223.** Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with-

- sodium metal
- hot concentrated sulphuric acid

**Ans :**

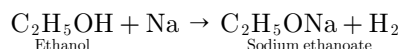
Delhi 2019, Foreign 2015

The name of the ingredient of the alcoholic drink is ethanol. Its formula is  $C_2H_5OH$ .

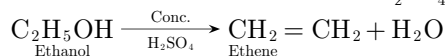
Two uses of ethanol ( $C_2H_5OH$ ) are :

- It is used as a solvent in various industries.
- It is also used as an antiseptic solution.

(i) Reaction of ethanol with sodium metal



(ii) Reaction of ethanol with conc.  $H_2SO_4$



**224.** What is methane? Draw its electron dot structure. Name the type of bonds formed in this compound. Why are such compounds:

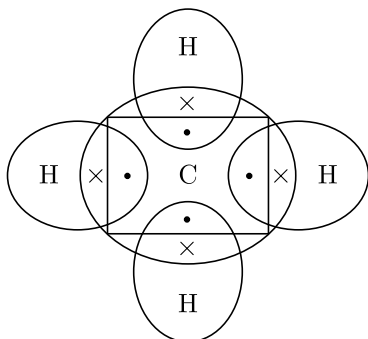
- poor conductors of electricity? and
- have low melting and boiling points? What happens when this compound burns in oxygen?

**Ans :**

2019

Methane is a hydrocarbon formed by the combination of carbon with hydrogen. Its molecular formula is  $CH_4$ . It is a main green house gas. The type of bond formed in methane is covalent bond.

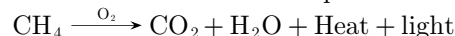
Electron dot structure of methane ( $CH_4$ ) :



(i) Covalent compounds are poor conductors of electricity because it has no free electrons to conduct electricity. Moreover this compound is formed by sharing of electrons. So no electron is available for the conduction.

(ii) They have weak forces of attraction between them so less energy is required to break the force of binding. Thus they have low melting and boiling points.

When this compound burns in oxygen, combustion reaction takes place.



**225.** (a) Why are most carbon compounds poor conductors of electricity?

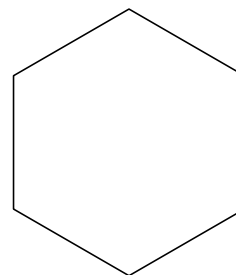
(b) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

**Ans :**

OD 2018

(a) Electricity is conducted by moving electrons. But carbon forms covalent bonds by sharing of electrons. It does not have free electrons.

(b) Cyclohexane is a saturated compound in which carbon atoms are arranged in a ring.



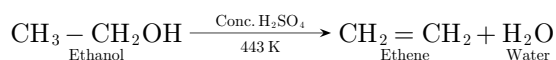
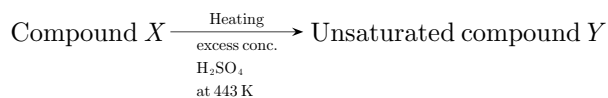
Cyclohexane

There are 6 single bonds present in this compound.

**226.** A compound 'X' on heating with excess conc. sulphuric acid at 443 K gives an unsaturated compound 'Y'. 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction of formation of 'Y' and also write the role of sulphuric acid in the reaction.

**Ans :**

Delhi 2018, Foreign 2016



187. What happens when ethanol is treated with chromic anhydride ( $\text{CrO}_3$ ) ?

or

Give any one chemical equation for the oxidation of ethanol.

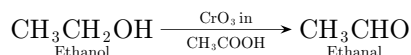
or

Name the product obtained when ethanol is oxidised by chromic anhydride.

Ans :

Delhi 2014

When ethanol is treated with chromic anhydride, it is oxidised to ethanal.



188. What happens when ethanol is treated with alkaline potassium permanganate ?

or

Name the main product formed when ethanol is oxidised by an alkaline solution of  $\text{KMnO}_4$ .

Ans :

Foreign 2015, Delhi 201

It gets oxidized into ethanoic acid.



189. Write three uses of acetic acid.

Ans :

OD 2014

- It is used in making synthetic vinegar.
- It is used as a reagent in chemical industry.
- It is used for making white lead  $[\text{2PbCO}_3 \cdot \text{Pb(OH)}_2]$

190. An organic compound A having molecular formula  $\text{C}_2\text{H}_4\text{O}_2$  reacts with sodium metal and evolves a gas B which readily catches fire. A also reacts with ethanol in the presence of concentrated sulphuric acid to form sweet smelling substance C used in making perfumes.

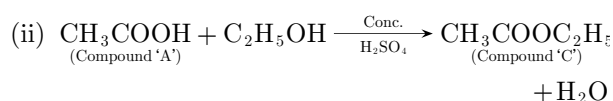
- Identify the compounds A, B and C.
- Write balanced chemical equations to represent the conversion of :
  - compound A into compound B.
  - compound A into compound C.

Ans :

SQP 2013

- Compound A is ethanoic acid ( $\text{CH}_3\text{COOH}$ ), gas B is hydrogen gas and compound C is ethyl ethanoate ( $\text{CH}_3\text{COOC}_2\text{H}_5$ ).

(b)



191. What happens when sodium acetate (sodium ethanoate) is heated with soda lime ? What is this reaction called ? Why is it called so ?

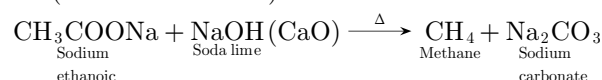
or

Name the main product formed when sodium ethanoate is heated with soda lime.

Ans :

OD 2012, SQP 2011

- Methane is produced on heating sodium acetate (sodium ethanoate) with soda lime.



- This reaction is called decarboxylation because in this reaction a molecule of  $\text{CO}_2$  is removed from a molecule of acid.

192. Write a test to show the presence of alcohol in an organic liquid.

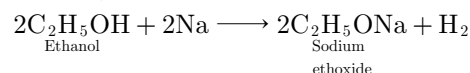
or

Give a chemical test to show/detect the presence of ethanol.

Ans :

Delhi 2013

Add a small piece of sodium metal to the organic liquid to be tested. If effervescence of hydrogen gas is produced, it indicates the presence of alcohol.



The presence of hydrogen can be confirmed by bringing a burning splinter near the mouth of the test tube. It will burn with a pop sound.

193. Give a chemical test to show a saponification reaction.

Ans :

Delhi 2012, Delhi 2010

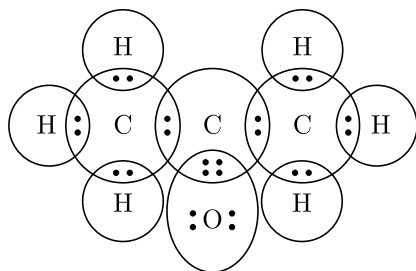
Take 2 mL of ethyl ethanoate and add 4 mL of sodium hydroxide solution in a boiling tube. Two distinct layers are formed as the two liquids are immiscible with one another. Heat the mixture in a water bath at about 330 K for 20 minutes. The ester layer which is immiscible in water decreases. The two immiscible layers become miscible because saponification of ester forms sodium ethanoate and ethanol, both of which are soluble in water.

194. Explain why synthetic detergents made with linear hydrocarbons are environmentally more acceptable.

or

Explain giving reason :

Detergent made up of molecules in which branching is minimum are preferred these days.



Electron dot structures of Propanone

**229.** Two carbon compounds A and B have the molecular formulae  $C_3H_8$  and  $C_3H_6$  respectively.

- (a) Which one of the two is most likely to show addition reaction? Justify your answer.
- (b) Explain with the help of chemical equation, how an addition reaction is useful in vegetable ghee industry.

or

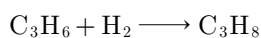
Two carbon compounds A and B have the molecular formulae  $C_3H_8$  and  $C_3H_6$  respectively. Which one of the two is most likely to show addition reaction? Explain with the help of chemical equation, how an addition reaction is useful in industries.

Ans :

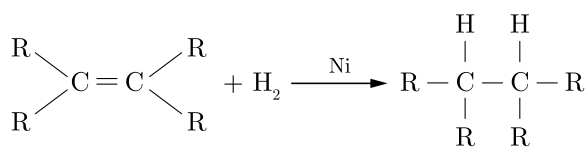
OD 2017

- (a)  $C_3H_6$  (B) will show addition reaction as it is an unsaturated hydrocarbon.

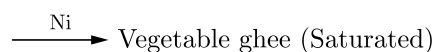
$C_3H_6$  reacts with hydrogen in the presence of a catalyst to give propane on adding one molecule of hydrogen across carbon-carbon double bond.



- (b) Vegetable oil reacts with hydrogen in presence of Ni as a catalyst to form vegetable ghee, which is a saturated compound.



Vegetable oil (Unsaturated) +  $H_2$



a group of atoms present in a molecule which largely determines its chemical properties.

A functional group acts as a reactive site in the molecule.

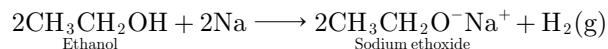
- (a) Alcoholic group
- (b) Aldehyde group.

- 230.** (a) Give chemical tests to detect the presence of (i) Ethanol (ii) Ethanoic acid.
- (b) Why ethanoic acid is called glacial acetic acid?

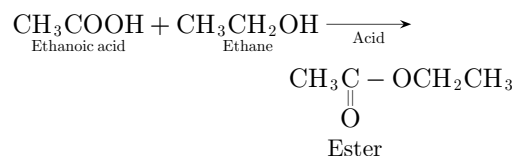
Ans :

Delhi 2017

- (a) (i) Reaction with sodium : Reactive metals like Na liberate hydrogen gas which is combustible.



- (ii) Esterification reaction : Esters are formed by the reaction of an acid and alcohol.



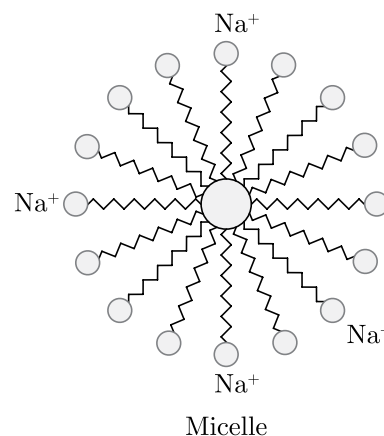
- (b) The melting point of pure ethanoic acid is 290 K and hence it often freezes during wind in cold climates. This gives rise to its name glacial acetic acid.

- 231.** What are micelles? How does the formation of a micelle help to clean the clothes?

Ans :

OD 2016

Soap molecules consist of two parts-one part is hydrophobic and the other part is hydrophilic. The hydrophilic part dissolves in water while hydrophobic part dissolves in hydrocarbons. When soap is dissolved in water, it forms groups of many molecules known as micelles as shown in the diagram. In these groups of molecules, the hydrophobic tails are in the interior of the group and the ionic ends are on the surface of the group.



Micelle

Soap in the form of a micelle is able to clean the dirty cloth as the oily dirt is collected in the center of the micelle. When water is agitated, the dirt sticks to



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sweet smelling compound 'C' is formed.

- (1) Identify 'B' and 'C'.
- (2) State the role of acid in this reaction.
- (3) Write chemical equation for the reaction involved.

Ans :

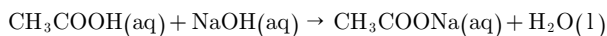
OD 2023

- (i) Compound A- Acetic acid/  $\text{CH}_3\text{COOH}$

Nature: Its nature is acidic.

Name of the functional group:  $\text{COOH}$

Chemical equation :

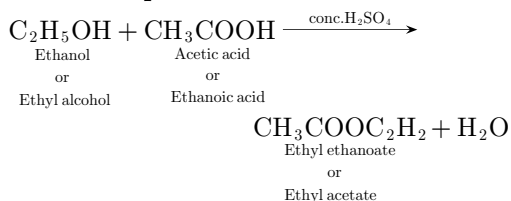


- (ii) (1) B – Ethanol( $\text{C}_2\text{H}_5\text{OH}$ )

C – Ethyl acetate

- (2) **Role of acid :** It is a catalyst which will speed up the process and esterification will proceed speedily and complete on time.

- (3) **Chemical equation :**



220. (i) Name the compound formed when ethanol is heated at 443 K in the presence of conc.  $\text{H}_2\text{SO}_4$  and draw its electron dot structure. State the role of conc.  $\text{H}_2\text{SO}_4$  in this reaction.

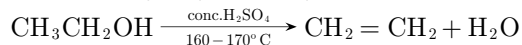
- (ii) What is hydrogenation? Explain it with the help of a chemical equation. State the role of this reaction in industry.

Ans :

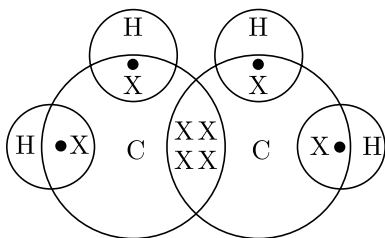
OD 2023

- (i) Ethyl alcohol is converted into Ethene by heating Ethyl alcohol ( $\text{C}_2\text{H}_5\text{OH}$ ) in the presence of concentrated Sulphuric acid ( $\text{H}_2\text{SO}_4$ ).

The chemical reaction is as follows :

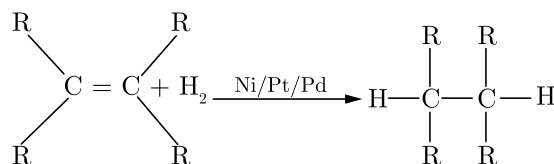


Electron dot structure of Ethene :



**Role of Conc.  $\text{H}_2\text{SO}_4$ :** Concentrated sulphuric acid (conc.  $\text{H}_2\text{SO}_4$ ) acts as a dehydrating agent in the conversion from ethanol to ethane. It helps in removing water molecule.

- (ii) **Hydrogenation:** The process in which unsaturated compounds reacts with hydrogen in the presence of nickel (as a catalyst) to form saturated compounds are called hydrogenation.



**Role in industry:** This reaction is commonly used in the hydrogenation of vegetable oils. Vegetable oils have long unsaturated carbon chains, which are converted into vegetable ghee i.e., saturated fatty acids.

221. "Carbon forms strong bonds with most other elements making the compounds exceptionally stable." Give reason to justify this statement.

Ans :

SQP 2021, Delhi 2014

Carbon has 4 electrons in its outermost shell and requires 4 more electrons to attain a noble gas electronic configuration. It cannot form an ion, as a huge amount of energy is required for the removal of 4 valence electrons. The ion thus formed will have 6 protons and 2 electrons, which will make it highly unstable. Carbon cannot form an ion, as its nucleus with 6 protons cannot 10 electrons due to inter electronic repulsion. So, carbon achieves a noble gas electronic configuration only by sharing its 4 valence electrons with other elements. Thus, it forms compounds mainly by covalent bonds.

The two main reason for carbon forming a large number of compounds are as follows :

- (a) **Catenation :** It is the ability of carbon to form bonds with other carbon atoms; this results in compounds having long branched chains and rings.
- (b) **Tetravalency :** Carbon has 4 valence electrons, so it is capable of forming covalent bonds with 4 other atoms.

222. Which compounds are called (i) alkanes, (ii) alkenes and (iii) alkynes?  $\text{C}_4\text{H}_{10}$  belongs to which of these? Draw two structural isomers of this compound.

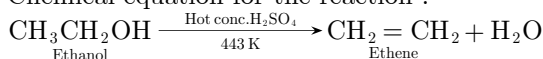
Ans :

OD 2019

- (i) The hydrocarbons in which carbon atoms are connected by only single covalent bonds are called alkanes.
- (ii) The hydrocarbons in which carbon atoms are connected by double bond are called alkene.
- (iii) The hydrocarbons in which carbon atoms are connected by triple bond are called alkynes.

- (ii) When ethanol is heated with excess concentrated sulphuric acid at 443 K, it loses water and gives ethene as a product.

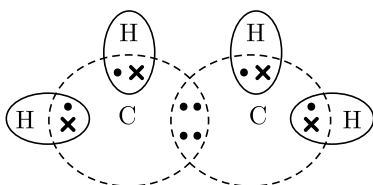
Chemical equation for the reaction :



The concentrated sulphuric acid can be regarded as a dehydrating agent which removes water from ethanol.

- (iii) Hydrocarbon produced in the above reaction is ethene.

Electron dot structure:



- 248.** The formulae of four organic compounds are given below:

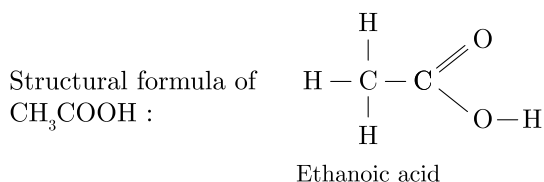


- Which one of these compounds A, B, C or D is a saturated hydrocarbon?
- Identify the organic acid and give its structural formula.
- Which of the above compounds when heated at 443K in the presence of concentrated  $\text{H}_2\text{SO}_4$  forms ethene as the major product? What is the role played by concentrated  $\text{H}_2\text{SO}_4$  in this reaction? Also write the chemical equation involved.
- Give a chemical equation when B and C react with each other in presence of concentrated  $\text{H}_2\text{SO}_4$ . Name the major product formed and mention one of its important use.

**Ans :**

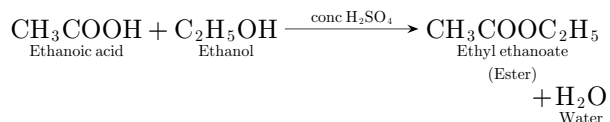
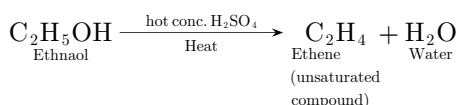
OD 2020

- D is a saturated hydrocarbon.
- B is an organic acid.



- (iii) C is the compound.

Cont.  $\text{H}_2\text{SO}_4$  acts as a dehydrating agent and removes a water molecule from ethanol.



- (iv) Major product is Ester and it is used in making perfumes/flavouring agents.

- 249.** (a) A compound X undergoes addition reaction with  $\text{H}_2$  to form a compound Y having molecular mass  $30 \text{ g mol}^{-1}$ . X decolourize bromine water and burns with a smoky flame. Identify X and Y and write chemical equations of the reactions involved.

- (b) Write the structural formulae of

- Butanone and
- Pentanoic acid.

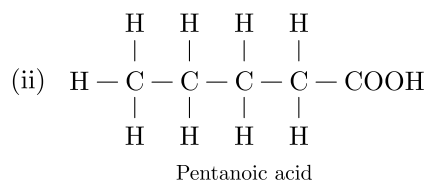
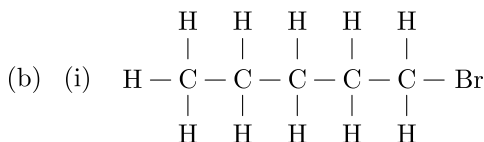
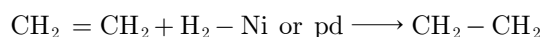
- (c) Would you be able to check if water is hard by using a detergent ? Give reason to justify your answer.

**Ans :**

Comp 2020

- (a) X = Ethene

Y = Ethane



- (c) No we would not be able to check if water is hard by using a detergent. It is because detergents are long ammonium or sulphonate salts of long chain carboxylic acids. The ionic ends of these compounds do not form insoluble precipitates with the calcium and magnesium ions present in hard water. Hardness of water could only be checked with soaps which forms scum on reaction with hard water.

- 250.** (a) Compare soaps and detergents on the basis of their composition and cleansing action in hard water.

- (c) Carbon giving rise to large molecules.  
 (d) Atoms are satisfied by forming single covalent bond.
- (ii) What is catenation?  
 (a) It forms bonds with its bond only.  
 (b) Carbon decreases the molecules.  
 (c) Existence of an element is 2 or more forms.  
 (d) Carbon form bonds with other atoms of carbon.
- (iii) What is a covalent bond ?  
 (a) Compound contains five carbon atoms.  
 (b) Undergo substitution reactions with bond.  
 (c) Electrons shared between atoms to contribute an electron.  
 (d) Molecule adds on to the multiple bonds.
- (iv) What do you mean by isomer ?  
 (a) Atoms have similar rights over shared electrons.  
 (b) Atoms arising due to electron pair sharing.  
 (c) Two or more compounds having the same molecular formula.  
 (d) A three-dimensional structure.

**Ans :**

- (i) (d) Atoms are satisfied by forming single covalent bond.  
 (ii) (d) Carbon form bonds with other atoms of carbon.  
 (iii) (c) Electrons shared between atoms to contribute an electron.  
 (iv) (c) Two or more compounds having the same molecular formula.

- 314.** Study the table related to carbon compounds and answer the questions that follow :

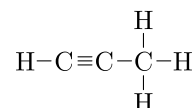
General Formula	$C_nH_{2n}$	$C_nH_{2n-2}$	$C_nH_{2n+2}$
IUPAC name of the homologous series	Alkene	Alkyne	Alkanes
Characteristic bond type	Double bond	Triple bond	Single bond

IUPAC name of the first member of the series	Ethene	Ethyne	Methane
Type of reaction with chlorine	Addition	Addition	Substitution

- (i) Which of the following compound is the next homologous of  $C_4H_8$ ?  
 (a)  $C_5H_{12}$  (b)  $C_5H_{10}$   
 (c)  $C_5H_8$  (d) None of these
- (ii) Write the general formula of Butane and Hexene?
- (iii) Write the IUPAC name of third member of homologous series of alkynes.
- (iv) Which of the following compound will contain triple bond?  
 (a)  $C_4H_{10}$  (b)  $C_2H_4$   
 (c)  $C_2H_6$  (d)  $C_3H_4$

**Ans :**

- (i) (b)  $C_5H_{10}$   
 (ii)  $C_4H_{10}$  ,  $C_6H_{14}$   
 (iii) Propyne ( $CH_3-C \equiv CH$ )  
 (iv) (d)  $C_3H_4$



- 315.** Read the following case based passage and answer the questions given after passage.

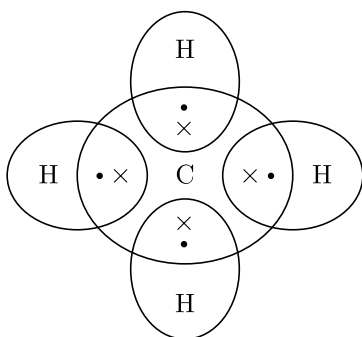
In diamond, each carbon atom is bonded to four other carbon atoms by a single covalent bond. This is why a diamond is a rigid, compact, three dimensional structure and is very hard to break. It is a bad conductor of heat and electricity, as there are no free electrons present in it. On the other hand graphite contains free electrons, it is a good conductor of heat and electricity. Lead pencils contain graphite encased in a wooden covering. A fullerene molecule consists of 60 carbon atoms arranged in pentagons and hexagons, like in a standard football. In carbon compounds, different compounds are formed with different structures with the same molecular formula. These compounds are called isomers and the phenomenon is called 'isomerism'. Carbon compounds in which all the four valencies of carbon atom are satisfied by forming single covalent bonds are known saturated carbon compounds.

252. (a) Draw electron dot structure of methane molecule.
- (b) Identify the functional groups present in the following compounds :
- (i)  $C_2H_6O$
- (ii)  $C_2H_4O$
- (c) A mixture of oxygen and ethyne is burnt for welding. Why do you think a mixture of ethyne and air is not used for welding ?

Ans :

Comp 2019

- (a) Methane  $CH_4$



- (b) (i)  $C_2H_6O$   
 $CH_3 - CH_2 - OH \rightarrow$  Functional group  $-OH$  (alcohol)  
 $CH_3 - O - CH_3 \rightarrow$  Functional group  $-O-$  (ether)
- (ii)  $C_2H_4O$   
 $CH_3 - \overset{\overset{O}{\parallel}}{C} - H \rightarrow$  Functional group  $-CHO$  (Aldehyde)  
 $CH_2 = C \begin{matrix} \nearrow OH \\ \searrow H \end{matrix} \rightarrow$  Enol

- (c) Because ethyne undergoes incomplete combustion in air and gives a sooty flame in oxygen. Ethane gives a clean flame with high temperature ( $3000^\circ C$ ) because of complete combustion and it is not possible to attain such a high temperature with air.

253. (a) Carry out the following conversions giving complete conditions for the reaction to take place in each case :

- (i) Ethanoic acid from Ethanol
- (ii) Ethane from Ethene
- (iii) Ester from Ethanoic acid and ethanol

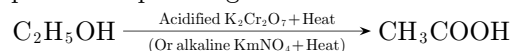
Also state the names given to all the above conversions.

- (b) Detergents are preferred over soaps. Why ? (Give one reason)

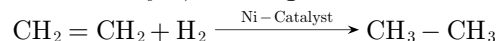
Ans :

SQP 2019, Foreign 2012

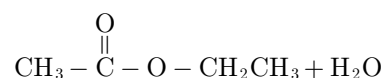
- (a) (i) Ethanoic acid from ethanol by the oxidation of ethanol in presence of oxidising agent like acidified potassium dichromate or alkaline potassium permanganate.



- (ii) On cathodic hydro generation in presence of Nickel catalyst, ethane gives ethane.



- (iii)  $CH_3 - \overset{\overset{O}{\parallel}}{C} - OH + HO - CH_2CH_3 \xrightleftharpoons{H^+}$



- (b) Detergents are preferred over soaps because
- (i) Detergents can be used in hard water whereas soaps fail to do so.
- (ii) Detergents have strong cleansing action.
- (iii) They form more lather than soap.

254. (a) Explain why carbon forms covalent bond? Give two reasons for carbon forming a large number of compounds.

- (b) Explain the formation of ammonia molecule.

Ans :

2019

- (a) Carbon has electronic configuration 2, 4. It could gain four electrons forming  $C^{4-}$  anion or lose 4 electrons to form  $C^{4+}$  cation. Both are not possible due to energy considerations.

Carbon overcomes this problem by sharing electrons and forming covalent compounds.

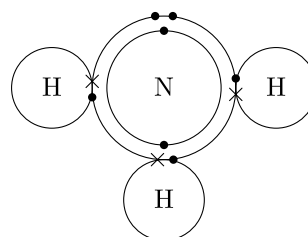
Two reasons for forming large number of compounds are:

- (i) Catenation.
- (ii) Tetravalency.

- (b) Formation of  $NH_3$  molecule :

The electronic configuration of N - 2, 5

The electronic configuration of H - 1



Ammonia molecule

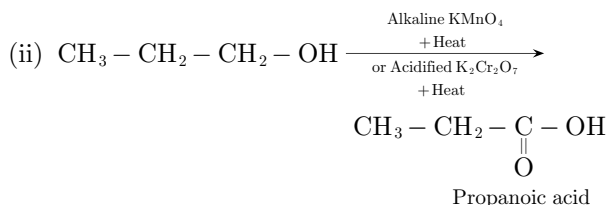
more number of soap molecules. With lot of rinsing, the water washes away the soap molecules and move with dirt attached to them.

- 232.** What is an oxidizing agent ? What happens when an oxidizing agent is added to propanol ? Explain with the help of a chemical equation.

**Ans :**

Delhi 2016

- (i) It is a substance which can give oxygen to other substances.



- (iii) Propanol is oxidised to propanoic acid.

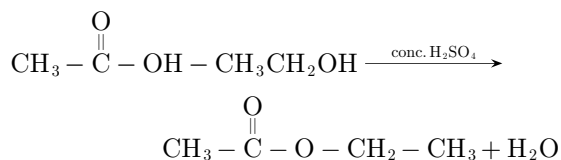
- 233.** When ethanol reacts with ethanoic acid in the presence of conc.  $\text{H}_2\text{SO}_4$ , a substance with fruity smell is produced. Answer the following :

- (i) State the class of compounds to which the fruity smelling compounds belong. Write the chemical equation for the reaction and write the chemical name of the product formed.
- (ii) State the role of conc.  $\text{H}_2\text{SO}_4$ .

**Ans :**

Foreign 2017, Delhi 2014

- (i) Esters



Chemical name of product-ethyl ethanoate.

- (ii) Conc.  $\text{H}_2\text{SO}_4$  acts as a dehydrating agent. It helps in the removal of water formed in the reaction.

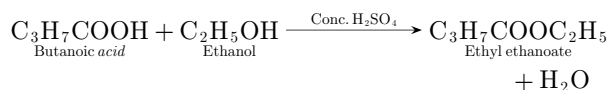
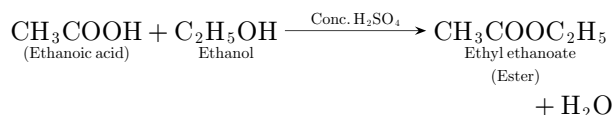
- 234.** When ethanol reacts with ethanoic acid in the presence of conc.  $\text{H}_2\text{SO}_4$ , a substance with fruity smell is produced ? Answer the following :

- (i) State the class of compounds to which the fruity smelling compounds belong. Write the chemical equation for the reaction and write the chemical name of the product formed.
- (ii) State the role of conc.  $\text{H}_2\text{SO}_4$  in this reaction.

**Ans :**

Foreign 2016

- (i) The class of compounds to which the fruits smelling compound belong is Esters.



- (ii) The role of conc.  $\text{H}_2\text{SO}_4$  in this reaction is of a catalyst.

- 235.** (i) Chemical properties of ethanol is different from methyl ethanoate. Justify the statement with proper reason.
- (ii) Methyl ethanoate is used in making perfume. Justify.
- (iii) Ethanol is converted into ethene with excess of hot concentrated  $\text{H}_2\text{SO}_4$ . Justify with the help of chemical equation.

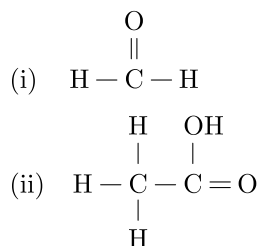
**Ans :**

Foreign 2017

- (i) Ethanol reacts with sodium metal, methyl ethanoate does not. They differ in functional group. Therefore, differ in chemical properties.
- (ii) It is because it has pleasant fruity smell.
- (iii)  $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{conc. HNO}_3} \text{CH}_2 = \text{CH}_2 + \text{H}_2\text{O}$

Ethanol gets dehydrated with conc.  $\text{H}_2\text{SO}_4$  to form ethene and  $\text{H}_2\text{O}$ .

- 236.** (a) Define the term functional group. Identify group present in

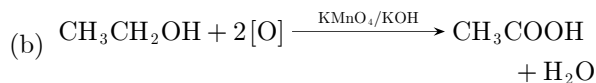


- (b) What happens when 5% alkaline  $\text{KMnO}_4$  solution is added drop by drop to warm ethanol taken in a test tube ? State the role of alkaline  $\text{KMnO}_4$  solution in this reaction.

**Ans :**

SQP 2016, Delhi 2011

- (a) It is an atom or group of atoms or reactive part of compound which largely determine the chemical properties of compound.
- (i) Methanal, (ii) Ethanoic acid.



Alkaline  $\text{KMnO}_4$  acts as oxidising agent.



ions from the soap molecules forming an insoluble substance called scum.

Problems that arise due to use of detergents instead of soap :

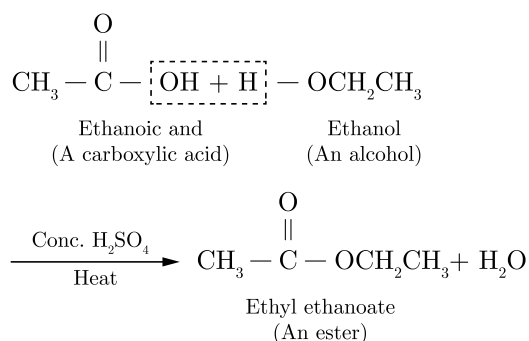
- Detergents being non-biodegradable they accumulate in the environment causing pollution.
- The entry of detergents into food chain leads to bioaccumulation in living beings and tends toward health issues.

- 258.** (a) Differentiate between esterification and saponification giving one example of each.  
 (b) Write any two advantages of detergents over soaps.

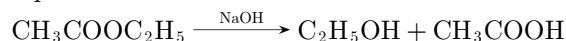
**Ans :**

Delhi 2016, Foreign 2012

- (a) **Esterification reaction :** The process of formation of an ester by the reaction of carboxylic acid and an alcohol in presence of concentrated sulphuric acid is called esterification reaction.



**Saponification :** Esters react in presence of an acid or base to give back the alcohol and carboxylic acid. This reaction is known as saponification.



- (b) Advantages :
- Detergents can be used even in hard water.
  - They can be used even in acidic medium.
  - They produce lather much more easily than soaps.
  - The cleansing power of detergents is much higher than that of soaps.
  - They are more soluble in water than soaps.

- 259.** What are covalent compounds? Why are they different from Ionic compounds ? List their three characteristic properties.

**Ans :**

Delhi 2017

**Covalent Compounds :** The compounds containing covalent bonds are known as covalent compounds.

Differences between Ionic and Covalent Compounds

	Ionic Compounds	Covalent Compounds
1.	They have high melting points and high boiling point.	Covalent compounds have usually low melting points and boiling points.
2.	They conduct electricity when dissolved in water or melted.	They do not conduct electricity.
3.	They are usually soluble in water.	They are usually insoluble in water (except, glucose sugar, urea, etc.)

Characteristic properties of covalent compounds

- They have low melting and boiling points.
- They do not conduct electricity.
- They are usually insoluble in water but they are soluble in organic solvents.

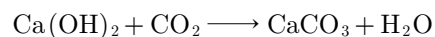
- 260.** An organic compound with molecular formula  $\text{C}_2\text{H}_4\text{O}_2$ , produces brisk effervescence on addition of sodium carbonate bicarbonate.

- Identify the organic compound
- Name the gas evolved.
- How will you test the gas evolved ?
- Write a chemical equation for the above reaction.
- List two important uses of the above compound.

**Ans :**

Foreign 2016

- The organic compound is ethanoic acid ( $\text{CH}_3\text{COOH}$ ).
- The gas evolved is carbon dioxide.
- Pass the gas evolved through lime water. If lime water turns milky, the evolved gas is carbon dioxide.
- $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \longrightarrow \text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$

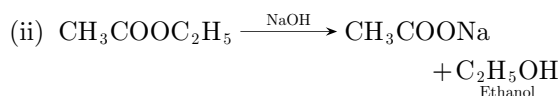


- Dilute solution of ethanoic acid is used to preserve pickles.
  - On reaction with alcohols it produces ester, which is used in making perfumes and as a flavouring agent.

- 261.** (a) Why does carbon form largest number of compounds ? Give two reasons.  
 (b) Why are some of these called saturated and the other unsaturated compounds ?

Ans :

Comp 2017



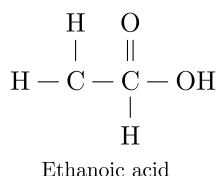
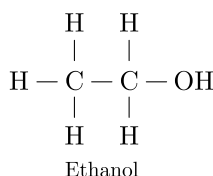
244. An organic compound  $X$  is an essential constituent of wine and beer.  $X$  is responsible for the intoxication caused by these drinks. Oxidation of  $X$  yields an organic acid  $Y$  which is present in vinegar. Name the compounds  $X$  and  $Y$  and write their structural formulae.

Ans :

Comp 2016

The compound  $X$  is ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) while  $Y$  is ethanoic acid ( $\text{CH}_3\text{COOH}$ ).

Structural formulae :



245. (a) Draw the structure of ethyne ( $\text{C}_2\text{H}_2$ ).  
 (b) List any two differences between soaps and detergents.

Ans :

OD 2017, Foreign 2012



- (b) (i) Soaps are sodium salts of long chain fatty acids, whereas detergents are sodium or potassium salts of sulphonic acids of hydrocarbons.  
 (ii) Soaps cannot be used with hard water but detergents work well with both hard and soft water.

## FIVE MARKS QUESTIONS

246. (i) Define a homologous series of carbon compounds.  
 (ii) Why is the melting and boiling points of  $\text{C}_4\text{H}_8$  higher than that of  $\text{C}_3\text{H}_6$  or  $\text{C}_2\text{H}_4$ ?  
 (iii) Why do we not see any gradation in chemical properties of a homologous series compounds?

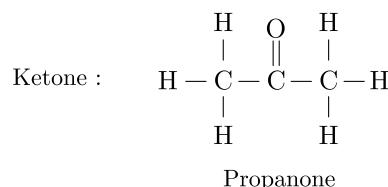
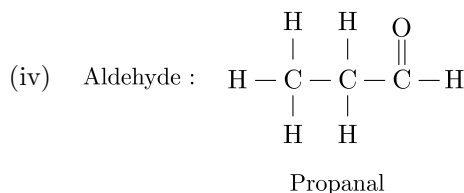
- (iv) Write the name and structures of

- (a) aldehyde and  
 (b) ketone with molecular form  $\text{C}_3\text{H}_6\text{O}$ .

Ans :

OD 2024

- (i) A homologous series is a series of compounds with the same general formula and same functional group and the adjacent numbers of which differ by  $\text{CH}_2$  14 mass unit.  
 (ii)  $\text{C}_2\text{H}_4$ ,  $\text{C}_3\text{H}_6$  and  $\text{C}_4\text{H}_8$  belong to the same homologous series. As the molecular mass increases in any homologous series, gradation in physical properties is seen. Melting and boiling points increase with increasing molecular mass.  
 (iii) Since the functional group remains the same in all the members of a homologous series, any gradation in their chemical properties is not seen.

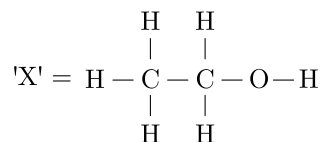


247. (i) Write the name and structure of an organic compound "X" having two carbon atoms in its molecule and its name is suffixed with -ol",  
 (ii) What happens when 'X' is heated with excess concentrated sulphuric acid at 443 K? Write chemical equation for the reaction stating the conditions for the reaction. Also state the role played by concentrated sulphuric acid in the reaction.  
 (iii) Name and draw the electron dot structure of hydrocarbon produced in the above reaction.

Ans :

OD 2024

- (i) Structure of organic compound



Name of organic compound 'X' = Ethanol

- (b) (i) Ethanol is used in the preparation of tincture iodine because it acts as a solvent.  
 (ii) Ethanoic acid is used in the preservation of pickles as it kills bacteria.
- 265.** (a) An organic compound *A* is widely used as a preservative in pickles and has a molecular formula  $C_2H_4O_2$ . This compound reacts with ethanol in the presence of a mineral acid to form a sweet smelling compound *B*.  
 (i) Identify the compound *A*.  
 (ii) Which gas is produced when *A* reacts with sodium carbonate? Write the balanced chemical equation for the reaction involved.
- (b) Write the names of :  
 (i)  $CH_3CH_2Br$   
 (ii)  $CH_3 - CH = CH_2$ .

Ans :

Delhi 2017, Foreign 2014

- (a) (i) Ethanoic acid.  
 (ii)  $CO_2$  is produced.  

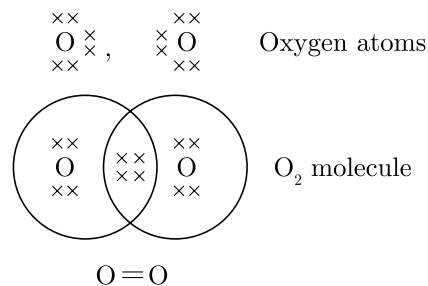
$$2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$$
- (b) (i) Bromoethane  
 (ii) Propene
- 266.** (a) Answer the following questions in one sentence or one word :  
 (i) What type of organic compounds show substitution reaction ?  
 (ii) How will you convert ethanol into unsaturated hydrocarbon ?  
 (iii) How is carboxylic acid different from mineral acids ?
- (b) With the help of electron dot representation explain the formation of  $O_2$  molecule.

Ans :

Delhi 2016

- (a) (i) Saturated hydrocarbons or  
 (ii) Dehydration of alcohols with excess concentrated sulphuric acid at 443 K produces unsaturated hydrocarbons.  

$$C_2H_5OH \xrightarrow{\text{Hot conc. } H_2SO_4} CH_2 = CH_2 + H_2O$$
  
 (iii) Mineral acids are strong acids because they completely ionize, whereas carboxylic acids are weak acids as they do not ionize completely.
- (b) Atomic number of oxygen = 8  
 Electronic configuration = 2, 6

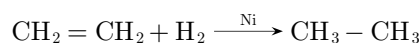
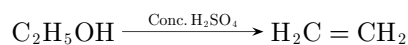


Double bond between two oxygen atoms.

- 267.** An organic compound *A* on heating with conc.  $H_2SO_4$  forms a compound *B* which on addition of one mole of hydrogen in presence of nickel forms a compound *C*. One mole of *C* on combustion forms two moles of  $CO_2$  and two/three moles of  $H_2O$ . Identify the compounds *A*, *B* and *C* and write the equations for the reactions involved.

Ans :

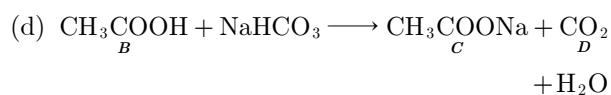
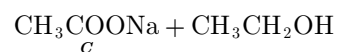
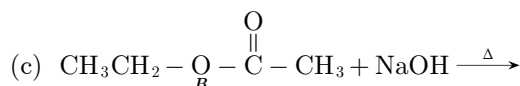
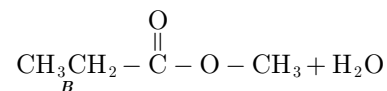
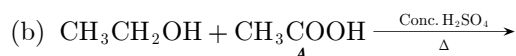
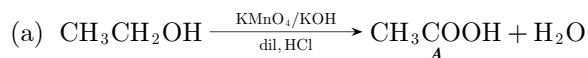
Foreign 2017

Compound *A* is ethanol.Compound *B* is ethene.Compound *C* is ethane.

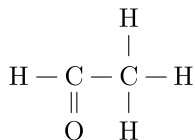
- 268.** Identify the compounds *A* to *E* in the following reaction sequence :
- (a)  $CH_3CH_2OH \xrightarrow[\text{dil. HCl}]{KMnO_4/KOH} A + H_2O$   
 (b)  $CH_3CH_2OH + A \xrightarrow[\Delta]{\text{Conc. } H_2SO_4} B + H_2O$   
 (c)  $B + NaOH \longrightarrow C + CH_3CH_2OH$   
 (d)  $A + NaHCO_3 \longrightarrow C + D + H_2O$   
 (e)  $CH_3CH_2OH + E \longrightarrow CH_3CH_2ONa + H_2$

Ans :

Delhi 2016



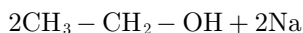
- (b) What happens when ethanol is treated with sodium metal? State the behaviour of ethanol in this reaction.
- (c) Draw the structure of cyclohexane.
- (d) Name the following compound.



Ans :

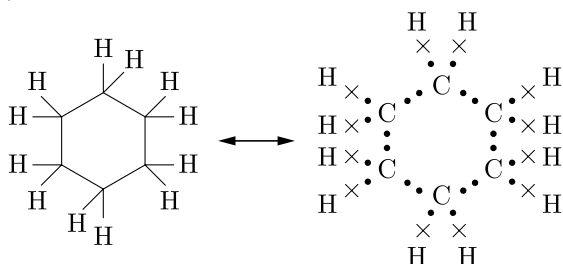
OD 2020, Foreign 2015

- (a) Soaps are potassium or sodium salts of a carboxylic acid having a long aliphatic chain attached to it. They are surfactants (compounds that reduce surface tension between a liquid and another substance) so, help in the emulsification of oils in water. They are not effective in hard water and saline water. Detergents are the potassium or sodium salts of a long alkyl chain ending with a sulphonated group. They are soluble in hard water. This solubility is attributed to the fact that the sulphonated group does not attach itself to the ions present in hard water.
- (b) When ethanol is treated with sodium metal, sodium ethoxide is obtained with the liberation of hydrogen gas. Sodium is an alkali metal, its standard reduction potential is low. Hence it can displace hydrogen from alcohol.



Ethanol acts as an oxidising agent in the reaction as :

- (i) There is increase in oxidation number of sodium.
- (ii) Since sodium is an electro-positive element, its addition in ethanol will reduce ethanol.
- (c) Structure of cyclohexane



- (d) Acetaldehyde or Ethanal

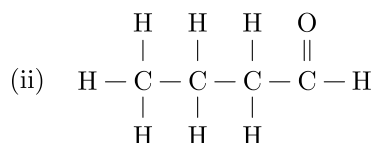
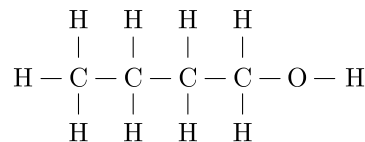
251. (a) Write the names and structures of (i) an alcohol, and (ii) an aldehyde with four carbon atoms in their molecules.

- (b) List two differences between saturated and unsaturated hydrocarbons

Ans :

Comp 2020

- (a) (i) The Name of an alcohol with four carbon atoms in its molecule is butanol. The structure of butanol is as follows:



- (b) The hydrocarbon in which all the consecutive carbon atoms are linked by single bonds are called Saturated hydrocarbons.

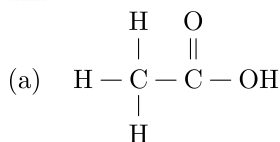
The hydrocarbons in which consecutive carbon atoms are linked by at least one double or triple bonds are called Unsaturated hydrocarbons.

Since the type of bond between carbon atoms in both types is different, certain differences arise in their properties.

These differences are as follows :

Differing character	Saturated hydrocarbons	Unsaturated hydrocarbons
Type of C - C bond	All single covalent bonds. No pi bonds	At least one double or triple bond. Have one or two pi bonds.
Hybridization of C atom	All in $\text{sp}^3$	$\text{sp}^2, \text{sp}$
Reactivity and stability	Less reactive more stable	More reactive less stable.
General formula	$\text{C}_n\text{H}_{2n+2}$	$\text{C}_n\text{H}_{2n-2}$ for alkynes and $\text{C}_n\text{H}_{2n}$ for alkenes
General structure	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H} - \text{C} - \text{C} - \text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ Ethane	$  \begin{array}{c}  \text{H} \quad \quad \text{H} \\  \diagdown \quad \diagup \\  \text{C} = \text{C} \\  \diagup \quad \diagdown \\  \text{H} \quad \quad \text{H}  \end{array}  $ Ethene
		$\text{H} - \text{C} \equiv \text{C} - \text{H}_{\text{Ethyne}}$

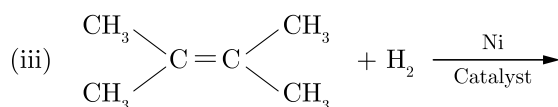
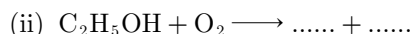
Ans :



(b) Ethyl ethanoate/Ethyl acetate



274. (a) Complete the following reactions and name the main product formed in each case :

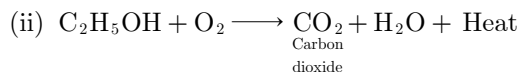
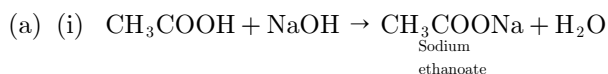


(b) What is covalent bond ? How many such bonds are present in ethane ?

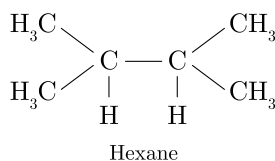
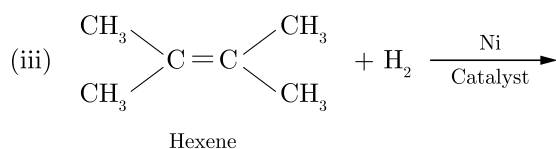
Write two characteristic features of covalent compounds.

Ans :

OD 2016, Delhi 2012



+ Light



(b) Bonds which are formed by sharing of an electron pair between two atoms are known as covalent bonds. Seven single covalent bonds are present in ethane.

The properties of covalent compounds are :

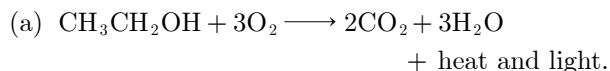
- They have low melting and boiling points.
- They are generally gaseous or liquid substances.
- They are bad conductors of electricity and heat.
- They are of two types—polar and non-polar covalent compounds.

Delhi 2017

275. (a) Write a chemical equation for the combustion of ethanol.
- (b) List any two differences between saturated and unsaturated carbon compounds.

Ans :

Foreign 2017

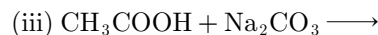


- (b) Compounds of carbon that have only single bonds between the carbon atoms are called saturated compounds.

They usually burn with a clean blue flame.

Compounds of carbon which contain double or triple bonds between the carbon atoms are called unsaturated compounds. These compounds are more reactive than saturated ones. They burn with a sooty flame.

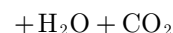
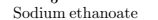
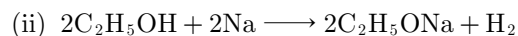
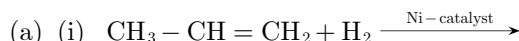
276. (a) Complete the following reactions stating the main products formed in each :



- (b) Write the next homologue of propanol ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ ) and butanal ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ ).

Ans :

OD 2016, Delhi 2010



- (b) Next homologue of propanol (Butanol) :  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

Next homologue of butanal (Pentanal) :  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$

277. (a) Define catenation. Why no other element exhibits the properties of catenation to the extent seen in carbon compounds ?

- (b) Name the type of compound formed by the reaction of an organic acid and an alcohol. Write the chemical equation for the reaction involved.

Ans :

OD 2015

- (a) The self-linking property of an element due to which a large number of its atoms can be linked

To acquire noble gas configuration, each of the three hydrogen atoms share their 1 electron with nitrogen to form three covalent bonds and make Ammonia molecule an ammonia molecule ( $\text{NH}_3$ ).

- 255.** (a) Give a chemical test to distinguish between saturated and unsaturated hydrocarbons.  
 (b) Name the products formed when ethane burns in air. Write the balanced chemical equation for the reaction showing the types of energies liberated.  
 (c) Why is reaction between methane and chlorine in the presence of sunlight considered a substitution reaction.

Ans :

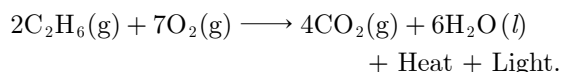
OD 2017

- (a)  $\text{Br}_2$  water test :  $\text{Br}_2$ —water is a brown coloured liquid.

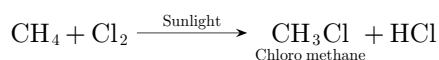
Unsaturated hydrocarbons give addition reaction with  $\text{Br}_2$ , so the colour of  $\text{Br}_2$ —water gets decolourised.

Saturated hydrocarbons do not react with  $\text{Br}_2$ —water, so the colour of  $\text{Br}_2$ —water does not get decolourised.

- (b) On burning ethane in air, the products obtained are carbon dioxide and water along with heat and light.



- (c) Methane reacts with chlorine in the presence of sunlight to form chloromethane and hydrogen chloride.



With the excess of chlorine, all the four hydrogen atoms of methane are replaced by chlorine atoms to form carbon tetrachloride ( $\text{CCl}_4$ ). This reaction is considered as substitution reaction because hydrogen of methane is substituted by chlorine.

- 256.** Why are certain compounds called hydrocarbons? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.

Ans :

OD 2016

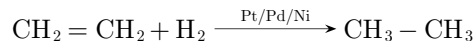
Certain compounds are called as hydrocarbons because they are formed mainly from carbon and hydrogen.

Formula for homologous series of alkanes :  $\text{C}_n\text{H}_{2n+2}$

Formula for homologous series of alkenes :  $\text{C}_n\text{H}_{2n}$

Formula for homologous series of alkynes :  $\text{C}_n\text{H}_{2n-2}$

Hydrogenation converts alkenes into alkane.



Dihydrogen gas adds to alkene in the presence of finely divided catalysts like platinum, palladium or nickel to form alkanes.

- 257.** Soaps and detergents are both types of salts. State the difference between the two. Write the mechanism of the cleaning action of soap. Why do soaps not form lather with hard water ? Mention any two problems that arise due to the use of detergents instead of soaps.

Ans :

Delhi 2017

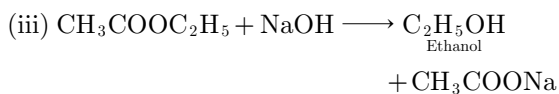
	Soap	Detergents
1.	Soaps are sodium or potassium salts of long chain carboxylic acids.	Detergents are ammonium or sulphonate salts of long chain carboxylic acids.
2.	Soaps have lesser cleansing action or quality as compared to detergents.	Detergents have better cleansing action as compared to soaps.

**Cleansing action of soap :** When soap is dissolved in water, it forms a colloidal solution. In this colloidal suspension the soap molecules cluster together to form micelles and remain radially suspended in water with the hydrocarbon end towards the center and the ionic end directed outward.

The dirt particles always adhere to the oily or greasy layer present on the skin or clothes when a dirty cloth is dipped into a soap solution, the non-polar hydrocarbon end of micelles get attached to the grease or oil present in dirt and polar and remains in water layer.

The mechanical action of rubbing subsequently dislodges the oily layer from the dirty surface shaping it into small globules. A stable emulsion of oil in water is formed. The emulsified oil or grease globules, bearing the dirt can now be readily washed with water.

Soaps do not form lather when the water is hard. When soap is added water, calcium and magnesium salts present in water displace sodium or potassium

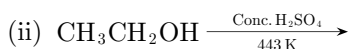
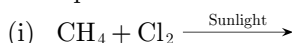


(b) (i) Butanone,

(ii) Ethyl ethanoate

Functional group : Keto and ester respectively.

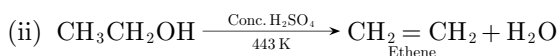
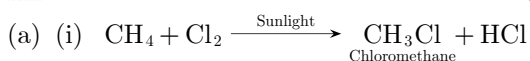
**282.** (a) Complete the following reactions and state the main product formed in each case :



(b) State in brief a chemical test to distinguish between ethanol and ethanoic acid.

**Ans :**

Foreign 2014



(b) Ethanoic acid reacts with  $\text{NaHCO}_3$  and forms brisk effervescence of  $\text{CO}_2$ , but ethanol does not react with  $\text{NaHCO}_3$ .

**283.** (a) Amongst soaps and detergents which can work effectively in hard water and why ?

(b) Name the salts which cause hardness of water.

(c) What change will you observe if you test soap with litmus paper (red and blue).

**Ans :**

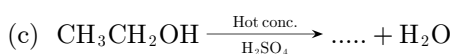
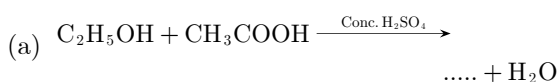
Delhi 2015, SQP 2014

(a) Detergents work more effectively in hard water. They are ammonium or sulphonate salts of long chain hydrocarbons. The charged ends of these compounds do not form insoluble precipitate with calcium and magnesium ions present in hard water while soaps form an insoluble precipitate with hard water which hinders the cleansing action. Thus, they do cleansing more effectively.

(b) The salts that lead to hardness of water are chlorides and sulphates of calcium and magnesium i.e.,  $\text{CaCl}_2$ ,  $\text{MgCl}_2$ ,  $\text{CaSO}_4$ ,  $\text{MgSO}_4$ .

(c) Soap solution will turn red litmus paper blue while there will be no effect on blue litmus paper indicating that soaps are basic in nature.

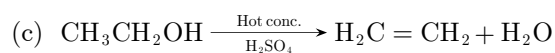
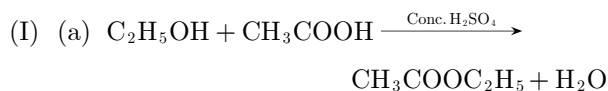
**284.** (I) Complete the following reactions :



(II) State two properties of carbon which lead to huge number of carbon compounds we see around us.

**Ans :**

OD 2015



(II) (i) **Catenation** : Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large number of molecules. This property is called catenation.

(ii) **Tetravalency** : Since carbon has a valency of four, it is capable of bonding with four other atoms of carbon or atoms of other monovalent elements. In order to satisfy the tetravalency, carbon can form double or triple bond with other carbon atoms or with oxygen, nitrogen also.

**285.** (a) An organic compound *A* is liquid at room temperature. It is also a good solvent and has the molecular formula  $\text{C}_2\text{H}_6\text{O}$ . On oxidation gives compound *B* which gives effervescence with sodium hydrogen carbonate. *A* reacts with *B* in the presence of conc. sulphuric acid to give another compound *C*, which has a pleasant smell. Identify *A* and *C*. Also write the chemical equations for the reactions involved in the formation of *B* and *C*.

(b) Draw the structures of benzene ( $\text{C}_6\text{H}_6$ ) and cyclohexane ( $\text{C}_6\text{H}_{12}$ ).

(c) What is the difference between vegetable oil and animal fat ?

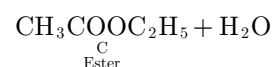
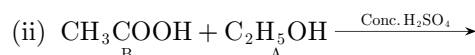
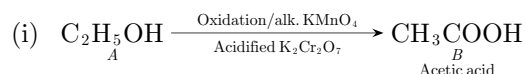
**Ans :**

Comp. 2014

(a) Compound *A* : Ethyl alcohol ( $\text{C}_2\text{H}_5\text{OH}$ )

Compound *C* : Ester ( $\text{CH}_3\text{COOC}_2\text{H}_5$ )

Chemical equations :





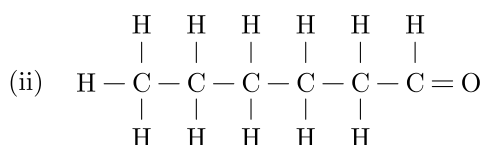
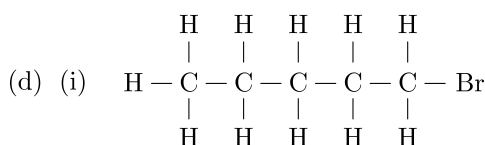
- (c) Which of these two is more reactive and why ?  
 (d) Draw the structures of the following compounds:  
 (i) Bromopentane  
 (ii) Hexanal.

Ans :

Delhi 2017, Comp 2012

Carbon forms large number of compounds due to the following reasons :

- (a) (i) **Catenation** : Carbon forms bond with other atoms of carbon.  
 (ii) **Tetravalency** : Carbon shares four electrons with other atoms.  
 (b) Some compounds are called saturated because they contain single bond only between two carbon atoms while some are termed as unsaturated because in these compounds valency of carbon is satisfied by double or triple bond.  
 (c) Unsaturated compounds are more reactive. It is so because they contain double or triple bond and are less stable as compared to saturated compounds. They react readily to satisfy their valency with single bonds and hence to become stable.



- 262.** (a) Write chemical equation of the reactions of ethanoic acid with (i) sodium, (ii) sodium carbonate, (iii) ethanol in the presence of conc.  $\text{H}_2\text{SO}_4$ .  
 (b) State the role of concentrated sulphuric acid in the esterification reaction.  
 (c) Write one use of ethanoic acid.

Ans :

SQP 2016

- (a) (i)  $2\text{CH}_3\text{COOH} + 2\text{Na} \longrightarrow 2\text{CH}_3\text{COONa} + \text{H}_2$   
 (ii)  $2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$   
 (iii)  $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$

- (b) Sulphuric acid, being a strong dehydrating agent removes water from the reaction mixture. As a result, the reaction proceeds only in the forward direction to form ester.  
 (c) Ethanoic acid is used for making vinegar.

- 263.** An organic compound *A* is widely used as a preservative in pickles and has a molecular formula  $\text{C}_2\text{H}_4\text{O}_2$ . This compound reacts with ethanol to form a sweet smelling compound *B*.

- (a) Identify the compound *A*.  
 (b) Write the chemical equation for the reaction with ethanol to form compound *B*.  
 (c) How can we get compound *A* from *B*?  
 (d) Name the process and write corresponding chemical equation.  
 (e) Which gas is produced when compound *A* reacts with washing soda ? Write the chemical equation.

Ans :

OD 2017, Foreign 2011

- (a) *A* is ethanoic acid ( $\text{CH}_3\text{COOH}$ ).  
 (b)  $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{Conc. H}_2\text{SO}_4} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$   
 (c) Compound *A* can be obtained from compound *B* by the action of an acid or a base.  
 (d) Saponification :  
 $\text{CH}_3\text{COOC}_2\text{H}_5 \xrightarrow{\text{NaOH}} \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH}$   
 (e)  $\text{CO}_2$  gas is produced.  
 $2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \longrightarrow 2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$

- 264.** Answer the following questions :

- (a) Describe a chemical test to distinguish between ethanol and ethanoic acid.  
 (b) Give reason for the following :  
 (i) Ethanol is used in the preparation of tincture iodine.  
 (ii) Ethanoic acid is used in the preservation of pickles.

Ans :

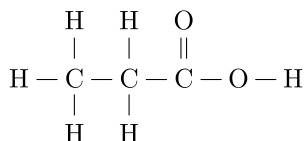
OD 2016

- (a) We can distinguish between ethanol and ethanoic acid by using laboratory reagent  $\text{Na}_2\text{CO}_3$  solution.  
 (i) When  $\text{Na}_2\text{CO}_3$  is added to the test tube containing ethanoic acid ( $\text{CH}_3\text{COOH}$ ),  $\text{CO}_2$  gas is evolved which turns lime water milky.  
 (ii) When  $\text{Na}_2\text{CO}_3$  is added to the test tube containing ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ ), no gas is evolved.

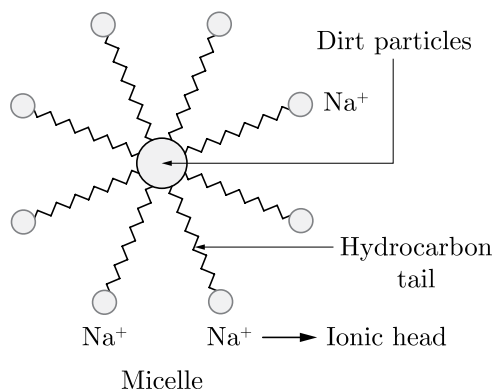
Ans :

OD 2015

(a) Propanoic acid :



- (b) It is because sometimes the air holes of the burner get blocked resulting in incomplete burning of fuel which in turn releases much soot that blackens the bottom of the cooking vessels.
- (c) Micelle is a structure formed when soap molecules get arranged and aligned along the surface of water with the ionic end in water and the hydrocarbon 'tail' protruding out of water.

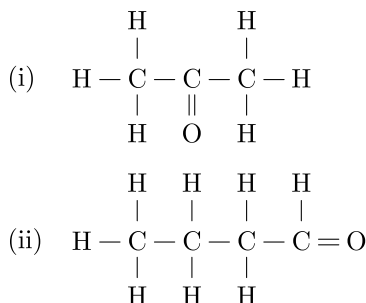


290. (a) Draw the structure of :

- (i) Chloropentane ( $\text{C}_5\text{H}_{11}\text{Cl}$ )
- (ii) Ethanoic acid.

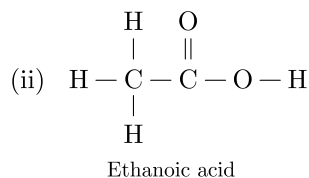
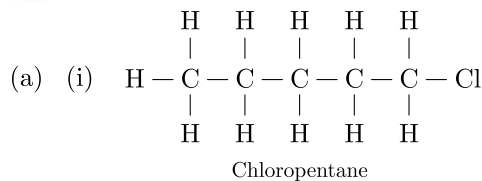
(b) How is scum formed ?

(c) Write the names of the following compounds :



Ans :

Foreign 2014



- (b) When soap reacts with hard water, the minerals present in water react with soap and form a white curdy substance known as scum. It reduces the cleansing ability of soap.
- (c) (i) Propanone,  
(ii) Butanal.

291. (a) A compound X having formula  $\text{C}_2\text{H}_4\text{O}_2$  when treated with ethanol and a few drops of conc.  $\text{H}_2\text{SO}_4$  forms a sweet smelling substance Y. Name X and Y. Write the equation of the reaction leading to the formation of Y from X. What is the function of conc.  $\text{H}_2\text{SO}_4$  in the above reaction?
- (b) Why do soaps form scum instead of lather in hard water ?

Ans :

Comp 2015

(a) X is ethanoic acid, Y is ethyl ethanoate.



Conc.  $\text{H}_2\text{SO}_4$  acts as a catalyst and removes water from the product mixture.

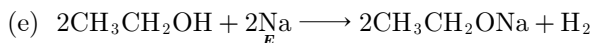
- (b) Hard water contains Ca and Mg ions which react with soap to form insoluble salts of Ca and Mg. These hinder lather formation. Thus soaps form scum instead of lather in hard water.

292. Compound A ( $\text{C}_2\text{H}_6\text{O}$ ) is obtained by reacting a compound B with water in the presence of phosphoric acid. A burns in air with a blue flame to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . On reacting with  $\text{K}_2\text{Cr}_2\text{O}_7$  it produces compound C which turns blue litmus red. Identify the compounds A, B and C. Write the chemical equations involved in all the reactions.

Ans :

Comp 2014

Compound A is obtained by addition of water to another compound B, so it can be alcohol and B can be an alkene. With the given molecular formula  $\text{C}_2\text{H}_6\text{O}$ , A can be ethanol and B can be ethene.

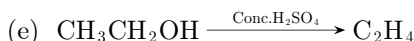
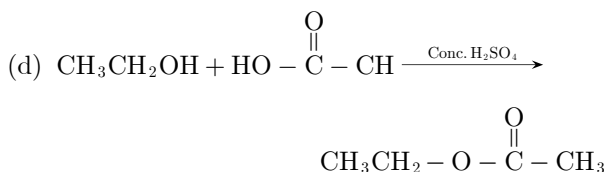
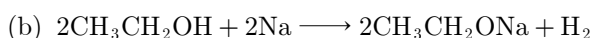
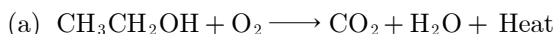


**269.** Write chemical equations to represent what happens when :

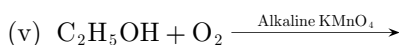
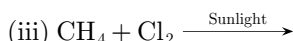
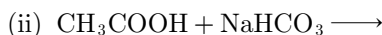
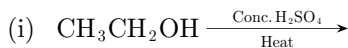
- Ethanol burns in air.
- Ethanol reacts with sodium metal.
- Ethanol is heated with alkaline  $\text{KMnO}_4$ .
- Ethanol is heated with ethanoic acid in presence of few drops of concentrated sulphuric acid.
- Ethanol is heated at 443 K with excess concentrated  $\text{H}_2\text{SO}_4$ .

**Ans :**

Comp 2017

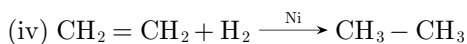
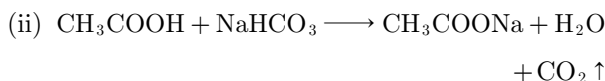
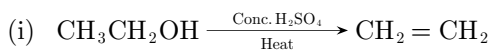


**270.** Complete the following reactions :



**Ans :**

OD 2016, Foreign 2012

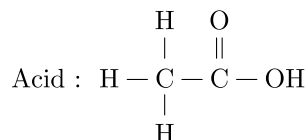
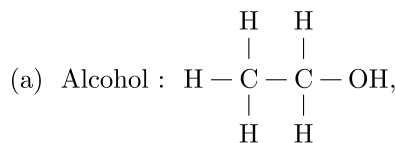


**271.** (a) The formula of an ester is  $\text{CH}_3\text{COOC}_2\text{H}_5$ . Write the structural formulae of the corresponding alcohol and the acid.

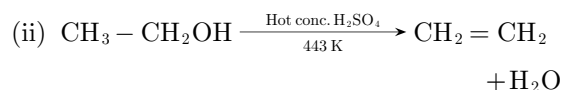
- (i) Mention the experimental conditions involved in obtaining ethene from ethanol.
- (ii) Write the chemical equation for the above reaction.

**Ans :**

OD 2017



- (i) Heating upto 443 K in the presence of excess of conc.  $\text{H}_2\text{SO}_4$ .



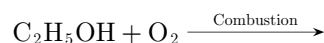
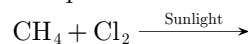
- 272.** (a) What is vinegar ? Give its use.
- (b) Name two properties of carbon which led to the huge number of carbon compounds we see around us.
- (c) Give a chemical test to distinguish between butter and cooking oil.
- (d) Why does carbon form compounds having low melting and boiling points ?

**Ans :**

OD 2016, Foreign 2013

- 5 to 8% solution of acetic acid in water is called vinegar. It is used as a preservative in pickles.
- Catenation and tetravalency.
- Alkaline potassium permanganate can be used to distinguish between butter and cooking oil. Cooking oil decolorises the pink colour of alkaline potassium permanganate whereas butter does not. This shows that cooking oil is unsaturated and butter is saturated.
- The force of attraction between carbon compounds are not very strong. Thus, carbon forms compounds having low melting and boiling points.

- 273.** (a) Draw the structure of ethanoic acid.
- (b) Name the compound formed when ethanol is heated with ethanoic acid in the presence of conc.  $\text{H}_2\text{SO}_4$ .
- (c) Complete the following equations :



depend on the elements other than the carbon present in the molecule.

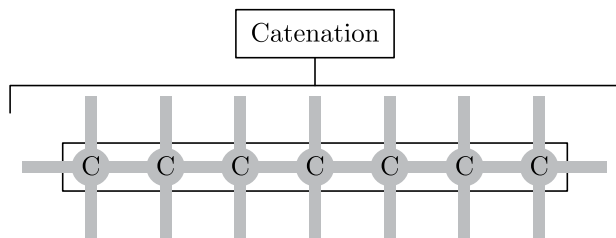


Figure: Long Chain of Carbon atoms

- Write the name of the term used for four valency of carbon.
- Name the term used to define property of carbon to form bond with another carbon atom.
- Name the group and period to which carbon belong.
- Which of the following statements is incorrect?
  - Valence electrons of carbon are 4.
  - Carbon has a valency of four.
  - Organic chemistry forms a separate branch of chemistry which deals mainly with carbon and its compounds.
  - Electronic configuration of carbon is 2, 6.

Ans :

- The term used for four valency of carbon is tetravalency.
- Catenation is the term used to define property of carbon to form bond with another carbon atom.
- Carbon belongs to second period and fourteenth group of periodic table.
- (d) Total electrons present in carbon are 6. Out of these 6 electrons, 2 are present in first shell and other four in next shell. This gives electronic configuration of carbon to be 2, 4. Hence, the incorrect option is (d).

**296.** Read the following case based passage and answer the questions given after passage.

Study the table and answer the following questions :

Table-A

S. No.	Molecular Formula	Name
1.	$\text{CH}_3\text{OH}$	Methanol
2.	$\text{CH}_3\text{CHO}$	Ethanal
3.	$\text{CH}_3\text{COCH}_3$	Acetone
4.	$\text{CH}_3\text{COOH}$	Acetic acid
5.	$\text{CH}_3\text{CH}_3$	Ethane

- Name the functional group present in ethane.
- Which functional group present in acetone ?
- Give one example of carboxylic acid.
- What is the general formula of alcohols?

Ans :

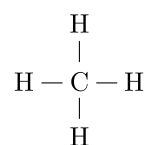
- Ethane is a hydrocarbon. It does not contain any other atom or group other than carbon and hydrogen.
- Acetone contains ketonic functional group.
- Propanoic acid ( $\text{CH}_3\text{CH}_2\text{COOH}$ ) is an example of carboxylic acid.
- The general formula of alcohols in  $\text{ROH}$ .

**297.** Read the following case based passage and answer the questions given after passage.

The compounds entirely consisting of carbons and hydrogen's are known as hydrocarbons. There are different categories in which hydrocarbons are divided out of which the two are :

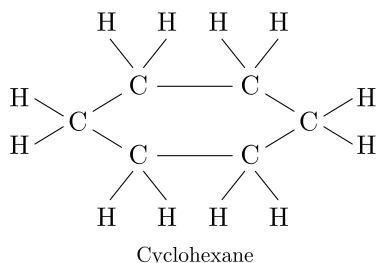
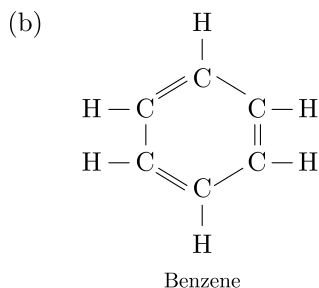
**Saturated Hydrocarbons :** The hydrocarbons having only single bonds between the carbon atoms are called saturated hydrocarbons. This includes alkanes having a general formula  $\text{C}_n\text{H}_{2n+2}$ . The first member of homologous series of alkanes is methane ( $\text{CH}_4$ ).

Structure of methane is as follows:



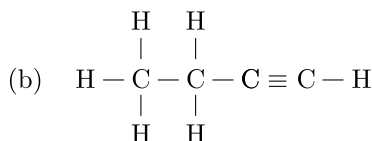
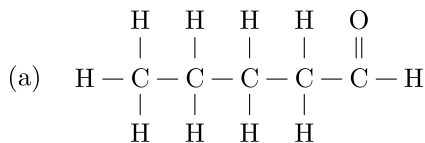
**Unsaturated Hydrocarbons :** The hydrocarbons having double and triple bonds between the carbon atoms are called unsaturated hydrocarbons. This includes alkenes and alkynes having general formula  $\text{C}_n\text{H}_{2n}$  and  $\text{C}_n\text{H}_{2n-2}$ , respectively. The first member of homologous series of alkenes is Ethene ( $\text{C}_2\text{H}_4$ ). The structure of ethene is as follows:  $\text{H}_2\text{C} = \text{CH}_2$ .

The first member of homologous series of alkynes is Ethyne ( $\text{C}_2\text{H}_2$ ) having structural formula  $\text{HC} \equiv \text{CH}$ .



- (c) Vegetable oil contains unsaturated fatty acids while animal fat contains saturated fatty acids.

**286.** (a) Write the names of the following compounds :



- (b) Write the chemical equations for the following reactions

- Ethene is made to react with hydrogen in the presence of nickel catalyst.
- Ethanol is heated with alkaline  $\text{KMnO}_4$ .
- Sodium carbonate is made to react with ethanoic acid.

**Ans :**

OD 2014, Foreign 2014

- (a) (a) Pentanal,  
(b) Butyne.

- (b) 1.  $\text{CH}_2 = \text{CH}_2 + \text{H}_2 \xrightarrow[\text{Catalyst}]{\text{Nickel}} \text{CH}_3 - \text{CH}_3$   
Ethene Ethane
2.  $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow[\text{or Acidified } \text{K}_2\text{Cr}_2\text{O}_7 + \text{Heat}]{\text{Alkaline } \text{KMnO}_4 + \text{Heat}} \text{CH}_3\text{COOH}$
3.  $\text{Na}_2\text{CO}_3 + 2\text{CH}_3\text{COOH} \longrightarrow 2\text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$

**287.** (a) Write the molecular formula of an organic compound having its name suffixed with '–ol'

and having two carbon atoms in the molecule.

With the help of balanced chemical equation indicate what happens when it is heated with excess of concentrated  $\text{H}_2\text{SO}_4$ .

- (b) Write names of the following compounds :  
(i)  $\text{HCOOH}$   
(ii)  $\text{CH}_3\text{COCH}_2\text{CH}_3$ .  
(c) Explain why carbon generally forms compounds by covalent bonds.

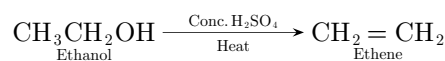
**Ans :**

Delhi 2015

- (a) Ethanol.

Molecular formula :  $\text{C}_2\text{H}_5\text{OH}$ .

When it is heated with excess of concentrated  $\text{H}_2\text{SO}_4$ , ethene is formed.



- (b) (i) Methanoic acid,  
(ii) Butanone.  
(c) Carbon generally forms covalent compounds because carbon can neither donate nor accept four electrons for completing its octet. So, it shares its four electrons with other atoms forming covalent bonds.

**288.** (a) Draw and write the names of any two structural isomers of  $\text{C}_5\text{H}_{12}$ .

- (b) Discuss the drawback of using soaps over detergents for cleansing process.

**Ans :**

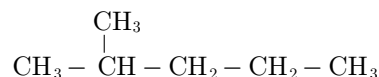
Delhi 2014

- (a) Structural isomers of  $\text{C}_5\text{H}_{12}$  :

- (i) Pentane



- (ii) 2-methylbutane

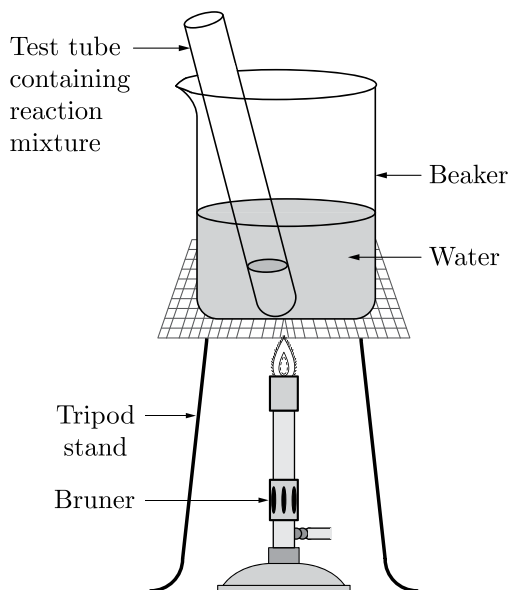


- (b) Soaps form an insoluble substance called scum with hard water. This is due to its reaction with the calcium and magnesium salts which cause the hardness of water. Thus, a larger amount of soap needs to be used. This is the main drawback of using soap over detergents for cleansing process.

**289.** (a) Draw the structure of propanoic acid ( $\text{C}_2\text{H}_5\text{COOH}$ ).

- (b) Why do the bottoms of cooking vessels get blackened ?  
(c) What is a micelle ? Draw a labelled diagram of micelle.

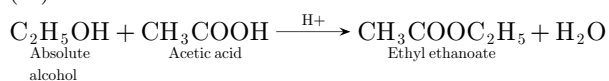
- Take 1 mL ethanol (absolute alcohol) and 1 mL glacial acetic acid along with a few drops of concentrated sulphuric acid in a test tube.
- Warm in a water-bath for at least five minutes as shown in Figure.
- Pour into a beaker containing 20-50 mL of water and smell the resulting mixture.



- Which one is stronger acid, HCl or ethanoic acid?
- What is glacial acetic acid?
- Name the reaction which takes place between glacial acetic acid and absolute alcohol.

Ans :

- Ethanoic acid is weaker acid than HCl, as pH of HCl is less than the pH of ethanoic acid.
- 100% pure acetic acid is called glacial acetic acid.
- It is called esterification



**301.** Read the following case based passage and answer the questions given after passage.

Teacher asked to Pawan to carry out following practical step under the observation of him:

- Take about 10 mL of water each in two test tubes.
- Add a drop of oil (cooking oil) to both the test tubes and label them as A and B.
- To test tube B, add a few drops of soap solution. Now shake both the test tubes vigorously for the same period of time

- Can you see the oil and water layers separately in both the test tubes immediately after you stop shaking, them?
- Leave the test tubes undisturbed for some time and observe. Does the oil layer separate out? In which test tube does this happen first?
- Is oil drop miscible in water?
- Take a test tube. Add a drop of oil in it. Add a piece of soap in it and shake it properly. Whether the oil droplets would appear again or disappear?
- What are soaps?

Ans :

- No, It is not clear.
- In test tube A the oil layer separate out. In test tube B, it happens first.
- No, oil drop is not miscible in water.
- Oil droplets disappear as these are acted upon by soap to form sodium salt of fatty acid.
- Soaps are sodium salt of fatty acid.

Example :  $\text{C}_{17}\text{H}_{35}\text{COONa}$  (sodium stearate).

**302.** Read the following case based passage and answer the questions given after passage.

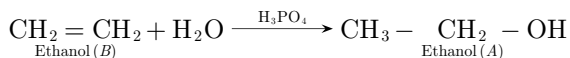
Teacher said to Ganesh to do following experiment

- Take about 10 mL of distilled water (or rain water) and 10 mL of hard water (from a tube-well or hand-pump) in separate test tubes.
- Add a couple of drops of soap solution to both.
- Shake the test tubes vigorously for an equal period of time and observe the amount of foam formed

- In which test tube do you get more foam?
- In which test tube do you observe a white curdy precipitate?
- What is hard water?
- Why does not soap form lather with hard water?
- Name one pure form of water present in nature.

Ans :

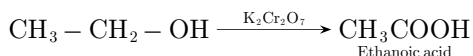
- The test tube containing distilled water has more foam.
- In the test tube containing hard water.
- A water containing soluble salts of  $\text{Mg}^{+2}$  and  $\text{Ca}^{+2}$  is a hard water.
- Soap reacts with hard water to form scum and acts to remove the hardness of water. So, lather is not formed with hard water and soap.
- Rain water is the purest form of water which is found in nature.



A burns in air with blue flame to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .



A is oxidized with  $\text{K}_2\text{Cr}_2\text{O}_7$  to give C which turns blue litmus red. It is ethanoic acid.



## CASE BASED QUESTIONS

**293.** Read the following case based passage and answer the questions given after passage.

R is an organic compound containing only carbon, chlorine and fluorine. It is produced as a volatile derivative of methane, ethane and propane. It has been widely used as refrigerant, propellant and solvent. Montreal protocol phased out manufacture of such compounds because R contributes to S in the atmosphere.

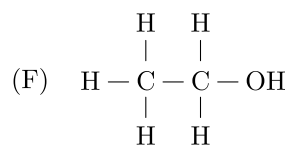
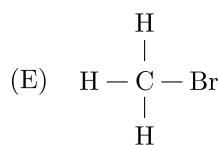
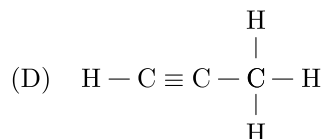
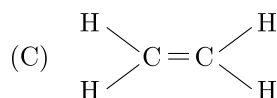
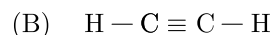
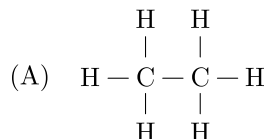
- What is ozone depletion?
- Identify the labelled parts R and S in this passage.
- Which of the following would not be a consequence of S?
  - Increased rates of lung cancer
  - Increased incidence of premature skin ageing
  - Increased incidence of severe sunburns
  - Increased incidence of cataracts
- Montreal protocol was signed in which year?
  - 1965
  - 1987
  - 2012
  - 1999

**Ans :**

- Ozone depletion means the thinning of ozone layer in the atmosphere. Many chemicals mainly CFCs are responsible for it.
- In the given passage, 'R' is chlorofluorocarbon (CFCs) and 'S' is ozone depletion.
- (a) Major consequences of ozone depletion are increased incidences of cataracts, severe sunburns, skin cancer and premature ageing of skin etc. UV rays do not affect respiratory organs.
- (b) Montreal protocol was signed on 16 September, 1987.

**294.** Read the following case based passage and answer the questions given after passage.

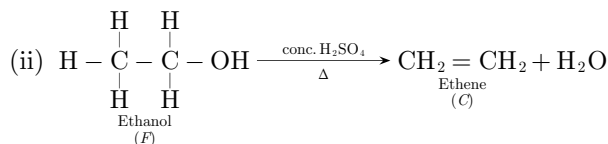
Structural formulae of some organic compounds are given below and every organic compound have different structural formulae.



- Name the compounds which can undergo addition reactions.
- How can F be converted to C ?
- What is the name of functional group of compound (F).
- Which compounds belong to same homologous series in given organic compound ?

**Ans :**

- Unsaturated hydrocarbons undergo addition reactions as they contain double or triple bonds, i.e., compound (B) and (D) undergoes addition reactions.



- Alcohol ( $-\text{OH}$ )
- (B) and (D)

**295.** Read the following case based passage and answer the questions given after passage.

Carbon is so versatile in nature that organic chemistry forms a separate branch of chemistry which deals mainly with carbon and its compounds. Carbon is an element with symbol C, atomic number 6 and electronic configuration  $-2, 4$ .

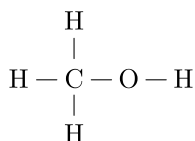
Carbon has a valency of four. So, it is capable of bonding with four other atoms of carbon or atoms of some other monovalent element. Compounds of carbon are formed with oxygen, nitrogen, hydrogen, sulphur, chlorine and many other elements, giving rise to compounds with specific properties which



- (iv) Which of the following hydrocarbon belongs to the alkene homologous series ?  $C_2H_4$ ,  $C_3H_4$ ,  $C_3H_8$ ,  $C_5H_{10}$ .

Ans :

- (i) Aldehyde functional group is present.  
 (ii)  $C_nH_{2n-2}$   $n \geq 2$   
 (iii) First member is methanol,  $CH_3OH$ . Its structure is:



- (iv) Alkenes have a general formula,  $C_nH_{2n}$ .  
 $C_2H_4$  and  $C_5H_{10}$  belongs to alkene homologous series.

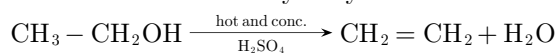
- 306.** Read the following case based passage and answer the questions given after passage.

Ethanol is a liquid at room temperature. Ethanol is commonly called alcohol and is the active ingredient of all alcoholic drinks. It is also used as a solvent in medicines such as tincture of iodine, cough syrup. Ethanol reacts with sodium as well as with carboxylic acids. Ethanol can also undergo dehydration in the presence of sulphuric acid.

- (i) What happens when ethanol is strongly heated in the presence of concentrated  $H_2SO_4$ ?  
 (ii) Write the chemical equation when ethanol reacts with sodium metal.  
 (iii) Write the molecular formula of ethanol and draw its structural formula.  
 (iv) What do you mean by denatured alcohol?

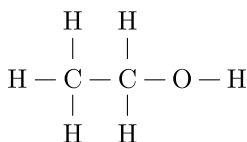
Ans :

- (i) Ethanol forms ethene by dehydration.



- (ii)  $2CH_3 - CH_2 - OH + 2Na \longrightarrow 2CH_3 - CH_2ONa + H_2$   
 $H_2$  gas is evolved.

- (iii) Molecular formula:  $C_2H_5OH$



- (iv) Alcohol which is unfit for drinking purposes is called denatured alcohol. This can be done by adding copper sulphate to alcohol.

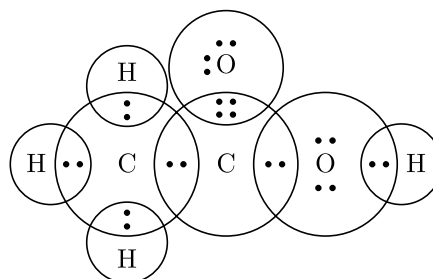
- 307.** Read the following case based passage and answer the questions given after passage.

Carboxylic acids are class of organic compounds containing  $-COOH$  functional group. The first member of the carboxylic acid homologous series is formic acid. Carboxylic acids are weak acids, but reacts with sodium hydroxide, alcohols, metals, etc.

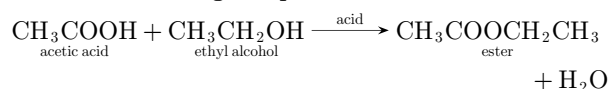
- (i) Complete the following equation with appropriate compound :  
 $CH_3COOH + NaHCO_3 \longrightarrow$   
 (ii) Draw the electron dot structure of ethanoic acid.  
 (iii) Methanoic acid is produced during bee sting and causes irritation. How will you neutralize this ?  
 (iv) What is esterification ?

Ans :

- (i)  $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$   
 (ii)



- (iii) We neutralize methanoic acid by applying weak base  $NaHCO_3$ .  
 $HCOOH + NaHCO_3 \longrightarrow HCOONa + H_2O + CO_2$   
 (iv) Esterification is the reaction of acetic acid with ethyl alcohol. In the presence of sulphuric acid a sweet-smelling compound called ester is formed.



- 308.** Read the following case based passage and answer the questions given after passage.

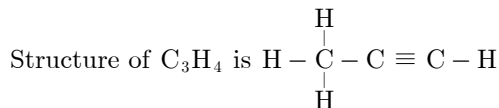
Soaps are sodium or potassium salts of long chain carboxylic acids. The action of soaps and detergents is based on the properties of both hydrophobic and hydrophilic groups in the molecule and this helps to emulsify the oily dirt and hence its removal.

- (i) Why soaps cannot be used with hard water?  
 (ii) The cleansing action of soap is due to the formation of clusters called .....

- Draw the structure of hydrocarbons with general formula  $C_nH_{2n-2}$  where  $n = 3$ .
- Which reaction used to convert saturated hydrocarbons to unsaturated hydrocarbons.
- Name the catalyst used in the above conversion reaction.
- Select alkenes and alkynes from the following:  
 $C_2H_4$ ,  $C_3H_4$ ,  $C_2H_2$ ,  $C_4H_8$

Ans :

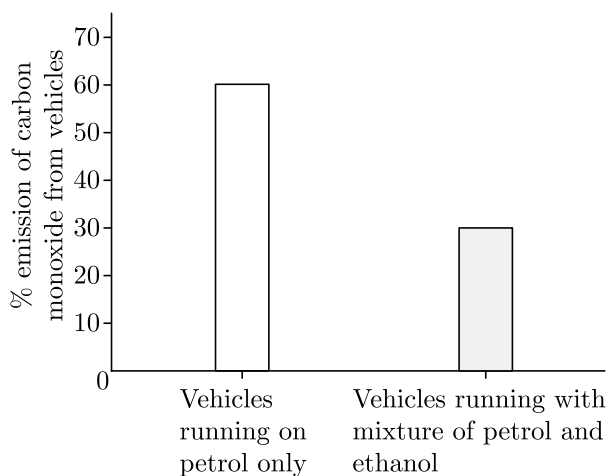
- Hydrocarbon is  $C_3H_4$



- Hydrogenation reaction.
- Nickel catalyst
- $C_2H_4$  and  $C_4H_8$  are alkenes,  $C_3H_4$  and  $C_2H_2$  are alkynes.

- 298.** Read the following case based passage and answer the questions given after passage.

Ethanol or ethyl alcohol is an important organic compound. It burns in air to form carbon dioxide and water. It is used in industries, hospitals and homes. Ethanol is supplied to hospitals and research laboratories without charging different taxes. Therefore, to prevent its misuse for drinking, it is mixed with some poisonous chemicals. Drinking such an alcohol causes blindness, liver damage and even death.



- Based on the data represented in the bar graph given alongside, why is there a reduction in emission of carbon monoxide from vehicles when a mixture of petrol and ethanol was used as fuel?
- Which substance is most commonly added to ethyl alcohol to make it unfit for drinking?
- Which organ in human body is most affected by the excessive intake of alcoholic drinks?

- Ethanol has no effect on litmus solutions. Why?

Ans :

- Ethanol is a clean fuel because it gives only carbon dioxide and water on burning. It does not produce any poisonous gas like carbon monoxide. So, addition of ethanol to petrol has an advantage of reducing the emission of carbon monoxide from vehicles.
- Methyl alcohol (methanol), a poisonous substance, is added to ethyl alcohol to make it unfit for drinking.
- Liver is most affected by the excessive intake of alcoholic drinks.
- Ethanol does not contain any hydrogen ions, so it is a neutral compound. Thus ethanol has no effect on any litmus solution.

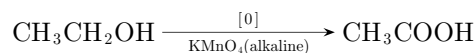
- 299.** Read the following case based passage and answer the questions given after passage.

A teacher said Mohan do the following step under the observation of him :

- Take about 3 mL of ethanol in a test tube and warm it gently in a water bath.
  - Add a 5% solution of alkaline potassium permanganate drop by drop to this solution.
- Does the colour of potassium permanganate persist when it is added initially ?
  - Why does the colour of potassium permanganate not disappear when excess is added ?
  - What happens when ethanol is treated with 5% alkaline solution of  $KMnO_4$  ?
  - What is the colour of potassium permanganate solution ?
  - What is the nature of potassium permanganate ?

Ans :

- The purple colour due to permanganate gets decolourised during the reaction.
- When all the alcohol gets consumed, the reaction stops and the purple colour persists.
- The oxidation of ethanol takes place and ethanoic acid is formed.



- It is of purple colour.
- Potassium permanganate is a powerful oxidizing agent.

- 300.** Read the following case based passage and answer the questions given after passage.

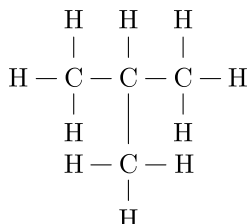
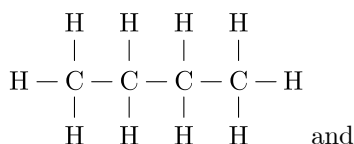
Teacher said to Ganesh to do following experiment.

Compound	Homologous series
Propane, C <sub>3</sub> H <sub>8</sub>	Alkane
Butane, C <sub>4</sub> H <sub>10</sub>	Alkane
Ethene, C <sub>2</sub> H <sub>4</sub>	Alkene
Propene, C <sub>3</sub> H <sub>6</sub>	Alkene
Ethyne, C <sub>2</sub> H <sub>2</sub>	Alkyne
Propyne, C <sub>3</sub> H <sub>4</sub>	Alkyne

- Draw the structural isomers of butane.
- Arrange the alkanes in order of increasing boiling points.
- Identify the hydrocarbons which undergo hydrogenation in the presence of nickel catalyst.
- How many covalent bonds are present in ethyne?

Ans :

- There are two structured isomers.



- CH<sub>4</sub> < C<sub>2</sub>H<sub>6</sub> < C<sub>3</sub>H<sub>8</sub> < C<sub>4</sub>H<sub>10</sub>  
Increasing boiling point →
- Unsaturated hydrocarbons undergo addition of hydrogen in the presence of nickel catalyst, ethene, propene, ethyne and propyne.
- H - C ≡ C - H  
 Number of covalent bonds = 5

**312.** Read the following case based passage and answer the questions given after passage.

Some reaction with organic compound is given below :

- 2CH<sub>3</sub>CH<sub>2</sub>OH + 2Na → 2CH<sub>3</sub>CH<sub>2</sub>ONa + H<sub>2</sub>
- CH<sub>3</sub>CH<sub>2</sub>OH  $\xrightarrow[\text{H}_2\text{SO}_4]{\text{Hot conc.}}$  CH<sub>2</sub>=CH<sub>2</sub> + H<sub>2</sub>O
- CH<sub>3</sub>CH<sub>2</sub>OH  $\xrightarrow[\text{Heat}]{\text{Alkaline KMnO}_4}$  CH<sub>3</sub>COOH
- CH<sub>3</sub>CH<sub>2</sub>OH + NaOH → CH<sub>3</sub>CH<sub>2</sub>ONa + H<sub>2</sub>O

- Which of the above reaction does not take place?
- Which of the above reaction is a displacement reaction?
- What is the name of CH<sub>3</sub>CH<sub>2</sub>ONa.
- What type of reaction the third reaction is? What is alkaline KMnO<sub>4</sub> called ?

Ans :

- Alcohols do not react with NaOH. Hence, reaction (4) does not take place.
- The following reaction is a displacement reaction.  
 2CH<sub>3</sub>CH<sub>2</sub>OH + 2Na → 2CH<sub>3</sub>CH<sub>2</sub>ONa + H<sub>2</sub>
- Sodium ethoxide.
- The reaction (3) is an oxidation reaction as there is an addition of oxygen to the starting compound, ethanol.

Hot and alkaline KMnO<sub>4</sub> is an oxidizing agent.

**313.** Read the following case based passage and answer the questions given after passage.

Compounds having carbon atoms among the components are known as carbon compounds. Carbon compounds could only be obtained from a living source; hence they are also known as organic compounds. Bond formed by sharing of electrons is called covalent bond. Two or more atoms share electrons to make their configuration stable. In this type of bond, all the atoms have similar rights over shared electrons. Compounds which are formed because of covalent bond are called 'covalent compounds'. Covalent bonds are of three types: Single, double and triple covalent bond. Carbon combines with oxygen, hydrogen, nitrogen, sulphur, chlorine and many other elements to form various stable compounds. The stability of carbon compounds is due to the small size of carbon which enables the nucleus to hold on to the shared pair of electrons strongly. The reactions shown by carbon compounds involve breaking of old bonds in the reacting molecules and the formation of new bonds in the product molecules. Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation.

- Which of the following is true about saturated carbon compounds ?  
 (a) Carbon compounds could only be obtained from a living source.  
 (b) Two or more atoms share electrons to make their configuration.

- 303.** Read the following case based passage and answer the questions given after passage.

Teacher said to Raheem to do following experiment:

- Take two test tubes with about 10 mL of hard water in each.
  - Add five drops of soap solution to one and five drops of detergent solution to the other.
  - Shake both test tubes for the same period
- (i) Do both test tubes have the same amount of foam?
  - (ii) In which test tube is a curdy solid formed ?
  - (iii) What are detergents ?
  - (iv) Which will form foam with hard water easily soap or synthetic detergent ?
  - (v) Why is detergent a better cleansing agent than soap ?
  - (vi) Which causes water pollution, detergent or soap ?

**Ans :**

- (i) No, the test tube to which detergent was added has more foam.
- (ii) In the test tube in which soap was added.
- (iii) Synthetic detergents are sodium salts of sulphonic acid group ( $-\text{SO}_3\text{Na}$ ) attached to a long chain of hydrocarbon.
- (iv) Synthetic detergent will form foam more easily with hard water as it does not react with the soluble salts of Mg and Ca present in hard water.
- (v) Detergent is a cleansing agent better than soap because detergent acts better even in hard water.
- (vi) Detergent causes water pollution as detergents are non-biodegradable.

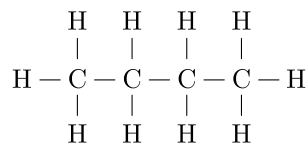
- 304.** Read the following case based passage and answer the questions given after passage.

The two characteristics features seen in carbon, that is, tetravalency and catenation, put together give rise to many compounds. Many compounds have different atoms or group of atoms attached to different carbon chains.

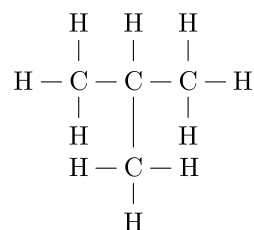
- (i) Draw the structure of the hydrocarbon containing four carbon atoms with single bonds and open chain structure, branched chain structure.
- (ii) Define catenation.
- (iii) Define functional group.
- (iv) What are saturated hydrocarbons?

**Ans :**

- (i) (a) Open chain structure:



- (b) Branched chain structure:

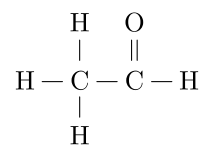


- (ii) Catenation is defined as the ability of carbon atom to form a bond with itself linking properly is known as catenation.
- (iii) Functional group in an atom or group of atoms attached to the carbon in an organic compound and determines the properties of organic compound.
- (iv) Saturated hydrocarbons are those hydrocarbons which contains only carbon-carbon single bonds.

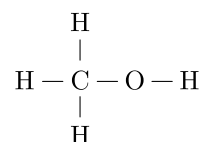
- 305.** Read the following case based passage and answer the questions given after passage.

A series of compounds in which the same functional group substitutes for hydrogen in a carbon chain is called homologous series. Each homologous series has its own general formula. In a given homologous series, there is a gradation in physical properties like melting point and boiling point.

- (i) Which functional group is present in the following organic compound ?



- (ii) Write the general formula of the alkyl in homologous series.
- (iii) Write the structure of the first member of the alcohol homologous series.



- (i) Discuss why a diamond is a rigid, compact, three dimensional structure and is very hard to break.
- (ii) What are saturated carbon compounds ?

**Ans :**

- (i) Each carbon atom is bonded to four other carbon atoms by a single covalent bond which makes it rigid and hard.
- (ii) Carbon compounds in which all the four valencies of carbon atom are satisfied by forming single covalent bonds.

**316.** Study the table which shows some information about four organic compounds *A*, *B*, *C* and *D* and answer the questions that follow :

Organic compound	Molecular formula	Melting point ( $^{\circ}\text{C}$ )	Boiling point ( $^{\circ}\text{C}$ )
<i>A</i>	$\text{C}_3\text{H}_8$	-188	-42
<i>B</i>	$\text{C}_4\text{H}_{10}$	-138	-1
<i>C</i>	$\text{C}_5\text{H}_{12}$	-130	36
<i>D</i>	$\text{C}_6\text{H}_{12}$	6	80

- (i) Which of these organic compounds belong to the alkane series?
- (ii) Based on the information given above, state one characteristic of the alkane series.
- (iii) The homologous series  $\text{C}_6\text{H}_{12}$  belong to
- (a) alkane                      (b) alkene
- (c) alkyne                      (d) none of these
- (iv) The IUPAC name of the compound having molecular formula,  $\text{C}_4\text{H}_{10}$  is
- (a) methane                      (b) butane
- (c) propane                      (d) ethane

**Ans :**

- (i)  $\text{C}_3\text{H}_8$ ,  $\text{C}_4\text{H}_{10}$  and  $\text{C}_5\text{H}_{12}$  all have general formula  $\text{C}_n\text{H}_{2n+2}$  thus, all of these belong to alkanes.
- (ii) They have general formula  $\text{C}_n\text{H}_{2n+2}$  and their melting points and boiling points increase with increase in molecular mass.
- (iii) (b) As  $\text{C}_6\text{H}_{12}$  has general formula  $\text{C}_n\text{H}_{2n}$  thus it belongs to alkene.
- (iv) (b) Butane

# CHAPTER 5

## Life Processes

Life processes are various essential processes which take place in the body of living beings for their survival. They are also called metabolic processes. These processes are nutrition, respiration, transportation, excretion and reproduction.

### 1. NUTRITION

Nutrition is the breakdown of complex food nutrients into simpler forms and their utilisation to get energy for various processes taking place in the body.

It may be of following types :

1. **Autotrophic Nutrition:** Some organisms manufacture their food from simple inorganic compounds. These organism are called autotrophs. They are green plants, some bacteria and some protists.
2. **Chemosynthetic Nutrition:** Non-green autotrophs like iron and sulphur bacteria prepare organic food by using chemical energy released during oxidation of simple inorganic compounds.
3. **Heterotrophic Nutrition:** The organisms obtain ready-made food from plants or animals, dead or alive. All animals, most protists and bacteria are heterotrophs. Heterotrophic nutrition may be saprotrophic (fungi), parasitic (Cuscuta, tapeworms, etc.) and holozoic (herbivores, carnivores, omnivores and scavengers).
  - Nutrition in unicellular organisms such as Amoeba, takes place through cell surface.
  - In Amoeba food is captured by pseudopodia and gets enclosed in a food vacuole. Digestion occurs inside food vacuole. The digested food diffuses into the cell cytoplasm and undigested part of food is expelled at any point on the body surface.
  - Nutrition in multicellular organisms such as human beings takes place through a specialised system called digestive system.

### 2. HUMAN ALIMENTARY CANAL

Human alimentary canal is about 9 metres long tube, from mouth to anus. In mouth, teeth bite, tear, chew and grind the food. Food is mixed thoroughly with saliva secreted by salivary glands and is swallowed with the help of muscular tongue.

1. Oesophagus is about 25 cm long muscular tube which passes food from mouth to stomach by its peristaltic movements.
2. Stomach is a muscular bag. It contains gastric glands in its wall that secrete gastric juice, hydrochloric acid (HCl) and mucus. Stomach stores food, churns it into a fine pulp called chyme and mixes gastric juice with it.
3. Small intestine is about 6 metres (20 feet) long and 2.5 cm wide coiled tube. It is the site of complete digestion of food. It receives the secretions from pancreas and liver. It has numerous finger-like projections called villi for absorption of food. The unabsorbed food is passed to large intestine.
4. Large intestine (colon) is about 1.5-1.8 metres (5-6 feet) long and about 6 cm wide tube. It opens outside through anus. Caecum is a small pouch in large intestine which ends into a blind tube called vermiform appendix. In man, it has no function and is a vestigial organ.
5. Salivary glands, liver and pancreas are main digestive glands which help in digestion.

### 3. DIGESTION OF FOOD

Digestion of food in different parts of alimentary canal takes place by the secretions of digestive glands.

1. In mouth, enzyme salivary amylase present in saliva acts upon the starch of food. Gastric glands release hydrochloric acid, pepsin and mucus. Hydrochloric acid makes food acidic. It destroys bacteria present in the food. Mucus protects the inner lining of stomach from action of HCl. Pepsin digests proteins.

2. In small intestine, bile juice secreted by liver and stored in a pouch-like organ called gall bladder, makes the medium alkaline for the action of enzymes of pancreatic and intestinal juice and emulsifies fats. Trypsin brings about protein digestion. Lipase acts on emulsified fats and breaks them into fatty acids and glycerol.

In large intestine, the water from undigested food is absorbed and rest is removed from the body through anus.

1. The end products of carbohydrate, fat and protein digestion are glucose, glycerol and fatty acids, and a acids respectively.
2. Glucose and amino acids diffuse into the blood through intestinal wall. Glycerol and fatty acids enter the lymph vessels or lacteals present in villi.

#### 4. RESPIRATION

Respiration is the process of oxidation or breaking down of organic compounds (particularly glucose) to obtain energy. Respiration may be :

1. Aerobic respiration, in which breakdown of glucose occurs in the presence of oxygen.
2. Anaerobic respiration, in which breakdown of glucose occurs in the absence of oxygen.

Glycolysis is the first step in the breakdown of glucose, common to both types of respiration. It occurs in cytoplasm. During glycolysis, one molecule of glucose (6-carbon molecule) is broken down into two molecules of pyruvic acid or pyruvate (3-carbon molecule) with four molecules of ATP.

1. In the presence of oxygen, pyruvic acid inside the mitochondria is broken down into  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  and energy is released. This process is called Krebs cycle.
2. In the absence of oxygen, pyruvic acid breaks into ethyl alcohol or ethanol (2-carbon molecule),  $\text{CO}_2$  and releases energy. It is called anaerobic respiration.
3. In lack (deficiency) of oxygen in muscles, pyruvic acid breaks into lactic acid (3-carbon molecule) and energy, is released.

Respiration in plants occurs through stomata of leaves, through lenticel in older portions of stems and through root hair in roots.

Respiration in unicellular animals (Amoeba, Paramecium) and simple multicellular animals (sponges, coelenterates, planarian and free-living nematodes) occurs as direct respiration and in complex multicellular animals occurs as indirect respiration through skin (frog, earthworm, etc.),

gills (fish, molluscs, etc.), air tubes or trachea (insects) book lungs (spider, scorpion) and lungs (vertebrates except fish).

#### 4.1 Respiratory System in Man

Air is taken into through nostrils and nasal passages (Nose). They open into the pharynx by internal nares. Hair and mucous lining of nasal passages trap dust and bacteria coming with air and make inhaled air moist.

Trachea opens in pharynx. Its opening in the pharynx called glottis and is guarded by a cartilaginous flap called epiglottis. The wall of trachea is supported with C-shaped cartilaginous rings. Trachea is divided into two primary bronchi.

1. Each primary bronchus enters the lung of its side and divides into secondary and tertiary (segmental) bronchi. A bronchus with its branches is called a bronchial tree.
2. Each segmental bronchus after fine branching, ends in alveolar ducts which open into alveolar sacs.
3. Alveoli have enormous surface area for gaseous exchange and are covered with network of capillaries for rich blood supply.
4. Passage of air in human body is nostrils → Trachea → Bronchi → Alveolar sacs.

The lungs are the main respiratory organs in man. They are a pair of conical, highly spongy, air-filled sacs formed of millions of alveoli. They are enclosed by a double-layered membrane called pleura and are located inside the air-tight thoracic cavity. The right lung is larger with three lobes while the left lung has just two lobes. Breathing is a mechanical process which is completed in following two steps:

1. **Inspiration:** It is taking in of air. In this process, ribs and sternum are pulled upward, forward and outward, diaphragm flattens increasing the volume of thoracic cavity and causing lungs to expand. Due to this, fresh air from air passages rushes in to fill in the alveoli.
2. **Expiration:** It is expelling of air out of lungs. In this process, ribs and sternum are pulled inward which decreases the volume of thoracic cavity and the air is forced out.
3. Exchange of gases occurs between alveolar air and blood in capillaries inside lung alveoli. Oxygen from the alveolar air diffuses into the blood and carbon dioxide from the blood diffuses into the alveolar air.



- 290.** (a) Draw diagram of human alimentary canal and label the following :
- Part in which starch digestion starts.
  - Part in which bile is stored.
  - Part in which nutrients are absorbed.
  - Part in which water is absorbed.
- (b) Mention the role of hydrochloric acid in the stomach.
- (c) What function is served by the following :
- Gastric sphincter
  - Anal sphincter

Ans :

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(a)

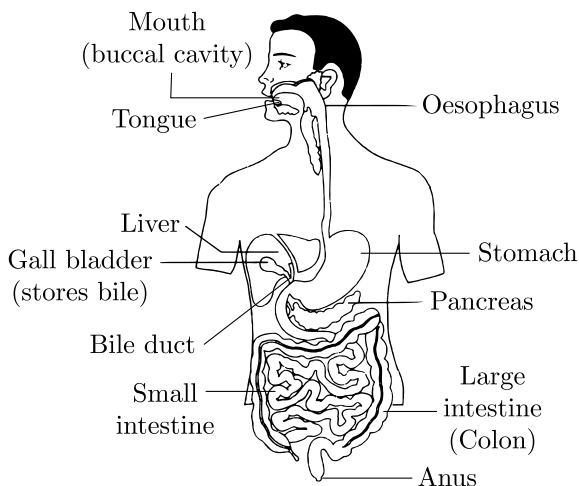


Figure: Human digestive system

- Mouth (Buccal cavity)
  - Gall bladder
  - Small intestine
  - Large intestine
- (b) Hydrochloric acid kills bacteria in the stomach and provides acidic medium for the action of pepsin.
- (c) (i) Gastric sphincter controls the release of food from the stomach to small intestine.
- (ii) Anal sphincter controls the release of undigested waste from the rectum through the anus.

- 291.** Draw neat diagram of digestive system. Label all of its parts. How the main components of the food get digested in the small intestine ? Explain.

Ans :

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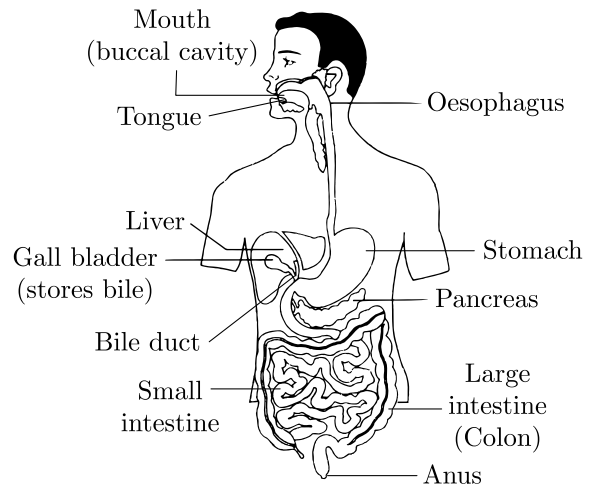


Figure: Human digestive system

Small intestine receives secretion from liver and pancreas in the form of bile juice and trypsin. Trypsin digests proteins and lipase digest fats. Bile juice makes basic medium and emulsifies fats and intestinal juice converts proteins to amino acids, carbohydrates to glucose and fats to fatty acids and glycerol.

- 292.** Why is respiration important for all living organisms?

Ans :

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Respiration is important for all living organisms because :

- For obtaining energy :  
The oxygen which we inhale along with air oxidises the food and liberates energy.
- For the removal of toxic carbon dioxide :  
Carbon dioxide is produced in our tissues as a result of oxidation of food.  $\text{CO}_2$  is injurious to our body, if it accumulates in the tissues in higher concentration and for longer period.  
During respiration, gaseous exchange ( $\text{O}_2$  and  $\text{CO}_2$ ) takes place between the tissue and blood. During this process,  $\text{CO}_2$  from the tissues gets diffused into the blood.  
The blood takes this  $\text{CO}_2$  into the respiratory organs (e.g., lungs), from where it is eliminated back into the atmosphere.

- 293.** Draw the diagram of alimentary canal of man and label the following parts :

- Mouth
- Oesophagus
- Stomach
- Intestine

## 5.7 Blood

It is a red-coloured fluid. The fluid matrix of blood is called plasma. Blood cells or corpuscles (RBCs, WBCs and platelets) are suspended in the plasma.

## 5.8 Lymphatic System

The lymphatic system consists of lymph (the fluid), lymph vessels and lymph nodes.

1. Lymph is filtered blood. It is a link between blood and tissue fluid which facilitates exchange of substances between blood and body cells by diffusion. The tissue fluid on entering lymphatic capillaries is called lymph.
2. Lymph vessels are called lymphatics. They form a network in the body. In the intestinal wall, they are called lacteals.
3. Lymph nodes are formed of lymphatic tissue. Thymus and spleen are lymphatic organs. Tonsils and adenoids are masses of lymphatic tissue.

## 6. EXCRETION

Excretion is the removal of harmful and unwanted metabolic wastes from the body.

Osmoregulation is the regulation of osmotic pressure of body fluids by controlling the amount of water and salts in the body.

### 6.1 Excretion in Plants

Waste products in plants are tannins, resins, gums, alkaloids, essential oils, salt crystal, etc. They are deposited in old and non-functional xylem, older leaves which are soon shed off, dead cells of bark, etc. The plants living in saline habitats excrete excess of salts.

### 6.2 Excretion in Animals

In unicellular animals, ammonia and carbon dioxide diffuse out of their body by simple diffusion.

Excretion in man occurs by one pair of kidneys located in the abdominal cavity. Kidneys form urine, remove nitrogenous wastes, excess of water and salts from the blood. Blood enters kidneys for filtration through a pair of renal arteries and a pair of renal veins collect filtered blood from kidneys.

Nephrons or uriniferous tubules are basic filtration units of kidney.

1. The cup-like hollow proximal part of each

nephron is known as Bowman's capsule. It is filled with a tuft of blood capillaries called glomerulus. The glomerulus and Bowman's capsule collectively form a Malpighian body which acts as ultrafilters. The blood while passing through glomerular capillaries is filtered under pressure and the filtrate is collected in the cavity of Bowman's capsule.

2. The remaining tubular part of nephron has Proximal Convoluted Tubule (PCT), U-shaped Henle's Loop and Distal Convoluted Tubule (DCT). The distal convoluted tubule opens into the collecting tubule which finally opens into the pelvic part of ureter. All parts of renal tubule are covered with a network of peritubular capillaries.

### 6.3 Urine Formation

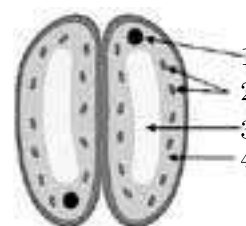
Urine formation involves following steps:

1. **Ultrafiltration:** Water and dissolved substances such as urea, uric acid, glucose, amino acids, some vitamins and inorganic salts are filtered from the blood flowing under pressure in glomerular capillaries and form nephric or glomerular filtrate.
2. **Selective Reabsorption:** Useful substances (glucose, all amino acids, some inorganic salts and most water) are reabsorbed from nephric filtrate into the blood.
3. **Tubular Secretion:** The excretory products such as creatinine and potassium are secreted from the blood into the nephric filtrate by diffusion.
4. This way nephric filtrate changes into urine which is a straw-coloured liquid due to presence of urochrome. It contains water and dissolved solids.

Urine is collected in the urinary bladder. It is released periodically to the exterior through urethra.

## OBJECTIVE QUESTIONS

1. In the given diagram of a closed stomata: (1), (2), (3) and (4) respectively are:



- (i) Left atrium receives oxygenated blood from different parts of body while right atrium receives deoxygenated blood from lungs.
- (ii) Left ventricle pumps oxygenated blood to different body parts while right ventricle pumps deoxygenated blood to lungs.
- (iii) Left atrium transfers oxygenated blood to right ventricle which sends it to different body parts.
- (iv) Right atrium receives deoxygenated blood from different parts of the body while left ventricle pumps oxygenated blood to different parts of the body.

- (a) (i)

(b) (ii)
- (c) (ii) and (iv)

(d) (i) and (iii)

Ans :

- (c) (ii) and (iv)

- 19.** What prevents back flow of blood inside the heart during contraction ?

- (a) Valves in heart
- (b) Thick muscular walls of ventricles
- (c) Thin walls of atria
- (d) All of the above

Ans :

- (a) Valves in heart

- 20.** Single circulation i.e., blood flows through the heart only once during one cycle of passage through the body, is exhibited by

- (a) Labeos, Chameleon, Salamander  
(b) Hippocampus, Exocoetus, Anabas  
(c) Hyla, Rana, Draco  
(d) Whale, Dolphin, Turtle

Ans :

- (b) Hippocampus, Exocoetus, Anabas

- 21.** In which of the following vertebrate group/groups, heart does not pump oxygenated blood to different parts of the body ?

- (a) Pisces and amphibians
- (b) Amphibians and reptiles
- (c) Amphibians only
- (d) Pisces only

Ans :

- (d) Pisces only

- 22.** Choose the correct statement that describes arteries.

- (a) They have thick elastic walls, blood flows under high pressure; collect blood from different organs and bring to the heart.

- (b) They have thin walls with valves inside, blood flows under low pressure and carry blood away from the heart to various organs of the body.
- (c) They have thick elastic walls, blood flows under low pressure; carry blood from the heart to various organs of the body.
- (d) They have thick elastic walls without valves inside, blood flows under high pressure and carry blood away from the heart to different parts of the body.

Ans :

- (d) They have thick elastic walls without valves inside, blood flows under high pressure and carry blood away from the heart to different parts of the body.

- 23.** The filtration units of kidneys are called ?

- (a) ureter                                      (b) urethra  
(c) neurons                                    (d) nephrons

Ans :

- (d) nephrons

- 24.** Oxygen liberated during photosynthesis comes from?

- (a) water                                      (b) chlorophyll  
(c) carbon dioxide                        (d) glucose

**Ans :**

- (a) water

- 25.** The blood leaving the tissues becomes richer in

- (a) carbon dioxide                      (b) water  
(c) haemoglobin                        (d) oxygen

Ans :

- (a) carbon dioxide

- 26.** Which of the following is an incorrect statement ?

- (a) Organisms grow with time
- (b) Organisms must repair and maintain their structure.
- (c) Movement of molecules does not take place among cells.
- (d) Energy is essential for live processes.

Ans :

- (c) Movement of molecules does not take place among cells.

- 27.** The internal (cellular) energy reserve in autotrophs is ?

10. In which part of the alimentary canal food is finally digested ?

(a) Stomach (b) Mouth cavity  
(c) Large intestine (d) Small intestine

Ans :

(d) Small intestine

11. Choose the function of the pancreatic juice from the following

(a) trypsin digests proteins and lipase carbohydrates  
(b) trypsin digests emulsified fats and lipase proteins  
(c) trypsin and lipase digest fats  
(d) trypsin digests proteins and lipase emulsified fats

Ans :

(d) Trypsin digests proteins and lipase emulsified fats

12. When air is blown from mouth into a test-tube containing lime water, the lime water turned milky due to the presence of

(a) oxygen (b) carbon dioxide  
(c) nitrogen (d) water vapour

Ans :

(b) carbon dioxide

13. The correct sequence of anaerobic reactions in yeast is

(a) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{mitochondria}}$  Ethanol + carbon dioxide  
(b) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{cytoplasm}}$  Lactic acid  
(c) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{mitochondria}}$  Lactic acid  
(d) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{cytoplasm}}$  Ethanol + Carbon dioxide

Ans :

(d) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{cytoplasm}}$  Ethanol + Carbon dioxide

14. Which of the following is most appropriate for aerobic respiration ?

(a) Glucose  $\xrightarrow{\text{mitochondria}}$  Pyruvate  $\xrightarrow{\text{cytoplasm}}$   $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$   
(b) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$

(c) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + Energy  
 $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O}$

(d) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + Energy  
 $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O}$  Energy

Ans :

(d) Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + Energy  
 $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O}$  Energy

15. Which of the following statement(s) is(are) true about respiration ?

(i) During inhalation, ribs move inward and diaphragm is raised.  
(ii) In the alveoli, exchange of gases takes place i.e., oxygen from alveolar air diffuses into blood and carbon dioxide from blood into alveolar air.  
(iii) Haemoglobin has greater affinity for carbon dioxide than oxygen.  
(iv) Alveoli increase surface area for exchange of gases.  
(a) (i) and (iv) (b) (ii) and (iii)  
(c) (i) and (iii) (d) (ii) and (iv)

Ans :

(d) (ii) and (iv)

16. Which is the correct sequence of air passage during inhalation ?

(a) Nostrils  $\rightarrow$  larynx  $\rightarrow$  pharynx  $\rightarrow$  trachea  $\rightarrow$  lungs  
(b) Nasal passage  $\rightarrow$  trachea  $\rightarrow$  pharynx  $\rightarrow$  larynx  $\rightarrow$  alveoli  
(c) larynx  $\rightarrow$  nostrils  $\rightarrow$  pharynx  $\rightarrow$  lungs  
(d) Nostrils  $\rightarrow$  pharynx  $\rightarrow$  larynx  $\rightarrow$  trachea  $\rightarrow$  alveoli.

Ans :

(d) Nostrils  $\rightarrow$  pharynx  $\rightarrow$  larynx  $\rightarrow$  trachea  $\rightarrow$  alveoli.

17. During respiration exchange of gases take place in

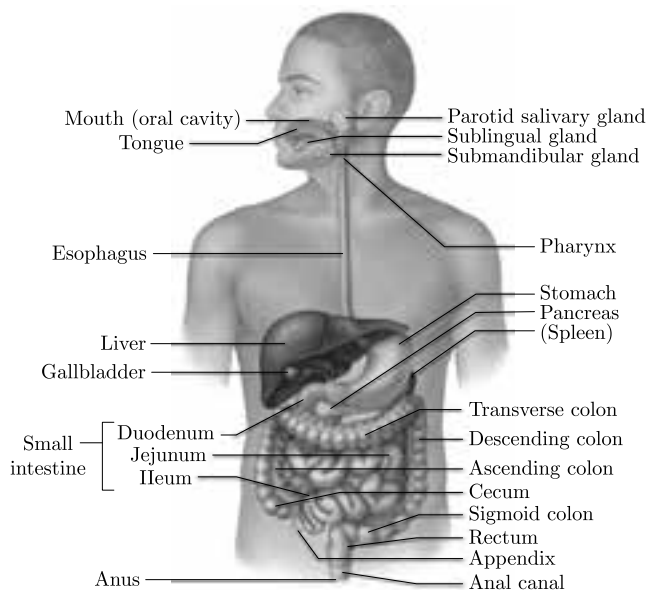
(a) trachea and larynx  
(b) alveoli of lungs  
(c) alveoli and throat  
(d) throat and larynx

Ans :

(b) alveoli of lungs

18. Which of the following statement(s) is (are) true about heart ?

the acid under normal conditions.



- (i) What is the name of the enzyme present in saliva?
- (ii) What type of substance is secreted by gastric glands?
- (iii) What is the role of mucus?

**Ans :**

- (i) The name of the enzyme present in saliva is salivary amylase.
- (ii) Gastric glands release hydrochloric acid.
- (iii) The mucus protects the inner lining of the stomach from the action of the acid under normal conditions.

**323.** Chronic Kidney Disease (CKD) is a condition characterized by a gradual loss of kidney function over time. CKD is also known as chronic renal disease. With increasing life expectancy and prevalence of life style diseases, US has seen a 30% increase in prevalence of Chronic Kidney Disease (CKD) in the last decade. Unfortunately, from India there is no longitudinal study and limited data on the prevalence of CKD.

In western countries, diabetes and hypertension account for over 2/3<sup>rd</sup> of the cases of CKD. In India too, diabetes and hypertension today account for 40-60% cases of CKD. As per recent Indian Council of Medical Research data, prevalence of diabetes in Indian adult population has risen to 7.1%, (varying from 5.8% in Jharkhand to 13.5% in Chandigarh) and in urban population (over the age of 40 years) the prevalence is as high as 28%. Likewise, the reported prevalence of hypertension in the adult population today is 17% (14.8% from rural and 21.4% from

urban belt). A similar prevalence of 17.4% has been reported by Panesar et al. (in the age group of 20-59 years) even from slum-resettlement colony of Delhi. With rising prevalence of these diseases in India, prevalence of CKD is expected to rise and obviously, this is the key target population to address.

A study published in this issue is from a rural belt of Karnataka. The population had a mean age of  $39.88 \pm 15.87$  years with 3.82% prevalence of diabetes and 33.62% of hypertension. Authors found 6.3% prevalence of CKD stage 3; which is the highest reported till date by any Indian worker. It is disturbing to note, the high prevalence of hypertension in a rural setting where over 75% population had normal or low body mass index. In comparison to most other published studies from India, the present study population is younger and even the prevalence of diabetes is low but surprisingly despite that prevalence of stage 3 CKD is reported to be higher (6.3%). It is disturbing to see the rising prevalence of hypertension and CKD in rural belts. Possibly, with shifting population the difference between urban and rural areas is getting blurred. Undoubtedly, we need more Indian data to validate these findings.

- (i) What is CKD?
- (ii) What are the major causes of CKD?
- (iii) In which segment of society is CKD more prevalent?
- (iv) What is the highest percentage of CKD reported?

**Ans :**

- (i) It is a condition characterized by a gradual loss of kidney function over time.
- (ii) Diabetes and hypertension
- (iii) Rural
- (iv) 6.3%

**324.** Study these tables related to haemoglobin levels and answer the questions that follow.

Table A: Haemoglobin level chart

Remarks	Haemoglobin (g/dL)
Doctor's advice needed	9-7
	7-4
Good	10-13
Excellent	14-16

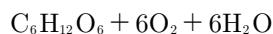
- (a) glycogen (b) protein  
(c) Starch (d) fatty acid

Ans :

(c) Starch

28. Which of the following equations is the summary of photosynthesis ?

- (a)  $6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$   
(b)  $6\text{CO}_2 + \text{H}_2\text{O} + \text{Sunlight} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 + 6\text{H}_2\text{O}$   
(c)  $6\text{CO}_2 + 12\text{H}_2\text{O} + \text{Chlorophyll} + \text{Sunlight} \rightarrow$



- (d)  $6\text{CO}_2 + 12\text{H}_2\text{O} + \text{Chlorophyll} + \text{Sunlight} \rightarrow$   
 $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$

Ans :

(c)  $6\text{CO}_2 + 12\text{H}_2\text{O} + \text{Chlorophyll} + \text{Sunlight} \rightarrow$   
 $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$

29. Choose the event that does not occur in photosynthesis

- (a) Absorption of light energy by chlorophyll  
(b) Reduction of carbon dioxide to carbohydrates  
(c) Oxidation of carbon to carbon dioxide  
(d) Conversion of light energy to chemical energy

Ans :

(c) Oxidation of carbon to carbon dioxide

30. The opening and closing of the stomatal pore depends upon

- (a) oxygen  
(b) temperature  
(c) water in guard cells  
(d) concentration of  $\text{CO}_2$  in stomata

Ans :

(c) water in guard cells

31. Choose the forms in which most plants absorb nitrogen

- (i) Proteins  
(ii) Nitrates and Nitrites  
(iii) Urea  
(iv) Atmospheric nitrogen  
(a) (i) and (ii) (b) (ii) and (iii)  
(c) (iii) and (iv) (d) (i) and (iv)

Ans :

(b) (ii) and (iii)

32. Which is the first enzyme to mix with food in the digestive tract ?

- (a) Pepsin (b) Cellulose  
(c) Amylase (d) Trypsin

Ans :

(c) Amylase

33. Which of the following statement(s) is/(are) correct ?

- (i) Pyruvate can be converted into ethanol and carbon dioxide by yeast.  
(ii) Fermentation takes place in aerobic bacteria.  
(iii) Fermentation takes place in mitochondria.  
(iv) Fermentation is a form of anaerobic respiration.  
(a) (i) and (iii) (b) (ii) and (iv)  
(c) (i) and (iv) (d) (ii) and (iii)

Ans :

(c) (i) and (iv)

34. Lack of oxygen in muscles often leads to cramps among cricketers. This results due to

- (a) conversion of pyruvate to ethanol  
(b) conversion of pyruvate to glucose  
(c) non-conversion of glucose to pyruvate  
(d) conversion of pyruvate to lactic acid

Ans :

(d) conversion of pyruvate to lactic acid

35. Choose the correct path of urine in our body

- (a) kidney  $\rightarrow$  ureter  $\rightarrow$  urethra  $\rightarrow$  urinary bladder  
(b) kidney  $\rightarrow$  urinary bladder  $\rightarrow$  urethra  $\rightarrow$  ureter  
(c) kidney  $\rightarrow$  ureters  $\rightarrow$  urinary bladder  $\rightarrow$  urethra  
(d) urinary bladder  $\rightarrow$  kidney  $\rightarrow$  ureter  $\rightarrow$  urethra

Ans :

(c) kidney  $\rightarrow$  ureters  $\rightarrow$  urinary bladder  $\rightarrow$  urethra

36. During deficiency of oxygen in tissues of human beings, pyruvic acid is converted into lactic acid in the

- (a) cytoplasm (b) chloroplast  
(c) mitochondria (d) golgi body

Ans :

(a) cytoplasm



37. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Nutrition	(p)	The increase in cell size and/or number
(B)	Synthesis	(q)	The movement of materials within the cell or within the organism.
(C)	Growth	(r)	The process of obtaining food
(D)	Transport	(s)	Combining small molecules to create larger more complex molecules.

	A	B	C	D
(a)	q	r	p	s
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

(c)A-r, B-s, C-p, D-q

38. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Regulation	(p)	The removal of metabolic waste from an organism
(B)	Reproduction	(q)	The chemical process of oxidizing organic molecules to release energy.
(C)	Respiration	(r)	The replication of an organism
(D)	Excretion	(s)	The control and coordination of chemical processes within the organism

	A	B	C	D
(a)	s	r	q	p
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

(a)A-s, B-r, C-q, D-p

39. **Assertion (A)** : The rate of breathing in aquatic organisms is much faster than in terrestrial organisms.

**Reason (R)** : The amount of oxygen dissolved in water is very high as compared to the amount of oxygen in air.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
 (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).  
 (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

Ans :

OD 2024

Terrestrial organisms breathe the oxygen in the atmosphere, but animals that live in water (aquatic organisms) use the oxygen dissolved in water. Since the amount of dissolved oxygen is very low as compared to amount of oxygen in the air (21%). So, the rate of breathing in aquatic organisms is much faster than that in terrestrial organisms.

Thus (c) is correct option.

40. **Assertion** : All the plants possess autotrophic mode of nutrition.

**Reason** : Due to the presence of green coloured pigment chlorophyll in them.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Both Assertion and Reason are false.

Ans :

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

All plants possess autotrophic mode of nutrition due to the presence of green coloured pigment chlorophyll in the leaves of the plants due to which



they make their own food in the presence of sunlight through photosynthesis process. So both assertion and reason are true and reason is the correct explanation of the assertion.

- 41. Assertion :** Egestion in amoeba takes place through a permanent membrane present in them.

**Reason :** Cilia is absent in amoeba.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

In amoeba, there is no fixed place through which egestion takes place whenever considerable amount of undigested food collects inside its cell membrane suddenly ruptures and at any place the undigested food is thrown out of the body. So, both assertion and reason are false.

- 42. Assertion :** Ethanol is obtained during the anaerobic process of respiration.

**Reason :** This is due to presence of oxygen and it takes place in the mitochondria.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

During the anaerobic respiration in the absence of oxygen ethanol is formed in the presence of micro-organism such as yeast through the fermentation process where it breaks down the glucose into ethanol and carbon dioxide along with the two molecules of ATP. So, assertion is true but the reason is false.

- 43. Assertion :** During the night the effect of root pressure in transport of water is more important.

**Reason :** Stomata is open during day, transpiration takes place which help in transport of water.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Transpiration becomes the main driving force during the day, but during night there is no sunlight thus no transpiration takes place, so water is pulled up due to root pressure. So, both assertion and reason are true and reason is the correct explanation of the assertion.

- 44. Assertion :** Carbon monoxide is injurious to the health of the individual.

**Reason :** Carbon monoxide has very strong affinity for the blood.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

Carbon monoxide binds very strongly with the haemoglobin present in the blood and prevents it from carrying oxygen to the brain and other parts of the body due to which the person cannot breathe and is injurious to health. So, both assertion and reason are true but reason is not the correct explanation of the assertion.

- 45. Assertion :** In plants, water is transported through phloem.

**Reason :** It is because sieve tubes are absent in phloem.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

left ventricles are separated by an interventricular septum.

- 57. Assertion :** Excretion is the biological process by which harmful wastes are removed from an organism's body.

**Reason :** The mode of excretion is completely same in both unicellular and multicellular organisms.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

- (c) Assertion is true but Reason is false.

Excretion is the biological process by which harmful metabolic wastes are removed from the body. The mode of excretion is completely different in unicellular organisms. In unicellular organisms, waste products are diffused into surrounding water through body surface. While, in multicellular organisms, specialised organs perform the function of excretion.

- 58. Assertion :** The main organ of human excretory system is kidney.

**Reason :** Kidneys perform the function of adding water and nitrogenous wastes from the body.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The main organ of human excretory system is kidney. The major function performed by kidneys is to remove excess water and nitrogenous wastes from blood in the form of urine.

- 59. Assertion :** Artificial kidney is a device used to remove nitrogenous waste products from the blood through dialysis.

**Reason :** Reabsorption does not occur in artificial kidney.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

- (c) Assertion is true but Reason is false.

- (d) Assertion is false but Reason is true.

**Ans :**

- (c) Assertion is true but Reason is false.

Kidney failure can be managed by artificial kidney. It is a device used to remove nitrogenous waste products from the blood through dialysis.

Artificial kidney is different from natural kidney as the process of reabsorption does not occur in artificial kidney.

## ONE MARK QUESTIONS

- 60.** Why is respiration considered an exothermic reaction?

**Ans :**

Comp 2021

Respiration is an exothermic process because energy is released during the process.

- 61.** Why do arteries have thick elastic walls ?

**Ans :**

SQP 2021

The heart pumps blood at high pressure. If arteries have thin walls they would burst because of high blood pressure. That is why arteries have thick walls.

- 62.** Name the molecule of energy which is synthesized during respiration.

**Ans :**

SQP 2020

The energy released during respiration is stored in the form of Adenosine Triphosphate(ATP).

- 63.** Name an enzyme present in pancreatic juice.

**Ans :**

Comp 2019

Lipase

- 64.** Why are plants called alive ?

**Ans :**

OD 2017

The living organisms have invisible molecular movement. Plants also have such type of movement, so they are called alive.

- 65.** Why are molecular movements needed for life ?

**Ans :**

Delhi 2014

Molecular movements are needed for repair and maintenance of the body structures of life forms.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

Amoeba is an omnivore organism, its mode of nutrition is holozoic. Lion is a carnivore organism because it eats other animals (meat eaters). Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

- 52. Assertion :** Liver is known as the largest gland of the body.

**Reason :** It secretes salivary amylase.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(c) Assertion is true but Reason is false.

Liver is known as the largest gland of the body, which secretes bile juice. Salivary glands secrete salivary amylase. Both Assertion and Reason are false.

- 53. Assertion :** Respiration is not a biochemical process opposite to photosynthesis.

**Reason :** Energy is released during respiration.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

Respiration is defined as the process of biochemical oxidation of nutrients at cellular level. It occurs in the presence of specific enzymes at optimum temperature in the cells to release energy for various metabolic activities.

- 54. Assertion :** In woody plants, gaseous exchange occurs through lenticels.

**Reason :** Lenticels are specialised cells found along with stomata on the stem of woody plants.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(c) Assertion is true but Reason is false.

In woody plants, gaseous exchange occurs through the small pores found on stems called lenticels. Stomata on the stem aid in gaseous exchange, in herbaceous plants.

- 55. Assertion :** Haemoglobin is not the respiratory pigment in human beings.

**Reason :** It transports oxygen in the human body.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

Haemoglobin is the respiratory pigment in human beings. It takes up oxygen from the air in the lungs and carries it to tissues.

- 56. Assertion :** Interventricular septum separates left from right atrium.

**Reason :** Interventricular septum separates left from right ventricle.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

There are four chambers of the heart. The left and right atria are separated by an interauricular septum. The two inferior chambers of the heart, i.e., right and

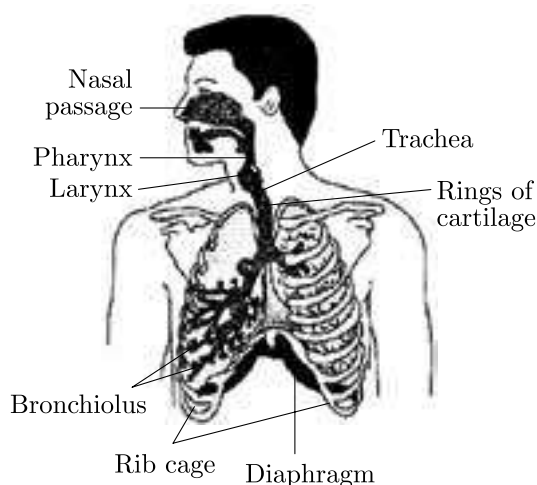
- (c) Pharynx
- (d) Trachea
- (e) Larynx
- (f) Diaphragm

- (ii) What are the factors needed for maintaining the direction of diffusion in plants.

Ans :

OD 2015

(i)



- (ii) Factors needed for maintaining the direction of diffusion in plants are :

- (a) environmental condition.
- (b) requirement of the plant.

**297.** Write down the functions of the blood ?

Ans :

Comp 2016

The different functions of the blood are as follows :

- (i) Transport of nutrients.
- (ii) Transport of respiratory gases ( $O_2$  and  $CO_2$ ).
- (iii) Transport of metabolic waste products (urea, uric acid, ammonia, etc.).
- (iv) Transport of enzymes and hormones.
- (v) Transport of ions.
- (vi) Regulation of the body temperature.
- (vii) Protection of the body from the attack of disease-causing agents.

**298.** (a) Draw diagram of respiratory system and label the following :

- (i) Part through which air is taken in.
- (ii) Part which protects the lungs.
- (iii) Part which carries the air into the lungs.

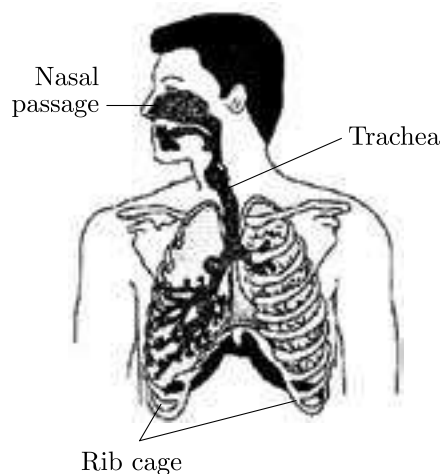
(b) What are alveoli ? Mention their role in respiration.

(c) Differentiate between aerobic and anaerobic respiration.

Ans :

(a)

Comp 2010



(i) Nasal passage

(ii) Rib cage

(iii) Trachea

- (b) Within the lungs, the passage divides into smaller and smaller tubes which finally terminate in balloon-like structures called alveoli.

The walls of the alveoli contain an extensive network of blood vessels.

The alveoli provide a surface where the exchange of gases can take place.

- (c) Aerobic respiration takes place in the presence of oxygen, whereas anaerobic respiration takes place in the absence of oxygen.

**299.** What is the composition of blood ? Give one function of each of its components.

or

Name the constituents of blood.

Ans :

OD 2006

Blood is a liquid connective tissue. It chiefly contains two components :

- (i) Fluid matrix or plasma which is colourless and transports many substances like glucose, amino acids, urea, etc. It contains a lot of water and many proteins.
- (ii) Cellular elements, which are of three types :
  - (a) Red blood corpuscles (RBCs) or erythrocytes, which transport  $O_2$  and  $CO_2$
  - (b) White blood corpuscles (WBCs) or leucocytes, which fight disease-causing agents.
  - (c) Blood platelets or thrombocytes which help in blood-clotting.

66. Name two life processes.

Ans :

SQP 2018

- (i) Nutrition
- (ii) Respiration.

67. What is the main basic element in the food ?

Ans :

Comp. 2015

Carbon.

68. What types of chemical reactions take place in our body to break down the food materials ?

Ans :

OD 2013

- (i) Oxidation reaction
- (ii) Reduction reaction

69. Write two modes of nutrition.

Ans :

Foreign 2011

- (i) Autotrophic
- (ii) Heterotrophic

70. Give two examples of autotrophs.

Ans :

Foreign 2016

- (i) Green plants
- (ii) Chlorobacteria

71. Give two examples of heterotrophs.

Ans :

OD 2012

- (i) Human
- (ii) Cow

72. Name two types of heterotrophs.

Ans :

Comp. 2018

- (i) Parasites
- (ii) Saprophytes

73. Give two examples of parasites.

Ans :

OD 2013

- (i) Plasmodium
- (ii) Cuscuta

74. Give two examples of saprophytes.

Ans :

Delhi 2010

- (i) Fungi
- (ii) Bacteria

75. Name the process by which autotrophs make their own food.

Ans :

Delhi 2006

Photosynthesis.

76. In which form is food stored in the human body ?

Ans :

Delhi 2009

Glycogen.

77. Which mode of nutrition is found in plants ?

Ans :

Foreign 2013

Autotrophic nutrition.

78. Name the raw materials required for photosynthesis.

Ans :

OD 2019

Carbon dioxide, water, sunlight and chlorophyll.

79. Which raw material traps the solar energy ?

Ans :

Delhi 2016

Chlorophyll present in the chloroplast of the leaves.

80. What are stomata ?

Ans :

Comp. 2011

The small holes present on the lower surface of the leaves are called stomata.

81. Name the process by which food is converted into energy.

Ans :

Foreign 2013

Respiration.

82. Name the substance formed in the first step of respiration.

Ans :

SQP 2019

Pyruvate.

83. Where does the process of formation of pyruvate take place ?

Ans :

Delhi 2014

In the cytoplasm.

84. How many types of respiration are there ?

Ans :

OD 2009

There are two types of respiration :

- (i) Aerobic respiration.
- (ii) Anaerobic respiration.

85. Where does the breakdown of pyruvate take place ?

Ans :

OD 2011

In mitochondria.

86. What are the products of aerobic respiration ?

Ans :

Delhi 2016

Carbon dioxide and water vapour.

**87.** What are the products of anaerobic respiration ?

**Ans :** SQP 2011  
Ethanol and carbon dioxide.

**88.** Name the type of respiration in which more energy is released.

**Ans :** Comp 2017  
Aerobic respiration.

**89.** Write the full form of ATP.

**Ans :** OD 2013  
Adenosine triphosphate.

**90.** How many ATP molecules are formed in the oxidation of glucose ?

**Ans :** Delhi 2007  
38 ATP molecules.

**91.** What is breathing ?

**Ans :** Foreign 2011  
The mechanism by which organisms obtain oxygen from the environment and release carbon dioxide into the environment is called breathing.

**92.** Why do aquatic animals breathe faster than terrestrial animals ?

**Ans :** OD 2010  
Amount of oxygen dissolved in water is comparatively low to amount of oxygen in the air so, aquatic animals breathe faster than terrestrial animals.

**93.** What is blood ?

**Ans :** Foreign 2012  
Blood is a fluid connective tissue.

**94.** Name two fluids in humans which are involved in transport.

**Ans :** Delhi 2015  
(i) Blood,  
(ii) Lymph.

**95.** Write the fluid medium in blood.

**Ans :** SQP 2008  
Plasma.

**96.** Which organ is called pumping organ ?

**Ans :** Comp 2006  
Heart.

**97.** Name three kinds of blood vessels.

**Ans :** Delhi 2010  
(i) Arteries  
(ii) Veins  
(iii) Capillaries.

**98.** Name two major parts of transport system in humans.

**Ans :** OD 2015  
(i) Heart,  
(ii) Blood vessels.

**99.** What are the components of blood ?

**Ans :** Delhi 2017  
(i) Blood plasma,  
(ii) Corpuscles.

**100.** Name three types of blood cells.

**Ans :** Foreign 2013  
(i) RBC,  
(ii) WBC,  
(iii) Platelets.

**101.** Write full form of RBC.

**Ans :** Comp 2016  
Red blood corpuscles.

**102.** Give expanded form of WBC.

**Ans :** OD 2007  
White blood corpuscles.

**103.** Name the red pigment which makes the colour of blood red.

**Ans :** Foreign 2010  
Haemoglobin.

**104.** Write two main parts of human heart.

**Ans :** OD 2016  
(i) Atrium,  
(ii) Ventricle.

**105.** Which is called pumping part of the heart ?

**Ans :** Delhi 2014  
Ventricle.

**106.** How many chambers are there in human heart ?

**Ans :** Delhi 2012  
Four.



**107.** Which blood vessels carry oxygenated blood ?

**Ans :** OD 2019  
Arteries.

**108.** Which blood vessels carry de-oxygenated blood ?

**Ans :** Comp 2017  
Veins.

**109.** During one cycle how many times blood goes to heart of fish and why ?

**Ans :** Foreign 2010  
One time. Fish has only two chambered heart so, blood is pumped to the gills for oxidation and passed directly to the rest of the body.

**110.** Name one substance and its source place, other than water, that is transported in plants.

**Ans :** AI 2008  
Apart from water, plants also need various minerals which they absorb from the soil.

**111.** Name the part of the plant which absorbs water and minerals from the soil.

**Ans :** OD 2006  
Plants absorb water and minerals from the soil through their roots (root hairs).

**112.** Plants absorb water and minerals from the soil through their roots. Name the parts of the plant where they are transported.

**Ans :** Foreign 2013  
The water and minerals are transported to the leaves, stem and flowers of the plant.

**113.** Name the conducting tissues of plants.

**Ans :** OD 2017  
Xylem and phloem.

**114.** Name the two cellular elements of xylem.

**Ans :** Delhi 2014  
Tracheids and vessels.

**115.** What is the similarity between tracheids and vessels?

**Ans :** Foreign 2016  
They are both non-living and highly thick walled.

**116.** What is the rate of rise of water in flowering plants?

**Ans :** Delhi 2011  
Water in some flowering plants rises at the rate of 10 to 100 cm per minute during the day.

**117.** How much water is used in photosynthesis or other metabolic activities ?

**Ans :** AI 2010  
About 1 to 2% of the water absorbed by the plant is used up in photosynthesis and other metabolic activities.

**118.** Under optimal conditions what quantity of water can leaf transpire in an hour ?

**Ans :** SQP 2015  
Under optimal conditions, leaf can transpire an amount of water equivalent to its own weight in less than an hour.

**119.** What quantity of water does a tree transpire in its lifetime ?

**Ans :** AI 2013  
On an average, a tree transpires water equivalent to 100 times its weight in its lifetime.

**120.** Minerals needed by plants are taken up in the inorganic form. Name two such forms.

**Ans :** SQP 2011  
Nitrates and phosphates.

**121.** What is osmosis ?

**Ans :** Foreign 2016  
The movement of water molecules from a dilute (weaker) solution to a concentrated (stronger) solution through a semi-permeable membrane is called osmosis.

**122.** What are the two factors that control the stomatal opening ?

**Ans :** SQP 2018  
Rate of loss of water and intensity of light are the two factors that control the opening of stomata.

**123.** Define the term 'excretion'.

**Ans :** OD 2013  
Excretion is the process of removal of metabolic waste products like urea, ammonia, CO<sub>2</sub> and water from the body.

**124.** What is osmoregulation ?

**Ans :** OD 2006  
Osmoregulation is the process which maintains the right amount of water and proper ionic balance in the body.

**125.** What are the two basic changes which occur during biochemical reactions in the body ?

**Ans :** Delhi 2011  
The two basic changes are :



- (i) Production of toxic waste.  
(ii) Increase or decrease of water content in the body.
- 126.** Which system is responsible for maintaining osmoregulation and excretion ?  
**Ans :** Delhi 2017  
The urinary system or excretory system.
- 127.** Give reason why all organisms must excrete.  
**Ans :** Foreign 2012  
All organisms must excrete because the metabolic wastes are very toxic and will be harmful to the body if stored.
- 128.** Name the excretory organ in human.  
**Ans :** AI 2009  
Kidney.
- 129.** Name the excretory unit in human.  
**Ans :** Foreign 2014  
Nephron.
- 130.** What is the shape of kidney in human beings ?  
**Ans :** Delhi 2016  
In human beings, kidneys are bean-shaped.
- 131.** Where are kidneys located in the human body ?  
**Ans :** OD 2010  
The kidneys are located in the abdomen.
- 132.** What are ureters ?  
**Ans :** Foreign 2013  
Ureters are excretory tubes which come out from each kidney (one tube from one kidney) and open into the urinary bladder.
- 133.** What is urinary bladder ?  
**Ans :** OD 2007  
Urinary bladder is a pear-shaped reservoir that stores urine before being discharged outside the body.
- 134.** What is urethra ?  
**Ans :** Delhi 2009  
Urethra is a muscular tube present at the neck of the urinary bladder which throws out urine through an opening at its end, the urinary opening.
- 135.** Name the chief nitrogenous waste product in the human urine.  
**Ans :** Foreign 2013  
Urea.
- 136.** Blood passes through narrow capillaries and develops very high pressure, as a result of which much fluid part of blood is forced out. Where precisely in our kidneys this process is occurring ?  
**Ans :** AI 2013  
Glomerulus of nephrons.
- 137.** Which is more harmful urea or ammonia ?  
**Ans :** OD 2008  
Ammonia is more harmful.
- 138.** Which of the following contains less nitrogenous waste: the renal vein or the renal artery ?  
**Ans :**  
The renal vein contains less nitrogenous waste.
- 139.** Name the blood vessels which bring waste products to kidneys.  
**Ans :** Foreign 2015  
Renal arteries bring waste products to kidneys.
- 140.** What is the function of glomerulus ?  
**Ans :** Delhi 2012  
Glomerulus filters the nitrogenous waste and other substances from the blood.
- 141.** Major amount of water is selectively reabsorbed by the tubular part of nephron. On what factor does the amount of water reabsorbed depend on ?  
**Ans :** Delhi 2010  
Amount of water reabsorbed by nephron depends on :  
(i) quantity of excess water is present in the body.  
(ii) quantity of dissolved waste to be excreted from the body.
- 142.** (a) What are the main toxic wastes that kidney filters from the blood ?  
(b) Name any two substances which are selectively reabsorbed from the tubules of a nephron.  
**Ans :** Delhi 2012, 14

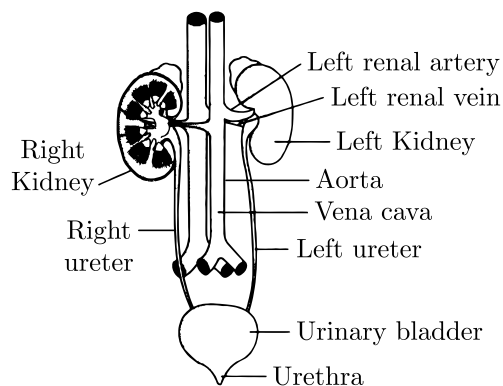


Figure: Human excretory system

- (a) Urea and uric acid.  
(b) Water, glucose, amino acids.
- 143.** Mention the site of complete digestion of carbohydrates, proteins and fats in humans.  
**Ans :** Delhi 2011  
Small intestine in alimentary canal.
- 144.** Name the process of loss of water in the form of vapour from the aerial parts of the plants.  
**Ans :** OD 2016  
Transpiration.
- 145.** Name the component of blood, which transport.  
(i) Food, Carbondioxide and nitrogenous wastes  
(ii) Oxygen.  
**Ans :** Foreign 2013  
(i) Plasma.  
(ii) Haemoglobin present in RBCS.
- 146.** Name the form in which carbohydrates are stored in plants.  
**Ans :** OD 2016  
Starch.
- 147.** What is emulsification of fat ?  
**Ans :** Delhi 2017  
The breakdown of fat globules into fatty acids and glycerol.
- 148.** Identify the category in which the organisms use carbondioxide and water for making food.  
**Ans :** Comp 2011  
Autotrophs.
- 149.** Name the component of blood that helps in the formation of blood clot in the event of a cut.  
**Ans :** Foreign 2016  
Platelets.
- 150.** Name the organisms which utilize complex substances break down to simpler forms.  
**Ans :** Comp 2013  
Heterotrophic organisms or heterotrophs e.g., animals and fungi.
- 151.** Name the cell organelle in which breakdown of pyruvate to give carbondioxide, water and energy takes place.  
**Ans :** OD 2011  
Mitochondria.
- 152.** When we breath out, why does the air passage not collapse ?  
**Ans :** OD 2016  
The air passage is covered with the rings of cartilage which prevent it from collapsing when there is no air in it.
- 153.** Name the vein which brings blood to left atrium from lungs.  
**Ans :** Delhi 2013  
Pulmonary Vein.
- 154.** Name the respiratory pigment in human beings. Where is this pigment present?  
**Ans :** OD 2011  
Haemoglobin which is present in red blood corpuscles.
- 155.** Which is the first enzyme to mix with food in the digestive system ?  
**Ans :** Comp 2015  
Salivary amylase.
- 156.** Name the organelle in which photosynthesis occurs.  
**Ans :** AI 2010  
Photosynthesis occurs in the green coloured plastids called chloroplast.
- 157.** Which organ synthesis urea ?  
**Ans :** AI 2013  
Synthesis urea.
- 158.** What prevents the entry of food into trachea while swallowing.  
**Ans :** Foreign 2015  
Epiglottis : It covers the opening of wind pipe during swallowing.
- 159.** Why rate of breathing is faster in aquatic animals as compared to terrestrial animals ?  
**Ans :** Foreign 2014  
Because the amount of dissolved  $O_2$  in water is less as compared to the air in atmosphere.
- 160.** What is the mode of nutrition in fungi ?  
**Ans :** Foreign 2010  
Saprophytic or Parasitic.
- 161.** What is the location of kidneys in the body ?  
**Ans :** Delhi 2010  
The kidneys are located on either side of back bone towards the back of the lower part of the abdominal cavity.

(c) Right ventricle

(d) Aorta

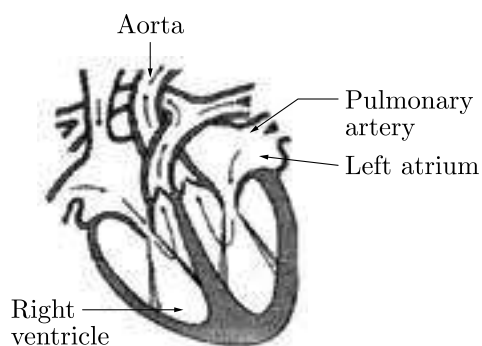
(ii) Why are the valves needed in the heart ?

(iii) Leakage of blood from vessels reduces the efficiency of pumping system. How is the leakage prevented ?

Ans :

AI 2013

(i)



(ii) Valves ensure that blood does not flow backward when the atria or ventricles contract.

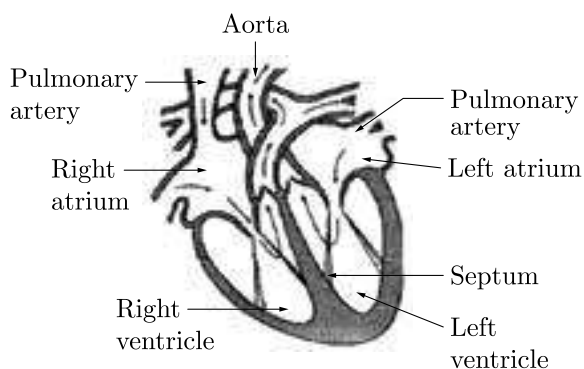
(iii) To avoid leakage blood has platelets cells which circulate around the body and plug into leakage by clotting the blood. at the point of injury.

**305.** What is the advantage of having four chambered heart ? Support your answer with a diagram of the section of a human heart.

Ans :

OD 2010

In four chambered heart, left half is completely separated from the right half by septa. This prevents oxygenated and deoxygenated blood from mixing. This allows a highly efficient supply of oxygenated blood to all parts of the body. This is useful in animals that have high energy needs, such as birds and mammals.



**306.** Draw a neat diagram of internal structure of human heart and label the parts which do the following

functions :

(a) Chamber where oxygenated blood from lungs is collected.

(b) Largest blood vessel in our body.

(c) Muscular wall separating right and left chambers.

(d) Blood vessel that carry blood from heart to the lungs.

Ans :

Delhi 2012

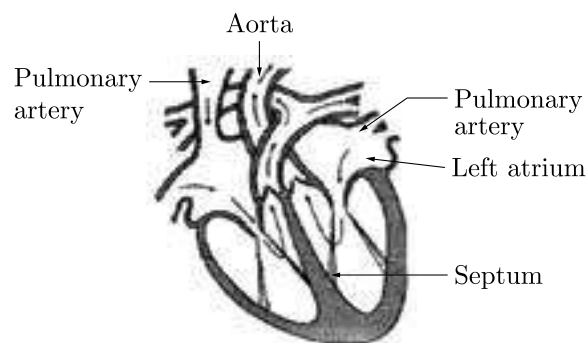
Draw a figure as given below and mark :

(a) Left atrium

(b) Aorta

(c) Septum

(d) Pulmonary artery



**307.** (i) Draw the diagram of human heart and label the following :

(a) Part which receives deoxygenated blood from vena cava.

(b) Part which sends deoxygenated blood to lung through pulmonary artery.

(c) Part which receives oxygenated blood from lungs.

(d) Part which sends oxygenated blood to all parts of the body through aorta.

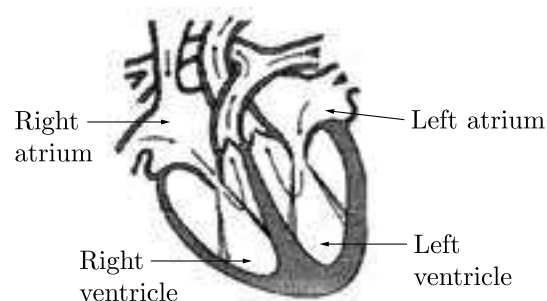
(ii) What does the blood consist of ?

(iii) Write two functions of blood.

Ans :

OD 2017

(i)



173. Which are the first simple molecules of food produced during photosynthesis ? What happens to these simple molecules in the leaves later ?

Ans :

Foreign 2014

- (i) Glucose molecules are the first simple molecules of food produced during photosynthesis.
- (ii) These molecules combine to produce starch which is stored in various parts of the plant.

174. What are the events taking place during photosynthesis?

Ans :

AI 2010

The following events occur during photosynthesis :

- (i) Absorption of light energy by chlorophyll.
- (ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
- (iii) Reduction of carbon dioxide into carbohydrates.

175. What is the compensation point with relation to the release of CO<sub>2</sub> by the plants ?

Ans :

OD 2013, 15

When the intensity of light is low (mainly during morning and evening), the amount of CO<sub>2</sub> released during respiration by plants equals its consumption by photosynthesis. This state is called compensation point.

176. What is parasitism ? Give two examples of parasites one from animals and one from plants.

Ans :

Delhi 2008

Parasitism is an association between two organisms in which one (the parasite) lives in or on and at the expense of the other (the host) and obtains food and shelter from it.

- The host does not get any benefit from such an association.
- Cuscuta (amar bel) is a parasitic plant.
- Roundworm (Ascaris) is a parasitic animal.

177. What is the mode of nutrition in fungi ?

Ans :

Delhi 2011

- Fungi obtain their nourishment from the dead and decaying organic matter. Such a mode of nutrition is known as saprophytic nutrition.
- Fungi first give out enzymes over their food which digest it.

- This digested food is then absorbed by the fungi.

178. Name the different parts of the human alimentary canal in their proper sequence.

Ans :

Comp 2017

Buccal cavity → oesophagus → stomach → duodenum → jejunum → ileum → caecum → colon → rectum.

179. Briefly describe the digestive activity in the small intestine of man.

Ans :

Foreign 2010

The partially digested carbohydrates, proteins and emulsified fat enter the small intestine.

The digestive glands in the intestinal wall secrete a juice called succus entericus.

Succus entericus contains many enzymes, which complete the digestive process as follows :

All proteins and peptone are digested into amino-acids.

All carbohydrates are ultimately digested into glucose.

Fat droplets are digested into fatty acids and glycerol.

180. Write one function each of the salivary glands, liver and pancreas.

Ans :

AI 2012

**Salivary glands :** It secretes saliva containing ptyalin which digests starch into maltose.

**Liver :** It secretes bile juice which breaks down fats into fat globules.

**Pancreas :** It secretes pancreatic juice which contains protein-digesting and starch-digesting enzymes.

181. Explain the process of nutrition in Amoeba with suitable diagram.

Ans :

Delhi 2013

First of all, Amoeba takes in food using temporary finger-like extensions of the cell surface which surround the food particle forming a food-vacuole. Inside the food-vacuole, complex substances are broken down into simpler ones which then diffuse into the cytoplasm. The remaining undigested material is moved to the surface of the cell and thrown out of the body.

- 162.** Name the substance whose build up in the muscles during vigorous physical exercise may cause cramps.

**Ans :**

Comp 2012

Lactic acid.

- 163.** Plants growing in arid regions have deep roots and sunken stomata, why ?

**Ans :**

AI 2016

- (a) Plants growing in arid regions obtain water from deeper layers of the soil. Hence, they grow long roots.  
(b) Sunken stomata prevent or slow down transpiration and help plants conserve water.

- 164.** Why do birds drink very little water ?

**Ans :**

OD 2019

- (i) Birds excrete solid crystals of uric acid.  
(ii) They do not have cutaneous glands. They minimize loss of water and reduce its need.

- 165.** Why blood corpuscles are called 'soldiers of the body'? Why ?

**Ans :**

SQP 2013

White blood corpuscles secrete antibodies to immobilize germs and other foreign particles. The immobilized foreign particles and germs are engulfed by white blood corpuscles and eliminated through phagocytosis.

- 166.** Give reason why the milk teeth in children are replaced by permanent teeth.

**Ans :**

SQP 2010

In growing children, the milk teeth become progressively inadequate as the head grows and therefore, are replaced by permanent teeth.

## TWO MARKS QUESTIONS

- 167.** Give the name of the enzyme present in the fluid in our mouth cavity.

State the gland which produces it. What would happen to the digestion process if this gland stops secreting this enzyme?

**Ans :**

OD 2023

Enzyme present in the fluid of mouth cavity is salivary amylase. Gland which produces this enzyme is salivary gland. This enzyme helps in digestion of starch in our mouth if this gland stops secreting this

enzyme. The digestion of starch will stop and it will be kept in the body negatively.

Salivary amylase is a glucose-polymer cleavage enzyme that is produced by the salivary glands. It comprises a small portion of the total amylase excreted, which is mostly made by the pancreas.

- 168.** Systemic circulation carries oxygenated blood from the left ventricle, through the arteries, to the capillaries in the tissues of the body. From the tissue capillaries, the deoxygenated blood returns through a vein. What are the functions of food ?

**Ans :**

SQP 2018

The functions of food are following-

- (i) It provides energy.  
(ii) It helps in repairing of damaged tissues.  
(iii) It helps in the growth and development of the body.

- 169.** What is diffusion ?

**Ans :**

Comp 2014

The movement of molecules from their higher concentration to lower concentration is called diffusion.

- 170.** What do you mean by 'nutrient'?

**or**

Define the term 'nutrient'.

**Ans :**

OD 2006

A nutrient is a substance which a living organism, i.e., a plant or an animal, obtains from its surroundings and utilizes for the growth of its body, repair of worn out tissues and getting energy.

- 171.** Define the term nutrition.

**Ans :**

OD 2008

Nutrition is the procurement of substances for the growth of the body, repair of the worn out tissues and to obtain energy to do work.

- 172.** What is photosynthesis ? Mention its importance.

**Ans :**

Delhi 2012

Photosynthesis is an important activity of all green plants by which they prepare their own food from carbon dioxide and water in the presence of chlorophyll and light energy.

**Importance :**

- (i) It is the only way of converting solar energy into food (biochemical) energy.  
(ii) It is the only biological process that releases oxygen into the atmosphere, which supports all life forms on the earth.

189. Name any two digestive enzymes secreted in the human digestive system and write their functions.

Ans :

OD 2010

	Enzymes	Functions
(i)	Pepsin	Digestion of proteins.
(ii)	Lipase	Digestion of fats.

190. Stomata of desert plants remain closed during day time. How do they take up carbon dioxide and perform photosynthesis ?

or

How do desert plants perform photosynthesis process though their stomata remain closed during day time ?

Ans :

Delhi 2016

Desert plants take up  $\text{CO}_2$  at night and prepare an intermediate molecule. The intermediate molecule is acted upon by the energy absorbed by the chlorophyll during the day.

191. (a) What will happen to the guard cells and stomatal pore when water flows to guard cells ?  
(b) How do plants transmit informations from cell to cell ?

Ans :

Foreign 2011

- (a) When water flows to guard cells, they swell up. Swelling of guard cells leads to opening of stomatal pore.  
(b) By using electrical and chemical means plants transmits informations.
192. Explain the significance of peristaltic movement that occurs all along the gut during digestion.

Ans :

AI 2014

It is necessary to move the food in a regulated manner along the digestive tube so that it can be processed properly in each part.

The lining of canal has muscles that contract rhythmically in order to push the food forward.

193. Which is the largest digestive gland present in human body ? What is the name and function of its secretion?

Ans :

Comp 2010

Largest digestive gland in human body is liver. It secretes bile juice.

Bile juice helps in the emulsification of fats.

194. What are the final products produced after digestion of carbohydrate, proteins and fats ?

Ans :

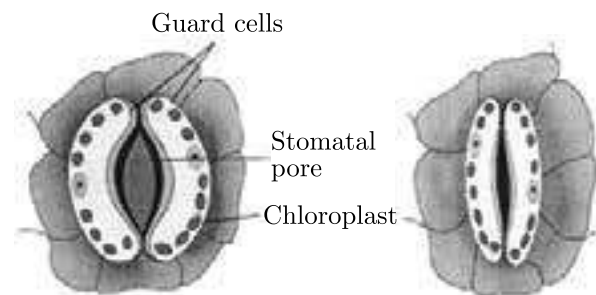
OD 2009

Digested substances	Final products
Carbohydrate	Glucose
Proteins	Amino acid
Fats	Glycerol + Fatty acids

195. Draw a labelled diagram of stomata. Write two functions of stomata.

Ans :

OD 2006



Functions of stomata :

- Exchange of gases.
- Transpiration.

196. Name the different types of respiration. Give one example of each.

Ans :

Delhi 2016

The different types of respiration are :

- Cutaneous respiration : Respiration through skin, e.g., earthworm.
- Tracheal respiration : Respiration through trachea and tracheole, e.g., insects.
- Branchial respiration : Respiration through gills, e.g., fish.
- Cell surface respiration : Respiration through body surface by diffusion, e.g., amoeba.
- Pulmonary respiration : Respiration through lungs, e.g., human beings.

197. What are the conditions essential for effective respiration ?

Ans :

Delhi 2013

- Respiratory surface should be thin, moist and permeable to oxygen and carbon dioxide.
- The surface should have a large surface area.
- It should be richly supplied with blood vessels for easy transport of gases.



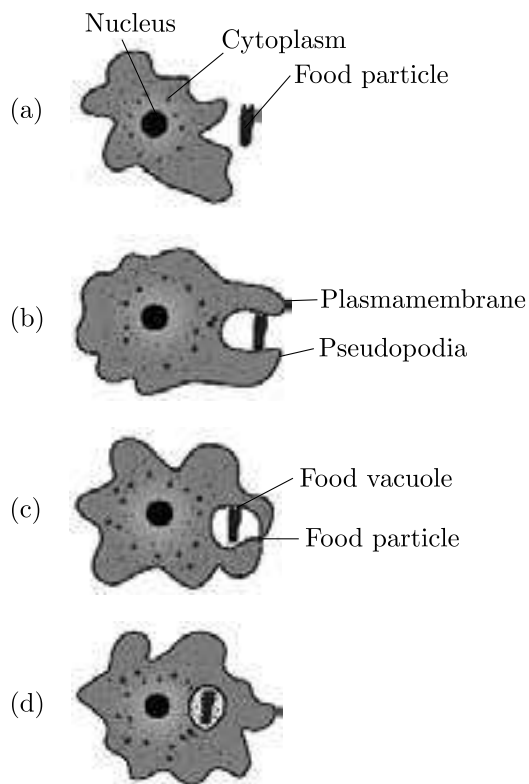


Figure: Stages of phagocytosis in Amoeba :

- Amoeba approaching the food particle.
- Extensions of plasma membrane forming pseudopodia to surround the food particle.
- Engulfed food particle.
- Food vacuole containing food particle in the cytoplasm of Amoeba.

**182.** Briefly describe the functions of the gastric juice.

**Ans :** OD 2010

The gastric juice, in fact, is a mixture of secretions from three different types of glands :

- Hydrochloric acid kills the bacteria that enter the stomach along with food and activates the pepsin.
- Pepsin digests the proteins into peptone.
- Mucus lubricates the food.

**183.** Briefly describe the digestive functions of liver and pancreas.

**Ans :** Delhi 2013

**Liver :** The liver secretes bile juice which is stored in the gall bladder from where it is sent to the duodenum whenever needed.

The bile juice breaks down the fat droplets into small fat globules. This phenomenon is known as emulsification of the fat.

**Pancreas :** Pancreas secretes pancreatic juice which is sent to the duodenum.

Pancreatic juice contains two enzymes :

The trypsin, which digests proteins into peptone, and the pancreatic amylase, which digests starch into sugar.

**184.** What is the cause of peptic ulcer ?

**Ans :**

Delhi 2011

Peptic ulcer is caused by imbalance in the rate of gastric juice secretion. High acidic secretion causes irritation of the mucosal layer of the stomach. This results in poor secretion of mucus that protects the inner lining. Ultimately, the mucosal layer is eroded causing the ulcer.

**185.** Name the four types of teeth present in adult human and mention their main functions.

**Ans :**

Delhi 2015

The four types of teeth and their functions are as follows :

	Types of teeth	Functions
1.	Incisors	Cutting foods
2.	Canines	Tearing foods
3.	Premolars	Chewing or
4.	Molars	grinding foods

**186.** What is the meaning of the term “assimilation” ?

**Ans :**

Comp 2013

Utilization of the food in the body is known as assimilation. Food is used in building up of new cells or replacement of worn out cells and tissues. Food is utilized in obtaining energy. Energy is obtained by the oxidation of food.

**187.** What is the function of rectum ?

**Ans :**

Delhi 2008

The function of rectum are following :

- The rectal wall absorbs much water from the undigested food.
- After the required amount of water is absorbed, the contents of the rectum become semi-solid faeces.
- The faecal matter is egested out through the anus.

**188.** What is holozoic nutrition? Give three examples.

**Ans :**

Foreign 2013

The feeding of complex organic matter by ingestion, which is subsequently digested and absorbed is called holozoic nutrition, e.g., amoeba, frog, human beings.



- 208.** Lack of oxygen in muscles often leads to cramps among cricketers. Explain why?

or

When a sportsman runs, he gets muscle cramps. Why?

**Ans :** OD 2010

During running, the cricketers (sportsman) require large amount of energy instantly. In order to release more energy, pyruvate is converted into lactic acid in the absence of oxygen and produce lactic acid as the product. Formation of lactic acid in the muscles cause cramps.

- 209.** What product is released after the first step of glucose break-down ? Where does it take place ?

**Ans :** Foreign 2013

The first step is the breakdown of glucose having 6 carbon molecule into pyruvate a 3 carbon molecule. It takes place in the cytoplasm.

- 210.** During one cycle how many times blood goes to heart of fish and why ?

**Ans :** AI 2010

One time. Fish has only two chambered heart so, blood is pumped to the gills for oxidation and passed directly to the rest of the body.

- 211.** What is clotting of blood ?

**Ans :** AI 2006

It is the mechanism that prevents the loss of blood at the site of an injury or wound by forming a mesh into which RBCs get entangled and form a clot.

- 212.** Briefly describe the shape and function of human white blood corpuscles.

or

Why are white blood corpuscles called soldiers of the body ?

**Ans :** OD 2010, 08

- Most WBCs or leucocytes are amoeboid, have variously shaped nuclei but lack haemoglobin.
- WBCs are capable of forming pseudopodia and can squeeze out of blood capillaries to ingest foreign matter.
- They protect the body from infections.
- They produce antibodies which are responsible for immunity. That is why, WBCs are called soldiers of the body.

- 213.** Briefly describe about the blood platelets.

**Ans :** Comp 2012

Blood platelets are fragments of cells. They do not possess nuclei. They participate in the coagulation

of blood. Blood cells are manufactured in the bone marrow from cells called stem cells.

- 214.** Name a non-nucleated cell present in human blood and state one function of this cell.

**Ans :** Foreign 2006

- (i) A non-nucleated cell present in human blood is RBC.
- (ii) RBC contains a respiratory pigment called haemoglobin which carries the oxygen from lungs to tissues and carbon dioxide from tissues to lungs.

- 215.** Which blood cell in human blood carries haemoglobin? What is its average lifespan ?

**Ans :** AI 2009

- (i) In humans, red blood cells carry haemoglobin.
- (ii) Its average lifespan is 120 days.

- 216.** What is blood pressure ? How does it vary ?

**Ans :** SQP 2013

The pressure exerted by the flow of blood through the aorta and arteries is called blood pressure.

Blood pressure varies according to the contraction and relaxation of the heart.

- 217.** Name the following :

- (i) The blood vessel which carries oxygenated blood from the lungs into the heart.
- (ii) The blood vessel which carries the oxygenated blood to different parts of the body from the left ventricle.
- (iii) The blood vessel which carries deoxygenated blood away from the heart to the lungs.

**Ans :** Delhi 2008

- (i) Pulmonary vein
- (ii) Aorta
- (iii) Pulmonary artery

- 218.** Name the following :

- (i) The structure which represents the remnant of sinus venosus in human heart.
- (ii) The valve which guards the right auriculo-ventricular aperture in human heart.
- (iii) The valve which guards the left auriculo-ventricular aperture in human heart.

**Ans :** Delhi 2015

- (i) Sinu-auricular node (SA node) or pacemaker.
- (ii) Tricuspid valve.
- (iii) Bicuspid valve or Mitral valve.

- The urinary system consists of a pair of kidneys lying in the abdomen.
- Each kidney gives out an excretory tube or ureter.
- The two ureters open in a common urinary bladder.
- The urine collected into the urinary bladder passes out through a muscular tube, the urethra and is ultimately thrown out of the body through an opening at its tip.

**311.** What is the principle of dialysis ?

**Ans :**

AI 2009

Blood is made to flow into the dialysis machine made of long cellulose tubes coiled in a tank having a dialysing solution. Waste substances diffuse out of blood into the tank. The clean blood is pumped back into the body of the patient.

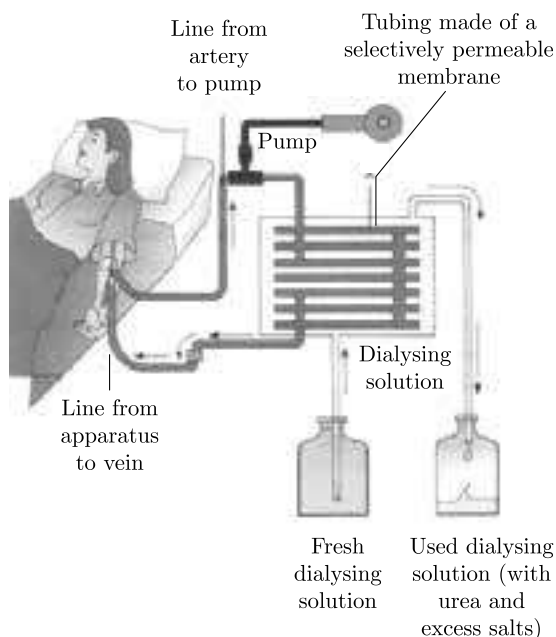


Figure: Artificial kidney or Dialysis.

- 312.** (a) Draw the human excretory system and label :
- Kidney,
  - Aorta,
  - Ureter,
  - Urinary bladder.
- (b) What is the purpose of sending blood to the kidney's for filtration ?

**Ans :**

(a)

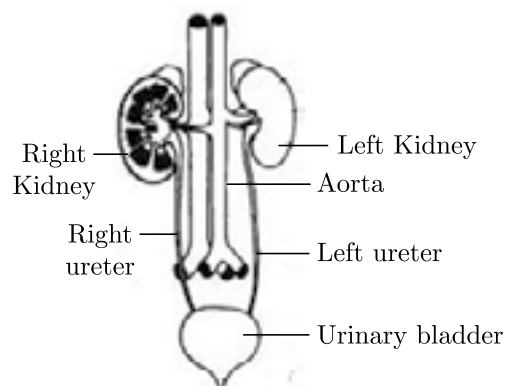


Figure: Human excretory system

- (b) The kidneys purify the blood. It also removes toxic wastes like urea or uric acid.

**313.** (a) Draw a diagram of human urinary system and label in it :

- Kidney
- Ureter
- Urinary bladder
- Urethra

(b) Write two major components of human urine.

**Ans :**

Delhi 2015

(a)

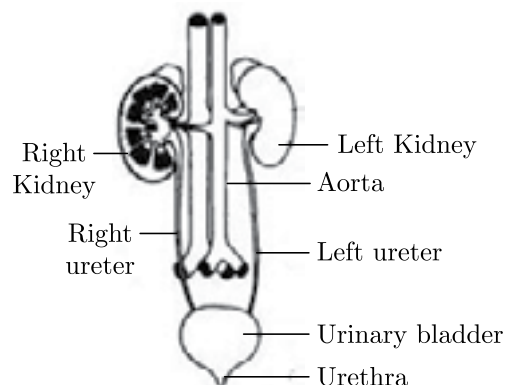


Figure: Human excretory system

(b) Urea, uric acid.

**314.** Draw a neat diagram of excretory system in humans and label the following :

- Kidney
- Left renal artery

- 229.** A certain tissue in a green plant somehow got blocked and the leaves wilted. What was the tissue that got blocked ?

**Ans :**

OD 2012

The tissue must be xylem. It is through the xylem that water and minerals absorbed by the roots from the soil are transported to the leaves and other parts of the plant. So, if xylem is blocked, the leaves will not get their nourishment and will wilt.

- 230.** A certain tissue in a green plant somehow got blocked and the roots were deprived of food. What was the tissue that got affected ?

**Ans :**

Delhi 2015

The tissue must be phloem. It is through the phloem that food prepared, by the leaves is transported to the roots. So, if the phloem is blocked, the roots will be naturally deprived of their food.

- 231.** Name the conducting elements in the non-flowering and flowering plants.

**Ans :**

Foreign 2011

- (i) Non-flowering plants : Tracheids only.  
(ii) Flowering plants : Tracheids and vessels both.

- 232.** Differentiate between tracheids and vessels.

**Ans :**

SQP 2016

	Tracheids	Vessels
(i)	They are long thin spindle-shaped cells.	They are cylindrical in shape.
(ii)	Their ends are not open but they have pits in their walls. Water flows from one tracheids to another through these pits.	Their ends are open and are placed one above the other so as to form a continuous column stretching from roots to leaves. They have pits which are not open pores but are the thin areas of the cell wall.

- 233.** What is phloem ? Name its two main components (elements) which help in the conduction of food.

**Ans :**

SQP 2018

Phloem is a conductive tissue which transports the food throughout the parts of a plant.

Two main components are :

- (i) Sieve tube,  
(ii) Companion cell.

- 234.** What is translocation ? Why is it essential for plants?

**Ans :**

Foreign 2014

Translocation is the transport of food from leaves to all other parts of the plant, including roots.

Translocation is necessary as every part of the plant needs food for harnessing energy and for building and maintaining the organism.

- 235.** What are companion cells ?

**Ans :**

AI 2011

Companion cells are, cells which always accompany sieve tube cells and contain a nucleus, cytoplasm and a thin wall.

- 236.** What is the function of the sieve plates in the sieve tube cells of phloem ?

**Ans :**

OD 2013

Sieve plates have pores through which the food is translocated from one sieve tube cell to the next.

- 237.** Name the substances which are transported through phloem to various parts of the plant.

**Ans :**

Comp 2016

Sugars synthesized in the leaves and hormones synthesized by the root tips and shoot tips are transported through phloem to various parts of the plant.

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- 238.** Name the parts of a nephron in their proper sequence starting from the point of entry of blood into it upto the point of pouring out of the urine from the nephron.

**Ans :**

Comp 2013

Renal artery → glomerulus → Bowman's capsule → proximal convoluted tubule → Henle's loop → distal convoluted tubule → collecting duct.

- 239.** Draw a diagram to represent a single renal tubule.

- 198.** Write the differences between breathing and cellular respiration.

**Ans :**

AI 2010

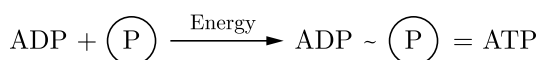
	Breathing	Cellular respiration
(i)	It is a physical process.	It is a biochemical process.
(ii)	No energy is released.	Energy is released and stored as ATP.
(iii)	It is an extracellular process breathing organs like trachea, lungs, etc.	It is an intracellular process.
(iv)	It occurs only in animals that possess.	It occurs in all plants and animals.
(v)	Exchange of gases takes place in breathing ( $O_2$ is taken in and $CO_2$ is given out).	In this process, food is oxidised in the cells to produce $CO_2$ , water and energy.
(vi)	No enzyme action takes place.	This process is controlled by the action of various enzymes.

- 199.** What is ATP ?

**Ans :**

Comp 2014

ATP is the source of energy for most of the cellular processes. The energy released during the process of respiration is used to make ATP from ADP and phosphate.



Here,  $\textcircled{P}$  = phosphate

- 200.** Starting with external nostrils through which air enters, write different parts in their correct sequence through which air travels upto the alveoli in our respiratory system.

**Ans :**

Comp 2011

External nostrils → Nasal cavities → Internal nostrils → Pharynx → Trachea (windpipe) → Bronchi → Bronchioles → Alveoli.

- 201.** What is the function of epiglottis in man?

**Ans :**

Foreign 2006

The function of epiglottis in man is that, at the time of swallowing food, the epiglottis closes the

tracheal opening thereby preventing the food from entering the windpipe.

- 202.** How are the breathing movements controlled ?

**Ans :**

SQP 2018

The breathing movements are largely controlled by a respiratory centre located in the medulla oblongata of the brain. This centre is stimulated by the carbon dioxide contents of the blood.

- 203.** Mention the three functions of the nasal cavity of man.

**Ans :**

Foreign 2013

The three functions of the nasal cavity in man are :

- (i) It warms the air as it passes over.
- (ii) It adds moisture (humidifies) to the air.
- (iii) It entraps the harmful particles (filtration) as they pass through.

- 204.** Breathing movements are voluntary or involuntary?

**Ans :**

AI 2016

Breathing movements are involuntary, but to some extent one can consciously increase or decrease the rate and extent of breathing.

- 205.** Why does the breathing rate increase during vigorous exercise ?

**Ans :**

SQP 2014

During vigorous exercise, our body muscles require more energy and as such more oxygen is needed, thus breathing rate is increased.

- 206.** What is the function of the trachea ? Why do its walls not collapse even when there is less air in it ?

**Ans :**

Comp 2010

Trachea allows movement of air in and out of lungs. The walls of trachea do not collapse even when there is less air in it because these are supported by rings of cartilage.

- 207.** What are the end products formed during fermentation in yeast ? Under what condition a similar process takes place in our body that leads to muscle cramps ?

**Ans :**

OD 2015

Ethyl alcohol and carbon dioxide are the end products formed during fermentation in yeast.

When there is a lack of oxygen in our muscle cells, pyruvate is converted into lactic acid.

This build-up of lactic acid in our muscles, during sudden activity, causes cramps.

247. Draw a cross-section of leaf and label it.

Ans :

OD 2010

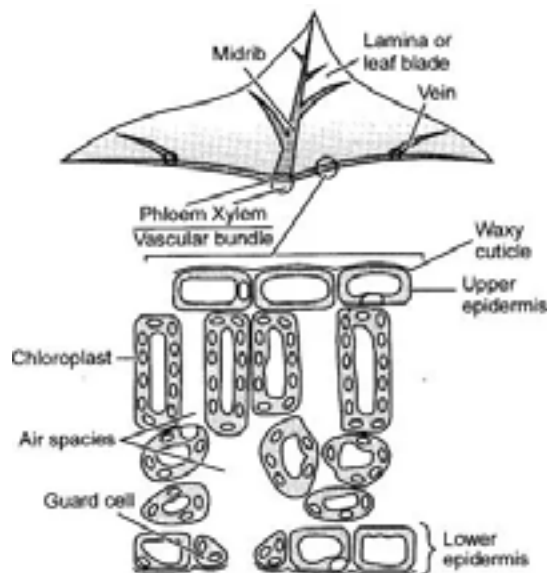


Figure: Cross-section of a leaf.

248. State two functions performed by bile juice.

Ans :

Delhi 2016

- (i) It contains bile-pigments, bile salts that emulsifies fat to fatty acids.
- (ii) Bile juice neutralizes the acidic food in the stomach and makes it alkaline so that it can react with the enzymes of pancreatic juice.

249. What are the final products after digestion of carbohydrates and proteins ?

Ans :

Foreign 2011

The final product produced after digestion of carbohydrates is glucose and of proteins is amino acids. The site of complete digestion in our body is the small intestine.

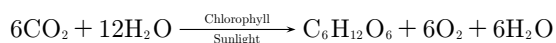
250. How do autotrophs obtain food ? Explain the process with the help of a balanced chemical equation.

Ans :

OD 2017

The autotrophs obtain the raw material in the form of water from soil and carbondioxide from the atmosphere.

They synthesize their food in the presence of sunlight by the process of photosynthesis.



251. Why is nitrogen considered an essential element ? How do plants acquire nitrogen ?

Ans :

OD 2015

- (i) Nitrogen is a major component of chlorophyll. It is also a component of amino acid which are called building blocks of proteins.
- (ii) Plants obtain nitrogen from the soil in the form of inorganic nitrates or nutritics.

252. (i) How many chambers are present in the heart of :

- (a) Fish
- (b) Amphibians.

Ans :

Comp 2011

- (i) Fish—two chambers.  
Amphibian—three chambers.
- (ii) Such separation allows a highly efficient supply of oxygen to the body. This is useful in animals that have higher energy need such as birds and mammals. They constantly use the energy to maintain their body temperature.

253. State the function of Bowman's Capsule and glomerulus.

Ans :

Delhi 2012

Bowman's Capsule and glomerulus have semi permeable walls. The glomerulus is a tuft of cappillaries contained in Bowman's Capsule. The water and dissolved substances (wastes and useful) are filtered into Bowman's Capsule and from here they are filtered into the lobule. Thus, both the structures act as filtering apparatus.

254. How are the lungs designated in human beings to maximise the area for exchange of gases ?

Ans :

OD 2010

There are millions of alveoli in the lungs. The presence of millions of alveoli in the lungs provides a very large area for the exchanges of gases. The availability of large surface area maximises the exchange of gases.

255. How does Paramecium obtain its food ?

Ans :

Foreign 2016

The Paramecium cell has a definite shape (slipper shape) and food is taken in at a definite spot (called mouth). The food particle is moved into this spot

- 219.** What are the functions of bicuspid and tricuspid valves in human heart ?

**Ans :** OD 2014

- (i) The bicuspid valve prevents the back flow of the blood from left ventricle into left auricle.
- (ii) The tricuspid valve prevents the back flow of the blood from the right ventricle into the right auricle.

- 220.** Differentiate between oxygenated blood and de-oxygenated blood.

**Ans :** OD 2016

	Oxygenated blood	Deoxygenated blood
(i)	It contains more oxygen and very little carbon dioxide.	It contains more carbon dioxide and very little oxygen.
(ii)	It is carried from heart to all body parts.	It is carried from all body parts to heart.

- 221.** Describe how deoxygenated blood from right auricle is sent to lungs for oxygenation.

**Ans :** OD 2009

The right auricle pours deoxygenated blood into right ventricle. From here the deoxygenated blood flows to the lungs through pulmonary artery for oxygenation.

- 222.** Describe how oxygenated blood from left auricle is sent to all parts of the body.

**Ans :** Foreign 2007

When oxygenated blood comes into the left auricle, it contracts and pours blood into the left ventricle. From the left ventricle the oxygenated blood is distributed to all parts of the body through aorta.

- 223.** Why and how does water enter continuously into the root xylem ?

**Ans :** Delhi 2013

Cells of roots are in close contact with soil and so actively take up ions. The ion concentration, increases inside the root and hence osmotic pressure increases the movement of water from the soil into the root which occurs continuously.

- 224.** (a) Name the respiratory pigment present in our body. Where is it present ?  
(b) Why are valves present in heart and veins ?

**Ans :** Delhi 2011

- (a) Haemoglobin. It is present in RBC.
- (b) To prevent back flow.

- 225.** What do the following transport ?

- (i) Xylem
- (ii) Pulmonary artery
- (iii) Pulmonary vein
- (iv) Phloem

**Ans :** Delhi 2014

- (i) Xylem — Water and minerals in plants.
- (ii) Pulmonary artery — Deoxygenated blood from heart to lungs.
- (iii) Pulmonary veins — Oxygenated blood from lungs to heart.
- (iv) Phloem — Synthesised food in plants.

- 226.** Roots of the plant cannot prepare their own food. From where do they get their food ?

**Ans :** Comp 2014

The leaves of the green plant prepare the food by photosynthesis. It is this food which is transported to the roots.

- 227.** Why is transportation of materials necessary in plants?

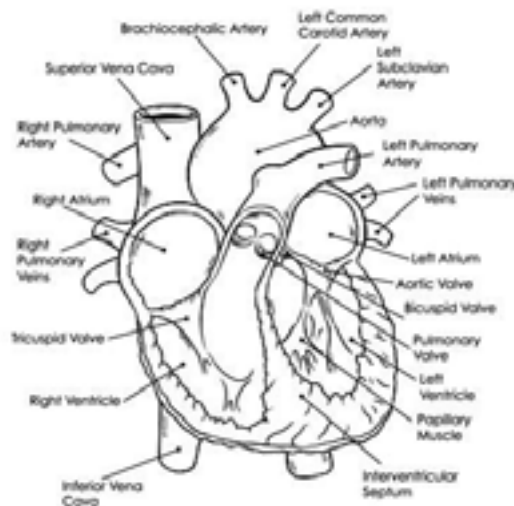
**Ans :** Comp 2017

The roots of plant absorb water and dissolved minerals from the soil, which are needed by the aerial parts of the plant. As such these substances are to be transported from roots upto stem, leaves and flowers.

Similarly, leaves of a green plant prepare the food which is needed in all parts of the plant, including roots. This food has to be transported to all parts of the plant.

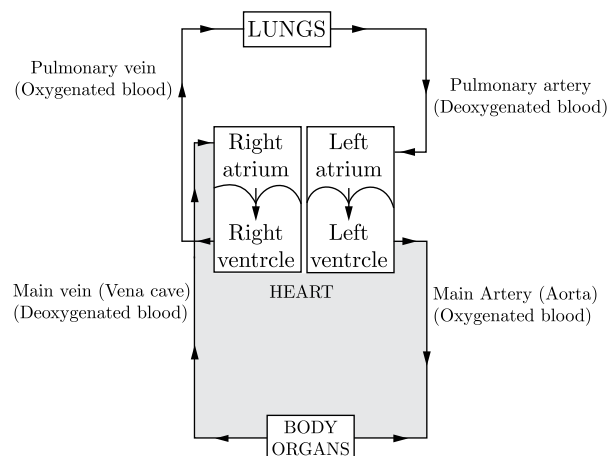
- 228.** Draw labelled diagram of sectional view of human heart.

**Ans :** AI 2016

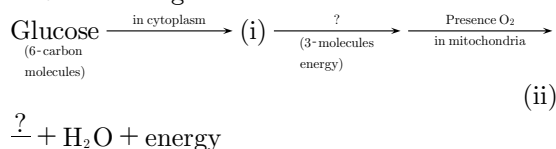




capillaries in the tissues of the body. From the tissue capillaries, the deoxygenated blood returns through a system of veins to the right atrium of the heart.



263. (a) In the process of respiration, state the function of alveoli.  
 (b) Rate of breathing in aquatic organisms is much faster than that in terrestrial organisms. Give reasons.  
 (c) Complete the following pathway showing the breakdown of glucose :



Ans :

Delhi 2020

- (a) Function of Alveoli :
- Gaseous exchange takes place in alveoli in the lungs.
  - Alveoli provide a large surface area for the exchange of gases.
- (b) Rate of breathing in aquatic organism is much faster than that in terrestrial organisms. Terrestrial organisms breathe the oxygen in the atmosphere, but animals that live in water (aquatic organisms) use the oxygen dissolved in water. Since the amount of dissolved oxygen is very low as compared to amount of oxygen in the air (21%). So, the rate of breathing in aquatic organisms is much faster than that in terrestrial organisms.

- (c) Glucose  $\xrightarrow{\text{in cytoplasm}}$
- (i) Pyruvate  $\xrightarrow{\text{Presence O}_2}$   
 (3-molecules energy) in mitochondria
- (ii)  $\text{CO}_2$  (Carbon dioxide) +  $\text{H}_2\text{O}$  + energy

264. Mention the three kinds of cells present in blood. Write one function of each.

Ans :

OD 2016

Blood is made up of plasma and corpuscles. Three kinds of corpuscles are WBC, RBC and blood platelets. Red blood Corpuscles (RBC) are small biconvex cells that contain Haemoglobin to transport  $\text{O}_2$  from the lungs to the body cells and  $\text{CO}_2$  from body cells to the lungs. White blood cells (WBC)—main function is defence of the body against diseases and other infection.

Blood platelets are responsible for the clotting of blood during injuries.

265. Write one function of each of the following components of the transport system in human beings

- Blood vessels
- Lymph
- Heart

Ans :

Foreign 2011

- (a) **Blood Vessels** : There are three types of blood vessels of different sizes involved in blood circulation viz., arteries, veins and capillaries, which are all connected to a continuous closed system.
- (b) **Lymph** : It carries digested and absorbed fat from intestine and drains excess fluid from extra cellular space back into the blood.
- (c) **Heart** : It is a pumping organ that receives blood from the veins and pumps it into the arteries.

266. State the functions of the following in the alimentary canal :

- Liver
- Gall bladder
- Villi.

Ans :

OD 2016

- (i) **Liver** :
- It consists bile juice.
  - Bile salts break down the large globules of fats into smaller globules to increase the efficiency of enzyme action.
- (ii) **Gall bladder** :
- It stores the bile secreted by the liver.
  - The bile from gall bladder is transported to small intestine through bile duct.
- (iii) **Villi** :
- They are found on the inner wall of the small intestine.
  - They greatly increase the absorptive surface area of the innerlining of the intestine for the absorption of digested food.



Ans :

SQP 2009

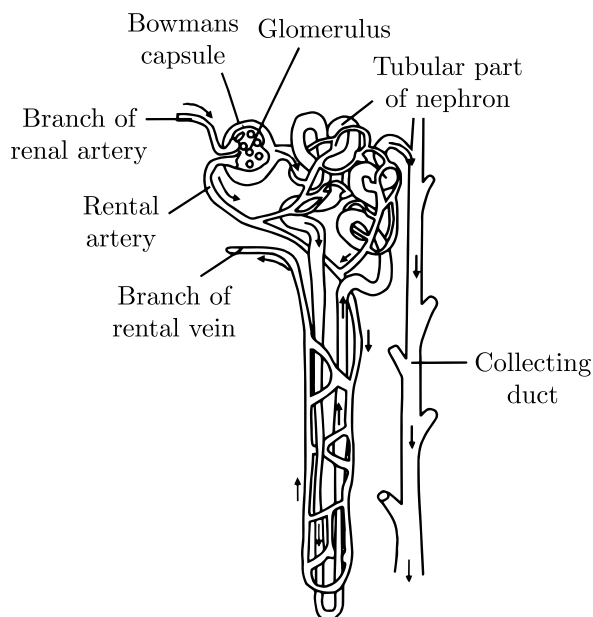


Figure: A single renal tubule

- 240.** Urine passed during summer is usually less in quantity and is somewhat thicker. Why is it so ?

Ans :

Foreign 2011

The urine in summers is usually less in quantity and is somewhat thicker because of two reasons :

- Much water is lost by sweating.
- Water from the kidneys is reabsorbed to maintain the normal concentration of the blood.

- 241.** In winter the frequency of urination is more. Why ?

Ans :

OD 2014

In winters the frequency of urination is more because there is hardly any water loss due to sweating, and also because there is no need for the kidneys to reabsorb water.

Therefore, the kidneys not only functions to remove nitrogenous waste products, like urea, ammonia, etc. but also controls water balance (i.e., osmoregulation).

- 242.** Differentiate between nephron and nephridia.

Ans :

Delhi 2017

	Nephron	Nephridia
(i)	It is the excretory organ of man.	It is the excretory organ of earthworm.
(ii)	Filtration occurs in the glomerulus of Bowman's capsule.	Filtration occurs in the tubular part of the nephridium.

	Nephron	Nephridia
(iii)	Waste is removed from tubular part of nephron in the kidney and is collected in urinary bladder.	Waste is removed through nephridiopore either in the intestine or directly outside via the skin.

- 243.** If both kidneys of a person stop functioning, which machine can be used ? What is this procedure known as ?

Ans :

Delhi 2015

In such cases, artificial kidney is employed to remove the metabolic wastes from the blood and to maintain normal levels of water and mineral ions in the body fluids. The procedure is known as dialysis.

- 244.** What is haemodialysis ? Which excretory organ is said to be the dialysis bag of human beings ?

Ans :

Delhi 2012

- Haemodialysis is a process in which artificial kidney is used to filter the blood of a person whose kidneys are damaged.
- Glomerulus is called the dialysis bag of human beings.

- 245.** Name the parts of the body responsible for excretion in

- Amoeba
- Earthworm.

Ans :

OD 2016

- Amoeba—Contractile Vacuole
- Earthworm—Nephridia.

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- 246.** Why does herbivores have longer small intestine than carnivores ?

Ans :

OD 2017

Herbivores have longer small intestine to allow the cellulose to be digested completely. Herbivores have longer intestine than carnivores to digest grass. The intestine would host mainly small bacteria that process and breakdown cellulose into glucose.

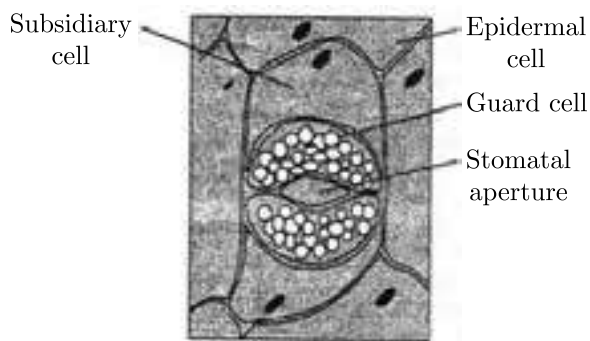


Figure: Stomata—the tiny pores on leaf surface open and close for exchange of respiratory gases and transpiration.

274. Draw diagram of Nephron.

Ans :

AI 2009

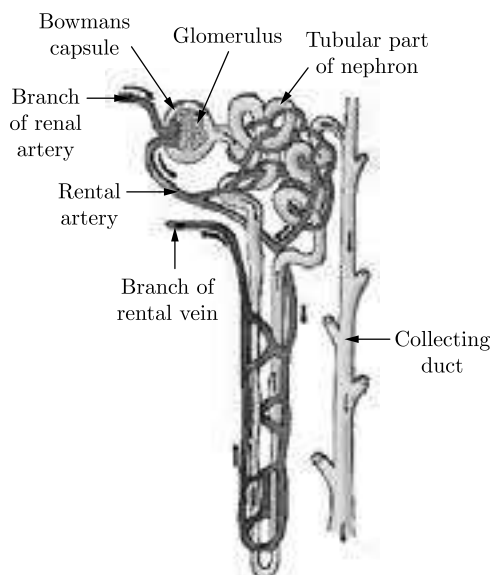


Figure: Structure of Nephron

275. (i) What is the role of mucus in stomach ?  
 (ii) How exit of food from the stomach is regulated?  
 (iii) Where does food enter from stomach ?

Ans :

Foreign 2013

- (i) Mucus protects the inner lining of the stomach from the action of the acid under normal conditions.  
 (ii) The exit of food from the stomach is regulated by sphincter muscles which release it in small amounts into the small intestine.  
 (iii) From stomach food enters into the small intestine.

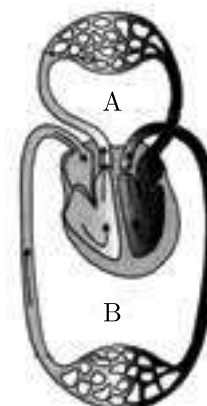
276. (a) Blood pressure is high in the arteries and low in the veins. Give the possible reason for such difference.  
 (b) What is the major cause of high blood pressure?  
 (c) What may happen if a person is having a very high blood pressure ?

Ans :

SQP 2018

- (a) Blood pressure is the force that blood exerts against the walls of the vessels by the discharge of blood into them by contraction of the left ventricle. The heart pushes blood into artery. Therefore, blood pressure is high in the arteries which gradually drops in the arteries and capillaries and finally becomes very low in the veins.  
 (b) High blood pressure is caused by constriction of arterioles.  
 (c) Constriction of arterioles results in increased resistance to blood flow leading to the rupture of an artery and internal bleeding.

277. Study the picture carefully and answer the following:



- (a) What does diagram given below depict?  
 (b) What are A and B ?  
 (c) Which vessel carried deoxygenated blood to lungs and which vessel brings oxygenated blood from lungs to heart ?  
 (d) Which half of heart has oxygenated blood ?

Ans :

Delhi 2014

- (a) Double circulation.  
 (b) A – pulmonary circulation.  
       B – systemic circulation.  
 (c) Pulmonary arteries, pulmonary veins.  
 (d) Left half of heart.

by the movement of thin, hair like Cilia which cover the entire surface of Paramecium cell.

- 256.** Differentiate between the functions of enzyme and trypsin.

**Ans :**

OD 2017

	<b>Pepsin</b>	<b>Trypsin</b>
(i)	Pepsin acts in stomach.	Trypsin acts in small intestine.
(ii)	It acts in acidic medium	It acts in alkaline medium.

- 257.** State the necessary conditions of autotrophic nutrition and name the by product. Mention the source of this by product.

**Ans :**

OD 2016

Carbondioxide, water, sun and energy are the basic requirements of autotrophic nutrition. Chlorophyll utilises carbondioxide and water, taken from the surroundings and energy of the sun to synthesize food, i.e., carbohydrates.

The by-product of this process is oxygen, which is produced from the splitting of water.

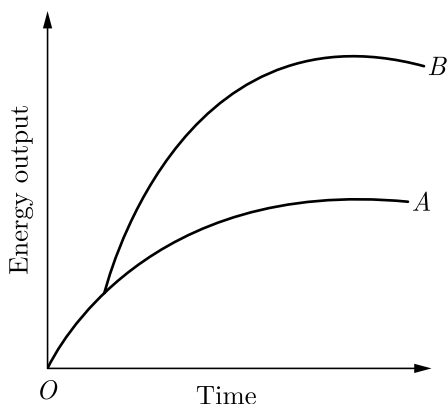
- 258.** State two functions of Pancreas.

**Ans :**

OD 2014

- It secretes pancreatic juice which contains the enzyme trypsin for digesting proteins.
- It also contains the enzyme lipase for breaking down emulsified fate.

- 259.** A graph was plotted to show the energy output of two types of respiration. Identify the type of respiration denoted by curves *A* and *B*.



**Ans :**

Comp 2009

Curve *A* – Anaerobic respiration (less energy).

Curve *B* – Aerobic respiration (more energy).

- 260.** Do the fresh water animals reabsorb water through their excretory system like marine animal ? Justify your answer.

**Ans :**

AI 2014

The fresh water animals do not reabsorb water through their excretory system because in case of fresh water animals, large amount of water is taken up through their skin and mouth.

The water content of the body is maintained by getting rid of excess water through excretory system. Marine animals need to conserve water that is why water is reabsorbed by excretory system in marine animals.

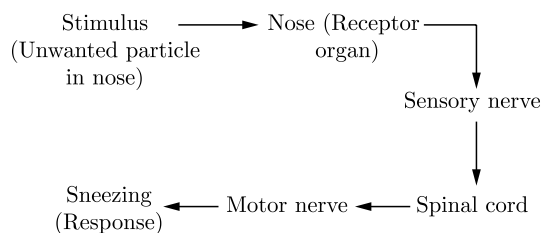
### THREE MARKS QUESTIONS

- 261.** Define reflex action. With the help of a flow chart show the path of a reflex action such as sneezing.

**Ans :**

OD 2024

Reflex action is a spontaneous, involuntary and automatic response which do not require any thinking by the brain and is without the will of the organism but under the control of spinal cord. Withdrawal of hand on touching a hot object, blinking of eyes, sneezing, coughing, vomiting, withdrawal of leg when stepped on a pointed object while walking barefoot, watering of mouth at the sight of tasty food, etc. are examples of reflex action.



- 262.** Explain the process of transport of oxygenated and deoxygenated blood in a human body.

**Ans :**

OD 2023

Pulmonary circulation transports oxygen-poor blood from the right ventricle to the lungs, where blood picks up a new blood supply. Then it returns the oxygen-rich blood to the left atrium.

Systemic circulation carries oxygenated blood from the left ventricle, through the arteries, to the

**281.** What are the various steps involved in holozoic mode of nutrition?

**Ans :**

OD 2015

The different steps of holozoic mode of nutrition are as follows :

- (i) Ingestion
- (ii) Digestion
- (iii) Absorption
- (iv) Assimilation
- (v) Egestion

Ingestion is the taking in of the food in the body or alimentary canal.

Amoeba engulfs the food by forming pseudopodia all around the food and then captures the food into the food-vacuole. This is called phagocytosis.

Digestion is the breaking down of complex and insoluble food with the help of enzymes into simpler and soluble substances so that they can be utilized in the body. In amoeba, digestion occurs in the food vacuole with the help of digestive enzymes.

Absorption is the diffusion of the digested food into the cytoplasm.

Assimilation is the utilization of the digested food by the cell.

Egestion is the removal or throwing out the undigested food from the body.

- 282.** (i) List three events that occur during the process of photosynthesis. State in brief the role of stomata in this process.
- (ii) Describe an experiment to show that sunlight is essential for photosynthesis.

**Ans :**

OD 2010

- (i) The following events occur during photosynthesis:
- (a) Absorption of light energy by chlorophyll.
  - (b) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
  - (c) Reduction of carbon dioxide into carbohydrates.

**Role of stomata :** Massive amount of gaseous exchange takes place through stomata.

(ii) **Activity :**

- (a) Cover a leaf of potted plant with black paper and kept the plant in sun for about six hours.
- (b) Pluck one covered and one uncovered leaf from the plant and boiled in water-bath for starch test inference.

- (c) Now put iodine on the leaves to test the presence of starch.
- (d) The uncovered leaf turned blue-black while covered leaf did not.
- (e) Thus, it is clear that the leaf that was exposed to sunlight prepared starch but the uncovered one could not do so.

Thus, this activity shows that sunlight is necessary for photosynthesis.

- 283.** (a) Draw a neat diagram of alimentary canal and label the following parts :
- (i) The largest gland.
  - (ii) The gland that secretes digestive enzymes as well as hormones.
  - (iii) The part where digested food is absorbed.
- (b) What are villi ? Mention their functions.

**Ans :**

Delhi 2016

- (a)
- (i) Liver
  - (ii) Pancreas
  - (iii) Small intestine

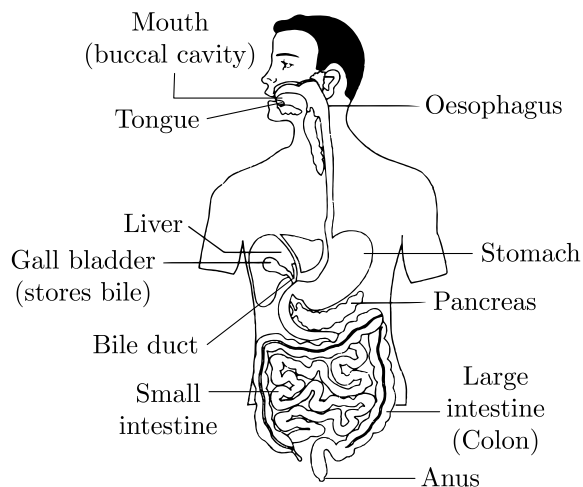


Figure: Human digestive system

- (b) Numerous finger like projections present in the inner lining of the intestine which increase the surface area for absorption of food are called villies. They absorb digested food in small intestine and absorb water in large intestine.

- 284.** (a) Draw the cross-section of the leaf and label the following parts :
- (i) Upper epidermis,
  - (ii) Chloroplast.
- (b) Define photosynthesis.

**267.** Draw diagram of human excretory system.

Ans :

Comp 2013

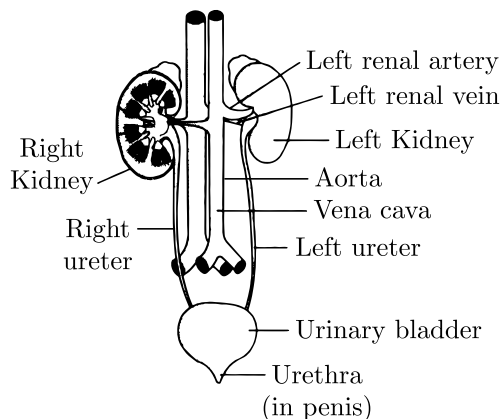


Figure: Excretory system of human beings.

**268.** Write three events which occur during the process of photosynthesis.

Ans :

Comp 2017

Three events which occur during photosynthesis :

- (i) Absorption of light energy by chlorophyll.
- (ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
- (iii) Reduction of carbondioxide to carbohydrates.

**269.** How does small intestine tissues help the digestion of fats, protein and starch?

Ans :

OD 2016

- Small intestine is the longest part of the alimentary canal.
- It is the site of complete digestion of carbohydrates, proteins and fats.
- The secretions of liver and pancreas are released in this part.
- Bile juice, a secretion of liver, helps to change the acidic food into alkaline which is essential for the action of pancreatic enzymes.
- Bile salts break down the large globules of fats into smaller globules, increasing the efficiency of enzyme action.
- Pancreatic lipase helps in breakdown of fats and converts them into fatty acids and glycerol.

**270.** Explain the process of assimilation of proteins in human digestive system.

Ans :

OD 2014

- (i) The different types of proteins in the food are converted into amino acids after digestion.

- (ii) The amino acids are absorbed by blood and transported through blood vessels to cells and tissues.
- (iii) In the cells, the amino acids are used up for building components of cells and tissues. There are the basic materials for the growth.

**271.** Draw a diagram of human alimentary canal and label it.

Ans :

Delhi 2010

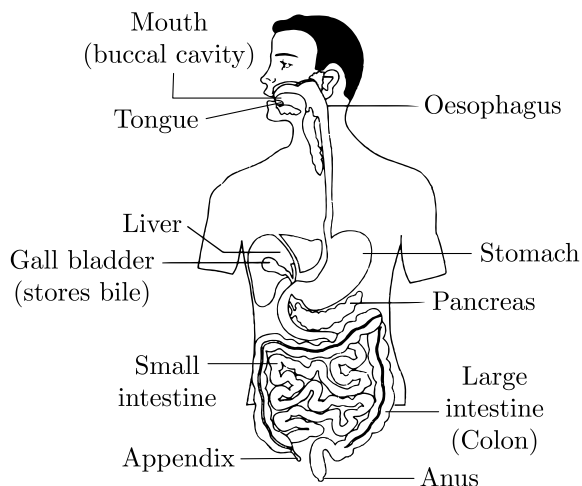


Figure: Human alimentary canal.

**272.** (i) Name the following :

- The three carbon molecule that is formed due to break-down of glucose during respiration.
- The nitrogenous waste that is removed from the blood in our Kidneys.

(ii) How do unicellular organisms generally remove waste ?

Ans :

OD 2011

- (i) (a) The three carbon molecule formed due to break-down of glucose during respiration is pyruvate.  
(b) Urea.
- (ii) Unicellular organisms generally remove waste by the process of diffusion from the body surface into the surrounding water.

**273.** With the help of diagram explain how exchange of gases occurs in leaf of a plant.

**Ans :**

Delhi 2013

Tiny apertures called stomata are found on the surface of leaf.  $O_2$  diffuses in through stomata and finds its way into the cells of the leaf. Increase in concentration of  $CO_2$  opens the stomata and  $CO_2$  is released in the atmosphere.

- 287.** (i) Draw a neat labelled diagram of human alimentary canal. Label the following :
- Buccal cavity
  - Liver
  - Pancreas
  - Stomach
  - Gall bladder
  - Large intestine
- (ii) On which type of food does salivary amylase act at buccal cavity and write the name of the initial product due to the action of amylase.

**Ans :**

AI 2010

(i)

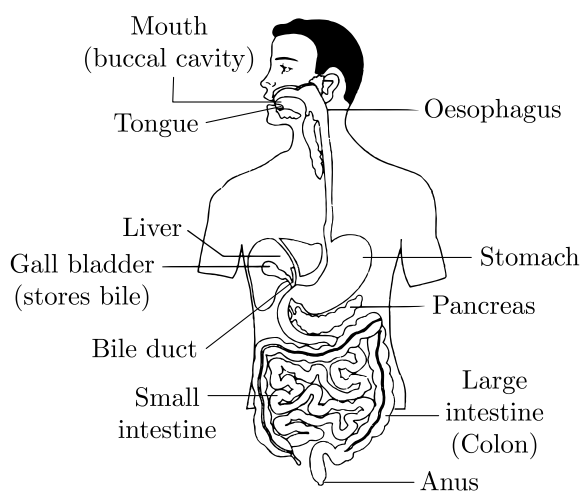


Figure: Human digestive system

- (ii) Salivary amylase acts on starch in the buccal cavity and sugar is the initial product when salivary amylase acts on starch.

- 288.** How do the guard cells regulate opening and closing of stomatal pores ?

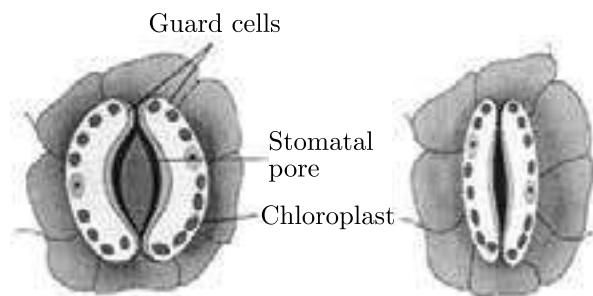
**or**

Explain with the help of diagram. Also, indicate what happens to the rate of photosynthesis if stomata get blocked due to dust.

**Ans :**

Delhi 2014

The swelling of guard cells due to absorption of water causes opening of stomatal pores while shrinking of guard cells closes the pores. Opening and closing of stomata occurs due to turgor changes in guard cells. When guard cells are turgid, stomatal pore is open while in flaccid conditions, the stomatal aperture closes. Rate of photosynthesis decreases when the stomata of a leaf get blocked due to dust.



- 289.** Describe an experiment to prove that  $\text{CO}_2$  is necessary for photo-synthesis.

**Ans :**

Comp 2012

- Take two healthy potted plants which are nearly of the same size.
- Keep them in a dark room for three days.
- Place a watch-glass containing potassium hydroxide by the side of one of the plants. The potassium hydroxide is used to absorb carbon dioxide.

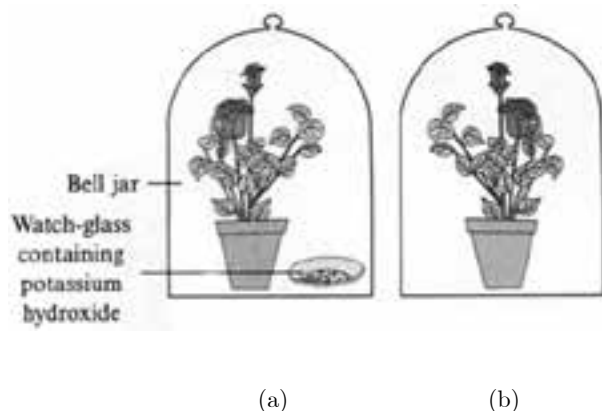


Figure: Experimental set-up (a) with potassium hydroxide (b) without potassium hydroxide.

- Cover both plants with separate bell-jars as shown in the figure.
- Use vaseline to seal the bottom-of the jars to the glass plates so that the set-up is air-tight.
- Keep the plants in sunlight for about two hours.
- Pluck a leaf from each plant and check for the presence of starch.

The leaf from the plant near which potassium hydroxide was not put showed the presence of starch.

Above experiment shows that  $\text{CO}_2$  is necessary for photosynthesis.



4. Transport of respiratory gases occurs by haemoglobin in RBCs of blood which combines with oxygen and forms an unstable compound, oxyhaemoglobin. Oxyhaemoglobin breaks down in the tissues and releases oxygen.
5. Carbon dioxide produced during cellular respiration is removed as bicarbonate dissolved in blood plasma and is carried to the lungs. In lungs, bicarbonate releases  $\text{CO}_2$

## 5. TRANSPORTATION

Transportation is the movement of glucose, oxygen and other organic and inorganic substances from one part of the body to other.

1. In unicellular and simple multicellular organisms, substances move from cell to cell by diffusion.
2. In complex organisms, transport systems are developed.

### 5.1 Transportation in Plants

1. The upward movement of water and mineral salts from roots to the aerial parts (leaves, branches, flowers, etc.) of the plant against the gravitational force is called ascent of sap. It occurs through xylem tissue throughout the plant body,
2. Root pressure, cohesion-adhesion tension of water molecules and the transpiration pull help in the upward movement of sap from root to the apex of a tree.

The transport of food from leaves to different parts of plant is called as translocation. It is carried out by phloem tissue.

### 5.2 Transportation in Human Beings

In human beings, transportation is carried out by circulatory system. It is composed of blood, blood vessels, heart, lymph and lymph vessels.

### 5.3 Heart – The Pumping Machine

1. Heart is a muscular pumping organ of the size of a fist. It is enclosed in a sac called pericardium, formed of two pericardial membranes.
2. Human heart is four-chambered. It consists of two auricles or atria and two ventricles. Auricles are receiving chambers, whereas ventricles are distributing chambers.
3. Each atrium opens into the ventricle of its side by an atrioventricular aperture. A bicuspid

valve guards the left atrioventricular aperture, whereas a tricuspid valve guards the right atrioventricular aperture.

4. Three semilunar pulmonary valves guard the opening of right ventricle into the pulmonary aorta. Three semilunar aortic valves guard opening of left ventricle into aorta.
5. Right auricle receives deoxygenated blood from the body through superior or anterior vena cava or precaval and inferior or posterior vena cava or postcaval.
6. Left auricle receives oxygenated blood from the lungs via four pulmonary veins.
7. Pulmonary trunk arises from the right ventricle and carries de-oxygenated blood to the lungs.
8. Aorta or aortic arch arises from the left ventricle and supplies oxygenated blood to the whole body.
9. In double circulation, separation of de-oxygenated and oxygenated blood results in two independent circulations: Pulmonary circulation for the oxygenation of de-oxygenated blood and systemic circulation for the supply of oxygenated blood to all body organs.

### 5.4 Heartbeat and Cardiac Cycle

Working of heart includes rhythmic contractions (systole) and relaxations (diastole) of Cardiac cycle is one complete heartbeat which includes one systole and one diastole.

### 5.5 Blood Pressure

The pressure exerted by the blood discharged due to contraction of left ventricle on the wall of blood vessels is called blood pressure.

1. Systolic pressure (120 mm of Hg) is exerted during ventricular contraction (ventricular systole).
2. Diastolic pressure (80 mm of Hg) is exerted during relaxation of ventricle (ventricular diastole).

### 5.6 Blood Vessels

These are of three types :

1. Arteries are distributing vessels. They carry blood from heart to various body organs.
2. Veins are collecting vessels. They collect blood from various parts of the body and carry it to the heart.
3. Capillaries are microscopic vessels which form a link between arteries and veins.

Where do carbohydrates, proteins and fats get digested in human beings ?

Ans :

Comp 2016

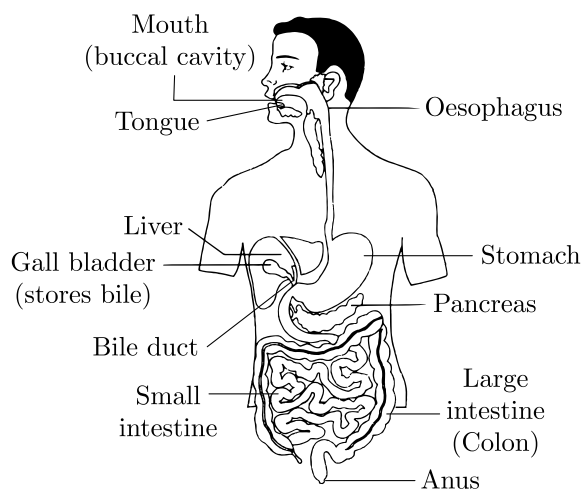


Figure: Human digestive system

Carbohydrates, proteins and fats get digested in the small intestine.

- 294.** Mention the three common features of the various respiratory organs found in animals.

Ans :

Delhi 2007

Three common features of the respiratory organs are :

- (i) They have a large surface area for gaseous exchange.
- (ii) They have thin walls for easy diffusion to facilitate exchange of respiratory gases.
- (iii) They are richly supplied with blood vessels. (Trachea are the exception because there is no blood in insects and as such branches of trachea reach each and every cell of the body).

- 295.** Explain the mechanism of breathing.

Ans :

Delhi 2011

For continued gaseous exchange in the lungs, a constant renewal of the air is necessary. This happens in two steps :

- (i) Inspiration (or inhalation) i.e., drawing the air into the lungs is the result of increase in size of the thoracic cavity and this increase is due to the combined action of the ribs and the diaphragm.

The ribs are moved upward and outward by the muscles (intercostal muscles) stretched between them, thus enlarging the chest cavity all

around. The other structure which contributes in inspiration is the diaphragm.

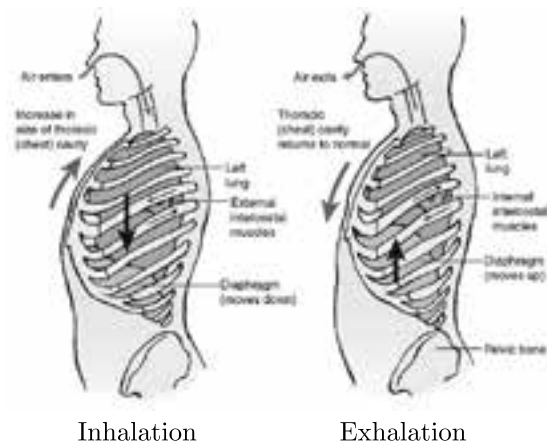


Figure: Processes of inhalation and exhalation.

The diaphragm is a sheet of muscular tissue, which normally remains arched upward like a dome, towards the base of the lungs. On contraction, it falls or flattens from the dome-shaped outline to an almost horizontal plane and thus contributes to the enlargement of the chest cavity lengthwise. As the diaphragm flattens, it presses the organs inside the abdomen and with the abdominal muscles relaxed, the abdominal wall moves outwards.

Decreased pressure inside the lungs draws the air inward.

When the thoracic (chest) cavity increases in size, the pressure in the pleural cavities is decreased; the lungs expand and as a result, the pressure inside the lungs is lowered below the atmospheric pressure. Therefore, the outside air which is at a greater pressure rushes in, to equalize the pressure.

- (ii) Expiration (or exhalation) i.e., expelling the air out, is the result of reverse movements of the ribs and diaphragm. The other set of intercostal muscles contracts and pulls the ribs down and inward.

The diaphragm is relaxed and is moved upwards to its dome-like outline as a result of the pressure of the abdominal contents when the muscles in the abdominal wall contract. As a consequence, the cavity of the thorax is diminished and the lungs are compressed forcing the air out into the atmosphere.

- 296.** (i) Draw a neat labelled diagram of human respiratory system and label the following parts:
- (a) Bronchioles
  - (b) Rings of cartilage

- (a) nucleus, chloroplast, guard cell, vacuole
- (b) nucleus, chloroplast, vacuole, guard cell
- (c) chloroplast, nucleus, vacuole, guard cell
- (d) vacuole, guard cell, nucleus, chloroplast

Ans :

OD 2023

Label 1 - nucleus

Label 2 - chloroplast

Label 3 - vacuole and

Label 4 - guard cell.

Thus option (b) is correct option.

2. Which of the following statements about the autotrophs is incorrect ?

- (a) They synthesise carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll.
- (b) They store carbohydrates in the form of starch.
- (c) They convert carbon dioxide and water into carbohydrates in the absence of sunlight.
- (d) They constitute the first trophic level in food chains.

Ans :

(c) They convert carbon dioxide and water into carbohydrates in the absence of sunlight.

3. In which of the following groups of organisms, food material is broken down outside the body and absorbed ?

- (a) Mushroom, green plants, Amoeba
- (b) Yeast, mushroom, bread mould
- (c) Paramecium, Amoeba, Cuscuta
- (d) Cuscuta, lice, tapeworm

Ans :

(b) Yeast, mushroom, bread mould

4. Select the correct statement :

- (a) Heterotrophs do not synthesise their own food.
- (b) Heterotrophs utilise solar energy for photosynthesis.
- (c) Heterotrophs synthesise their own food.
- (d) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates.

Ans :

(a) Heterotrophs do not synthesise their own food.

5. Which is the correct sequence of parts in human alimentary canal ?

- (a) Mouth → stomach → small intestine → oesophagus → large intestine
- (b) Mouth → oesophagus → stomach → large intestine → small intestine.
- (c) Mouth → stomach → oesophagus → small intestine → large intestine
- (d) Mouth → oesophagus → stomach → small intestine → large intestine

Ans :

(d) Mouth → oesophagus → stomach → small intestine → large intestine

6. If salivary amylase is lacking in the saliva, which of the following events in the mouth cavity will be affected ?

- (a) Proteins breaking down into amino acids
- (b) Starch breaking down into sugars
- (c) Fats breaking down into fatty acids and glycerol
- (d) Absorption of vitamins

Ans :

(b) Starch breaking down into sugars

7. The inner lining of stomach is protected by one of the following from hydrochloric acid. Choose the correct one.

- (a) Pepsin
- (b) Mucus
- (c) Salivary amylase
- (d) Bile

Ans :

(b) Mucus

8. Which part of alimentary canal receives bile from the liver ?

- (a) Stomach
- (b) Small intestine
- (c) Large intestine
- (d) Oesophagus

Ans :

(b) Small intestine

9. A few drops of iodine solution were added to rice water. The solution turned blue-black in colour. This indicates that rice water contains

- (a) complex proteins
- (b) simple proteins
- (c) fats
- (d) starch

Ans :

(d) starch

**300.** (a) Draw neat diagram of respiratory system and label the following parts :

- (i) Lungs
- (ii) Trachea
- (iii) Bronchus
- (iv) Diaphragm.

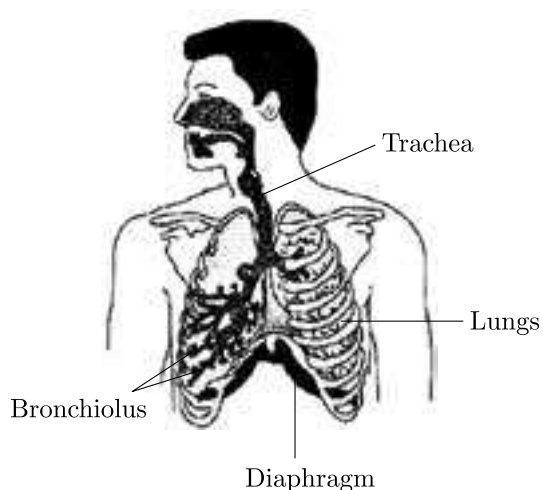
(b) Name the respiratory pigment in human beings and discuss its role.

(c) Why is the rate of breathing in aquatic organisms much faster than that in terrestrial organisms ?

**Ans :**

AI 2013

(a)



(b) Haemoglobin is the respiratory pigment in human beings. It takes up  $O_2$  from the air in the lungs and carry it to tissues that are deficient in oxygen.

(c) The amount of dissolved oxygen in water is fairly low compared to the amount of oxygen in the air, so aquatic organisms breathe much faster than terrestrial organisms.

**301.** Briefly describe the shape and function of human red blood corpuscles.

**Ans :**

Delhi 2014

- RBCs are circular and do not contain nuclei.
- RBC contains a respiratory pigment called haemoglobin. It is because of this pigment that the blood appears red.
- Haemoglobin carries the oxygen from lungs to tissues and carbon dioxide from tissues to lungs.
- The lifespan of RBC is 120 days.

**302.** Differentiate between blood and lymph.

**Ans :**

OD 2016

	Blood	Lymph
(i)	Blood is red in colour due to the presence of haemoglobin.	Lymph is light yellow in colour due to the absence of haemoglobin.
(ii)	Blood flows in blood vessels.	Lymph flows in the lymphatic capillaries which join to form large lymph vessels.
(iii)	Blood contains RBCs, WBCs, plate-lets and plasma.	Lymph contains lymphocytes, a type of WBC.
(iv)	Blood flows from heart to different organs of the body and back to heart.	Lymph flows from tissues to the heart.

**303.** (i) Draw a sectional view of the human heart and label :

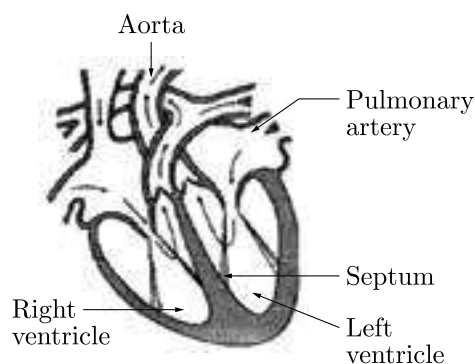
- (a) Pulmonary artery
- (b) Aorta
- (c) Septum
- (d) Ventricles

(ii) Arteries have thick elastic walls while veins have valves, explain.

**Ans :**

Foreign 2011

(i)



(ii) Arteries carry blood with a lot of pressure whereas veins have valves to prevent back flow of blood.

**304.** (i) Draw the sectional view of the human heart and label the following parts :

- (a) Left atrium
- (b) Pulmonary arteries

## FIVE MARKS QUESTIONS

**278.** Give reasons :

- (a) Ventricles have thicker muscular walls than atria.
- (b) Transport system in plants is slow.
- (c) Circulation of blood in aquatic vertebrates differs from that in terrestrial vertebrates.
- (d) During the daytime, water and minerals travel faster through xylem as compared to the night.
- (e) Veins have valves whereas arteries do not.

**Ans :**

Delhi 2020

- (a) Ventricles have thicker muscular walls than atria because they have to pump blood into various organs.
- (b) Transport system in plants is slow because :
  - (i) Plants have low energy needs as
  - (ii) Plant bodies have a large proportion of dead cells in many tissue.
  - (iii) Plants do not move.
- (c) Aquatic vertebrates like fish have a two chambered heart (which consists of one atrium and one ventricle). The heart pumps deoxygenated to the gills and it gets oxygenated in the gills. The oxygenated blood from the gills is supplied to the body parts. Thus, blood goes only once through the heart in the fish during one cycle of passage through the body. But in terrestrial organisms, heart may be 3 or 4 chambered, blood gets oxygenated in the lungs and most of them have double circulation.
- (d) During the daytime, water and minerals travel faster through xylem as compared to the night. The water column in the xylem tracheids and vessels moves upwards due to pull generated by transpiration. (loss of water in the form of

vapours from living tissues of aerial parts of plants.) The water is lost from the tiny pores called stomata present on the surface of leaves of plant. Stomata are open during day time, so transpiration process is faster and water alongwith mineral moves faster through xylem during day time as compared to night time.

- (e) Veins have valves that ensure that the blood flows only in one direction. Valves allow the blood to flow only towards the heart and prevent back-flow but arteries do not have valves.

**279.** How would you classify a green plant, an animal, a fungus and a roundworm based on their modes of nutrition ? Explain very briefly the manner how they get their nutrition.

**Ans :**

Comp 2017

A green plant is an autotroph, which produces its food by photosynthesis, using  $\text{CO}_2$  and water as raw materials (obtained from the atmosphere) and using sunlight.

An animal is a heterotroph that cannot prepare its own food. It consumes food prepared by the plants or obtained from the animal sources.

A fungus is a saprophyte which obtains food from the dead and decaying organic material, by giving out digestive enzymes and then absorbing this digested organic material.

A roundworm is a parasite which obtains food from its host's intestine. Parasite is an organism which obtains its nourishment from another organism (host) and also gets shelter from it.

**280.** Mention the various digestive glands, their secretions, sites of their action, enzymes they produce, the food nutrient on which they act and end products after digestion associated with the alimentary canal of man.

**Ans :**

Foreign 2013

Name of digestive glands	Secretion	Site of action	Enzymes	Food on which they act	End product
1. Salivary gland	Saliva	Buccal cavity	Ptyalin	Starch	Maltose
2. Gastric gland	Gastric juice	Stomach	Pepsin	Protein	Peptone
3. Liver	Bile juice	Duodenum		Fat	Emulsification of fat
4. Pancreas	Pancreatic juice	Duodenum	(i) Amylase (ii) Trypsin (iii) Lipase	Starch Protein Fat	Maltose Peptides Fatty acids
5. Intestinal glands	Succus entericus	Small intestine	(i) Erepsin (ii) Sucrase (iii) Lactase (iv) Lipase	Peptone Sucrose Lactose Fat	Amino acids Glucose and fructose Glucose Fatty acid and glycerol

- (a) Right atrium
  - (b) Right ventricle
  - (c) Left atrium
  - (d) Left ventricle
- (ii) Blood consists of plasma and blood cells.
- (iii) (a) It transports oxygen and carbon dioxide to all parts of the body.
- (b) It also transports food, salts, etc.

**308.** What is transpiration ? Mention its importance to the plants.

**Ans :**

SQP 2012

Transpiration is the loss of water in the form of water vapours from the surface of the leaf (and other aerial parts of plant) into the atmosphere.

Transpiration has great significance for the plants. Its main advantages are as follows :

- Cooling effect :** Evaporation reduces temperature. Therefore, transpiration is useful to plants on hot sunny days.
- Suction force :** Transpiration helps in the ascent of sap by producing a suction force acting from the top of a plant. Evaporation from the leaves concentrates cell sap and increases their osmotic pressure. This draws water from the cells of the lower levels in a sequential manner (ascent of sap) and finally favours absorption of water from the soil by osmosis.

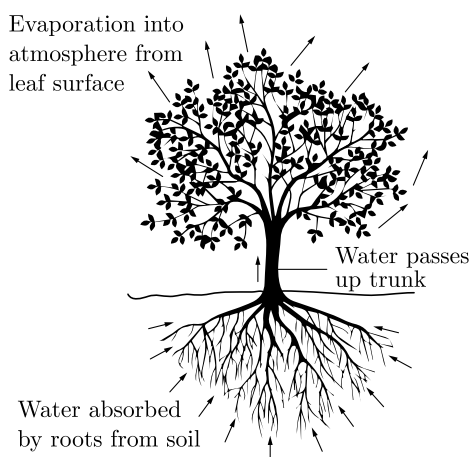


Figure: Importance of .transpiration.

- Distribution of water :** Since, leaves are present at the tips of all branches and twigs, transpiration from their surfaces tends to draw water towards them and thus helps in the distribution of water throughout the plant body.

- Elimination of excess water :** Roots continuously absorb a very large quantity of water. Transpiration is an effective method of removing excess water from the plant body.

**309.** Describe the structure of a sieve tube. Name the cells which are present along sieve tubes in the phloem tissue. Draw a labelled diagram of phloem tissue.

**Ans :**

Delhi 2014

- Sieve tubes are living components of phloem. These are placed one above the other. Their end walls have sieve plates. These plates have pores through which the food is translocated from one sieve tube cell to the next.
- Companion cells and phloem parenchyma cells are present along sieve tubes in the phloem tissue.
- 

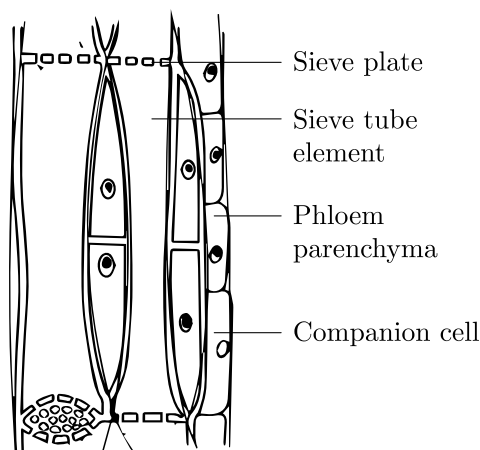


Figure: A part of the phloem tissue.

**310.** With the help of a labelled diagram, briefly describe the urinary system of a human being.

or

Draw a labelled diagram of human urinary system.

**Ans :**

Foreign 2006

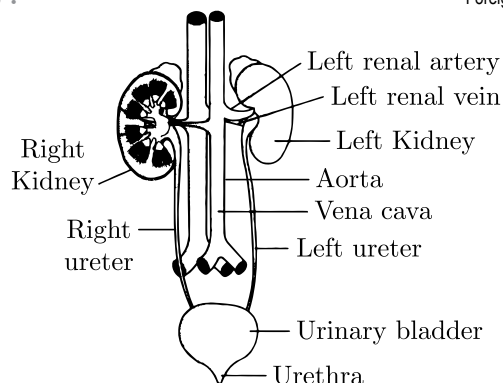


Figure: Human excretory system



- (c) List three events which occur during this process.  
 (d) Write down the chemical equation involved in photosynthesis.  
 (e) How is unused energy stored in plants ?

Ans :

SQP 2011

(a)

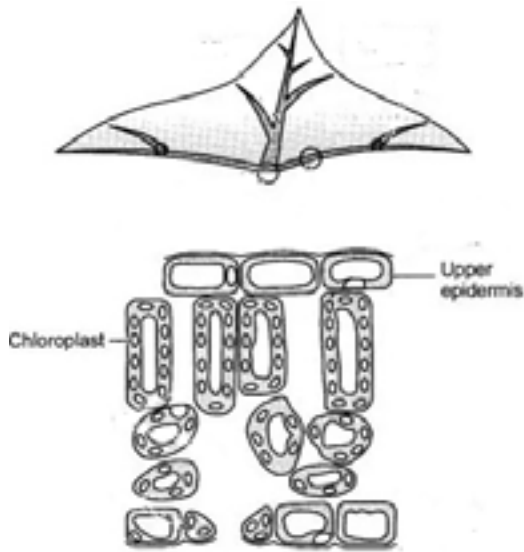


Figure: Cross-section of a leaf.

- (b) **Photosynthesis :** Green plants synthesise their own food by utilizing inorganic substances like carbon dioxide and water in the presence of sunlight and chlorophyll. This process is known as photosynthesis.  
 (c) The following events occur during photosynthesis:  
 (i) Absorption of light energy by chlorophyll.  
 (ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.  
 (iii) Reduction of carbon dioxide into carbohydrates.  
 (d) 
$$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \underset{\text{Glucose}}{\text{C}_6\text{H}_{12}\text{O}_6} + 6\text{O}_2$$
  
 (e) Unused energy of the plant is stored in the form of starch.

285. (a) Draw a diagram of human alimentary canal and label on it :  
 (i) Gall bladder  
 (ii) Liver  
 (iii) Pancreas  
 (iv) Small intestine  
 (b) What is emulsification of fats ? Why is it necessary?

Ans :

SQP 2018

(a)

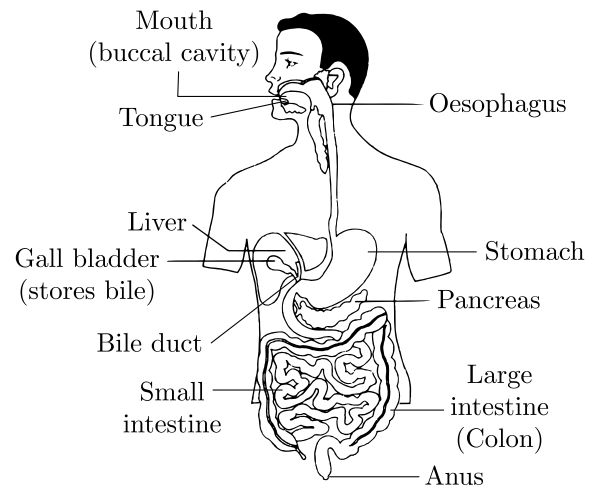


Figure: Human digestive system

- (b) Emulsification is the process of breaking down of fat globules into smaller globules. It increases efficiency of enzyme action.  
 286. (i) Why is nutrition a necessity for an organism ? State three reasons.  
 (ii) What is likely to happen if green plants disappear from earth ?  
 (iii) "All plants give out oxygen during day and carbon dioxide during night." Justify this statement.

or

"All plants give out oxygen during day and carbon dioxide during night." Do you agree with this statement ? Give reason.

Ans :

Delhi 2012

- (i) Nutrition is necessary :  
 (a) for energy for metabolic processes.  
 (b) for growth of new cells and repair of older ones.  
 (c) to develop resistance.  
 (ii) All organisms require green plants for energy. In the absence of green plants all herbivores will die due to starvation and consequently carnivores will also die.  
 (iii) During day time rate of photosynthesis is more than the rate of respiration. So, net result is evolution of  $\text{O}_2$ .  
 At night there is little photosynthesis compared to respiration so, result is evolution of  $\text{CO}_2$ .

- (iii) Left renal vein
- (iv) Vena cava
- (v) Urinary bladder
- (vi) Ureter

Ans :

OD 2013

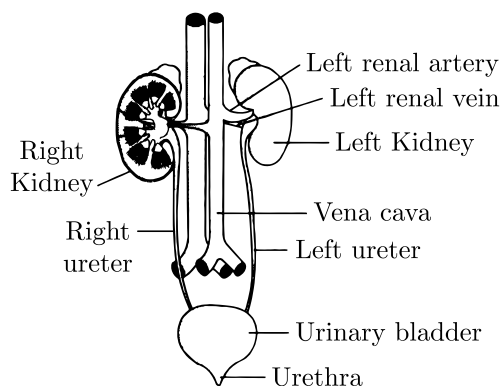


Figure: Human excretory system

- 315.** What is translocation ? Name the cells involved in the transport of food in plants. What are the steps involved in the translocation of food in plants ?

Ans :

OD 2016

Transportation of soluble product of photosynthesis or food from leaves to other parts of plants is called translocation.

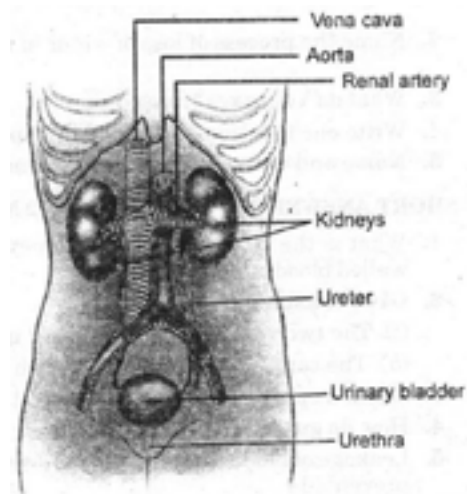
Seven tubes of phloem are involved in the transport of food in plants for translocation, food molecules enter into the sieve tubes from where they can be transported upwards or downwards to all parts of the plant including roots.

Mechanism of translocation is an active process that utilizes energy. Materials are transferred from leaf cells or from the site of storage into phloem tissue. For this energy is required which is provided by the ATP molecules. This energy, increases the osmotic pressure, as a result, water from outside moves into the phloem. This pressure maintains the movement of food through all the parts of plants.

- 316.** Given below is the diagrammatic representation of the excretory system, answer the following question:

- (a) In which part of the excretory system are the nephrons located ?
- (b) Name the blood vessel that brings nitrogenous wastes to the kidneys for removal.
- (c) Name the blood vessel that is taking the blood away from the kidneys after removal of nitrogenous wastes.

- (d) Which part of the kidney is connected to the ureters ?
- (e) Name the bunch formed by the capillaries in the cup-like structure of nephron.



Ans :

Comp 2013

- (a) In kidneys
- (b) Renal arteries
- (c) Renal vein
- (d) Pelvis/Renal pelvis
- (e) Glomerulus.

- 317.** (i) How is lymph formed ?  
 (ii) Write two points of difference between blood and lymph.  
 (iii) State two important functions of lymph.

Ans :

Comp 2016 ,07

- (i) Through the pores present in the walls of capillaries some amount of plasma, protein and blood cells escape into inter-cellular spaces in the tissues and form a tissue fluid called lymph.
- (ii)

	Blood	Lymph
1.	The constituents of blood are RBC, WBC, platelets and plasma.	The constituents of lymph are plasma and lymphocytes.
2.	It is red in colour due to the presence of RBCs.	It is colourless.

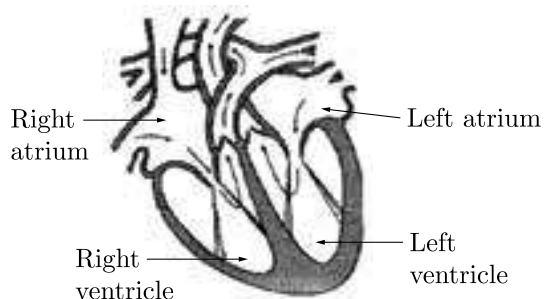
- (iii) Two important function of lymph are following :
  - (a) Lymph carries digested and absorbed fat from intestine.
  - (b) It drains excess fluid from extra cellular space back into the blood.

- 318.** (i) Draw the diagram of heart and label its four chambers.  
 (ii) Construct a table to show the functions of these four chambers.

Ans :

Comp 2012

(i)



(ii)

	Name of chamber	Function
1.	Left atrium	Receives oxygenated blood from lungs through pulmonary veins and pours it into left ventricle.
2.	Right atrium	Receives deoxygenated blood from various body parts through superior and inferior vena cava and pours it into right ventricle.
3.	Left ventricle	Pumps oxygenated blood to various parts of body through aorta.
4.	Right ventricle	Pumps deoxygenated blood into lungs through pulmonary artery.

## CASE BASED QUESTIONS

- 319.** Each of your kidneys is made up of about a million filtering units called nephrons. Each nephron includes a filter, called the glomerulus, and a tubule. The nephrons work through a two-step process: the glomerulus filters your blood, and the tubule returns needed substances to your blood and removes wastes. Study the table and answer the following questions.

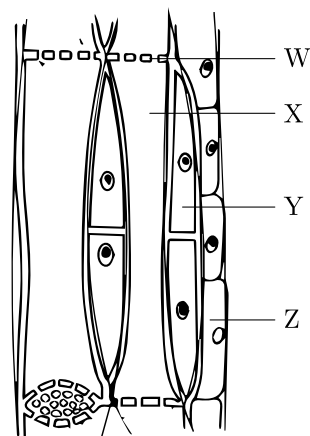
S. No.	Substance	Amount filtered (grams)	Amount reabsorbed (grams)	Amount in urine (grams)
1.	Water	180 L	179 L	1 L
2.	Proteins	10-20	10-20	0
3.	Chlorine	635	630	6
4.	Sodium	540	535	3

- (i) The urine is produced by which organ system ?  
 (ii) What are nephrons ?  
 (iii) What do you mean by urine ?  
 (iv) What is the final part of the urinary system ?

Ans :

- (i) The formation of urine takes place in the kidney which is a part of the urinary system.  
 (ii) Nephron is the first part of the urinary system present inside the kidneys. The wastes and water from blood plasma move to the nephron through hollow tubules. Nephron produces urine and urine has all the wastes.  
 (iii) The waste fluid produced during metabolic activities is known as urine. The wastes and toxins are removed out of the body through urine.  
 (iv) Urethra is the final part of the urinary system is known as the urethra. The function of this part is to remove urine out of the body. It is a single tubular structure that is functional when urinary bladder expands and gets filled with urine.

- 320.** Study the given figure and answer the questions that follow.



- (i) Identify the correct pair of labelled parts with the help of this figure.

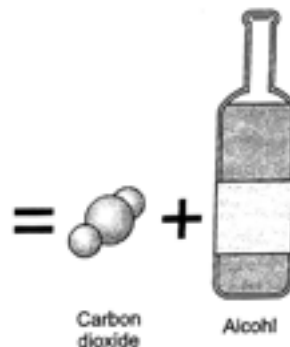
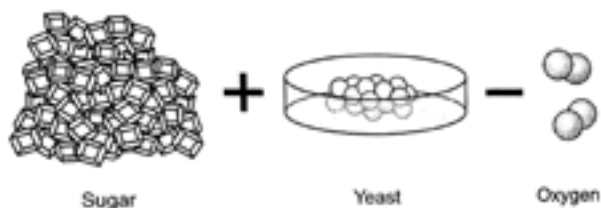
a.	W-Sieve plate	Y-Companion cell
b.	X-Sieve plate	Z-Companion cell
c.	Y-Sieve tubes	Z-Sieve plate
d.	X-Companion cell	Y-Phloem parenchyma cell

- (ii) Name the labelled part which contain cytoplasm but no nucleus.  
 (iii) Describe the function of part Y ?  
 (iv) Define the labelled part Z.

Ans :

- (i) a.  
 The given figure is L.S of phloem in which W represents sieve plate, X represents sieve tubes, Y represents companion cell and Z represents phloem parenchyma.  
 (ii) Sieve tubes (X) are living cells which contain cytoplasm but no nucleus.  
 (iii) Companion cell (Y) help in maintaining a proper pressure gradient in sieve tube elements.  
 (iv) Phloem parenchyma (Z) are ordinary living elongated cells having abundant plasmodesmata. They store food, mucilage and latex.

321. The breakdown of complex substances into simpler substances by action of enzymes released by anaerobic bacteria is called fermentation. By this method, we can prepare only ethanol. In this, firstly, Sugarcane juice and water are mixed and heated to form sweet liquid called molasses. Then, in presence of yeast and enzyme invertase, it breaks into glucose and fructose and then further, glucose and fructose break into further simpler substances called ethanol and carbon-dioxide. This method is generally carried out in breweries.



- (i) Name two enzymes that convert sugarcane juice into glucose and fructose.  
 (ii) Which enzyme is responsible for conversion of glucose and fructose into ethanol and carbon-dioxide ?  
 (iii) What is the condition for fermentation ?

Ans :

- (i) Two enzymes are yeast and invertase.  
 (ii) Zymase converts glucose and fructose into ethanol and carbon-dioxide.  
 (iii) Fermentation occurs in absence of oxygen that is in anaerobic conditions.

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322. The saliva contains an enzymes called salivary amylase that breaks down starch which is a complex molecule to give sugar. The food is mixed thoroughly with saliva and moved around the mouth while chewing by the muscular tongue. From the mouth, the food is taken to the stomach through the food-pipe or oesophagus. The stomach is a large organ which expands when food enters it. The muscular walls of the stomach help in mixing the food thoroughly with more digestive juices. These digestion functions are taken care of by the gastric glands present in the wall of the stomach. These release hydrochloric acid, a protein digesting enzyme called pepsin and mucus. The hydrochloric acid creates an acidic medium which facilitates the action of the enzyme pepsin. The mucus protects the inner lining of the stomach from the action of

In plants, water is transported through xylem vessels or tracheid and not through phloem sieve tubes are present in phloem for the transport of food in the plants, in xylem there is no cytoplasm or nuclei but through the xylem vessels the transport of water takes place. So, both assertion and reason are false.

- 46. Assertion :** The thickest muscles are present in left atrium.

**Reason :** Left atrium receives deoxygenated blood from the lungs.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

In the whole body, the left ventricle pumps the blood and it has thickest muscles. So, both assertion and reason are false.

- 47. Assertion :** Failure of the kidneys leads to death of the person and there is no way he can survive.

**Reason :** Transplant of kidneys in humans is not possible.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

Failure of the kidneys results in the build up of waste products such as urea and other waste products in the blood. But, with the advancements in technology organ transplant can be done in humans although it is expensive but is successful as well, also the blood of the person can be purified through the procedure of dialysis in which the waste substance is separated from the blood of the person. So, assertion and reason both are false.

- 48. Assertion :** Aerobic animals are not truly aerobic.

**Reason :** Anaerobically they produce lactic acid.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

- (c) Assertion is true but Reason is false.

- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

In most animals, tissue oxidations are carried out by aerobic respiration. Anaerobic metabolism takes place in certain tissues like skeletal muscles which do not get as much as oxygen required and produce lactic acid sometimes in aerobically respiring organisms.

- 49. Assertion :** Dark phase reactions take place at night.

**Reason :** Dark phase is independent of light, hence, called light independent phase.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

At night the dark phase reactions do not take place, they are independent of light. Thus, light is not the mandatory factor.

- 50. Assertion :** in the daytime,  $\text{CO}_2$  generated during respiration is used up for photosynthesis.

**Reason :** There is no  $\text{CO}_2$  release during day.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

In night, dark reaction of photosynthesis occurs, in which the products of light reaction, i.e.  $\text{CO}_2$ , ATP, NADPH and  $\text{H}_2\text{O}$  are utilised.  $\text{CO}_2$  is reduced for the production of carbohydrates.

- 51. Assertion :** Amoeba is not an omnivore organism.

**Reason :** Lion is a carnivore organism.



Table B: Haemoglobin levels of patients

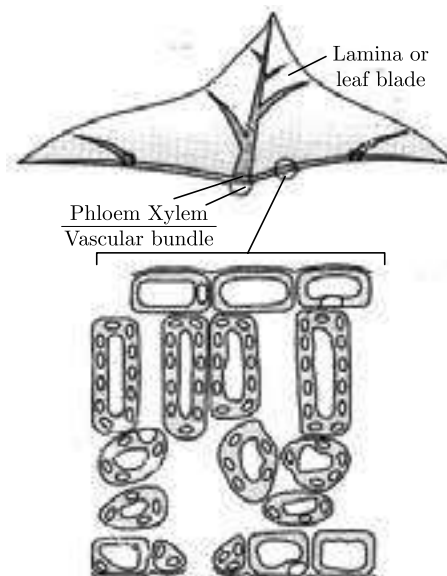
Checking Time	Haemoglobin (g/dL)	
	Patient X	Patient Y
Blood test	4	6

- Refer to table B showing the haemoglobin level reports of patients (X and Y). Which disease can be diagnosed from the given data ?
- Name the element which is transported by haemoglobin from lungs to all parts of the body.
- What is the excellent haemoglobin level in human body ?

Ans :

- Anaemia
- Oxygen
- 15 g/dL

**325.** The leaf is the main photosynthetic organ in a plant. It controls gas exchange in plants, controls the amount of water loss in plants. Upper epidermis cells contain no chloroplasts which is not true for the guard cells. They form layers on the upper and lower surface of the leaf. Their function is to prevent water from getting out and stopping unwanted substances/organisms getting in. The palisade mesophyll layer is where most of the photosynthesis occurs in the leaf. The palisade cells contain a lot of chloroplasts to help them perform this photosynthesis. Lower epidermis is the bottom layer of the leaf and is one cell thick. They may not contain a cuticle within the lower epidermis, there are some holes found in leaves called stoma. These holes allow gases to diffuse in and out of the leaves. The stoma are formed by two highly specialized epidermis cells, called guard cells. Guard cells are the only epidermis cells that contain chloroplasts.



- Mention two function of lower epidermis.
- Where are chloroplasts present in the leaf ?
- What are the functions of xylem and phloem in leaf ?
- List one structural and one functional difference between upper and lower epidermis.

Ans :

- (a) To allow transpiration (b) Allow gas exchange
- Guard cells and palisade cells
- Xylem** : It transports water and minerals to leaf cells.  
**Phloem** : It translocated dissolved food prepared by photosynthesis by palisade cells.
- Structural difference** : Upper epidermis has cuticle and does not have stomata or have fewer stomata. Lower may not have cuticle and have more stomata.  
**Functional difference** : Upper epidermis is more for protection while lower is for gas exchange/transpiration.

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- 326.** More than a million Americans die of cardiac diseases each year. One of the major causes is high cholesterol levels in the blood. The National Cholesterol Education Program suggests that total



blood cholesterol level should be :

Blood Cholesterol Level Chart			
	Desirable	Borderline (high)	High Risk
Total Cholesterol	< 200	200-240	> 240
Triglycerides	< 150	150-500	> 500
Low Density Cholesterol	< 130	130-160	> 160
High Density Cholesterol	> 50	50-35	< 35

Given below are blood report of two persons

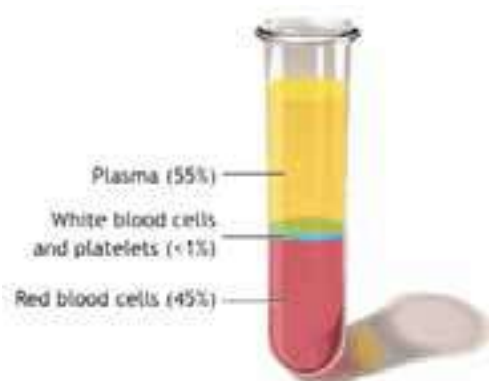
	Total Cholesterol	Triglycerides
Patient A	356	180
Patient B	180	100

- Which of the organ can be affected in a patient A? Can you infer the same risk factor for patient B ?
- What information is left out for the blank columns?

Ans :

- Heart, No
- Low density cholesterol, High density cholesterol

**327.** Blood is a fluid connective tissue that circulates throughout our body and delivers essential substances like oxygen to the body cells. It also transports metabolic waste products away from the cells. Figure given below depicts the percentage composition of different components of blood.

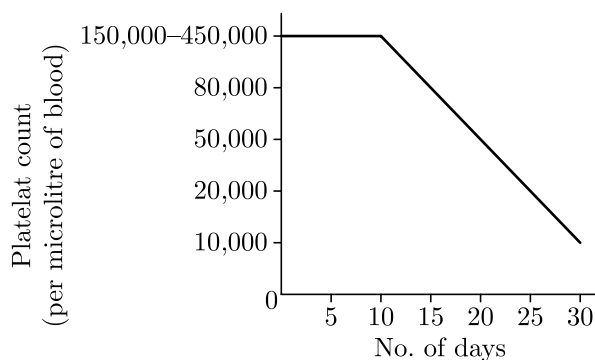


Blood cannot be made or manufactured outside the body. Blood donation is the only source of blood for patients that need blood transfusion.

- Why do you think donating blood is not harmful even though red blood cells carry oxygen to the body cells ?
- Which component is deficient in your blood if you lose too much of blood from a cut ?
- Name the pigment present in red blood cells that carries oxygen from the lungs to all the body tissues.
- Based on the information shown by the bar graph, what could be the possible cause for reduced platelet count ?

Ans :

- Red blood cells make up about 40% of our blood and are constantly being replaced in our body.
- Platelets, as they help in clotting of blood.
- Haemoglobin



- Dengue, which is caused by the dengue virus, reduces the blood platelet count of a person drastically.

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# CHAPTER 6

## Control and Coordination

### 1. COORDINATION

Coordination is the interaction of two or more organs of an organism to adjust the life processes taking place in the body to provide appropriate response to a stimulus. All living organisms possess systems of control and coordination for the recognition of various events taking place in the environment and responding to them.

Control and coordination in animals is achieved by nervous and chemical controls.

1. Nerve control involves receiving the stimulus, processing of stimulus, transmission of nerve impulse, interpretation of nerve impulse and transfer of appropriate response to effector organ.
2. Nerve cells or neurons are the structural and functional units of nervous system. A neuron consists of dendrites, cyton and axon.
3. Nerve impulse is a signal that travels along the length of a nerve fibre like the conduction of an electric current through copper wire. A nerve impulse from axon of one neuron to the dendrites of next neuron pass as chemical message through a gap called synapse.
4. Neuromuscular junction is a point of contact between the axonal end of a motor neuron and a muscle cell.
5. Reflex action is a spontaneous, involuntary and automatic response which do not require any thinking by the brain and is without the will of the organism but under the control of spinal cord. Withdrawal of hand on touching a hot object, blinking of eyes, sneezing, coughing, vomiting, withdrawal of leg when stepped on a pointed object while walking barefoot, watering of mouth at the sight of tasty food, etc. are examples of reflex action.
6. Reflex arc is a simple nervous pathway which involves a sensory neuron carrying impulse from a receptor organ to spinal cord followed by motor nerve carrying order from spinal cord

to effector organ.

#### 1.1 Pathway of Nerve Impulse in a Reflex arc

Stimulus → Receptor organ → Sensory nerve → Spinal cord → Motor nerve → Effector organ → Response to stimulus

#### 1.2 Divisions of Nervous System

1. Central nervous system (CNS) consists of brain and spinal cord.
2. Peripheral nervous system (PNS) includes the nerves that bring sensory impulses to the central nervous system (brain and spinal cord) and transmit motor impulses from impulses from CNS to effector organs.
3. Autonomic nervous system (ANS) consists of nerves connecting sympathetic and parasympathetic nervous systems.

### 2. HUMAN BRAIN

Human brain is encased in a bony case called cranium which protects it from external injuries. The brain is covered with three meninges—Dura mater, arachnoid and pia mater. The space between the meninges is filled with cerebrospinal fluid. The brain matter or nervous matter is differentiated into Grey matter which forms the surface layer of the brain and is formed of cell bodies of neurons and white matter that lies on the inner side of the brain and is formed of white myelinated axons of neurons that form nerve fibres.

The human brain is divided into forebrain, midbrain and hindbrain.

#### 2.1 Forebrain

Forebrain is the largest part of human brain. It consists of olfactory lobes, cerebrum and diencephalon.

1. Olfactory lobes are concerned with sense of smell but they are poorly developed in human beings.

2. Cerebrum is centre of instinct, thinking, memorising, reasoning, consciousness, sense of responsibility and learning, feelings of love, admiration and hatred; associated with perception of pain, temperature, touch, sense of sight, hearing, taste and smell and stores information as knowledge.
3. Diencephalon consists of thalamus and hypothalamus and two endocrine glands – pineal gland and pituitary gland associated with them. Thalamus serves as a relay centre for sensory and motor impulses pain, light and pressure. Hypothalamus controls food intake, thirst, body temperature and behavioural patterns of sleep and stress and partially controls activities of pituitary gland.

## 2.2 Mid-brain

Mid-brain connects the forebrain and hindbrain and has four optic lobes which are centres of vision.

## 2.3 Hindbrain

Hindbrain consists of cerebellum, pons varolii and medulla oblongata.

1. Cerebellum (the little brain) controls and coordinates the movements of voluntary muscles, maintains body posture and body balance while walking or jumping.
2. Pons varolii transfers impulses from one hemisphere of cerebellum to other and coordinates the muscular movements of the two sides.
3. Medulla oblongata also called brain stem, controls involuntary activities such as swallowing, peristaltic movements of alimentary canal, heartbeat, breathing movements, etc. Medulla has cardiac centre, respiratory centre, vasomotor centre and reflex centres for sneezing, coughing, vomiting and swallowing.

## 2.4 Spinal Cord

Spinal cord is the extension of medulla oblongata of brain. Like brain, it is also protected by same three meninges and the cerebrospinal fluid. On each side of the spinal cord, grey matter forms two horns :

1. The dorsal horn or posterior horn joined by a sensory nerve which picks up impulses from sense organs and brings them to spinal cord.
2. The ventral horn or anterior horn which gives rise to motor nerve that takes the message from spinal cord to the concerned effector organ.

Spinal cord conducts impulses to and from the brain, acts as a reflex centre and controls reflex actions and mediates most of the involuntary activities.

## 3. COORDINATION IN PLANTS

Coordination in plants is carried out by showing movements in their parts in response to stimulus or by chemicals released by stimulated cells.

Plants do not have nervous and muscular tissues. Hence, movements in their body parts in response to stimuli are carried out by means of cell-to-cell electrical-chemical processes and by changing cell shape. Plants show :

### 3.1 Immediate Response to Stimulus

Growth Independent Movements or Nastic Movements or Turgor Movements : They are caused due to change in the turgidity of the cells and occur at the site of bending and are reversible. Examples : Seismonasty or Thigmonasty (response to touch or vibration), Photo-nasty response to light intensity, Thermonasty (response to temperature), Nyctinasty or Sleep or Nocturnal movements (movements at night or in the dark), Hydronasty (response to water) and Chemonasty (response to chemicals).

### 3.2 Movement due to Growth

Growth Dependent Movements or Tropic Movements: They occur due to unequal growth in different parts of plant organ in the direction or away from direction of external stimulus. Examples : Phototropism (response to unidirectional light), Geotropism (response to gravity), Hydrotropism (response to water), Chemotropism (response to chemicals) and Thigmotropism (response to contact).

### 3.3 Chemical Coordination in Plants

Chemical coordination in plants occurs by substances called plant hormones or phytohormones or growth regulators. Examples :

1. Auxins are growth promoter hormones, produced in apical meristems, young flower buds, young leaves and developing seeds. They promote growth of stem, roots and fruits, promote growth of apical bud and suppress growth of lateral buds (apical dominance), increase rate of respiration, prevent premature drop of fruits and fall of leaves, induce rooting in the cutting of woods stems and produce

seedless fruits without fertilisation.

2. Gibberellins are also growth promoting hormones that cause cell elongation, elongation of internodes in dwarf varieties, break dormancy of buds in stem tubers, inhibit development of root tubers, cause parthenocarpy in apple and pear and promote flowering in long-day plants under unfavourable short-day conditions.
3. Cytokinins cause cell division. The most common cytokinin is Zeatin. They stimulate cell division even in non-meristematic tissues, cause differentiation of cells and tissues, break seed dormancy, suppress apical dominance, increase resistance to diseases and to low and very high temperatures, induce flowering and are required for phloem transport in plants.
4. Ethylene is a gaseous hormone. It enhances fruit ripening, modifies growth by inhibiting stem elongation, causes swelling of nodes and accelerates abscission of leaves, flowers and fruits.
5. Absciscic acid is a growth inhibitor and acts as a stress hormone. It inhibits growth and makes axillary buds to become dormant with the approach of winter, induces dormancy of buds and seeds, promotes wilting and senescence of leaves, causes abscission of flowers and fruits and checks transpiration by closing stomata.

## 4. HORMONES IN ANIMALS

### 4.1 Chemical Coordination

It is carried out by hormones. They are called chemical regulators or chemical messengers or the molecular messengers. Hormones are secreted by ductless endocrine glands directly into the blood. They are produced in one organ and influence the functioning of some other organ, called target organs. Hormones are slow acting and trigger specific chemical and physiological processes in their target cells. Chemically, hormones may be proteins, amino acids, amines or steroids. Their hyper-secretion (excess) as well as hypo-secretion (deficiency) results in serious hormonal disorders.

## OBJECTIVE QUESTIONS

1. In a nerve cell, the site where the electrical impulse is converted into a chemical signal is known as:
  - (a) Axon
  - (b) Dendrites

- (c) Neuromuscular junction
- (d) Cell body

Ans :

OD 2024

Neuromuscular junction is the site where the electrical impulse is converted into a chemical signal for onward transmission.

Thus (c) is correct option.

2. Walking in a straight line and riding a bicycle are the activities which are possible due to a part of the brain. Choose the correct location and name of this part from the given table:

	Part of the Brain	Name
(a)	Fore brain	Cerebrum
(b)	Mid brain	Hypothalamus
(c)	Hind brain	Cerebellum
(d)	Hind brain	Medulla

Ans :

OD 2023

Walking in a straight line and riding a bicycle are voluntary actions and are controlled by cerebellum. Cerebellum controls voluntary actions such as body posture and balance of the body. Involuntary actions such as vomiting, blood pressure are under the control of medulla of hind brain.

Thus option (c) is correct option.

3. Which of the following statements is correct about receptors ?
  - (a) Gustatory receptors detect taste while olfactory receptors detect smell.
  - (b) Both gustatory and olfactory receptors detect smell.
  - (c) Auditory receptors detect smell and olfactory receptors detect taste.
  - (d) Olfactory receptors detect taste and gustatory receptors detect smell.

Ans :

(a) Gustatory receptors detect taste while olfactory receptors detect smell.

4. Electrical impulse travels in a neuron from
  - (a) Dendrite → axon → axonal end → cell body
  - (b) Cell body → dendrite → axon → axonal end
  - (c) Dendrite → cell body → axon → axonal end
  - (d) Axonal end → axon → cell body → dendrite

Ans :

(c) Dendrite → cell body → axon → axonal end

**50. Assertion :** Phototropism is caused by auxin.

**Reason :** When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Auxin promotes phototropism. When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light while growing.

**51. Assertion :** Absciscic acid is a stress hormone.

**Reason :** Stimulation of ABA occurs in adverse conditions.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Absciscic acid is a stress hormone as its production is stimulated by drought, water logging and other adverse (stressful) conditions.

**52. Assertion :** Nerve impulse is a one way conduction.

**Reason :** Nerve impulse is transmitted from dendrite to axon terminals.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

Nerve impulses are always transmitted across a synapse from the axon terminals of one neuron to the dendrite/cell body of the next neuron but never in the reverse direction. Since, the neurotransmitter is present only in the axon terminals and not in the dendrite or cell body, it cannot be released from the dendrite or cell body even if the impulse reaches there.

**53. Assertion :** Units which make up the nervous system are called neurons.

**Reason :** Nerve impulses are carried by dendrites towards the cell body.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Both the statements are true. Nervous system is the system of conducting tissues that receives the stimulus and transmits it to other parts of the body forming a network of nerves. It is involved in receiving information (sensation) and generating responses to that information (motor response). The units which make up the nervous system are called nerve cells or neurons. Nerve impulses are always transmitted across a synapse from the axon terminals of one neuron to the dendrite/cell body of the next neuron.

**54. Assertion :** Males have more stature than females during puberty.

**Reason :** This is because of presence of thyroxine in the blood of females.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

15. Iodine is necessary for the synthesis of which hormone?

(a) Adrenaline (b) Thyroxine  
(c) Auxin (d) Insulin

Ans :

(b) Thyroxine

16. Choose the incorrect statement about insulin.

(a) It is produced from pancreas  
(b) It regulates growth and development of the body  
(c) It regulates blood sugar level  
(d) Insufficient secretion of insulin will cause diabetes

Ans :

(b) It regulates growth and development of the body

17. Select the mismatched pair

(a) Adrenaline : Pituitary gland  
(b) Testosterone : Testes  
(c) Estrogen : Ovary  
(d) Thyroxin : Thyroid gland

Ans :

(a) Adrenaline : Pituitary gland

18. The shape of guard cells changes due to change in the

(a) protein composition of cells  
(b) temperature of cells  
(c) amount of water in cells  
(d) position of nucleus in the cells

Ans :

(c) amount of water in cells

19. The growth of tendril in pea plants is due to

(a) effect of light  
(b) effect of gravity  
(c) rapid cell divisions in tendrillar cells that are away from the support  
(d) rapid cell divisions in tendrillar cells in contact with the support

Ans :

(c) rapid cell divisions in tendrillar cells that are away from the support

20. The growth of pollen tubes towards ovules is due to

(a) hydrotropism (b) chemotropism  
(c) geotropism (d) phototropism

Ans :

(b) chemotropism

21. The movement of sunflower in accordance with the path of sun is due to

(a) phototropism (b) geotropism  
(c) chemotropism (d) hydrotropism

Ans :

(a) phototropism

22. The substance that triggers the fall of mature leaves and fruits from plants is due to

(a) auxins (b) gibberellin  
(c) abscisic acid (d) cytokinin

Ans :

(c) abscisic acid

23. Which of the following statements about transmission of nerve impulse is incorrect ?

(a) Nerve impulse travels from dendritic end towards axonal end.  
(b) At the dendritic end electrical impulses bring about the release of some chemicals which generate an electrical impulse at the axonal end of another neuron.  
(c) The chemicals released from the axonal end of one neuron cross the synapse and generate a similar electrical impulse in a dendrite of another neuron.  
(d) A neuron transmits electrical impulses not only to another neuron but also to muscle and gland cells.

Ans :

(b) At the dendritic end electrical impulses bring about the release of some chemicals which generate an electrical impulse at the axonal end of another neuron.

24. Involuntary actions in the body are controlled by

(a) medulla in fore brain  
(b) medulla in mid brain  
(c) medulla in hind brain  
(d) medulla in spinal cord

Ans :

(c) medulla in hind brain



5. In a synapse, chemical signal is transmitted from
- dendritic end of one neuron to axonal end of another neuron.
  - axon to cell body the same neuron.
  - cell body to axonal end of the same neuron.
  - axonal end of one neuron to dendritic end of another neuron.

**Ans :**

(d) axonal end of one neuron to dendritic end of another neuron.

6. In a neuron, conversion of electrical signal to a chemical signal occurs at in
- cell body
  - axonal end
  - dendritic end
  - axon

**Ans :**

(b) axonal end

7. Which is the correct sequence of the components of a reflex arc ?
- Receptors → Muscles → Sensory neuron → Motor neuron → Spinal cord
  - Receptors → Motor neuron → Spinal cord → Sensory neuron → Muscle
  - Receptors → Spinal cord → Sensory neuron → Motor neuron → Muscle
  - Receptors → Sensory neuron → Spinal cord → Motor neuron → Muscle.

**Ans :**

(d) Receptors → Sensory neuron → Spinal cord → Motor neuron → Muscle.

8. Which of the following statements are true ?
- Sudden action in response to something in the environment is called reflex action.
  - Sensory neurons carry signals from spinal cord to muscles.
  - Motor neurons carry signals from receptors to spinal cord.
  - The path through which signals are transmitted from a receptor to a muscle or a gland is called reflex arc.
- (i) and (ii)
  - (i) and (iii)
  - (i) and (iv)
  - (i), (ii) and (iii)

**Ans :**

(c) (i) and (iv)

9. Which of the following statements are true about the brain ?

- The main thinking part of brain is hind brain.
  - Centres of hearing, smell, memory, sight etc. are located in fore brain.
  - Involuntary actions like salivation, vomiting, blood pressure are controlled by the medulla in the hind brain.
  - Cerebellum does not control posture and balance of the body
- (i) and (ii)
  - (i), (ii) and (iii)
  - (ii) and (iii)
  - (iii) and (iv)

**Ans :**

(c) (ii) and (iii)

10. Posture and balance of the body is controlled by
- cerebrum
  - cerebellum
  - medulla
  - pons

**Ans :**

(b) cerebellum

11. Spinal cord originates from
- cerebrum
  - medulla
  - pons
  - cerebellum

**Ans :**

(b) medulla

12. The movement of shoot towards light is
- geotropism
  - hydrotropism
  - chemotropism
  - phototropism

**Ans :**

(d) phototropism

13. The main function of abscisic acid in plants is to
- increase the length of cells
  - promote cell division
  - inhibit growth
  - promote growth of stem

**Ans :**

(c) inhibit growth

14. Which of the following is not associated with growth of plant ?

- Auxin
- Gibberellins
- Cytokinins
- Absciscic acid

**Ans :**

(d) Absciscic acid

- (c) neural joint
- (d) synapse

Ans :

- (d) synapse

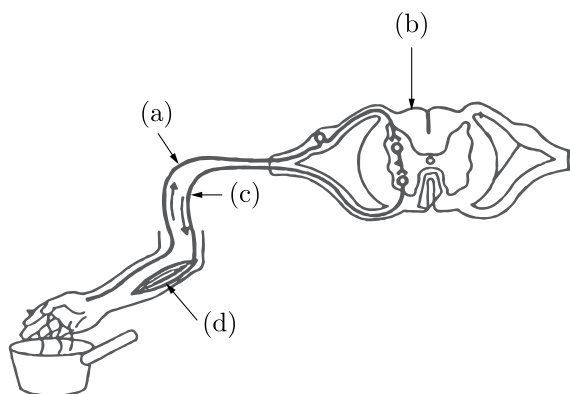
35. In humans, the life processes are controlled and regulated by

- (a) reproductive and endocrine systems
- (b) respiratory and nervous systems
- (c) endocrine and digestive systems
- (d) nervous and endocrine systems

Ans :

- (d) nervous and endocrine systems

36. Label the parts (a), (b), (c) and (d) and show the direction of flow of electrical signals in Figure.



Ans :

- (a) Sensory neuron
- (b) Central Nervous System (CNS)
- (c) Motor neuron
- (d) Effector = Muscle in arm.

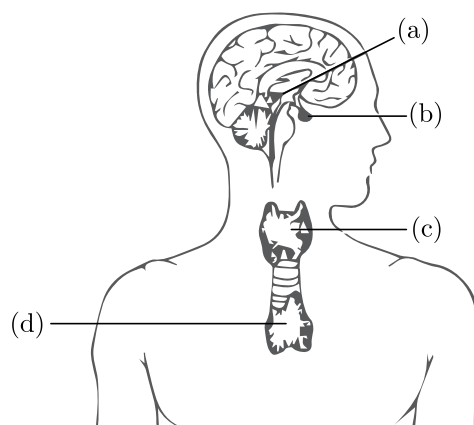
37. Name the plant hormones responsible for the following

- (a) elongation of cells
- (b) growth of stem
- (c) promotion of cell division
- (d) falling of senescent leaves.

Ans :

- (a) Auxin
- (b) Gibberellin
- (c) Cytokinin
- (d) Absciscic acid

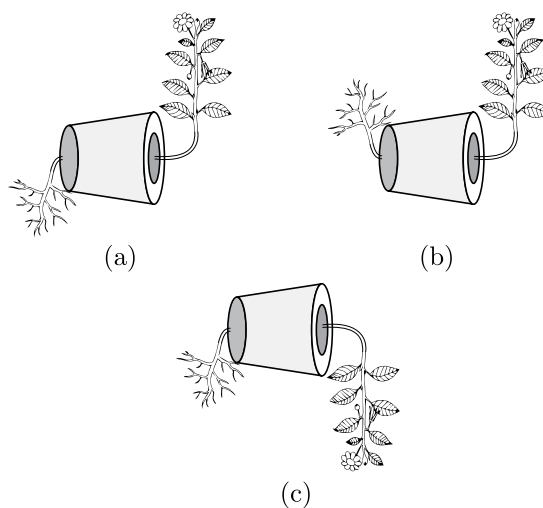
38. Label the endocrine glands in figure.



Ans :

- (a) Pineal gland
- (b) Pituitary gland
- (c) Thyroid
- (d) Thymus

39. In figure (a), (b) and (c), which appears more accurate and why ?



Ans :

Figure (a) is more appropriate because in a plant shoots are negatively geotropic hence, grow upward and roots are positively geotropic so grow downwards.

**106.** Why is oxytocin called as 'birth hormone' ?

**Ans :** OD 2015  
Oxytocin is called 'birth hormone' because it regulates the ejection of milk during lactation.

**107.** Name two hormones of pancreatic islets.

**Ans :** Delhi 2017  
Two hormones of pancreatic islets are insulin and glucagon.

**108.** Name one gland in the human body which secretes digestive enzymes as well as hormones.

**Ans :** AI 2011, 14  
Pancreas in the human body secretes digestive enzymes as well as hormones.

**109.** Name the disease that occurs in children due to deficiency of thyroxine.

**Ans :** Delhi 2013  
Deficiency of thyroxine leads to cretinism in children.

**110.** What is exocrine gland ?

**Ans :** SQP 2017  
A gland which secretes its product into a duct is called exocrine gland, e.g., salivary gland.

**111.** Give an example of a gland which is both endocrine and exocrine.

**Ans :** OD 2015  
Pancreas is both an endocrine and an exocrine gland.

**112.** Which hormone is injected to a diabetic patient and why ?

**Ans :** Delhi 2010  
Insulin. Because it helps in regulating blood sugar levels.

**113.** Name the hormone secreted by one endocrine gland during emergency. Name the gland which secretes this hormone.

**Ans :** Foreign 2013  
Adrenaline.  
Adrenal gland.

**114.** How does our body maintain blood sugar level ?

**Ans :** Delhi 2017  
Timing and amount of hormone released are regulated by feedback mechanisms.  
If sugar level in blood rises, cells of pancreas detect

it and secrete more insulin which leads to fall of sugar level.

**115.** Define feedback mechanism of hormones.

**Ans :** OD 2013  
The mechanism that controls the flow of hormones is called feedback mechanism of hormones.

**116.** Name the hormones in humans which regulate carbohydrates, protein and fat metabolism in the body. Mention the site where it is synthesized.

**Ans :** OD 2016  
The hormone is thyroxine. The site where it is synthesized, thyroid gland.

**117.** Name the two components of peripheral nervous system.

**Ans :** Foreign 2011  
Cranial nerve arising from the brain and the spinal nerves arising from the spinal cord.

**118.** Mention the part of the brain which controls the involuntary-actions like blood pressure, salivation etc.

**Ans :** Delhi 2016  
Medulla in the hind brain.

**119.** What is a synapse ?

**Ans :** OD 2014  
A microscopic gap between a pair of adjacent neurons over which electrical impulses (nerve impulses) pass when going from one neuron to another is called a synapse.

**120.** Name the diseases by which a person is likely to suffer due to deficiency of :

- (i) Iodine,
- (ii) Insulin.

**Ans :** AI 2011  
(i) Goitre,  
(ii) Diabetes.

**121.** Name the plant hormone which inhibits growth. Write its one more function.

**Ans :** Delhi 2017  
Absciscic acid.

**122.** Name the hormones that are released in human males and females when they reach puberty.

**Ans :** OD 2019  
Testosterone in human males and oestrogen in females are released.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Cytokinins are the hormones, which promote cell division. Highest concentrations of cytokinins occurs in fruit and seeds, i.e., areas of rapid cell division.

- 46. Assertion :** Absciscic acid is responsible for wilting of leaves.

**Reason :** It is a growth inhibitor.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Absciscic acid is responsible for wilting of leaves because it is a growth inhibitor.

- 47. Assertion :** Plant hormones are growth regulator.

**Reason :** Growth regulators promote or inhibit the growth.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Plant hormones are chemical compound produced naturally in plants which control the growth and other physiological functions at a site far away from the place of secretion and required in very small amount. It can have promoting or inhibiting effect on a process and hence, it is a growth regulator.

- 48. Assertion :** Our body maintains blood sugar level.

**Reason :** Pancreas secretes insulin which helps to regulate blood sugar levels in the body.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Pancreas secretes insulin which helps to regulate blood sugar levels in the body. If the sugar level in blood rises, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

- 49. Assertion :** Auxins are in the growing tips of the plant.

**Reason :** Auxin concentration is highest at the tip of the root.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

Auxin, a plant hormone is synthesized at the growing tips of the plant i.e. tip of coleoptiles. in buds and in growing tips of leaves and roots. The concentration of auxin found at the tip of the root is significantly lower than the concentration found at the top of coleoptiles.

**Ans :**

AI 2011

- (i) Hind Brain
- (ii) Hind Brain
- (iii) Fore brain
- (iv) Fore brain.

- 185.** Name the glands present in the wall of the stomach that release secretion for digestion of food. Write the three components of secretion that are released by these glands.

**Ans :**

OD 2015

Gastric gland

Three components of secretion of gastric gland :

- (i) Hydrochloric acid,
- (ii) Mucus
- (iii) Pepsin.

- 186.** Distinguish between Spinal nerve and Cranial nerve.

**Ans :**

OD 2017

	Spinal nerve	Cranial nerve
(i)	They arise from Spinal Cord.	They arise from Brain.
(ii)	There are 31 pairs of Spinal nerves.	There are 12 pairs of cranial nerves.

- 187.** What are the function of medulla ?

**Ans :**

Foreign 2008

- (i) Medulla controls various involuntary actions such as heart beat (blood circulation), breathing, blood pressure and peristaltic movements of alimentary canal.
- (ii) Medulla is also the controlling centre for reflexes such as swallowing coughing, sneezing, secretion of Saliva and Vomiting.

- 188.** Distinguish between Cerebrum and Spinal Cord.

**Ans :**

OD 2006

	Cerebrum	Spinal Cord
(i)	It contains cell bodies of neurons outside and axons of the neuron inside.	It contains axons outside and cell bodies inside.
(ii)	It is the region for memory speech reasoning etc.	It controls the reflex action.

- 189.** Write the main functions of the following :

- (i) Sensory neuron
- (ii) Cranium
- (iii) Vertebral Column
- (iv) Motor neuron.

**Ans :**

OD 2016

- (i) To pass information from receptors to brain.
- (ii) Bony box which protects our brain.
- (iii) Bony structure that protects the Spinal Cord.
- (iv) To transmit information from brain or spinal cord to effector organ.

- 190.** How does our body maintain blood sugar level ?

**Ans :**

Comp 2013

Timing and amount of hormone released are regulated by feed back mechanisms. If sugar level in blood rises, cells of pancreas defect and secrete more insulin which leads to the fall of sugar level.

- 191.** On touching a hot plate, you suddenly withdraw your hand. Which category of neurons became active first and which one next ?

**Ans :**

OD 2009

On touching a hot plate, first the sensory neurons are activated. Which take the information to the brain or the spinal cord. Next the motor neurons become active and bring the impulses from the brain to the muscles. In receiving these impulses, the muscles contract and the hand is immediately removed from the hot plate.

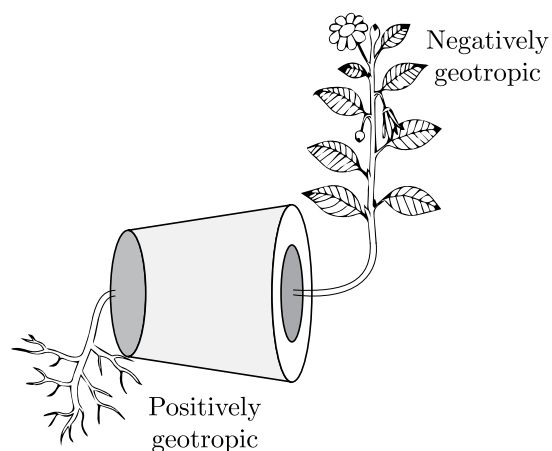
- 192.** Why there is comparatively delayed flow of information through the brain than through spinal cord ?

**Ans :**

Delhi 2015

Delayed flow of information through brain is because the axons of neuron in the brain are without myelin sheath. Hence, they are not fast conducting and take longer than passing through spinal tissue which is formed by myelinated neurons.

- 193.** The given experimental set-up tests the response of different parts of plant towards gravity. Use scientific terms for the conclusions.



- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.  
Males has more stature than females because of action of male sex hormone called testosterone, which is secreted by testis in males. Testosterone controls the development of secondary sexual characters in males.  
Thyroxin increases the metabolic rate of the body and maintains BMR.

## ONE MARK QUESTIONS

55. Name the systems in animals which help in the process of control and coordination.

**Ans :**

Comp 2021

- (i) Nervous system.  
(ii) Hormonal (Endocrine) system.

56. Write the functional and structural unit of the nervous system.

**Ans :**

OD 2017

Nerve cell or neuron.

57. Which is the largest cell in the human body ?

**Ans :**

AI 2014

Nerve cell or neuron.

58. What are the main divisions of nervous system ?

**Ans :**

SQP 2020

The nervous system is broadly divisible into two parts:

- (i) Central nervous system,  
(ii) Peripheral nervous system.

59. What do you mean by neuron ?

**Ans :**

Foreign 2011

A neuron or nerve cell is the structural and functional unit of the nervous system.

60. What are the various parts of the nervous system ?

**Ans :**

OD 2019

The various parts of the nervous system are the brain, the spinal cord and the nerves.

61. What do you understand by response to stimulus ?

**Ans :**

Delhi 2012

Any change in the environment stimulates an organism to respond. This is known as response to stimulus.

62. How do amoeba behave in warm water ?

**Ans :**

Delhi 2018

In warm water, amoeba tend to aggregate together.

63. Why do amoeba tend to aggregate together in warm water ?

**Ans :**

Comp 2013

Amoeba tend to aggregate together in warm water in response to the stimulus of temperature.

64. Apart from nervous system, there is another system which controls and coordinates various functions of the body. Name it.

**Ans :**

AI 2010

It is the endocrine or hormonal system which also controls and coordinates various functions of the body.

65. A car driver suddenly applies brakes after finding that a child is crossing the road in front of his speeding car. Which organ system was the first to become operative in this act ?

**Ans :**

OD 2019

Nervous system.

66. What is the action done suddenly called ?

**Ans :**

Foreign 2014

Reflex action.

67. Reflex actions are performed by a specific part of the nervous system. Name it.

**Ans :**

Delhi 2008

Spinal cord.

68. What is the path of reflex actions called ?

**Ans :**

OD 2011

Reflex arc.

69. Name the main controlling part of the nervous system.

**Ans :**

SQP 2009

Brain.



25. Which of the following is not an involuntary action ?

- (a) Vomiting (b) Salivation  
(c) Heart beat (d) Chewing

Ans :

(d) Chewing

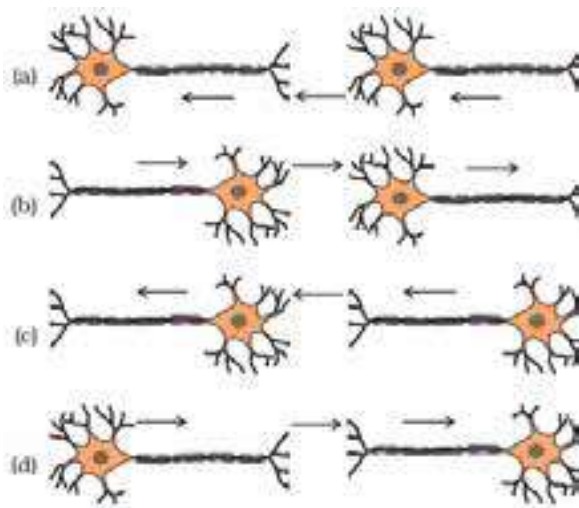
26. When a person is suffering from severe cold, he or she cannot

- (a) differentiate the taste of an apple from that of an ice cream.  
(b) differentiate the smell of a perfume from that of an agarbatti.  
(c) differentiate red light from green light  
(d) differentiate a hot object from a cold object.

Ans :

(b) differentiate the smell of a perfume from that of an agarbatti.

27. What is the correct direction of flow of electrical impulses ?



Ans :

(c)

28. Which statement is not true about thyroxin ?

- (a) Iron is essential for the synthesis of thyroxin  
(b) It regulates carbohydrates, protein and fat metabolism in the body  
(c) Thyroid gland requires iodine to synthesise thyroxin  
(d) Thyroxin is also called thyroid hormone.

Ans :

(a) Iron is essential for the synthesis of thyroxin.

29. Dwarfism results due to

- (a) Excess secretion of thyroxin  
(b) Less secretion of growth hormone  
(c) Less secretion of adrenaline  
(d) Excess secretion of growth hormone

Ans :

(b) Less secretion of growth hormone

30. Dramatic changes of body features associated with puberty are mainly because of secretion of

- (a) oestrogen from testes and testosterone from ovary  
(b) estrogen from adrenal gland and testosterone from pituitary gland  
(c) testosterone from testes and estrogen from ovary  
(d) testosterone from thyroid gland and estrogen from pituitary gland

Ans :

(c) testosterone from testes and estrogen from ovary

31. A doctor advised a person to take an injection of insulin because

- (a) his blood pressure was low  
(b) his heart was beating slowly  
(c) he was suffering from goitre  
(d) his sugar level in blood was high

Ans :

(d) his sugar level in blood was high

32. The hormone which increases the fertility in males is called

- (a) oestrogen (b) testosterone  
(c) insulin (d) growth hormone

Ans :

(b) testosterone

33. Which of the following endocrine glands is unpaired?

- (a) Adrenal (b) Testes  
(c) Pituitary (d) Ovary

Ans :

(c) Pituitary

34. Junction between two neurons is called

- (a) cell junction  
(b) neuromuscular junction

- 88.** Name the substances which are involved in the control and coordination between environment and plant responses.

**Ans :** SQP 2020

Phytohormones and phytochromes are involved in the control and coordination between environment and plant responses.

- 89.** In plants, nastic movement and breaking of dormancy are controlled by which of the following : phytohormone or phytochrome ?

**Ans :** Comp 2014, 10

Nastic movement and breaking of dormancy are controlled by phytohormone.

- 90.** State the main function of abscisic acid in plants.

**Ans :** AI 2010

It inhibits germination of seeds.

- 91.** Name the plant hormone responsible of the promotion of cell division.

**Ans :** Delhi 2017

Cytokinin.

- 92.** What do we call the movement of shoot towards light?

**Ans :** SQP 2010

Phototropism.

- 93.** Name the plant hormones responsible for elongation of cells.

**Ans :** OD 2013

Auxin.

- 94.** Name the substances which are responsible for chemical coordination in animals.

**Ans :** AI 2016

Hormones.

- 95.** Name the chemicals which transmit the informations in animals.

**Ans :** SQP 2020

Hormones.

- 96.** Name the glands which secrete these chemicals.

**Ans :** OD 2013

Endocrine glands.

- 97.** Name the scientists who gave the term hormone.

**Ans :** Delhi 2009

The term hormone was given by Bayliss and Starling.

- 98.** The coordination and control of all the hormone-producing glands is lost in a person. Which gland in such an individual may have become non-functional?

**Ans :** Comp 2021

Pituitary gland.

- 99.** Name the hormone which acts opposite to glucagon.

**Ans :** OD 2012

Insulin.

- 100.** Name the endocrine glands which produce gametes.

**Ans :** Foreign 2015

The testes and ovary produce gametes.

- 101.** If you find a large swelling in the neck projecting outward, which category of secretions you think is being produced in shortage ?

**Ans :** OD 2011

Thyroxin hormone. Its shortage causes simple goitre.

- 102.** Name the hormone secreted by parathyroid glands and give its one function.

**Ans :** Foreign 2016

Parathyroid secretes calcitonin or parathormone which regulates blood calcium and phosphate.

- 103.** Which hormone helps in lowering the level of blood glucose in human beings ?

**Ans :** OD 2006

Insulin helps in lowering the level of blood glucose in human beings.

- 104.** Which hormone is responsible for the development of moustache and beard in man ?

**Ans :** Foreign 2011

Testosterone is responsible for the development of moustache and beard man.

- 105.** Name the disease caused due to failure of insulin secretion.

**Ans :** Foreign 2008

Diabetes mellitus is caused due to failure of insulin secretion.

**Gibberellins** : It stimulates stem elongation, seed germination and flowering.

167. What is tropism? Describe the types of tropism. Mention two differences between tropism and nastic movement.

**Ans :**

Foreign 2010

**Tropism** : It is a change in the direction of a part of a plant in response to other stimuli.

**Types of tropism** : Geotropism, phototropism, hydrotropism, chemotropism, etc.

	<b>Tropism</b>	<b>Nastic movement</b>
(i)	It is a slow response towards any stimulus.	It is an immediate response towards a stimulus.
(ii)	It is directional.	It is non-directional.

168. Why are endocrine glands also called ductless glands?

**Ans :**

SQP 2020

Endocrine glands are also called ductless glands because they do not have ducts, rather they pour their secretions directly into the blood. The blood takes these hormones to their target organs.

169. List the characteristics of hormones.

**Ans :**

Delhi 2012

Hormones have the following characteristics :

- They are secreted by an endocrine gland.
- They are specific chemical regulators.
- They are poured directly into the blood and are circulated through it.
- They act on a specific tissue or organ called target organ.
- Their excess or deficiency may lead to serious consequences.

170. Name the endocrine glands found in human body.

**Ans :**

OD 2014

- Hypothalamus
- Pituitary
- Pineal
- Thyroid
- Parathyroid
- Pancreas
- Adrenal
- Testis
- Ovary

171. Why is pituitary gland also called the master gland?

**Ans :**

AI 2011

The pituitary gland is called the master gland because it controls and coordinates the secretion of all the other endocrine glands.

172. State the main function of pituitary gland. Write the effect of (i) excessive and (ii) sluggish activity of this gland on the growth of a child.

**Ans :**

Foreign 2006

The main function of pituitary gland is to control the other endocrine glands and the development of bones and muscles. Excessive activity of this gland leads to gigantism and sluggish activity of this gland leads to dwarfism.

173. How does feedback mechanism regulate the hormone secretion ?

**or**

Site an example to explain feedback mechanism for regulation of hormonal secretion.

**Ans :**

OD 2013

The feedback mechanism regulates the timing and amount of hormone to be secreted, e.g., if a person has more sugar in his blood this is detected by the cells of the pancreas. As a result, more insulin will be secreted to oxidise the sugar. In a reverse situation, the secretion of insulin will be depleted.

174. Name a hormone secreted by :

- Pancreas,
- Pituitary,
- Thyroid

Write one function of each of the hormones.

**Ans :**

Delhi 2010

	<b>Name of the gland</b>	<b>Name of the hormone</b>	<b>Function</b>
(a)	Pancreas	Insulin	It controls blood sugar level.
(b)	Pituitary	Growth hormones	It regulates growth and development of the body.
(c)	Thyroid	Thyroxine	It regulates metabolism of carbohydrates, proteins and fats.

- 123.** Name a gland associated with brain. Which problem is caused due to the deficiency of the hormone released by this gland ?

**Ans :** OD 2016  
Pituitary gland. Pituitary gland releases growth hormones. The deficiency of this hormone causes stunted growth.

- 124.** Define phototropism.

**Ans :** Delhi 2014  
Movement or bending of the shoot towards light is called phototropism.

- 125.** Give an example of plant hormone that promote growth.

**Ans :** Foreign 2010  
Gibberellins helps in the growth of stem.

- 126.** Give examples of Chemotropism.

**Ans :** OD 2015  
The growth of pollen tube towards ovule.

- 127.** Name the part of brain which controls posture and balance of the body.

**Ans :** SQP 2020  
Cerebellum.

- 128.** Name the part of the neuron where information is acquired.

**Ans :** OD 2016  
Dendrite.

- 129.** How brain is protected from injury and shock ?

**Ans :** Delhi 2011  
(i) The brain is located inside a bony box cranium.  
(ii) The brain is contained in a fluid filled cavity which provides further shock absorption.

- 130.** What is the structural and functional unit of nervous system ?

**Ans :** AI 2013  
Neuron.

- 131.** Name the part of neuron through which the information travels as an electric impulse.

**Ans :** Comp 2016  
Axon.

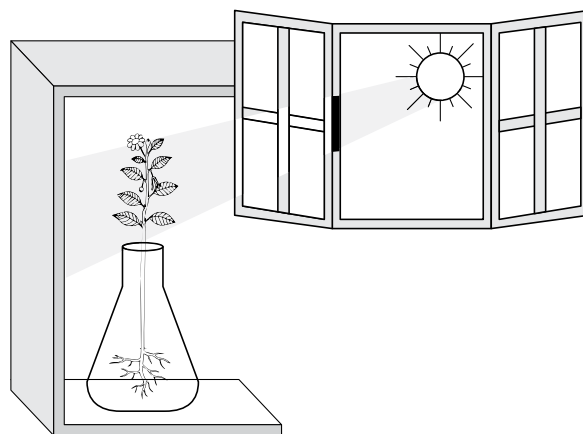
- 132.** How is the Spinal Cord protected in human body ?

**Ans :** OD 2009  
Spinal Cord is enclosed in a bony cage called vertebral column.

- 133.** List two body functions that will be affected if cerebellum gets damaged.

**Ans :** Comp 2012  
(i) Walking in a straight line.  
(ii) Picking up a thing from ground.

- 134.** What does the given experimental set-up demonstrate?



**Ans :** SQP 2019  
The given experimental set-up demonstrates, "Response of the plant to the direction of light".

## TWO MARKS QUESTIONS

- 135.** Name one directional growth movement each in response to chemicals and water in plants. Write an example for each of them.

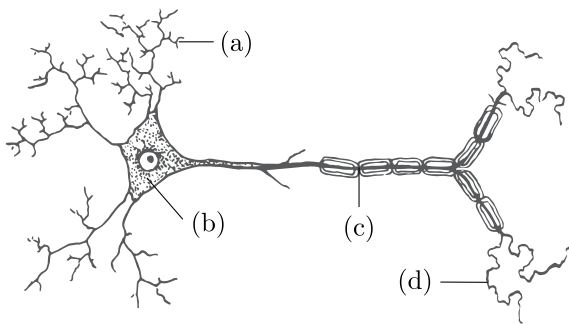
**Ans :** OD 2024  
Chemotropism and hydrotropism are the directional growth movement each in response to chemicals and water respectively.

**Chemotropism :** Example – growth of pollen tube towards ovule.

**Hydrotropism :** Example – growth of roots towards water.

- 136.** (i) Which organisms have a three-chambered heart? Why do they have three-chambered hearts?  
(ii) List two functions of lymph.

40. Label the parts of a neuron in figure.



Ans :

- (a) Dendrite  
(b) Cell body  
(c) Axon  
(d) Nerve ending

41. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Parthenocarpy	(p)	Photoperiodism
(B)	Apical dominance	(q)	Development of seed less fruit
(C)	Extreme cold treatment	(r)	Vernalization
(D)	Response to length of the day	(s)	Auxin

	A	B	C	D
(a)	q	s	r	p
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

- (a) A-q, B-s, C-r, D-p

42. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Auxin	(p)	GA <sub>3</sub>
(B)	Gibberellin	(q)	IAA
(C)	Cytokinin	(r)	ABA
(D)	Dormin	(s)	Zeatin

	A	B	C	D
(a)	q	s	r	p
(b)	q	p	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

- (b) A-q, B-p, C-s, D-r

43. **Assertion :** Plants lack the nervous system, but they do coordinate.

**Reason :** It is so because of hormones.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

Ans :

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Plants lack the nervous system, but coordinate *via* the hormones.

44. **Assertion :** Reflex actions are automatic and rapid responses to stimuli.

**Reason :** These actions are controlled by brain.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

Ans :

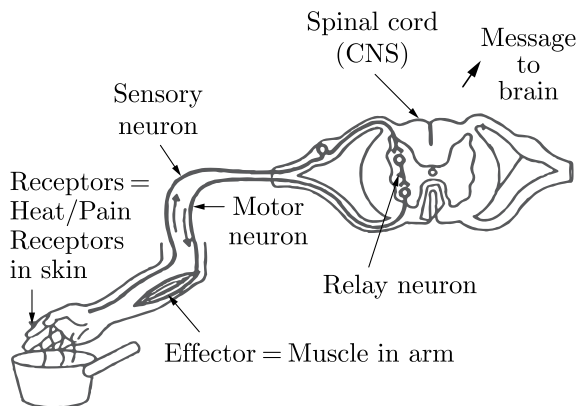
- (c) Assertion (A) is true but reason (R) is false.

Reflex actions are automatic and rapid response to stimuli. These actions are controlled by spinal cord, not by brain.

45. **Assertion :** Cytokinins are present in highest concentration in fruits and seeds.

**Reason :** Cytokinins are responsible for promoting cell division.

the message from a receptor is relayed by a sensory nerve to the spinal cord. The spinal cord sends orders through motor nerves to the concerned muscles. This is called a reflex arc. The muscles, on receiving orders, contract and the hand is removed in case our hand happens to touch a hot utensil.



**144.** Ram has met with an accident after that he lost the capacity to

- (i) walk in straight line.
- (ii) smell anything.
- (iii) to feel full after eating. Which part of brain is damaged in each case ?

**Ans :**

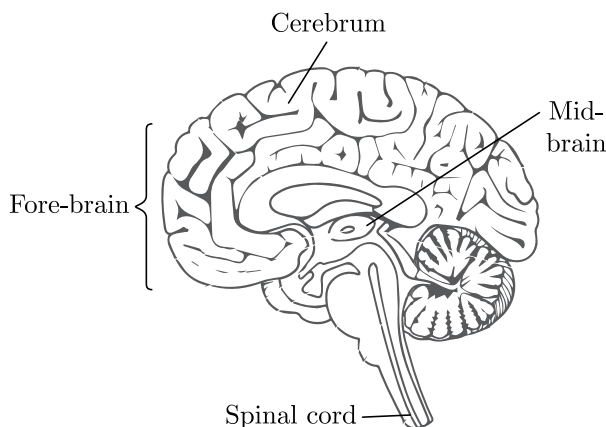
Comp 2021

- (i) Hindbrain/Cerebellum,
- (ii) Forebrain,
- (iii) Forebrain.

**145.** Draw diagram of human brain and label any four parts. Write one function each of any two parts.

**Ans :**

Foreign 2013



### Function of :

- (i) **Forebrain :** It is the main thinking part of the brain. It has regions which receive sensory impulses from various receptors.
- (ii) **Midbrain :** The mid-brain receives and integrates visual and auditory inputs.

- 146.** (a) What is the function of midbrain ?  
 (b) Name the three different parts of hind brain and give one function of each.

**Ans :**

OD 2017

- (a) **Functions of mid-brain :** The mid-brain receives and integrates visual and auditory inputs.
- (b) **Hind brain :** It has three parts :
  - (i) Pons
  - (ii) Medulla
  - (iii) Cerebellum
  - (i) Pons has centre for regulating the breathing rhythm.
  - (ii) Medulla controls involuntary functions like blood pressure, salivation, vomiting, etc.
  - (iii) Cerebellum is responsible for :
    - Precision or coordination of voluntary actions.
    - Maintaining the posture and balance of the body.

**147.** What is a receptor ? Name the receptors for light, sound and smell.

**Ans :**

Comp 2015

Animals receive a variety of external information through specialised structures called receptors or sense organs.

- (i) The receptor for light is called photoreceptor.
- (ii) The receptor for sound is called phonoreceptor.
- (iii) The receptor for smell is called olfactory receptor.

**148.** Differentiate between motor neuron and sensory neuron.

**Ans :**

Foreign 2006

Motor neuron is a type of nerve cell which carries information from the brain to the effector organs.

Sensory neuron is a type of nerve cell which passes information from the receptors to the brain.

**149.** Define nerve impulse.

**Ans :**

OD 2011

The information, in the form of electrical and



- 70.** Name the bony box in which brain is protected.  
**Ans :** Delhi 2017  
Cranium.
- 71.** Write down the name of various parts of the brain.  
**Ans :** AI 2014  
(i) Forebrain  
(ii) Midbrain  
(iii) Hindbrain
- 72.** Write the name of the fluid which gives mechanical support to the brain.  
**Ans :** OD 2019  
Cerebrospinal fluid.
- 73.** Which part of the human brain is responsible for adjustment of movement and posture ?  
**Ans :** Delhi 2006, 15  
The cerebellum of the hindbrain is responsible for adjustment of movement and posture.
- 74.** We suddenly withdraw our hand when a pin pricks. Name the type of response involved in this action.  
**Ans :** AI 2008  
Reflex action.
- 75.** Which parts of the human brain are responsible for auditory reception and sensation of smell ?  
**Ans :** Foreign 2011  
The temporal lobe of the forebrain is responsible for auditory reception and the parietal lobe of the forebrain is responsible for the sensation of smell.
- 76.** Which part of the brain controls respiratory centre?  
**Ans :** OD 2015  
The pons present in the hindbrain control respiratory centre.
- 77.** Name the part of hind brain which takes part in regulation of respiration.  
**Ans :** Comp 2016  
Pons.
- 78.** Name the part of the brain which controls the involuntary activities.  
**Ans :** Comp 2011  
Medulla oblongata.
- 79.** Mention the exact part of brain which controls the voluntary movements of muscles.  
**Ans :** SQP 2018  
The cerebellum controls the voluntary movements of muscles.
- 80.** A person under the influence of alcoholic drink walks clumsily. Which part of his brain is affected to show this condition ?  
**Ans :** SQP 2020  
Cerebellum.
- 81.** You are walking in a dark room. Suddenly looking at something snake-like lying on the floor, you jumped on one side. What kind of action is this called ?  
**Ans :** Delhi 2015  
This is called a reflex action.
- 82.** Write the full form of CSF.  
**Ans :** Delhi 2013  
The full form of CSF is cerebrospinal fluid.
- 83.** What is the full form of EEG ?  
**Ans :** OD 2011  
The full form of EEG is electroencephalograph.
- 84.** Which part of the human brain is responsible for intelligence and memory ?  
**Ans :** Foreign 2016  
The cerebrum of the forebrain is responsible for intelligence and memory.
- 85.** Name the stimuli to which plants respond.  
**Ans :** SQP 2012  
Plants respond to three stimuli, namely light, touch and gravitational force.
- 86.** How do control and coordination take place in plants?  
**Ans :** AI 2015  
In plants, control and coordination take place with the help of plant hormones called phytohormones.
- 87.** List various phytohormones.  
**Ans :** Comp 2017  
Some of the phytohormones are : Auxins, Gibberellins, Cytokinins, Abscissic Acid (ABA) and Ethylene.

	<b>Phototropism</b>	<b>Photoperiodism</b>
(ii)	The stimulus is perceived by the phytohormone which is present at the shoot apex.	The stimulus is perceived by the phytochrome, a pigment present in the leaves.
(iii)	It is responsible for the movement of shoot towards light.	It controls flowering and seed germination in plants.

**159.** Differentiate between phytochrome and phytohormone.

**Ans :**

SQP 2019

	<b>Phytochrome</b>	<b>Phytohormone</b>
(i)	It is a pigment.	It is a chemical substance.
(ii)	It controls flowering and seed germination in plants.	It controls various physiological processes to maintain growth and development in plants.

**160.** Which is the internal energy reserve in plants ? Do the animals have the same energy reserve ?

**Ans :**

SQP 2020

Plants have starch as the storage carbohydrate which acts as internal energy reserve, But animals have glycogen as internal energy reserve.

**161.** If you keep the potted plant horizontally for 2-3 days, what type of movements would be shown by the shoot and root after two or three days. Why ?

**Ans :**

OD 2010

If we keep the potted plant horizontally for 2-3 days, shoots may grow upwards and away from the earth while roots always grow downwards. It happens because shoots are negatively geotropic and positively phototropic while roots are positively geotropic.

**162.** Name various plant hormones. Give one function of each.

**Ans :**

Delhi 2014

- Auxins promote cell elongation, root formation, cell division, etc. They also promote fruit growth.
- Gibberellins stimulate stem elongation, seed germination and flowering.
- Cytokinin help in breaking the dormancy of seeds and buds. They delay ageing in leaves. They promote the opening of stomata.

(iv) Absciscic acid promotes falling of leaves and fruits.

(v) Ethylene promotes ripening of fruits.

**163.** (a) Name a plant hormone that promotes cell division.

(b) Give an example of plant hormone that inhibits growth.

**Ans :**

Delhi 2010

(a) Cytokinin.

(b) Absciscic acid.

**164.** (a) Which hormone is secreted when growing plants detect light ?

(b) Why do plants appear to bend towards light ?

**or**

Why does the shoot of the plant bend towards light when it is kept inside cardboard box with a small hole.

**Ans :**

OD 2015

(a) Auxin.

(b) When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. So plant appears to bend towards light.

**165.** (a) How is movement of leaves of touch-me-not plant and growth of stem towards light differ ?

(b) Give a suitable example of chemotropism.

**Ans :**

Delhi 2009

(a) The movement of leaves of touch-me-not plant is fast and non-directional while the growth of stem towards the light is slow and directional.

(b) Growth of pollen, tubes towards odes is an example of chemotropism.

**166.** What is chemotropism ? Give one example. Name any two plant hormones and mention their functions.

**Ans :**

AI 2007

**Chemotropism :** It is the response of the plant due to chemical stimulus.

**Example :** Growth of pollen tube during fertilization. Auxins and gibberellins are two major plant hormones.

**Functions of :**

**Auxin :** It promotes cell elongation, root formation, cell division, etc.

chemical signals, passing through neurons is called nerve impulse.

Dendrite conducts the impulse towards the cell body, while axon conducts the impulse away from the cell body.

- 150.** Where does cerebrospinal fluid occur in our body ? Mention its function.

**Ans :**

Delhi 2009

The brain is covered by three membranes called meninges. The space between membranes is filled by cerebrospinal fluid. Its main function is to protect the brain from mechanical shocks.

- 151.** What is the nature of information which passes from one neuron to another ?

**Ans :**

SQP 2018

- (i) The information passing from one neuron to another is in the form of chemical and electrical signals.
- (ii) These signals are called nerve impulses.

- 152.** What is electroencephalograph ?

**Ans :**

OD 2016

Electroencephalograph is an instrument which can record or test the electrical activity of the brain. The activity of the brain is recorded as electric potentials. By placing two electrodes on the scalp and leading via suitable amplifier to ink-writing device, a record of four different types of waves is obtained. These waves give the characteristic activity of the brain.

- 153.** What are the functions of the forebrain ?

**Ans :**

Foreign 2013

The forebrain is the seat of intelligence, memory, will power, voluntary actions and consciousness. It has the centres for visual and auditory receptions, touch, smell and temperature.

- 154.** Give four examples of simple human reflexes.

**Ans :**

SQP 2017

- (i) Knee-jerk reflex in which the leg is involuntarily extended forward as a result of a sharp tap below the knee-cap in a relaxed (freely hanging) leg.
- (ii) Closing of the eyelids when an object suddenly approaches the eye or when a strong beam of light is flashed across.
- (iii) Withdrawal of the hand on pricking a pin or a thorn.
- (iv) Movement of the diaphragm.

- 155.** On touching a hot plate, you suddenly withdraw your hand. Which category of neurons became active first and which one next ?

**Ans :**

OD 2019

- (i) On touching a hot plate, first the sensory neurons are activated, which take the information to the brain or the spinal cord.
- (ii) Next, the motor neurons become active and bring the orders (impulses) from the brain to the muscles.

On receiving these impulses, the muscles contract and the hand is immediately removed from the hot plate.

- 156.** When your finger is accidentally pricked by a needle, you instantaneously withdraw your hand. Which parts of your nervous system are involved in this response ?

**Ans :**

Delhi 2012

- (i) Receptors located in the skin of the finger receive the stimulus.
- (ii) Sensory nerves take the information to the spinal cord.
- (iii) Motor nerves from the spinal cord take the impulses to the muscles and the hand is removed.

- 157.** What name is given to the movement of a plant in the direction of stimulus ? Give any three examples.

**Ans :**

OD 2014

The movement of a plant in the direction of stimulus is called tropism. For example :

- (i) **Phototropism** : It is the response of the plant towards light, e.g., bending of stem towards light.
- (ii) **Geotropism** : It is the response of the plant towards gravitational force, e.g., downward movement of roots.
- (iii) **Chemotropism** : It is the response of the plant due to chemical stimulus, e.g., growth of pollen tube during fertilization.

- 158.** Differentiate between phototropism and photoperiodism.

**Ans :**

Comp 2017

	Phototropism	Photoperiodism
(i)	This phenomenon is brought about by the direction of light.	This phenomenon is brought about by the exposure to light for a certain duration of time.

- 175.** What is endocrine gland ? Name any two endocrine glands present in a human body and write hormones secreted by them.

**Ans :**

Delhi 2008

Glands which do not have a duct and secrete its product directly into blood stream are called as endocrine glands.

- Thyroid and pituitary glands are the two endocrine glands present in a human body.
- Thyroid secretes thyroxine.

Pituitary secretes growth hormones.

- 176.** Name the hormones secreted by thyroid, pancreas and adrenal glands. Write a function of each hormone.

**Ans :**

Foreign 2013

Gland	Hormone	Function
Thyroid	Thyroxine	Regulates fat, protein and carbohydrate metabolisms.
Pancreas	Insulin	Regulates blood sugar level.
Adrenal gland	Adrenaline	Prepares the body to face the emergency situation and blood pressure.

- 177.** Write two differences between the response of the plants and response of the animals to stimuli ?

**Ans :**

OD 2017

	Plants	Animals
(i)	No specific or specialized tissue present for conduction of information.	Specialised tissues are present in the body for conduction of information.
(ii)	Plant cells change shape by changing the amount of water in them.	Specialized proteins found in muscle cells that help in changing shape.

- 178.** How is our brain double protected against injuries and shocks ?

**Ans :**

OD 2013

- The brain is located inside a bony box.
- Inside the box, the brain is contained in a fluid-filled balloon which provides further shock absorption.

- 179.** Write the functions of mid-brain.

**Ans :**

Delhi 2016

- The mid-brain controls reflex movements of the head, neck and trunk in response to visual and auditory stimuli.
- It also controls the reflex movements of the eye muscles, changes in pupil size and shape of the eye lens.

- 180.** Write any two involuntary actions performed by our body. Which part of our brain controls these actions?

**Ans :**

OD 2012

Involuntary actions :

- Blinking (contraction) of pupils in bright light.
  - Rapid withdrawal of hands from a hot surface.
- Spinal Cord is involved in controlling reflex actions in our body.

- 181.** What is a reflex arc ? Why have reflex arcs evolved in animals ?

**Ans :**

OD 2016, 10

A reflex arc is a neural pathway that controls a reflex action.

Reflex arcs have evolved in animals, in order to perform quick responses, as the thinking process of brain is not fast enough.

- 182.** State the role of the brain in reflex action.

**Ans :**

OD 2013

The sensory area of the brain receives information, interprets it and makes a rapid decision. The message is transmitted to the motor area. The motor neuron sends information to the receptor organ. The entire process is controlled by medulla in the hind-brain.

- 183.** A boy was not able to gain height. The doctor diagnosed that it is due to deficiency of a hormone. Name the hormone and the gland which secretes this hormone. Which diseases is he suffering from ?

**Ans :**

OD 2010, 06

- Growth hormone
- Pituitary gland Disease is Dwarfism. (Stunted growth).

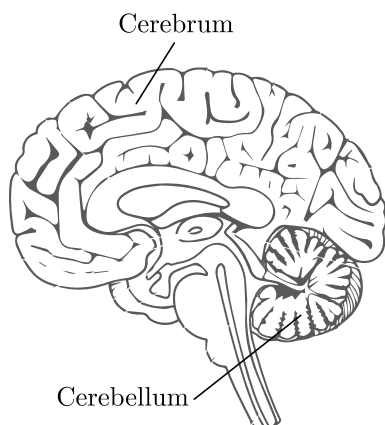
- 184.** Name the parts of the brain that perform the following functions :

- Maintaining the posture and balance of the body.
- Regulating blood pressure.
- Sensation of hunger or feeling full.
- Seeing

Ans :

Comp 2021

(a)



- (b) Cerebrum and cerebellum are labelled on it.  
 (c) Cerebellum is responsible for precision of voluntary action and maintaining the posture and equilibrium of the body.

**199.** Name any three endocrine glands in human body and briefly write the function of each of them.

Ans :

OD 2014

Three endocrine glands with their function in human body are as follows :

- (i) **Thyroid gland** : It secretes a hormone called thyroxine which regulates the metabolism of carbohydrates, fats and proteins in the body and so provide the best balance for growth.
- (ii) **Adrenal glands** : It secretes two hormones adrenalin and corticoids hormones which regulate blood pressure, heart beat, breathing rate, carbohydrate metabolism and mineral balance.
- (iii) **Pancreas** : It secretes two hormones-insulin and glucagon. Insulin hormone lowers the blood glucose. Glucagon hormone increases the blood glucose.

**200.** Explain the feedback mechanism to regulate the action of the hormones with the help of one suitable example.

Ans :

Delhi 2016

Hormones should be secreted in precise quantities. The lining and amount of hormone released are reguted by feedback mechanism. For example, If the sugar level in blood rises, they are detected by the cells of the pancreas which repoud by producing more insulin. As the blood sugar, level falls, insulin secretion is reduced.

**201.** Nervous and hormonal system together per the function of control and coordination in human beings. Justify the statement.

Ans :

SQP 2018

Nervous and hormonal system together perform the function of control and coordination in human beings. Let us take an example, in the case of any emergency, stimulus is being perceived by CNS (nervous system). The stimulus is analysed and the response is sent to the effectors. Simultaneously, sympathetic nerves stimulate adrenal gland to release adrenaline which regulates blood pressure, increases heartbeat, constricts blood vessels and dilates pupil, etc. So, both nervous and endocrine systems interact and overcome the crisis together.

**202.** How are involuntary action and reflex action different from each other ?

Ans :

Delhi 2014

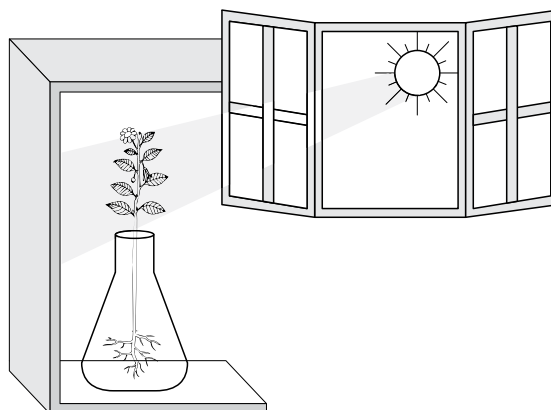
Involuntary actions are those which we cannot control even if we want to do so. There is no stimulus involved in the involuntary actions. They take place on their own. For example, our heart beats all the time without our thinking about it. Therefore, the beating of heart is purely involuntary action. The reflex action is also a kind of involuntary action but it takes place in response to a stimulus. For example, the decrease in the size of the pupil of our-eye on stepping out in bright light is a reflex action which takes place in response to a stimulus light.

**203.** What is 'phototropism' ? How does it occur in plants? Describe an activity to demonstrate phototropism.

Ans :

SQP 2020

Movement of shoot towards light is called phototropism. This movement is caused due to more growth of cells towards the shaded side of the shoot as compared to the side of shoot towards light. More growth of cells is due to secretion of auxin towards the shaded side.



**Ans :**

AI 2011

This plant is showing geotropism, i.e., the response towards the gravity. Roots of the plants are positively geotropic whereas shoots can be seen moving away from the gravity and, therefore, are negatively geotropic.

- 194.** A particular hormone requires iodine for its synthesis. Name the endocrine gland which secretes this hormone and state its location in the human body.

**Ans :**

OD 2012

The thyroid gland secretes the hormones (thyroxine and triiodothyronine) which requires iodine for their synthesis.

Thyroid gland is located in the neck region.

### THREE MARKS QUESTIONS

- 195.** (i) Write the significance of peripheral nervous system in human beings.  
(ii) How is human brain protected from mechanical injuries and shocks?

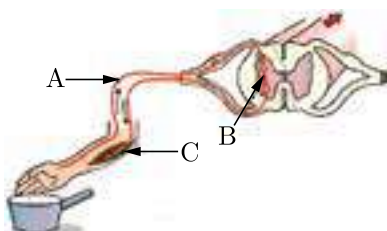
**Ans :**

OD 2024

- (i) Peripheral nervous system plays key role in both sending information from different areas of the body back to the CNS, as well as carrying out commands from the CNS to various parts of the body.  
(ii) Brain lies inside a bony box called cranium, such bony structures protect the brain from mechanical injury and shock. Cerebrospinal fluid present in the brain which serves as a pad to cushion the central nervous system from shocks.

- 196.** In the given diagram

- (i) Name the parts labelled A, B, and C,  
(ii) Write the functions of A and C.  
(iii) Reflex arcs have evolved in animals? Why?

**Ans :**

OD 2023

- (i) A - Sensory neuron  
B - Relay neuron  
C - Effector (Muscle in arm)  
(ii) Function of part A - Sensory neuron carries impulses from the receptor to the CNS (spinal cord).  
**Function of part C :** An effector is a part of the body which can respond to a stimulus according to the instructions sent from the nervous system (spinal cord and brain). The effectors are mainly the muscles and glands of our body.  
(iii) Reflex arc, have evolved in animals, in order to perform quick responses, as the thinking process of brain is not fast enough.

- 197.** (a) Define hormone. Write four characteristics in humans.  
(b) Name the disorder caused by the following situations :  
(i) Under secretion of growth hormone  
(ii) Over secretion of growth hormone  
(iii) Under secretion of insulin  
(iv) Deficiency of iodine.

**Ans :**

OD 2016

- (a) **Hormones :** Hormones are the chemical messengers that regulate the biological processes in living organisms.

**Characteristics of hormones :**

- (i) They are produced by ductless glands i.e., their secretion is directly released into the blood.  
(ii) They are released in traces i.e., in a very little quantity.  
(iii) They act on specific tissues or organs called target organs.  
(iv) They are organic compounds.  
(v) They are generally slow in action.  
(vi) They act away from the site of production.  
(b) (i) Dwarfism (Low height)  
(ii) Gigantism (Excessive growth)  
(iii) Diabetes mellitus  
(iv) Goitre.

- 198.** (a) Draw a diagram of human brain.  
(b) Label on it Cerebrum, Cerebellum.  
(c) What is the role of Cerebellum ?



- (iv) Absciscic acid promotes the dormancy in seeds and buds. It promotes the closing of stomata and falling of leaves. Inhibits growth, reverses the growth promoting effects of auxins and gibberellins. Its effects include wilting of leaves.
- (v) Ethylene promotes the falling of leaves, ripening of fruits and helps in breaking bud dormancy only induce flowering.
- 217.** (a) What are hormones ? List any three characteristics of hormones.
- (b) Name the hormones that perform the following functions :
- Development of secondary sexual characters in females.
  - Regulation of carbohydrate and protein metabolism in the body.
  - Increase the blood glucose level.
  - Regulation of growth and development of the body.

**Ans :**

Delhi 2015

- (a) Hormones are the chemical compounds or substances, which help in control and co-ordination the activities of living organisms.

**Characteristics of Hormones :**

- Hormones are the secretion of endocrine glands.
  - They are also known as chemical messengers as they act as a place different from the site of their manufacture.
  - Their hyper and hyposecretion may cause disorder.
- (b) (i) Development of secondary sexual characters in females–Oestrogen.
- (ii) Regulation of carbohydrate and protein metabolism in the body–Thyroxine.
- (iii) Increase of blood glucose level–Glucagon.
- (iv) Regulation of growth and development of the body–Growth hormone.

- 218.** Give a reason to explain why :

- adrenaline helps in dealing emergency situations?
- secretions of growth hormone should be specific in the human body ?
- some patients of diabetes are treated by giving injections of insulin ?

**Ans :**

AI 2012

- (i) Adrenaline increases the heart beat and breathing rate which results in the supply of more oxygen to muscles. It reduces the blood

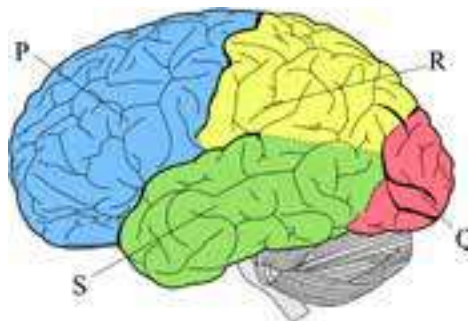
to the digestive system and skin, as a result the blood is further diverted to skeletal muscles. All these responses together prepare the body to deal with the emergency situations.

- If growth hormone is secreted in excess during childhood, then it leads to gigantism while the less secretion of this hormone during childhood causes dwarfism.
- The patients suffering from diabetes have high blood sugar level as insulin is not secreted in sufficient amount by the pancreas which lowers the blood sugar level. Therefore, to regulate the blood sugar level, insulin hormone is injected in such patients.

## CASE BASED QUESTIONS

- 219.** The human brain is the command centre for the human nervous system. It receives signals from the body's sensory organs and outputs information to the muscles. The human brain has the same basic structure as other mammal brains but is larger in relation to body size than the brains of many other mammals, such as dolphins, whales and elephants.

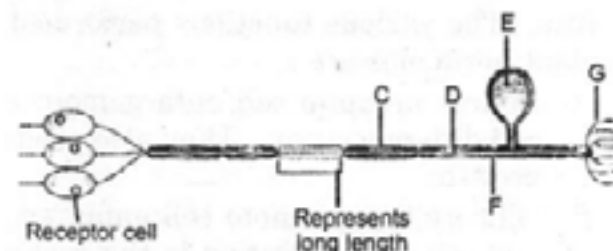
The human brain weighs about 3 lbs. (1.4 kilograms) and makes up about 2% of a humans body weight. On average, male brains are about 10% larger than female brains, according to Northwestern Medicine in Illinois. The average male has a brain volume of nearly 78 cubic inches (1,274 cubic centimetres), while the average female brain has a volume of 69 cubic inches (1,131 cubic cm). The cerebrum, which is the main part of the brain located in the front area of the skull, makes up 85% of the brain's weight.



- Name the given figure and identify the labelled part Q and R.
- Which region is responding for pain and conscious association ?
- Give two functions of the part 'P'.

To demonstrate it we will place a potted plant in a box in which light comes only from one direction. In a few days we will observe that the shoot has moved towards the side from which light came in the box.

- 204.** Name the parts *C* to *G* on the diagram of a sensory neuron given here. State two ways in which this neuron differs from a motor neuron.



Ans :

OD 2019

- C* = Myelin sheath,  
*D* = Axon,  
*E* = Cell body,  
*F* = Node of Ranvier,  
*G* = Dendrite

Differences between Sensory and Motor Neurons :

- (a) Sensory neuron is connected with receptor cells. It receives sensory impulses. It carries sensory impulses to CNS.
- (b) Motor neuron is connected with association or connector neuron. It carries motor impulses from CNS. It transmits motor impulses to the effector organ.
- 205.** A motor cycle rider without helmet just an accident and suffered a spinal cord injury. In this case which signals will get disrupted and why ?

Ans :

Delhi 2016

In case of a spinal cord injury, signals for reflex action and involuntary action will get disrupted. Reflex actions are monitored and controlled through the spinal cord of nervous system and not by the brain. In fact, nerves from all over the body meet in a bundle in the spinal cord on their way to the brain. In case of any injury to the spinal cord, the signals coming from the nerves as well as signals coming to the receptors will be disrupted.

## FIVE MARKS QUESTIONS

- 206.** Name six phenomena in plants which are regulated by phytohormones.

Ans :

SQP 2020

Phytohormones regulate many phenomena in plants, such as :

- Growth of roots, stem and leaves.
- Flowering.
- Responses towards light (photo-tropism).
- Responses towards gravitational force (geotropism).
- Ripening of fruits.
- Stomatal opening and closure.

- 207.** Explain the term photoperiodism.

Ans :

Foreign 2011

Photoperiodism is the stimulus brought about by the duration of exposure of light. In plants, flowering and seed germination depend on the time duration they are exposed to light.

Plants respond to photoperiodic stimulus by a pigment called phytochrome. This pigment is present in very small quantity.

- 208.** Name the hormones secreted by pituitary gland and give their functions.

Ans :

Delhi 2013

The hormones secreted by pituitary gland and their functions are :

	Hormone	Function
(i)	Growth hormone	Development of bones and muscles.
(ii)	Trophic hormone	Regulation of the secretion of hormones from endocrine gland, like adrenal, thyroid, testes and ovary.
(iii)	Vasopressin	Regulation of water and electrolyte balance.
(iv)	Prolactin	Regulation of function of mammary gland.
(v)	Oxytocin	Regulation of the ejection of milk during lactation.

- 209.** Name the endocrine glands which secrete testosterone and estrogen. Give functions of each of them.

**Ans :**

OD 2024

- (i) Amphibians and many reptiles have three chambered heart because they can tolerate some mixing of the oxygenated and de-oxygenated blood.
- (ii) Two important function of lymph are following:
- Lymph carries digested and absorbed fat from intestine.
  - It drains excess fluid from extra cellular space back into the blood.
- 137.** List two differences between the movement of leaves of a sensitive plant and the movement of a shoot towards light.

**Ans :**

OD 2023

The type of movement of leaves of the sensitive plant is known as a nastic movement. This type of movement does not depend on the direction of stimuli. The movement of shoot towards light is known as a tropic movement. This movement depends on the direction of light. Hence, Refractive index of medium. B with respect to medium A =  $n_g/n_A$ . This type of movement is directional and growth development.

- 138.** What happens at synapse between two neurons? State briefly.

**Ans :**

OD 2023

Transmission of nerve impulses between two neurons takes place through the synapse. At the end of the axon, the electrical impulse sets off the release of some chemicals called neurotransmitters. These chemicals cross the gap or synapse and start a similar electrical impulse in the dendrite of the next neuron.

- 139.** Name the gland and the hormone secreted by it in scary situations in human beings. List any two responses shown by our body when this hormone is secreted into the blood.

**Ans :**

OD 2023

**Hormone :** Adrenaline**Functions :**

- Increases the heart rate.
  - Increases blood pressure.
  - Expands the air passages of the lungs.
  - Enlarges the pupil in the eye.
- 140.** In a neuron :
- Where is information received ?
  - Through what information travels as an impulse ?

- Where does the impulse get converted into a chemical signal for outward transmission ?

**Ans :**

SQP 2010

- In a neuron, information is received by the dendrites.
  - The information travels through axon.
  - Impulse gets converted into a chemical signal at the nerve endings for outward transmission.
- 141.** (a) If the cerebellum is not functioning properly, what activities of our body would get affected ?
- (b) How do muscle cells move ?

**Ans :**

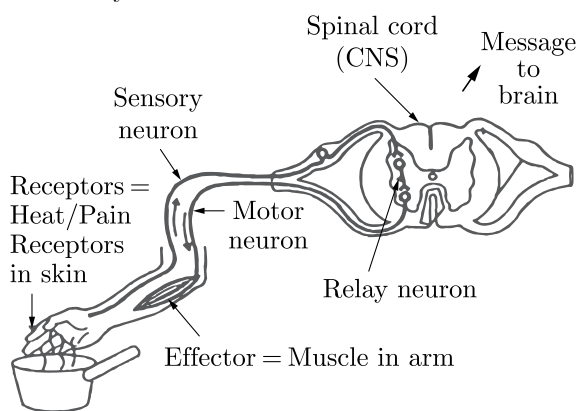
Delhi 2010

- Cerebellum controls the voluntary action of our body. So if it is not functioning properly, voluntary actions of our body like maintaining the posture, balance, etc. will be affected.
  - Muscle cells are highly flexible. They move by changing their shape.
- 142.** If you happened to touch a hot object, what would be your response ? How will it happen ? Show it with the help of a diagram.

**Ans :**

Comp 2017

If we touch a hot object unknowingly, our hand will be taken away from it. It happens due to reflex arc of the body.



- 143.** What are reflex actions ? Give two examples. Explain a reflex arc.

**or**

With the help of a diagram explain reflex arc and reflex action.

**Ans :**

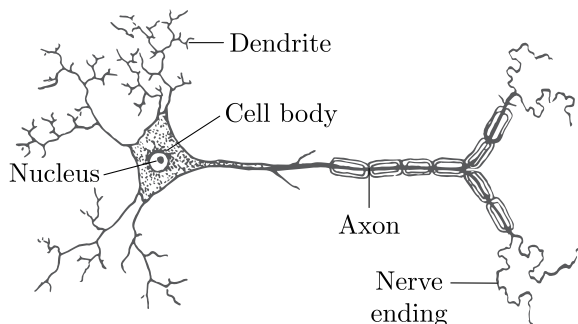
Delhi 2011

A reflex action is defined as an unconscious (without will) and involuntary response of effectors (muscles or glands) to a sudden stimulus. For example, we suddenly remove our hand on touching a very hot plate or if we step on something sharp accidentally we move our foot away at once. In reflex action,

Ans :

Delhi 2016

(a)



(b) The part of neuron :

- (i) where information is acquired is at the end of the dendrite tip of a nerve cell.
- (ii) The information travels as an electrical impulse from the dendrite to the cell body and then along the axon to its end.

215. (a) What is (i) phototropism and (ii) geotropism ? With labelled diagrams describe an activity to show that light and gravity change the direction that plant parts grow in.

(b) Mention the role of each of the following plant hormones :

- (i) Auxin,
- (ii) Absciscic acid.

Ans :

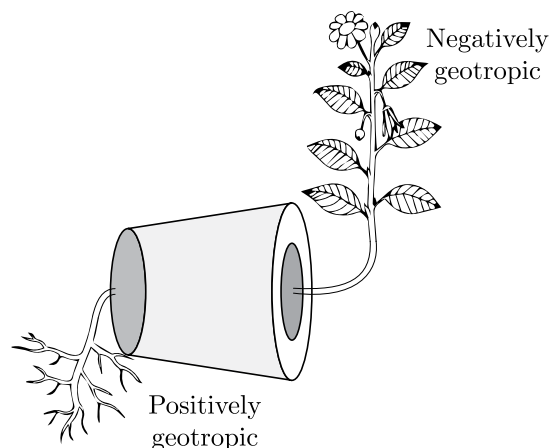
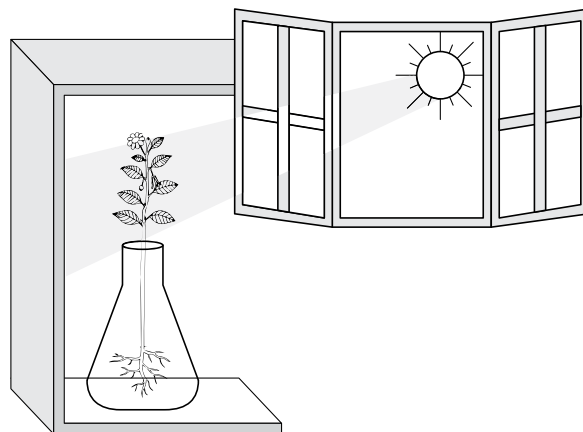
SQP 2018

- (a) (i) **Phototropism** : Movement of plant part (stem) towards light is termed as phototropism.
- (ii) **Geotropism** : Movement of plant part (root) towards gravity is termed as geotropism.

**Activity :**

- (i) Fill a conical flask with water.
- (ii) Cover the neck of the flask with a wire mesh.
- (iii) Keep two or three freshly germinated bean seeds on the wire mesh.
- (iv) Take a cardboard box which is open from one side.
- (v) Keep the flask in the box in such a manner that the open side of the box faces light coming from a window.
- (vi) After two or three days, you will notice that the shoots bend towards light and roots away from light.
- (vii) Now turn the flask so that the shoots are away from light and the root towards light. Leave it undisturbed in this condition for a few days.

(viii) After few days it is found that the shoot is turned towards the light and roots away from the light.



- (b) (i) **Auxin** : It promotes cell elongation and cell differentiation in plants.
- (ii) **Absciscic acid** : It inhibits growth and induces wilting of leaves.

216. Give five functions performed by the plant hormones.

Ans :

OD 2019

The various functions performed by the plant hormones are :

- (i) Auxins promote cell enlargement and cell differentiation. They also promote growth.
- (ii) Gibberellins promote cell enlargement and cell differentiation in the presence of auxin. It also helps in breaking the dormancy in seeds and buds. It promotes the growth in fruits.
- (iii) Cytokinins promote cell division and help in breaking the dormancy of seeds and buds. It delays the ageing in leaves. It promotes the opening of stomata and also fruit growth.

<b>Table B : Approx. Ideal BP According to Age Chart</b>		
<b>Age</b>	<b>Female</b>	<b>Male</b>
25-29	120/80	121/80
30-35	122/81	123/82
40-45	124/83	125/83
50-55	129/85	128/85
60+	134/84	135/88

- (i) Refer to Table B showing the blood pressure of male and female. Infer the disease which can be diagnosed in a boy of 14 years who have same blood pressure as a 60 year old man.
- (ii) Identify the hormone whose level in the blood is responsible for raise in blood pressure in certain situations.

**Ans :**

- (i) Hypertension  
(ii) Adrenaline

- 234.** Questions are based on the two tables given below and the related studied concepts. Study them and answer the questions that follow.

**Table A: Blood Glucose Chart**

<b>Remarks</b>	<b>Mean Blood Glucose Level (mg/dL)</b>
Doctor's advice required	200–400
Good	100–140
Excellent	80–100

**Table B: Blood report of Patient**

<b>Checking Time</b>	<b>Blood Sugar Range (mg/dL)</b>
Fasting (before breakfast)	> 126
Just after eating	> 220
3 hours after eating	> 200

- (i) Refer Table B that shows the blood sugar level of a patient. Which disease can be diagnosed from the given data ?
- (ii) Which hormone is responsible for the disease diagnosed ?
- (iii) Which of the following glands secretes the hormone identified in (ii) ?
- (iv) What would be the diagnosis of a patient whose blood sugar level 120 mg/dL just after eating ?

**Ans :**

- (i) Diabetes  
(ii) Deficiency of insulin hormone in the body causes diabetes.  
(iii) Adrenal gland.  
(iv) It is good.

- 235.** Questions are based on the two tables given below and the related studied concepts. Analyse the tables related to blood pressure of a patient and answer the questions that follow.

**Table A : Blood Pressure Chart**

<b>Remarks</b>	<b>Systolic (mm of Hg)</b>	<b>Diastolic (mm of Hg)</b>
Doctor's advice required	200-400	100 or higher
Good	100-140	80-89
Excellent	120	80

**Table B : Blood Pressure report of a Patient**

<b>Checking Time</b>	<b>Systolic (mm of Hg)</b>	<b>Diastolic (mm of Hg)</b>
Blood pressure for a week	130-150	100-120

- (i) Refer Table B that shows the blood pressure report of a patient. Which disease can be diagnosed from the given data ?
- (ii) What is meant by systolic pressure ?
- (iii) Refer Table A and find out the normal blood pressure value ?
- (iv) Which part of the brain controls blood pressure ?
- (v) Which instrument is used to measure blood pressure ?

**Ans :**

- (i) The blood pressure value of the patient is approx. 150-120 mm of Hg, which is higher than the normal blood pressure value, hence the person may be suffering from hypertension.
- (ii) The pressure of blood inside the artery during ventricular systole (contraction) is called systolic pressure.
- (iii) 120-80 mm of Hg.
- (iv) Medulla controls involuntary actions such as blood pressure.
- (v) Sphygmomanometer.

- 236.** Ramesh's friend was diabetic and every day before her meal in the recess she had to check her sugar



- (iv) Facial muscular activities and auditory reception are respectively controlled by

Ans :

- (i) The given figure is of human brain showing major lobes. Here, P is frontal lobe, Q is occipital lobe, R is parietal lobe and S is temporal lobe.
- (ii) Parietal lobe R is the region for touch, pain, heat, cold and conscious association.
- (iii) Functions of frontal lobe P is :
  - (a) It controls involuntary movements of visceral organs.
  - (b) It controls voluntary movements of body parts.
- (iv) Frontal lobe P is the region for facial muscular activities. While temporal lobe S is the region for auditory reception.

**220.** Nastic movements in plants are not directional movements. They are not dependent on the stimulus and are growth independent. For example, the leaves of a touch me not plant (*Mimosa pudica*), fold up immediately when touched. These kinds of changes occur due to the changes in the amount of water in the leaves. Depending on the quantity, they either swell up or shrink. Plant hormones or phytohormones are responsible for the control and coordination of plants. There are different types of hormones, which affect the growth of a plant. Phytohormones are chemical compounds which are released by stimulated cells. These hormones are diffused around the plant cells. They have a role in the cell division, cell enlargement, cell differentiation, fruit growth, falling of leaves, ripening of fruits, ageing of plants etc.



- (i) Name the phenomenon called for the movement in growth of plants.
- (ii) What do you mean by nastic movement ?

- (iii) What are the different types of harmonies of plants?

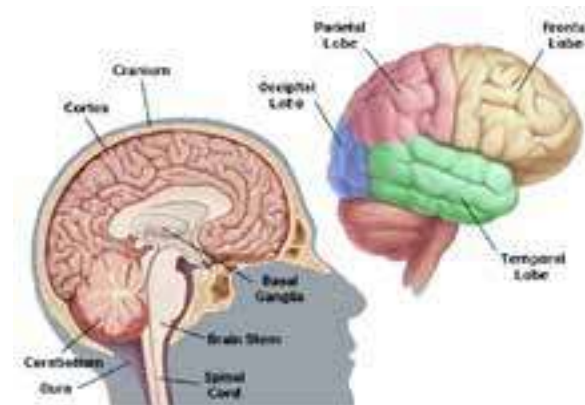
- (iv) The plant hormone help in the cell growth at the shoot tips by elongating the cells and help in the growth process is :

Ans :

- (i) Growth-dependent movements are called the Tropic Movements (towards or away from a stimulus).
- (ii) Non-growth dependent movements called the nastic Movements (independent of stimulus).
- (iii) The different types of phytohormones are :
  - (a) Auxins
  - (b) Gibberellins
  - (c) Cytokinins
  - (d) Absciscic acid
- (iv) Auxins

- 221.** The communication between the central nervous system and the other parts of the body is facilitated by the peripheral nervous system consisting of cranial nerves arising from the brain and spinal nerves arising from the spinal cord. The brain thus allows us to think and take actions based on that thinking.

The brain has three such major parts or regions, namely the fore-brain, mid-brain and hind-brain. The fore-brain is the main thinking part of the brain. It has regions which receive sensory impulses from various receptors. Separate areas of the fore-brain are specialised for hearing, smell, sight and so on. There are separate areas of association where this sensory information is interpreted by putting it together with information from other receptors as well as with information that is already stored in the brain. Based on all this, a decision is made about how to respond and the information is passed on to the motor areas which control the movement of voluntary muscles.



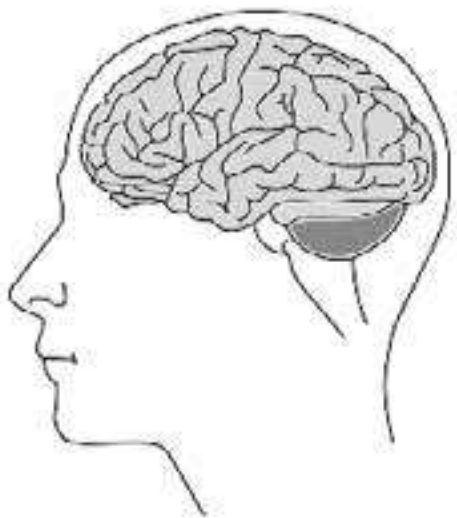


- (i) Which system facilitates the communication between the central nervous system and the other parts of the body ?
- (ii) What is the role of the brain ?
- (iii) What are three parts of the human brain ?
- (iv) Which is the main thinking part of the brain ?

**Ans :**

- (i) The peripheral nervous system consisting of cranial nerves arising from the brain and spinal cord system facilitates the communication between the central nervous system and the other parts of the body.
- (ii) The brain thus allows us to think and take actions based on that thinking.
- (iii) The brain has three such major parts or regions, namely the fore-brain, mid-brain and hind-brain.
- (iv) The fore-brain is the main thinking part of the brain.

**222.** The brain directs our body's internal functions. It also integrates sensory impulses and information to form perceptions, thoughts and memories. The brain gives us self awareness and the ability to speak and move in the world.



- (i) The brain is divided into three major subclasses. Name these subclasses.
- (ii) Name the part of the brain that is responsible for maintaining body posture.
- (iii) Name the part of the brain that has the reflex centres for sneezing and vomiting.
- (iv) Is brain the part of the central nervous system or peripheral nervous system ?

**Ans :**

- (i) The brain is divided into three main subclasses : the fore-brain, the mid-brain and the hind-brain. The structure present toward the lower back of the skull is the hind-brain. The narrow region that links the hind-brain with the fore-brain is the mid-brain. The structure in front of the brain is the fore-brain.
- (ii) The cerebellum is present in the hindbrain. It controls the body posture and coordinates motor activity for moving limbs. It is densely packed with neurons.
- (iii) The medulla oblongata is the region which regulates the breathing, heart rate and blood pressure and also consists of reflex centres for sneezing, vomiting, defecating, coughing, hiccup-ping and swallowing.
- (iv) The nervous system present in vertebrates is divided into the peripheral nervous system and central nervous system. The brain and spinal cord are found in the central nervous system. Thus, the brain is part of the central nervous system.

**223.** Study the table and answer the following questions :

Category	Systolic	Diastolic
Optimal	< 120	< 80
Normal	120-129	80-84
High	130-139	85-89

- (i) What are systolic and diastolic blood pressures ?
- (ii) Which blood vessel is known to have the lowest blood pressure ?
- (iii) Define the term sphygmomanometer.
- (iv) What is the meaning of blood pressure ?

**Ans :**

- (i) The pressure with which blood moves due to contraction of ventricles is termed as the systolic pressure (upper value) and the pressure of the blood when ventricles relax is known as diastolic pressure (lower value).
- (ii) The blood vessel that has the lowest blood pressure is vein.
- (iii) The sphygmomanometer is a device that is composed of an inflatable cuff, a measuring unit and a valve. It is a device that is used for measuring blood pressure.
- (iv) The blood exerts a certain amount of pressure on these blood vessels. This exerted pressure on the

wall of arteries is termed as blood pressure. The normal blood pressure of a person is 120/80 mm Hg.

**224.** Plant hormones affect gene expression and transcription levels, cellular division and growth. They are naturally produced within plants, but very similar chemicals are produced by fungi and bacteria that can also affect plant growth. A large number of related chemical compounds are synthesized by humans. They are used to regulate the growth of cultivated plants, weeds and in vitro-grown plants and plant cells; these man-made compounds are called plant growth regulators or PGRs for short. Plant hormones are not nutrients, but chemicals that in small amounts promote and influence the growth, development and differentiation of cells and tissues. The biosynthesis of plant hormones within plant tissues is often diffused and not always localized. Plants lack glands to produce and store hormones, because, unlike animals which have two circulatory systems (lymphatic and cardiovascular) powered by a heart that moves fluids around the body. Plants use more passive means to move chemicals around their bodies. Plants utilize simple chemicals as hormones, which move more easily through their tissues. They are often produced and used on a local basis within the plant body. Plant cells produce hormones that affect different regions of the cell producing the hormone.

Different hormones can be sorted into different classes, depending on their chemical structures. Within each class of hormone the exact structures vary, but they have similar physiological effects. Initial research into plant hormones identified five major classes : abscisic acid, auxin, cytokinins, ethylene and gibberellins. This list was later expanded and brassinosteroids, jasmonates, salicylic acid and strigolactones are now considered as major plant hormones.



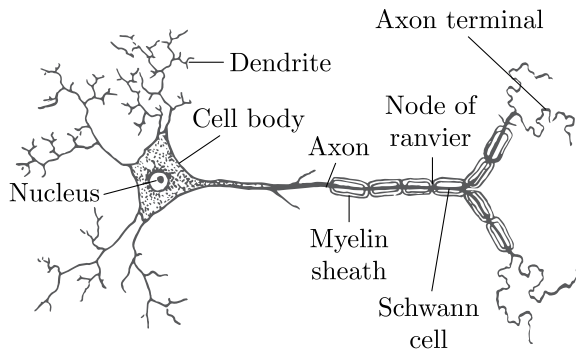
- (i) What are the factors affected by the plant hormones ?
- (ii) What does PGR stands for ?
- (iii) Which class does plant hormones fall into ?
- (iv) What were the five major plant hormones discovered in the initial research ?

**Ans :**

- (i) Plant hormones affect gene expression and transcription levels, cellular division and growth.
- (ii) PGR stands for plant growth regulators.
- (iii) Plant hormones fall into the class of chemicals which promote and influence the growth, development and differentiation of cells and tissues.
- (iv) The five major plant hormones discovered by the initial research were abscisic acid, auxin, cytokinins, ethylene and gibberellins.

**225.** All humans have a basic need to control and coordinate all the movements occurring in them. One of the most important requirements of controlling all the factors of the body is a system of rapid communication. All the cells, tissues and organs do not work independently. They work together as one team. For example, during the process of ingestion the eyes locate food, nose register smell, hands pick up the food, mouth opens to eat it, teeth chew it and saliva masticates it. So you can see so many parts are involved in a single task. But there has to be coordination between them. This coordination is known as control and coordination. The whole body systems are interconnected and work like a team. For control and coordination there is a system inside our body which is known as the nervous system and the hormonal system.

Cells of the nervous system are called neurons which are the largest cells in body. It consist of 3 parts namely Axon, Dendrite and cyton. The irregular structure is called a cell body that encloses a nucleus in the neoplasm. From the cell body small branches arise on the upper side called the dendrite. On the lower side it gives out only one branch that is elongated and is called the axon. Our body contains three types of nerves which are sensory nerve, motor nerve and relay nerve. Neurons are of two types namely medullated neuron and non-medullated neuron.



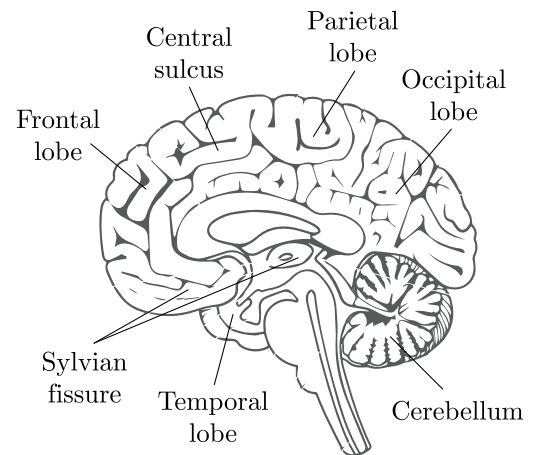
- (i) How does axon look like ?
- (ii) Which is the system responsible for control and coordination inside our body ?
- (iii) How many types of neurons are there? What are they ?

**Ans :**

- (i) Axon is an elongated branch, which is present at the lower side of the cell body.
- (ii) The system responsible for control and coordination inside our body is nervous system and the hormonal system.
- (iii) There are two types of neurons. They are medullated neuron and non-medullated neurons.

**226.** The human brain is the central organ of the human nervous system and with the spinal cord makes up the central nervous system. The brain consists of the cerebrum, the brain-stem and the cerebellum. It controls most of the activities of the body, processing, integrating and coordinating the information it receives from the sense organs and making decisions as to the instructions sent to the rest of the body. The brain is contained in and protected by, the skull bones of the head. The cerebrum is the largest part of the human brain. It is divided into two cerebral hemispheres. The cerebral cortex is an outer layer of grey matter, covering the core of white matter. The cortex is split into the neocortex and the much smaller allocortex. The neocortex is made up of six neuronal layers, while the allocortex has three or four. Each hemisphere is conventionally divided into four lobes – the frontal, temporal, parietal and occipital lobes. The frontal lobe is associated with executive functions including self-control, planning, reasoning and abstract thought, while the occipital lobe is dedicated to vision. The brain is protected by the skull, suspended in cerebrospinal fluid and isolated from the bloodstream by the blood brain barrier. However, the brain is still susceptible to damage, disease and infection. Damage can

be caused by trauma, or a loss of blood supply known as a stroke. The brain is susceptible to degenerative disorders, such as Parkinson's disease, dementias including Alzheimer's disease and multiple sclerosis. Psychiatric condition, including schizophrenia and clinical depression, are thought to be associated with brain dysfunctions. The brain can also be the site of tumours, both benign and malignant; these mostly originate from other sites in the body. The study of the anatomy of the brain is neuroanatomy, while the study of its function is neuroscience.



- (i) Which is the central part of the nervous system?
- (ii) What are the functions of the brain?
- (iii) What is the largest part of the human brain?
- (iv) What is the branch which studies the anatomy of brain?

**Ans :**

- (i) The central part of the nervous system is the brain.
- (ii) It controls most of the activities of the body like processing, integrating and coordinating the information it receives from the sense organs and making decisions on the instructions sent to the rest of the body.
- (iii) The cerebrum is the largest part of the human brain.
- (iv) The study of the anatomy of the brain is neuroanatomy.

**227.** The thyroid is a small, butterfly-shaped gland located at the base of your neck just below the Adam's apple. It is part of an intricate network of glands called the endocrine system. The endocrine system is responsible for coordinating many of your body's activities. The thyroid gland manufactures

hormones that regulate your body's metabolism.

Several different disorders can arise when your thyroid produces too much hormone (hyperthyroidism) or not enough (hypothyroidism). Four common disorders of the thyroid are Hashimoto's disease, Graves' disease, goitre and thyroid nodules.

In hyperthyroidism, the thyroid gland is overactive. It produces too much of its hormone. Hyperthyroidism affects about 1 percent of women. It's less common in men.

Graves' disease is the most common cause of hyperthyroidism, affecting about 70 percent of people with an overactive thyroid. Nodules on the thyroid – a condition called toxic nodular goitre or multinodular goitre can also cause the gland to overproduce its hormones.

Excessive thyroid hormone production leads to symptoms such as : restlessness nervousness, racing heart, irritability, increased sweating, shaking, anxiety, trouble sleeping, thin skin, brittle hair and nails, muscle weakness, weight loss, bulging eyes (in Graves' disease).

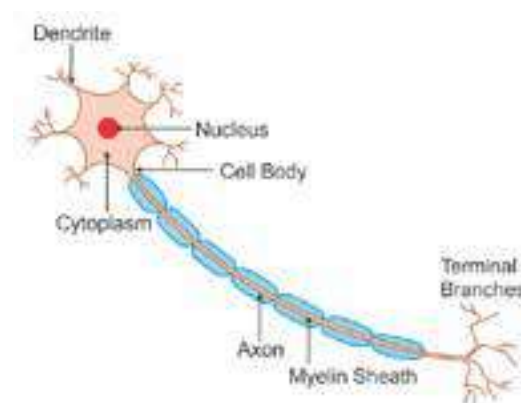
- (i) What is thyroid gland ?
- (ii) What is the function of the thyroid gland ?
- (iii) Name some common disorders of the thyroid.
- (iv) Give some symptoms of hyperthyroidism.

**Ans :**

- (i) It is a small, butter-shaped gland located at the base of your neck just below the Adam's apple. It is part of an intricate network of glands called the endocrine system.
- (ii) The thyroid gland manufactures hormones that regulate body's metabolism.
- (iii) Hashimoto's disease, Graves' disease, goitre and thyroid nodules.
- (iv) Restlessness, nervousness, racing heart, irritability, increased sweating, shaking, anxiety, trouble sleeping, thin skin, brittle hair and nails, muscle weakness, weight loss, bulging eyes.

**228.** Touching a hot object is an urgent and dangerous situation for us. We need to detect it and respond to it. All information from our environment is detected by the specialized tips of some nerve cells. These receptors are usually located in our sense organs, such as the inner ear, the nose, the tongue and so on. So, gustatory receptors will detect taste while olfactory receptors will detect smell. This information, acquired at the end of the dendritic tip of a nerve cell sets off a chemical reaction that

creates an electrical impulse. This impulse travels from the dendrite to the cell body and then along the axon to its end. At the end of axon, the electrical impulse sets off the release of some chemicals. These chemicals cross the gap or synapse and start a similar electrical impulse in a dendrite of the next neuron. This is a general scheme of how nervous impulses travel in the body.



- (i) Which type of cells detects the information from our environment ?
- (ii) What is the role of gustatory receptors and olfactory receptors ?
- (iii) What is the tip of a nerve cell called ?
- (iv) What is the type of signal used by the nervous system to transmit messages ?

**Ans :**

- (i) Nerve cells detect the information from our environment.
- (ii) Gustatory receptors detect taste while olfactory receptors detect smell.
- (iii) The tip of a nerve cell is called dendrite.
- (iv) The nervous system uses electrical impulses to transmit messages.

**229.** Different plant hormones help to coordinate growth, development and responses to the environment. They are synthesized at places away from where they act and simply diffuse to the area of action. When growing plants detect light, a hormone called auxin, synthesized at the shoot tip, helps the cells to grow longer. When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plants appear to bend towards light.

Another example of a plant hormone is gibberellins which, like auxins, help in the growth

Ans :

OD 2017

Name of the hormone	Endocrine gland which secretes it	Function
(i) Testosterone	Testes	Stimulates the male secondary sex characters like moustache, beard and cracking of the voice.
(ii) Estrogen	Ovary	Regulation of female accessory sex organs and secondary sex characters, like development of mammary glands and thickening of the wall of the uterus.

- 210.** Adrenalin hormone secreted by adrenal gland is also called 'emergency hormone'. Explain.

Ans :

Delhi 2010

Adrenalin is also called as 'emergency hormone' as it does the following :

- Increases heartbeat,
- Increases blood pressure,
- Increases blood supply to the muscles,
- Decreases blood supply to the visceral organs, and
- Releases more glucose into the blood.

- 211.** Draw an outline of the human body and show the location of any six endocrine glands in that.

Ans :

AI 2008

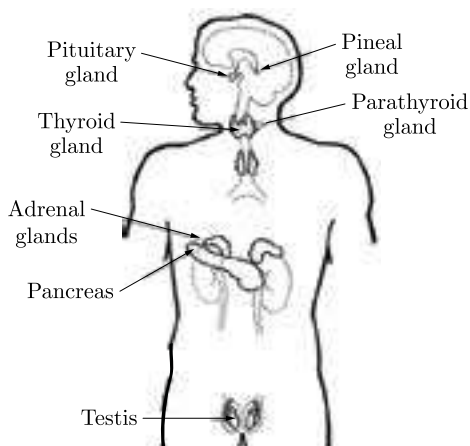


Figure: Endocrine glands in human.

- 212.** Write the difference between hormone and enzyme.

Ans :

AI 2006

	Hormone	Enzyme
(i)	These are the chemical substances which coordinate and control the activities of living organisms and also their growth.	They are biological catalysts, i.e., they increase the rate of biological reactions.
(ii)	Function of hormones is not affected by temperature.	They catalyse specific biochemical reactions under specific temperature conditions.

- 213.** Give various functions performed by plant hormones.

Ans :

OD 2019

Various functions performed by plant hormones :

- Auxins promote cell enlargement and cell differentiation. They also promote fruit growth.
- Gibberellins promote cell enlargement and cell differentiation in the presence of auxin. It also helps in breaking the dormancy in seeds and buds. It promotes the growth in fruits.
- Cytokinin promotes cell division and helps in breaking the dormancy of seeds and buds. It delays the ageing in leaves. It promotes the opening of stomata. It also promotes fruit growth.
- Abscisic acid promotes the dormancy in seeds and buds. It promotes the closing of stomata and falling of leaves.
- Ethene (or ethylene) promotes the falling of leaves, ripening of fruits and helps in breaking bud dormancy.

- 214.** (a) Draw the structure of a neuron and label the following on it :  
Nucleus, Dendrite, Cell body and Axon.

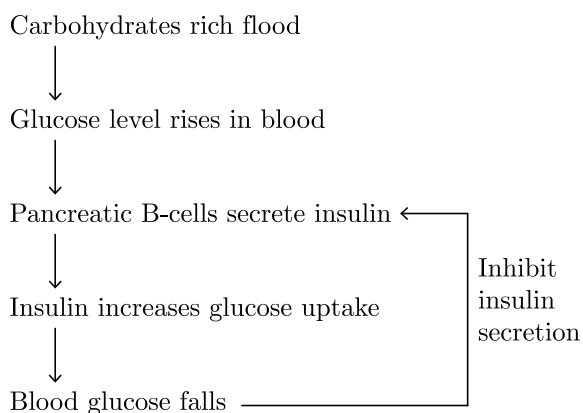
- (b) Name the part of neuron :

- where information is acquired.
- through which information travels as an electrical impulse.



Ans :

- (i) Negative feedback mechanism of hormone control.
- (ii) Negative feedback occurs when a hormone results in decrease of its own production. This happens when the level of hormone is very high in blood.
- (iii)



- (iv) Reduced thyroid hormones will result in goitre.

**232.** Questions are based on the two table given below. Study these tables related to blood pressure level and answer the question that follow :

**Table-A**

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (Upper number)	DIASTOLIC mm Hg (Lower number)
Normal	120	80
Elevated	120–129	Less than 80
High Blood Pressure (Hypertension) Stage 1	130–139	80–90
High Blood Pressure (Hypertension) Stage 2	140 or higher	90 or higher
Hypertensive crisis (consult your doctor immediately)	Higher than 180	Higher than 120

**Table-B**

Time of Measurement	Blood Pressure	
	Patient-X	Patient-Y
Morning	75–115	85–125
Afternoon	79–122	80–120
Evening	82–132	75–110

- (i) In the table B, at which time patient-Y have ideal normal blood pressure ?
- (ii) Identify the patient, which have hypertension stage-1 blood pressure ?
- (iii) Which Diet is the best for high blood pressure patient ?
- (iv) What is the ideal blood pressure measurement of a human ?

Ans :

- (i) Afternoon (80-120)
- (ii) Patient X (82-132) Evening
- (iii) Grain and fruits
- (iv) 80-120 mm Hg

**233.** Questions are based on the two tables given below. Study this table and answer the questions that follows.

**Table A : Normal Blood Pressure**

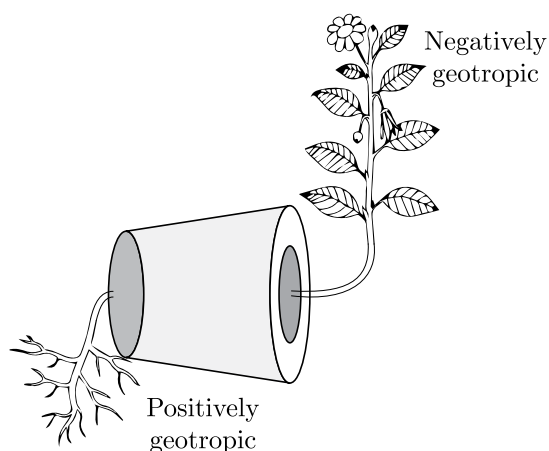
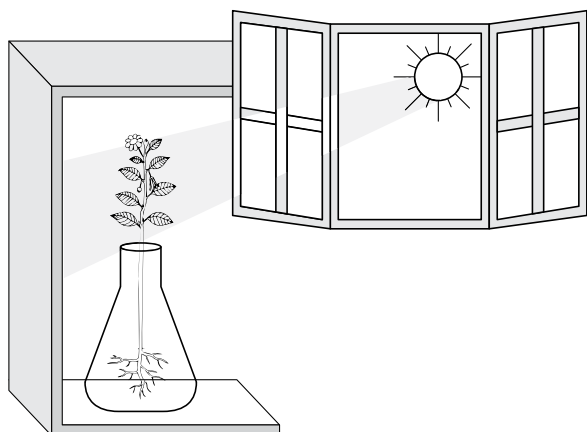
Systolic Pressure (mm Hg)	Diastolic Pressure (mm Hg)	Pressure Range
130	85	High Normal Blood Pressure
120	80	Normal Blood Pressure
110	75	Low Normal Blood Pressure

**Table B : Approx. Ideal BP According to Age Chart**

Age	Female	Male
10	111/73	112/73
13	117/75	117/76
14	120/75	119/77
15	120/76	120/78
19-24	120/79	120/79



of the stem. Cytokinins promote cell division and it is natural then that they are present in greater concentration in areas of rapid cell division, such as in fruits and seeds. These are examples of plant hormones that help in promoting growth. But plants also need signals to stop growing. Abscissic acid is one example of a hormone which inhibits growth. Its effects include wilting of leaves.



- (i) What do plant hormones do ?
- (ii) Which hormone is synthesized at the shoot tip ?
- (iii) Which hormone stimulates the growth of the stem?
- (iv) What hormone inhibits the growth of a plant? What are its effects ?

**Ans :**

- (i) Plant hormones help to coordinate growth, development and responses to the environment.
- (ii) A hormone called auxin, synthesized at the shoot tip.
- (iii) Hormone called gibberellins stimulates the growth of the stem.

- (iv) Abscissic acid inhibits the growth of a plant. Its effects include wilting of leaves.

**230.** Adrenaline hormone is released in the body during stress or emergency situations. It generates several responses which together enable the body to deal with a situation. Given below is a table to the possible effects of adrenaline hormone on liver glycogen and blood as a result of increased adrenaline secretion glucose.

Concentration of glycogen in the liver	Concentration of glucose in the blood
Decrease	Increase
Increase	Increase
No effect	Decrease

- (i) Identify the gland from which the adrenaline hormone is secreted.
- (ii) Which of the following options given in table above correctly depicts the effect of adrenaline on blood glucose ?

**Ans :**

- (i) Adrenal gland.
- (ii) Adrenaline increases the blood glucose level. This is achieved by increasing the rate of conversion of glycogen to glucose in liver and muscles.

**231.** In humans, the hypothalamus secretes thyrotropin-releasing hormone (TRH). It stimulates the pituitary to produce TSH which in turn stimulates the secretion of thyroid hormones. When thyroid hormones have reached high levels, they feedback to stop the hypothalamus from secreting TRH and pituitary from secreting TSH. Without the stimulation from these hormones, thyroid gland stops producing its hormones and soon their level falls low.

- (i) What does the above scenario represent in terms of hormone regulation ?
- (ii) State the principle behind the above mentioned mechanism of hormonal control.
- (iii) Create a situation using insulin as an example to depict the same mechanism of regulation discussed above.
- (iv) What would happen if thyroid secretion is left unregulated in the body and decreases to a very low level ?

level. To monitor it at times she used to take injections also. Ramesh was very fond of sweets but she never carried any sweets in her tiffin. They both shared each other's tiffin.

- (a) What is the cause of diabetes ?
- (b) What helps in the digestion of sugar ?

**Ans :**

- (a) Diabetes is caused due to deficiency of an enzyme that can digest the sugar.
- (b) Insulin hormone released by pancreas helps in the digestion of sugar.

**237.** A group of students studied that many people suffered with a disease called Goitre. Students brought iodised salt packets and advised people to eat the same.

- (a) Which hormone deficiency leads to the Goitre ?
- (b) Name one disease caused due to deficiency of hormone other than Goitre.

**Ans :**

- (a) Deficiency of thyroxine leads to Goitre.
- (b) Diabetes is caused due to the deficiency of insulin.

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# CHAPTER 7

## How do organisms Reproduce

### 1. PRODUCTION

Reproduction is the process by which organisms produce young ones of their own kind. Organisms reproduce for the continuation and perpetuation of race.

1. Reproduction is essential because it brings continuation of life, preservation of species, replacement of dead individuals in the population. It also introduces variations in the offspring and plays a key role in evolution.
2. Reproduction is the means of transmission of hereditary material.
  - During reproduction the hereditary material (DNA) is copied and passed on to next generation through gametes.
  - The copied DNA is similar, but not identical to parent DNA due to introduction of variations during the copying of the DNA.
  - Variations introduced in the DNA at the time of reproduction may be useful, harmful or neutral.

#### 1.1 Modes of Reproduction used by Single Organisms-Asexual Reproduction

##### 1. Fission

A unicellular organism may divide into two (Binary fission - Amoeba, Paramecium, Leishmania and bacteria) or more (multiple fission - Plasmodium) identical daughter organisms under favourable and unfavourable environmental conditions respectively.

##### 2. Budding

The new organism arises as an outgrowth on parent organism (yeast, Hydra).

##### 3. Spore Formation

Fungi such as Rhizopus (bread mould) Mucor, Penicillium, Aspergillus, etc. form tiny structures called spores which give rise to new individuals.

##### 4. Fragmentation

The body of a multicellular organism breaks into two or more fragments and each one grows into a new individual (Spirogyra).

##### 5. Regeneration

The process of getting back a full organism from the cut parts of an organism (Hydra and Planarian).

#### 1.2 Vegetative Propagation

The process of growing new plants from vegetative parts - root, stem or leaf.

The plants produced by vegetative propagation are genetically similar to the parent plant, hence they do not produce new varieties and lose vigour when grown repeatedly.

Vegetative propagation may be Natural or Artificial.

1. **Natural vegetative propagation** occurs by roots (sweet potato, Dahlia, Asparagus, etc.), by stem (ginger, potato, onion, turmeric, etc.), by leaves (Bryophyllum, Begonia, etc.) and by bulbils (Agave, Oxalis, Dioscorea, etc.).
2. **Artificial vegetative propagation** is carried out by stem cutting (rose, sugarcane, lemon, etc.), root cutting

Tissue culture or micro-propagation is a technique of propagating plants by culturing cells or tissues from growing tips of a plant in a culture medium (orchids, gladioli, Chrysanthemum, etc.).

### 2. SEXUAL REPRODUCTION

Sexual Reproduction is a mode of reproduction in which two parents are involved to give rise to a new individual. Sexual mode of reproduction in organisms is evolved to generate more variations the population which ensures the survival of the species.

#### 2.1 Sexual Reproduction in Flowering Plants

Sexual reproduction in flowering plants (angiosperms) takes place with the help of flowers

which contain the reproductive organs.

1. Stamens (male) and carpels (female) are the reproductive organs of a flower.
2. Flowers may be uni-sexual having either stamen or carpels (papaya, watermelon, etc.) or bisexual having both stamens and carpels (Hibiscus, mustard, etc.).

The process of reproduction in plants takes place by:

### 1. Pollination

Pollination, which is the process of transfer of pollen from anther to the stigma of flower. It may be Self-pollination (if pollen grains transfer from the anther to the stigma of the same flower or of another flower of the same plant) or Cross-pollination (if the pollen grains transfer from the anther of one flower to the stigma of another flower of another plant but of the same species).

### 2. Fertilisation

Fertilisation, which is the fusion of male and female gametes to form zygote. In angiosperms, double fertilisation occurs in which one male gamete fuses with egg to form zygote and other male gamete fuses with two polar nuclei to form endosperm.

## 2.2 Post-fertilisation Changes

Post-fertilisation changes involve development of zygote into an embryo within the ovule, development of ovule into seed and development of ovary into fruit.

On getting favourable environmental conditions, seed germinates to form a small seedling which finally grows into a plant.

## 3. REPRODUCTION IN HUMAN BEINGS

Human beings are uni-sexual. They show sexual dimorphism (males and females are visibly different from each other).

### 3.1 Puberty

Puberty is the age at which reproductive organs become functional. Generally, boys attain puberty at the age of 13-14 years, whereas girls reach puberty at the age of 10-12 years. The male sex hormone testosterone secreted from the testes and the female sex hormones estrogen and progesterone secreted from ovary start puberty in boys and girls respectively.

### 3.2 The Male Reproductive System

The Male Reproductive System in human beings consists of a pair of testes which produce sperm (male gamete), associated ducts (vas efferens, epididymis and vas deferens), accessory reproductive organs (penis and urethra) and accessory reproductive glands (seminal vesicles, a pair of Cowper's glands and a prostate gland).

1. **Urethra** is a common tube for meant to expel urine and sperm out of the body.
2. **Penis** is a muscular and erectile copulatory organ of man.
3. **Semen** is a mixture of mature sperm and secretions of various accessory glands.

### 3.3 The Female Reproductive System

The female reproductive system in human beings consists of a pair of ovaries which produce ova (female gamete), a pair of fallopian tubes and accessory reproductive organs (uterus, vagina and vulva).

1. **Uterus** is a pear-shaped, highly muscular hollow structure where development of foetus occurs.
2. **Vagina** is a short and wide muscular tube which receives sperm during intercourse or mating and acts as birth canal during child birth.
3. **Vulva** is the external genitalia of human female. It consists of labia majora, labia minora and clitoris.

#### 1. Fertilisation

Fertilisation is the fusion of male and female gametes. In human beings, fertilisation is internal. During copulation (mating), sperm are deposited in the vagina. They travel to the fallopian tube where the fusion of sperm and ovum takes place.

#### 2. Implantation

Implantation is the process of attachment of blastocyst (embryo) in the uterine wall.

#### 3. Gestation Period

Gestation period is the time period of development of embryo in the mother's uterus. In humans, it lasts for about 280 days or 40 weeks or 9 months.

#### 4. Birth of a Child is Called Parturition.

### 3.4 When Egg is Not Fertilised

The endometrium of uterus erodes and the unfertilised ovum comes out of vagina in the form of blood flow called menstruation or menstrual flow.

### 3.5 Menstrual Cycle or Menstruation

Menstruation usually occurs 14 days after ovulation and usually lasts for 3-5 days. If the ovum does not get fertilised, the menstrual cycle is repeated again after every 28 days.

1. **Menarche** is the first menstruation in a girl after attaining puberty at 10-12 years of age. **Menopause** is the permanent stoppage of menstruation in a woman which occurs at the age of about 45 years.

### 3.6 Reproductive Health

Reproductive Health refers to total well-being in all aspects of reproduction which includes physical, emotional, social and behavioural well-being of an individual.

### 3.7 Sexually Transmitted Diseases (STD) or Venereal Diseases

Sexually transmitted diseases (STD) or venereal diseases spread by sexual contact with infected persons. These are caused by bacteria, viruses and protozoans. Common STDs are Gonorrhoea (by the bacterium, *Neisseria gonorrhoea*, mainly in females), Syphilis (by the bacterium *Treponema pallidum*), Genital Herpes (by a virus *Herpes simplex*) Genital Warts (by human papillomavirus : HPV) and Acquired Immune Deficiency Syndrome : AIDS by HIV (Human Immunodeficiency Virus).

### 3.8 The Family Planning Programme

The family planning programme is being run by the government to create awareness in the mass to maintain a balance between home economy and size of the family including nutrition of the child and of the pregnant woman.

### 3.9 Contraception

Contraception is the avoidance of pregnancy by preventing the fertilisation of ovum. The methods of contraception include Withdrawal technique, Barrier methods (Condom - Nirodh, Diaphragm), the Intra-uterine Contraceptive Device : IUCD (Loop or Coper - T), Chemical methods (Spermicide, Oral Contraceptives : OCs or Birth Control Pills), and Surgical methods (Vasectomy in males and Tubectomy in a females).

## OBJECTIVE QUESTIONS

1. Which one of the following organ is NOT a part of human female reproductive system?  
(a) Ovary (b) Uterus  
(c) Vas deferens (d) Fallopian tube

Ans :

OD 2024

Vas deferens is a part of the male reproductive system. It is a tube like passage through which the sperms formed in testis are delivered to urethra.

Thus (c) is correct option.

2. In which of the following organisms, multiple fission is a means of asexual reproduction?  
(a) Yeast (b) Leishmania  
(c) Paramoecium (d) Plasmodium

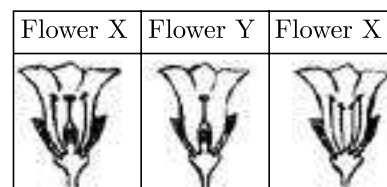
Ans :

OD 2024

Plasmodium, divides into many daughter cells simultaneously by multiple fission.

Thus (d) is correct option.

3. Consider the following three flower namely X, Y and Z. Which flower (s) would develop into a fruit?



- (a) X only
- (b) Z' only
- (c) 'X' and 'Y' only
- (d) 'Y' and Z'

Ans :

OD 2023

Fertilization occurs inside the ovary female reproductive part (carpel). After fertilization the ovary develops into a fruit. In this case, flower Z lacks carpel so it could not develop into fruit. The flowers X and Y would develop into a fruit.

Thus option (c) is correct option.

4. Cessation of menstrual cycle in the human female is known as  
(a) ovulation (b) puberty  
(c) menopause (d) maturation

Ans :

Ovulation is the process of releasing the matured egg or ovum.

Puberty is the process of physical changes whereby the child's body matures into an adult body capable of sexual reproduction.

The cessation of the woman's menstrual cycle and hence the end of reproductive ability is called as menopause. Menopause occurs due to the natural cessation of the estradiol and progesterone production by the ovaries over a period of years. This is the part of the normal aging process.

The process of becoming mature is maturation.

Thus (c) is the correct option.

5. The reproductive life of a woman lasts from menarche to menopause.
- (a) reproductive life a woman lasts from menarche to menopause.
- (b) reproductive life a woman lasts from menarche to menopause.
- (c) reproductive life a woman lasts from menarche to menopause.
- (d) reproductive life a woman lasts from menarche to menopause.

**Ans :**

Menarche is the first occurrence of menstruation and marks the beginning of the reproductive period. Menopause is the end of menstruation and marks the end of the reproductive period of women.

Thus (a) is the correct option.

6. Lower narrow end of uterus is called as
- (a) urethra (b) cervix
- (c) clitoris (d) vulva

**Ans :**

The uterine tubes terminate in the uterus, a hollow muscular organ located in front of the rectum and behind the urinary bladder. It is like an inverted pear when viewed anteriorly and is pear size as well, during pregnancy it increases 3 - 6 times. Round ligament help the uterus tilted forward over the bladder. It is attached to the lateral wall of the pelvis by two broad ligaments. Uterus has three parts:

Fundus is the upper, dome shaped part.

Body is the tapering middle portion.

Cervix is terminal narrow portion.

The constricted region between the body and cervix is the isthmus. The interior of the cervix is the cervical canal, which opens into vagina.

Thus (b) is the correct option

7. Other than spirogyra, fragmentation also occurs in
- (a) amoeba (b) hydra
- (c) planaria (d) none of the above

**Ans :**

Fragmentation is defined as the process of breaking up of parent animal into small parts, each of which can grow into a new complete individual. This process of asexual reproduction is found in planaria and hydra. Planaria can be cut into pieces, and each piece can regenerate into a complete organism. Cells at the location of the wound site proliferate to form a blastema that will differentiate into new tissues and regenerate the missing parts of the piece of the cut planaria.

Thus (c) is the correct option.

8. Which of the following cell is formed as a product of fertilization?
- (a) embryo (b) gamete
- (c) zygote (d) fruit

**Ans :**

A fertilization event takes place by the fusion of gametes. A gamete is a haploid cell which has half the required number of chromosomes. Sperm, of paternal origin and egg, of maternal origin fuse to form a zygote (which has the required number of chromosomes) in fertilization. Zygote is capable of undergoing cell division to form a new individual.

Thus (c) is the correct option

1. In the list of organisms given below, those that reproduce by the asexual method are
- (i) Banana
- (ii) Dog
- (iii) Yeast
- (iv) Amoeba
- (a) (ii) and (iv) (b) (i), (iii) and (iv)
- (c) (i) and (iv) (d) (ii), (iii) and (iv)

**Ans :**

Delhi 2013

(b) (i), (iii) and (iv)

2. In a flower, the parts that produce male and female gametes (germ cells) are
- (a) stamen and anther
- (b) filament and stigma
- (c) anther and ovary
- (d) stamen and style

**Ans :**

(c) anther and ovary.

3. Which of the following is the correct sequence of events of sexual reproduction in a flower?



- (a) pollination, fertilisation, seedling, embryo
- (b) seedling, embryo, fertilisation, pollination
- (c) pollination, fertilisation, embryo, seedling
- (d) embryo, seedling, pollination, fertilisation.

**Ans :**

(c) pollination, fertilisation, embryo, seedling

- 4.** Offspring formed by asexual method of reproduction have greater similarity among themselves because
- (i) asexual reproduction involves only one parent
  - (ii) asexual reproduction does not involve gametes
  - (iii) asexual reproduction occurs before sexual reproduction
  - (iv) asexual reproduction occurs after sexual reproduction
- (a) (i) and (ii)                      (b) (i) and (iii)
  - (c) (ii) and (iv)                    (d) (iii) and (iv)

**Ans :**

(a) (i) and (ii)

- 5.** Characters transmitted from parents to offspring are present in
- (a) cytoplasm                      (b) ribosome
  - (c) golgi bodies                  (d) genes

**Ans :**

(d) genes

- 6.** Characters that are transmitted from parents to offspring during reproduction show
- (a) only similarities with parents
  - (b) only variations with parents
  - (c) both similarities and variations with parents
  - (d) neither similarities nor variations

**Ans :**

(c) both similarities and variations with parents

- 7.** A feature of reproduction that is common to Amoeba, Spirogyra and yeast is that
- (a) they reproduce asexually
  - (b) they are all unicellular
  - (c) they reproduce only sexually
  - (d) they are all multicellular

**Ans :**

(a) they reproduce asexually

- 8.** In Spirogyra, asexual reproduction takes place by
- (a) breaking up of filaments into smaller bits
  - (b) division of a cell into two cells
  - (c) division of a cell into many cells
  - (d) formation of young cells from older cells

**Ans :**

(a) breaking up of filaments into smaller bits.

- 9.** The ability of a cell to divide into several cells during reproduction in Plasmodium is called
- (a) budding                              (b) reduction division
  - (c) binary fission                      (d) multiple fission

**Ans :**

OD 2017

(d) multiple fission

- 10.** The correct sequence of reproductive stages seen in flowering plants is
- (a) gametes, zygote, embryo, seedling
  - (b) zygote, gametes, embryo, seedling
  - (c) seedling, embryo, zygote, gametes
  - (d) gametes, embryo, zygote, seedling

**Ans :**

Foreign 2012

(a) gametes, zygote, embryo, seedling

- 11.** The number of chromosomes in parents and offsprings of a particular species remains constant due to
- (a) doubling of chromosomes after zygote formation
  - (b) halving of chromosomes during gamete formation
  - (c) doubling of chromosomes after gamete formation
  - (d) halving of chromosomes after gamete formation

**Ans :**

(b) halving of chromosomes during gamete formation

- 12.** In Rhizopus, tubular thread-like structures bearing sporangia at their tips are called
- (a) filaments                              (b) hyphae
  - (c) rhizoids                                (d) roots

**Ans :**

(b) hyphae

- 13.** Vegetative propagation refers to formation of new plants from
- (a) stem, roots and flowers
  - (b) stem, roots and leaves

- (c) stem, flowers and fruits
- (d) stem, leaves and flowers

**Ans :**

- (b) stem, roots and leaves

- 14.** Factors responsible for the rapid spread of bread mould on slices of bread are

- (i) large number of spores
- (ii) availability of moisture and nutrients in bread
- (iii) presence of tubular branched hyphae
- (iv) formation of round shaped sporangia

- (a) (i) and (iii)                      (b) (ii) and (iv)
- (c) (i) and (ii)                      (d) (iii) and (iv)

**Ans :**

- (c) (i) and (ii)

- 15.** Length of pollen tube depends on the distance between

- (a) pollen grain and upper surface of stigma
- (b) pollen grain on upper surface of stigma and ovule
- (c) pollen grain in anther and upper surface of stigma
- (d) upper surface of stigma and lower part of style

**Ans :**

- (b) pollen grain on upper surface of stigma and ovule

- 16.** Which of the following statements are true for flowers?

- (i) Flowers are always bisexual
- (ii) They are the sexual reproductive organs
- (iii) They are produced in all groups of plants
- (iv) After fertilisation they give rise to fruits
- (a) (i) and (iv)                      (b) (ii) and (iii)
- (c) (i) and (iii)                      (d) (ii) and (iv)

**Ans :**

Delhi 2016

- (d) (ii) and (iv)

- 17.** Which among the following statements are true for unisexual flowers?

- (i) They possess both stamen and pistil
- (ii) They possess either stamen or pistil
- (iii) They exhibit cross pollination
- (iv) Unisexually flowers possessing only stamens cannot produce fruits

- (a) (i) and (iv)                      (b) (ii), (iii) and (iv)
- (c) (iii) and (iv)                      (d) (i), (iii) and (iv)

**Ans :**

- (b) (ii), (iii) and (iv)

- 18.** Which among the following statements are true for sexual reproduction in flowering plants?

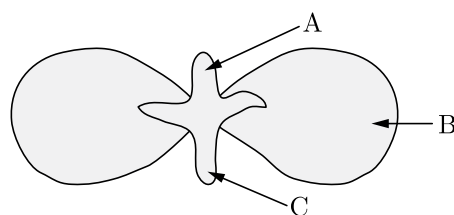
- (i) It requires two types of gametes
- (ii) Fertilisation is a compulsory event
- (iii) It always results in formation of zygote
- (iv) Offsprings formed are clones

- (a) (i) and (iv)                      (b) (i), (ii) and (iv)
- (c) (i), (ii) and (iii)                      (d) (i), (iii) and (iv)

**Ans :**

- (c) (i), (ii) and (iii)

- 19.** In following diagram the parts A, B and C are sequentially



- (a) cotyledon, plumule and radicle
- (b) plumule, radicle and cotyledon
- (c) plumule, cotyledon and radicle
- (d) radicle, cotyledon and plumule

**Ans :**

Foreign 2013

- (c) plumule, cotyledon and radicle

- 20.** Offspring formed as a result of sexual reproduction exhibits more variations because

- (a) sexual reproduction is a lengthy process
- (b) genetic material comes from two parents of the same species
- (c) genetic material comes from two parents of different species
- (d) genetic material comes from many parents

**Ans :**

- (b) genetic material comes from two. parents of the same species

- 21.** Reproduction is essential for living organisms in order to

- (a) keep the individual organism alive
- (b) fulfil their energy requirement
- (c) maintain growth
- (d) continue the species generation after generation

**Ans :**

(d) continue the species generation after generation

- 22.** During adolescence, several changes occur in the human body. Mark one change associated with maturation in boys

- (a) loss of milk teeth  
(b) increase in height  
(c) cracking of voice  
(d) weight gain

**Ans :**

OD 2012

(c) cracking of voice

- 23.** In human females, an event that reflects onset of reproductive phase is

- (a) growth of body  
(b) change in hair pattern  
(c) change in voice  
(d) menstruation

**Ans :**

(d) menstruation

- 24.** In human males, the testes lie in the scrotum, because it helps in the

- (a) process of mating  
(b) formation of sperm  
(c) easy transfer of gametes  
(d) all the above

**Ans :**

Foreign 2014

(b) formation of sperm

- 25.** Which among the following is not the function of testes at puberty?

- (a) formation of germ cells  
(b) secretion of testosterone  
(c) development of placenta  
(d) secretion of estrogen  
(a) (i) and (ii)                      (b) (ii) and (iii)  
(c) (iii) and (iv)                    (d) (i) and (iv)

**Ans :**

Delhi 2013

(c) (iii) and (iv)

- 26.** The correct sequence of organs in the male reproductive system for transport of sperms is

- (a) testis → vas deferens → urethra  
(b) testis → ureter → urethra

(c) testis → urethra → ureter

(d) testis → vas deferens → ureter

**Ans :**

(a) testis → vas deferens → urethra

- 27.** Which among the following diseases is not sexually transmitted?

- (a) syphilis                                      (b) Hepatitis-A  
(c) HIV-AIDS                                  (d) Gonorrhoea

**Ans :**

(b) Hepatitis-A

- 28.** Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Seminal vesicle	(p)	Latex sheath
(B)	Urinogenital duct	(q)	Semen plasma
(C)	Condom	(r)	Protozoan
(D)	Trichomoniasis	(s)	Corpus spongiosum

	A	B	C	D
(a)	q	s	p	r
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

(a) A-q, B-s, C-p, D-r

- 29.** Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Amoeba	(p)	Budding
(B)	Hydra	(q)	Regeneration
(C)	Planaria	(r)	Fission
(D)	Rhizopus	(s)	Fragmentation
(E)	Spirogyra	(t)	Spore formation

	A	B	C	D	E
(a)	r	p	t	s	q
(b)	p	q,	s,	r,	t
(c)	r	s,	p,	q	t
(d)	r	q	s	p	t

**Ans :**

(a)A-r, B-p, C-t D-s, E-q

- 30. Assertion (A):** Amoeba takes in food using finger like extensions of the cell surface.

**Reason (R):** In all unicellular organisms. the food is taken in by the entire cell surface.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation (A)
- (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

**Ans :**

OD 2023

Amoeba takes in food using temporary finger-like extensions of the cell surface, called pseudopodia, which extend and fuse over the food particle forming a food-vacuole. Inside the food vacuole, complex substances are broken down into simpler ones which then diffuse into the cytoplasm.

A unicellular organism does not need specific organ for taking in food, because the entire surface of the organism is in contact with the environment.

Thus option (c) is correct option.

- 31. Assertion :** Individuals produced by asexual reproduction are known as clones.

**Reason :** They are known as clones because they are genetically identical.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

The new individuals produced after cell divisions in asexual reproduction are always genetically identical or clone to each other and their parents.

- 32. Assertion :** Vagina is also called as birth canal.

**Reason :** During birth, the baby passes through the vagina.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Vagina is called as birth canal, because the baby passes through the vagina during birth.

- 33. Assertion :** Vasectomy is a surgical method or birth control.

**Reason :** In vasectomy, small portion of oviduct is cut or tied properly.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Vasectomy is a surgical method or birth control. in which small portion of the sperm duct is cut or tied properly.

- 34. Assertion :** Amoeba reproduces by Binary fission.

**Reason :** All unicellular organisms reproduce asexually.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Amoeba is a unicellular organism. It reproduces asexually through binary fission. It is the division of one cell into two similar or identical cells.

- 35. Assertion :** Surgical methods are most effective methods of contraception.

**Reason :** Surgical method blocks gametes transport and hence prevent fertilisation.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Surgical method like vasectomy in male and tubectomy in female prevent pregnancy. These methods block gamete transport and hence prevent fertilisation. They are very effective but reversibility is very poor.

- 36. Assertion :** Characteristics of parental plants can be preserved through asexual reproduction.

**Reason :** Vegetative reproduction involves only mitosis.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Asexual reproduction involves a single individual, which give rise to new individual that are genetically identical to parents. It is because, when organisms reproduce asexually, only mitotic divisions are involved and the chromosome number remains the same.

- 37. Assertion :** Scrotum is present outside the abdominal cavity.

**Reason :** It stores sperms which require a lower temperature than the normal body temperature.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Scrotum, a pouch containing testis is present outside the abdominal cavity because sperms require a lower temperature than the normal body temperature..

- 38. Assertion :** DNA copying is necessary during reproduction.

**Reason :** DNA copying leads to the transmission of characters from parents to offspring.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

DNA copying is necessary during reproduction because it leads to the transmission of characters from parents to offsprings and brings about variation.

- 39. Assertion :** An embryo is formed from fertilized egg.

**Reason :** A monocot embryo comprises embryonal axis with two cotyledons.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

- (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.  
 Zygote, a fertilized egg give rise to an embryo, which has the ability to develop into a complete plant. A typical dicot embryo comprises an embryonal axis with two cotyledons.

- 40. Assertion :** Unisexual flowers have separate male and female flowers whereas a typical monocot embryo comprises an embryonal axis with single cotyledon.

**Reason :** Cucumber, pumpkin and water melon are example of unisexual flowers.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Unisexual flowers have separate male and female flowers. The example includes cucumber, pumpkin and watermelon.

- 41. Assertion :** Double fertilisation is unique to angiosperms.

**Reason :** Triple fusion occurs in both fertilization.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.  
 Double fertilization is a characteristic feature of flowering plants. In this process, out of the two sperm nuclei, one sperm nucleus fuses with the egg nucleus to form an embryo (process is called

syngamy) and another fuses with the secondary nucleus to form an endosperm (process is called triple fusion). Because two kinds of fusion-syngamy and triple fusion-take place, the process is known as double fertilisation.

- 42. Assertion :** Sexual reproduction increases genetic diversities and plays a role in origin of new species.

**Reason :** Sexual reproduction involves formation of gametes and fusion of gametes.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Sexual reproduction involves two parents that results in the offsprings that are not identical to the parents. It causes variations; which are essential for evolution as well as survival of species under unfavourable conditions.

- 43. Assertion :** In human male, testes are extra abdominal which are present inside scrotum.

**Reason :** Scrotum has a relatively lower temperature needed for the production and storage of sperms.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Formation of sperms needs lower temperature than the normal body temperature. Hence, testes lie outside the body cavity in the scrotum.



- 44. Assertion :** At puberty, in boys, voice begins to crack and thick hair grows on face.

**Reason :** At puberty, there is decreased secretion of testosterone in boys.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

Puberty in boys is regulated by male sex hormone called testosterone, which are secreted by testes. In puberty, secondary sexual characters like growth of hair on face, chest, broadening of shoulders and deepening of voice occurs.

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## ONE MARK QUESTIONS

- 45.** Give an example of a flower which contains both stamens and carpels.

**Ans :**

Delhi 2018

Such flowers are called Bisexual flowers.

**Examples :** Flowers of Mustard, Hibiscus (China rose).

- 46.** What is parthenogenesis?

**Ans :**

OD 2017

Parthenogenesis is the development of an organism from a haploid egg without fertilization.

- 47.** What is DNA?

**Ans :**

OD 2016, Delhi 201

Deoxyribonucleic acid (DNA) is a double stranded genetic molecule which carries genetic information from one generation to another its each strand is being made up of many nucleotide units, while both strands are attached by hydrogen bonds.

- 48.** Give an example of organism where binary fission takes place.

**Ans :**

Delhi 2017

Amoeba.

- 49.** Name an organism in which multiple fission takes place.

**Ans :**

Delhi 2016, Delhi 2012

Plasmodium.

- 50.** What happens when a Planaria gets cut into two pieces?

**Ans :**

Foreign 2017

Each piece grows into a complete organism through regeneration.

- 51.** Name three methods by which plant reproduces by stems.

**Ans :**

Delhi 2016

- (i) Cutting  
(ii) Layering  
(iii) Grafting.

- 52.** Name two examples where budding takes place.

**Ans :**

SQP 2017, Delhi 2013

Hydra and yeast.

- 53.** Name the part of Bryophyllum where the buds are produced for vegetative propagation.

**Ans :**

OD 2016

On the stems as well as the leaves of the Bryophyllum plant.

- 54.** Name two STDs.

**Ans :**

Comp. 2017

- (i) Gonorrhoea  
(ii) Syphilis.

- 55.** What is the function of sepals?

**Ans :**

OD 2016

Sepals protect the immature reproductive organs of flower in their bud stage.

- 56.** Name the life process of an organism that helps in the growth of its population.

**Ans :**

Delhi 2017

Reproduction.

- 57.** Give three examples of organisms which reproduce by spore formation.

- Ans :** Delhi 2016  
(i) Mucor  
(ii) Rhizopus  
(iii) Penicillium.
- 58.** Name an algae which reproduces by the process of fragmentation.  
**Ans :** Foreign 2017  
Spirogyra.
- 59.** Give the respective scientific terms used for studying  
(i) The mechanism by which variations are created and inherited and  
(ii) The development of new type of organisms from the existing ones.  
**Ans :** OD 2016  
(i) Heredity  
(ii) Reproduction.
- 60.** Where are the male and female gametes produced in flowers?  
**Ans :** Comp 2015  
Male gametes : In pollen grains.  
Female gametes : In embryo sac of ovule of ovary.
- 61.** Name the causative organism of AIDS.  
**Ans :** Comp 2016  
HIV virus.
- 62.** Give an advantage of vegetative propagation.  
**Ans :** OD 2017  
This method can be practised for growing such plants which usually do not produce seeds or produce non-viable seeds.
- 63.** How many vas deferences are there in male reproductive system?  
**Ans :** Foreign 2016  
Two.
- 64.** Name the male and female gonads in human beings.  
**Ans :** Delhi 2017  
Male gonad : Testis  
Female gonad : Ovary
- 65.** What name is given to primary sex organs?  
**Ans :** Delhi 2016  
Gonads.
- 66.** How many fallopian ducts are there in female reproductive system?  
**Ans :** Foreign 2017  
Two
- 67.** Name the male and female gametes in animals.  
**Ans :** SQP 2016  
Male gamete : sperm  
Female gamete : egg.
- 68.** What happens when vas deferens gets blocked?  
**Ans :** OD 2015, Delhi 2014  
Sperms will not pass down from testis to semen.
- 69.** What is the function of petals?  
**Ans :** OD 2014  
Usually colourfull Petals help in the insect pollination of plants by attracting them.
- 70.** Name any two hermaphrodite animals.  
**Ans :** Delhi 2015  
(i) Tapeworm  
(ii) Earthworm.
- 71.** Name two types of openings of female reproductive system.  
**Ans :** Delhi 2014, Delhi 2014  
(i) Vaginal opening.  
(ii) Urethral opening.
- 72.** What is the function of DNA?  
**Ans :** Foreign 2015  
DNA is genetic material which is the information source of whole body design for making proteins.
- 73.** How do different organisms get different body designs?  
**Ans :** Comp. 2014  
Different adaptations and proteins eventually lead to different body design due to variations in their DNA.
- 74.** Where is DNA found in a cell?  
**Ans :** SQP 2015  
Nucleus, Mitochondria and Chloroplast.
- 75.** When an organism bears both the types of sex organs, what name is given to such organism?

- Ans :** SQP 2014  
Bisexual or hermaphrodite.
- 76.** Name two multicellular organisms which reproduce by asexual reproduction.  
**Ans :** OD 2015  
Sponge and Hydra.
- 77.** Name the process by which organisms produce new young ones?  
**Ans :** OD 2013  
Reproduction.
- 78.** How do unicellular organisms reproduce?  
**Ans :** Delhi 2015  
Unicellular organisms reproduce by asexual reproduction such as fission in bacteria.
- 79.** Name few plants which reproduce by layering.  
**Ans :** Delhi 2014  
Hibiscus, jasmine, guava and lemon, etc.
- 80.** What is the product of fertilisation?  
**Ans :** Foreign 2015, Delhi 2011  
Diploid Zygote
- 81.** Name the agents that help in cross-pollination.  
**Ans :** Foreign 2014  
Wind, water and insects.
- 82.** How is the AIDS prevented?  
**Ans :** Comp 2015  
AIDS can be prevented by using condom during sexual contact.
- 83.** An organism produces two different gametes which fuse to form new individual. What do you call this type of reproduction?  
**Ans :** Comp 2014  
Sexual reproduction.
- 84.** Why do organisms reproduce?  
**Ans :** OD 2015  
Reproduction is necessary to ensure the existence of any species by producing young ones.
- 85.** Name the male and female reproductive parts of flower.  
**Ans :** OD 2014  
Male : Stamen.  
Female : Carpel (Pistil).
- 86.** What is the other name of tissue culture?  
**Ans :** Delhi 2015  
Micro-propagation
- 87.** List any two contraceptive methods practiced only by women.  
**Ans :** Delhi 2014  
(i) Use of IUD contraceptive devices like Copper-T.  
(ii) Surgical method such as Tubectomy.
- 88.** Write two modes of reproduction.  
**Ans :** Foreign 2015  
(i) Asexual reproduction.  
(ii) Sexual reproduction.
- 89.** What is the reproductive organ in higher plants?  
**Ans :** Foreign 2014, Delhi 2010  
Flower
- 90.** Name the body part where fertilisation occurs in human female ?  
**Ans :** OD 2012  
Fallopian tube.
- 91.** Name the types of nucleic acids.  
**Ans :** Delhi 2013  
DNA (Deoxyribonucleic Acid)  
RNA (Ribonucleic Acid).
- 92.** Name parts of a stamen.  
**Ans :** Delhi 2012  
(i) Filament  
(ii) Anther.
- 93.** What does involve at the most basic level of reproduction?  
**Ans :** Foreign 2013  
Reproduction at its most basic level involves making copies of the blue prints of body design, known as DNA from parent to child.
- 94.** Where are the pollen grains produced?  
**Ans :** Foreign 2012  
Pollen grains are produced in the anthers.
- 95.** Name an IUCD ?  
**Ans :** SQP 2013  
Copper T

96. What is the expanded form of AIDS ?

**Ans :** Comp. 2013  
Acquired Immuno Deficiency Syndrome.

97. How do we know that two different organisms belong to the same species ?

**Ans :** OD 2013  
Species is the group of living organisms. Consisting of similar individuals capable of exchanging gene or interbreeding.

98. By which part bryophyllum reproduces ?

**Ans :** OD 2012, Delhi 2010  
By vegetative buds of leaves.

99. Where is embryo sac present in the flower ?

**Ans :** Delhi 2013  
Embryo sac is present in ovule of ovary.

100. What is the primary sex organ in human female?

**Ans :** Delhi 2012  
Ovary

101. Explain how do organisms create an exact copy of themselves.

**Ans :** Foreign 2013  
Through asexual reproduction in which a single organism reproduce the exact copy of themselves known as clone.

102. Why cannot fertilisation take place in flowers if pollination does not occur?

**Ans :** Comp 2011  
If pollination does not occur, male gamete is not available to the female part of flower, hence fertilisation (fission of haploid male and female gametes) will not take place.

103. Out of the following plants which two plants are reproduced by vegetative propagation?

Jasmine, Wheat, Mustard, Banana  
**Ans :** OD 2013  
Jasmine and banana.

104. Leaves of Bryophyllum fallen on the ground to produce new plants. Why ?

**Ans :** Comp 2017  
Bryophyllum bears adventitious buds in the notches along the leaf margin. When the buds fall on the soil they develop into new plants under favourable conditions.

105. State in brief two functions of copper-T used by some women.

**Ans :** OD 2011  
Copper-T prevents implantation of embryo. Hence, it prevents pregnancy. It is a long term (5-10 years) contraceptive method.

106. List any two reasons for adopting contraceptive methods.

**Ans :** Delhi 2011  
(i) Population control.  
(ii) To prevent unwanted pregnancies.

## TWO MARKS QUESTIONS

107. Give reason why herbivorous animals have longer, small intestine than carnivorous animals?

**Ans :** OD 2024  
Herbivorous animals have longer, small intestine than carnivorous animals because they eat grass which contain cellulose and the digestion of cellulose takes a longer time.

108. You soak seeds of bean and observe them after 2-3 days. What will be your observations?

**Ans :** Delhi 2019  
It will be observed that the seed coat would become soft and gets ruptured. Between the two cotyledons of the bean, radical emerges first and this is followed by emergence of leafy plumule.

109. With the help of diagram show the different stages of binary fission in Amoeba.

**Ans :** OD 2017

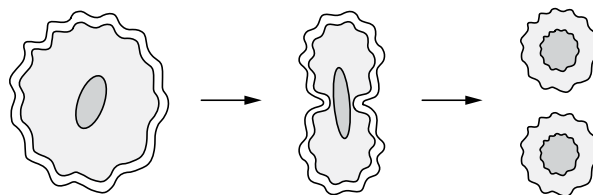


Figure: Binary fission in Amoeba

In Amoeba, asexual reproduction in suitable conditions takes place by binary fission. In this process, the Amoeba divides into two daughter cells

and each one of them grows into an adult organism. During this, the nuclear division takes place first, followed by the appearance of a constriction in the cell membrane, which gradually increases inwards and divides the cytoplasm into two parts. Finally, two daughter organisms are formed.

**110.** How do following organisms reproduce by asexual reproduction?

- (a) Hydra
- (b) Planaria
- (c) Malarial parasite
- (d) Potato

**Ans :**

OD 2016, Delhi 2011

- (a) Hydra — Budding/Regeneration.
- (b) Planaria — Regeneration.
- (c) Malarial parasite — Multiple fission.
- (d) Potato — Vegetative propagation by stem.

**111.** What is the basic event in reproduction?

**Ans :**

Delhi 2017

The basic event in reproduction is the creation of a parent DNA copy. Cells use chemical reactions to build copies of their DNA. This creates two copies of the DNA in a reproducing cell and they need to be separated from each other. For this it is necessary to create an additional cellular structure. Thus, DNA copies separate to these two cells.

**112.** What is grafting? What do the terms 'stock' and 'scion' mean in grafting?

**Ans :**

Delhi 2016

Grafting is a method in which two parts of two closely related plants are joined in such a way that they grow as one plant.

'Stock' is the rooted plant in which grafting is performed. 'Scion' is the portion of other plant (bud, branch etc.) that is grafted on the stock.

**113.** What will happen when :

- (a) A mature Spirogyra filament attains considerable length?
- (b) Planaria gets cut into two pieces?

**Ans :**

OD 2017

- (a) If a mature Spirogyra attains considerable length, its filament breaks into smaller fragments and each fragment gives rise to a new filament through fragmentation.
- (b) If a Planaria is cut into two pieces each piece regenerates into a new Planaria.

- 114.** (a) Trace the path of sperms from where they are produced in human body to the exterior.
- (b) Write the functions of secretions of prostate gland and seminal vesicles in humans.

**Ans :**

Foreign 2016, Delhi 2011

- (a) The sperms produced in testes are delivered through the vas deferens which unites with a another tube urethra emerging from urinary bladder. Urethra carries the sperms to an organ called penis. The penis passes the sperms from the man's body into vagina in the woman's body during mating.
- (b) (i) **Seminal vesicles** : It secretes alkaline secretions which lower the pH of the semen and provide nourishment to sperms.
- (ii) **Prostate glands** : The secretions of these glands keeps the sperms active and mobile. It secretes fluid comprising up to a third of semen volume and assists sperm motility.

**115.** Variations are important for the survival of species overtime. Justify this statement with reasons.

**Ans :**

SQP 2017

Variations (change in DNA structure) help the individuals to survive even after the drastic change occur in nature due to accumulations of various new which leads to evolution of new species. Which is more suitable to these new changes in environment. These changes may be in the niche, temperature, salinity or water levels, etc.

**116.** Why is DNA copying necessary during reproduction?

**Ans :**

OD 2013

Because DNA is a genetic biomolecule which carries genetic information from one generation to another and errors in DNA copying leads to variation which not only gives better survival advantage to an organism but also leads to evolution.

**117.** Mention the two functions of human testes.

**Ans :**

Comp. 2016

The function of testes are :

- (i) to produce the male sex cells or male gametes called sperms
- (ii) to produce the male sex hormone called testosterone.

**118.** Are the two cells formed in reproduction are identical?

**Ans :**

OD 2017

The two cells are identical or not it depends on

the copying reactions. No biochemical reaction is absolutely reliable. So, there are some variations occur in the copying of the DNA each time. As a result, the DNA copies generated will be similar, but not be identical to the original. Thus, surviving cells are similar to, but subtly different from each other.

119. Draw a labelled diagram of human male reproductive system.

Ans :

OD 2016

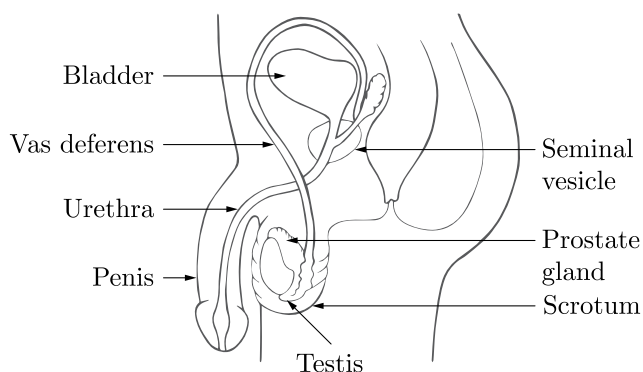


Figure: Human male reproductive system.

120. Draw a labelled diagram of a human female reproductive system.

Ans :

Delhi 2017

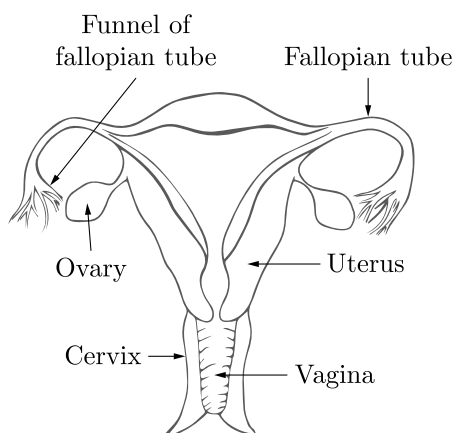


Figure: Human female reproductive system.

121. (a) Write full form of DNA.  
(b) Why are variations essential for the species?

Ans :

Delhi 2016

- (a) Deoxyribonucleic Acid.  
(b) It important for the survival of species through evolution.

122. (a) What is vegetative propagation ?  
(b) Write any two advantages of practising this method.

or

List two advantages of vegetative propagation.

Ans :

Foreign 2017

- (a) **Vegetative propagation** : Is a sexual method of reproduction by which new plants are developed by using the vegetative parts of the plants, like roots, leaves or stems.  
(b) **Advantages of practising vegetative propagation** :  
(i) It is useful for those plants which do not have seeds or have few seeds only.  
(ii) New plants can be produced in comparatively very less time.

123. What are the various methods of asexual reproduction?

Ans :

Foreign 2016, Delhi 2012

- (a) Fission  
(b) Budding  
(c) Regeneration  
(d) Spore formation  
(e) Vegetative propagation

124. Leaves of Bryophyllum fallen on the ground produce new plants, whereas the leaves of Jasmine do not. Why ?

Ans :

SQP 2017

In case of Bryophyllum. It bears adventitious buds produced in the notches along the leaf margin, when these leaves fall on the soil they develop into a new plant. But in case of Jasmine, no such buds are produced in the notches of leaves.

125. What are the disadvantages of natural vegetative propagation?

Ans :

Comp 2016

The disadvantages of natural vegetative propagation are :

- (i) There is less adaptability to the environment since there is no genetic variation.  
(ii) The disease of the parent plant gets transferred to the offspring.



- (iii) Undesirable characters cannot be eliminated.  
 (iv) New characters cannot be introduced.

**126.** The organisms formed by asexual reproduction are considered as clones. Why? State the advantage of sexual reproduction over asexual reproduction.

**Ans :**

OD 2017

Organisms produced by asexual reproduction contain exactly the same number of chromosomes and same DNA sequence as the parent cells. Hence, they have no variations from parent and look like and same DNA sequence clones.

Sexual reproduction results in the mixing of gametes of two individuals, hence variation occurs in offspring leading to evolution.

**127.** What is meant by pollination? Name and differentiate between the two modes of pollination in flowering plants.

**Ans :**

OD 2016

**Pollination :** Is the process of transfer of pollen grains from the anther to the stigma of flower. If this transfer of pollen occurs in the same flower or flowers of same plant, it is referred to as self-pollination whereas if the pollen is transferred from one flower to another of same species, it is known as cross-pollination.

**128.** Mention the role of sex hormones in human reproduction.

**Ans :**

Delhi 2017

The role of sex hormones in human reproduction are following :

- They regulate the process of sperm and egg formation.
  - They regulate the functions of various glands associated with reproductive systems.
  - They develop secondary sex characters.
- 129.** Name the female reproductive part of a flower. Which part of a flower develops into a seed and a fruit? Where are the male germ cell and female gamete produced in a flower?

**Ans :**

OD 2015, Delhi 2012

- Carpel is the female reproductive part of a flower.
- Ovule develops into seed while ovary develops into fruit.
- In a flower, male germ cells are produced by pollen grain, while female gametes are present in the ovule.

**130.** Explain external and internal fertilisation.

**Ans :**

Delhi 2016

Fertilisation is the process of fusion of haploid male and female sex cell, i.e., sperm and ovum, which results in formation of zygote.

**External fertilisation :** When the process of fusion of male and female gametes takes place outside the body of female, it is called external fertilisation, e.g., fishes and frogs.

**Internal fertilisation :** When the process of fusion of male and female gametes takes place inside the body of female, it is called internal fertilisation, e.g., birds, reptiles and mammals including human beings.

**131.** What are sexually transmitted diseases? Name few of them.

**Ans :**

Foreign 2017

The diseases which take place when a healthy person establishes sexual contact with an infected person, are called sexually transmitted diseases (STDs) e.g., Gonorrhoea, syphilis and AIDS

**132.** How is the amount of DNA maintained in each generation?

**Ans :**

OD 2016

In sexual reproduction, the amount of DNA is maintained in each generation by a specialized mode of cell division called meiosis which produces specialized male and female germ cells called gametes which are haploid. One male and female gamete fertilize to give rise to a diploid zygote which has the same chromosome number as the parent. This process maintains the chromosome number and the amount of DNA in each generation.

In asexual reproduction, mitosis takes place and only a single parent is involved number of chromosomes in progeny remain constant.

**133.** What are the functions of testis in the human male reproductive system? Why are these located outside the abdominal cavity? Who is responsible for bringing about changes in appearance seen in boys at the time of puberty?

**Ans :**

Foreign 2015, Delhi 2012

The functions of testes are (i) to produce male sex cells called sperms and (ii) to produce the male sex hormone called testosterone. The testosterone hormone brings about sexual secondary sex changes seen in the appearance of boys at the time of puberty. The testis are outside the abdominal cavity of the body because the sperm formation requires a lower

temperature than the normal body temperature. Being outside the abdominal cavity, the temperature of scrotum is about  $3^{\circ}\text{C}$  lower than the temperature inside the body. In this way, testis provide an optimum temperature for the formation of sperms.

- 134.** List the advantages of sexual reproduction.

**Ans :**

OD 2014

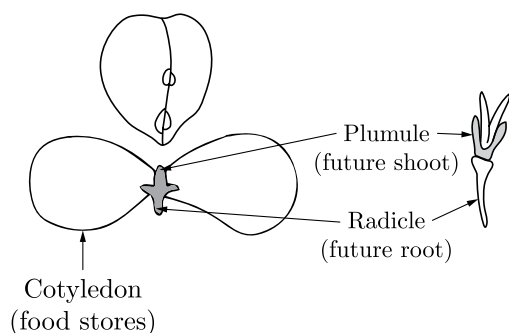
Sexual reproduction has many advantages, for example :

- There is always a possibility of diversity of characters in the offspring because the offspring is formed as a result of fusion of two gametes produced by two different individuals — the male and the female parents.
  - There is every opportunity for new combinations of characters, i.e., variations.
  - New variation are essential for evolution and the origin of new species.
- 135.** How does the process of seed germination take place in plants? Describe in brief.
- Ans :**
- Delhi 2015
- After fertilization, ovule develops a tough coat and is gradually converted into a seed. The seed contains a future plant or embryo which develops into a seedling containing plumule and radicle under suitable conditions such as water or moisture in soil, air, sunlight, etc. This process is known as seed germination.
- 136.** (a) Name an organism in which binary fission occurs in a definite orientation.  
 (b) Draw a neat diagram of a germinating seed and label on it the following :  
 Cotyledon, Plumule, Radicle.

**Ans :**

Foreign 2014

- Leishmania
- 



- 137.** In a bisexual flower inspite of the young stamens being removed artificially, the flower produces fruit. Give reasons.

**Ans :**

Foreign 2014

Even if the young stamens are removed, the pistil remains intact. So, when cross-pollination occurs, it leads to fertilization and hence formation of fruits takes place.

- 138.** How does the process of budding differ from the process of spore formation?

**Ans :**

SQP 2015

Budding is the process of asexual reproduction where bud develops as an outgrowth of body due to repeated cell division and grows into tiny individuals when matures which can later separate from parent body e.g. hydra.

Spore formation is the process of asexual reproduction in which tiny bulb like structures called sporangia develop in organisms like Rhizopus. Sporangia contains minute, single celled and thin or thick walled spores which grow into new organisms in suitable environment conditions.

- 139.** What are sexually transmitted diseases? Name an STD which damages the immune system of human body.

**Ans :**

Comp. 2014

Diseases that spread through the sexual contact, are called sexually transmitted diseases.

An STD which damages the immune system of human body is AIDS.

- 140.** Compare the vegetative propagation in Bryophyllum and money plant.

**Ans :**

OD 2015, Delhi 2013

- In Bryophyllum, adventitious buds are present in the notches along the leaf margin. When leaves fall on the ground, the buds develop into small plants under favourable conditions.
- In money plant, the nodes of stem can reproduce and give rise to new plant under favourable conditions.

- 141.** List four points of significance of reproductive health in a society. Name any two areas related to reproductive health which have improved over the past 50 years in our country.

**Ans :**

OD 2014

**Significance or reproductive health:**

- Prevent STDs,
- Advantage of small family,

- Less mortality among new borns,
- Reduces the cases of maternal mortality.

**Areas which have improved :** Family planning and Decreases in STD cases.

- 142.** Protozoans reproduce by binary fission as well as by multiple fission. In your opinion, which process is better and why?

**Ans :**

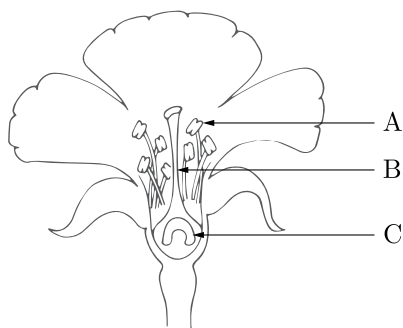
Delhi 2015

In my opinion multiple fission is better because it forms a protective cyst and at one time so many daughter cells can be produced which increase survival changer of species.

- 143.** Name the parts A, B and C shown in the given diagram above and, state one function of each part.

**Ans :**

Delhi 2014, Delhi 2014



**Ans :**

- A. **Anther** : produces pollen grains.  
 B. **Style** : passage of pollen tube.  
 C. **Ovary** : ovary contains ovules. After fertilization ovary develops into fruit while ovule matures into seed.
- 144.** (a) Name two animals which reproduce asexually.  
 (b) What are the male and female gonads in human beings known as?

**Ans :**

Foreign 2015

- (a) (i) Hydra,  
 (ii) Spirogyra  
 (b) Male gonad : Testis  
 Female gonad : Ovary

- 145.** What is placenta? State its any two roles during pregnancy.

**Ans :**

Delhi 2014

Placenta is a specialised vascular tissue attached to uterus that provides all requirements of the foetus during pregnancy.

**Role :**

- (i) It provides nutrition to the foetus.  
 (ii) The waste substances generated by the foetus are excreted out through the placenta.

- 146.** In what respect is the human male gamete different from the female gamete?

**Ans :**

Comp 2015

	Male gamete	Female gamete
(i)	These are smaller.	These are larger because they contain food reserve.
(ii)	They are motile.	They are non-motile.

- 147.** State the significance of human testis being located in the scrotum.

**Ans :**

Delhi 2014

Development and production of sperms need a temperature less than the body temperature. Scrotum protects the testes by regulating its temperature.

- 148.** (a) List two reproductive parts of a flower.  
 (b) How is a unisexual flower different from a bisexual flower? State in brief.

**Ans :**

OD 2015

- (a) The two reproductive parts of a flower :  
 (i) Stamen (male part).  
 (ii) Pistil/Carpel (female part).  
 (b) Unisexual flower has either stamen or carpel in it i.e., it has only male or female part, whereas bisexual flower has both stamen and carpel i.e., it has both male and female parts.

- 149.** Define reproduction. How does it help in providing stability to the population of species?

**Ans :**

OD 2014

The production of new organisms from the existing organisms of the same species is known as **reproduction**.

The rate of birth and death in a given population determine its stability. The rate of birth should be approximately equal to the rate of death. So, by checking birth rate, which is increasing at an alarming rate, stability to population of species can be provided.

- 150.** In tobacco plant, the male gametes have 24 chromosomes. State the number of chromosomes in (i) egg nucleus, (ii) zygote, (iii) endosperm and (iv) leaf cell.

**Ans :**

Delhi 2015

- (i) Chromosomes in egg Nucleus — 12  
 (ii) Zygote — 24  
 (iii) Endosperm — 36  
 (iv) Leaf cell — 24
- 151.** (a) Surgical methods can be used to create a block in the reproductive system for contraceptive purposes. Name such parts where blocks are created in :  
 (i) males  
 (ii) females  
 (b) State any two reasons for using contraceptive devices.

**Ans :**

Delhi 2014

- (a) (i) Vas deferens  
 (ii) Fallopian tube  
 (b) Reasons for using contraceptive devices :  
 (i) Spacing between children.  
 (ii) Avoiding infectious STDs.
- 152.** What are the advantages and disadvantages of asexual reproduction?

**Ans :**

OD 2015

The only advantage of asexual reproduction is that it is fast and simple and progeny is clone of parent.  
 Disadvantages of asexual reproduction :

- (a) No variations are produced. Hence no evolutionary change takes place.  
 (b) In case of any defect in the parent organism, it is passed on to the offspring.
- 153.** State the mode of reproduction in following organisms: Earthworm, Frog, Rhizopus, Plasmodium

**Ans :**

Foreign 2014

Earthworm — Sexual reproduction  
 Frog — Sexual reproduction  
 Rhizopus — Spore formation  
 Plasmodium — Multiple fission

- 154.** Name the sex hormones secreted by male and female sex organs in human beings. State one function of each.

**Ans :**

OD 2013, Delhi 2010

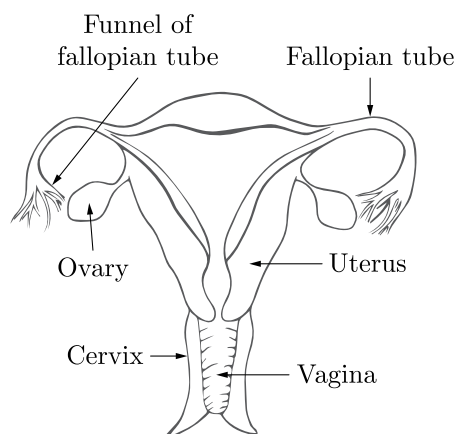
- (i) **Hormones secreted by male sex organ :**  
 Testosterone — It controls the production of sperms.  
 (ii) **Hormones secreted by female sex organ :**  
 Estrogen — It controls the production of ova.

- 155.** (a) Draw a neat diagram of female reproductive system in human being and label :  
 (i) the part which secretes ova.  
 (ii) the part where implantation takes place.  
 (b) What happens if the fallopian tube is blocked?

**Ans :**

OD 2012

- (a)



- 156.** In a sexually reproducing plant, what happens to zygote formed after fertilization? State in brief.

**Ans :**

Delhi 2013

Zygote divides to form embryo within ovule. Ovule develops a tough coat and converts into seed, while Ovary ripens to form fruit. After seed germination embryo develop into new plant.

- 157.** (a) Give reason : regeneration is not the same as reproduction.  
 (b) State the mode of asexual reproduction in Plasmodium.

**Ans :**

OD 2013

- (a) Regeneration is not the same as reproduction since most organisms would not be able to reproduce if cut. It is the ability to repair body parts, not to produce a new individual.  
 (b) Multiple fission.

- 158.** (a) What is the site of implantation and development of young one in human female ?  
 (b) Mention two advantages of using mechanical barriers during sexual act.

Ans :

Foreign 2013

- (a) Uterus.  
 (b) (i) It prevents from STD's.  
 (ii) It prevents the entry of sperms in female genital tract.

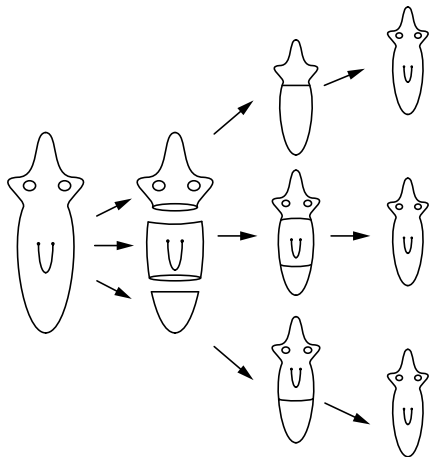
159. What is regeneration of an organism? Describe with a neat diagram the different steps of regeneration in Planaria.

Ans :

SQP 2012

**Regeneration :** The ability of an organism to replace its lost body parts is called regeneration.

**Regeneration in Planaria :** In the body of Planaria, specialised cells, which can carry out regeneration, are present. When Planaria gets cut into pieces, these cells proliferate and make large number of cells. From this mass of cells, different cells undergo changes to become various cell types and tissues. These changes take place in an organised sequence and a complete Planaria grows.



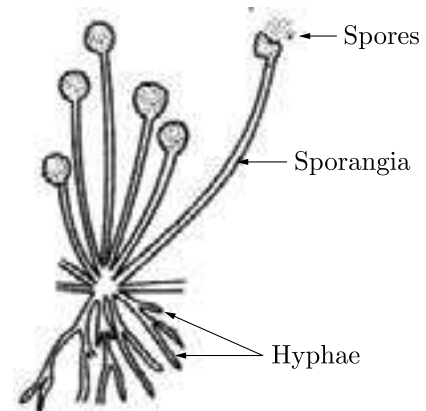
160. How does Rhizopus multiply by spores? Explain in brief. Sketch neat labelled diagram of this method.

Ans :

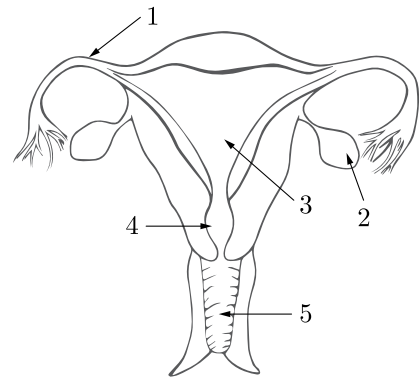
OD 2012, Delhi 2010

Hyphae of Rhizopus produces tiny structures called sporangia. In these bulbs of sporangia, a number of spores are produced through mitosis cell division which are covered by thick walls.

On maturation, sporangia burst and release spores which germinate into new mycelium in moist conditions.



161. (a) Name the parts 1 to 5 of human female reproductive system.  
 (b) Name the part in which fertilization takes place in this system.



Ans :

SQP 2012, Delhi 2011

- (a) 1. Fallopian tube, 2. Ovary, 3. Uterus, 4. Cervix, 5. Vagina  
 (b) Fertilization takes place in fallopian tube.  
 (b) If the fallopian tube is blocked, no fertilization will take place as the ovum and sperm will not be able to fuse.

162. Pre-natal sex determination has been prohibited by law. State two reasons.

Ans :

OD 2013

Pre-natal sex determination has been prohibited because of;

- (i) Reckless female foeticide.  
 (ii) Declining female sex ratio.

163. What is meant by pollination? List its two types. State any two agents which help in pollination.

Ans :

OD 2012

Pollination is the process of transfer of pollen grains from the anther of stamen to the stigma of pistil of

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the flower.

**Types of pollination :**

- (i) Self-pollination
- (ii) Cross-pollination.

**Agents that help in pollination :** Wind and animals.

164. (a) How do the oral pills function as contraceptives ?

- (b) The use of these pills may be harmful. Why ?

**Ans :**

Foreign 2012

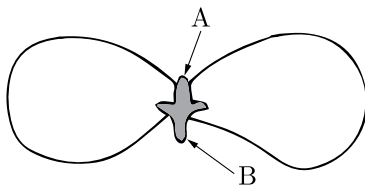
- (a) Oral pills function by changing the hormonal balance of the body. This prevents release of ova from the ovary and hence fertilization does not occur.
- (b) These pills cause change in hormonal balance which may cause some side effects on the body.

165. (a) Name the parts of the flower which ripen to form fruit and seed.

**or**

What will happen to ovary and ovule after fertilization in angiosperm plants?

- (b) In the following diagram label A and B.



**Ans :**

Comp 2013, Delhi 2011

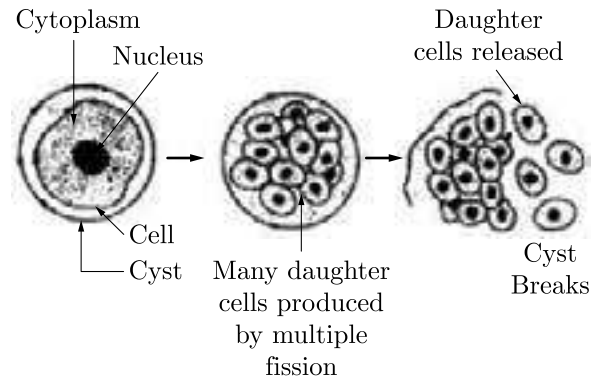
- (a) After fertilization, ovary changes into fruit while ovule changes into seed.
- (b) (A) Plumule, (B) Radicle

166. What is multiple fission ? How does it occur in an organism ? Explain briefly. Name one organism which exhibits this type of reproduction.

**Ans :**

Delhi 2012

Division of single called organisms such as malarial parasite plasmodium into many daughter cells simultaneously is termed **multiple fission**. During multiple fission, organism secretes a protective covering, the cyst around the cell. Inside the cyst, nucleus divides several times to form a number of daughter nuclei. Each daughter nucleus gets surrounded with a bit of cytoplasm. Thus, a large number of daughter individuals are formed. On the arrival of favourable conditions, the cyst ruptures and single-celled daughter individuals are set free, which grows into a complete organism.



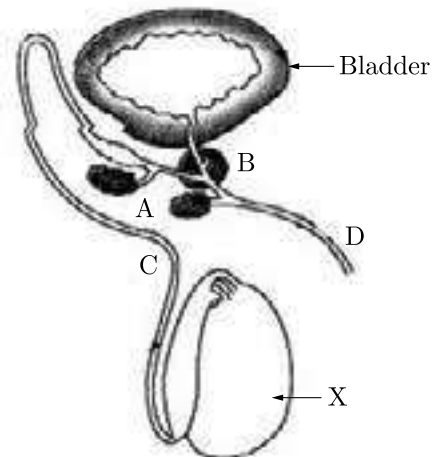
**Figure:** Multiple fission in plasmodium.

167. (a) Identify the asexual method of reproduction in each of the following organisms :
- (i) Rose, (ii) Yeast, (iii) Planaria
- (b) What is fragmentation? Name a multicellular organism which reproduces by this method.

**Ans :**

OD 2013, Delhi 2011

- (a) (i) Vegetative propagation by stem  
(ii) Budding  
(iii) Regeneration.
- (b) Fragmentation is a method of asexual reproduction in which a multicellular organism breaks up into smaller pieces upon maturation. These pieces or fragments grow into new complete individuals. A multicellular organism which reproduces by this method is spirogyra.
168. In the diagram of human male reproductive system given below :
- (a) Label parts A and B.
  - (b) Name the hormone produced by organ 'X'. What is the role of this hormone in the human male ?
  - (c) Mention the name of substances that are transported by tubes (i) C, and (ii) D.



**Ans :**

Comp 2013

- (a) A : Seminal vesicle, B : Prostate gland.  
 (b) The organ 'X' testis produces testosterone hormone.

**Role :**

- (i) It controls sperm formation.  
 (ii) It is responsible for secondary sexual characters.  
 (c) Tube C : Sperms.  
 Tube D : Sperms/Semen and urine.

169. Which kind of contraceptive method prevents STDs and how ?

**Ans :**

Comp 2012, Delhi 2009

Barrier method prevents STDs because by this method there is no direct contact of genital organs of male and female and thus it prevents transmission of infection.

### THREE MARKS QUESTIONS

170. (i) Name three techniques/devices used by human females to avoid pregnancy. Mention the side effects caused by each.  
 (ii) What will happen if in a human female (a) fertilisation takes place, (b) an egg is not fertilised?

**Ans :**

OD 2024

- (i) The three techniques/devices used by human females to avoid pregnancy are :

- (a) Cervical Cap and Diaphragm

**Side effects :** If not fitted properly, it can lead to sexually transmitted infections and can cause vaginal irritation.

- (b) Loop and Copper-T

**Side effects :** They can cause irritation of the uterus, excess menstrual bleeding, pain and risk of infection.

- (c) Tubectomy

**Side effects :** If not performed properly, it can cause infections and other problems.

- (ii) (a) If fertilization takes place, it will stop menstruation in females.  
 (b) If an egg is not fertilised, the overgrown lining of the uterus breaks down and comes out along with the unfertilized egg through the vagina with blood and mucus.

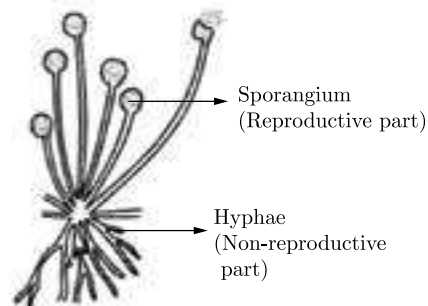
171. (i) Draw a diagram showing spore formation in Rhizopus and label the (a) reproductive and (b) non-reproductive parts. Why does Rhizopus not multiply on a dry slice of bread?

- (ii) Name and explain the process by which reproduction takes place in Hydra.

**Ans :**

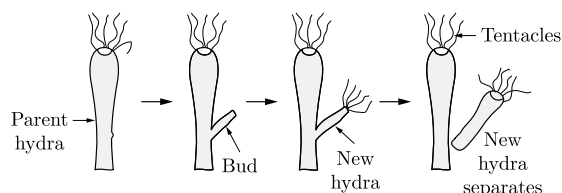
OD 2024

- (i) Diagram showing spore formation in Rhizopus



Rhizopus does not multiply on a dry slice of bread due to the lack of moisture.

- (ii) Hydra use regenerative cells for reproduction in the process of budding. In hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and when fully mature, detach from the parent body and become new independent individuals.



172. Name the process of reproduction observed in yeast. Design an activity to observe this mode of reproduction in a school laboratory. Name one more organism which reproduces by this mode.

**Ans :**

Delhi 2020

- Yeast reproduce through budding, a mode of asexual reproduction.
- Observe the permanent slide of yeast under compound micro scope or grow yeast in a sugar solution and then observe under compound microscope.
- Hydra also reproduce through budding.

173. What is carpel? Write the function of its various parts.

**Ans :**

OD 2019

The flask-shaped organ in the centre of a flower is called carpel. It is also called as female reproductive organ of the plant.

It is made up of three parts :

1. Stigma, 2. Style, 3. Ovary.

1. Stigma is the top part of carpel and is sticky. So, it receives the pollen from the anther of stamen.
2. Style connects stigma to ovary and acts as the passage for the growth of pollen tube.
3. Ovary contains female gametes of the plant and helps in reproduction, it is the site of fertilization.

**174.** Distinguish between pollination and fertilisation. Mention the site and the product of fertilisation in a flower.

**Ans :**

OD 2019

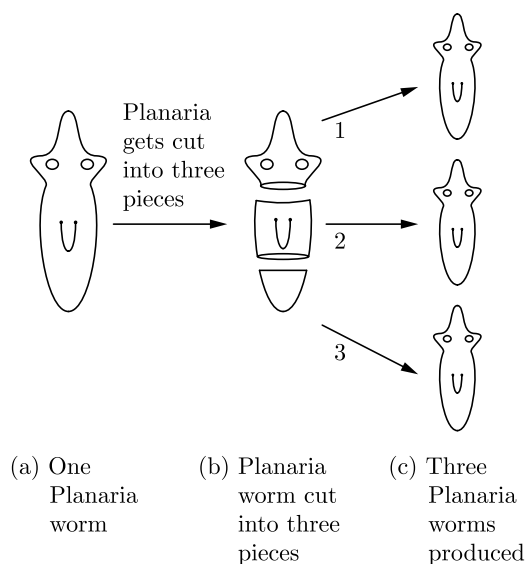
1. The transfer of pollen grains from anther of a stamen to the stigma of a carpel is called pollination whereas fertilisation is the process when the male gamete present in pollen grain joins the female gamete present in ovule.
2. Pollination is an external mechanism whereas fertilisation is an internal mechanism which takes place inside the flower.  
Site of fertilisation in flower is ovary.  
Product of fertilisation in flower is zygote.

- 175.** (a) Budding, fragmentation and regeneration, all are considered as asexual mode of reproduction. Why?
- (b) With the help of neat diagrams, explain the process of regeneration in Planaria.

**Ans :**

OD 2019, Delhi 2015

- (a) Budding, fragmentation and regeneration are considered as asexual mode of reproduction because only one parent is involved no sex cells are involved.
- (b) Regeneration in Planaria.



The process of getting back a full organism from its body parts is called regeneration. Planaria reproduces by this method in which if the body of Planaria somehow gets cut into a number of pieces, then each body piece can regenerate into a complete Planaria by growing all the missing parts.

- 176.** Our government launches campaigns to provide information about AIDS prevention, testing and treatment by putting posters, conducting radio shows and using other agencies of advertisements. To which category of diseases AIDS belongs? Name and explain. What is its causative organism? Also give two more examples of such diseases.

**Ans :**

SQP 2018

AIDS belongs to STDs (Sexually Transmitted Diseases). The diseases which are spread by sexual contact with an infected person are called sexually transmitted disease.

Its causative organism is a virus —HIV.

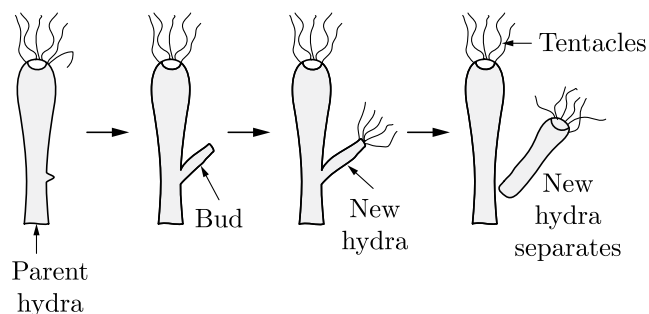
Some examples are:

- (i) Gonorrhoea caused by bacteria
- (ii) Syphilis caused by bacteria
- (iii) Warts

- 177.** Draw a labelled diagram in proper sequence to show budding in hydra.

**Ans :**

OD 2019



- 178.** A student observed a permanent slide showing asexual reproduction in yeast. Draw diagrams of the observations he must have made from the slide. Name the process also.

or

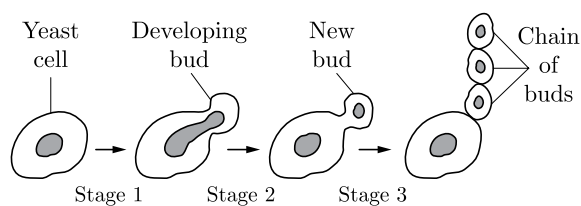
A student is viewing under a microscope a permanent slide showing various stages of asexual reproduction by budding in yeast. Draw diagram of what he observes in proper sequence.

**Ans :**

Delhi 2018

This process is known as Budding method of Asexual Reproduction.





**179.** State one function of each of the following parts of human male reproductive system :

- (i) vas deferens
- (ii) testis
- (iii) prostate gland

**Ans :**

OD 2016, Delhi 2012

- (i) Vas deferens : It provides passage of sperms.
- (ii) Testis : It produces sperm.
- (iii) Prostate glands : It secretes alkaline fluid which is discharged into urethra to neutralise acidity of urine during mating.

**180.** Name the process by which an amoeba reproduces. Draw the various stages of its reproduction in a proper sequence.

**Ans :**

Delhi 2018

Amoeba reproduces by binary fission. It results in division of nucleus followed by division of cytoplasm.

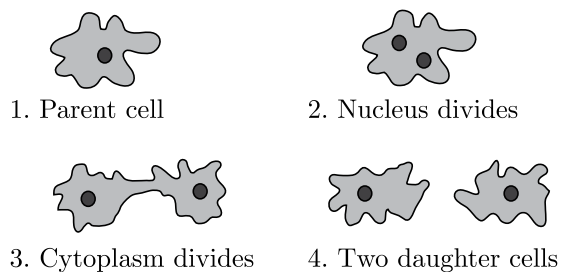


Figure: Binary fission in Amoeba

- 181.** (a) How many eggs are produced every month by either of the ovaries in a human female ? Where does fertilization take place in the female reproductive system ?
- (b) What happens in case the eggs released by the ovary are not fertilized?

**Ans :**

OD 2017

- (a) One egg is produced every month by one of the ovaries. Fertilization takes place in the fallopian tube.
- (b) In case the egg released by the ovary is not fertilized, it lives for about one day. Since the

uterus prepares itself every month to receive a fertilized egg its lining becomes thick and spongy and since it is not required anymore, this lining slowly breaks and comes out through the vagina as blood and mucous. This is known as menstruation.

**182.** Name those parts of a flower which serve the same function as the following do in the animal :

- (i) Testis
- (ii) Ovary
- (iii) Eggs
- (iv) Sperms

**Ans :**

Delhi 2017

- (i) Testis — Anthers
- (ii) Ovary — Ovary
- (iii) Eggs — Egg cell of embryo sac
- (iv) Sperms — haploid male gamete of pollen grain.

**183.** Suggest three contraceptive methods to control the size of human population. Mention two factors that determine the size of population.

**Ans :**

Delhi 2016, OD 2014

- (a) Three contraceptive methods to control the size of human population :
  - (i) One category is the use of a mechanical barrier, e.g., condoms.
  - (ii) Another category of contraceptive acts by changing the hormonal balance of the body so that eggs are not released and fertilization doesn't occur, e.g., oral pills.
  - (iii) Use of intrauterine device like copper-T to prevent pregnancy.
- (b) Two factors that determine the size of population:
  - (i) Rate of birth;
  - (ii) Rate of death.

**184.** How do the following organisms reproduce by asexual methods ?

- (a) Euglena
- (b) Spirogyra
- (c) Ginger
- (d) Chrysanthemum
- (e) Strawberry
- (f) Mango

**Ans :**

Comp 2017

- (a) Euglena — Binary fission.
- (b) Spirogyra — Fragmentation.

- (c) Ginger — Natural vegetative propagation by stems.
- (d) Chrysanthemum — Artificial vegetative propagation by cutting.
- (e) Strawberry — Artificial vegetative propagation by layering.
- (f) Mango — Artificial vegetative propagation by grafting.

**185.** Write one main difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of survival—the one reproducing asexually or the one reproducing sexually? Give reasons to justify your answer.

**Ans :**

Foreign 2016

Asexual reproduction involves only one parent and the off springs produced are clone and similar copies of their parents whereas sexual reproduction involves two parents and the off springs produced are different from their parents. Off springs produced by sexual reproduction have better chances of survival. Sexual reproduction leads to variation because it leads to the formation of offspring by the combination of DNA from both the parents, so the species will have better adaptability and better survival rate.

**186.** Explain the term 'Regeneration' as used in relation to reproduction of organisms. Describe briefly how regeneration is carried out in multicellular organisms like Hydra.

**Ans :**

SQP 2015

**Regeneration :** It is the ability to give rise to new organism, when the individual is cut or broken-up into many pieces.

Hydra use regenerative cells for reproduction in the process of budding. In hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and when fully mature, detach from the parent body and become new independent individuals.

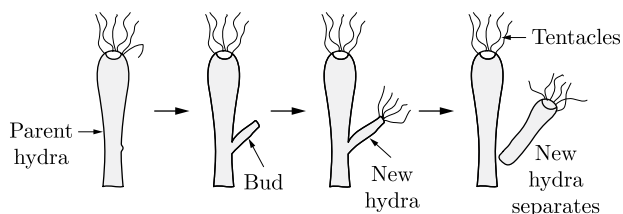


Figure: Budding in Hydra.

- 187.** (a) Explain the terms :  
 (i) implantation, (ii) placenta  
 (b) What is the average duration of human pregnancy?

**Ans :**

Comp. 2016

- (a) (i) The embedding of embryo in the thick lining of the uterus is called implantation.  
 (ii) After implantation, a disc like special tissue develops between the uterus wall and the embryo called placenta. The exchange of nutrients, oxygen and waste products between the embryo and the mother takes place through the placenta.  
 (b) The average duration of human pregnancy is about nine months and ten days (40 weeks).

- 188.** (a) List three distinguishing features between sexual and asexual types of reproduction.  
 (b) Explain why variations are observed in the offsprings of sexually reproducing organisms ?

**Ans :**

OD 2017

(a)

	Asexual Reproduction	Sexual Reproduction
1.	Offspring arises from a single individual parent	It involves two individuals of different sexes-male and female.
2.	Fusion of gametes is not involved.	Fusion of gamete takes place
3.	Meiosis does not occur at any time during reproduction.	Meiosis occurs at the time of gamete formation.

- (b) During sexual reproduction, the DNA copying mechanism is not accurate due to meiosis during haploid sex cells formation and the resultant errors as well as genetic recombination of chromosome of two different individuals i.e., father and mother are a source of variations in populations of organisms.

**189.** How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.

**Ans :**

OD 2016

In sexual reproduction, the amount of DNA is maintained in each generation by a specialized mode of cell division called meiosis which produces specialized male and female germ cells called gametes which are haploid. One male and female gamete

fertilize to give rise to a diploid zygote which has the same chromosome number as the parent. This process maintains the chromosome number and the amount of DNA in each generation.

In asexual reproduction, mitosis takes place and only a single parent is involved number of chromosomes in progeny remain constant.

190. (a) Explain the process of regeneration in planaria.  
(b) How is regeneration different from reproduction?

Ans :

Delhi 2017

- (a) If the body of planaria somehow gets cut into a number of pieces, then each body piece can regenerate into a complete planaria by growing all the missing parts. (see Fig.)  
(b) The process of getting back a full organism from the body parts is called regeneration.

The production of new organisms from the existing organisms of the same species is known as reproduction.

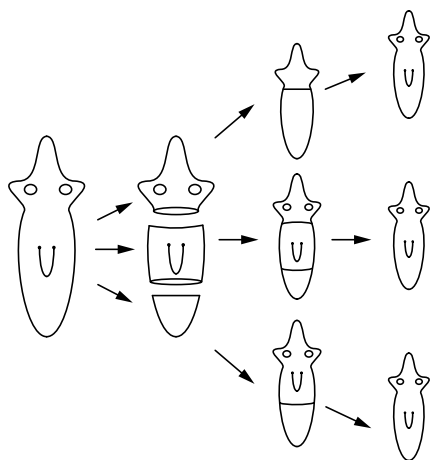


Figure: Regeneration in planaria.

191. Define the following processes of asexual reproduction.  
(a) Spore formation  
(b) Regeneration  
(c) Multiple fission

Ans :

Delhi 2016, OD 2011

- (a) Minute, single-celled, thin or thick-walled spores produced by sporangia develop into new life under suitable conditions.  
(b) Organisms are cut into any number of pieces and each piece grows into a complete organism.  
(c) Unicellular organisms divide into many daughter cells simultaneously.

192. (a) Why is vegetative propagation practised for growing some types of plants?  
(b) Name the different parts of a flower that has germ cells.  
(c) List any two agents of pollination.

Ans :

Foreign 2017

- (a) Vegetative propagation is performed in the plants which do not have viable seeds or seeds which are dormant. Plants which have desirable superior traits are also vegetatively propagated because it results in producing identical plants. Plants which need intensive care during the early stages of their development also are vegetatively propagated.  
(b) Anther of stamen and ovule in ovary of pistil have germ cells.  
(c) (i) Wind,  
(ii) Water.

193. State in brief the function of the following organs in the human female reproductive system :

- (a) Ovary  
(b) Fallopian tube  
(c) Uterus

Ans :

Foreign 2016

- (a) **Function of ovary :** It produces the female gamete (ovum) as well as secretes the female hormones (estrogen and progesterone).  
(b) **Function of fallopian tube :** It is the site of fertilization. Here a female egg may get fused with the male gamete (sperm).  
(c) **Function of uterus :** The fertilized egg gets implanted in the lining of the uterus and starts dividing. Uterus prepares itself every month to receive and nurture the in case of fertilisation embryo.

194. Define the two main methods of reproduction in living organisms.

Ans :

Comp 2017

- (a) Asexual reproduction, in which the offspring arises from a single individual parent. It occurs in unicellular organisms like Amoeba, plants and certain multicellular animals like sponges and hydra.  
(b) Sexual reproduction which essentially involves two individuals – one male and the other female. This zygote develops into embryo and eventually to new born. It occurs in higher organisms. Fusion of their haploid sex cells (sperm and ovum) which is known as fertilisation leads to development of a diploid zygote.

195. List six specific characteristics of sexual reproduction.

Ans :

Delhi 2016

**Characteristics :**

- Two parents are involved.
- Two dissimilar gametes are formed and gamete formation involves meiosis.
- Variations are produced.
- Occurs in all the higher and some of the lower organisms.
- Fertilization of gametes leading to zygote formation.
- Slow process.

196. (a) What is the difference between self-pollination and cross-pollination ?

(b) What happens to the pollen which falls on a suitable stigma ? Explain.

Ans :

OD 2015

(a) Self-pollination is the transfer of pollen grains from the anther of one flower to the stigma of the same flower or another flower of the same plant.

Cross-pollination is the transfer of pollen grains from the anther of one flower to the stigma of another flower growing on another plant of the same species.

(b) Soon after the pollination, the pollen grain starts germinating and forms a pollen tube. The pollen tube grows in the style until it reaches the embryo sac of ovule, where it fertilizes the female gamete.

197. (i) What is vegetative propagation ?

(ii) What methods you will use for growing jasmine and rose plants ?

Ans :

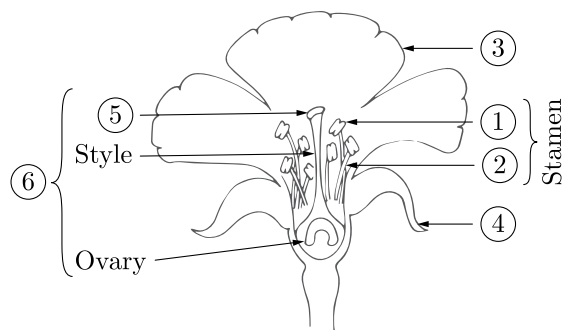
Delhi 2014, OD 2010

(i) It is a means of propagation in which new plants are obtained from the vegetative parts of old plants like stem, roots and leaves, without the help of any reproductive organ. Vegetative propagation is of two types :

(a) Natural and (b) Artificial.

(ii) Layering method of artificial vegetative propagation can be used for growing jasmine plants. Stem cutting method of artificial vegetative propagation can be used for growing rose plant.

198. (a) In the given figure name the parts marked 1 to 6:



(b) Differentiate between self-pollination and cross-pollination.

Ans :

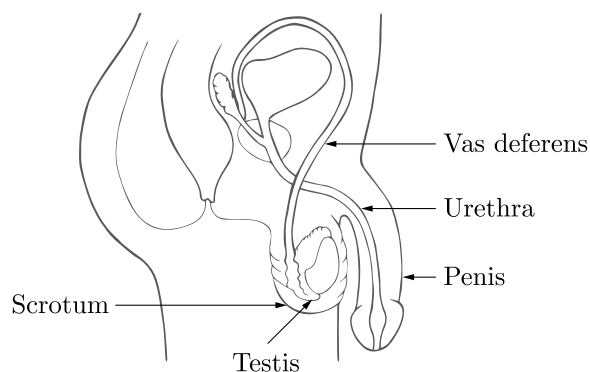
Delhi 2014

(a) 1. Anther, 2. Filament, 3. Petal, 4. Sepal, 5. Stigma, 6. Pistil.

(b) Self-pollination is the transfer of pollen grains from the anther of one flower to the stigma of the same flower or another flower of the same plant.

Cross-pollination is the transfer of pollen grains from the anther of one flower to the stigma of another flower growing on another plant of the same species.

199. A part of the male reproductive system is shown below. Study the diagram and answer the questions that follow.



(a) Two parts have been incorrectly labelled. Identify them.

(b) Give the function of urethra.

(c) Which hormone is released by testis?

Ans :

SQP 2015, OD 2010

(a) Testis, Penis.

(b) It serves as a common passage for both sperms and urine.

(c) Testosterone.

200. (a) State any two changes seen in boys at the time of puberty.  
(b) Define fertilization and implantation.  
(c) State the role of ovary and fallopian tube in human body.

Ans :

Comp 2015

- (a) (i) Boys begin to have thick hair growth on the face.  
(ii) Their voices begin to crack.  
(b) Fertilization is the fusion of haploid male and female gametes to form a diploid zygote.  
Implantation is the process of attachment of embryo in the uterine wall for further development.  
(c) Fallopian tube is the site where fertilization occurs.

Ovary produces female gamete and also secretes female sex hormone estrogen and progesterone.

201. (a) Write the functions of the following parts in human female reproductive system :  
(i) Ovary, (ii) Oviduct, (iii) Uterus.  
(b) Write the structure and function of placenta.

Ans :

Foreign 2015, OD 2012

- (a) (i) **Ovary** : Production of ova and sex hormones.  
(ii) **Oviduct** : Site of fertilization.  
(iii) **Uterus** : Keeps the foetus implanted till complete development.  
(b) **Placenta** : A special tissue embedded in the uterus wall with the help of which human embryo gets nutrition from mother's blood.

**Functions :**

- (i) To provide large surface area for glucose and  $O_2$  to pass through mother's blood to the embryo.  
(ii) The metabolic waste generated by embryo is removed through placenta into mother's blood.

202. Differentiate between :

- (a) Plumule and radicle  
(b) Pollination and fertilization

Ans :

SQP 2016, OD 2014

- (a) Plumule becomes the shoot and the radicle becomes the root of the plant.  
(b) Pollination is the process of transfer of pollen grains from the anther of stamen to the stigma of pistil of the flower.

**Types of pollination :**

- (i) Self-pollination  
(ii) Cross-pollination.

**Agents that help in pollination :** Wind and animals.

**Types of fertilization :**

**External fertilisation :** When the process of fusion of male and female gametes takes place outside the body of female, it is called external fertilisation, e.g., fishes and frogs.

**Internal fertilisation :** When the process of fusion of male and female gametes takes place inside the body of female, it is called internal fertilisation, e.g., birds, reptiles and mammals including human beings.

203. Define pollination. Explain the different types of pollination. List two agents of pollination? How does suitable pollination lead to fertilization?

Ans :

SQP 2019

Pollination is the transfer of pollen from the anther of the stamen to the stigma of the pistil with the help of air, water and insects.

Types of pollination :

1. **Self pollination** : Transfer of pollen grain from the anther to the stigma of the same flower.
2. **Cross pollination** : Transfer of pollen grain from the anther of one flower to the stigma of other flower of the same species.

Two agents of pollination are air, water, insects, winds etc.

When correct species of pollen grain lands on the stigma it results in some chemical response from the ovary that causes the growth of pollen tube from pollen grain. The pollen grain slides down the pollen tube and enters the ovary where it meets the egg. This process is called as fertilization and leads to the formation of zygote.

204. A student wants to germinate dicot seeds. Write the four steps in correct sequence that will help him to perform the experiment in the right way.

Ans :

Comp 2019

Steps to perform seed germination experiment are as follows:

1. Collect 10-15 whole and undamaged dicot seeds of gram, soybean or mungbean.
2. Now put these seeds in a beaker of fresh water or first dip them into water for few minutes and then put them into wet cloth along with a wet cotton ball.

3. Now observe these seeds after 24-26 hours.
4. We with seed white coloured thread like radical (future root) which starts to absorb water actively to initiate development of seedling. It is the result of seed germination.

**205.** What are the aspects included in reproductive health?

**Ans :**

Foreign 2014

The aspects included in the reproductive health are:

- (i) Awareness regarding the fertility regulation method.
- (ii) The right, the freedom and the choice to control child birth.
- (iii) The ability to prevent and control sexually transmitted disease.
- (iv) To manage disorders related to the reproductive system.

- 206.** (a) How will an organism be benefited if it reproduces through spores ?  
(b) How is regeneration different from fragmentation?

**Ans :**

Delhi 2016, OD 2013

- (a) Spores remain viable for a longer period because of presence of a thick wall even under adverse environmental conditions.
- (b) Regeneration involves the production of complete new individuals due to the ability of parent organism to replace its lost body parts. Fragmentation is an asexual mode of reproduction in which a multicellular organism breaks up into smaller pieces upon maturation and these pieces results in formation of a complete new individual. It may or may not involve differentiation.

**207.** Write the two causes of human population explosion. Explain with the help of suitable examples how this explosion can be checked.

**Ans :**

OD 2017

Causes of human population explosion are :

- (i) Poverty,
- (ii) Lack of family planning.

Family planning enables a couple to decide on the number of children they want to have and when to have them. Family planning can be done by practicing birth control measures. Birth control can be done by preventing pregnancy in females. Pregnancy can be prevented either by adopting a

method or procedure by which sperms produced during copulation between man and his wife, can be prevented from meeting the ovum (or egg) and fertilizing it or by preventing implantation of embryo. Since frequent pregnancies add to our already exploding population, so a number of techniques or methods have been developed to prevent pregnancies in women.

**208.** Answer the following questions :

- (a) What happens if an egg is not fertilized?
- (b) Why do we need to adopt contraceptive measures?
- (c) Name one bacterial and one viral sexually transmitted disease.

**Ans :**

Delhi 2015

- (a) If an egg is not fertilized then the entire endometrium or uterus lining is lost along with blood and tissues in the form of menstrual excretions.
- (b) (i) To prevent unwanted pregnancies.  
(ii) To prevent sexually transmitted diseases.  
(iii) For spacing between children.  
(iv) For sound health.
- (c) Bacterial : gonorrhoea: Viral : AIDS.

## FIVE MARKS QUESTIONS

**209.** Give reason for the following:

- (a) During reproduction inheritance of different proteins will lead to altered body designs.
- (b) Fertilization cannot take place in flowers if pollination does not occur.
- (c) All multicellular organisms cannot give rise to new individuals through fragmentation or regeneration.
- (d) Vegetative propagation is practised for growing only some type of plants.
- (e) The parents and off-springs of organisms reproducing sexually have the same number of chromosomes.

**Ans :**

OD 2023

- (a) During reproduction, the information for inheritance of characteristics is passed on from the parents to the offsprings in the form of DNA. DNA in the cell nucleus carry the genetic information. Hence DNA copying is the basic event in reproduction. If the information during the



DNA copying is changed, different proteins will be made. Different proteins will eventually lead to altered body designs.

- (b) The process of fertilisation is the fusion of both male and female gametes. If pollination does not occur it means that the male gamete is not available, hence fertilization cannot take place.
- (c) Regeneration and fragmentation is only possible when the entire body part is made up of similar kind of cells. All multicellular organisms cannot give rise to new individuals through fragmentation or regeneration because the complex multicellular organisms have organ system level organization. The tissues in these organisms are highly differentiated to perform specialized functions and cannot regenerate a new individual.
- (d) Vegetative propagation is practiced for growing some types of plants because of following advantages:
  - (i) It is used to grow a plant in which viable seeds are not formed or very few seeds are produced such as orange, banana, pineapple.
  - (ii) It helps to introduce plants in new areas where the seed germination fails to produce mature plant due to change in environmental factors and the soil.
  - (iii) It is more rapid, easier and cheaper method.
  - (iv) By this method a good quality of a race or variety can be preserved.
- (e) Gametes of sexually-reproducing animals have half the number of chromosomes as that of the parents. During fertilisation, when two gametes i.e. male and female gametes fuse, the offspring produced will have the same amount of DNA or the same number of chromosomes as that of the parent.

- 210.** (a) "Use of a condom is beneficial for both the sexes involved in a sexual act." Justify this statement giving two reasons.
- (b) How do oral contraceptive help in avoiding pregnancies ?
- (c) What is sex selective abortion? How does it affect a healthy society ? (State any one consequence)

**Ans :**

OD 2020

- (a) Using condom for the penis during sex helps to prevent transmission of many of infections to some extent. The sexual act always has the potential to lead to pregnancy. Pregnancy will make major demands on the body and the mind of the woman, and if she is not ready for it, her health will be adversely affected. Therefore,

many ways have been devised to avoid pregnancy. Condoms on the penis or similar coverings worn in the vagina can serve this purpose. Another category of contraceptives acts by changing the hormonal balance of the body so that eggs are not released and fertilisation cannot occur. These drugs commonly need to be taken orally as pills. However, since they change hormonal balances, they can cause side-effects too. Contraception to avoid pregnancy can be achieved by the use of condoms. Thus, use of condoms is beneficial for both the sexes involved in a sexual act.

- (b) Oral contraceptives act by changing the hormonal balance of the body so that eggs are not released and fertilisation cannot occur. Thus, in this way they help in avoiding the pregnancies.
- (c) Sex-selective abortion of female fetuses involves surgical removal of unwanted pregnancies with female foetus. These may be misused by people who do not want a particular child. For a healthy society, the female-male sex ratio must be maintained due to the reckless female feticides, child sex ratio is declining at an alarming rate in some sections of our society, although prenatal sex determination has been prohibited by law in order to protect the abortion of the female foetus.

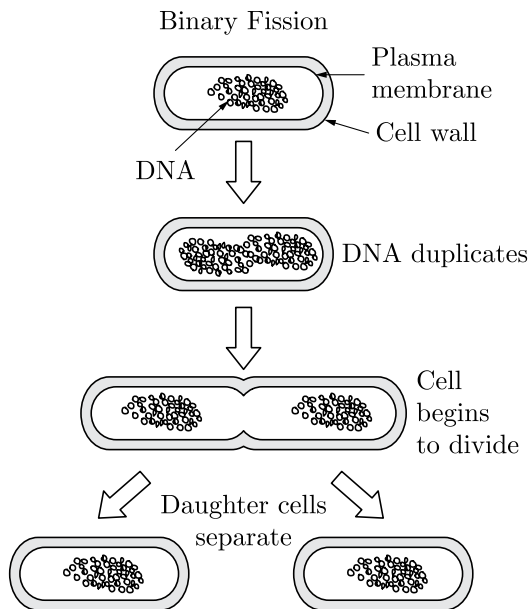
- 211.** (i) Describe the various steps involved in the process of binary fission with the help of a diagram.
- (ii) Why do multicellular organisms use complex way of reproduction ?

**Ans :**

Delhi 2020

- (i) Various steps involved in the process of binary fission are as follows:
- DNA of the parent cell duplicates.
  - The parent cell elongates and a constriction develops.
  - The constriction deepens further and the parent cell divides into two daughter cells, each carrying its own DNA.

This process of splitting of the parent cell into two daughter cells is called binary fission.



(ii) Multicellular organisms cannot reproduce by cell because they are not simple random collection of cells. In them, specialized cells are organized as tissues which are organized into organs. Cell-by-cell division would be impractical. Multicellular organisms, therefore, require to use more complex ways of reproduction.

- 212.** (i) Describe the role of prostate gland, seminal vesicle and testes in the human male reproductive system.
- (ii) How is the surgical removal of unwanted pregnancies misused?
- (iii) Explain the role of oral contraceptive pills in preventing conception.

Ans :

OD 2020

**(i) Role of Prostate Gland and Seminal Vesicle**

- The secretion of these glands provide nutrition to the sperms.
- Their secretions lubricates the urethra for easy movements of sperms.
- The fluid of these glands prevents sperms from the acidity of the urethra.

**Role of Testes**

- Testes produce male gametes called sperms.
  - Testes secrete testosterone which brings about changes in the appearances in the boys at the time of puberty.
- (ii) Surgical removal of unwanted pregnancies leads to illegal abortion and killing of female foetus.
- (iii) Oral contraceptive pills are hormonal preparations. These interfere in the release

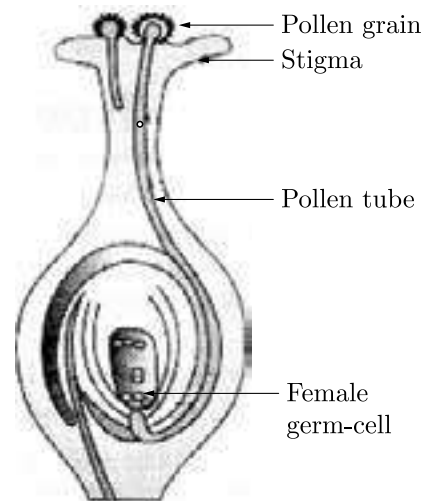
of ovum by ovary. Therefore, the ova are not released. Hence, fertilisation does not take place.

- 213.** (a) Draw a diagram showing germination of pollen on stigma of a flower and mark on it the following organs/parts :
- Pollen Grain
  - Pollen tube
  - Stigma
  - Female germ cell
- (b) State the significance of pollen tube.
- (c) Name the parts of flower that develop after fertilisation into
- Seed
  - Fruit

Ans :

OD 2020, SQP 2015

(a)



- The pollen tube of most seed plants acts as a passage way. It transports sperm cells from the pollen grain, from the stigma (in flowering plants) to the ovules at the base of the pistil.
  - After fertilisation, the zygote divides several times to form an embryo within the ovule.
    - The ovule develops a tough coat and is gradually converted into a seed.
    - The ovary grows rapidly and ripens to form a fruit.
- 214.** (a) Suggest any two categories of contraceptive methods to control the size of human population which is essential for the prosperity of a country. Also explain about each method briefly.

- (b) Name two bacterial and two viral infections each that can get sexually transmitted.
- (c) List two advantages of using condom during sexual act.

Ans :

SQP 2020, OD 2016

- (a) Contraception is an artificial methods or other techniques mainly used to prevent pregnancy as a consequence of sexual intercourse.

- (i) **Barrier Method :** This method involves putting up a barrier between the male and the female sex cells (sperms and ova). It blocks the sperms from reaching the ovary, thus preventing fertilisation. The barrier method can be used by both men and women.

Women could use items like the contraceptive sponge, diaphragm, cervical shield or cervical cap to prevent the sperm from reaching the egg. The barrier method in males involves the use of male condoms.

- (ii) **Hormonal Method :** The hormonal method of birth control interferes with the hormonal balance in a woman's body in order to hamper fertilisation, ovulation or fertilised egg implantation. It could be done with the help of contraceptive pills, estrogen and progestin releasing patches or vaginal rings. Birth control injections are also available now-a-days.

- (b) Bacterial infections such as gonorrhoea and syphilis and viral infections such as warts and HIV-AIDS can be sexually transmitted.

- (c) Two advantages of using condom are :

- (i) Condom for the penis during sex helps to prevent transmission of many infections to some extent and it is highly effective against the most dangerous of sexually transmitted infections —HIV, the virus that causes AIDS.

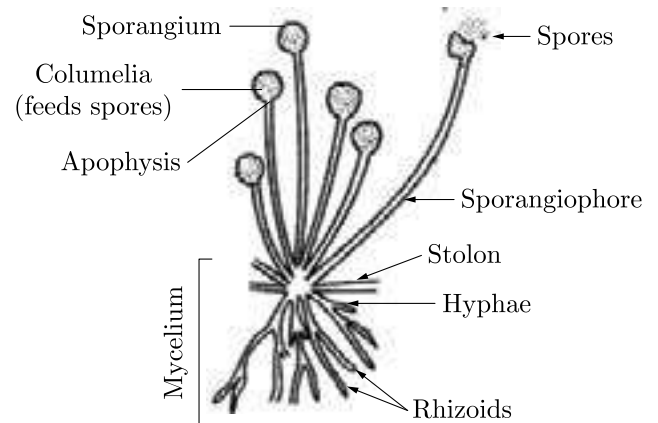
- (ii) The sexual act always has the potential to lead to pregnancy. Condoms provide a mechanical barrier so that sperm does not reach the egg and are also effective against unintended pregnancy.

215. (a) Draw a diagram to show spore formation in Rhizopus.
- (b) With the help of an example differentiate between the process of Budding and Fragmentation.
- (c) Why is vegetative propagation practiced for growing some type of plants?

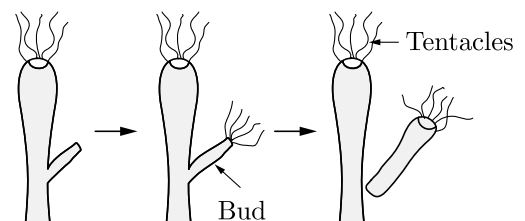
Ans :

Comp. 2020

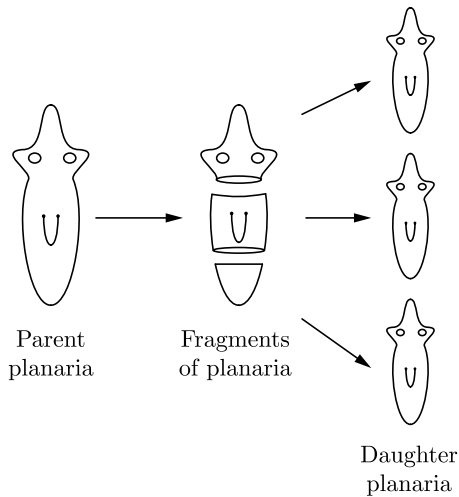
(a)



- (b) Organisms such as Hydra use regenerative cells for reproduction in the process of budding. In Hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and when fully mature, detach from the parent body and become new independent individuals. This process is known as budding. Bud formation is a result of cell division. Then this bud enlarges and receives a nucleus from the parent. While attached to the parent, this bud becomes matured. Later it detaches from the parent cell and becomes a new individual which is genetically identical to its parent. In some organisms, these buds can remain attached to the parent cell for a long time until a chain of buds develops. This resulting chain of buds is known as pseudomycelium.



In multi-cellular organisms with relatively simple body organisation for example Spirogyra, simple reproductive methods can work. The body simply breaks up into smaller pieces upon maturation. These pieces or fragments grow into new individuals. This process is known as fragmentation. Fragmentation is a type of asexual reproduction which occurs in multicellular organisms. These individuals are genetically identical to each other and to parent.



Fragmentation is commonly seen in flatworms, marine worms, algae, jellyfish, starfish, fungi and other echinodermata. Fragmentation is the simplest method of reproduction in fungi. Small fragments of the fungal thallus can be separated from the mother thallus and grow into new fungal thalli. Fragmentation produces clones of the original organism. Hence, it is a common type of vegetative propagation method in plants

- (c) There are many plants in which parts like the root, stem and leaves develop into new plants under appropriate conditions. Vegetative propagation is used in methods such as layering or grafting to grow many plants like sugarcane, roses, or grapes for agricultural purposes. Plants raised by vegetative propagation can bear flowers and fruits earlier than those produced from seeds. Such methods also make possible the propagation of plants such as banana, orange, rose and jasmine that have lost the capacity to produce seeds. Another advantage of vegetative propagation is that all plants produced are genetically similar enough to the parent plant to have all its characteristics.

**216.** Define the term pollination. Differentiate between self pollination and cross pollination. What is the significance of pollination?

Ans :

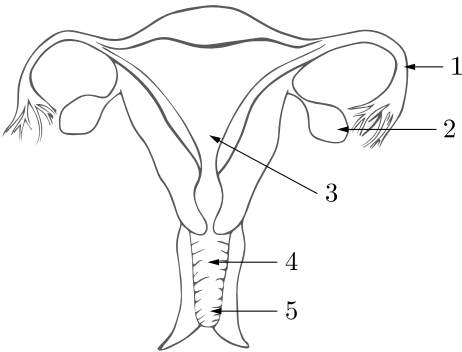
OD 2020, OD 2014

Pollination is the transfer of pollen grains from anther of a stamen to the stigma of a carpel. Pollination is a significant process as it helps in fertilisation by bringing the male gamete (male pronucleus) closer to the female (egg) and allowing their fusion. It, helps in the production of seeds and fruits and thereby help in reproduction as the

seeds formed helps in generation of new off springs. Cross-pollination helps in the introduction of new variations in plants.

	Self-pollination	Cross-pollination
1.	In self-pollination, the pollen grains are transferred from anther to stigma of the same flower or different flower present on the same plant.	In cross-pollination, the pollen grains are transferred from anther to stigma of another flower present on a different plant.
2.	In self-pollination, only one plant is involved.	In cross-pollination, two different plants are involved.
3.	It is a sure method of pollination (pollination rarely fails).	It is not a sure method of pollination (pollination may fail).

**217.** (a) Identify the given diagram. Name the parts 1 to 5.



(b) What is contraception? List three advantages of adopting contraceptive measures.

Ans :

Delhi 2019

The parts of the female Reproductive system are as follows :

1. Fallopian tube or Oviduct
2. Ovary
3. Uterus
4. Cervix
5. Vagina

Contraception is the method by which a female inhibits fertilization and hence prevents pregnancy.

The three advantages of contraception are :

1. It makes the people more aware about the concept of family planning keeping population under control.

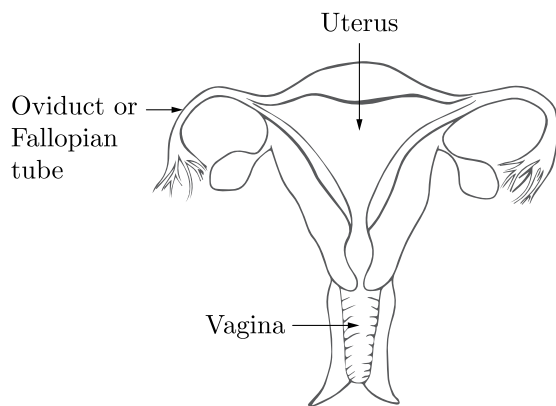
2. It educates the people about Sexually Transmitted Diseases and ways to avoid it.
3. It helps the female to space children.
4. It reduces the risk of unwanted pregnancies.

- 218.** (a) Draw the diagram of female reproductive system and match and mark the part(s) :
- (i) Where block is created surgically to prevent fertilization.
  - (ii) Where Copper-T is inserted?
  - (iii) Inside which condom can be placed.
- (b) Why do more and more people prefer to use condoms? What is the principle behind use of condoms?

**Ans :**

2019

(a)



- (i) Fallopian Tube/Oviduct,
- (ii) Uterus,
- (iii) Vagina

- (b) More people prefer to use condoms because
- (i) it prevents sexually transmitted diseases (STDs),
  - (ii) it gives privacy to the user.

**Principle :** Condoms create a mechanical barrier and prevent the meeting of sperms and egg/ovum.

- 219.** (a) What is variation? How is variation created in a population? How does the creation of variation in a species promote survival?
- (b) Explain how, offspring and parents of organisms reproducing sexually have the same number of chromosomes.

**Ans :**

SQP 2018, OD 2015

- (a) The difference in the characters among individuals of a species is called variation.
- (i) A basic event in reproduction is the creation of a DNA copy. Cells use chemical reactions

to build copies of their DNA. The DNA in the cell nucleus is the information source for making proteins. If the information is changed, different proteins will be made. Different proteins will eventually lead to altered body designs. This causes of variations among the population.

- (ii) The great advantage of variation to a species is that it increases the chances of its survival in a changing environment. For example, the accumulation of heat resistant variation in some bacteria will ensure its survival even when the temperature in its environment rises too much due to heat wave. On the other hand, the bacteria which did not have variation to withstand heat would not survive.

- (b) In sexual reproduction, organisms produce gametes through a special type of division, meiosis reductional division, in which the original number of chromosomes becomes half. These two gametes then combine to form the zygote and original number of chromosomes is restored as in the case of human beings.

- 220.** (a) Draw a neat labelled diagram of pistil showing germination of pollen on stigma.

- (b) Give the functions of :

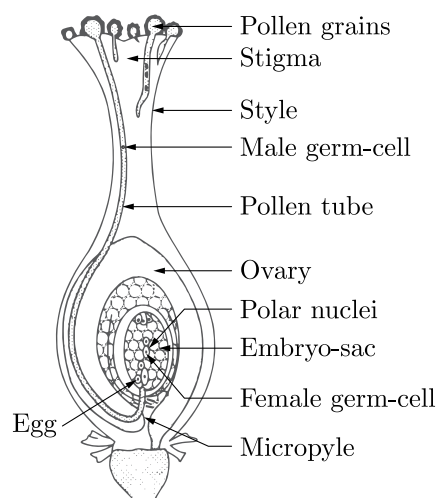
- (i) Stigma
- (ii) Ovary

- (c) State in brief the formation of seed in a flower.

**Ans :**

SQP 2017, OD 2011

(a)



- (b) **Function of stigma :** Stigma is the sight for pollination. The pollen grain lands on the stigma, which is generally sticky. Here it begins



to germinate.

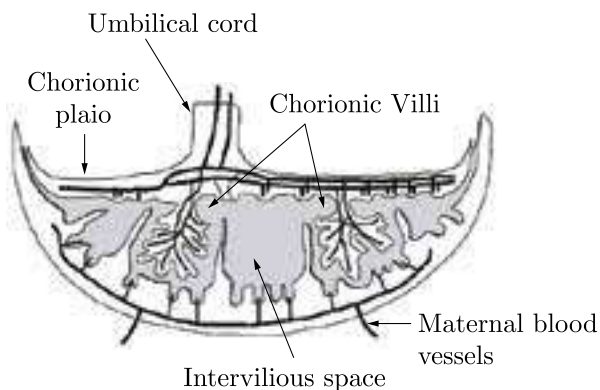
**Function of ovary :** The ovary contains ovules. Each ovule has an egg—the female gamete. It is the sight of fertilization.

- (c) **Formation of seed in a flower :** After fertilization, the ovary develops into a fruit, while the integuments of ovule develops into a tough seed coat and ovule gradually gets converted into a seed.
- 221.** (a) Write the function of following parts in human female reproductive system :
- (i) Ovary (ii) Oviduct (iii) Uterus
- (b) Describe in brief the structure and function of placenta.

**Ans :**

Delhi 2018

- (a) (i) **Ovary :** It produces egg for fertilisation. It secretes estrogen and progesterone. Estrogen regulates secondary sexual characters and progesterone controls the thickness of the lining of uterus.
- (ii) **Oviduct :** It is the site of fertilization and carries egg or fertilized ovum (zygote) to the uterus.
- (iii) **Uterus :** It helps to nourish the fertilised ovum that will develop into foetus. It holds the baby till it is, ready for birth.
- (b) Placenta is a disc shaped structure on uterine wall before implantation of embryo. It provides oxygen and nutrients to the foetus.



It helps to remove waste also. The placenta is composed of both material tissues and tissue derived from the embryo. The chorion is the embryonic derived portion of the placenta. It is composed of fetal blood vessels and trophoblast which are organized into finger-like structures called chorionic villi.

**222. Explain budding.**

**or**

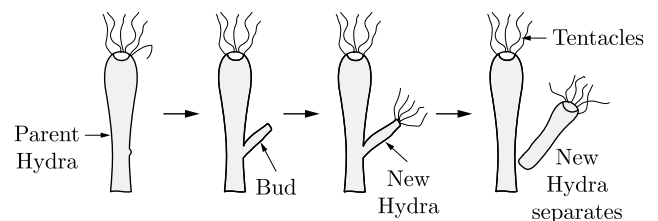
How does Hydra reproduce? Explain in brief with the help of a labelled diagram.

**Ans :**

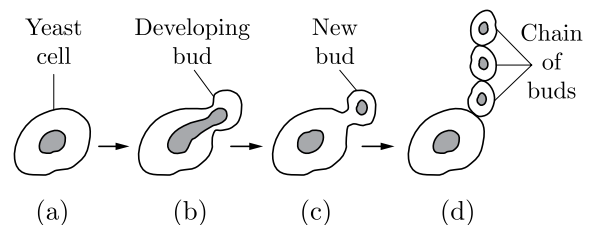
Delhi 2017

Budding is a mode of asexual reproduction. It takes place in organisms like Yeast and Hydra.

In this mode, the body wall of the Hydra is produced outwardly in the form of a bulge, as a result of repeated mitotic division in the cells. The bulge is called bud. It gradually enlarges in size and develops into a new animal. For some time, this new animal remains attached on the body of the parent, but later on it gets detached from the parent body and starts leading an independent life. This complete process is known as budding.



In unicellular fungus, yeast, a small protuberance appears on upper part of the adult yeast cell which slowly grows in size. On the tip of this newly formed cell, another bud appears. This process continues for 3-4 times. And in this way a chain of yeast cells is formed.



**223. (a) With the help of diagram show asexual reproduction in Rhizopus.**

- (b) How is this method advantageous for Rhizopus?
- (c) How is mode of reproduction in unicellular organisms differ from multicellular organisms?

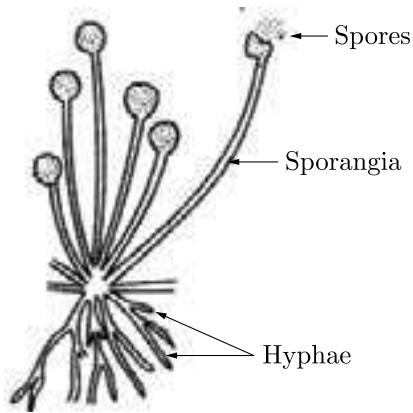
**Ans :**

Foreign 2017, OD 2016

- (a) Hyphae of Rhizopus produces tiny structures called sporangia. In these bulbs of sporangia, a number of spores are produced through mitosis cell division which are covered by thick walls.

On maturation, sporangia burst and release spores which germinate into new mycelium in moist conditions.





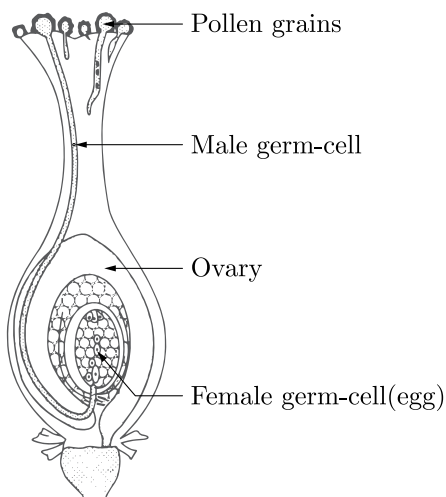
- (b) By this method large number of spores are produced even under adverse environment conditions which help the Rhizopus to spread easily.
- (c) In unicellular organisms, fission leads to production of new individuals. In multicellular, complex reproductive method and specialized cells are involved in production of new individual.

- 224.** (a) Sketch a neat diagram of longitudinal section of flower showing fertilization of pollen on stigma and label on it the following :
- Pollen grain
  - Male germ cell
  - Female germ cell
  - Ovary
- (b) What does a seed contain?

Ans :

Foreign 2016

(a)



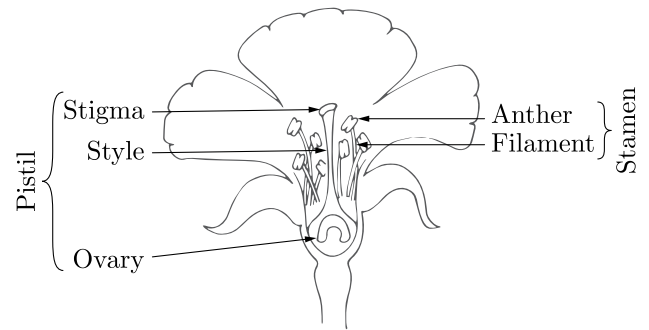
- (b) Seed contains a future plant or embryo that develops into seedling under favourable conditions.

- 225.** (a) Draw the diagram of a flower to show its male and female reproductive parts. Label the following parts in it :
- Ovary
  - Anther
  - Filament
  - Stigma
- (b) How does fusion of male and female gametes take place in plants?

Ans :

Comp. 2016, OD 2013

(a)



- (b) In plants, pollination is followed by fertilisation. The process is as follows :
- As the pollen grain lands on the stigma of this correct plant i.e., same species, it begins to germinate.
  - The pollen grain forms two pollen tubes.
  - One pollen tube grows through the style and reaches the ovary where ovules are already present.
  - The pollen tube vastly passes through a minute pore of ovule called micropyle.
  - Inside the ovule, the pollen tube releases two male gametes.

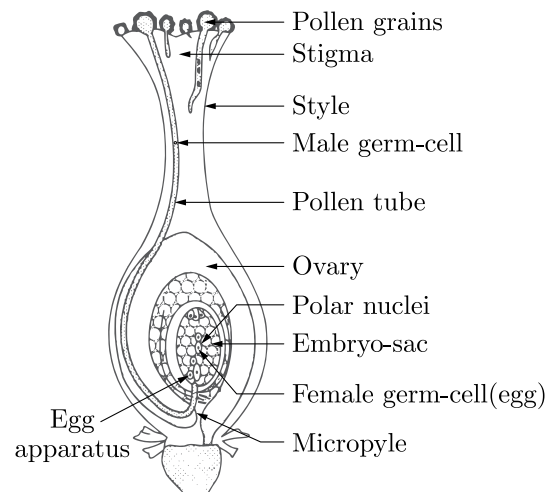


Figure: Fertilisation in a flowering plant.

6. In the centre of the ovule occurs an embryo-sac which contains the egg or female gamete covered by integuments of ovule.
7. One male gamete fuses with the female gamete or egg. This process of fusion of haploid male and female nuclei or gametes is called as syngamy or true fertilisation.
8. The product of syngamy is called zygote. Which is diploid and develops into embryo.
9. Second haploid male gamete fuses with central polar cell of embryo sac containing two haploid nuclei and forms triploid primary endosperm cell (PEC).
10. This is known as triple fusion or double fertilisation as fusion of haploid gametes occurs twice PEC results in formation of endosperm a nutritious tissue for growing embryo.
11. After fertilisation, the ovary develops into the fruit, while the ovules develop into seeds.

- 226.** (a) Differentiate between germination and fertilization.
- (b) State in brief the functions of the following parts of the human male reproductive system :
- (i) Scrotum
  - (ii) Testes
  - (iii) Vas deferens

Ans :

Foreign 2017, OD 2012

- (a) **Germination** : Development of embryo present in seed into a seedling is termed as germination.
- Fertilization** : Fusion of male and female gametes is called fertilization.
- (b) (i) Scrotum provides an optimal temperature for the formation of sperms. This temperature is  $1^{\circ}\text{C}$ - $3^{\circ}\text{C}$  lower than the temperature of the body.
- (ii) The testes not only produce male gametes (sperms) but also the male hormone (testosterone).
- (iii) Vas deferens is a tube like passage through which the sperms formed in testis are delivered to urethra.

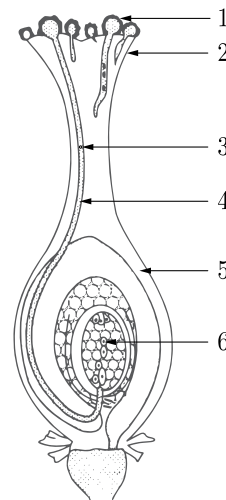
- 227.** (a) Differentiate between pollen grain and ovule.
- (b) State in brief the functions of the following parts of the human female reproductive system:
- (i) Ovary
  - (ii) Fallopian tube
  - (iii) Uterus

Ans :

Foreign 2016

- (a) In plants pollen grains contain male gametes and ovules contain female gametes.
- (b) (i) Ovary — Production of ova and sex hormone.
- (ii) Fallopian tube — site of fertilization.
- (iii) Uterus — Site of implantation and foetus development.

- 228.** (a) In the given figure name the parts marked 1 to 6:



- (b) Differentiate between pollination and fertilization.

Ans :

OD 2016, OD 2014

- (a) 1. Pollen grain, 2. Pollen tube, 3. Male germ-cell, 4. Style, 5. Ovary, 6. Polar nuclei.
- (b)

	Pollination	Fertilisation
1.	It is the transfer of pollen grains from the anther of stamens to the stigma of a carpel through any agency.	It is defined as the fusion of a male gamete (sperm) with a female gamete (an ovum or egg) to form a zygote during sexual reproduction.
2.	It involves external agencies like air, water, insects (bees and butterflies) birds, man etc.	It doesn't involve any external agencies but it involves certain enzymes and stimulation without which sperms can't fused with ovum.

- 229.** (a) Draw a neat diagram to show fertilization in a flower and label on it the following parts :
- (i) Stigma
  - (ii) Pollen tube

(iii) Ovary

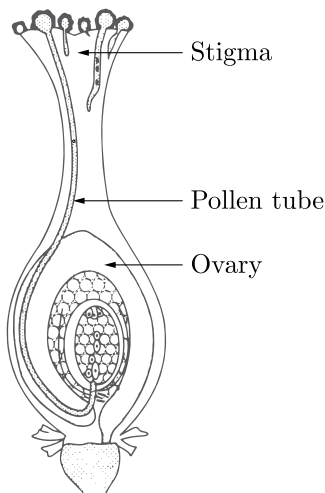
State the function of pollen tube.

- (b) List in tabular form any two differences between a male gamete and a female gamete.

Ans :

OD 2017

(a)



**Function of pollen tube :** To transfer a male germ cell from stigma to embryo sac of ovule where female germ cell is present.

(b)

	Male gamete	Female gamete
(i)	These are smaller.	These are larger because they contain food reserve..
(ii)	They are motile..	They are non-motile.

230. Describe different parts of a bisexual flower.

Ans :

SQP 2014, Delhi 2013, OD 2007

A flower which contains both male and female reproductive parts is called as bisexual flower.

Different parts of a bisexual flower are as follows :

- There is a stalk (pedicel) which supports the flower.
- The tip of the stalk is expanded to form a receptacle or thalamus.
- The parts of the flower are borne on the receptacle in four whorls :
  - First whorl — green sepals (collectively called calyx).
  - Second whorl — large brightly coloured petals (collectively called corolla).
  - Third whorl (male parts) — long thread-like processes somewhat projecting out and each usually ending in a bilobed tip.

These are stamens (collectively named androecium). Each stamen consists of thread-like filament and bilobed anther. The anthers produce the pollen grains. The pollen grain produces two male gametes.

- (d) Fourth whorl (female parts) — centrally located pistil that may be formed of a single female unit (carpel) or of several fused carpels (collectively called gynoecium). Each carpel consists of a basal ovary, a middle style and an uppermost stigma. The ovary contains ovules. Each ovule has an egg as — the female gamete.

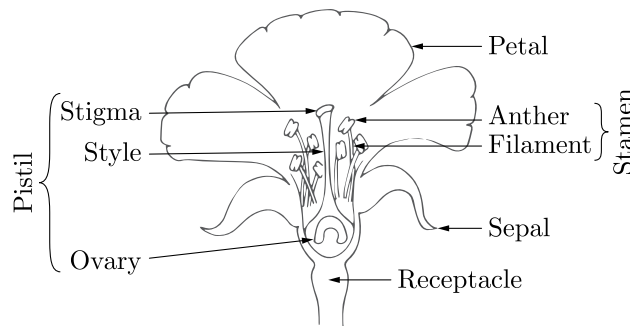


Figure: A flower showing male reproductive (stamens) and female reproductive (pistil) parts.

231. (a) Draw a neat diagram of longitudinal section of a flower showing the fertilization of pollen on stigma and label on it the following parts :

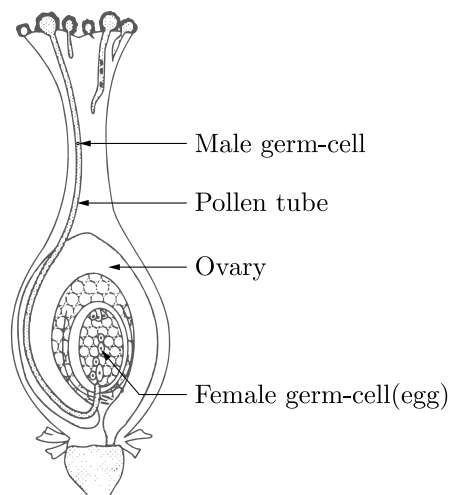
- Male germ-cell
- Female germ-cell
- Ovary
- Pollen tube

- (b) "Fertilization will not occur without pollination." Justify this statement.

Ans :

Delhi 2017, OD 2016

(a)

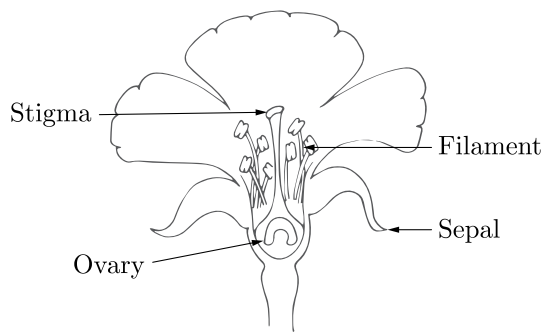


- (b) The fusion of the haploid germ-cells or fertilization produces diploid zygote grows into embryo which is capable of growing into a new plant. For this, transfer of pollen from the anther to stigma is essential. This is why fertilization cannot occur without pollination.
- 232.** (a) Sketch a neat diagram showing longitudinal section of flower and label on it.
- Stigma
  - Ovary
  - Filament
  - Sepal
- (b) What does ovary of a plant contain?

**Ans :**

Delhi 2016

(a)

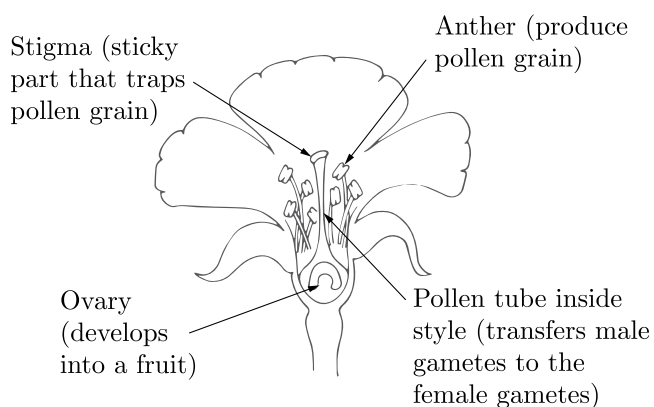


- (b) The ovary contains ovules and each ovule has one or more embryo sac which contains an egg cell the female gamete.
- 233.** (a) Draw a longitudinal section of a flower and label the following parts :
- Part that produces pollen grain.
  - Part that transfers male gametes to the female gametes.
  - Part that is sticky to trap the pollen grain.
  - Part that develops into a fruit.
- (b) Differentiate between pollination and fertilisation.

**Ans :**

Comp 2017, OD 2013

(a) See Fig.



	Pollination	Fertilisation
1.	It is the transfer of pollen grains from the anther of stamens to the stigma of a carpel through any agency.	It is defined as the fusion of a male gamete (sperm) with a female gamete (an ovum or egg) to form a zygote during sexual reproduction.
2.	It involves external agencies like air, water, insects (bees and butterflies) birds, man etc.	It doesn't involve any external agencies but it involves certain enzymes and stimulation without which sperms can't fused with ovum.

- 234.** What is vegetative propagation? Briefly describe various methods of vegetative propagation.

**Ans :**

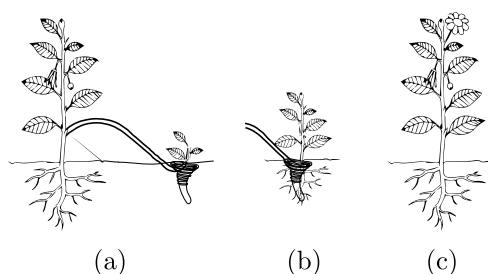
OD 2015

**Vegetative propagation :** Is a sexual method of reproduction by which new plants are developed by using the vegetative parts of the plants, like roots, leaves or stems.

Three methods of artificial vegetative propagation are usually employed : (i) cutting, (ii) layering, and (iii) grafting.

- Cutting :** A piece of a stem, root, leaf or even a bulb scale may be used as cutting in which it is placed partly under moist soil, where it develops new roots and leaves and finally develops into a new plant which is similar to the parent plant, e.g., rose, grapes, phalsa, etc.
- Layering :** A part of the stem is pulled out and buried in the soil in such a way that it remains attached with the parent plant.

In due course of time modes of layered stem give rise to roots. Now, this new plant can be taken out from the soil and grown at any other suitable place, e.g., pudina.



**Figure:** Vegetative propagation by layering shown in three steps : (a) shoot is bent and pegged in the ground, (b) appearance of root from the buried part and (c) new plant.

- (iii) **Grafting** : In grafting, two parts from two different plants are joined together in such a way that they unite and grow as one plant.

The stock, i.e., the plant in which grafting is performed and scion, i.e., the portion of the plant that is grafted are tied together in such a way that the cambium of the two parts comes in contact with each other, e.g., citrus plants like orange, lime etc.

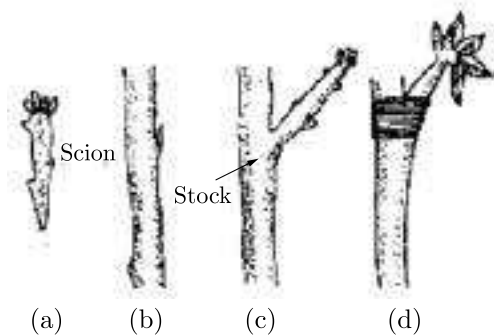


Figure: Different stages in grafting : (a) prepared scion, (b) root stock, (c) scion inserted into stock, and (d) graft showing growth.

- 235.** (a) Draw a sectional view of human female reproductive system and label the following parts:
- Where the development of egg occurs
  - Where fertilization takes place.
- (b) Describe the changes the uterus undergoes :
- to receive the zygote
  - If zygote is not formed.

**Ans :**

Comp 2016

(a)

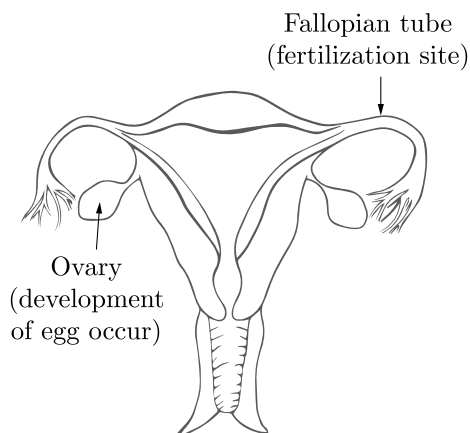


Figure: Human female reproductive system.

- The inner lining of the uterus becomes thick and soft with lots of blood capillaries (blood vessels) in it.
- The uterus lining breaks down and comes out through the vagina in the form of blood and mucous.

- 236.** Briefly describe the male reproductive system in human beings.

**or**

- (a) Draw a neat diagram of human male reproductive system and label on it the following parts :
- Prostate gland
  - Seminal vesicle
  - Testis
- (b) State the function of testis.

**or**

- (a) Mention the role of following organs of human male reproductive system :
- Testis
  - Scrotum
  - Vas deferens
  - Prostate glands
- (b) State the reason why testes are located outside the abdominal cavity.

**or**

- (a) Sketch a neat diagram showing male reproductive system in human beings and label on it the following :
- Vas deferens
  - Prostate glands
  - Seminal vesicle, and
  - Testis
- (b) Why are the testes situated outside the abdominal cavity?

**or**

- (a) Draw a neat diagram of human male reproductive system and label on it the following parts :
- Vas deferens
  - Seminal vesicle
  - Prostate gland
  - Testis
- (b) Name the male hormone and write its function.

**or**

- (a) Draw a neat diagram of female reproductive system and label on it the following parts :
- Oviduct
  - Cervix
  - Vagina
  - Uterus

(b) State any two functions of human ovary.

Ans :

Delhi 2015, OD 2013

Part	Detail
Testis	Paired oval-shaped primary male sex organs. Consist of seminiferous tubules, where the sperms are produced. Produce a male sex hormone called testosterone. Which bring about changes in appearance of boys at puberty.
Scrotum	Small pouch that contains testis. Present outside the abdominal cavity. As sperms are formed here, which requires a lower temperature upto than the normal body temperature,
Vas deferens	Tube-like structure which connects testis to the urethra in order to allow the passage of semen.
Urethra	Common passage for both the sperms and urine. It never carries both of them at the same time. Secretes seminal fluid and nutrients.
Prostate Gland and Seminal Vesicles	Fluid and nutrients combine with sperm to form semen, Milky, viscous fluid contains fructose, proteins and other chemicals for nourishing and stimulating sperms.
Penis	External male genital organ. Transfers sperms into the vagina of the female during copulation.
Penis	Tiny and motile bodies that use their long tail to move through the female reproductive tract.

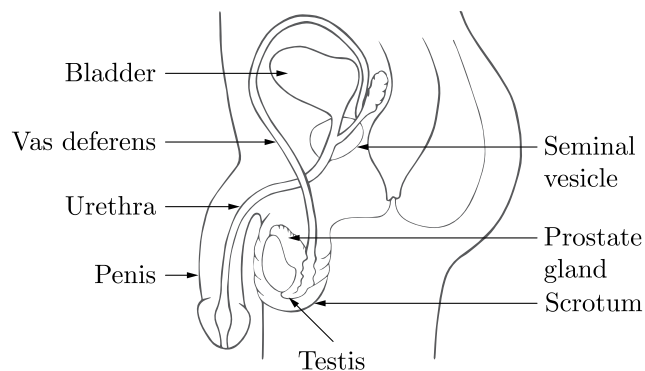


Figure: Male reproductive system.

- The urethra runs through the muscular organ penis, and opens outside through the male “genital pore, through which both the sperms and the urine are released outside.

**237.** Briefly describe the female reproductive system in human beings.

Ans :

Delhi 2014, OD 2011

Different parts of female reproductive system are discussed below:

Parts and Details of the Female Reproductive System

Part	Detail
Ovaries	Paired, oval-shaped organs located in the abdominal cavity near the kidney. Produce thousands of ova or egg cells. Secrete female sex hormones like oestrogen and progesterone.
Oviduct (Fallopian tube)	It has a funnel-shaped opening near the ovary. Carries ova or egg from ovary to the uterus. It is the site of fertilisation. These open into the uterus from both the sides.
Uterus (womb)	Hollow, pear-shaped. bag-like structure. Here, implantation of embryo and the growth and development of foetus takes place.
Cervix	It is the lower and the narrower portion of uterus which opens into the vagina.
Vagina	Receives the sperms from the male partner. Serves as a birth canal.

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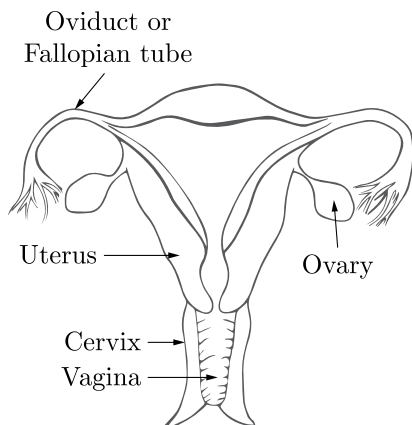


Figure: Female reproductive system.

**238.** Define the terms :

- (i) Syngamy
- (ii) Triple fusion
- (iii) Implantation
- (iv) Placenta
- (v) Gestation.

**Ans :**

Foreign 2015, OD 2009

- (i) **Syngamy** : The process in which one haploid male gamete fuse with a haploid egg cell to form zygote is called syngamy.
- (ii) **Triple fusion** : The process double fertilisation of flowering plants in which second male gamete fuse with two polar nuclei to produce triploid primary endosperm cell is called triple fusion.
- (iii) **Implantation** : The process by which embryo attached with uterus wall to get its nourishment and further development is called implantation.
- (iv) **Placenta** : It is a specific tissue by which embryo is attached with uterus wall. Embryo gets its nourishment and oxygen through placenta.
- (v) **Gestation** : The period in which embryo remains in the uterus in its development is called gestation. It is of about 270-280 days for human.

**239.** Draw a neat diagram of the human female reproductive system and label the parts which perform the following functions :

- (a) Production of eggs
- (b) Site of fertilization
- (c) Site of implantation
- (d) Entry of sperms

What happens when the egg is not fertilized ?

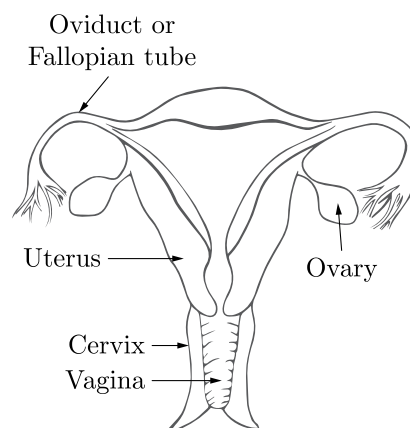
**Ans :**

SQP 2015

Different parts of female reproductive system are discussed below:

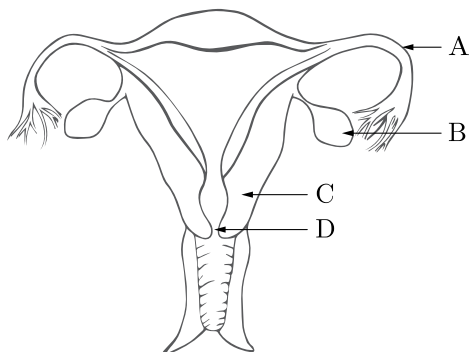
Parts and Details of the Female Reproductive System

Part	Detail
Ovaries	Paired, oval-shaped organs located in the abdominal cavity near the kidney. Produce thousands of ova or egg cells. Secrete female sex hormones like oestrogen and progesterone.
Oviduct (Fallopian tube)	It has a funnel-shaped opening near the ovary. Carries ova or egg from ovary to the uterus. It is the site of fertilisation. These open into the uterus from both the sides.
Uterus (womb)	Hollow, pear-shaped. bag-like structure. Here, implantation of embryo and the growth and development of foetus takes place.
Cervix	It is the lower and the narrower portion of uterus which opens into the vagina.
Vagina	Receives the sperms from the male partner. Serves as a birth canal.



When the egg is not fertilized it lives for about one day and then disintegrates. The thick lining of the uterus breaks down and comes out through the vagina as blood and mucous. It is known as menstruation.

240. (a) Name the parts labelled — A, B, C and D in the given diagram.



- (b) Name the parts associated with :
- fertilization
  - production of an egg
- (c) What happens to the lining of the uterus :
- before release of fertilized egg?
  - if no fertilization occurs?

Ans :

SQP 2014

- (a) A — Oviduct/Fallopian tube  
B — Ovary  
C — Uterine wall  
D — Cervix
- (b) (i) Fertilization - Oviduct/Fallopian tube  
(ii) Production of egg - Ovary
- (c) (i) Before the release of egg, lining of uterus increases in thickness under the influence of a sex hormone called estrogen.  
(ii) If no fertilization occurs then the entire uterus = lining is lost along with blood and tissues in the form of menstrual excretion.

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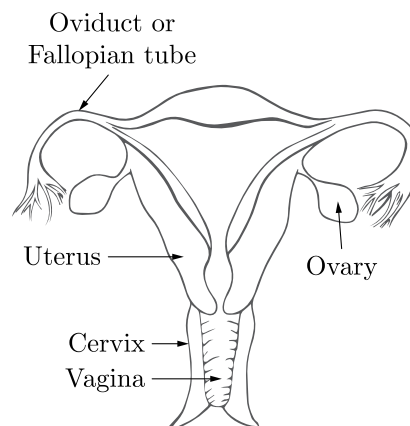
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241. (a) Draw a neat labelled diagram of human female reproductive system.
- (b) Name one organ each in the body of male and female reproductive system that plays a role of endocrine gland along with the production of germ cells. Name one hormone in each case.
- (c) Name the part where the fertilization of gametes takes place and also the place where the fertilized egg is implanted.

Ans :

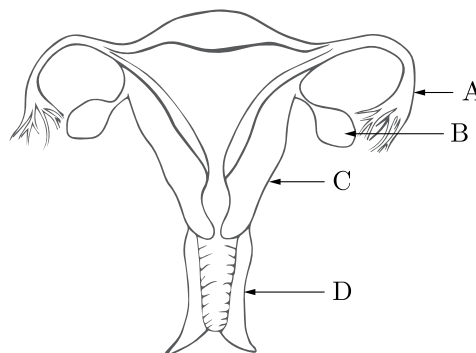
OD 2014, Comp. 2012

(a)



- (b) **In males :** The organ that plays a role of endocrine gland is testis. It secretes the hormone called as testosterone.
- In females :** The organ that plays a role of endocrine gland is ovary. It secretes the hormone called as estrogen and progesterone.
- (c) The fertilization of gametes takes place in fallopian tubes and fertilized egg is implanted in the uterus.

242. (a) In the given figure label the parts A, B, C and D and state in brief the functions of each of these parts :



- (b) Name two surgical methods of birth control.

Ans :

Delhi 2015

- (a) A — Oviduct or Fallopian tube  
Function : Movement of egg.  
B — Ovary  
Function : Production of egg.  
C — Uterus  
Function : Implantation of embryo.  
D — Vagina  
Function : Entry of sperms.
- (b) (i) Blockage of vas deferens — Vasectomy  
(ii) Blockage of fallopian tube — Tubectomy

**243.** What are the three categories of contraceptive methods? Write briefly about each.

**Ans :**

Foreign 2015, OD 2010

Three categories of contraceptive methods :

(i) **Mechanical barrier :** It prevents the sperm to reach near the egg. For example, condoms on the penis or similar coverings worn in the vagina can be used for this purpose.

Intra-uterine devices such as copper-T are also popular exemplar.

(ii) **Chemical or hormonal method :** There are various chemicals or the pills which act by changing the hormonal balance of the body so that eggs are not released and fertilization cannot occur.

(iii) **Surgical method :** In order to prevent pregnancy, surgery can be done both in the male as well as in female. If the vas deferens in the male is blocked (vasectomy), sperm transfer will be prevented. If the fallopian tube in the female is blocked (tubectomy), transfer of egg is prevented and no fertilization takes place.

**244.** (a) Sketch a neat diagram of female reproductive system in human beings and label on it :

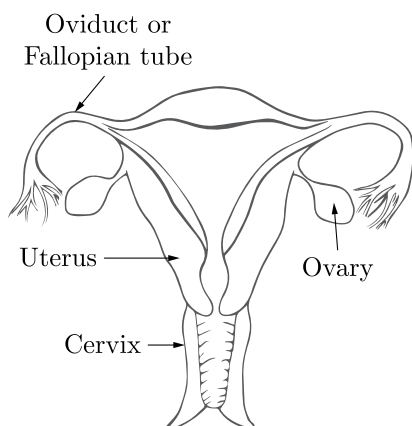
- (i) Fallopian tube
- (ii) Ovary
- (iii) Uterus
- (iv) Cervix

(b) How do mechanical barrier devices prevent pregnancy?

**Ans :**

Delhi 2014

(a)



(b) Mechanical barriers do not allow entry of sperms into the female genital tract at the time of copulation.

**245.** What is placenta? Describe its structure. State its functions in case of pregnant human female.

**Ans :**

OD 2015

Placenta is a special tissue that helps human embryo in obtaining nutrition from mother's blood.

**Structure :** Placenta is a disc like structure embedded in the uterine wall. It contains villi on the side of the embryo. On mother's side are blood spaces, which surround the villi.

**Function :**

- (i) It provides large surface area for glucose and  $O_2$  to pass from mother's blood to, the embryo.
- (ii) It also removes metabolic wastes from the embryo.

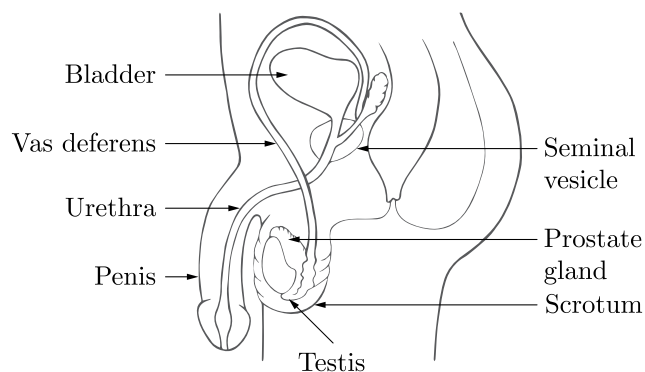
**246.** Draw a neat diagram of the human male reproductive system and label the parts performing the following function :

- (a) Production of sperms.
- (b) Gland which provides fluid.
- (c) Provides low temperature for the formation of sperms.
- (d) Common passage for sperms and urine.

Name a sexually transmitted disease and a method to avoid it.

**Ans :**

Foreign 2014



**A sexually transmitted disease :** Bacterial infections like gonorrhoea.

**Prevention :** Use of barrier method like condom during intercourse.

- 247.** (a) Which device prevents implantation by irritating the lining of uterus ?
- (b) What could be the possible reason for declining female : male sex ratio in our country? Suggest two measures to achieve 1:1 ratio.
- (c) Name those parts of a flower which serve the

same function as the following do in animals :

- (i) Testis
- (ii) Ovary
- (iii) Eggs
- (iv) Sperms

**Ans :**

Comp 2014

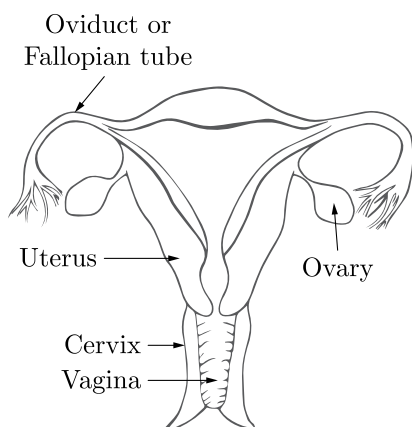
- (a) Copper-T.
- (b) The reason for declining Female : Male sex ratio — The main reason behind it is sex selective abortions of female foetuses using pre-natal sex-determination techniques illegally. This can be avoided by banning pre-natal sex determination. Everyone needs to be educated in the society about equality of gender and health of women.
- (c) (i) Anther,
- (ii) Ovary,
- (iii) Female gamete (egg) in ovary,
- (iv) Male gametes in pollen grains.

- 248.** (a) Draw a neat diagram of the reproductive system of a human female and label on it the following :
- (i) Reproductive part that produces the female hormone.
  - (ii) Site of fertilization.
  - (iii) Organ where growth and development of the embryo takes place.
- (b) How does the growing embryo meet with its nutritional requirements?
- (c) What happens if the ovum is not fertilized?
- (d) Mention a contraceptive method that can be used by the human female.

**Ans :**

Comp 2015

(a)



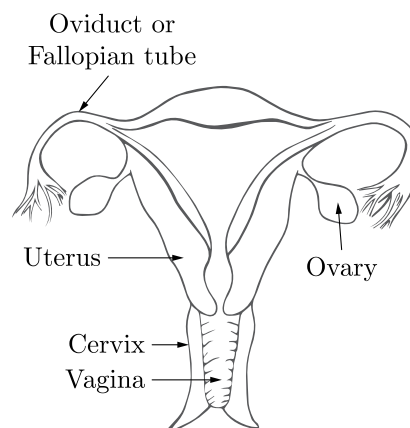
- (i) Ovary,

- (ii) Fallopian tube or oviduct,
  - (iii) Uterus.
- (b) Embryo meets its nutritional requirements from special tissue embedded in the uterine wall called placenta.
- (c) If the ovum is not fertilized, uterine lining breaks and comes out of vagina with blood and mucous as menstrual fluid.
- (d) Oral pills.
- 249.** (a) Draw a neat and labelled diagram of female reproductive system.
- (b) Give the function of the following :
- (i) Pollen tube
  - (ii) Ovary
- (c) List any two changes observed in the body of a female during puberty.

**Ans :**

SQP 2015, Comp. 2013

(a)



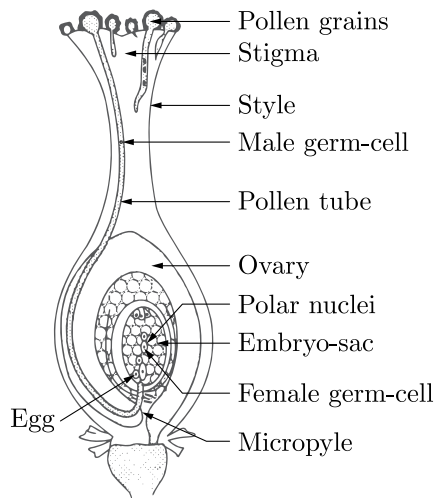
- (b) (i) Transfer of male gamete.
  - (ii) Production of female gamete.
- (c) Breast size begins to increase and onset of menstrual cycle.
- 250.** (a) Name the female reproductive part of a flower. Draw diagram of its longitudinal section depicting the process of fertilization of pollen on stigma and label on it the following :
- (i) Male germ cell
  - (ii) Female germ cell
  - (iii) Ovary
- (b) What happens to the following parts after fertilization?
- (i) Ovum
  - (ii) Ovary

- (iii) Ovule  
(iv) Sepals and petals

Ans :

OD 2014

- (a) Carpel is called as the female reproductive part of a flower.



- (b) (i) Forms zygote,  
(ii) forms fruit,  
(iii) forms seed,  
(iv) shrivel and fall off.

251. Explain the term fission used in relation to reproduction.

Ans :

Delhi 2014

Fission is a mode of asexual reproduction. Unicellular organisms, like Amoeba, Paramecium and other such protozoans reproduce by this method.

In Amoeba, the parent organism divides into two daughter organisms, and each organism then grows into an adult organism. Since in this process, two organisms are produced from a single unicellular parent, this process is called binary fission (division into two).

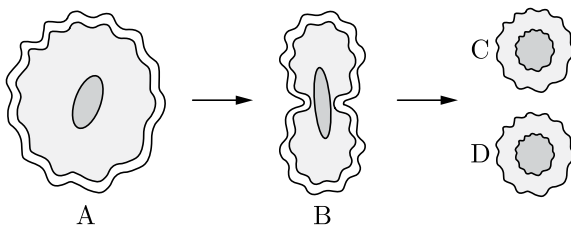


Figure: Binary fission in Amoeba.

During binary fission, first the nucleus divides followed by the division of the cytoplasm leading to two daughter organisms,

Sometimes, the nucleus divides and redivides repeatedly in many nuclei (as in the case of Plasmodium, the malarial parasite).

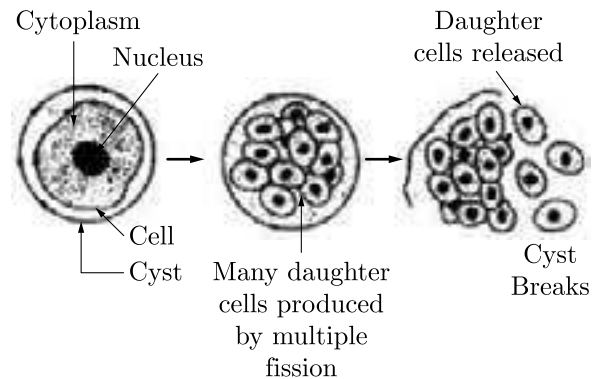


Figure: Multiple fission in plasmodium.

Each nucleus is then surrounded by a little bit of cytoplasm that finally leads to large number of tiny daughter organisms. Such sort of division is called as multiple fission (= division into many).

## CASE BASED QUESTIONS

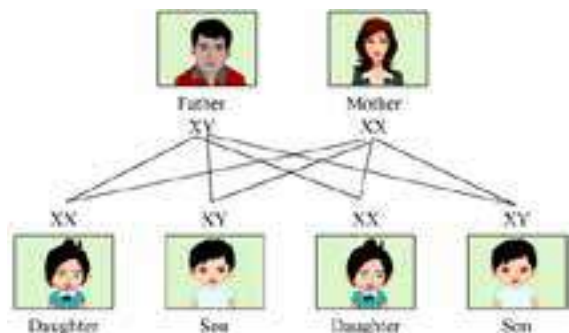
252. All human chromosomes are not paired. Most Human Chromosomes have a maternal and a paternal copy and we have 22 such pairs. But one pair sex chromosomes is odd in not always being a perfect pair. Women have a perfect pair of sex chromosomes. But man have a mismatched pair in which one is normal sized while the other is a short one.
- In humans, how many chromosomes are present in a zygote and in each gamete.
  - A few reptiles rely entirely on environmental cues for sex determinations. Comment.
  - The sex of a child is a matter of chance and none of the parents are considered to be responsible for it." Justify it through flow chart only.
  - Why do all the gametes formed in human females have an X chromosome ?

Ans :

OD 2023

- Zygote is formed due to the fusion of male and female gametes. Gametes are haploid cells. Thus fusion of two haploid cells results in the formation of a diploid cell. Therefore zygote is a diploid cell with 46 chromosomes.
- In a few reptiles, the temperature at which fertilised eggs are kept determines whether the animals developing in eggs will be male or female. By this we can say that some animals rely entirely on environmental cues for sex determination.

- (c) There is equal chance of fusion of either X or Y chromosome with the egg. So, we can say that the sex of new born child is a matter of chance and none of the parent is responsible for it.



- (d) Human females are homomorphic. They have two sex chromosomes that are identical. One X-chromosome enters each gamete during meiosis at the time of gamete formation. So, all gametes have an X-chromosome.

**253.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The growing size of the human population is a cause of concern for all people. The rate of birth and death in a given population will determine its size. Reproduction is the process by which organisms increase their population. The process of sexual maturation for reproduction is gradual and takes place while general body growth is still going on. Some degree of sexual maturation does not necessarily mean that the mind or body is ready for sexual acts or for having and bringing up children. Various contraceptive devices are being used by human beings to control the size of population.

- List two common signs of sexual maturation in boys and girls.
- What is the result of reckless female foeticide ?
- Which contraceptive method changes the hormonal balance of the body ?
- Write two factors that determine the size of a population.

**Ans :**

Delhi 2020

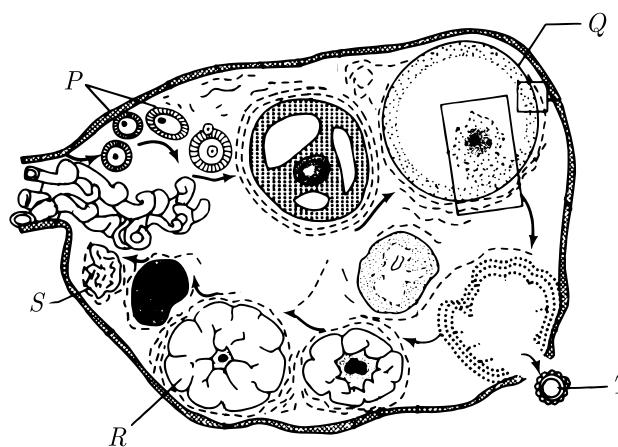
- Common signs of sexual maturation in boys and girls are :
  - Thick hair growing in new parts of the body such as armpits and the genital area between the thighs. Thinner hair can also appear on legs and arms, as well as on the face.

- The skin frequently becomes oily and might begin to develop pimples.

- Due to reckless female foeticide, child sex ratio is declining at an alarming rate in some sections of the society.
- Contraceptive pills changes the hormonal balance of the body.
- Birth rate and Death rates are the factors which determines the size of the population.

**254.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Figure given below which shows monthly changes in the human ovary during the reproductive cycle. Study this related figure and answer the questions that follow.



- Which of the following statements is correct regarding the labelled structures?
  - Before puberty, only structure T undergoes meiosis.
  - The hormone produced by structure R stimulates the pituitary gland to secrete luteinising hormone.
  - The hormone produced by structure S is responsible for the development of female secondary sexual characters.
  - The hormone produced by P and Q stimulates the proliferation of the endometrial lining of the uterine wall.
- The formation of T begins in female
  - at birth
  - before birth
  - after puberty
  - none of these
- What is term used for release of T?
- Which hormone is secreted by R?



Ans :

- (i) (d) The hormone produced by P and Q stimulates the proliferation of the endometrial lining of the uterine wall.

In the given figure of human ovary, P is primary follicle, Q is mature Graafian follicle, R is corpus luteum, S is corpus albicans and T is secondary oocyte. Secondary oocyte (T) is formed only after puberty in a menstrual cycle (one in each cycle). The corpus luteum (R) is developed under the effect of production of luteinising hormone (LH) from pituitary gland. The hormone progesterone secreted by it, maintains the uterine endothelium and stimulates secretion of water mucus from uterine glands. Corpus albicans (S) secretes no hormone. P (primary follicle) and Q (Graafian follicle) secrete estrogen which stimulates the proliferation of endometrial lining of the uterine wall.

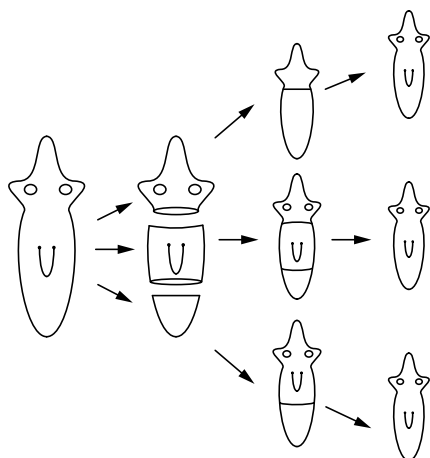
- (ii) (b) before birth

The formation of ova begins in female fetus before birth.

- (iii) Ovulation

- (iv) R (Corpus luteum) secretes the hormone progesterone.

- 255.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.



- (i) The type of reproduction shown in the figure is
- (a) budding                      (b) fragmentation  
(c) regeneration                (d) fission
- (ii) Which of the following is correct example of the process shown in given figure?
- (a) Hydra                          (b) Planaria  
(c) Amoeba                        (d) Both (a) and (b)

- (iii) How regeneration is carried out?  
(iv) Name any two type of asexual reproduction.

Ans :

- (i) (c) regeneration

Regeneration is the process by which small cut parts of body organism grow to form whole new organisms.

- (ii) (d) Both (a) and (b)

Simple animals like Hydra and Planaria can be cut parts of body organism grow to form whole new organisms.

- (iii) Regeneration is carried out by specialised cells which proliferate and make large numbers of cells. From this mass of cells, different cells undergo changes to become various cell types and tissues.

- (iv) (a) Fragmentation
- (b) Budding

- 256.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The sexual act always has the potential to lead to pregnancy will make major demands on the body and the mind of the woman and if she is not ready for it, her health will be adversely affected. Therefore, many ways have been devised to avoid pregnancy.



- (i) Name any two bacterial diseases that are caused due to unprotected sex.
- (ii) In what a pill helps in preventing pregnancy?
- (iii) What is vasectomy?
- (iv) What are the common side-effects of using contraceptive pills?

**Ans :**

- (i) The two bacterial diseases that are caused due to unprotected sex are gonorrhea and syphilis.
- (ii) The pill helps in preventing pregnancy as prevent the release of the ovum, by changing the hormonal balance.

- (iii) Vasectomy is the surgical process by which the vas deferens is cut. This prevents the sperms from reaching the ejaculatory duct.
- (iv) The common side-effects of using contraceptive pills are irritation, nausea and mood swings.

**257.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Reproduction in human beings is by sexual reproduction where both the male and female gametes fertilise to give rise to an embryo. The fertilization of the human embryo occurs inside the body of the female.



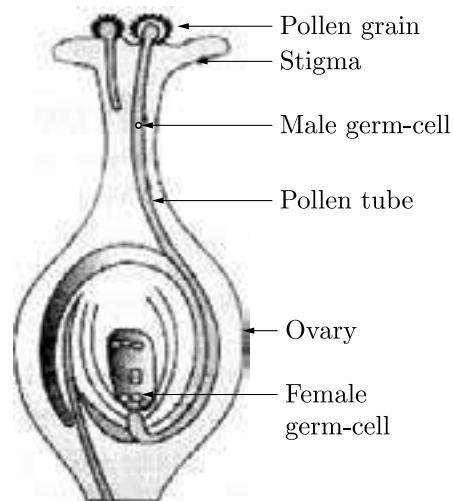
- (i) Name the part of the male reproductive system where the formation of sperms takes place.
- (ii) What is the placenta?
- (iii) What is the other name of the oviduct?
- (iv) Define the term implantation.

**Ans :**

- (i) The scrotum is the part of the male reproductive system where the formation of sperms occurs.
- (ii) The embryo develops a special structure called the placenta. This structure helps in the transportation of components from the mother's body to the embryo. Placenta also prevents the mixing of the mother's blood with the baby's blood.
- (iii) The other name of the oviduct is the fallopian tube.
- (iv) The process by which the blastocyst gets attached to the lining of the uterus wall is termed as implantation. It is an important post-fertilisation process. The successful fusion of male and female gamete results in implantation.

**258.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Carpel is present at the centre of a flower and is the female reproductive part. It is made of three parts. The swollen bottom part is the ovary, the middle elongated part is the style and the terminal part which may be sticky is the stigma. The ovary contains ovules and each ovule has an egg cell. The male germ-cell produced by pollen grain fuses with the female gamete present in the ovule. This fusion of the germ-cells or fertilization gives us the zygote which is capable of growing into a new plant. Thus, the pollen needs to be transferred from the stamen to stigma. If this transfer of pollen occurs in the same flower, it is referred to as self-pollination. On the other hand, if the pollen is transferred from one flower to another, it is known as cross-pollination. This transfer of pollen from one flower to another is achieved by agents like wind, water or animals. After the pollen lands on a suitable stigma, it has to reach the female germ-cells which are in the ovary. For this, a tube grows out of the pollen grain and travels through the style to reach the ovary.



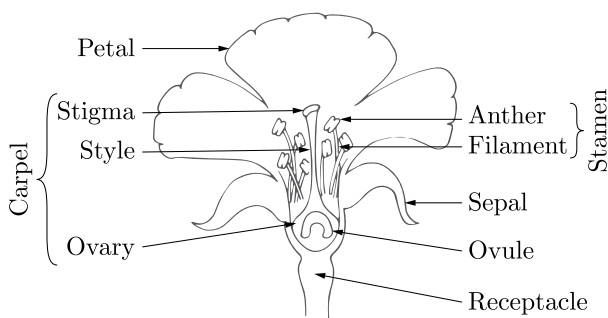
- (i) What is present at the centre of the flower?
- (ii) How many parts does the carpel have?
- (iii) What do you mean by cross-pollination?
- (iv) What do you mean by self-pollination?

**Ans :**

- (i) Carpel is present at the centre of the flower.
- (ii) Carpel has three parts.
- (iii) If the pollen is transferred from one flower to another, it is known as cross-pollination.
- (iv) If transfer of pollen occurs in the same flower, it is referred to as self-pollination.

**259.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The reproductive parts of angiosperms are located in the flower. The different parts of a flower are sepals, petals, stamens and carpels. Stamens and carpels are the reproductive parts of a flower which contain the germ-cells. The flower may be unisexual (papaya, watermelon) when it contains either stamens or carpels or bisexual (hibiscus, mustard) when it contains both stamens and carpels. Stamen is the male reproductive part and it produces pollen grains that are yellowish in colour. Carpel is present in the centre of a flower and is the female reproductive part. It is made of three parts. The swollen bottom part is the ovary, middle elongated part is the style and the terminal part which may be sticky is the stigma. The ovary contains ovules and each ovule has an egg cell. The male germ-cell produced by pollen grain fuses with the female gamete present in the ovule. This fusion of the germ-cells or fertilization gives us the zygote which is capable of growing into a new plant.



- (i) What are the different parts of a flower?
- (ii) Name the reproductive parts of a flower.
- (iii) Which is the male reproductive part of a flower?
- (iv) Which is the female reproductive part of a flower?

**Ans :**

- (i) The different parts of a flower are sepals, petals, stamens and carpels.
- (ii) Stamens and carpels are the reproductive parts of a flower.
- (iii) Stamen is the male reproductive part of a flower.
- (iv) Carpel is the female reproductive part of a flower.

**260.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Reproduction (or procreation or breeding) is the biological process by which new individual organisms-“offspring” are produced from their “parents”. Reproduction is a fundamental feature of all known life; each individual organism exists as the result of reproduction. There are two forms of reproduction: asexual and sexual. In asexual reproduction, an organism can reproduce without the involvement of another organism. Asexual reproduction is not limited to single-celled organisms. The cloning of an organism is a form of asexual reproduction. By asexual reproduction, an organism creates a genetically similar or identical copy of itself. The evolution of sexual reproduction is a major puzzle for biologists. Sexual reproduction typically requires the sexual interaction of two specialized organisms, called gametes, which contain half the number of chromosomes of normal cells and are created by meiosis, with a male typically fertilizing a female of the same species to create a fertilized zygote. This produces offspring organisms whose genetic characteristics are derived from those of the two parental organisms. Asexual reproduction is a process by which organisms create genetically similar or identical copies of themselves without the contribution of genetic material from another organism. Bacteria divide asexually via binary fission. Sexual reproduction is a biological process that creates a new organism by combining the genetic material of two organisms in a process that starts with meiosis, a specialized type of cell division.





- (i) What do you mean by reproduction?
- (ii) How many forms of reproduction are there? What are they?
- (iii) What do you mean by asexual reproduction?
- (iv) What do you mean by sexual reproduction?

**Ans :**

- (i) Reproduction (or procreation or breeding) is biological process by which new individual organisms-“offspring” are produced from their “parents”.
- (ii) There are two forms of reproduction. They are asexual and sexual.
- (iii) In asexual reproduction, an organism can reproduce without the involvement of another organism.
- (iv) Sexual reproduction is a biological process that creates a new organism by combining the genetic material of two organisms.

- 261.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

A receptor is a specialised cell or a group of cells in a sense organ that perceive a particular type of stimulus in the environment like light, heat, pressure, etc. Different sense organs have different receptors for detecting different stimuli.

Name of Receptors	Stimulus	Location in our body
Photoreceptors	Light	Eyes
Phonoreceptors	Sound	Inner ears
Olfactory receptors	Smell	Nose
Gustatory receptors	Taste	Tongue
Thermoreceptors	Heat/Cold	Skin
Tactile receptors	Touch	Skin

Receptors are either neuron endings or specialized

cells that are in close contact with neuron endings to perceive information about their external or internal environments. The receptor cells receive stimuli from the environment and transform these excitations into electro-chemical impulse. Therefore, all the receptors in various sense organs receive stimuli from the surrounding environment and send messages to the spinal cord and brain through sensory nerves. Another type of nerve cells called motor nerves transmit the response from the sensory organs to central nervous system towards effectors, in the form of electrical impulse.

- (i) What is nerve impulse?
- (ii) What will be the path followed by a nerve impulse on hearing a sound?
- (iii) Upon receiving a signal the dendrite tip of a nerve cell sets off a chemical reaction that
  - (a) creates an electrical impulse in the dendrite.
  - (b) creates an electrical impulse in the next neuron.
  - (c) releases some chemicals in the cell body of the neuron.
  - (d) creates a stimulus.
- (iv) When stimulated by a stimuli, the nerve impulses are
  - (a) continuously discharged.
  - (b) discharged for a short time.
  - (c) discharged at different rates depending on the type of receptor.
  - (d) discharged at a high rate initially and declines later.

**Ans :**

- (i) The information passing through neurons is in the form of chemical and electrical signals, called nerve impulse.
- (ii) Nerve impulses travel in the following manner from one neuron to the next : Dendrites → Cell body → Axon → Nerve endings at the tip of axon → Synapse → Dendrite of next neuron
- (iii) (a) creates an electrical impulse in the dendrite.
- (iv) (d) discharged at a high rate initially and declines later.

- 262.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

To carry out a simple function such as eating food there has to be coordination of the eyes, hands and

- (i) What is this method of propagation of plants known as?
- (ii) What type of branches should a plant have to be able to be propagated by this method?
- (iii) Name any two plants which are grown for their flowers and propagated by this method.
- (iv) Name any two plants which are grown for their fruits and propagated by this method
- (v) Name one plant which gets propagated by this method naturally by forming runners (soft horizontal stems running above the ground).

**Ans :**

- (i) Layering
- (ii) Slender branches (Thin branches)
- (iii) Jasmine and China rose
- (iv) Lemon and Guava
- (v) Strawberry

**282.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

A worm *X* found in freshwater and slow-moving streams has been accidentally cut into three pieces. It was observed that in due course of time, each cut piece of the worm develops to become a complete worm by growing all the missing parts.

- (i) Name the worm *X* which can exhibit this phenomenon of making complete worm from its cut body parts.
- (ii) Name another organism *Y* which possesses the same characteristic of growing fully from its cut body parts.
- (iii) What is the name of this process in which a complete organism is formed from its cut body part.
- (iv) State whether *X* and *Y* are unicellular and/or multicellular organisms.
- (v) Can a dog be produced completely from its cut body part (say, a cut tail) just like organisms *X* and *Y*? Why?

**Ans :**

- (i) Planaria (Flatworm)
- (ii) Hydra
- (iii) Regeneration
- (iv) Simple multicellular organisms
- (v) No; Because dog is a complex multicellular organism

**283.** Answer given questions on the basis of your understanding of the following paragraph and the

related studies concepts.

A thickened underground stem *X* of a plant which is swollen with stored food has a number of points *Y* on its surface. When the old stem *X* is planted in the soil of a field in the next growing season, then each point *Y* present on its surface grows into a new plant.

- (i) What is the general name of the underground stems like *X*?
- (ii) Give one example of *X*.
- (iii) What are points *Y* present on *X* known as?
- (iv) Is it necessary to plant the whole of stem *X* in the ground to obtain its new plants? Explain your answer.
- (v) What is the name of this method of reproduction of plants?
- (vi) What is the advantage of growing new plants from the underground stems like *X*?

**Ans :**

- (i) Stem tubers
- (ii) Potato tuber
- (iii) Eyes or Buds
- (iv) No; Even cut pieces of *X* can be planted in the soil to obtain new plants provided each cut piece has an eye or bud on it
- (v) Vegetative propagation by tubers
- (vi) The vegetative propagation method of growing new plants from tubers like *X* is much faster than the production of new plants from their seeds

**284.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

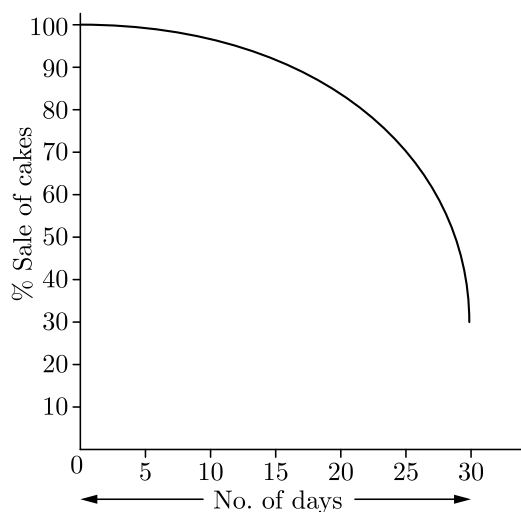
A filamentous alga *X* is found in ponds, lakes and slow-moving streams. The filament of this alga simply breaks into two (or more) pieces on maturing and each piece then grows to become a complete new alga.

- (i) Name an alga which *X* is likely to be.
- (ii) What is the colour of *X*?
- (iii) What is the method of forming new algae by the breaking of parent alga known as?
- (iv) An Amoeba also breaks up to form two daughter Amoebae. What is the difference in the splitting of Amoeba and splitting of this alga as a method of reproduction?
- (v) Name one marine animal which reproduces in the same way as alga *X*.



- 264.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

To make a bread dough, a baker mixes flour, sugar and baking powder (mixture of baking soda and tartaric acid). After mixing all the ingredients, the dough is placed in a container for a few hours (in an oven). On heating, the mixture releases carbon dioxide gas leaving bubbles behind. This increases the size of the bread and makes it soft and spongy. Tartaric acid helps in removing bitter taste.



- Why does the bread dough rise?
- 'Yeast can be used in place of baking powder for making bread dough'. What is yeast?
- What would you use to measure pH of baking powder?
- Based on the graph represented alongside, answer the following questions:

A bakery shop started using baking soda instead of baking powder for baking cakes. What could be the reason for the decrease in the sale of cakes?

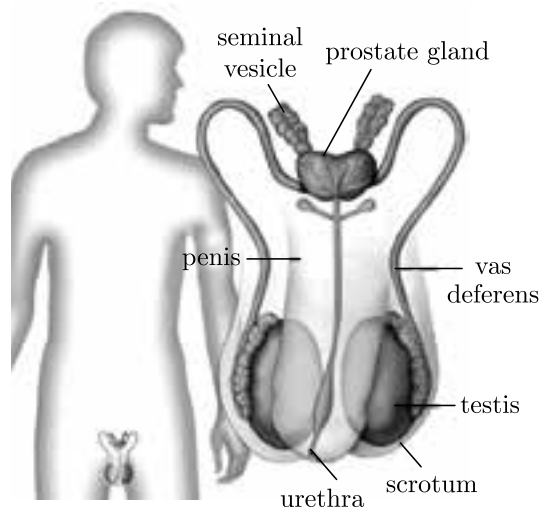
**Ans :**

- On heating, baking soda (Sodium hydrogen-carbonate) decomposes to give  $\text{CO}_2$  gas which makes the bread dough rise.
- Yeast is a single-celled fungi.
- Universal indicator solution.
- Baking soda (sodium hydrogen-carbonate) makes the cakes bitter in taste. This could be the reason for the decrease in sales.

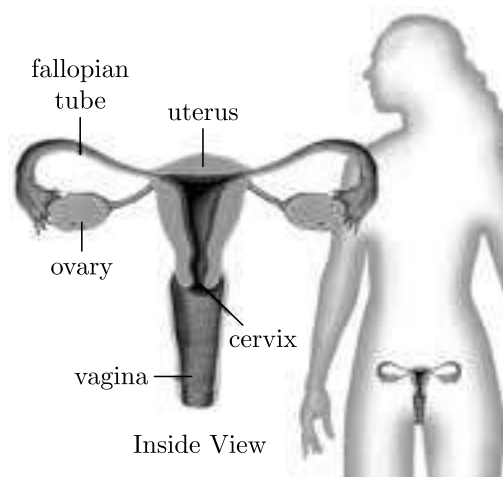
- 265.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The female germ-cells or eggs are made in the ovaries. They are also responsible for the production of some hormones. When a girl is born, the ovaries already contain thousands of immature eggs. On reaching puberty, some of these start maturing. One egg is produced every month by one of the ovaries. The egg is carried from the ovary to the womb through a thin oviduct or fallopian tube. The two oviducts unite into an elastic bags-like structure known as the uterus. The uterus opens into the vagina through the cervix. The sperms enter through the vaginal passage during sexual intercourse. They travel upwards and reach oviduct where they may encounter the egg. The fertilized egg, the zygote, gets implanted in the lining of the uterus and starts dividing. We have seen in earlier sections that the mother's body is designed to undertake the development of the child. Hence, the uterus prepares itself every month to receive and nurture the growing embryo. The lining thickness and is richly supplied with blood to nourish the growing embryo.

Male Reproductive System



Female Reproductive System

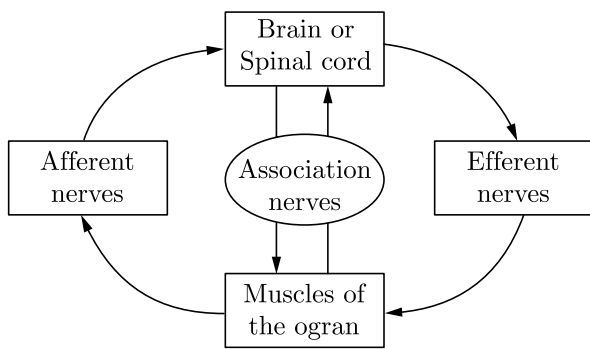




the mouth. The eyes have to focus on the food, the hands have to pick it up and take it to the mouth where it will be chewed. All these actions have to be coordinated in such a manner that they follow a particular sequence and the action is completed. A similar mechanism is also needed for internal functions of the body. This function is carried out by the nervous system.

It is composed of :

- specialised cells which can detect, receive and transmit different kinds of stimuli. These are called neurons.
- nerve fibres which are certain bundles of extended processes of nerve cells.



The individuals also have to adjust to the changing conditions of the body should vary their responses. At the same time, the internal conditions of the body should be maintained constant. This is called homeostasis. The internal conditions of the body are maintained at a constant by controlling the physiology of the organisms.

- What will the correct sequence in which conduction of information through nerves take place?
- How homeostasis is said to maintain the equilibrium of the body?
- What function does the central nervous system perform?
- What happens when the dendrite tip of a nerve cell receives a signal?

Ans :

- Dendrites  $\longrightarrow$  Cell body  $\longrightarrow$  Axon  $\longrightarrow$  Nerve endings at the tip of axon  $\longrightarrow$  Synapse  $\longrightarrow$  Dendrite of next neuron
- Homeostasis maintains the equilibrium of the body and keep the overall system constant.
- The central nervous system is comprised of the brain and the spinal cord which process the

information received from the receptors on/in the body.

- Upon receiving a signal the dendrite tip of a nerve cell sets off a chemical reaction that creates an electrical impulse in the dendrite.

**263.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

In tissue culture, the callus is transferred to a medium that contains hormones for growth and differentiation.

- From which part of the plant are the cells extracted for tissue culture?
  - Growing tip
  - Leaves
  - Bark
  - Pith
- The cells placed in the nutrient medium for tissue culture grow rapidly to form.
  - Thallus
  - Callus
  - Hyphae
  - Protonema
- Give two advantages of tissue culture.
- What is meant by vegetative propagation?

Ans :

- (a) Growing tip

In tissue culture, new plants are grown by removing tissues or separating cells from the growing tip of plant.

- (b) Callus

The cells placed in artificial medium containing nutrients for tissue culture, grow rapidly to form a small group of cells which are called callus. Callus is transferred to another medium containing hormones for growth and differentiation.

- The advantages of tissue culture are

- Many plants can be grown from one parent in a disease free condition.
- Rapid production of ornamental plants like carnations, etc. is possible.

- Vegetative propagation is a type of asexual plant reproduction in which new plants are obtained from a part of the parent plant.

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It is evident that a single copy of T is enough to make a plant tall, while both copies have to be t for the plant to be short. Therefore, trait T (tallness) is dominant and t (dwarfness) is recessive.

- (iv) When a round and yellow seeded plant is crossed with wrinkled and green seeded plant, the phenotypic ratio of the  $F_2$  progeny would be 9 : 3 : 3 : 1 (9-Round Yellow, 3-Round Green, 3-Wrinkled Yellow and 1-Wrinkled Green)

**267.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The growing size of the human population is a cause of concern for all people. The rate of birth and death in a given population will determine its size. Reproduction is the process by which organisms increase their population. The process of sexual maturation for reproduction is gradual and takes place while general body growth is still going on. Some degree of sexual maturation does not necessarily mean that the mind or body is ready for sexual acts or for having and bringing up children. Various contraceptive devices are being used by human beings to control the size of population.

- (i) Sex ratio of females per thousand males in different states are as follows:

States	2013-15	2012-14
Delhi	870	880
Haryana	840	870
Uttar Pradesh	880	870
Punjab	895	880

Name the state which improves the ratio to maximum extent in 2013-15.

- (a) Punjab (b) Delhi  
(c) Haryana (d) Uttar Pradesh
- (ii) According to the table in above question, which state declines this ratio to maximum extent in 2013-15.  
(a) Haryana (b) Uttar Pradesh  
(c) Punjab (d) Delhi
- (iii) What is the major cause of less females than males in India?  
(a) Males live longer than females  
(b) Female foeticide  
(c) Naturally, male child birth rate is higher than female child

(d) None of these

- (iv) Which of the following is not a common sign of sexual maturation in boys and girls.  
(a) Wider chest in males  
(b) Broad shoulders in females  
(c) Menstrual cycle in females  
(d) Pubic hair
- (v) Which contraceptive method changes the hormonal balance of the body?  
(a) IUCD (b) Condoms  
(c) Orals pills (d) None of these

**Ans :**

- (i) (a) Punjab  
(ii) (a) Haryana  
(iii) (b) Female foeticide  
(iv) (b) Broad shoulders in females  
(v) (c) Orals pills

**268.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The transfer of pollen grains from anther to stigma of a flower is called pollination.

This act is very important because, it is the need for fertilisation and seed formation.

When the anther produces pollen grains and it is transferred to stigma of the same flower, it is called self-pollination. For which the maturation of both, anther and pistil at the same time is essential.

When the anther produces pollen grains and it is transferred to stigma of another flower, it is called cross-pollination. Various agents help in the transfer of pollen grains. These agents are called pollinating agents, such as insects, wind, water, animals, birds, etc.

This transfer of pollen from one flower to another is achieved by agents like wind, water or animals.

After the pollen lands on a suitable stigma, it has to reach the female germ-cells which are in the ovary. For this, a tube grows out of the pollen grain and travels through the style to reach the ovary.

After fertilisation, the zygote divides several times to form an embryo within the ovule. The ovule develops a tough coat and is gradually converted into a seed. The ovary grows rapidly and ripens to form a fruit. Meanwhile, the petals, sepals, stamens, style and stigma may shrivel and fall off. The seed contains the future plant or embryo which develops into a seedling under appropriate conditions. This

- (i) Where are the female germ-cells made?
- (ii) What happens to the eggs when females reach puberty?
- (iii) What is the role of fallopian tube?
- (iv) What do you mean by uterus?

**Ans :**

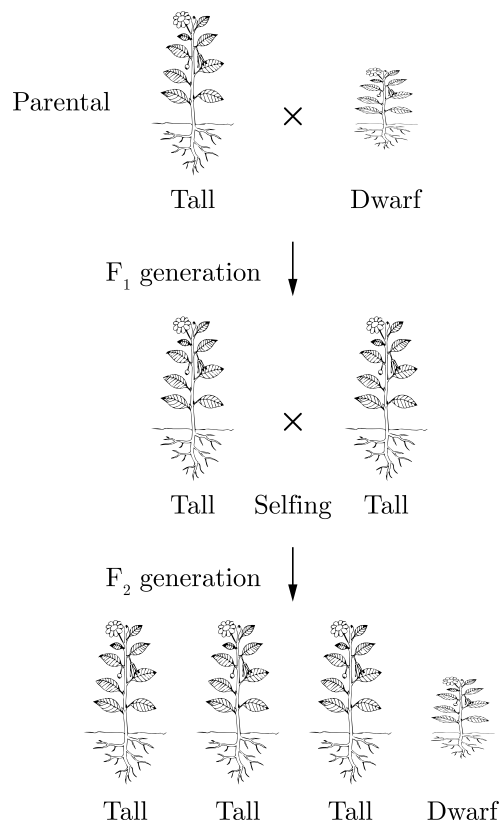
- (i) The female germ-cells or eggs are made in the ovaries.
- (ii) When the females reach puberty, some of the eggs start maturing.
- (iii) The egg is carried from the ovary to the womb through a thin oviduct or fallopian tube.
- (iv) The two oviducts unite into an elastic bag-like structure known as the uterus.

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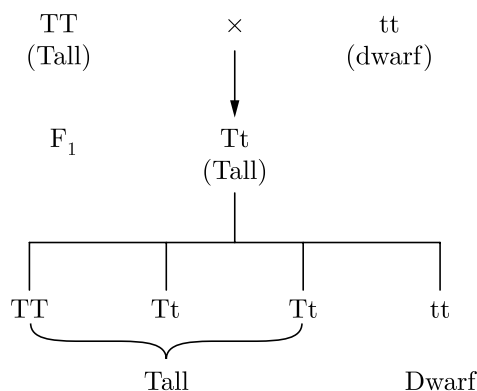
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- (iv) If a round and yellow seeded plant is crossed with a plant with wrinkled and green seeds, what would be the phenotypic ratio of the F<sub>2</sub> progeny?

**Ans :**

- (i) The trait of an organism is determined by both the maternal and paternal DNA.
- (ii) A true breeding line is one that has undergone continuous self-pollination and shows stable trait inheritance and expression for several generations.
- (iii) The cross given in the figure can be worked out as.



- 266.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

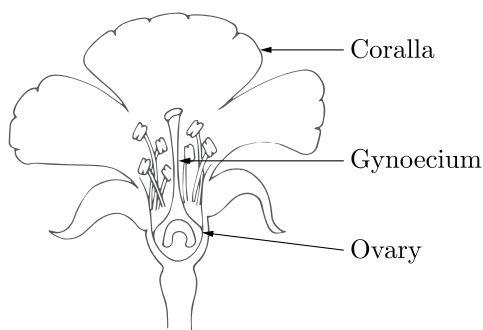
Gregor Mendel, conducted the hybridisation experiments by applying statistical analysis and mathematical logic. The confirmation of his inferences from experiments on successive generations of his test plants, proved that his results pointed to general rules of inheritance. Mendel investigated characters in garden pea plant that were manifested as two opposing traits e.g. tall and dwarf plants, yellow and green seeds, etc. He conducted his cross-pollination experiments using several true breeding pea lines, i.e. the ones that have undergone continuous self-pollination and shows stable trait inheritance and expression for several generations.

- (i) What determines the trait of an organism?
- (ii) What is a true breeding line?
- (iii) Based on the figure below, workout which trait should be considered dominant and which one is recessive?

**270.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

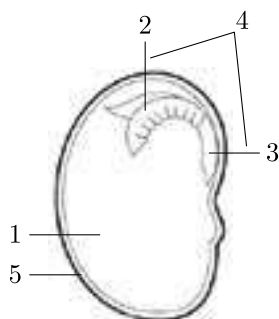
The reproductive parts of a flowering plants are located in the flower. The flower may contain either stamens or carpels or both. For producing new generation, pollen from stamens need to be transferred to carpels. Later on, the seed develops, which contains the future plant.

- (i) Which of the following statements correctly describes the function of parts of carpel?
- Stigma is the site of fertilization
  - Ovary receives the pollen
  - Ovule contains the female germ-cell
  - Style gives rise to pollen tube
- (ii) The given diagram represents the longitudinal section of watermelon flower.



Such flowers are not able to self-pollinate because

- it is a bisexual flower
  - it is unisexual flower
  - it contains short style
  - it doesn't contain sepals
- (iii) Study the picture given below and choose the correct combination of plots provided in the following table.



	Parts of Seed	Definition	Function
(a)	1 represents cotyledon	Seed leaf within the embryo	Provides nourishment for the growing plant.
(b)	5 represents plumule	The primary root	Anchoring the seedling
(c)	3 represents radicle	The young shoot	Bearing the first true leaves of a plant
(d)	2 represents seedcoat	Outer covering of the ovule	A source of stored food

- (iv) Which of the following statement are true about the parts of a typical flower?
- Middle elongated part of a carpel is termed as filament.
  - Stamens are present at the centre of the flower.
  - Stigma is the terminal sticky part of a carpel.
  - The ovary contains ovules and each ovule has an egg cell.
- I and II only
  - III and IV only
  - II and IV only
  - I and III only
- (v) Study the table given below and select the row that has the correct information.

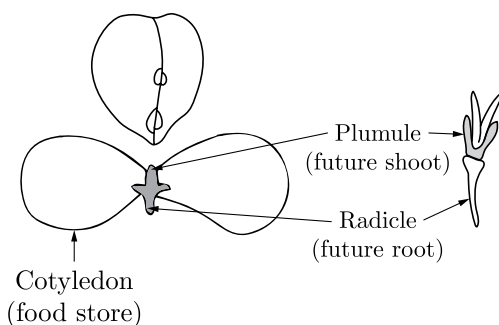
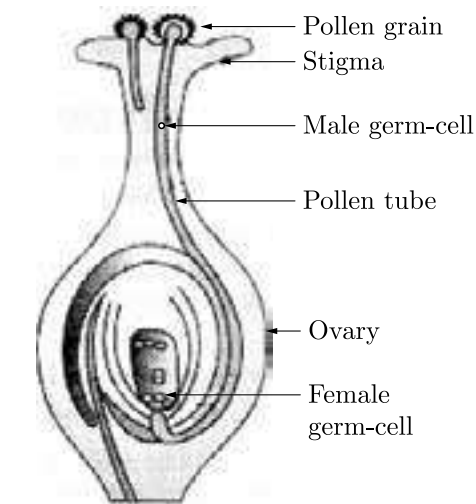
	Type of Flower	Example
(a)	Bisexual	Papaya
(b)	Unisexual	Hibiscus
(c)	Bisexual	Mustard
(d)	Bisexual	Maize

**Ans :**

- (c) Ovule contains the female germ-cell
- (b) it is unisexual flower
- (a) 1 represents cotyledon - Seed leaf within the embryo - Provides nourishment for the growing plant.
- (b) III and IV only
- (c) Type of Flower-Bisexual; Example-Mustard

**271.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

process is known as germination.



- (i) The structure formed after fertilisation is:
  - (a) Zygote
  - (b) Pollen grain
  - (c) Ovule
  - (d) Seed
- (ii) Which of the following structure develops into seed?
  - (a) Ovule
  - (b) Ovary
  - (c) Stigma
  - (d) Zygote
- (iii) Which of the following agents may help in the transfer of pollen grains from one flower to another flower?
  - (a) Animals
  - (b) Air
  - (c) Water
  - (d) All of the above
- (iv) The fusion of male and female gametes is called:
  - (a) Germination
  - (b) Pollination
  - (c) Fertilisation
  - (d) None of the above
- (v) The transfer of pollen grains from another lobes of one flower to the stigma of anther flower is called:
  - (a) Cross-pollination
  - (b) Fertilisation
  - (c) Self-pollination
  - (d) None of these

Ans :

- (i) (a) Zygote
- (ii) (a) Ovule
- (iii) (d) All of the above
- (iv) (c) Fertilisation
- (v) (a) Cross-pollination

**269.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

If the zygote is to grow and develop into an organism which has highly specialised tissues and organs, then it has to have sufficient stores of energy for doing this. In very simple organisms, it is seen that the two germ-cells are not very different from one another, or may even be similar. But as the body designs become more complex, the germ-cells also specialise. One germ-cell is large and contains the food-stores while the other is smaller and likely to be motile. Conventionally, the motile germ-cell is called the male gamete and the germ-cell containing the stored food is called the female gamete. These two different types of gametes give rise to differences in the male and female reproductive organs and, in some cases, differences in the bodies of the male and female organisms.

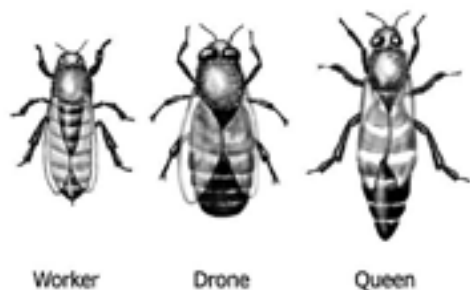
- (i) What is formed due to fusion of male and female gamete?
  - (a) Organism
  - (b) Zygote
  - (c) Male gamete
  - (d) Female gamete
- (ii) Which of the following structure develops into an organism?
  - (a) Ovum
  - (b) Sperm
  - (c) Zygote
  - (d) All of the above
- (iii) In human beings, the male germ-cell is called:
  - (a) Ovum
  - (b) Tissue
  - (c) Zygote
  - (d) Sperm
- (iv) The female germ-cell in human beings is called:
  - (a) Ovum
  - (b) Zygote
  - (c) Sperm
  - (b) Gamete
- (v) Which of the following germ-cell (Gamete) is larger, non-motile and stores food?
  - (a) Ovum
  - (b) Sperm
  - (c) Both (a) and (b)
  - (d) None of these

Ans :

- (i) (b) Zygote
- (ii) (c) Zygote
- (iii) (d) Sperm
- (iv) (a) Ovum
- (v) (a) Ovum

Inside of this, in a colony of bees we find both haploid and diploid individuals.

Choose the correct combination of plots provided in the following table.



	Queen	Worker	Drone
(a)	Fertile diploid female	Sterile diploid females	Fertile haploid males
(b)	Sterile diploid females	Fertile haploid males	Fertile diploid female
(c)	Fertile diploid female	Fertile haploid males	Sterile diploid females
(d)	Fertile haploid males	Sterile diploid females	Fertile diploid female

(iv) Which of the following statement(s) is (are) true about sexual reproduction?

- I. It ensures the creation of new variants.
- II. Somatic cells are involved.
- III. It ensures the genetic recombination.
- IV. The rate of reproduction is faster.

- (a) I and II only
- (b) I and III only
- (c) II and III only
- (d) I and IV only

(v) Study the table below and select the row that has the incorrect information.

	Type of gamete	Conventional features
(a)	Female	Large and non-motile
(b)	Male	Small and motile
(c)	Female	Large, motile and stores food
(d)	Female	Large and stores food

Ans :

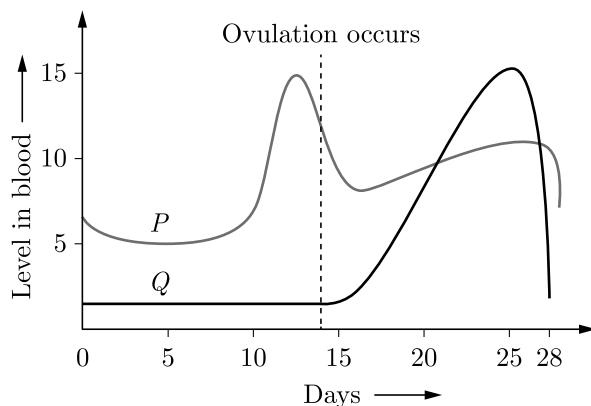
(i) (a) offspring do not possess exact copies of parental DNA

- (ii) (a) variations within the population
- (iii) (a) Fertile diploid female - Sterile diploid females - Fertile haploid males
- (iv) (b) I and III only
- (v) (c) Female - Large, motile and stores food

273. Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Humans use sexual mode of reproduction. But the actual transfer of germ cells between two people needs special organs for the sexual act. In mammals such as humans, the baby is carried in the mother's body for a long period, and is breastfed later. The female reproductive organs and breasts will need to mature to accommodate these possibilities. Hence some specialized systems are involved in the process of sexual reproduction.

- (i) In humans, testes are located outside the abdominal cavity in scrotum because
  - (a) sperm formation requires a lower temperature than the normal body temperature
  - (b) sperm formation requires a higher temperature than the normal body temperature
  - (c) testosterone secretion requires a higher temperature than the normal body temperature
  - (d) testosterone secretion requires a lower temperature than the normal body temperature
- (ii) The given graph shows the hormonal changes during a normal menstrual cycle.



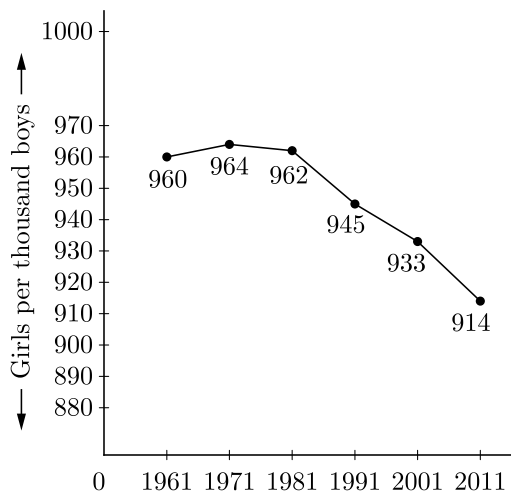
What would be a likely consequence if the



In our country, ultrasound imaging (echography) is used to take images of the developing babies (foetus). It is considered safe for both the mother and the foetus. In this method, the doctor holds a probe and moves it across the abdomen of the mother.

Ultrasound waves which are transmitted into the abdomen are reflected from the surface of the foetus. These reflected waves are picked up by the probe and relayed to a machine that produces the image of the developing baby. In some parts of our country, ultrasound is done illegally.

- (i) What could be the reason of performing ultrasound illegally?
- (ii) "Man, and not the woman is responsible for the birth of a girl child." What is meant by this statement?
- (iii) Can ultrasound examination of expecting mothers answer the following questions? Write 'Yes' or 'No'.
  - (a) What is the colour of the baby's eyes?
  - (b) Is there more than one foetus?
- (iv) Based on the data shown in the graph alongside, state what could be the reason for the decline in the boys child sex ratio ?



Ans :

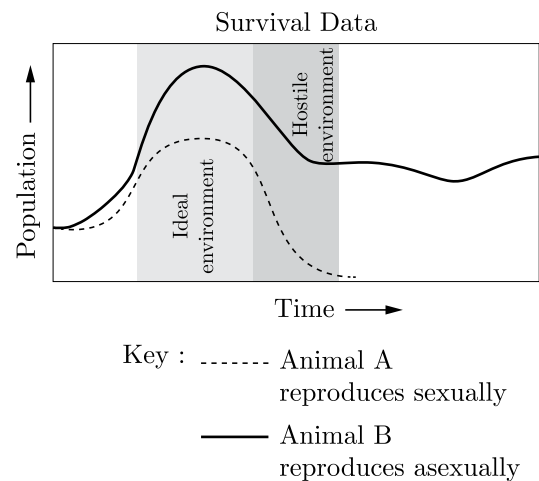
- (i) Ultrasound scan is done to know the sex of the foetus which is prohibited by law.
- (ii) Half of the male sperms have 'X' sex chromosome while the other half sperms have 'Y' sex chromosome. All the eggs of the female have 'X' chromosomes. When the sperm carrying 'X' chromosome fertilizes an egg carrying 'X' chromosome, a girl child is conceived. Hence, the male is responsible for the birth of a girl child and not the women.

- (iii) (a) No. Explanation: It cannot determine the colour of baby's eyes.
- (b) Yes. Explanation: It can tell us if there are multiple foetus.
- (iv) The decline in child sex ratio may be due to female foeticide.

**272.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Bulls alone cannot produce new calves, nor can hens alone produce new chicks. In such cases, both sexes, males and females are needed to produce new generations. So, such modes of reproduction depend on the involvement of two individuals before a new generation can be created.

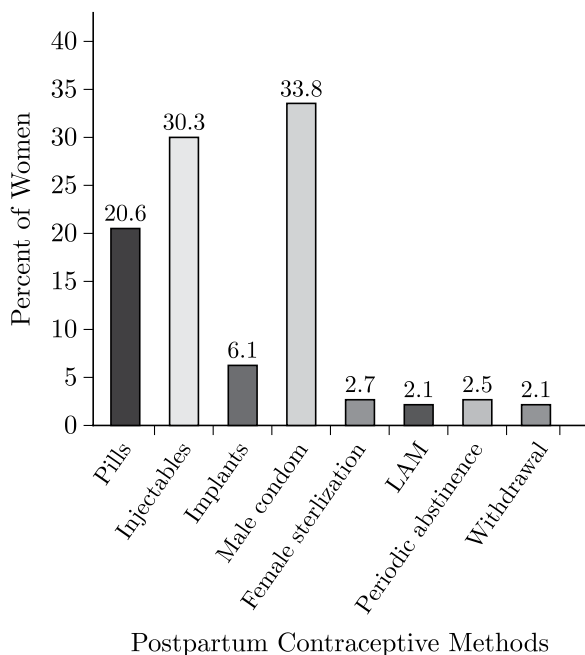
- (i) The term 'clone' cannot be applied to offspring formed by sexual reproduction because
  - (a) offspring do not possess exact copies of parental DNA
  - (b) DNA of only one parent is copied and passed on to the offspring
  - (c) offspring are formed at different times
  - (d) DNA of parent and offspring are completely different
- (ii) Given graph represents two populations, reproducing sexually and asexually.



According to the graph, Animal A population survived because of

- (a) variations within the population
  - (b) larger number of viable offspring
  - (c) a greater number of female individuals
  - (d) different forms for each generation
- (iii) Honeybees produce their young ones only by sexual reproduction.

- (i) Vasectomy is
- also called tubectomy
  - a method of preventing the passage of eggs
  - a method of blocking the continuity of oviduct
  - a method of sterilization in human males
- (ii) The given graph indicates the percentage of widely used postpartum contraceptive methods among women of a country.



Out of the given methods, number of natural family planning methods is

- 7
  - 3
  - 8
  - 1
- (iii) The given box consists of various diseases. Identify the sexually transmitted diseases and choose the correct combination of plots provided in the following table.

Measles	AIDS	Tetanus	Syphilis
Gonorrhoea	Scabies	Mumps	Cholera
	Typhoid	Filaria	

	STD-1	STD-2	STD-3
(a)	AIDS	Scabies	Filaria
(b)	Syphilis	Gonorrhoea	Mumps
(c)	Gonorrhoea	AIDS	Syphilis
(d)	Cholera	Tetanus	Typhoid

- (iv) Which of the following statement(s) is (are) true about reproductive health of humans?
- Condoms serve the role of mechanical barrier in pregnancies.
  - The copper-T are placed in the uterus to prevent ovulation.
  - If the fallopian tube in the female is blocked, the egg will not be able to reach the uterus.
  - Surgery can't be used for removal of unwanted pregnancies.
- I and II only
  - II and III only
  - I and III only
  - I, III and IV only
- (v) Study the table below and select the row that has the incorrect information.

	Method	Mode of action
(a)	Pill	Prevents ovulation
(b)	Tubectomy	Prevents the egg from reaching the uterus
(c)	Condom	Prevents eggs reaching cervix
(d)	IUDs	Disrupts the process of conception

Ans :

- (d) a method of sterilization in human males
- (b) 3
- (c) Gonorrhoea - AIDS - Syphilis
- (c) I and III only
- (c) Condom - Prevents eggs reaching cervix

**275.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

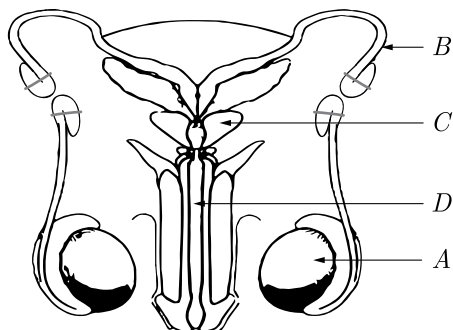
There are four tiny organisms *A*, *B*, *C* and *D*. The organism *A* is a parasitic protozoan which causes a disease known as kala-azar. The organism *B* is a microscopic single-celled animal which causes malaria disease in human beings. The organism *C* is a unicellular animal which can change its body shape according to need, it has no fixed shape. The organism *D* is also a unicellular animal which is slipper-shaped having a large number of tiny hair all around its body.

- Name the organisms *A*, *B*, *C* and *D*
- Name one characteristic body feature of organism *A*.
- Name the insect which carries organism *B* and transmits it from one person to another.
- What name is given to the asexual method

hormone represented by graph *Q* is lacking in an adult female?

- (a) The uterine lining might not be sufficiently stable for implantation of fertilised ovum.
- (b) Levels of the hormone represented by graph *P* would be higher than normal.
- (c) Fertilisation of ovum would fail to occur.
- (d) There would be no significant effect since the functions of the hormones overlap.

(iii) Given below is the outline of the male reproductive system.



Identify *A*, *B*, *C* and *D* to choose the correct combination of plots provided in the following table.

	<i>A</i>	<i>B</i>	<i>C</i>
(a)	Forms germ cells	Stores sperm for maturation	Helps sperms to move towards the female germ cell
(b)	Secretes primary male sex hormone	Transports mature sperm to ' <i>D</i> '	Produce seminal fluid
(c)	Located outside the abdominal cavity	Produce seminal fluid	Stores sperm for maturation
(d)	Requires a lower temperature than the normal body temperature	Helps sperms to move towards the female germ cell	Transports mature sperm to ' <i>D</i> '

(iv) Which of the following statement(s) is (are) true about reproduction in human beings?

- I. As the rate of general body growth begins to slow down, reproductive tissues begin to mature.
  - II. When a girl is born, the ovaries already contain thousands of mature eggs.
  - III. The embryo gets nutrition from mother with the help of placenta.
  - IV. The egg is carried from the ovary to the womb through ureter.
- (a) I and III only      (b) II and III only  
 (c) II and IV only      (d) III and IV only
- (v) Study the table below and select the row that has the incorrect information.

	Menarche	Menopause
(a)	Starting of menstruation in human females	End of menstruation in human females
(b)	Occurs at around 11-16 years of age	Occurs at around 40-45 years of age
(c)	Marks the end of reproductive phase	Marks the start of reproductive phase
(d)	Repeated process	Non-repeated process

Ans :

- (i) (a) sperm formation requires a lower temperature than the normal body temperature
- (ii) (a) The uterine lining might not be sufficiently stable for implantation of fertilised ovum.
- (iii) (b) Secretes primary male sex hormone - Transports mature sperm to '*D*' - Produce seminal fluid
- (iv) (a) I and III only
- (v) (c) Marks the end of reproductive phase - Marks the start of reproductive phase

**274.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The sexual act is a very intimate connection of bodies so that may lead to transmission of many diseases. Is it possible to prevent the transmission of such disease? The sexual act always has the potential to lead to pregnancy. Is there any way to avoid pregnancy? It is possible via surgery but this method may be misused by people who do not want a particular child. As reproduction leads to increase in population size, the size of the human population is a cause of concern for many people.

- (v) Name any two plants which are produced by this method.
- (vi) What is the other name of this method [other than that given in (b) above?]

**Ans :**

- (i) Callus
- (ii) Tissue culture
- (iii) Agar
- (iv) Plant hormones
- (v) Dahlia and Carnation
- (vi) Micropropagation

- 279.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The stem of a fruit tree *X* fixed in soil is cut in a slanting way. The upper part of stem of another fruit tree *Y* of different variety of same species is also cut in a slanting way. The cut stem of tree *Y*, without roots but having some leaves, is placed over the rooted cut stem of tree *X* in such a way that their cut surfaces fit together properly. While joining the two cut stems, care is taken to make sure that the layer *Z* of one cut stem is in contact with layer *Z* of the other cut stem. The joint of cut stem is bound tightly with a piece of cloth and covered properly with polythene. Soon the cut heals and the two stems grow together and become one fruit tree producing leaves, flower and fruits.

- (i) What is the name of this method of producing plants or trees?
- (ii) What name is given to the cut stem of tree *X* having roots?
- (iii) What name is given to the cut stem of tree *Y* which has no roots but has some leaves?
- (vi) Name the layer *Z*.
- (v) Why should the layer *Z* of one cut stem be in contact with the layer *Z* of the other cut stem?
- (vi) Name any four fruit trees which are usually bred by this technique.
- (vii) State any one advantage of producing fruit trees by this technique.

**Ans :**

- (i) Grafting
- (ii) Stock
- (iii) Scion
- (iv) Cambium layer
- (v) Because the layer *Z* (called cambium layer) in the stem is responsible for growth.
- (vi) Apple, peach, apricot and pear trees

- (vii) It enables us to combine the most desirable characteristics of the two plants in fruits

- 280.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

A small part of shoot of a plant is removed with a sharp knife. When the lower end of this small part of the shoot is buried in moist soil, it gradually develops roots and shoots and grows to become a new plant.

- (i) What is the name of this method of propagating plants?
- (ii) What care should be taken while removing a small part of the shoot from the parent plant with a knife?
- (iii) Name any two plants which provide us with food directly or indirectly and are grown by this method.
- (iv) Give one advantage of this method of producing new plants.
- (v) State whether it is a sexual method of reproduction or an asexual method. Why?
- (vi) What special name can be given to the genetically identical new plants produced by this technique?

**Ans :**

- (i) Cuttings method
- (ii) The cutting should have one (or more) bud on it
- (iii) Sugar cane and Banana plants
- (iv) By using the cuttings method, we can produce many new plants from just one plant quickly, without waiting for flowers and seeds
- (v) Asexual method of reproduction : Because new plants are produced from a single parent plant without the involvement of sex cells (or gametes) of the plant
- (vi) clones

- 281.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

When the branches of a plant growing in the field are pulled towards the ground and a part of them is covered with moist soil (leaving the tips of the branches exposed above the ground), then after some time new roots develop from the parts of branches buried in the soil. On cutting these branches from the parent plant, new plants are produced from the cut parts of branches which had developed roots.

of reproduction of (i) organism *A*, and (ii) organism *B*?

(v) Where do organisms *C* and *D* live?

**Ans :**

- (i) *A* is Leishmania, *B* is Plasmodium, *C* is Amoeba and *D* is Paramecium
- (ii) Organism *A* (Leishmania) has a whip-like structure called flagellum at its one end.
- (iii) Female Anopheles mosquito.
- (iv) (i) Binary fission  
(ii) Multiple fission
- (v) In pond water.

**276.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Two very small organisms *X* and *Y* both reproduce by the method of budding. Organism *X* is industrially very important because it is used in making alcohol from sugar. It is also used in making alcohol from sugar. It is also used in making bread. Organism *Y* lives in freshwater. If organism *Y* gets cut into a number of parts accidentally, each cut part can grow to form complete organism.

- (i) What are organisms *X* and *Y*?
- (ii) What is the name of the process in which *X* converts sugar into alcohol?
- (iii) To which class of organisms does *X* belong?
- (iv) Name an important body feature of organism *Y*.
- (v) Which organism is multicellular and which one is unicellular?

**Ans :**

- (i) *X* is yeast and *Y* is Hydra.
- (ii) Fermentation
- (iii) Fungi
- (iv) *Y* has tentacles.
- (v) *Y* is multicellular whereas *X* is unicellular.

**277.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

When a moist slice of bread was kept aside for a few days then some organism grew on it to form a white cottony mass which later turned black. When this slice of bread was observed through a magnifying glass, then fine thread-like projections and thin stems having bulb-like structures at the top were seen.

- (i) What is the common name and scientific name of the organism which grew on the moist slice of bread?
- (ii) How did this organism grow on the moist slice of bread automatically?
- (iii) What are the fine, thread-like projections on the surface of slice of bread known as?
- (iv) What name is given to the knob-like structures and what do they contain?
- (v) What is the name of this method of reproduction?
- (vi) Name one unicellular organism which reproduces by this method.
- (vii) Name two non-flowering plants which reproduce by this method.

**Ans :**

- (i) Bread mould; Rhizopus.
- (ii) Spores of bread mould plant are always present around us. One such spore landed on moist slice of bread and finding the conditions favourable (presence of moisture, nutrients and warmth, etc.) grew into bread mould.
- (iii) Hyphae
- (iv) Sporangia; Spores
- (v) Spore formation
- (vi) Bacteria
- (vii) Ferns and Mosses

**278.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

A scientist removed some cells from the growing point of a plant and placed it in a suitable medium leading to the formation of a shapeless lump of mass *X*. *X* is then transferred to another medium which stimulates it to develop roots. When *X* with developed roots is placed in a yet another medium, then it developed shoots to form tiny plantlets. These plantlets can then be transplanted in pots or soil where they can grow to form mature plants.

- (i) What is the shapeless lump of mass *X* known as?
- (ii) What name is given to this method of producing new plants?
- (iii) The growth medium used in this method contains plant nutrients in the form of a 'jelly' Name this jelly.
- (iv) What is the general name of chemicals used to stimulate the growth of plant cells and development of roots and shoots?

Ans :

- (i) Spirogyra
- (ii) Green
- (iii) Fragmentation
- (iv) The binary fission in Amoeba is a reproduction process which takes place in unicellular organisms; Fragmentation in alga is a reproduction process which takes place in simple multicellular organisms.
- (v) Sea anemone

**285.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

When a broken piece of the stem of a plant  $X$  is planted in the soil, a new plant grows from it in a week's time. The leaves of plant  $X$  also have many small entities  $Y$  in their margins which can fall to the ground alone or along with leaves and grow into new plants.

- (i) Name a plant which  $X$  could be.
- (ii) What are the entities  $Y$  present on the leaves of  $X$  known as?
- (iii) Name a plant other than  $X$  which can be reproduced from its leaves.
- (iv) Name a common plant grown in many homes which can be propagated from its broken stems like plant

Ans :

- (i) Bryophyllum
- (ii) Buds
- (iii) Begonia
- (iv) Money plant

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# CHAPTER 8

## Heredity And Evolution

### 1. INHERITANCE OR HEREDITY

Inheritance or heredity is the process of passing on characteristics from parents to offspring or from one generation to the next generation.

#### 1.1 Variations

Variations are the differences in characters in the organisms of a species.

1. The variations acquired by individuals from parents or variations occurring in germ cells are called heritable or germinal variations.
2. The variations which are not passed on to the offspring or occurred in body cells except germ cells are called non-heritable or somatic variations.
3. Accumulation or variations during reproduction in a species do not ensure equal chances of survival of each variant in the environment.

#### 1.2 Genetics

Genetics is the branch of biology that deals with the study of heredity and variations.

1. **Gregor Johann Mendel**, the **Father of Genetics**, gave scientific explanation for the mechanism of inheritance of characters from parents to offspring, generation after generation.
2. Mendel conducted experiments on Garden pea, (*Pisum sativum*) for different contrasting visible characters-Tall/Short plant, round/wrinkled seed shape, yellow/green seed colour, violet/white flower colour, inflated/constricted pod shape, green/yellow pod colour, and axial/terminal flower position.
3. Of these contrasting characters, tall, round, yellow (seed colour), violet, inflated, green (pod colour) and axial were dominant characters.
4. Mendel studied the inheritance of one trait at a time and produced progeny for each trait.
5. Mendel cross-pollinated homozygous tall plants with homozygous dwarf plants. These plants formed the parent generation (P generation).
6. The seed produced by parent generation were grown to produce hybrid plants. These belonged to  $F_1$  generation. All the plants of  $F_1$  generation were tall.
7. The plants of  $F_1$  generation were self-pollinated. The plants raised from the seeds of  $F_1$  plants belonged to  $F_2$  generation. 75 per cent plants of  $F_2$  generation were tall and 25 per cent dwarf. In  $F_2$  generation, the tall and dwarf plants were produced in 3 : 1 ratio.
8. In  $F_3$  generation raised from  $F_2$  plants by self-pollination, the dwarf plants of  $F_2$  generation produced only dwarf plants on self-pollination. Of the  $F_2$  tall plants, only 25 per cent were pure tall and produced tall plants. The remaining 50 per cent of the tall plants, on self-pollination, produced tall and dwarf plants in 3 : 1 ratio.
9. Mendel interpreted the results as follows :
  - (i) The height of pea plants (tall and short) is controlled by a pair of contrasting factors. A plant is tall because it possesses factors for tallness (T) and a plant is short because it possesses factors for dwarfness (t).
  - (ii) These factors occur in pairs (a tall plant has TT and a short plant has tt factors). One member of this pair comes from each parent (male and female).
  - (iii) All  $F_1$  plants have both the factors T and t. They are tall because T factor dominates t factor. Thus, tallness is a dominant trait and shortness a recessive trait.
  - (iv) The factors (T and t) are separate entities. When gametes are formed, these unit factors segregate and each gamete gets only one of the two alternative factors (either T or t). Thus,  $F_1$  plants produce two types of gametes in equal number.
  - (v) There are four possible combinations of these genes during random fusion of  $F_1$  gametes (TT, Tt, tT and tt). As a result, both tall and short plants are formed in  $F_2$  generation in 3 : 1 ratio.

10. Monohybrid cross is made to study the inheritance of one pair of contrasting characters.
11. Dihybrid cross is made to study the inheritance of two pairs of contrasting characters simultaneously.
12. Mendel developed three laws of inheritance - Law of dominance, Law of segregation (purity of gametes) and Law of independent assortment.
  - (i) Law of dominance states that when homozygous individuals with one or more sets of contrasting characters are crossed, their offspring have both the contrasting genes of a pair but only the dominant allele expresses itself and recessive one is masked.
  - (ii) Law of segregation states that in a heterozygote (hybrid), the two alleles of a gene remain together without blending and during gamete formation, they separate and only one allele enters each gamete.
  - (iii) Law of independent assortment states that during the inheritance of two pairs of contrasting characters, the distribution of alleles of each pair in the gametes is independent of the distribution of other pair of alleles.
13. Genes are basic units of heredity. They are located on the chromosomes in a linear order. Hence, chromosomes are described as hereditary vehicles. Chromosomes are passed on from parents to the offspring through gametes during sexual reproduction.

## 2. SEX DETERMINATION

Sex determination in some animals is controlled by environmental temperature at which fertilised eggs are kept.

1. In snails, individuals can change their sex which indicates that sex is not genetically determined. For example, *Ophryotrocha* is male when young and changes to female later on.
2. Sex in human beings is determined genetically.
  - (i) The chromosomes of 23<sup>rd</sup> pair, called sex chromosomes (X in females, Y in males), are responsible for the development of sex of a child.
  - (ii) The human female has XX chromosomes, whereas human male has XY chromosomes.
  - (iii) The sex of a child is determined at the time of fertilisation which depends upon the type of sperm that fuses with the egg.

When egg fuses with the sperm carrying X-chromosome, the zygote develops into a female child and when egg fuses with the sperm carrying Y-chromosome, the zygote develops into a male child.

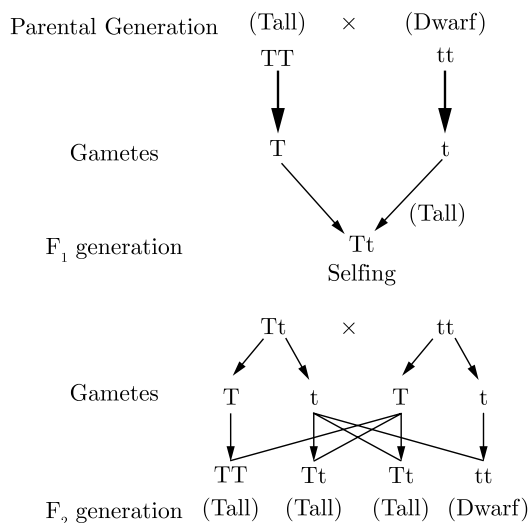
## OBJECTIVE QUESTIONS

1. In an experiment with pea plants, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plant to pure short plants in F<sub>2</sub> generation will be :
  - (a) 1 : 3
  - (b) 3 : 1
  - (c) 1 : 1
  - (d) 2 : 1

Ans :

OD 2023

When a pure tall plant (TT) is crossed with the pure short plant (tt), then the progeny in the F<sub>1</sub> generation will be hybrid (Tt). When the F<sub>1</sub> generation is self-crossed (Tt), then in the F<sub>2</sub> generation, the progeny produced will be tall homozygous (TT), Tall heterozygous (Tt), and dwarf homozygous (tt). Hence, the ratio of pure tall plant to pure short plants in F<sub>2</sub> generation will be 1 : 1 (TT : tt).

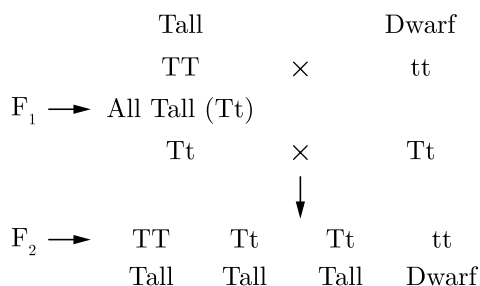


Thus option (c) is correct option.

2. Chromosomes :
  - (i) carry hereditary information from parents to the next generation.
  - (ii) are thread like structures located inside the nucleus of an animal cell.
  - (iii) always exist in pairs in human reproductive cells.

Thus, the inherited trait which is not expressed will be a recessive trait.

- (b) Yes; in Mendel's experiment, when pure tall pea plants were crossed with pure dwarf pea plants, only tall pea plants were obtained in  $F_1$  generation. On selfing the pea plants of  $F_1$  generation both tall and dwarf pea plants were obtained in  $F_2$  generation. Reappearance of the dwarf pea plants in  $F_2$  generation proves that the dwarf trait was inherited but not expressed in  $F_1$  generation. The recessive trait does not express itself in the presence of the dominant trait. So, it is possible that one trait may be inherited but may not be expressed in an organism.



and round seeds are the dominant traits.

When the  $F_1$  plants are self pollinated, the  $F_2$  progeny consisted of some tall plants with round seeds and some short plants with wrinkled seeds which are the parental traits all well as some of their new combinations such as tall plants with wrinkled seed and dwarf plants with round seeds.

Thus, it may be concluded that tall and short traits and round and wrinkled seed traits have been inherited independently.

121. Define genetics. What is the contribution of Mendel in this branch of biology ?

Ans :

OD 2016

Genetics is the study of inheritance of genetic characteristics from the generation of parents to offsprings and the laws relating to such transmission/inheritance.

In other words, genetics is the “science of heredity and variation”.

**Mendel's contribution :** Mendel observed the occurrence of contrasting characters in various generations of garden pea (*Pisum sativum*). Based on his observations, Mendel interpreted that these contrasting characters, (e.g., tall and dwarf plants, wrinkled and smooth seeds) are controlled by “factors”. He considered each and every character as a unit, which is controlled by a “factor”. What Mendel called “factors” the carriers of hereditary information are now known as genes.

120. How do Mendel's experiments show that

- (i) Traits may be dominant or recessive?
- (ii) inheritance of two traits is independent of each other.

Ans :

OD 2016

- (i) Traits may be dominant or recessive. When Mendel cross-bred plants of two different traits of character, a tall pea plant (TT) and a dwarf pea plant (tt) to get a progeny, in  $F_1$  generation, all plants were tall. Thus, only the dominant trait was visible in this generation. But when plants of  $F_1$  generation were self-crossed, then the two traits of character got separated in the plants of  $F_2$  generation. All plants obtained in the  $F_2$  generation were not tall. One-fourth of the  $F_2$  plants were short.

Appearance of tall characters in both the  $F_1$  and  $F_2$  generations shows that it is a dominant character. Whereas, the absence of dwarf character in  $F_1$  generation and its reappearance in  $F_2$  generation shows dwarfness is the recessive character.

- (ii) When a cross was made between a tall pea plant with round seeds and a short pea plant with wrinkled seeds, the  $F_1$  progeny plants are all tall with round seeds. This indicates that tallness

## CASE BASED QUESTIONS

122. Read the following case based passage and answer the questions given after passage.

Question numbers i - iv are based on the table given below. Study the table and answer the following questions.

Table-A

	Characters	Males	Females
1.	Total no. of chromosomes	23 pairs	23 pairs
2.	No. of autosome	22 pairs	22 pairs
3.	No. of sex chromosome	1 pair	1 pair

- (i) What is sex determination?
- (ii) What are the sex chromosomes in the males?
- (iii) What are the sex chromosomes in the females?
- (iv) Is the father responsible for the sex of the child?

- (d) Even though male and female gametes (sperm and egg) differ in size and morphology, they have the same number of chromosomes, suggesting equal genetic contributions from each parent.

Thus (a) is the correct option.

8. Exchange of genetic material takes place in

- (a) vegetative reproduction
- (b) asexual reproduction
- (c) sexual reproduction
- (d) budding

Ans :

- (c) sexual reproduction

9. Two pink coloured flowers on crossing resulted in 1 red, 2 pink and 1 white flower progeny. The nature of the cross will be

- (a) double fertilisation
- (b) self pollination
- (c) cross fertilisation
- (d) no fertilisation

Ans :

Delhi 2014

- (b) self pollination

10. A cross between a tall plant (TT) and short pea plant (tt) resulted in progeny that were all tall plants because

- (a) tallness is the dominant trait
- (b) shortness is the dominant trait
- (c) tallness is the recessive trait
- (d) height of pea plant is not governed by gene 'T' or 't'

Ans :

- (a) tallness is the dominant trait

11. Which of the following statement is incorrect?

- (a) For every hormone there is a gene.
- (b) For every protein there is a gene.
- (c) For production of every enzyme there is a gene.
- (d) For every molecule of fat there is a gene

Ans :

OD 2009

- (d) For every molecule of fat there is a gene

12. A round, green seeded pea plant (RR yy) is crossed with wrinkled, yellow seeded pea plant, (rr YY) the seeds produced in  $F_1$  generation are

- (a) round and yellow

- (b) round and green
- (c) wrinkled and green
- (d) wrinkled and yellow

Ans :

- (a) round and yellow

13. Human males all the chromosomes are paired perfectly except one. This/these unpaired chromosomes is/are

- (i) large chromosomes
- (ii) small chromosomes
- (iii) Y-chromosome
- (iv) X-chromosome
- (a) (i) and (ii)
- (b) (iii) only
- (c) (iii) and (iv)
- (d) (ii) and (iv)

Ans :

OD 2011

- (c) (iii) and (iv)

14. The maleness of a child is determined by

- (a) the X chromosome in the zygote
- (b) the Y chromosome in zygote
- (c) the cytoplasm of germ cell which determines the sex
- (d) sex is determined by chance

Ans :

- (b) the Y chromosome in zygote

15. A zygote which has an X-chromosome inherited from the father will develop into a

- (a) boy
- (b) girl
- (c) X-chromosome does not determine the sex of a child
- (d) either boy or girl

Ans :

Foreign 2014

- (b) girl.

16. Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds produce  $F_1$  progeny that have round, yellow (RrYy) seeds. When  $F_1$  plants are selfed, the  $F_2$  progeny will have new combination of characters. Choose the new combination from the following.

- (i) Round, yellow
- (ii) Round, green

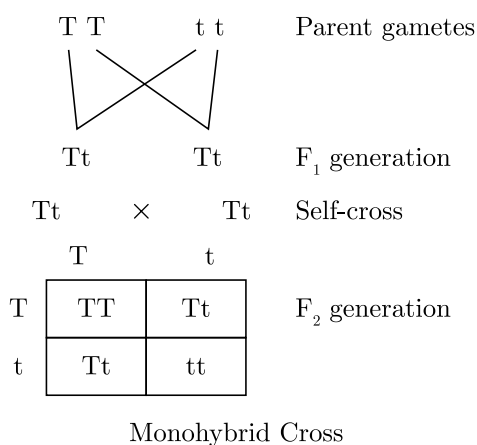
### THREE MARKS QUESTIONS

104. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in  $F_1$  and  $F_2$  generations when he crossed the tall and short plants? Write the ratio he obtained in  $F_2$  generation plants.

Ans :

Delhi 2019

Mendel used pea plant (*Pisum sativum*). When he crossed tall and short pea plants, the progeny obtained in  $F_1$  generation were tall. When the  $F_1$  plants were self-crossed the  $F_2$  generations showed three tall and one dwarf plant. The genotypic ratio of  $F_2$  generation is 1 : 2 : 1 (TT : Tt : tt). The phenotypic ratio is 3 : 1 (Tall : Dwarf).



105. How do Mendel's experiments show that traits may be dominant or recessive?

Ans :

Delhi 2018

Traits may be dominant or recessive. When Mendel cross-bred plants of two different traits of character, a tall pea plant (TT) and a dwarf pea plant (tt) to get a progeny, in  $F_1$  generation, all plants were tall. Thus, only the dominant trait was visible in this generation. But when plants of  $F_1$  generation were self-crossed, then the two traits of character got separated in the plants of  $F_2$  generation. All plants obtained in the  $F_2$  generation were not tall. One-fourth of the  $F_2$  plants were short.

Appearance of tall characters in both the  $F_1$  and  $F_2$  generations shows that it is a dominant character. Whereas, the absence of dwarf character in  $F_1$  generation and its reappearance in  $F_2$  generation shows dwarfness is the recessive character.

106. With the help of two suitable examples explain why certain experiences and traits earned by people during their lifetime are not passed onto their next generations. When such traits be passed on?

Ans :

OD 2016

Learning skills like swimming, dancing earned by people during their lifetime are not passed onto their next generations. If a person knows swimming or dancing, it is not necessary that this trait is seen in the progeny because learning a new skill does not change the genes of the germ cells of humans.

These acquired traits occur in the Somatic cells which do not involve germ cells and genetic materials. Therefore these traits are not passed onto their next generation.

107. Distinguish between the acquired traits and the inherited traits in tabular form, giving one example for each.

Ans :

Delhi 2017

	Acquired traits	Inherited traits
1.	These are somatic variations and do not bring any change in DNA	These are genetic variations and bring about changes in the DNA.
2.	These traits develop throughout the life time of an individual and are not inherited. <b>Example :</b> learning of dance and music.	These traits are transferred by or inherited from the parents to the offspring. <b>Example:</b> Eye colour, Hair colour.

108. How did Mendel's experiments show that different traits are inherited independently? Explain.

Ans :

Delhi 2016, Delhi 2011

When a cross was made between a tall pea plant with round seeds and a short pea plant with wrinkled seeds, the  $F_1$  progeny plants are all tall with round seeds. This indicates that tallness and round seeds are the dominant traits.

When the  $F_1$  plants are self pollinated, the  $F_2$  progeny consisted of some tall plants with round seeds and some short plants with wrinkled seeds which are the parental traits all well as some of their new combinations such as tall plants with wrinkled seed and dwarf plants with round seeds.

Thus, it may be concluded that tall and short traits and round and wrinkled seed traits have been inherited independently.

109. How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism?

Ans :

Foreign 2015

Yes; in Mendel's experiment, when pure tall pea

- 24. Assertion :** The sex of the children will be determined by chromosome received from the father.

**Reason :** A human male has one *X* and one *Y* -chromosome.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

If a child inherits *X*-chromosome from the father will be a girl and one who inherits a *Y*-chromosome will be a boy.

- 25. Assertion :** Changes in non-reproductive tissues can be passed on the DNA of the germ cells.

**Reason :** Inherited traits include the traits developed during the lifetime of an individual that cannot be passed on to its progeny.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (d) Assertion (A) is false but reason (R) is true.

Changes in non-reproductive tissues cannot be passed on the DNA of the germ cells

The traits developed during the lifetime of an individual that cannot be passed on to its progenies are acquired traits.

- 26. Assertion :** Chromosomes are known as hereditary vehicles.

**Reason :** The chromosomes are capable of self-reproduction and maintaining morphological and physiological properties through successive generations.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

- 27. Assertion :** DNA finger printing is a method in which polymerase chain reaction followed by DNA probe is used.

**Reason :** A DNA finger print is inherited and therefore, resembles that of parents.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

- 28. Assertion :** The genetic complement of an organism is called genotype.

**Reason :** Genotype is the type of hereditary properties of an organism.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).



(iii) Wrinkled, yellow

(iv) Wrinkled, green

(a) (i) and (ii)

(b) (i) and (iv)

(c) (ii) and (iii)

(d) (i) and (iii)

**Ans :**

(b) (i) and (iv)

**17.** A trait in an organism is influenced by

(a) paternal DNA only

(b) maternal DNA only

(c) both maternal and paternal DNA

(d) neither by paternal nor by maternal

**Ans :**

(c) both maternal and paternal DNA

**18.** From the list given below, select the character which can be acquired but not inherited

(a) colour of eye

(b) colour of skin

(c) size of body

(d) nature of hair

**Ans :**

OD 2014

(c) size of body

**19.** The two versions of a trait (character) which are brought in by the male and female gametes are situated on

(a) copies of the same chromosome

(b) two different chromosomes

(c) sex chromosomes

(d) any chromosome

**Ans :**

Delhi 2011

(a) copies of the same chromosome

**20.** Select the statements that describe characteristics of genes

(i) genes are specific sequence of bases in a DNA molecule

(ii) a gene does not code for proteins

(iii) in individuals of a given species, a specific gene is located on a particular chromosome

(iv) each chromosome has only one gene

(a) (i) and (ii)

(b) (i) and (iii)

(c) (i) and (iv)

(d) (ii) and (iv)

**Ans :**

Foreign 2012

(b) (i) and (iii)

**21.** The number of pair(s) of sex chromosomes in the zygote of humans is

(a) one

(b) two

(c) three

(d) four

**Ans :**

(a) one

**22.** Match the genetic cross of the parents on the left with the genotypes of the offspring most likely to be produced from that cross on the right.

	Column I		Column II
(A)	BB × bb	(p)	100% Bb
(B)	Bb × Bb	(q)	25% BB, 50% Bb, 25% bb
(C)	BB × BB	(r)	100% BB
(D)	bb × bb	(s)	100% bb

	A	B	C	D
(a)	q	r	p	s
(b)	p	q,	r,	s,
(c)	r	s,	p,	q
(d)	r	q	s	p

**Ans :**

(b) A-p, B-q, C-r, D-s

**23. Assertion :** Dominant allele is an allele whose phenotype expresses even in the presence of another allele of that gene.**Reason :** It is represented by a capital letter, e.g. T.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Dominant allele is an allele whose phenotype will be expressed even in the presence of another allele of that gene. It is represented by a capital letter, e.g. T. Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

## ONE MARK QUESTIONS

- 33.** Mendel took tall pea plants and short pea plants and produced  $F_1$  progeny through cross-fertilization. What did Mendel observe in the  $F_1$  progeny?

**Ans :** OD 2018  
Mendel observed that all pea plants were tall in  $F_1$  progeny. This meant that only one of the parental traits (tallness) was dominant over other one (dwarfness).

- 34.** A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plant bearing white flowers. What will be the result in  $F_1$  progeny?

**Ans :** Delhi 2018  
All the progeny of  $F_1$  generation will have violet flowers because violet colour is dominant over the recessive white colour.

- 35.** What is the source of hereditary informations in the cell ?

**Ans :** OD 2017  
DNA

- 36.** Name the characters which show their existence in  $F_1$  generation.

**Ans :** OD 2016, Delhi 2014  
Dominant characters.

- 37.** What is DNA?

**Ans :** Delhi 2015  
DNA is genetic biomolecule which is the carrier of hereditary information from parents to the next generation.

- 38.** In which year was Mendel's work rediscovered ?

**Ans :** SQP 2016  
Mendel's work was rediscovered in 1900 after his death.

- 39.** Who coined the term 'gene' ?

**Ans :** Foreign 2017  
The term 'gene' was coined by Johansen in 1909.

- 40.** How is the male produced ?

**Ans :** SQP 2017  
When Y chromosome from father fertilizes the ovum of female, then male (boy) is produced.

- 41.** What is heredity?

**Ans :** Delhi 2015  
The transmission of genetic characteristics from one generation to another is known as heredity.

- 42.** Name two dominant characters in pea plant.

**Ans :** Delhi 2016  
(a) Tallness,  
(b) Roundness of seeds.

- 43.** Write the name of two recessive characters in pea plant.

**Ans :** Foreign 2015  
(a) Shortness,  
(b) Wrinkleness of seeds.

- 44.** What is variation?

**Ans :** Foreign 2016  
Variation is the occurrence of smaller differences among the individuals of the same species. e.g., an offspring of same parents do not exactly resemble with each other and their parents.

- 45.** When pure breed tall pea plants of genotype TT are cross-bred with pure breed dwarf pea plants having genotype tt, all tall pea plants having genotype Tt are obtained in the  $F_1$  generation. What will be the genotype ratio between TT, Tt and tt in the  $F_2$  generation.

**Ans :** OD 2017  
 $TT : Tt : tt = 1 : 2 : 1$ .

- 46.** In which type of reproduction more variations are seen ?

**or**

Which type of reproduction causes greater diversity?

**Ans :** OD 2015  
Sexual reproduction.

- 47.** Name the biological term used to show similarities among individuals.

**or**

Give one word for the following : "resemblances among individuals related by descent."

**Ans :** SQP 2016  
Heredity.

- 48.** Write the expanded form of DNA.

**Ans :** Comp 2014  
Deoxyribonucleic Acid.

- 49.** What are the characters which do not show their existence in  $F_1$  generation, called ?

**Ans :** Foreign 2014  
Recessive characters.

Genotype of the organism include all dominant and recessive characters.

- 29. Assertion :** Mendel chose a number of varieties of garden pea as plant material for his experiments.

**Reason :** Garden pea has well defined characters and was bisexual.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Mendel chose garden pea as plant material for his experiment because garden pea plants were easily available/they grow in one season/fertilization was easy.

- 30. Assertion :** In humans, males play an important role in determining the sex of the child.

**Reason :** Males have two X chromosomes.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

Sex of a child is dependent on the type of the male gamete that fuses with the female gamete. Human beings possess 23 pairs of chromosomes. Out of these, 22 pairs are known as autosomes, while the remaining one pair comprises sex chromosomes (XX in females and XY in males). At the time of fertilisation, the egg cell fuses with the sperm cell, resulting in the formation of the zygote. If the egg cell carrying an X chromosome fuses with the sperm carrying an X chromosome, the resulting child would be a girl. If the egg cell carrying an X chromosome fuses with the sperm carrying a Y chromosome, the

resulting child would be a boy.

- 31. Assertion :** Learning a skill such as dance and music is an acquired trait.

**Reason :** Acquired traits develop in the life time of an individual and do not pass to the progeny.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Traits which develop in the life time of an individual and do not pass to the progeny are called acquired traits. Learning a skill such as dance/music/loss of body parts/weight etc are example of acquired traits.

- 32. Assertion :** Traits like eye colour or height are inherited traits.

**Reason :** Inherited traits are not transferred from parents to young ones.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

Eye colour and height are genetically inherited traits, as these are expressed by genes. Inherited traits are the traits which are transferred from parents to young ones. Acquired traits are the characters that are acquired by the individual during its lifetime. These traits cannot be inherited. For example, if a wrestler develops large muscles due to his training program that does not mean it will be passed on to his offspring.

66. What are inherited traits ?

**Ans :**

Foreign 2013, Delhi 2011

The characters which are transferred from one generation to the next generation are called inherited traits. This phenomenon is called inheritance.

67. What are acquired characters or traits ?

**Ans :**

Foreign 2012

The characteristics in an individual which are not inherited from the parents are called acquired characters. An individual acquires these traits from the nature.

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## TWO MARKS QUESTIONS

68. List two differences between acquired traits and inherited traits by giving an example of each.

**Ans :**

Board 2019

	Acquired traits	Inherited traits
1.	These are somatic variations and do not bring any change in DNA	These are genetic variations and bring about changes in the DNA.
2.	These traits develop throughout the life time of an individual and are not inherited. <b>Example</b> : learning of dance and music.	These traits are transferred by or inherited from the parents to the offspring. <b>Example</b> : Eye colour, Hair colour.

69. Give evidences to show that the science of heredity is not new.

**Ans :**

OD 2017

The following evidences show that the science of heredity is not new :

- (i) Selective breeding of horses and cattle used to be done by the ancient civilisations of Babylon and Assyria.
- (ii) Ancient Chinese writings mention about creating better varieties of paddy.
- (iii) Ancient Indian medical practitioner was aware of the factors that determine the sex of a child.

70. If the sperm, bearing Y-chromosome, fertilizes the egg, the child born will not be entirely like his father. Why is it so ?

**Ans :**

SQP 2016

It is so because the other sex chromosome which come from mother (i.e., X) as well as 22 auto some of egg will also have their effects.

71. Why are the chances of variation more in sexually developing organisms ?

**Ans :**

Delhi 2015

The chances of variation are more in sexually developing organisms because meiosis crossing over occurs in gamete to genesis and there is also fusion of gametes from two different individuals.

72. What are the rules of inheritance ?

**Ans :**

Delhi 2016

On the basis of his experiments, Mendel established some rules which are called the rules of inheritance. They are :

- (i) Law of Dominance,
- (ii) Law of Segregation and
- (iii) Law of Independent Assortment.

73. What is a sex chromosome ?

**Ans :**

Foreign 2017

A sex chromosome is one which helps in sex-determination of an organism.

In human males, the sex chromosomes are XY and the gametes (sperms) they produce are of two types : X-bearing and Y-bearing.

In females, the sex chromosomes are XX and the gametes (eggs) they produce are of only one type : X-bearing.

74. How do the traits get expressed ?

**Ans :**

Foreign 2016

DNA is the source of genetic information for making proteins in the cell. The section of function DNA is called gene. For example, the height of a plant depends on the hormone. The amount of the hormone depends on the process of its formation. A protein is important for this process. If this protein

works efficiently, a lot of hormone will be made. If the gene responsible for that protein has an alteration, that makes the protein less efficient. The amount of hormone will be less and the plant will be short. Thus, genes control genetic characteristics or traits of an organism.

75. How can we say that change in genes can be brought about the change in DNA?

Ans :

OD 2016

Genes are functional part of DNA, thus, Genes are made up of DNA. If any get changed, then it will also change DNA structure of the organism.

76. Write the differences between autosomes and sex chromosomes.

Ans :

Delhi 2017

	Human autosomes	Human sex chromosome
1.	They do not participate in sex determination	They determine the sex of an individual.
2.	There are 22 pairs of chromosomes in each cell.	There is one of sex chromosome in each cell.
3.	They are similar in the cells of male and female.	In males, the sex chromosome pair is XY, whereas in females, it is XX.

77. Why are some pea plants tall and others short in nature ? Explain with reference to the role of genes in controlling characteristics.

Ans :

Delhi 2016

DNA is the source of genetic information for making proteins in the cell. The section of function DNA is called gene. For example, the height of a plant depends on the hormone. The amount of the hormone depends on the process of its formation. A protein is important for this process. If this protein works efficiently, a lot of hormone will be made. If the gene responsible for that protein has an alteration, that makes the protein less efficient. The amount of hormone will be less and the plant will be short. Thus, genes control genetic characteristics or traits of an organism.

78. List two differences in tabular form between dominant trait and recessive traits. What percentage or proportion of the plants in the  $F_1$  generation, progeny were round, in Mendel's cross between round and wrinkled pea plants?

Ans :

Foreign 2017, Delhi 2014

	Dominant trait	Recessive trait
1.	The trait which appears in the $F_1$ progeny is dominant.	The trait which remains hidden or which not appear in the $F_1$ progeny is the recessive trait.
2.	It appears in more numbers.	It appears in less number.

In  $F_1$  generation all plants were with round seeds.

79. Is it correct to say that if fertilization of the egg occurs on a full moon night, the child produced will be a male ? Give reason.

Ans :

Foreign 2016

No, sex of the child is a matter of chance. Full moon has nothing to do with the sex of the child. The sperm having either X-chromosome or Y-chromosome, which fertilizes the egg, will determine the sex.

80. (a) Draw a flow chart to determine the characteristics of the progeny of a cross between tall pea plants with short pea plants showing :  
 (i)  $F_1$  Generation  
 (ii)  $F_2$  Generation  
 (b) List the dominant and recessive characters.

Ans :

Comp 2017, Delhi 2013

- (a) Tall (TT)  $\times$  Short (tt).

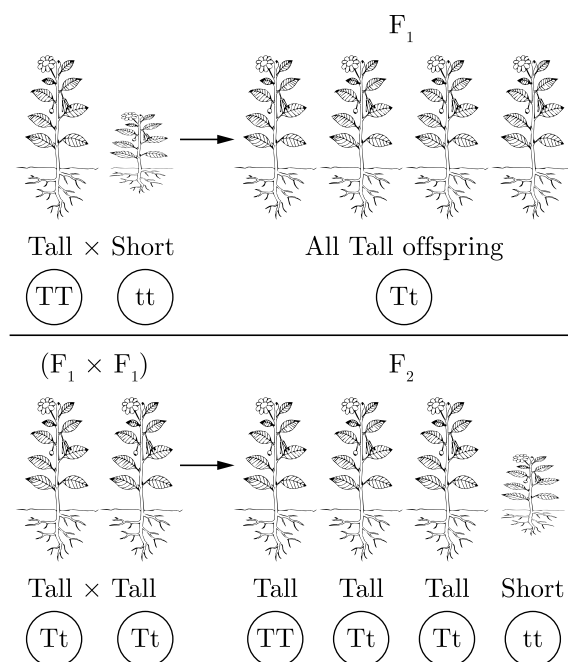


Figure: Flow Chart.

- (i) All tall plants in first generation.
- (ii) 75% tall and 25% short plants in second generation.

(b) Tall plants are Dominant and Short plants are Recessive.

81. What is the effect of high temperature on the sex-determination in turtle (*Chrysema picta*) and the lizard (*Agama agama*)?

Ans :

SQP 2016

- (i) In turtle (*Chrysema picta*), high temperature during incubation results in the development of female progeny.
- (ii) In the case of lizard (*Agama agama*), high incubation temperature results in male progeny.

82. Why is variation beneficial for the species, but not necessary for the individual?

Ans :

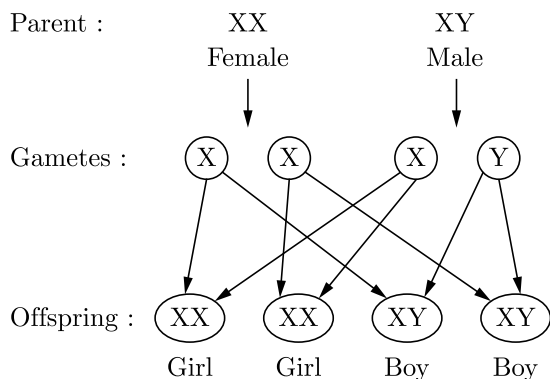
OD 2017

Variation in species enables them to adapt according to the changes and the new needs. This provides survival advantage to the species. But an individual does not get any advantage due to variation that takes place on him. Thus, variation is beneficial for a species, but not necessary necessarily for the individual.

83. With the help of X and Y show the sex determination in human beings.

Ans :

Delhi 2016



84. The genotype of green stemmed tomato plants is denoted as GG and that of purple stemmed tomato plants as gg. When these two are crossed :

- (i) What colour of stem would you expect in their  $F_1$  progeny ?
- (ii) What is the percentage of purple stemmed in  $F_2$  progeny if  $F_1$  plants are self-pollinated ?

- (iii) In what ratio would you find the genotype of GG and Gg in the  $F_2$  progeny ?

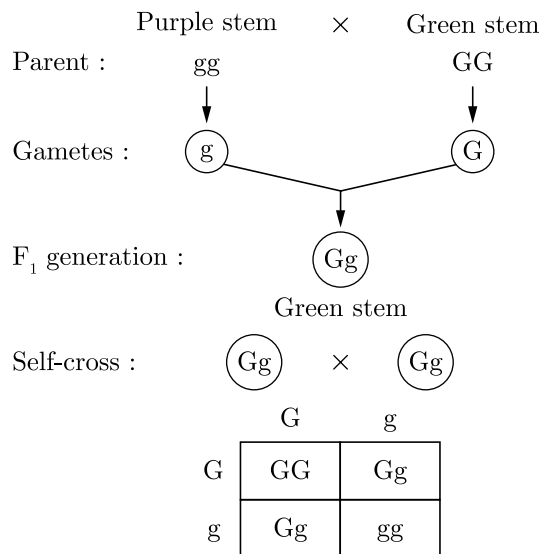
Ans :

Foreign 2017, OD 2012

(i)  $F_1$  progeny – All Green

(ii) Purple stemmed plant – 25%

(iii) Ratio of GG and Gg is 1 : 2.



Phenotype → Green stem : Purple stem

3                      1

Geno type → GG : Gg : gg

1                      2                      1

85. “The sex of the children is determined by what they inherit from their father and not their mother”. Justify.

Ans :

Foreign 2016

It is because a child who inherits an X chromosomes from the sperm of father will be a girl. and one who inherits a Y chromosome from the sperm of father will be a boy. But all children will inherit an X chromosome from their mother regardless of whether they are boys or girls.

86. Mention five characteristics of a gene.

Ans :

OD 2015, Delhi 2013

- (i) Gene is a unit of inheritance.
- (ii) It is a segment of functional DNA on a chromosome occupying a specific position.
- (iii) It is a unit of genetic information which codes for a specific trait or protein synthesis.
- (iv) It can maintain uniformity through generations.
- (v) It can undergo sudden heritable changes known as mutations.



(iv) are involved in the process of cell division.

The correct statements are :

- (a) (i) and (ii)
- (b) (iii) and (iv)
- (c) (i), (ii) and (iv)
- (d) (i) and (iv)

**Ans :**

OD 2024

Chromosomes are thread-like structures which carry hereditary information and are involved in the process of cell division.

Thus (c) is correct option.

**3.** Consider the following statements :

- (i) The sex of a child is determined by what it inherits from the mother.
- (ii) The sex of a child is determined by what it inherits from the father.
- (iii) The probability of having a male child is more than that of a female child.
- (iv) The sex of a child is determined at the time of fertilisation when male and female gametes fuse to form a zygote.

The correct statements are :

- (a) (i) and (iii)
- (b) (ii) and (iv)
- (c) (iii) and (iv)
- (d) (i), (iii) and (iv)

**Ans :**

OD 2024

A child who inherits an X chromosome from her father will be a girl and one who inherits a Y chromosome from him will be a boy.

Thus (b) is correct option.

**4.** Each gamete carries only one allele. This is proposed in which law ?

- (a) law of dominance
- (b) law of segregation
- (c) law of genetics
- (d) law of assortment

**Ans :**

During gamete formation, the alleles for each gene segregate from each other so that each gamete carries only one allele for each gene. This was proposed in the law of segregation.

Thus (b) is the correct option.

**5.** Structure present in a cell which is responsible for determination of the sex of a baby is :

- (a) cytoplasm
- (b) cell membrane
- (c) nucleus
- (d) chromosome

**Ans :**

Human cells are having two types of chromosomes: autosomes and sex chromosomes. Sex chromosomes in a male are XY and in female they are XX. There are no differences in the cytoplasm or membrane. The chromosome is present inside a nucleus.

Thus (d) is the correct option.

**6.** Which of the following the father of genetics ?

- (a) Mendel
- (b) Hook
- (c) Faraday
- (d) Newton

**Ans :**

Gregor Mendel discovered the fundamental laws of inheritance by working on pea plants.

He deduced that genes come in pairs and are inherited as distinct units, one from each parent. Mendel tracked the segregation of parental genes and their appearance in the offspring as dominant or recessive traits.

He was the first person to figure out genetics well enough to be able to predict the results of crosses that he made.

Some of his findings included the ideas of dominant and recessive factors, independent assortment and segregation of alleles.

Thus (a) is the correct option.

**7.** Which of the following statement for chromosomal theory of inheritance is incorrect?

- (a) Pairing and separation of a pair of the chromosomes would lead to segregation of a factor they carried.
- (b) Behaviour of chromosomes is parallel to the behaviour of genes.
- (c) The two alleles of a gene pair are located on homologous sites on homologous chromosomes.
- (d) Chromosomes as well as genes occur in pair

**Ans :**

The Chromosomal Theory of Inheritance was consistent with Mendel's laws and was supported by the following observations:-

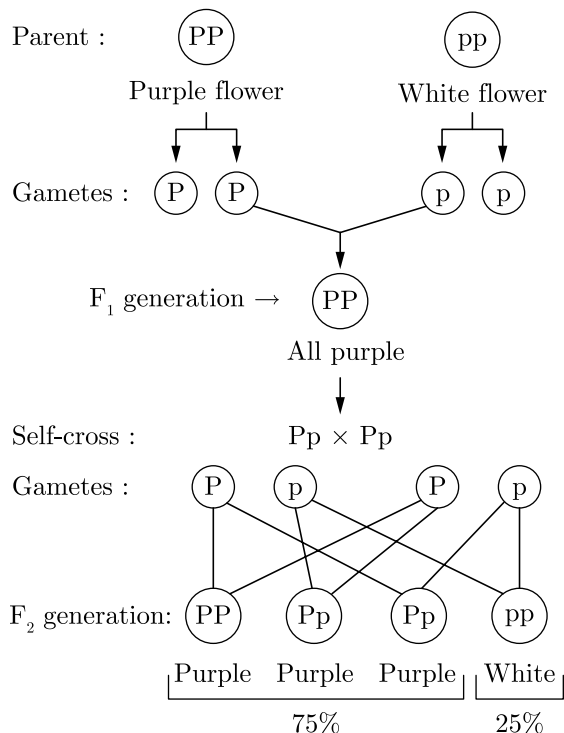
- (a) During meiosis, homologous chromosome pairs migrate as discrete structures that are independent of other chromosome pairs.
- (b) The sorting of chromosomes from each homologous pair into pre-gametes appears to be random.
- (c) Each parent synthesizes gametes that contain only half of their chromosomal complement.

**Ans :**

Comp.2015, Delhi 2010

- (a) Purple  
(b) 25%  
(c) 1 : 2

Flow chart :



92. Guinea pig having black colour when crossed with guinea pig having same colour produced 100 off springs out of which 75 were black and 25 were white. Now find out :

- (a) What is the possible genotype of the guinea pig?  
(b) Which trait is dominant and which trait is recessive ?  
(c) What is this cross called as, and what is the ratio of  $F_2$  progeny obtained from this cross ?

**Ans :**

Foreign 2014, Delhi 2008

- (a) Bb  
(b) Black colour is dominant.  
White colour is recessive.  
(c) Monohybrid cross.

$F_2$  generation phenotypic ratio of black : white  
= 3 : 1

$F_2$  generation genotypic ratio  
= BB : Bb : bb = 1 : 2 : 1

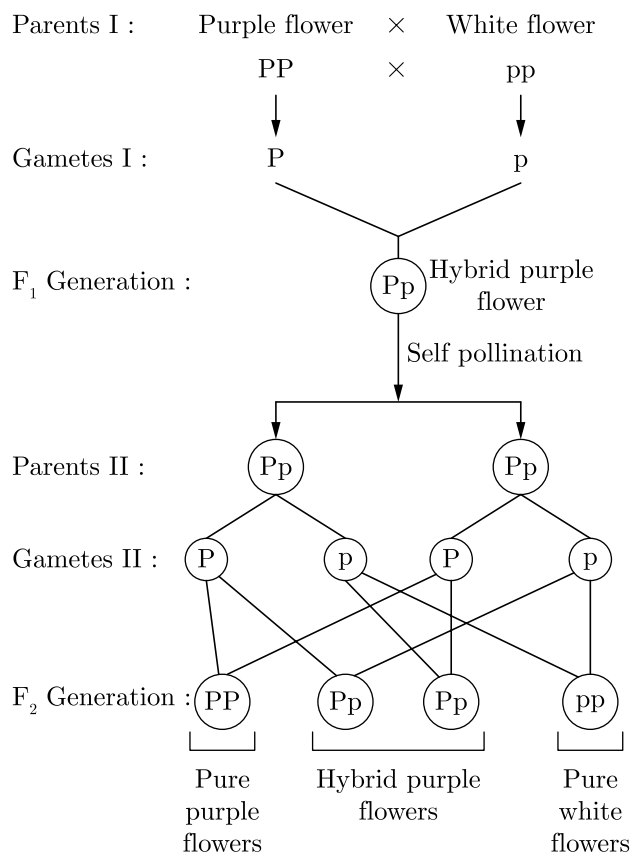
93. When a plant with purple flower was crossed with a plant having white flower, in  $F_1$  generation, all flowers appeared were purple. If  $F_1$  generation plants

are self-fertilized, what is expected in  $F_2$  progeny ? Explain with the help of a flow chart.

**Ans :**

Delhi 2014

As the trait of flowers bearing purple colour (PP) is dominant over white colour (pp). The monohybrid between two pea plants can be represented as:



- (a) In  $F_1$  generation, all the pea plants have purple flowers.  
(b) In  $F_2$  generation (progenies) pea plants with purple flowers and white flowers are in the ratio of 3 : 1.

94. In a monohybrid cross, pink coloured flowers are dominant over white coloured flowers. If parent plants belong to pure breeding dominant trait and pure breeding recessive trait, what will be the phenotype or morphological feature of  $F_1$  generation ? If  $F_1$  plants are self-fertilized, what would be the phenotypic ratio, or how many dominant and recessive traits will be produced in the progeny ? Explain with an illustration.

**Ans :**

Foreign 2013

Let the dominant trait pink flower be represented by PP.

Let the recessive trait white flower be represented by pp.

87. If a pure tall pea plant is crossed with a pure dwarf plant then in the first generation only tall plants appear.

- What happens to the traits of the dwarf plant ?
- In the second generation, the dwarf trait reappears. Why ?

Ans :

Foreign 2014

- In presence of the tall trait, the dwarf trait cannot express itself in the first generation.
- In the second generation, 25% of the plants reappears as dwarf in homozygous condition (tt). This indicates that both tallness and dwarfness traits were inherited in  $F_1$  plants but only tallness trait, being the dominant trait could express and dwarf trait being recessive could not.

88. The genotype of green stemmed tomato plants is denoted as GG and that of purple stemmed tomato plants is denoted as gg. When these two are crossed with each other :

- What colour of stem would you expect in the  $F_1$  progeny ?
- Give the percentage of purple stemmed plants if  $F_1$  plants are self-pollinated.
- In what ratio would you find the genotypes GG and gg in the progeny ?

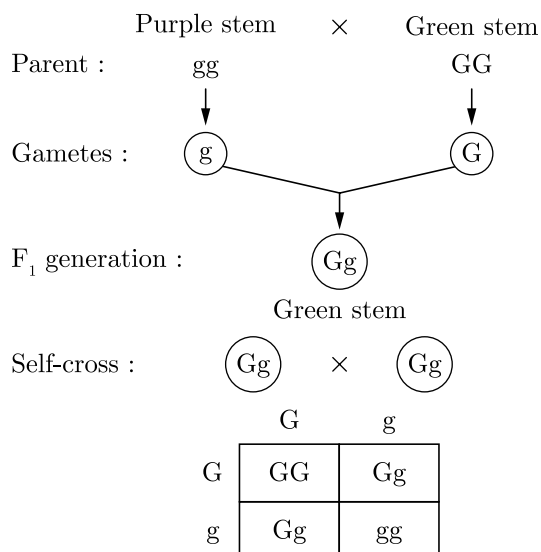
Draw flow chart in support of your answer.

Ans :

Delhi 2014

- Green
- 25%
- 1 : 1

Flow chart :



Phenotype → Green stem : Purple stem

3 : 1

Geno type → GG : Gg : gg

1 : 2 : 1

89. (a) Mendel selected garden pea plant for his experiments. List two reasons.
- (b) State the meaning of recessive and dominant genes.

Ans :

Foreign 2014

- (a) Mendel selected garden pea plant for his experiment because :
- This bisexual plant is normally self-pollinated but can be easily cross-pollinated.
  - It has many traits with distinctly contrasting forms and also has a short life.
- (b) (i) Recessive genes : Those genes which are not able to express themselves in the presence of their other allele are called recessive genes.
- (ii) Dominant genes : Those genes which are able to express themselves in the presence of their other allele are called dominant genes.

90. One plant with dominant tall height bearing purple flower is crossed with another plant with recessive dwarf and white flower.

- What do the plants of  $F_1$  generation look like ?
- What type of cross is it ?
- What is the phenotypic ratio in  $F_2$  generation and name the type of plants obtained according to phenotypic ratio ?

Ans :

SQP 2014, OD 2013

- Tall plants bearing purple flowers.
  - Dihybrid cross
  - 9 : 3 : 3 : 1
- 9 — tall plants bearing purple flowers.  
 3 — tall plants bearing white flowers.  
 3 — dwarf plants bearing purple flowers.  
 1 — dwarf plants bearing white flowers.

91. The genotype of a plant bearing purple flowers is PP and one with white flowers is pp. When these two are crossed :

- What colour of flowers would you find in  $F_1$  progeny ?
- Give the percentage of white flowers if  $F_1$  plants are self-pollinated.
- In what ratio would you find the genotypes PP and Pp in  $F_2$  progeny ? Draw flow chart in support of your answer.

99. Study the given data and answer the questions that follow :

1	2	3
Parental plant cross-fertilized and seeds collected.	F <sub>1</sub> generation offspring	F <sub>2</sub> generation offspring after self-pollination of F <sub>1</sub> hybrid.
Male parent - Round Green seeds Female parent - Wrinkled Yellow seeds	All seeds - Round Yellow	314 - Round Yellow 110 - Round Green 102 - Wrinkled Yellow 32 - Wrinkled Green

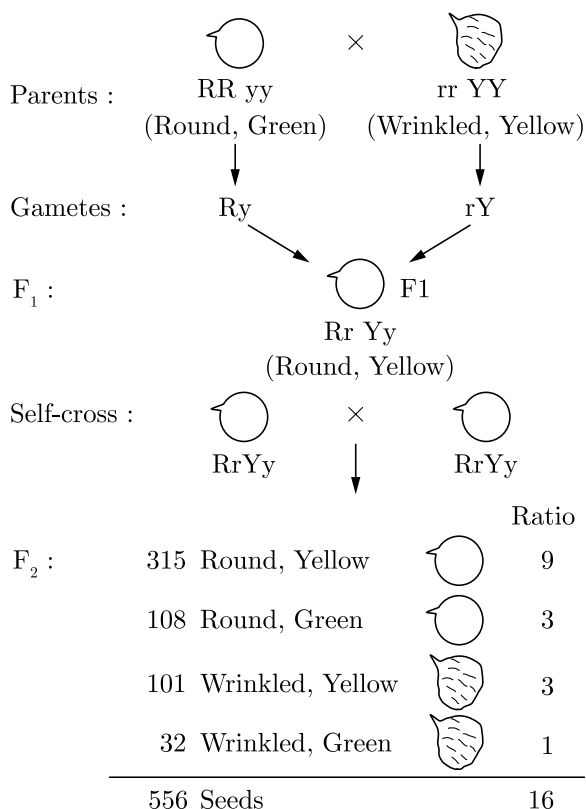
- (a) What is the term given to this type of cross ?  
 (b) What does the data in column 2 indicate ?  
 State how you arrived at this conclusion.

Ans :

OD 2014

- (a) Dihybrid cross.  
 (b) Round shape and Yellow colour in the pea plants are the dominant traits.

With the help of the following flow chart we reach at this conclusion :



100. In pea plant round seed is dominant over the wrinkled. If a cross is carried between these two plants, give answer to the following questions :

- (a) Mention the genes for the traits of parents.  
 (b) State the trait of F<sub>1</sub> hybrids.  
 (c) Write the ratio of F<sub>2</sub> progeny obtained from this cross. What is the name of the cross ?

Ans :

Delhi 2015

- (a) RR/rr  
 (b) Rr/Hybrid round  
 (c) Phenotypic ratio of Round and Wrinkle Seed = 3 : 1  
 Genotypic ratio of RR : Rr : rr = 1 : 2 : 1  
 Mono-hybrid cross

101. Name the type of sex-chromosome present in :

- (a) Human male and human female.  
 (b) What will be the sex of offspring if sperm carrying X chromosome fertilizes the egg ?  
 (c) Name an animal in which individuals can change sex. What does it indicate ?

Ans :

OD 2014

- (a) A sex chromosome is one which helps in sex-determination of an organism.

In human males, the sex chromosomes are XY and the gametes (sperms) they produce are of two types : X-bearing and Y-bearing.

In females, the sex chromosomes are XX and the gametes (eggs) they produce are of only one type : X-bearing.

- (b) If sperm carrying X chromosome fertilizes the egg, the child will be female; (XX).  
 (c) Snail can change sex according to temperature during incubation. Sex is not determined genetically in such animals.

102. What are the various situations about the variations?

Ans :

Delhi 2012

There are following situations about the variations :

- (a) Due to survival advantages or natural selection.  
 (b) No survival advantages but accidental survival of population.  
 (c) Due to poor nourishment.

103. During crossing why do new features which are not present in the parents appear in the offspring.

Ans :

Comp 2012

In crossing, if two or more genes or traits are involved, there genes assort independently, irrespective of the combinations present in the parents. So, new combinations of genes appear in the offsprings leading to new traits.

50. Write the sex chromosome in woman and man.

Ans :

Delhi 2015, OD 2013

In woman  $\longrightarrow$  XX

In man  $\longrightarrow$  XY

51. Define mutation.

Ans :

OD 2014

Sudden changes in the genetic form of an organism which are passed onto the next generation are called mutations.

52. Name the first Indian medical practitioner who was aware of the concepts of genetics.

Ans :

Delhi 2013

Charaka was the first Indian medical practitioner who knew the factors which determine the sex of the child.

53. Which of the following traits are recessive in pea plant?

Dwarfness, violet flower, wrinkled seed.

Ans :

Delhi 2014

Dwarfness and wrinkled seeds are the recessive characters.

54. How is the female produced ?

Ans :

Foreign 2015

When sperm with X chromosome from father fertilizes the egg, then female (girl) is produced.

55. How many types of chromosomes are there in the cell?

Ans :

Foreign 2014

There are two types of chromosomes in the cell :

- (i) Sex chromosomes, and
- (ii) Autosomes.

56. Do a tailless mice have a tailless progeny ?

Ans :

OD 2013

No, because removal of tail which is a quired trait cannot change the genes of the germ cell of mice.

57. Name the biological term used to show differences among individuals.

Ans :

Delhi 2012, OD 2010

Variation.

58. How many pairs of chromosomes are present in human beings?

Ans :

Foreign 2013

23 Pairs

59. Name the type of chromosomes which helps in the determination of sex in an organism.

Ans :

Delhi 2012

Sex chromosomes or allosomes.

60. What are traits ?

Ans :

OD 2012

The characters in individuals are called traits.

61. In a mono-hybrid cross a round seeded plant was crossed with a wrinkle seeded plant. In  $F_2$  generation genotype ratio obtained was 1:2:1. How many plants were homozygous round.

Ans :

OD 2013

A quarter of plants (25%) were homozygous round.

62. Name the plant on which Mendel performed his experiments.

Ans :

Foreign 2012

Mendel performed his experiments on garden pea (*Pisum sativum*).

63. What is  $F_2$  generation?

Ans :

OD 2012

The generation produced by the offsprings of  $F_1$  generation i.e., first generation as parent is called  $F_2$  or second generation.

64. (a) What is the genetic constitution of human sperm?  
(b) Mention the chromosomes pair present in zygote determining the sex of a male child.

Ans :

Delhi 2013

(a)  $22 + Y$  or  $22 + X$

(b)  $22 + Y$  and  $22 + X$  or  $44 + XY$

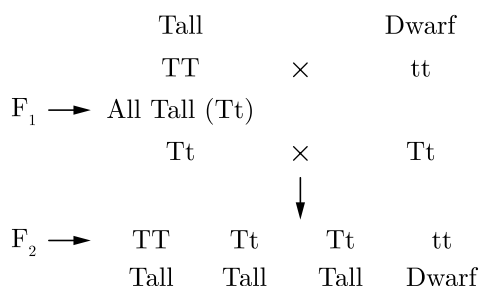
65. Define a gene.

Ans :

Comp 2012

A gene is a segment of functional DNA on a chromosome occupying a specific position which codes for a specific trait or protein synthesis. As such, it is a heredity determinant or a unit of genetic information.

plants were crossed with pure dwarf pea plants, only tall pea plants were obtained in  $F_1$  generation. On selfing the pea plants of  $F_1$  generation both tall and dwarf pea plants were obtained in  $F_2$  generation. Reappearance of the dwarf pea plants in  $F_2$  generation proves that the dwarf trait was inherited but not expressed in  $F_1$  generation. The recessive trait does not express itself in the presence of the dominant trait. So, it is possible that one trait may be inherited but may not be expressed in an organism.



- 110.** Explain Mendel's experiment with peas on inheritance of characters considering only one visible contrasting character.

**Ans :**

OD 2016, Delhi 2014

Mendel concluded his breeding experiments of inheritance of characters considering only one visible contrasting character i.e., monohybrid cross with garden peas.

- (i) He studied homozygous (pure) plants of a tall (TT) short (tt) varieties.
- (ii) He crossed them and obtained  $F_1$  progeny.
- (iii) He found that in  $F_1$  progeny all plants were tall.
- (iv) He selfed the plants of  $F_1$  progeny which were hybrid (Tt).
- (v) He found that in  $F_2$  progeny there were tall as well as short plants of which the three quarter plants were tall and one quarter was short.

- 111.** An angiosperm plant having red coloured flowers when crossed with the other having the same colour produced 40 progenies out of which 30 plants were with red coloured flowers 10 plants were with white colour flowers.

Finds out :

- (a) What is the possible genotype of parent plants ?
- (b) Which trait is dominated and recessive?
- (c) What is this cross called as and what is its phenotyping ratio ?

**Ans :**

OD 2015

- (a) Rr and Rr
- (b) Red colour of flower is the dominant trait while white colour is the recessive trait.
- (c) Monohybrid cross, phenotypic ratio of red and white flower is 3:1.

- 112.** (a) What is the role of autosomes ?  
(b) Why is it that offspring receives traits from both the parents.

**Ans :**

OD 2016

- (a) Autosomes are the chromosomes which contain genes for all somatic trait. They are identical in male and females and they do not have any role in the determination of sex.
- (b) During sexual reproduction, two haploid gametes which came from father and mother having half the number of chromosomes and together to form diploid zygote. It is therefore the offspring has the chromosomes from both parents having different genes of different traits.

- 113.** In one of his experiments with pea plants, Mendel observed that when a pure tall pea plant is crossed with a pure dwarf pea plant in the first generation,  $F_1$  only tall plants appear.

- (a) What happens to the traits of the dwarf plants in this case?
- (b) When the  $F_1$  generation plants were self-fertilised, he observed that in the plants of second generation,  $F_2$  both tall plants and dwarf plants were present. Why it happened? Explain briefly.

**Ans :**

Foreign 2017

- (a) The dwarf traits of the plants is not expressed in the presence of the dominant tall trait.
- (b) In the  $F_2$  generation, both the tall and dwarf traits are present in the ratio of 3 : 1. This showed that the traits for tallness and dwarfness are present in the  $F_1$  generation but the dwarfness, being the recessive trait does not express itself in the presence of tallness, the dominant trait and during gamete formation genes of both characters separates independently and not effect each other's functions and inheritance.

- 114.** Name the types of sex chromosomes present in

- (i) human male and
- (ii) human female.

What will be the sex of the child produced if a sperm carrying Y-chromosome fertilizes the egg ? Name an insect in which similar type of sex determination takes place.

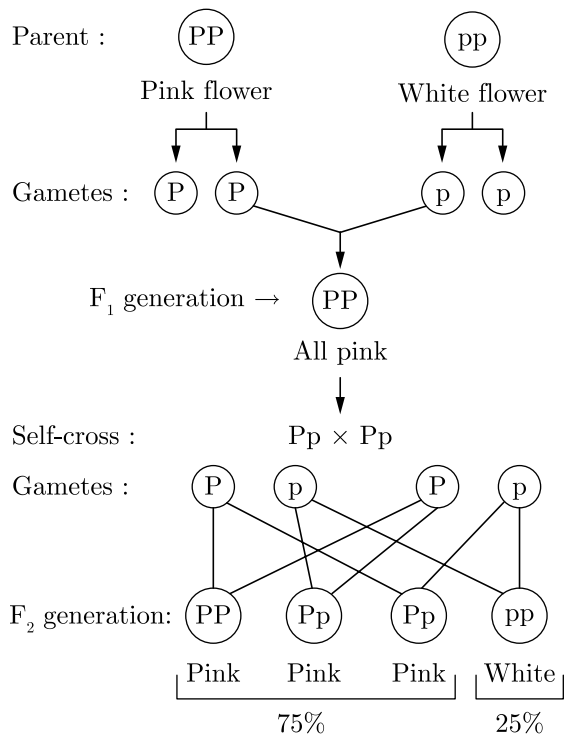


If  $F_1$  generation, all plant will be pink (hybrid-Pp).

If  $F_2$  generation, phenotypic ratio will be

$$\text{Pink : White} = 3:1$$

$$\text{Dominant trait : recessive trait} = 75\%:25\%$$



95. What are sex chromosomes ? What role do they play in determining genetically the sex of an individual in human beings ?

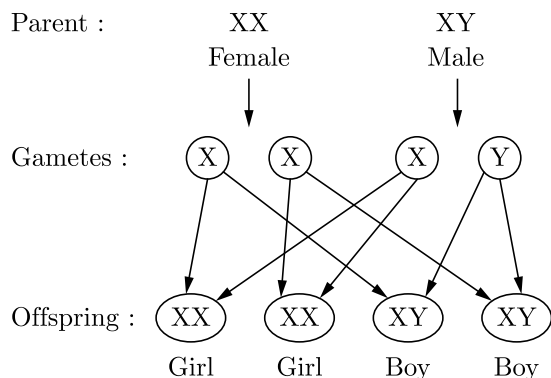
Ans :

Comp 2015

A sex chromosome is one which helps in sex-determination of an organism.

In human males, the sex chromosomes are XY and the gametes (sperms) they produce are of two types : X-bearing and Y-bearing.

In females, the sex chromosomes are XX and the gametes (eggs) they produce are of only one type : X-bearing.



96. How do proteins control the characteristics that are inherited ? Explain with the help of an example.

Ans :

Delhi 2015, OD 2014

- Segment of functional DNA (Gene) is the information source for making proteins.
- Proteins which are enzymatic in nature control a metabolic pathway which in turn regulates a specific characteristic.
- Any defect in DNA (Gene) alters the nature of protein and thus changes the expressed character.

97. (a) Name the plant used by Mendel to carry out his experiments.  
(b) Study the following cross and answer the questions that follow :

Parents	Green and Round seed $\times$ Yellow and Wrinkled seed
$F_1$ Generation	All Green and Round seeds
$F_2$ Generation	Green and Round (9) Green and Wrinkled (3) Yellow and Round (3) Yellow and Wrinkled (1)

- List the dominant and recessive characters.
- Are the characters linked or independent ?

Ans :

Foreign 2015

- Pea plant *Pisum sativum*.
- (i) Dominant : Round and Green Seed.  
Recessive : Wrinkled and Yellow Seed.  
(ii) Independent.

98. Answer the following questions:

- What enables bacteria to survive better in a heat wave ?
- How is the stability of DNA of the species ensured?

Ans :

OD 2015

- Development of cell wall due to variation caused by errors during DNA replication enables bacteria to survive better in adverse conditions such as heat wave.
- Stability of DNA of sexually reproducing species is caused by fusion of two haploid germ cells and in asexually reproducing species DNA replication occurs before cell division.

- (b) For one pair, whichever unit factor is received, it does not influence the outcome of segregation of any other pair.

- (iv) Yes, it is possible that a trait is inherited but may not be expressed.

For example, when pure tall pea plants are crossed with pure dwarf pea plants only tall pea plants are obtained in  $F_1$  generation but when members of  $F_1$  generation are selfed then the dwarf trait disappeared in  $F_1$  generation reappeared.

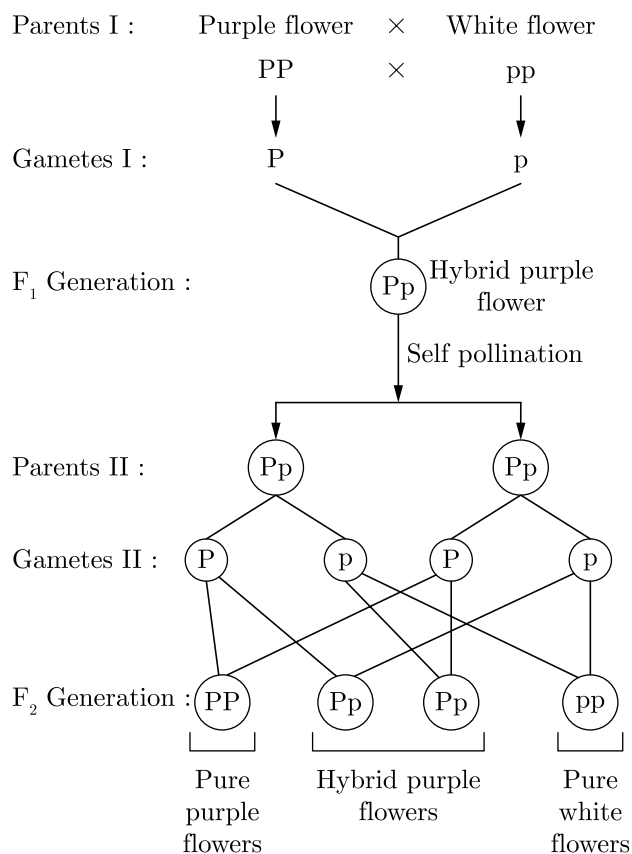
Hence, we can say it is possible that a trait is inherited but may not be expressed.

- 117.** In a pea plant, the trait of flowers bearing purple colour (PP) is dominant over white colour (pp). Explain the inheritance pattern of  $F_1$  and  $F_2$  generations with the help of a cross following the rules of inheritance of traits. State the visible characters of  $F_1$  and  $F_2$  progenies.

Ans :

Delhi 2020. OD 2015

As the trait of flowers bearing purple colour (PP) is dominant over white colour (pp). The monohybrid between two pea plants can be represented as:



- In  $F_1$  generation, all the pea plants have purple flowers.
- In  $F_2$  generation (progenies) pea plants with purple flowers and white flowers are in the ratio of 3:1.

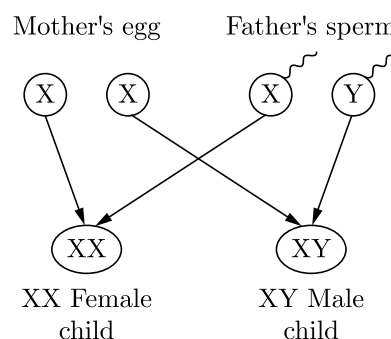
- 118.** “The sex of a new born child is a matter of chance and none of the parents may be considered responsible for it.” Justify this statement with the help of a flow chart showing sex-determination in human beings.

**Ans :**

OD 2019

The sex of a newborn depends on what happens at the time of fertilization.

- (i) If a sperm of male carrying X chromosome fertilizes the ovum of female carrying X chromosome, then the girl child will be born and the child will have XX combination of sex chromosomes.
- (ii) If a sperm carrying Y chromosome fertilizes the ovum carrying X chromosome, then the child born will be a boy and the child will have XY combination of sex chromosome.



The above presentation clearly shows that it is matter of chance whether the newborn will be boy or girl and none of the parents may be considered responsible for it.

119. (a) What are dominant and recessive traits?  
(b) “Is it possible that a trait is inherited but may not be expressed in the next generation?” Give a suitable example to justify this statement.

Ans :

OD 2019

- (a) The trait which can express its effect over contrasting trait is called dominant trait whereas the trait which cannot express its effect over contrasting trait or which gets suppressed by the contrasting trait is called recessive trait.

Ans :

OD 2014

- (a) X and Y are the sex chromosomes present in males.  
 (b) XX are sex chromosomes present in female.  
 (c) The sex of the child will be male if a sperm carrying Y-chromosome fertilizes the egg.  
 (d) A similar type of sex determination takes place in *Drosophila* (fruitfly).

115. In humans, genetically the sex of a child is determined by the father and not by the mother. Explain.

or

Describe, how the sex of the offspring is determined in the zygote in human beings.

or

What is the basis of sex determination at the time of fertilization in humans ?

or

Explain the mechanism of sex-determination in the zygote.

Ans :

Foreign 2015

In humans, genetically the sex of a child is determined by the father and not by the mother because in father, there are two types of sex chromosomes present X and Y, whereas in mother the both sex chromosomes are X. Hence, a male child will be born if a sperm carrying Y-chromosome fertilizes the egg. While a female child will be born if a sperm carrying X-chromosome fertilize the egg.

## FIVE MARKS QUESTIONS

116. Mendel worked out the rules of heredity by working on garden pea using a number of visible contrasting characters. He conducted several experiments by making a cross with one or two pairs of contrasting characters of pea plant. On the basis of his observations he gave some interpretations which helped to study the mechanism of inheritance.

- (i) When Mendel crossed pea plants with pure tall and pure short characteristics to produce  $F_1$  progeny, which two observations were made by him in  $F_1$  plants?  
 (ii) Write one difference between dominant and recessive trait.  
 (iii) In a cross with two pairs of contrasting characters

$RRYY \quad \times \quad rryy$   
 (Round Yellow)      (Wrinkled Green)

Mendel observed 4 types of combinations in  $F_2$  generation. By which method did he obtain  $F_2$  generation? Write the ratio of the parental combinations obtained and what conclusions were drawn from this experiment.

- (iv) Justify the statement :

“It is possible that a trait is inherited but may not be expressed”.

Ans :

OD 2024

- (i) Observations made by Mendel in  $F_1$  progeny of monohybrid cross :

The  $F_1$  generation consists of only tall plants that means only one of the parental traits was seen, not some mixture of the two.

- (ii) Differences between dominant and recessive traits are as follows :

	Dominant trait	Recessive trait
1.	The trait which appears in the $F_1$ progeny is dominant.	The trait which remains hidden or which not appear in the $F_1$ progeny is the recessive trait.
2.	It appears in more numbers.	It appears in less number.

- (iii)(1) Mendel took two pure breeding plants, one having round and yellow seeds (RRYY) and the other having wrinkled and green seeds (rryy).  
 (2) Parents were cross pollinated and  $F_1$  generation was raised in which all the plants produced had round and yellow seeds.  
 (3) By selfing the  $F_1$  plants when  $F_2$  generation was raised, he found four combinations of phenotypes as given below :

Dihybrid phenotypic ratio  $\Rightarrow 9:3:3:1$

Dihybrid genotypic ratio  $\Rightarrow$

$RRYY - 1 \quad RrYY - 2 \quad rrYY - 1$

$RRYy - 2 \quad RrYy - 4 \quad rrYy - 2$

$RRyy - 1 \quad Rryy - 2 \quad rryy - 1$

### Conclusions from dihybrid cross

- (a) This law states that any pair of unit factors or genes controlling different characters can segregate or separate independently of all other unit factors, during the formation of gametes.

Ans :

- (i) The process by which the sex of a newborn organism is detected is called sex determination.
- (ii) The males have two sex chromosomes which are X and Y.
- (iii) The sex chromosomes in the females are X and X.
- (iv) Yes, the mother is solely responsible for the sex of the child because the mother gives only the X chromosome to the child. It is the father that gives either the X or Y chromosome to the child.

**123.** Read the following case based passage and answer the questions given after passage.

Question numbers i - iv are based on the table given below. Study the table and answer the following questions.

**Table-A**

S. No.	Generation	Phenotypic ratio
1.	F <sub>1</sub> generation	23 pairs
2.	F <sub>2</sub> generation	22 pairs

- (i) State the law of dominance.
- (ii) What is the dominant allele?
- (iii) Define the term phenotype.
- (iv) What is the meaning of genotype ?

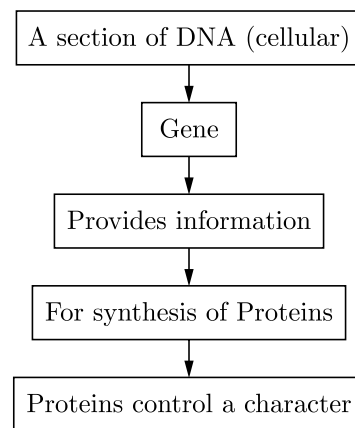
Ans :

- (i) According to the law of dominance, the parent contains two alleles out of which one is the dominant allele while the other is the recessive allele.
- (ii) The allele that expresses itself and reduces the expression of other alleles is termed as the dominant allele.
- (iii) The set of the morphological characteristics of an organism that are resulted from the interactions of the genes is known as the phenotype of the individual. For example, in pea plants, tallness is a phenotypic trait.
- (iv) The set of the alleles in DNA that carries the information for the expression of a trait in an individual is known as its genotype. For example, genotype 'TT' expresses the tallness in plants.

**124.** Read the following case based passage and answer the questions given after passage.

A gene is the basic physical and functional unit of heredity genes are made up of DNA.

Most of the characters or traits of an organism are controlled by the genes. Genes are actually segments of DNA guiding the formation of proteins by the cellular organelles. These proteins may be enzymes, hormones, antibodies, and structural components of different types of tissues. In other words, DNA/genes are responsible for structure and functions of a living body. Genotype of an individual controls its phenotype.



Gene T	→ Responsible for synthesis of efficient enzyme (Proteins)	→ More production of growth hormone	→ Result in Tall Plants
Gene t	→ Responsible for synthesis of less efficient enzyme	→ Less production of growth hormone	→ Result in Short Plants

- (i) Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds produce F<sub>1</sub> progeny that have round, yellow (RrYy) seeds. When F<sub>1</sub> plants are selfed, the F<sub>2</sub> progeny will have new combination of characters. Choose the new combination from the following.
  - I. Wrinkled, green
  - II. Wrinkled, yellow
  - III. Round, green
  - IV. Round, yellow
  - (a) I and II
  - (b) I and IV
  - (c) II and III
  - (d) I and III
- (ii) A section of DNA providing information for one protein is called-
  - (a) Gene
  - (b) Nucleus
  - (c) Chromosomes
  - (d) Trait
- (iii) Which one of the following is present in the nucleus ?
  - (a) Chromosomes
  - (b) Gene
  - (c) DNA
  - (d) All of these

- (iv) Select the statements that describe characteristics of genes
- I. In individuals of a given species, a specific gene is located on a particular chromosome
  - II. A gene does not code for proteins
  - III. Genes are specific sequence of bases in a DNA molecule
  - IV. Each chromosome has only one gene
- (a) I and II                      (b) I and III  
(c) I and IV                      (d) III and IV
- (v) A Mendelian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. In the progeny, all bore violet flowers, but almost half of them were short. This suggests that the genetic makeup of tall plant can be depicted as
- (a) TtWw                      (b) TTWW  
(c) TTww                      (d) TtWW

**Ans :**

- (i) (b) I and IV  
(ii) (a) Gene  
(iii) (d) All of these  
(iv) (b) I and III  
(v) (d) TtWW

# CHAPTER 9

## Light Reflection and Refraction

### 1. LIGHT

Light is that form of energy which produces the sensation of sight. Light energy travels through vacuum well as different transparent media in the form of electromagnetic waves. In vacuum as well as in air, light travels with a constant speed of  $3 \times 10^8 \text{ ms}^{-1}$ .

Light travels from one point to other along a straight path. This is called rectilinear propagation of light. A bundle of rays constitutes a light beam.

### 2. REFLECTION OF LIGHT

It is the phenomenon of bouncing back of light to the same medium after striking a surface. A glass sheet having a uniform thin coating of silver on one side acts as a reflector and is called a mirror.

#### 2.1 Laws of Reflection

Two important laws of reflection are as follows:

1. The incident ray, the reflected ray and the normal to the reflecting surface at the point of incidence, all lie in the same plane.
2. The angle of incidence and angle of reflection are equal and they lie on opposite sides of normal.

### 3. IMAGE

When rays of light starting from a point object, after reflection from a mirror, actually meet or appear to meet at a point, then this second point is called the image of that object point.

#### 3.1 Real and Virtual Images

If light rays from an object, after reflection or refraction, actually meet at a point, then the image is called a real image. A real image is always inverted and can be obtained on a screen.

If light rays from an object, after reflection or refraction, do not meet but appear to meet at a point, then the image is called a virtual image. A

virtual image is always erect and cannot be obtained on a screen.

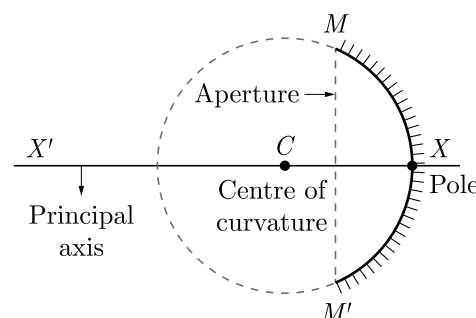
Image of an object formed by a plane mirror is virtual and erect, same size as the object, as much behind the mirror as the object is placed in front of it and is laterally inverted.

### 4. SPHERICAL MIRROR

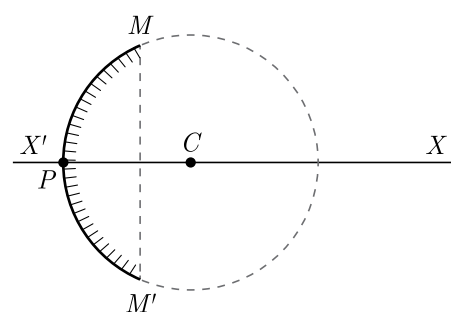
It is a mirror whose reflecting surface is a part of a hollow sphere of the glass. A spherical mirror whose reflecting surface is curved inwards is called a concave mirror. A spherical mirror whose reflecting surface is curved outwards is called a convex mirror.

A spherical mirror whose reflecting surface is curved outwards is called a convex mirror.

1. In a spherical mirror, the centre point of the reflecting surface is 'pole' ( $P$ ).



(a)



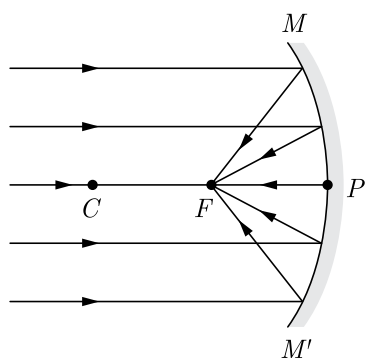
(b)



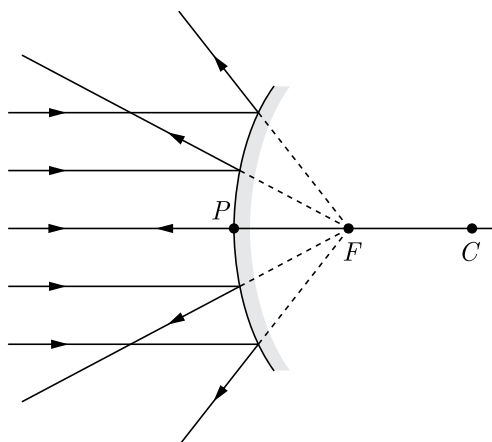
- The centre of curvature ( $C$ ) of a spherical mirror is the centre of hollow glass sphere, of which the given mirror is a part. The radius of curvature ( $R = PC$ ) of the given mirror is defined as the radius of the sphere, of which the reflecting surface of the mirror forms a part.
- Principal axis is the line passing through pole  $P$  and centre of curvature  $C$  of a mirror. The diameter of reflecting surface of a spherical mirror is called its aperture.
- The principal focus ( $F$ ) of a spherical mirror is a point on its principal axis where light rays travelling parallel to the principal axis of the mirror, after reflection, actually meet (in concave mirror) or appear to meet (in convex mirror). Principal focus of a concave mirror is a real point situated in front of the mirror and of a convex mirror is a virtual point situated behind it.
- The distance between pole  $P$  and principal focus  $F$  of a spherical mirror is focal length ( $f$ ), i.e.,  $PF = f$ . For a spherical mirror,

$$f = \frac{R}{2}$$

$$R = 2f$$



(a)



(b)

- Focal plane is a plane passing through principal focus and normal to the principal axis of a mirror.
- The position, nature and relative size of image formed by a concave mirror depend upon the position of the object situated in front of the mirror as shown in the following table.

**Formation of image by a concave mirror for different positions of the object**

	Position of the object	Position of the image	Relative size of the image	Nature of the image
1.	At infinity	At the focus ( $F$ )	Highly diminished (point-sized)	Real and inverted
2.	Beyond $C$	Between $F$ and $C$	Diminished	Real and inverted
3.	At $C$	At $C$	Same size as the object	Real and inverted
4.	Between $C$ and $F$	Beyond $C$	Enlarged	Real and inverted
5.	At $F$	At infinity	Highly enlarged	Real and inverted
6.	Between $P$ and $F$	Behind the mirror	Enlarged	Virtual and erect

- A convex mirror forms a virtual, erect and diminished image of an object situated in front of it as shown in the following table.

**Formation of image by a convex mirror for different positions of the object**

	Position of the object	Position of the image	Relative size of the image	Nature of the image
1.	An infinity	Behind the mirror at the focus $F$	Highly diminished (point-sized)	Virtual and erect
2.	Between infinity and pole $P$ of the mirror	Behind the mirror between $P$ and $F$	Diminished	Virtual and erect

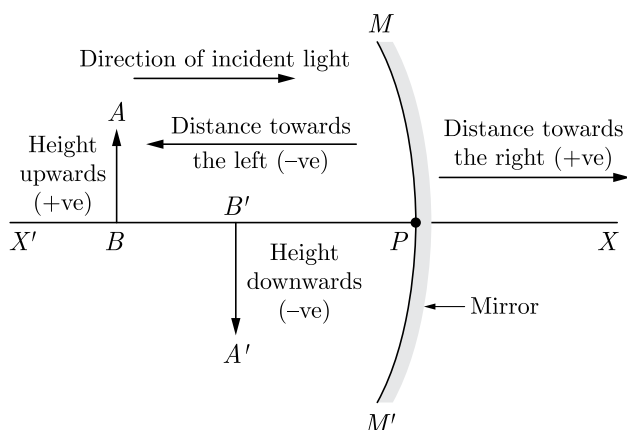
- Concave mirrors are used as shaving and make-up mirrors to see a large-sized erect image of

the face. They are used as reflectors in torches, searchlights and headlights of vehicles to get powerful parallel beam of light. They are used by dentists to see large images of a patient's teeth. Eye and ENT specialists also use these mirrors to focus light coming from a lamp onto the eye, ear, nose, throat, etc., of a patient in order to examine better. They are used to concentrate the sun's radiation to a point in a solar furnace.

- Convex mirrors are used as driver's mirrors in vehicles in order to have a wider field of view for traffic coming from behind. They are also used as reflectors in hilly areas at sharp turns and as shop security mirrors in large shopping halls and malls.

## 5. SIGN CONVENTION

According to new Cartesian sign convention for mirrors, all distances are measured from the pole of the mirror and object is always situated to the left of the mirror. Pole is considered as origin for measuring distances along principal axis. All distances measured to the right of origin along the principal axis are taken positive and to the left of origin are taken negative.



Along a direction perpendicular to principal axis, distances measured above the principal axis are taken positive but below the principal axis are taken negative.

## 6. MIRROR FORMULA

If object distance =  $u$ , image distance =  $v$  and focal length =  $f$ , then according to mirror formula, we have

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$  or  $\frac{2}{R}$ , where  $R$  = Radius of curvature of the mirror

On putting numerical values of  $u, v, f$  or  $R$ , proper sign must be used according to sign convention.

## 7. LINEAR MAGNIFICATION

The ratio of height of the image ( $h'$ ) to the height of the object ( $h$ ) is linear magnification of an object, i.e.,

$$m = \frac{h'}{h} = \frac{v}{u}$$

Linear magnification is negative for real image but positive for virtual image. If image is magnified,  $m > 1$  and if diminished,  $m < 1$ .

For plane mirror,  $m = +1$ .

## 8. REFRACTION OF LIGHT

It is the phenomenon of the change in direction/bending of a ray of light incident obliquely at the interface of two different transparent media.

- When light travels from optically denser medium to rarer medium, it bends away from normal.
- When light travels from optically rarer medium to denser medium, it bends towards the normal.

### 8.1 Laws of Refraction

Two important laws of refraction are as follows:

- The incident ray, the refracted ray and the normal to the interface of two media at the point of incidence, all lie in the same plane.
- The ratio of sine of angle of incidence ( $\sin i$ ) to the sine of angle of refraction ( $\sin r$ ) is a constant for light of a given colour or wavelength and for a given pair of media. This law is called Snell's law of refraction.

As per the law,

$$\frac{\sin i}{\sin r} = \text{a constant} \\ = (n_{21})$$

(Refractive index of med. 2 w.r.t. med. 1)

## 9. REFRACTIVE INDEX OF A MEDIUM

The ratio of speed of light in vacuum (or air) to speed of light in the given medium is called refractive index of a medium.

Refractive index,

Linear magnification is negative for a real image but positive for a virtual image.

## 11. POWER OF A LENS

It is a measure of its degree of convergence or divergence of light rays incident on it. It is also defined as reciprocal of its focal length.

Power of a lens,

$$(P) = \frac{1}{\text{Focal length of the lens (in metre)}}$$

$$= \frac{1}{f(\text{in m})}$$

The SI unit of power of a lens is dioptre ( $D$ ), where  $1 D = 1 \text{ m}^{-1}$ .

The power of convex lens is taken positive but power of concave lens is taken negative.

1. When two or more thin lenses of powers  $P_1, P_2, P_3, \dots$  are brought in contact, then

Combined power,  $P = P_1 + P_2 + P_3 + \dots$

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} + \dots$$

## OBJECTIVE QUESTIONS

1. At what distance from a convex lens should an object be placed to get an image of the same size as that of the object on a screen?
- Beyond twice the focal length of the lens.
  - At the principal focus of the lens.
  - At twice the focal length of the lens.
  - Between the optical centre of the lens and its principal focus.

Ans :

OD 2024

When object is placed at twice the focal length ( $2F$ ) of a convex lens, an image of the same size as that of the object is formed and it is real and inverted.

Thus (c) is correct option.

2. A student wants to obtain an erect image of an object using a concave mirror of 10 cm focal length. What will be the distance of the object from mirror?
- Less than 10 cm
  - 10 cm
  - between 10 cm and 20 cm
  - more than 20 cm

Ans :

OD 2023

Object distance should be less than the focal length for the formation of an erect image. Hence, the

range of distance of object from the mirror should be less than 10 cm (from 0 to 10 cm) in the front of mirror from the pole of the mirror. The nature of image will be virtual and erect.

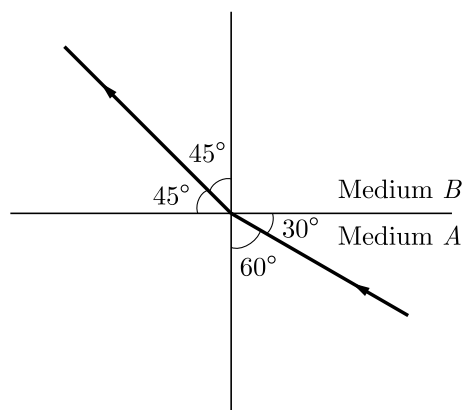
Thus option (a) is correct option.

3. Which of the following can make a parallel beam of light when light from a point source is incident on it ?
- Concave mirror as well as convex lens
  - Convex mirror as well as concave lens
  - Two plane mirrors placed at  $90^\circ$  to each other
  - Concave mirror as well as concave lens
- Ans :
- (a) Concave mirror as well as convex lens.
4. Under which of the following conditions a concave mirror can form an image larger than the actual object?
- When the object is kept at a distance equal to its radius of curvature
  - When object is kept at a distance less than its focal length
  - When object is placed between the focus and centre of curvature
  - When object is kept at a distance greater than its radius of curvature

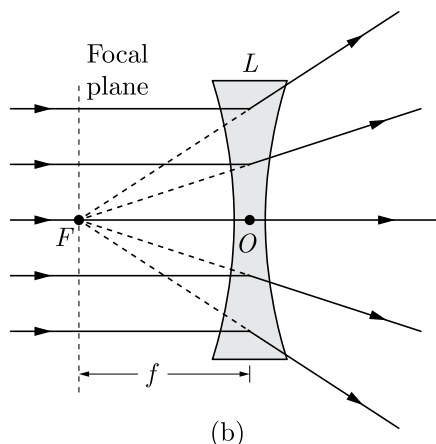
Ans :

- (c) When object is placed between the focus and centre of curvature.

5. Figure, shows a ray of light as it travels from medium A to medium B. Refractive index of the medium B relative to medium A is



- $\sqrt{3}/\sqrt{2}$
- $\sqrt{2}/\sqrt{3}$
- $1/\sqrt{2}$
- $\sqrt{2}$



4. A point where a light beam travelling parallel to the principal axis of the lens, after refraction, actually meets in convex lens or appears to be diverged from in concave lens is called principal focus ( $F$ ) of the lens. As, in a lens, parallel beam of light may be incident on any of its two surfaces having two principal foci  $F_1$  and  $F_2$ , placed symmetrically on two sides of a lens.
5. Focal length ( $f$ ) is the distance of principal focus from optical centre of a lens.
6. Focal plane is a plane passing through principal focus and perpendicular to the principal axis of a lens.

The position, nature and size of the image formed by a convex lens are based upon the position of the object placed in front of the lens as mentioned in the following table.

**Formation of image by a convex lens for different positions of the object**

	Position of the object	Position of the image	Relative size of the image	Nature of the image
1.	At infinity	At focus $F_2$	Highly diminished (point-sized)	Real and inverted
2.	Beyond $2F_1$	Between $F_2$ and $2F_2$	Diminished	Real and inverted
3.	At $2F_1$	At $2F_2$	Same size as the object	Real and inverted
4.	Between $F_1$ and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted

	Position of the object	Position of the image	Relative size of the image	Nature of the image
5.	At focus $F_1$	At infinity	Infinitely large (highly enlarged)	Real and inverted
6.	Between focus $F_1$ and optical centre $O$	On the same side of the lens as the object	Enlarged	Virtual and erect

7. A concave lens always forms a virtual, erect and diminished image of the object on the same side of the lens as mentioned in the following table:

**Formation of image by a concave lens for different positions of the object**

	Position of the object	Position of the image	Relative size of the image	Nature of the image
1.	An infinity	At focus $F_1$	Highly diminished (point-sized)	Virtual and erect
2.	Between infinity and optical $O$ of the lens	Behind focus $F_1$ and optical centre $O$	Diminished	Virtual and erect

8. Lenses are used in spectacles, different optical instruments such as microscope, telescope, photographic camera, film projector, etc.

The sign convention for lenses is same as that for mirrors except the optical centre of the lens which is taken to be the origin point.

If object distance =  $u$ , image distance =  $v$  and focal length =  $f$ , then from the lens formula, we have

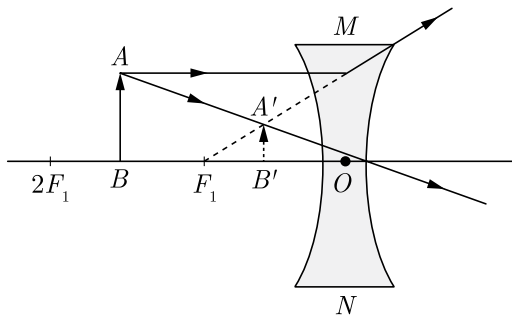
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

9. For a linear object placed normal to the principal axis of a spherical lens, linear magnification of a lens is stated as follows:

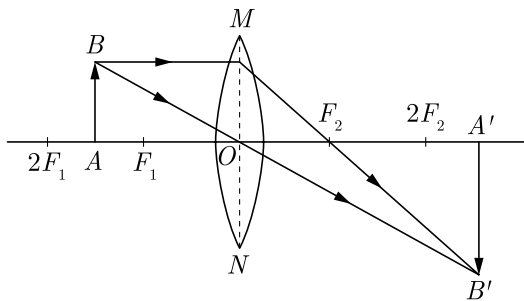
Linear magnification of a lens,

$$\begin{aligned}
 m &= \frac{\text{Height of the image } (h')}{\text{Height of the object } (h)} \\
 &= \frac{\text{Distance of the image } (v)}{\text{Distance of the object } (u)}
 \end{aligned}$$

(ii) Concave lens.



(b)

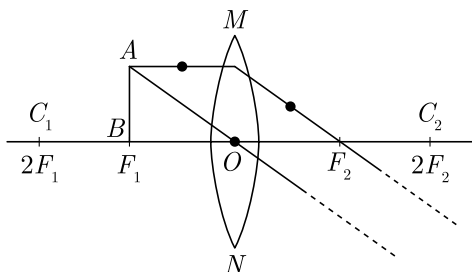


172. (a) Define optical centre of a spherical lens.  
 (b) You are given a convex lens of focal length 30 cm. Where would you place an object to get a real, inverted and highly enlarged image of the object? Draw a ray diagram showing the image formation.  
 (c) A concave lens has a focal length of 20 cm. At what distance should an object be placed so that it forms an image at 15 cm away from the lens?

Ans :

AI 2016

- (a) It is the central point of the lens through which a ray of light passes without suffering any deviation.  
 (b) The object is placed at F.



(c) Given,

$$f = -20 \text{ cm}, u = ?, v = -15 \text{ cm}$$

As we know that,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\begin{aligned} \frac{1}{u} &= \frac{1}{v} - \frac{1}{f} \\ &= \frac{1}{-15} + \frac{1}{20} = \frac{-1}{60} \\ u &= -60 \text{ cm} \end{aligned}$$

173. One half of a convex lens of focal length 20 cm is covered with black paper.

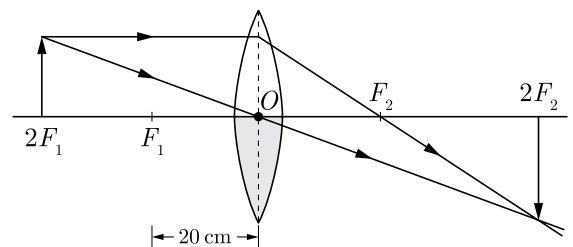
- (i) Will the lens produce a complete image of the object?  
 (ii) Show the formation of the image of an object placed at  $2F_1$  of such covered lens with the help of a ray diagram.  
 (iii) What will happen to the intensity of the image formed by a convex lens which is partly covered with black paper?

Ans :

Comp 2012

- (i) Yes, the lens will produce complete image.

- (ii)



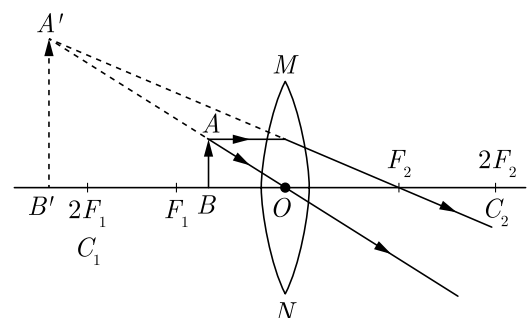
- (iii) Intensity of the image decreases.

174. (a) An object is placed at the focus of a convex lens. Draw a ray diagram to locate the position of the image formed, if any state its position and nature.  
 (b) An object placed 50 cm from a lens produces a virtual image at a distance of 10 cm from the lens. Find the focal length of the lens and also state the type of the lens used.

Ans :

Delhi 2007

- (a) Position : Infinity  
 Nature : Real image



Ans :

(a)  $\sqrt{3}/\sqrt{2}$

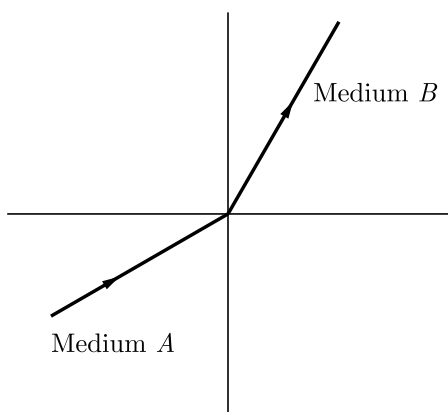
6. A 10 mm long alpin is placed vertically in front of a concave mirror. A 5 mm long image of the alpin is formed at 30 cm in front of the mirror. The focal length of this mirror is

- (a) -30 cm (b) -20 cm  
(c) -40 cm (d) -60 cm

Ans :

- (b) -20 cm.

7. A light ray enters from medium A to medium B as shown in Figure. The refractive index of medium B relative to A will be

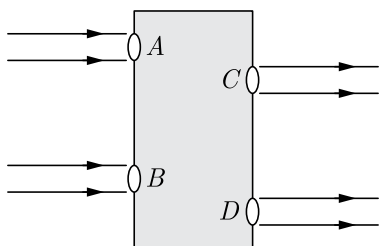


- (a) greater than unity  
(b) less than unity  
(c) equal to unity  
(d) zero

Ans :

- (b) less than unity

8. Beams of light are incident through the holes A and B and emerge out of box through the holes C and D respectively as shown in Figure. Which of the following could be inside the box ?

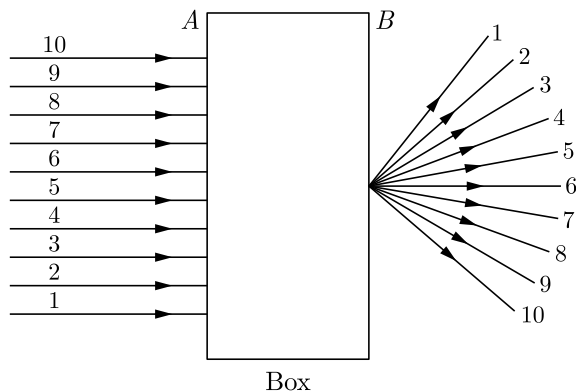


- (a) A rectangular glass slab  
(b) A convex lens  
(c) A concave lens  
(d) A prism

Ans :

- (a) A rectangular glass slab.

9. A beam of light is incident through the holes on side A and emerges out of the holes on the other face of the box as shown in Figure. Which of the following could be inside the box ?



- (a) Concave lens  
(b) Rectangular glass slab  
(c) Prism  
(d) Convex lens

Ans :

- (d) Convex lens

10. Which of the following statements is true?

- (a) A convex lens has 4 dioptre power having a focal length 0.25 m  
(b) A convex lens has -4 dioptre power having a focal length 0.25 m  
(c) A concave lens has 4 dioptre power having a focal length 0.25 m  
(d) A concave lens has -4 dioptre power having a focal length 0.25 m

Ans :

- (a) A convex lens has 4 dioptre power having a focal length 0.2 m.

11. Magnification produced by a rear view mirror fitted in vehicles

- (a) is less than one  
(b) is more than one  
(c) is equal to one  
(d) can be more than or less than one depending upon the position of the object in front of it

Ans :

- (a) is less than one



$$n = \frac{\text{Speed of light in vacuum (air)}}{\text{Speed of light in the given medium}} = \frac{c}{v}$$

It is a unit-less quantity and its numerical value is 1 or greater than 1. For vacuum and air,  $n = 1$ .

1. If a light ray is refracted from medium 1 to medium 2, then refractive index of medium 2 w.r.t. medium 1 ( $n_{21}$ ) is defined as the ratio of speed of light in medium 1 ( $v_1$ ) to speed of light in medium 2 ( $v_2$ ).

So, refractive index of medium 2 w.r.t. medium 1,

$$n_{21} = \frac{v_1}{v_2}$$

$$\text{or } n_{21} = \frac{v_1}{v_2} = \frac{n_2}{n_1}$$

$$\text{Therefore, } n_{12} = \frac{1}{n_{21}}$$

2. Relative refractive index of one medium w.r.t. another medium too is a unit-less quantity and its numerical value may be equal to 1 or greater than 1 or even less than 1.
3. The refractive index of vacuum is called absolute refractive index.
4. If a ray of light is refracted through a rectangular glass slab, the angle of emergence is same as angle of incidence. Hence, emergent ray travels in a direction parallel to that of incident ray. But, the ray suffers a lateral displacement whose value is based on (i) thickness of the glass slab, (ii) refractive index of the glass slab, and (iii) angle of incidence. For angle of incidence ( $\angle i$ ) =  $0^\circ$ , the lateral displacement is also zero (0).
5. Due to refraction of light, a pencil immersed in water in a glass tumbler appears to be displaced at water-air interface. When a glass slab is placed over some printed matter, words appear raised up when observed or seen through the glass slab.
6. If a coin is placed at the bottom of a tumbler filled with water, the apparent depth of the coin appears to be less than its true depth because of refraction of light.

Therefore,

$$\frac{\text{Real depth (h)}}{\text{Apparent depth (h')}} =$$

$$= \text{Refractive index of water (} n_w \text{)}$$

For similar reason, a pond of water appears to be shallower.

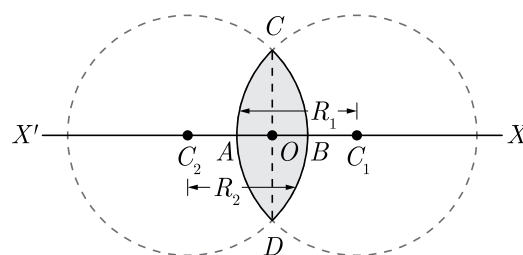
## 10. LENS

Is a part of refracting material, i.e., glass, bound by two non-parallel surfaces, of which either both or one surface is spherical.

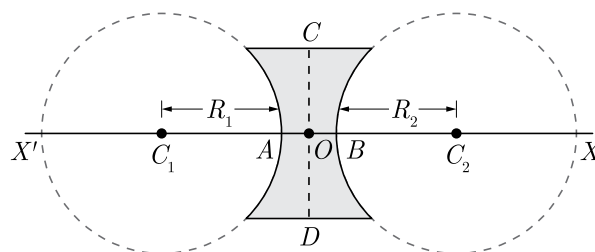
A lens thicker at the middle and thinner at the edges is known as a convex (converging) lens.

A lens thicker at the edges and thinner at the middle is known as a concave (diverging) lens.

1. A lens contains two centres of curvature and two radii of curvature as shown in the figure.
2. Principal axis is a line passing through two centres of curvature of a lens.

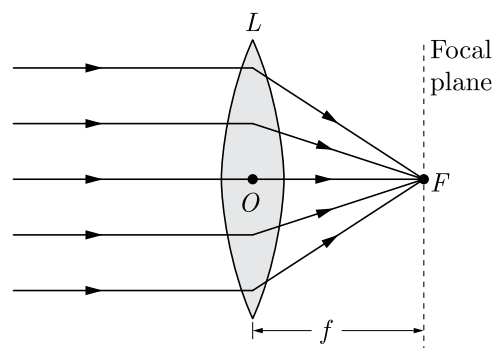


(a)



(b)

3. The optical centre of a lens is the point on its principal axis, a ray of light passing through which goes undeviated. It is the centre of the lens.

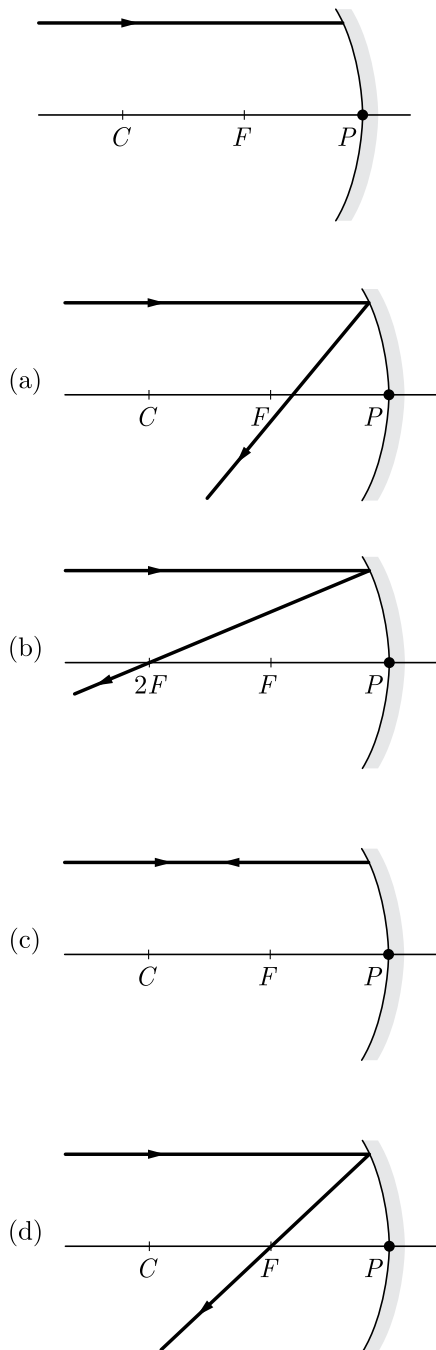


(a)

Ans :

(d) Glycerine

19. Which of the following ray diagrams is correct for the ray of light incident on a concave mirror as shown in Figure ?



(a) Fig. A

(b) Fig. B

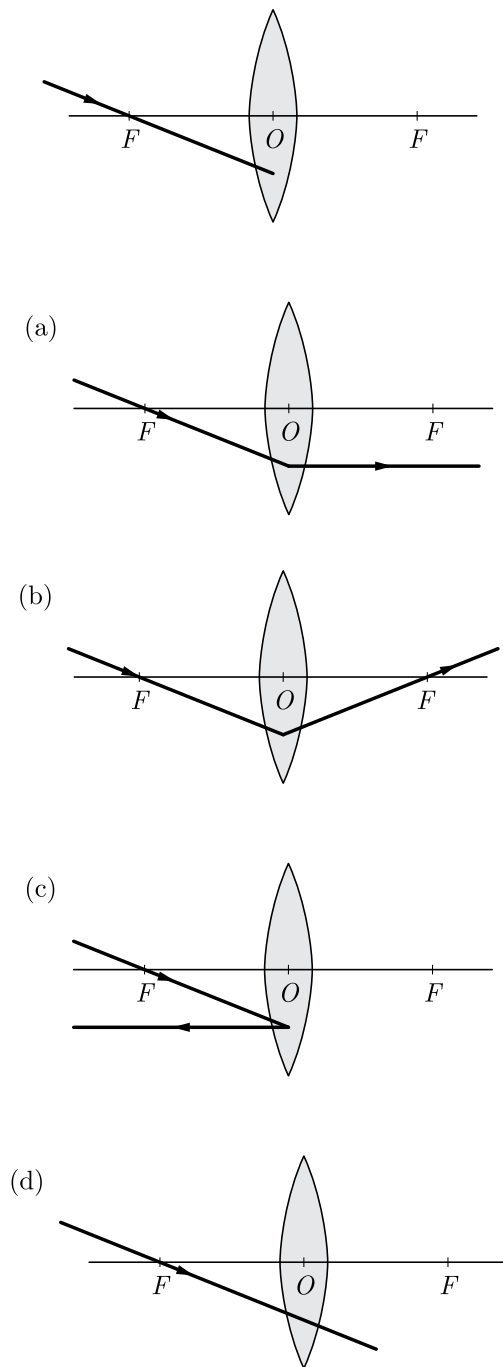
(c) Fig. C

(d) Fig. D

Ans :

(d) Fig. D

20. Which of the following ray diagrams is correct for the ray of light incident on a lens shown in Figure ?



(a) Fig. A

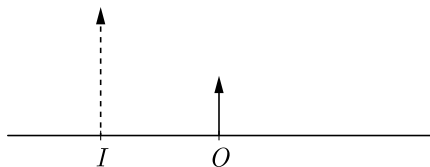
(b) Fig. B

(c) Fig. C

(d) Fig. D

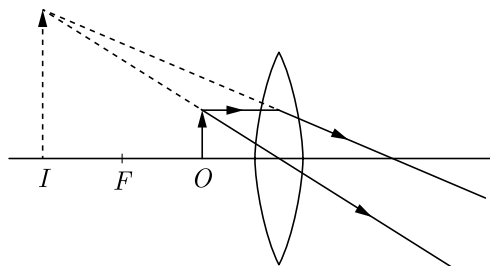
Ans :

(a) Fig. A.



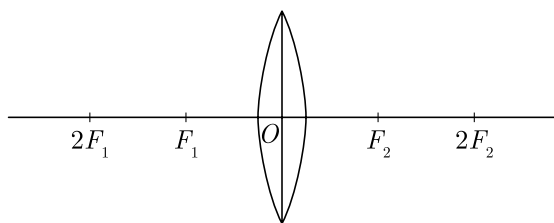
Ans :

Comp 2010



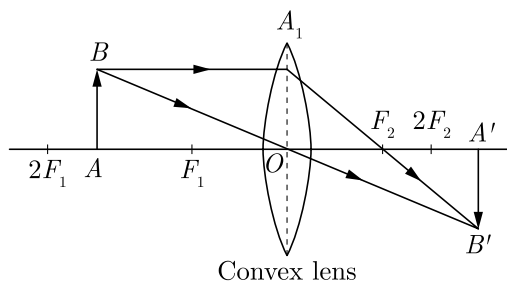
Type of lens : Convex lens.

106. Complete the diagram in your answer book and write the nature of the image formed.



Ans :

Comp 2016



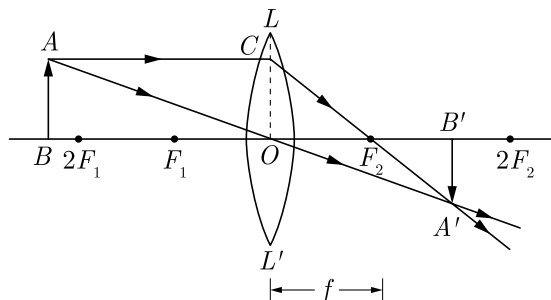
Nature of the image formed : Real and inverted.

107. Draw a ray diagram to show the position and nature of the image formed by a convex lens when the object is placed;
- beyond  $2F$ .
  - between  $F$  and  $2F$ .

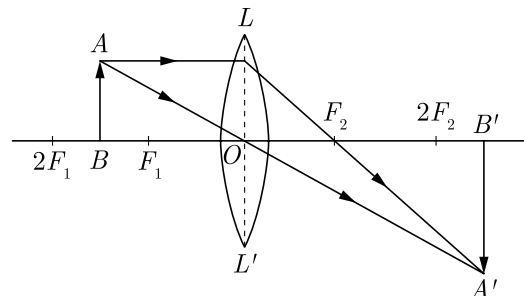
Ans :

Foreign 2011

- When the object is placed beyond  $2F$  :



- When the object is placed between  $F$  and  $2F$ .

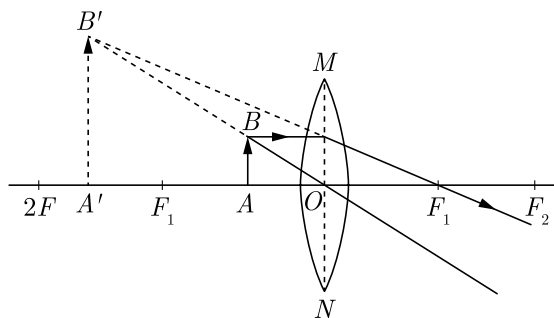


108. Name the type of lens that can be used as magnifying glass. Give reason(s) and draw a ray diagram to support your answer.

Ans :

Delhi 2015

Convex lens is used as magnifying glass. When an object is placed close to a convex lens, its erect and magnified image is formed.



109. To get a real and inverted image of same size as that of the object by a thin convex lens of focal length 20 cm, where should the object be placed ? Draw a ray diagram to show image formation in this case.

Ans :

Delhi 2013

Object should be placed at  $2F$  (i.e., 40 cm) distance from the optical centre of the lens.

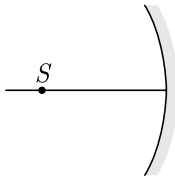
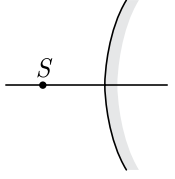
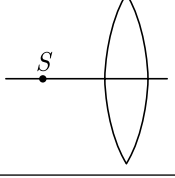
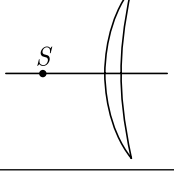
	Column I (Position of object)		Column II (Nature of image)
(C)	At centre of curvature	(r)	Diminished
(D)	At focus	(s)	Enlarged
		(t)	Same size

	A	B	C	D
(a)	p, q	q	r, s	q, r
(b)	r, s	q, r	s, t	p, q, r, s
(c)	p, s	q	r, s, t	r
(d)	p, q, r	p, q, r	p, q, t	p, q

Ans :

(d) A-p, q, r, B-p, q, r, C-p, q, t, D-p, q

25. An optical component and an object S placed along its optic axis are given in **Column I**. The distance between the object and the component can be varied. The properties of images are given in **Column II**. Match all the properties of images from **Column II** with the appropriate components given in **Column I**.

	Column I		Column II
(A)		(p)	Real image
(B)		(q)	Virtual image
(C)		(r)	Magnified image
(D)		(s)	Image at infinity

	A	B	C	D
(a)	p, q	q	r, s	q, r
(b)	p, q, r, s	q	p, q, r, s	p, q, r, s
(c)	p, s	q	r, s, t	r
(d)	p	q, r	r	s

Ans :

(b) A-p, q, r, s, B-q, C-p, q, r, s, D-p, q, r, s

26. **Assertion :** Convex mirror is used as a rear view mirror.

**Reason :** Convex mirror always forms inverted image.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Both Assertion and Reason are false.

Ans :

(c) Assertion is true but Reason is false.

Convex mirror is used as a rear view mirror because it always forms a virtual, erect and diminished image of an object. Also it has a wider view than concave or plane mirror. So, assertion is true but reason is false.

27. **Assertion :** Refractive indices of all transparent mediums are more than 1 (except air).

**Reason :** Air is the rarest medium.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Both Assertion and Reason are false.

Ans :

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Refractive index of any medium is defined as the ratio of speed of light in air or vacuum to speed of light in given medium. Since speed of light is maximum in air (as vacuum), so air is the rarest medium. Hence both assertion and reason are true.

28. **Assertion :** When light travels from one medium to another. The direction of propagation of light in second medium changes.

**Reason :** Light travels with different speeds in

12. Rays from Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object ?
- 15 cm in front of the mirror
  - 30 cm in front of the mirror
  - between 15 cm and 30 cm in front of the mirror
  - more than 30 cm in front of the mirror

Ans :

- 30 cm in front of the mirror
13. A full length image of a distant tall building can definitely be seen by using
- a concave mirror
  - a convex mirror
  - a plane mirror
  - both concave as well as plane mirror

Ans :

- a convex mirror
14. In torches, search lights and headlights of vehicles the bulb is placed
- between the pole and the focus of the reflector
  - very near to the focus of the reflector
  - between the focus and centre of curvature of the reflector
  - at the centre of curvature of the reflector

Ans :

- very near to the focus of the reflector
15. In which of the following, the image of an object placed at infinity will be highly diminished and point sized ?
- Concave mirror only
  - Convex mirror only
  - Convex lens only
  - Concave mirror, convex mirror, concave lens and convex lens

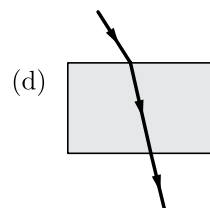
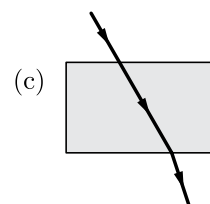
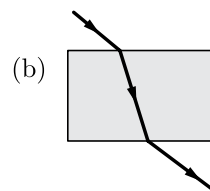
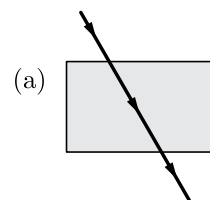
Ans :

- Concave mirror, convex mirror, concave lens and convex lens.
16. The laws of reflection hold good for
- plane mirror only
  - concave mirror only
  - convex mirror only
  - all mirrors irrespective of their shape

Ans :

(d) all mirrors irrespective of their shape

17. The path of a ray of light coming from air passing through a rectangular glass slab traced by four students as A, B, C and D in Figure. Which one of them is correct ?



- |       |       |
|-------|-------|
| (a) A | (b) B |
| (c) C | (d) D |

Ans :

(b) B

18. You are given water, mustard oil, glycerine and kerosene. In which of these media a ray of light incident obliquely at same angle would bend the most ?
- |                 |               |
|-----------------|---------------|
| (a) Kerosene    | (b) Water     |
| (c) Mustard oil | (d) Glycerine |

normal due to decrease in speed of light. Hence, both assertion and reason are false.

- 33. Assertion :** When light from sun is focussed on a sheet of paper using a convex lens, the paper begins to burn producing smoke. It may even catch fire after a while.

**Reason :** Convex lens is a converging lens.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Due to converging nature of convex lens. Light rays coming from sun are converged at one point after passing through convex lens and due to this the paper begins to burn. Hence, both assertion and reason are true.

- 34. Assertion :** Power of a convex lens is positive and that of a concave lens is negative.

**Reason :** Convex lens forms real image and concave lens forms virtual image.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

Power is expressed as  $P = \frac{1}{f(\text{in meters})}$  or  $\frac{1}{f(\text{in cms})}$ .

Focal length of convex lens is positive and focal length of concave lens is negative. So, assertion is true but reason is false.

- 35. Assertion :** Convex mirror is used as a shaving mirror.

**Reason :** Convex mirror always forms an enlarged image.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

- (c) Assertion is true but Reason is false.

- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

Concave mirror is used as a shaving mirror. When object is placed between focus and pole of a concave mirror, a virtual, erect and magnified image is formed on other side of the mirror which gives a better view of the face. Hence, both assertion and reason are false.

- 36. Assertion :** A small source of light casts a sharp shadow of an opaque object.

**Reason :** Light travels in straight lines.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Due to rectilinear propagation of light, when light falls on an opaque object casts its shadow. Hence, both assertion and reason are true.

- 37. Assertion :** Concave mirror has a real focus.

**Reason :** Concave mirror always forms real image.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

Any ray of light incident parallel to principle axis of a concave mirror after reflection passes through focus whereas in convex mirror it appears to pass through focus when produced backwards. Also concave mirror forms both real and virtual images. So, an assertion is true but reason is false.

- 38. Assertion :** For observing traffic at our back, we prefer to use a convex mirror.

**Reason :** A convex mirror has a much larger field of view than a plane mirror or a concave mirror.



different mediums.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

When light travels from one transparent medium to another then due to change in speed of light, its direction changes. Either light ray bends towards the normal or it bends away from the normal. Hence, both assertion and reason are true.

- 29. Assertion :** Radius of curvature of a spherical mirror is half its focal length.

**Reason :** A ray of light incident parallel to principal axis after reflection passes through  $C$ .

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

Radius of curvature of a spherical mirror is always twice the focal length as it is the distance between centre of curvature and pole of mirror. Whereas focal length is distance between focus and pole of mirror. The relationship between focal length ( $f$ ) and radius of curvature ( $R$ ) is  $f = \frac{R}{2}$ . So, neither assertion nor reason is true.

- 30. Assertion :** After refraction through a rectangular glass slab, emergent ray is parallel to the direction of incident ray.

**Reason :** Refractive indices of air and glass are different.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

After refraction through a rectangular glass slab, emergent ray is parallel to the direction of incident ray as opposite sides of rectangular glass slab performing refraction of light ray are parallel to each other. Also refractive indices of air and glass are different but this is not the cause of emergent ray being parallel to direction of incident ray. Hence, both assertion and reason are true but reason is not the correct explanation of assertion.

- 31. Assertion :** Magnification of real images is taken negative.

**Reason :** Magnification is ratio of image distance and object distance.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

Magnification of real images is taken negative. The height of the object is taken to be positive as the object is usually placed above the principal axis. A real image is always inverted to height of image is taken as negative. Since magnification is ratio of height of image to height of object so it is negative. Magnification is also related to object distance ( $u$ ) and image distance ( $v$ ) as  $m = -\frac{v}{u}$ .

Hence, assertion is true but reason is false

- 32. Assertion :** On moving from optically rarer to denser medium, a ray of light bends away from the normal.

**Reason :** Speed of light is more in denser medium and less in rarer medium.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false

When a light ray travels from optically rarer to optically denser medium, it bends towards the

44. What kind of wave is light ?

Ans :

OD 2017

Light is an electromagnetic wave.

45. What is image ?

Ans :

Foreign 2014

Image of an object is formed when reflected or refracted rays intersect each other.

46. What is real image ?

Ans :

OD 2019

Real image is formed by real intersection of refracted or reflected rays.

47. What is virtual image ?

Ans :

Delhi 2016

Virtual image is formed by the virtual intersection of refracted or reflected rays.

48. For regular reflection what is relation between angle of incidence and angle of reflection ?

Ans :

SQP 2018

Angle of incidence = Angle of reflection.

49. When a ray is made incident normal to the plane, what is angle of incidence and angle of reflection ?

Ans :

Delhi 2012

The angle of incidence and angle of reflection both are of zero degree.

50. Write the mirror formula.

Ans :

SQP 2020

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

51. Write the formula of magnification.

Ans :

Comp 2017

$$m = \frac{h_2}{h_1} = -\frac{v}{u}$$

52. Write one use of concave and convex mirrors each.

Ans :

OD 2013

Concave mirror is used in solar concentration, while convex mirror is used as rear view in automobiles.

53. Why do we use convex mirror for side-view mirror ?

Ans :

Delhi 2011

Convex mirror is used for side view because it forms a virtual, erect and image smaller which enables large field of view.

54. Can a virtual image be screened ?

Ans :

Delhi 2016

No, virtual image cannot be screened.

55. Define the focus of a spherical mirror.

Ans :

Foreign 2014

The virtual or real point on principal axis where all the light rays parallel to principal axis meet after reflection is called principal focus.

56. What is centre of curvature of convex mirror ?

Ans :

AI 2015

The convex mirror is a part of hollow sphere having inward surface polished. The inside centre of sphere is called centre of curvature of the convex mirror.

57. What is the minimum distance between an object and its real image in case of a concave mirror ?

Ans :

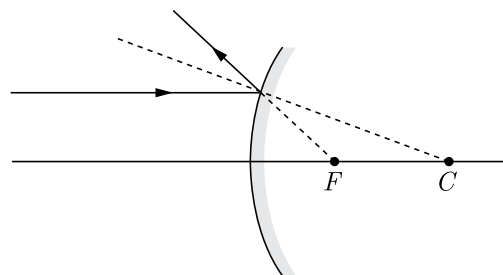
Delhi 2011

Zero

58. Draw a ray diagram to show reflection of an incident ray parallel to principal axis by a convex mirror.

Ans :

OD 2019



59. If the object is placed between the pole  $P$  and focus  $F$  of the concave mirror, what will be the position, size and nature of the image formed ?

Ans :

AI 2013

The image formed is virtual, enlarged, erect and behind the mirror.

60. What is value of speed of light in vacuum ?

Ans :

Foreign 2011

$3 \times 10^8$  m/s

61. Does the speed of light change with medium ?

Ans :

SQP 2017

Yes, speed of light changes with medium.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

A convex mirror bends light as it reflects the light and the farther away a point is from the centre, the more the light is bent. As a result, an image formed in a convex mirror is smaller than an image in a plane (flat) mirror. Because the image is smaller more images can fit onto the mirror, so a convex mirror provides for a larger field of view than a plane mirror. They are used whenever a mirror with a large field of view is needed to observe traffic.

- 39. Assertion :** A concave mirror of focal length ' $f$ ' in air is used in a medium of refractive index 2. Then the focal length of mirror in medium becomes double.

**Reason :** The radius of curvature of a mirror is double of the focal length.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

(d) Both Assertion and Reason are false.

Focal length of a mirror does not depend on the medium in which mirror is held. It depends on the radius of the sphere from which it is made. However focal length of a lens does depend on medium.

- 40. Assertion :** Large concave mirrors are used to concentrate sunlight to produce heat in solar cookers.

**Reason :** Concave mirror converges the light rays falling on it to a point.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

Concave mirror converges the light rays falling on it to a point. So large concave mirrors are used to concentrate sunlight to produce heat in solar cookers.

- 41. Assertion :** A ray incident along normal to the mirror retraces its path.

**Reason :** In reflection, angle of incidence is not equal to angle of reflection.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

(c) Assertion is true but Reason is false.

When light ray incident along normal to the mirror, angle of incidence  $\angle i = 0^\circ$ .

Now, according to the law of reflection angle of incidence = angle of reflection

$$\angle i = \angle r = 0^\circ$$

- 42. Assertion :** When a concave mirror is held under water, its focal length will decrease.

**Reason :** The focal length of a concave mirror is independent of the medium in which it is placed.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but reason is true.

**Ans :**

(d) Assertion is false but reason is true.

Focal length is the property of mirror and is independent of the medium in which it is placed.

## ONE MARK QUESTIONS

- 43. What is light ?**

**Ans :**

Light is the form of energy which gives sensation of vision.

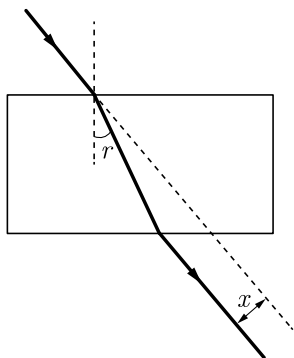
SQP 2021

77. (a) Draw a ray diagram to show the refraction of light through a glass slab and mark angle of refraction and lateral shift suffered by the ray of light passing through the slab.
- (b) If the refractive index of glass for light going from air to glass is  $\frac{3}{2}$ , find the refractive index of air for light going from glass to air.

Ans :

Delhi 2012

(a)

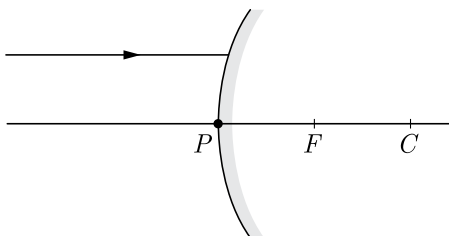


(b)

$${}_a n_g = \frac{3}{2} = 1.5$$

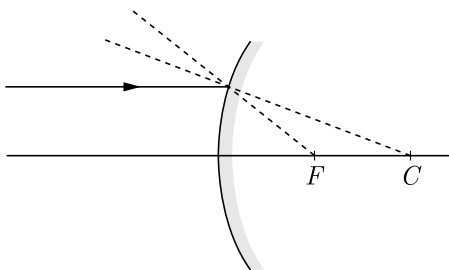
$${}_g n_a = \frac{1}{{}_a n_g} = \frac{1}{1.5} = \frac{2}{3}$$

78. A ray of light is incident on a convex mirror as shown. Redraw the diagram and complete the path of this ray after reflection from the mirror. Mark angle of incidence and angle of reflection on it.



Ans :

SQP 2017



79. Define the term principal focus for a convex mirror.

Ans :

Delhi 2013

It is a point on the principal axis at which the rays

parallel to the principle axis from where the rays of light seem to come after reflection.

80. What are the units of power of a lens ?

Ans :

Foreign 2011

Diopetre.

81. In what condition, the image formed by a concave mirror is virtual ?

Ans :

OD 2015

When the object is placed between the focus and the pole of a concave mirror, a virtual image is obtained.

82. Name the type of mirror which always forms a virtual and diminished image.

Ans :

OD 2016

Convex mirror.

83. Name the type of mirror which is known as shaving mirror.

Ans :

Delhi 2012

Concave mirrors are used as shaving mirrors because it magnifies the image.

84. How does the size of the image change as the object is brought closer from infinity towards the convex lens

Ans :

AI 2010

The size of the image formed keeps on increasing as the object is brought closer towards the convex lens.

85. The refractive index of diamond is 2.42. What is the meaning of this statement ?

Ans :

Foreign 2016

The refractive index of diamond 2.42 suggests that the speed of light in diamond will reduce by a factor 2.42 as compared to its speed in air.

86. The power of a lens is  $-4.0\text{ D}$ . What is the nature of the lens ?

Ans :

Delhi 2011

The lens is a diverging lens.

87. Define refractive index of a medium.

Ans :

Delhi 2009

Refractive index of a medium.

$$n = \frac{\text{Speed of light in vacuum } (c)}{\text{Speed of light in given medium } (v)}$$

- 165.** Which lens can be used as a magnifying glass ? For which position of object does a convex lens form ;  
 (a) a virtual and erect image ?  
 (b) a real and inverted image of same size as that of object ?

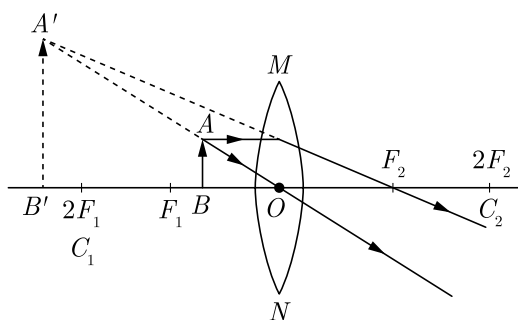
Draw labelled ray diagrams to show the formation of the required images in each of the above two cases.

**Ans :**

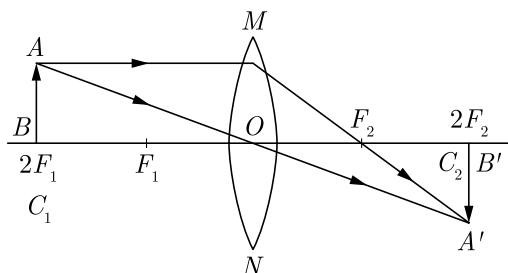
AI 2010

Convex lens can be used as magnifying glass.

- (a) When object is between optical centre and principal focus  $F_1$  :



- (b) When object is at  $2F_1$  :



- 166.** (a) A compound lens is made of two lenses in contact having powers  $+12.5\text{ D}$  and  $-2.5\text{ D}$ . Find the focal length and power of the combination.  
 (b) The magnification produced by a mirror is  $+1$ . What does this mean ?

**Ans :**

Comp 2008

$$\begin{aligned} \text{(a)} \quad P &= P_1 + P_2 \\ &= 12.5 + (-2.5) \\ &= 10\text{ D} \\ f &= \frac{1}{P} = \frac{1}{10} = 0.1\text{ m} \end{aligned}$$

- (b) '+' sign means image is virtual and erect.  
 1 means it is of the same size.

- 167.** Name the type of lens used to obtain;

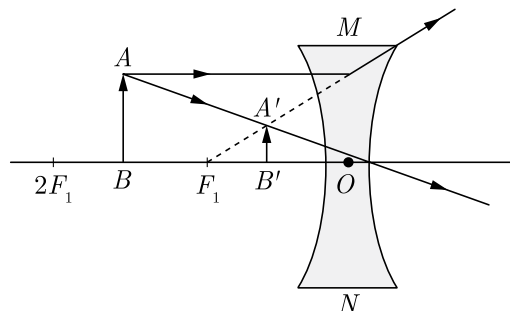
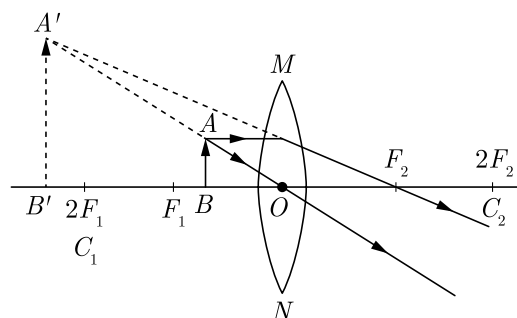
- (i) an erect, enlarged and virtual image of an object.  
 (ii) an erect, diminished and virtual image of an object.

Draw labelled ray diagrams to show the formation of image in each case. Which of these lenses could also form a magnified and real image of the object ? State the position of the object for which this could happen.

**Ans :**

Foreign 2010

- (i) Convex lens.  
 (ii) Concave lens.



Convex lens can also form real, inverted and magnified image.

Position of the object : Between  $F$  and  $2F$ .

- 168.** (a) Define power of a lens and write its S.I. unit.  
 (b) A convex lens of power  $4\text{ D}$  is placed at a distance of  $40\text{ cm}$  from a wall. At what distance from the lens should a candle be placed so that its image is formed on the wall ?

**Ans :**

Delhi 2013

- (a) Power of a lens is the reciprocal of focal length expressed in metres.  
 S.I. unit of power is dioptre.  
 (b) As we know that,

$$f = \frac{1}{P} = \frac{1}{4\text{ D}} = \frac{1}{4}\text{ m}$$

Object must be placed at 30 cm in front of the mirror.

- 97.** How do we distinguish a medium to be rarer or denser?

**Ans :**

Comp 2016

We distinguish a medium to be denser or rarer on the basis of following facts :

- Denser medium has higher value of refractive index.
- When light ray travels from rarer to denser, it bends towards normal and vice-versa.

- 98.** State Snell's Law.

**Ans :**

Delhi 2011

The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for a given colour and for the given pair of media.

$$\frac{\sin i}{\sin r} = \mu \text{ (Constant)}$$

- 99.** What is the meaning of

- optical centre and
- principal axis ?

**Ans :**

Delhi 2017

- Optical centre : It is a point of lens through which light ray passes without deviation.
- The principal axis : The line joining optical centre and focus of lens is called principal axis.

- 100.** When does a convex lens form

- a virtual, erect, enlarged image
- real, enlarged image ?

**Ans :**

SQP 2013

- For a virtual, erect and enlarged image the object is placed between optical centre and focus in front of a convex lens.
- For a real and enlarged image the object is kept in between  $F$  and  $2F$  in front of a convex lens.

- 101.** State laws of refraction of light.

**Ans :**

OD 2011

The following are the laws of refraction of light :

- The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
- The ratio of sine of angle of incidence to the sine of angle of refraction is constant, for the light of a given colour and for the given pair of

media. This law is also known as Snell's law of refraction.

If  $i$  is the angle of incidence and  $r$  is the angle of refraction then,

$$\frac{\sin i}{\sin r} = \text{constant}$$

This constant value is called the refractive index of the second medium with respect to the first.

- 102.** (a) What happens to a ray of light when it travels from one medium to another having equal refractive indices ?  
(b) State the cause of refraction of light.

**Ans :**

Foreign 2009

- No refraction or bending would take place. The light will travel in a straight line.
- The refraction occurs due to change in speed of light as it enters from one medium to another.

- 103.** What is meant by refractive index ? If the speed of light in a medium is  $\frac{2}{3}$ rd of the speed of light in vacuum, find the refractive index of that medium.

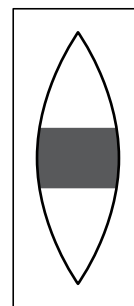
**Ans :**

AI 2012

Refractive index of a medium is the ratio between the speed of light in vacuum to the speed of light in the medium.

$$\text{R.I.} = \frac{c}{v} = \frac{c}{(2/3) \text{ of } c} = 1.5$$

- 104.** One portion of a convex lens is covered as shown. Will the lens produce a complete image of the object? Describe in brief the characteristics of the image formed.



**Ans :**

OD 2014

Yes, the lens would produce a complete image.

The image will be complete but with reduced intensity, i.e., the image formed will be blurred.

- 105.** The given diagram shows an object  $O$  and its image  $I$ . Copy the diagram in your answer book and draw suitable rays to locate the lens and its focus. Name the type of lens in this case.



62. State a condition for no refraction of light when light enters from one medium to another.

Ans :

Delhi 2011

No refraction of light occurs when light is incident normally on a boundary of two media.

63. Write the position between refractive index and speed of light in the medium.

Ans :

Delhi 2017

$$\text{Refractive index} = \frac{\text{Velocity of light in vacuum}}{\text{Velocity of light in medium}}$$

64. What is the cause of refraction ?

Ans :

Delhi 2014

Refraction of light ray is caused due to change in velocity of light travelling from one medium to another medium.

65. "Refractive index of glass is 1.5." What does it mean by this statement ?

Ans :

OD 2011

It means ratio of speed of light in vacuum to the speed of light in glass is equal to 1.5.

66. Write the lens formula.

Ans :

Foreign 2013

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

67. Is it possible to form a real image using a real object with a concave lens ?

Ans :

OD 2016

No, real image is not formed by a concave lens.

68. In which direction, the ray of light bends as it travels from denser to rarer medium ?

Ans :

Delhi 2012

The ray bends away from normal when it travels from denser to rarer medium.

69. What is the value of  ${}_1n_2 \times {}_2n_1$  ?

Ans :

AI 2011

$${}_1n_2 \times {}_2n_1 = \frac{V_1}{V_2} \times \frac{V_2}{V_1} = 1$$

70. Define absolute refractive index of a medium.

Ans :

Foreign 2009

Absolute refractive index of a medium is the refractive index of a medium with respect to vacuum.

71. What is the relation between emergent ray and incident ray when light ray passes through a rectangular glass slab ?

Ans :

OD 2015

Emergent ray and incident ray are parallel to each other.

72. Refractive index of water is  $4/3$  and for glass it is  $3/2$ , with respect to air. What is the refractive index of glass with respect to water ?

Ans :

OD 2006

$$\begin{aligned} {}_w n_g &= \frac{n_g}{n_w} = \frac{3/2}{4/3} \\ &= \frac{3}{2} \times \frac{3}{4} = \frac{9}{8} \\ {}_w n_g &= \frac{9}{8} \end{aligned}$$

73. What is meant by magnification in the context of image formation by mirror and lenses ?

Ans :

Delhi 2011

The ratio of the size of the image to the size of the object is called as magnification.

$$m = \frac{h_i}{h_o}$$

74. Which property of concave mirror is utilised for using them as shaving mirror?

Ans :

Delhi 2017

When an object is placed between the pole and focus of concave mirror a magnified, erect and virtual image is formed.

75. What are the values of angle of incidence and angle of reflection for the normal incidence ?

Ans :

OD 2016

Angle of incidence,  $\angle i = 0^\circ$

Angle of reflection,  $\angle r = 0^\circ$

76. Find the focal length of a convex mirror whose radius of curvature is 32 cm.

Ans :

OD 2014

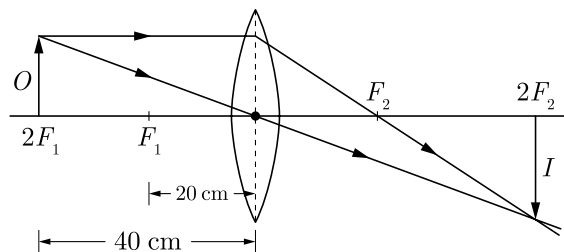
Given,

Radius of curvature,  $R = 32 \text{ cm}$

Radius of curvature,  $(R) = 2 \times \text{Focal length } (f)$

$$\text{or } f = \frac{R}{2} = \frac{32}{2} = 16 \text{ cm}$$

Hence the focal length of the given convex mirror is 16 cm.



110. An object is 2 m away from a lens, which forms an erect image one-fourth the size of the object. Determine the focal length of the lens. What type of lens is this ?

Ans :

AI 2011

Given,

$$u = -2 \text{ m}$$

$$\frac{1}{4} = \frac{v}{u}$$

$$\frac{1}{4} = \frac{v}{-2}$$

$$u = -\frac{1}{2} \text{ m} = -0.5 \text{ m}$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\left(-\frac{1}{0.5}\right) - \left(\frac{1}{-2}\right) = \frac{1}{f}$$

$$\frac{1}{f} = -\frac{3}{2}$$

$$f = \left(-\frac{2}{3}\right) \text{ m}$$

Lens is concave.

111. Two lenses of power  $-2.5 \text{ D}$  and  $+1.5 \text{ D}$  are placed in contact. Find the total power of the combination of lenses. Calculate the focal length of this combination.

Ans :

Delhi 2012

Given :

$$P_1 = 2.5 \text{ D}$$

$$P_2 = +1.5 \text{ D}$$

Total power of the combination,

$$P = P_1 + P_2$$

$$= -2.5 \text{ D} + 1.5 \text{ D}$$

$$= -1.0 \text{ D}$$

$$P = \frac{1}{f} \text{ (in metre)}$$

$$f \text{ (in metre)} = \frac{1}{P} = \frac{1}{-1} = -1 \text{ m}$$

The focal length of the lens is  $-1 \text{ m}$ .

112. An object placed at a distance of 30 cm in front of a convex mirror of focal length 15 cm. Write four

characteristics of the image formed by the mirror.

Ans :

SQP 2017

Four properties of image formed by the given convex mirror are :

- Image is always erect
- Small in size
- Virtual
- Always form behind the mirror between focus and pole.

113. An object is placed at a distance of 40 cm in front of a convex mirror of radius of curvature 40 cm. List four characteristics of the image formed by the mirror.

Ans :

Delhi 2013

Four properties of image formed by the given convex mirror are :

- Image is always erect
- Small in size
- Virtual
- Always form behind the mirror between focus and pole.

114. (i) Name the spherical mirror used as :
- Shaving mirror,
  - Rear view mirror in vehicles,
  - Reflector in search light.
- (ii) Write any three differences between a real and a virtual image.

Ans :

OD 2015

- Shaving mirror** : concave mirror,
  - Rear view mirror** : convex mirror,
  - Reflector in search lights** : concave mirror.
- Real image can be obtained on screen but virtual image cannot be obtained.
  - Reflected/refracted rays actually meet where real image is formed while for virtual they only appear to meet.
  - Real image is always inverted while virtual image is always erect.

115. An object is placed at a distance of 12 cm in front of a concave mirror of radius of curvature 30 cm. List four characteristics of the image formed by the mirror.

Ans :

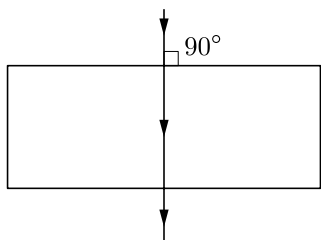
Delhi 2017

- Image is always erect.
- Big in size.
- Virtual.
- Always forms behind the mirror.

Thus, refractive index

$$= \frac{\text{Speed of light in vacuum}}{\text{Speed of light in the medium}} \\ = \frac{c}{0.6c} = 1.66$$

- (c) The ray of light should be incident normally to the surface of the glass slab.

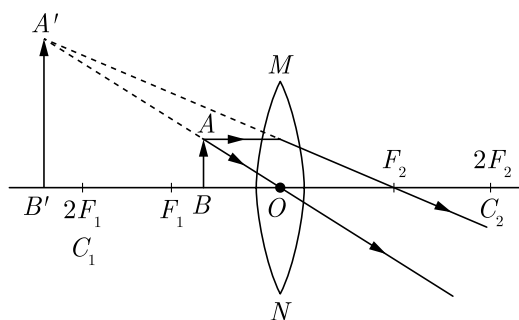


- 208.** (a) Draw a ray diagram in each of the following cases to show the position and nature of the image formed when the object is placed;
- between optical centre and principal focus ( $F$ ) of a convex lens.
  - between  $F$  and  $2F$  of a convex lens.
  - at  $2F$  of a convex lens.
- (b) How will the nature and position of image formed change in cases (i) and (ii) in part (a) of this question if the lens is replaced by a concave lens? Draw the corresponding ray diagram.

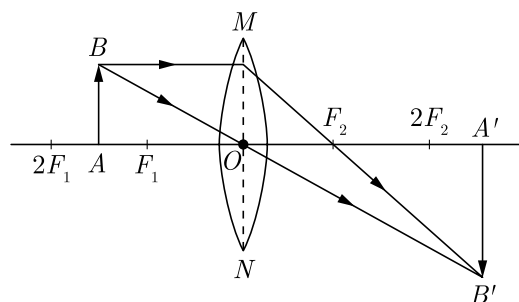
**Ans :**

Comp 2008

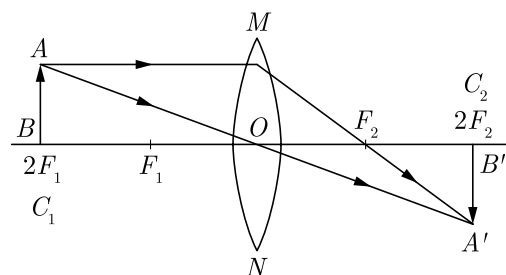
- (a) (i)



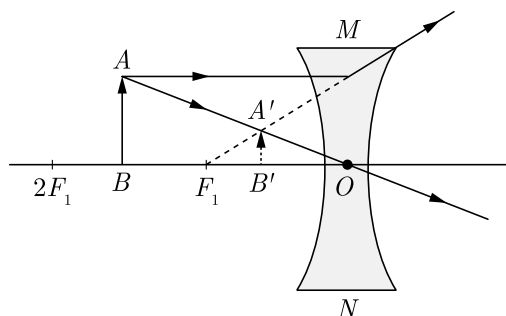
- (ii)



- (iii)



- (b) Virtual and erect in both the cases.



- 209.** A thin converging lens forms a;

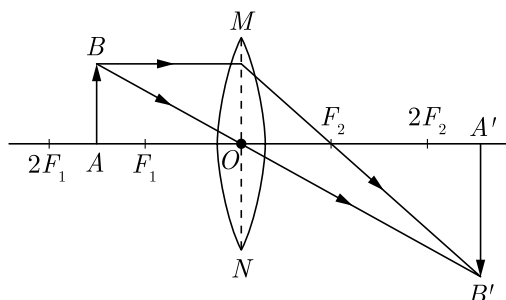
- real magnified image.
- virtual magnified image of an object placed in front of it.

- Write the positions of the objects in each case.
- Draw labelled ray diagrams to show the image formation in each case.
- How will the following be affected on cutting this lens into two halves along the principal axis?
  - Focal length,
  - Intensity of the image formed by half lens.

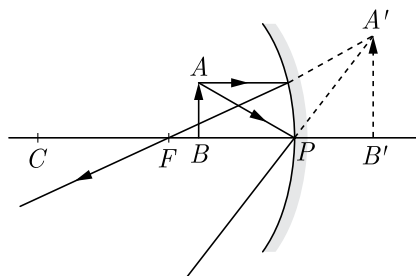
**Ans :**

Delhi 2017

- Between  $F$  and  $2F$  of a lens.
  - Within the focal length.
- Between  $F$  and  $2F$  :



respect to the pole of the mirror. Draw ray diagram to show the formation of image in this case.



Ans :

Foreign 2012

- (i) Concave mirror.
- (ii) Between the pole and focus.

125. State the two laws of reflection of light.

Ans :

Delhi 2010

- (i) The angle of incidence is equal to the angle of reflection.
- (ii) The incident ray, the normal to the reflecting surface at the point of incidence and reflected ray from that point, all lies in the same plane.

126. Differentiate a real image from a virtual image giving two points of difference.

Ans :

OD 2014

	Real Image	Virtual Image
1.	Formed when reflected rays meet.	Formed at a point from which the reflected rays appear to diverge.
2.	Image is always inverted.	It is always erect.

127. An object of height 1.2 m is placed before a concave mirror of focal length 20 cm so that a real image is formed at a distance of 60 cm from it. Find the position of an object. What will be the height of the image formed ?

Ans :

OD 2016

Given,  $h_o = 1.2 \text{ cm}$ ,  $f = -20 \text{ cm}$ ,  $v = -60 \text{ cm}$

As we know that,

$$\begin{aligned} \frac{1}{u} &= \frac{1}{f} - \frac{1}{v} \\ \frac{1}{u} &= \frac{1}{-20} - \frac{1}{-60} \\ &= \frac{1}{60} - \frac{1}{20} \\ &= \frac{1-3}{60} = \frac{-2}{60} \end{aligned}$$

or  $u = -30 \text{ cm}$

$$\frac{h_i}{h_o} = \frac{-v}{u}$$

$$h_i = -\frac{-60}{-30} \times 1.2 = -2.4 \text{ cm}$$

128. A convex lens of focal length 10 cm is placed at a distance of 12 cm from a wall. Calculate the distance from the lens where an object can be placed so as to form its distinct real image on the wall.

Ans :

OD 2013

Given,  $v = +12 \text{ cm}$ ,  $f = +10 \text{ cm}$

As we know that,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{12} - \frac{1}{u} = \frac{1}{10}$$

or  $\frac{1}{12} - \frac{1}{10} = \frac{1}{u}$

$$\frac{5-6}{60} = \frac{1}{u}$$

$$-\frac{1}{60} = \frac{1}{u}$$

$$u = -60 \text{ cm}$$

129. A concave mirror is known as a converging mirror while a convex mirror is known as a diverging mirror? Explain why ?

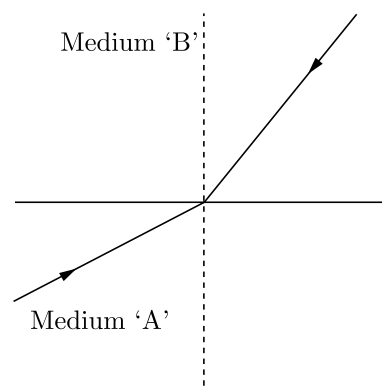
Ans :

Delhi 2017

A concave mirror converges a parallel beam of light falling on it, so it is known as a converging mirror. On the other hand, convex mirror diverges a parallel beam falling on it, so it is known as a diverging mirror.

## THREE MARKS QUESTIONS

130. A light ray enters from medium A to medium B as shown in the figure.



88. Refractive index of water with respect to air is 1.33. What is the refractive index of air with respect to water ?

Ans :

OD 2015

$$n_{aw} = \frac{1}{n_{wa}} = \frac{1}{1.33} = 0.75$$

89. What is the minimum distance between an object and its real image in case of a concave mirror ?

Ans :

Foreign 2010

Zero.

## TWO MARKS QUESTIONS

90. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position of the image formed by the mirror.

Ans :

OD 2024

Given,

Focal length  $(f) = +15$  cm

Object distance  $(u) = -10$  cm

As we know that,

From mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{15} - \frac{1}{(-10)}$$

$$v = \frac{2+3}{30} = 6 \text{ cm}$$

Image formed at 6 cm behind the mirror

91. What are the properties of the image formed by a plane mirror ?

Ans :

Comp 2021

- Image formed by a plane mirror is always virtual and erect.
- The size of the image is equal to that of the object.
- The image formed is as far behind the mirror as the object is in front of it.
- The image is laterally inverted.

92. Distinguish between convex mirror and concave mirror.

Ans :

OD 2019

**Convex mirror :**

- The reflecting surface is curved outward.
- The image formed is diminished and erect.

**Concave mirror :**

- The reflecting surface is curved inward.
- The image formed may be real or virtual and either diminished or enlarged.

93. Name the type of mirror used in a solar furnace. How is high temperature achieved by this device ?

Ans :

Comp 2020

Concave mirror is used in a solar furnace.

The solar furnace is placed at the focus of the large concave reflector. The concave reflector focuses the Sun's heat rays on the furnace and the high temperature is achieved.

94. Identify the nature of the mirror and mention two characteristics of the image formed when magnification  $(m) = +6$ .

Ans :

Delhi 2017

Mirror is concave.

- Image is virtual and erect.
- It is 6 times enlarged than the object.

95. (a) What should be the position of the object, when a concave mirror is to be used :
- as a shaving mirror, and
  - in torches producing parallel beam of light?
- (b) A man standing in front of a mirror, finds his image having a very small head and legs of normal size. What types of mirrors are used in designing such a mirror ?

Ans :

OD 2011

- Object should be between pole and focus.
  - At the focus.
- Small head – convex mirror.
  - Legs of normal size – plane mirror.

96. Where should an object be placed in front of a concave mirror of focal length 20 cm so as to obtain a two times magnified real image ?

Ans :

Foreign 2013

$$f = -20 \text{ cm}, m = -2, \text{ as image is real.}$$

$$m = -\frac{v}{u}$$

$$-2 = -\frac{v}{u}, v = 2u$$

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{-20} = \frac{1}{u} + \frac{1}{2u}$$

$$u = -30 \text{ cm}$$

Using mirror formula,

$$\begin{aligned}\frac{1}{f} &= \frac{1}{v} + \frac{1}{u} \\ \frac{1}{v} &= \frac{1}{f} - \frac{1}{u} \\ \frac{1}{v} &= \frac{1}{-15} - \frac{1}{-10} \\ &= \frac{-2+3}{30} = \frac{1}{30} \\ v &= +30 \text{ cm}\end{aligned}$$

Positive sign of  $v$  shows that the image is virtual.

$$\begin{aligned}m &= \frac{-v}{u} \\ m &= \frac{-30}{-10} = 3\end{aligned}$$

- (a) Position of image 30 cm behind the mirror  
(b) Size of image 3 times the size of object  
(c) virtual and erect.

- 134.** The refractive index of a medium  $x$  with respect to medium  $y$  is  $\frac{2}{3}$  and the refractive index of medium  $y$  with respect to medium  $z$  is  $\frac{4}{3}$ . Find the refractive index to medium  $z$  with respect to medium  $x$ . If the speed of light in medium  $x$  is  $3 \times 10^8 \text{ ms}^{-1}$ , calculate the speed of light in medium  $y$ .

**Ans :**

Comp 2020

The refraction index of medium 2 with respect to medium 1 is given by the ratio of the speed of light in medium 1 and the speed of light in medium 2.

Given, Refractive index of medium  $x$  with respect to medium  $y = \frac{2}{3}$

$$\begin{aligned}n_{xy} &= \frac{\text{Speed of light in medium } y}{\text{Speed of light in medium } x} \\ &= \frac{2}{3} \quad \dots(1)\end{aligned}$$

Refractive index of medium  $y$  with respect to medium  $z = \frac{4}{3}$

$$\begin{aligned}n_{yz} &= \frac{\text{Speed of light in medium } z}{\text{Speed of light in medium } y} \\ &= \frac{4}{3} \quad \dots(2)\end{aligned}$$

To calculate,

Refractive index of medium  $z$  with respect to medium  $x = ?$

$$n_{zx} = \frac{\text{Speed of light in medium } x}{\text{Speed of light in medium } z}$$

From (1) and (2) equations.

$$n_{zx} = \frac{\frac{3}{2}}{\frac{4}{3}} \text{ or } \frac{3}{2} \times \frac{3}{4} = \frac{9}{8}$$

Hence, refractive index of medium  $z$  with respect

to medium  $x$  is  $\frac{9}{8}$ .

Speed of light in medium  $x = 3 \times 10^8 \text{ m/s}$

Speed of light in medium  $y = ?$

$$n_x = \frac{\text{Speed of light in air}}{\text{Speed of light in medium } x}$$

$$\text{or } = \frac{C}{V_x}$$

$$n_y = \frac{\text{Speed of light in air}}{\text{Speed of light in medium } y}$$

$$= \frac{C}{V_y}$$

Refractive index of medium  $x$  with respect to  $y = \frac{2}{3}$

$$\frac{2}{3} = \frac{C}{V_x} \times \frac{V_y}{C}$$

$$\text{or } \frac{2}{3} = \frac{V_y}{V_x}$$

Speed of light in medium  $x = 3 \times 10^8 \text{ m sec}^{-1}$   
substituting the value we get

$$\begin{aligned}y &= \frac{2 \times 3 \times 10}{3} \\ &= 2 \times 10^8 \text{ m sec}^{-1}\end{aligned}$$

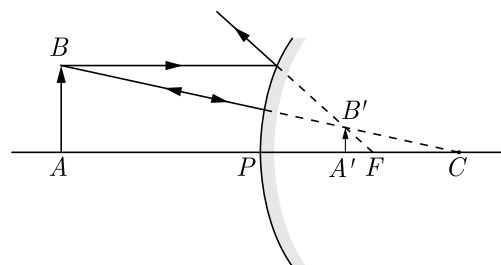
Hence, the speed of light in medium  $y$  is  $2 \times 10^8 \text{ m sec}^{-1}$ .

- 135.** (a) Which mirror do we use as a rear-view mirror in vehicles ?  
(b) Draw a ray diagram to illustrate the formation of an image when an object is placed anywhere in front of the mirror on its principal axis. State the nature and position of the image formed.

**Ans :**

SQP 2018

- (a) Convex mirror.  
(b)



Nature and position : Diminished between  $P$  and  $F$  behind the mirror.

- 136.** (a) Mention two properties of image formed by a convex mirror.  
(b) Draw a ray diagram for the formation of an image, when the object is placed beyond  $C$  in front of a concave mirror.



21. A child is standing in front of magic mirror. She finds the image of her head bigger, the middle portion of her body of the same size and that of the legs smaller. The following is the order of combinations for the magic mirror from the top.

- (a) Plane, convex and concave  
 (b) Convex, concave and plane  
 (c) Concave, plane and convex  
 (d) Convex, plane and concave

Ans :

- (c) Concave, plane and convex.

22. The graphs given apply to convex lens of focal length  $f$ , producing a real at a distance  $v$  from the optical centre when self luminous object is at distance  $u$  from the optical centre. The magnitude of magnification is  $m$ . Identify the following graphs with the first named quantity being plotted along y-axis.

	Column I		Column II
(A)	$v$ against $u$	(p)	
(B)	$\frac{1}{v}$ against $\frac{1}{u}$	(q)	
(C)	$m$ against $v$	(r)	
(D)	$(m+1)$ against $\frac{v}{f}$	(s)	

	A	B	C	D
(a)	q	r	p	s
(b)	p	q,	s,	r,
(c)	r	s,	q,	p
(d)	r	q	s	p

Ans :

- (c) A-r, B-s, C-q, D-p

23. A convex lens ( $f$ ) forms an images on a screen. Considering the object to be at the zero mark in a scale, match the following.

	Column I		Column II
(A)	Image	(p)	Moves the image of infinite object further away
(B)	Additional lens in contact	(q)	Not unique as lens is moved between object and source.
(C)	Reduction in refractive index	(r)	Virtual for screen position at a distance $< 4f$ from the object.
(D)	Slicing the lens to have one plane and another	(s)	Object at $d$ forms real image further convex surface nearer plano-convex lens.

	A	B	C	D
(a)	p, q	q	r	q,r
(b)	r	q	q, r, s	r, s
(c)	p, r	s	p	p, r
(d)	p	q, r	r	s

Ans :

- (c) A-p,r, B-s, C-p, D-p, r

24. In the following columns, the position of an object is given in column I and the nature of image formed in a concave mirror is given in column II.

	Column I (Position of object)		Column II (Nature of image)
(A)	At infinity	(p)	Real
(B)	Between infinity and centre of curvature	(q)	Inverted

$$\begin{aligned}
 &= -\frac{v}{u} \\
 \text{or } v &= -3u \\
 \frac{1}{f} &= \frac{1}{v} + \frac{1}{u} \\
 \frac{1}{-20} &= \frac{1}{-3u} + \frac{1}{u} \\
 &= \frac{2}{3u} \\
 \text{or } u &= -\frac{40}{3} = -13.33 \text{ cm}
 \end{aligned}$$

- 141.** Why does a ray of light passing through the centre of curvature of a concave mirror after reflection, is reflected back along the same path ?

**Ans :**

Delhi 2009

It is because the incident ray falls on the mirror along the normal to the reflecting surface. Hence the angle of incidence is zero and according to law of reflection, angle of incidence is always equal to angle of reflection. Therefore the reflected ray back along the same path.

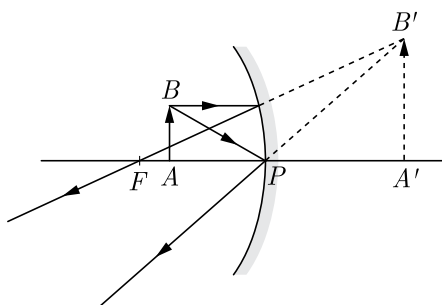
- 142.** It is desired to obtain an erect image of an object, using concave mirror of focal length 20 cm.

- What should be the range of distance of an object from the mirror ?
- Will the image be smaller or larger than the object ?
- Draw a ray diagram to show the image formation in this case.

**Ans :**

AI 2013

- The object should be kept at a distance less than 20 cm from the mirror.
- Image will be bigger in size than the size of object.
- 



- 143.** How can you identify the three types of mirrors without touching ?

**Ans :**

OD 2010

By looking into mirror and going close to it the

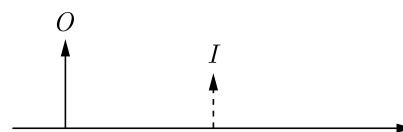
mirrors can be identified.

If image is of same size and erect, it is plane mirror.

If image is of bigger size and erect, it is concave mirror.

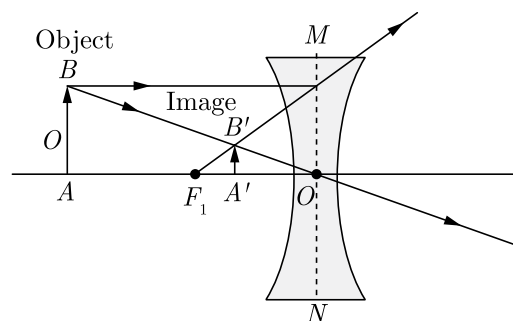
If image is of smaller size and erect, it is convex mirror.

- 144.** The diagram given below shows an object  $O$  and its image  $I$ . Copy the diagram and draw suitable ray to locate the lens and its focus. Name the type of lens used in this case.



**Ans :**

AI 2011



The lens used is concave lens.

- 145.** Name the type of mirror used in the following situations and support your answer with a reason :
- Mirror used for shaving.
  - Mirror used by ENT doctors.
  - Mirror used in the vehicles for viewing the traffic approaching from behind.

**Ans :**

OD 2017

- Concave mirror.
- Concave mirror.

Reason : When an object is held between the pole and principal focus of a concave mirror, the mirror forms a virtual, erect and magnified image of the object.

- Convex mirror.

Reason : The image formed by convex mirror is always virtual, erect and smaller than the object. It covers a large area.

- 146.** Why does a pencil immersed in water appear bent and short ? Explain with the help of a ray diagram.

**Ans :**

Foreign 2016

It is due to refraction of light.

Consider a pencil  $AB$ , such that  $CB$  portion of the

- 116.** An object is placed at a distance of 30 cm from a concave lens of focal lengths 15 cm. List four characteristics (nature, position, etc.) of the image formed by the lens.

**Ans :**

OD 2014

The four characteristics of the image formed by the lens are :

- (i) Image will be in between lens and focus.
  - (ii) Formed behind the lens.
  - (iii) Smaller than object.
  - (iv) Virtual image.
- 117.** An object is placed at a distance of 15 cm from a convex lens of focal lengths 20 cm. List four observations (nature, position, etc.) of the image formed by the lens.

**Ans :**

OD 2017

Four characteristics are :

- (i) Virtual
  - (ii) Magnified
  - (iii) Erect
  - (iv) Image is formed behind the lens.
- 118.** An object is placed at a distance of 15 cm from concave lens of focal length 30 cm. List four characteristics (nature, position, etc.) of the image formed by the lens.

**Ans :**

Comp 2010

Four characteristics will be :

- (i) Image is formed between object and the lens.
  - (ii) Erect
  - (iii) Smaller than the object
  - (iv) Virtual.
- 119.** State two positions in which a concave mirror produces a magnified image of a given object. List two differences between the two images.

**Ans :**

Foreign 2016

- (i) When the object is placed in front of the mirror :
    - (a) between the pole and focus.
    - (b) between the focus and centre of curvature.
  - (ii) In case (a) the image is virtual and erect.
  - (iii) In case (b) the image is real and inverted.
- 120.** What is meant by power of a lens ? What does its sign (+ve or -ve) indicate ? State its S.I. unit. How is this unit related to focal length of a lens.

**Ans :**

AI 2013

- (i) The power of a lens is defined as the reciprocal of its focal length in metres.

$$P = \frac{1}{f(\text{in metres})}$$

- (ii) Positive sign  $\rightarrow$  convex lens.  
Negative sign  $\rightarrow$  concave lens.
- (iii) S.I. unit dioptre.

$$1 \text{ dioptre} = \frac{1}{\text{focal length (m)}}$$

- 121.** The absolute refractive indices of glass and water are  $\frac{4}{3}$  and  $\frac{3}{2}$  respectively.

If the speed of light in glass is  $2 \times 10^8 \text{ ms}^{-1}$ , calculate the speed of light in (i) vacuum, (ii) water.

**Ans :**

Delhi 2011

$$n_g = \frac{4}{3}, n_w = \frac{3}{2}$$

$$v_g = 2 \times 10^8 \text{ ms}^{-1}$$

(i)

$$n_g = \frac{c}{v_g}$$

$$v_w = \frac{c}{n_w}$$

$$c = n_g v_g = \frac{4}{3} \times 2 \times 10^8 \text{ ms}^{-1}$$

$$= 2.67 \times 10^8 \text{ ms}^{-1}$$

(ii)

$$n_w = \frac{c}{v_w}$$

$$v_w = \frac{c}{n_w} = \frac{2.67 \times 2 \times 10^8}{3}$$

$$= 1.78 \times 10^8 \text{ ms}^{-1}$$

- 122.** An object is placed at a distance of 12 cm in front of a concave mirror. It forms a real image 4 times larger than the object. Calculate the distance of the image from the mirror.

**Ans :**

OD 2016

$$u = -12 \text{ cm and } m = -4$$

$$m = -\frac{v}{u}$$

$$-4 = -\frac{v}{(-12)}$$

$$v = -48 \text{ cm}$$

Thus, a real image is formed in front of concave mirror at a distance of 48 cm.

- 123.** What is the difference between virtual images produced by concave, plane and convex mirror ?

**Ans :**

Delhi 2010

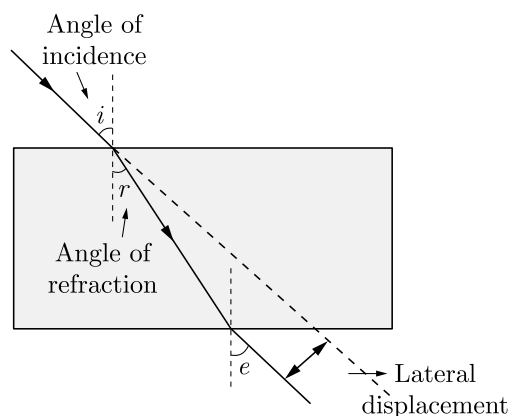
Virtual image produced by concave mirror is magnified, that produced by plane mirror is of the same size and the virtual image produced by convex mirror is diminished.

- 124.** The linear magnification produced by a spherical mirror is + 3. Analyse this value and state the (i) type of mirror and (ii) position of the object with

- 153.** A ray of light is incident obliquely on a glass slab. Draw a ray diagram showing the path of the light ray. Clearly mark angle of incidence, angle of refraction, angle of emergence and lateral displacement of the ray. Give a formula to find refractive index of glass slab in terms of angle of incidence and angle of refraction.

**Ans :**

Foreign 2006



Refractive index of glass slab :

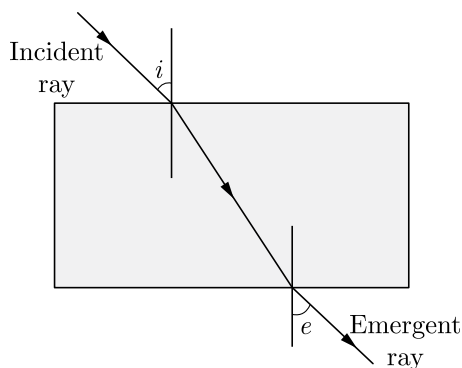
$$n_{ga} = \frac{\sin i}{\sin r}$$

- 154.** (a) With the help of a ray diagram show that when light falls obliquely on a side of a rectangular glass slab, the emergent ray is parallel to the incident ray.
- (b) The refractive index of water for light going from air to water is 1.33. Find the refractive index of air for a beam of light going from water to air.

**Ans :**

OD 2010

(a)



(b)  ${}_a n_w = 1.33$

$${}_w n_a = \frac{n_a}{n_w} = \frac{1}{1.33} = 0.75$$

- 155.** (a) For the same angle of incidence  $45^\circ$ , the angle of refraction in two transparent media; I and II is  $20^\circ$  and  $30^\circ$  respectively. Out of I and II, which medium is optically denser and why ?
- (b) Light enters from air to diamond which has refractive index of 2.42. Calculate the speed of light in diamond, if speed of light in air is  $3.00 \times 10^8 \text{ ms}^{-1}$ .

**Ans :**

Comp 2016

- (a) Medium I is optically denser as angle of refraction is lesser in it. Hence light is bending more towards normal.

(b) 
$$n = \frac{\text{Speed of light in air}}{\text{Speed of light in diamond}}$$

$$2.42 = \frac{3 \times 10^8}{v} \text{ m/s}$$

$$v = 1.24 \times 10^8 \text{ m/s}$$

- 156.** An object is placed in front of a convex lens of focal length 15 cm. The image formed is three times the size of the object. Calculate the two possible distances of the object from the lens.

**Ans :**

SQP 2011

- (a) As the lens is convex,

$$f = 15 \text{ cm}$$

For real image 
$$m = \frac{h_i}{h_o} = \frac{v}{u} = -3$$

$$v = -3u$$

Now, 
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

So, 
$$\frac{1}{-3u} - \frac{1}{u} = \frac{1}{f} = \frac{1}{15}$$

$$-\left(\frac{1+3}{3u}\right) = \frac{-4}{3u} = \frac{1}{15}$$

$$u = -20 \text{ cm}$$

- (b) For virtual image,

$$m = \frac{v}{u} = 3$$

$$v = 3u$$

Using lens formula,

$$u = -10 \text{ cm}$$

- 157.** (a) Consider two pairs of medium – pair A (1 and 2), pair B (3 and 4). With the help of a given table point out in which medium light speeds up

- (a) Which one of the two media is denser w.r.t. other medium? Justify your answer.  
 (b) If the speed of light in medium A is  $V_A$  and B is  $V_B$ , what is the refractive index of B with respect to A?

Ans :

OD 2023

- (a) As it is clear from the figure, when the light ray travelled from medium A to medium B, then it bends towards the normal which means that medium B is optically denser than medium A.  
 (b) Refractive index of medium

$$\mu_A = \frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in vacuum A (v}_A\text{)}}$$

$$\mu_A = \frac{c}{v_A}$$

Refractive index of medium B

$$\mu_B = \frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in vacuum B (v}_B\text{)}}$$

or

$$\mu_A = \frac{c}{v_B}$$

Now, refractive index of medium B with respect to A

$$\frac{\mu_B}{\mu_A} = \frac{\frac{c}{v_B}}{\frac{c}{v_A}}$$

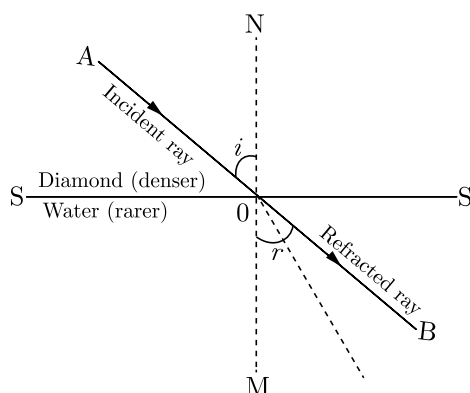
$$\frac{\mu_B}{\mu_A} = \frac{v_A}{v_B}$$

131. (a) A ray of light skirting from diamond is incident on the interface separating diamond and water. Draw a labeled ray diagram to show the refraction of light in this case.  
 (b) Absolute refractive indices of diamond and water are 2.42 and 1.33 respectively. Find the value of refractive index of water w.r.t. diamond.

Ans :

OD 2023

- (a) Labelled ray diagram to show the refraction of light



- (b) Given  
 Refractive index of diamond = 2.42  
 Refractive index of water = 1.33  
 As we know that,  
 Refractive index of water w.r.t diamond

$$= \frac{1.33}{2.42} = 0.55$$

132. State reasons for Myopia. With the help of ray diagrams, show the

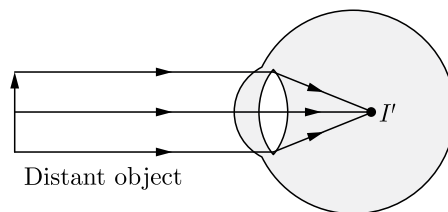
- (a) image formation by a myopic eye, and  
 (b) correction of myopia using an appropriate lens.

Ans :

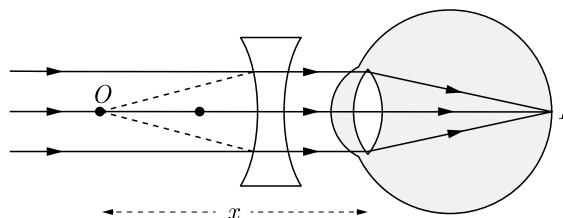
OD 2023

Two causes of myopic defect are (i) shortening of focal length of eye lens because of its excessive curvature, and (ii) elongation of eyeball.

- (a) This defect can be corrected by using a concave lens of suitable power.



- (b) The myopic defect is corrected by using of a concave lens of suitable power as shown in the figure.



133. A concave mirror is used for image formation for different positions of an object. What inferences can be drawn about the following when an object is placed at a distance of 10 cm from the pole of a concave mirror of focal length 15 cm ?

- (a) Position of the image  
 (b) Size of the image  
 (c) Nature of the image

Draw a labelled ray diagram to justify your inferences.

Ans :

Comp 2020

Object distance,  $u = -10$  cm

Focal length of concave mirror,

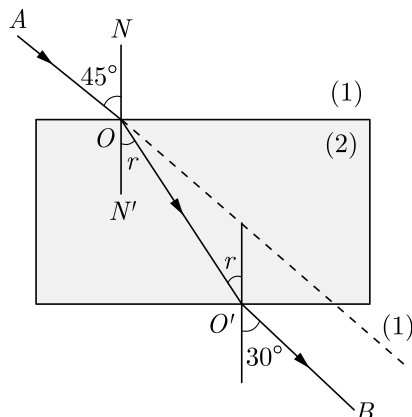
$$f = -15$$

Position of image,  $v = ?$

- (b) If second medium is water in place of medium (2), will the angle of refraction increase or decrease ? Why ? (Refractive index of water =  $4/3$ )

Ans :

Delhi 2016



Using Snell's law

$$\begin{aligned} {}_2n_1 &= \frac{\sin i}{\sin r} \\ &= \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{1}{\frac{1}{2}} \\ &= \sqrt{2} = 1.414 \end{aligned}$$

The angle of refraction will increase because medium (2) is denser than water.

162. (a) What is meant by 'power' of a lens ?  
 (b) State its unit and define it.  
 (c) Which of the two lenses has a greater power :  
 (i) a convex lens of focal length 5 cm ?  
 (ii) a convex lens of focal length 50 cm ?

Justify your answer.

Ans :

OD 2011

- (a) Power of convergence or divergence which is represented as the reciprocal of the focal length of the lens expressed in metre,

$$P = \frac{1}{f} (m)$$

- (b) Unit of power of lens : Dioptre.  
 1 dioptre is the power of a lens whose focal length is 1 metre.  
 (c) The convex lens of focal length 5 cm as  $P \propto \frac{1}{f}$ .

163. A convex lens forms a real image four times magnified at a distance of 60 cm from the lens. Calculate the focal length and the power of the lens.

Ans :

Foreign 2015

As we know that,

$$\begin{aligned} \text{Magnification, } (m) &= \frac{v}{u} \\ -4 &= \frac{60}{u} \end{aligned}$$

and

$$\begin{aligned} u &= \frac{60}{(-4)} \\ &= -15 \text{ cm} \end{aligned}$$

$$\begin{aligned} P &= \frac{1}{f} = \frac{1}{v} - \frac{1}{u} \\ &= \frac{1}{60} + \frac{1}{15} = \frac{5}{60} \\ &= 0.083 \text{ D} \end{aligned}$$

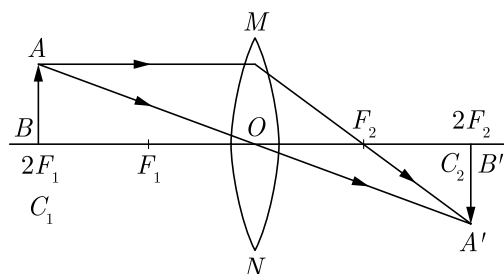
$$f = \frac{60}{5} = 12 \text{ cm}$$

164. (i) Where should an object be placed in case of a convex lens to form an image of same size as the object ? Show with the help of a ray diagram the position and nature of the image formed.  
 (ii) With the help of ray diagram, illustrate the change in position, nature and size of the image formed if the convex lens in case (i) is replaced by concave lens of same focal length.  
 (iii) State the condition under which a light ray passes undeviated through a lens.

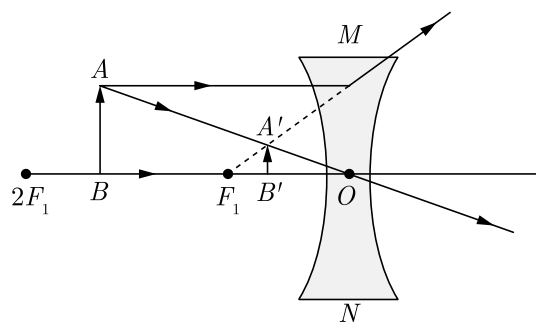
Ans :

Delhi 2013

- (i) Object should be placed at  $2F$ .



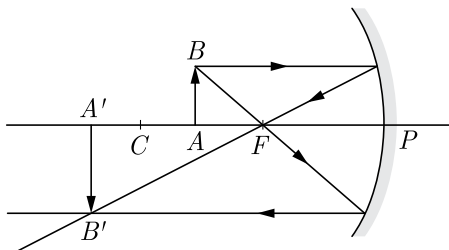
- (ii)



- (iii) When it passes through the optical centre of the lens.



- (i) The mirror that can also form real and magnified image of the object is concave mirror. This can happen if the object is placed between  $C$  and  $F$  of the concave mirror.



- (ii) A concave mirror can also give a virtual and magnified image of an object if the object is placed between  $F$  and  $P$  of the mirror.

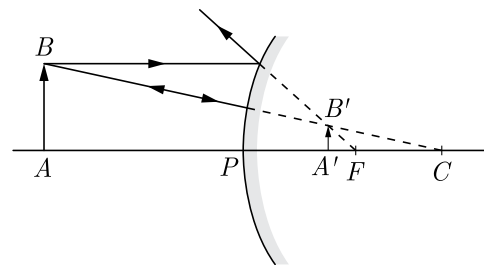
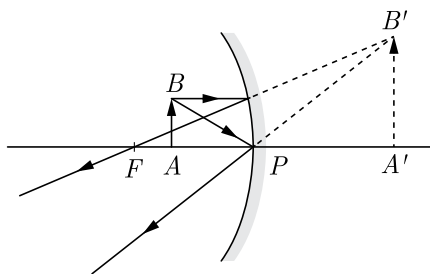


Image is virtual, erect, diminished and forms between pole and focus.

- 203.** Draw a ray diagram to show a virtual image of  $\frac{2}{5}$ th the size of an object 4 cm high, using a spherical mirror. Mark the position of the object, image and focal length.

**Ans :**

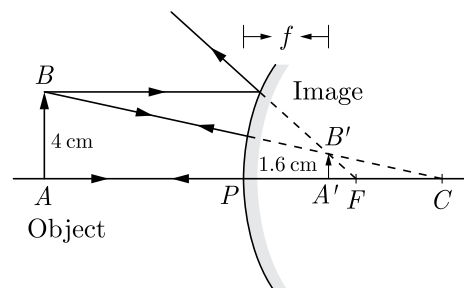
Delhi 2014

Given,  $h_o = 4 \text{ cm}$ ,  $h_i = \frac{2}{5} \times 4 = 1.6 \text{ cm}$

$PF =$  Focal length,

$PA =$  Object distance,

$PA =$  Image distance



- 202.** (a) Name the type of mirror used by a dentist to examine the teeth of a patient.  
 (b) Name the type of mirror used as a rear-view mirror in motor cars.  
 (c) Draw ray diagrams to show the image formation in both the above cases. Also state the position and nature of the image so formed.

**Ans :**

Foreign 2007

(a) Concave mirror

(b) Convex mirror.

(c)

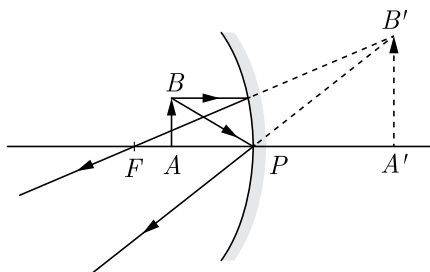


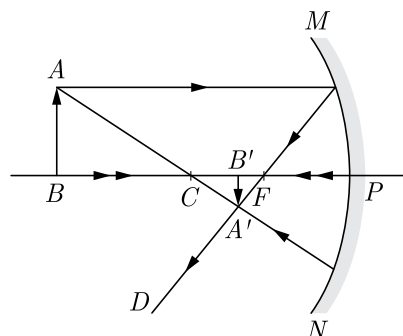
Image is virtual, erect, magnified forms behind the mirror.

- 204.** For what position of the object does a concave mirror form a real, inverted and diminished image of the object ? Draw a ray diagram.

**Ans :**

Delhi 2011

When the object is placed beyond  $C$ .



$$= 25 \text{ cm}$$

$$v = 40 \text{ cm}$$

Now,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{-3}{200}$$

$$u = -\frac{200}{3} \text{ cm}$$

So, candle should be placed  $\frac{200}{3}$  cm from the lens.

- 169.** An object is placed at a distance 100 cm from a lens of power  $-4 \text{ D}$ . Find the position and nature of image so formed.

**Ans :**

OD 2007

Given,

Power of lens,  $P = -4 \text{ D}$

Focal length of lens,  $f = \frac{100}{-4} \text{ cm} = -25 \text{ cm}$

Object distance,  $u = -100 \text{ cm}$

As we know that,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} = \frac{1}{u} + \frac{1}{f}$$

$$= \frac{1}{-25} + \frac{1}{-100}$$

$$= \frac{-4-1}{100} = \frac{-5}{100}$$

$$v = -20 \text{ cm}$$

$$m = \frac{v}{u} = \frac{-20}{-100} = \frac{1}{5} = 0.2$$

Nature of the image : Virtual, erect and diminished.

- 170.** It is required to get :

- a magnified, erect and virtual image.
- a diminished, virtual and erect image of a given object.

What type of lens should we use in each case and where should the object be kept ?

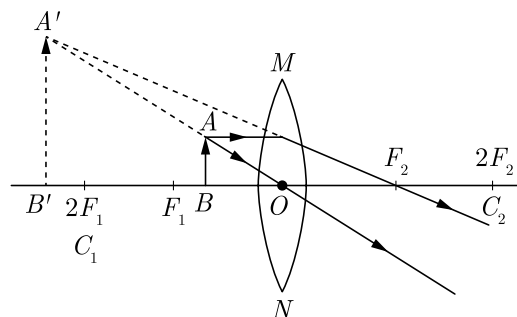
Draw a ray diagram to show the image formation in each case.

Which of these lenses could also form a magnified, real and inverted image of an object ? Also indicate the position of object for which this could happen ?

**Ans :**

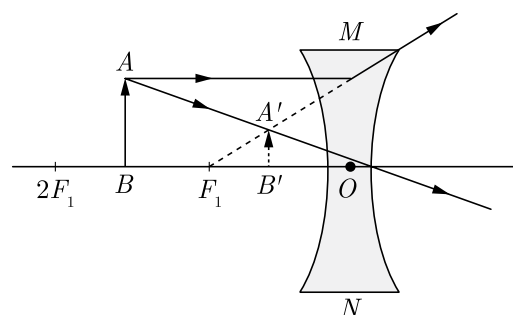
Foreign 2010

We need a convex lens for a magnified, erect and virtual image and the position of object is in between  $O$  and  $F$ .



We need a concave lens for a diminished, erect and virtual image.

Position of the object is anywhere in front of the lens.



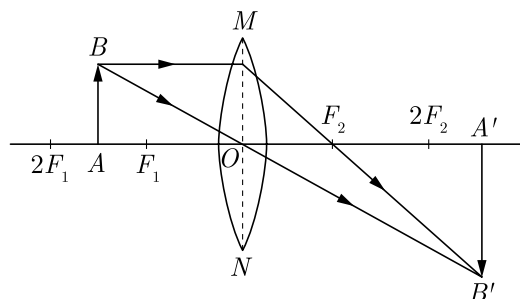
A convex lens can form a magnified, real and inverted image when the object is kept between  $F$  and  $2F$ .

- 171.** (a) Name the kind of lens that can form;
- an inverted magnified image.
  - an erect diminished image.
- Draw ray diagrams to illustrate your answer in each case.
- (b) Draw a ray diagram to show the image formed of an object placed between  $f$  and  $2f$  distances from a convex lens.

**Ans :**

SQP 2013

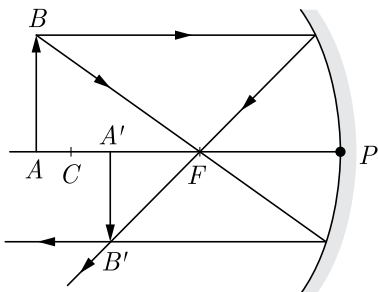
- (a) (i) Convex lens.



Ans :

Comp 2021

- (a) Image formed by a convex mirror is virtual and smaller in size.  
 (b)



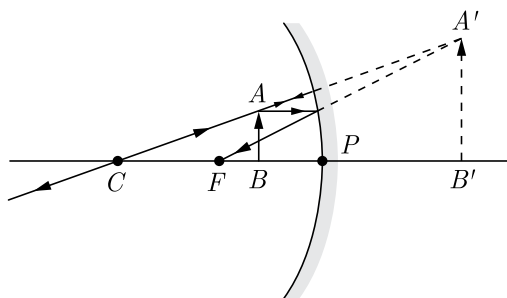
137. We wish to obtain an erect image of an object, using a concave mirror of focal length 15 cm. What should be the range of distance of the object from the mirror? Draw a ray diagram to show the image formation in this case.

Ans :

Delhi 2011

Here, the focal length of concave mirror is 15 cm. To obtain an erect image of an object with a concave mirror, the object should be placed between the pole and focus.

$$v < u < 15 \text{ cm}$$



138. A real image,  $\frac{1}{5}$ th the size of an object, is formed at a distance of 18 cm from a mirror. What is the nature of mirror? Calculate its focal length.

Ans :

OD 2014

Real image means the mirror is concave.

$$v = -18 \text{ cm}$$

$$m = -\frac{1}{5} = \frac{-(-18)}{u}$$

$$u = -90 \text{ cm}$$

Using the mirror formula,

$$\begin{aligned} \frac{1}{f} &= \frac{1}{v} + \frac{1}{u} \\ &= \frac{1}{-18} + \frac{1}{-90} \end{aligned}$$

$$\begin{aligned} &= \frac{5+1}{-90} \\ &= \frac{6}{-90} \end{aligned}$$

$$f = \frac{-90}{6} = -15 \text{ cm}$$

139. A concave mirror produces three times enlarged real image of an object placed at 12 cm in front of it. Calculate the radius of curvature of the mirror.

Ans :

SQP 2017

Given,

$$\text{Magnification, } m = -3$$

$$\text{Object distance, } u = -12 \text{ cm}$$

But,

$$m = -\frac{v}{u}$$

$$-3 = \frac{-v}{-12}$$

$$v = -36 \text{ cm}$$

$$\left(\frac{1}{v}\right) + \left(\frac{1}{u}\right) = \frac{1}{f}$$

$$\left(\frac{1}{-36}\right) + \left(\frac{1}{-12}\right) = \frac{1}{f}$$

$$f = \left(\frac{-36}{4}\right) \text{ cm}$$

$$= -9 \text{ cm}$$

Now,

$$R = 2f$$

$$= -18 \text{ cm}$$

140. An object is kept in front of a concave mirror of focal length 20 cm. The image is three times the size of the object. Calculate two possible distances of the object from the mirror.

Ans :

Foreign 2015

Given,

$$f = -20 \text{ cm}$$

(i) For real image,

$$m = -3$$

$$= -\frac{v}{u}$$

or

$$v = 3u$$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-20} = \frac{1}{3u} + \frac{1}{u}$$

$$= \frac{4}{3u}$$

$$u = -\frac{80}{3}$$

$$= -26.67 \text{ cm}$$

(ii) For virtual image,

$$m = +3$$

- (b) Given,
- $v = -10 \text{ cm}$
- ,
- $u = -50 \text{ cm}$

As we know that,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\text{or } -\frac{1}{10} + \frac{1}{50} = \frac{1}{f}$$

$$\text{or } \frac{-5+1}{50} = \frac{1}{f}$$

$$\text{or } f = \frac{-50}{4} = -12.5 \text{ cm}$$

Nature of lens – Concave lens.

175. (a) A divergent lens has focal length of 20 cm. At what distance should the object from the lens be placed so that an image is formed 10 cm away from the lens? What is the magnification produced, by the lens?
- (b) Draw a ray diagram to show the position and nature of the image formed by a convex lens when an object is placed between optical centre and focus of the lens.

Ans :

OD 2009

- (a) Given,  $f = -20 \text{ cm}$ ,  $u = ?$ ,  
 $v = -10 \text{ cm}$

As we know that,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

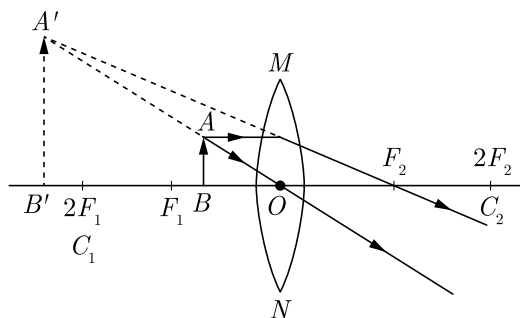
$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

$$-\frac{1}{10} + \frac{1}{20} = -\frac{1}{20}$$

$$u = -20 \text{ cm}$$

$$\text{Now, } m = \frac{v}{u} = \frac{-10}{-20} = \frac{1}{2}$$

- (b)

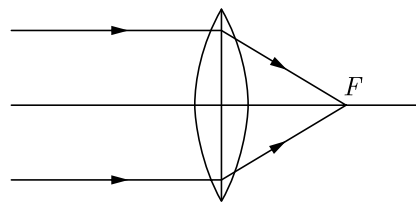


176. (a) Explain in brief, convex lens is converging in nature.
- (b) A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of convex lens if the image is equal to the size of the object? Also find the power of the lens.

Ans :

OD 2011

- (a) A convex lens is comprised of prisms and glass slab. The rays of light after refraction through prism bend towards its base. So, a convex lens converges the rays at a point on principal axis.



- (b) Given,

$$v = +50 \text{ cm}, u = ?, P = ?$$

As image formed by lens is real, inverted and of the same size. It is implied that object is at  $2F$ . So, image is at  $2F$ .

$$2f = 50 \text{ cm}$$

$$f = \frac{50}{2} = 25 \text{ cm}$$

$$P = \frac{1}{f(\text{cm})} \text{ or } \frac{100}{f(\text{cm})}$$

or

$$P = \frac{100}{25} = 4 \text{ D}$$

177. (a) Define 1 dioptre of power. Find the focal length of a lens of power  $-2.0 \text{ D}$ .
- (b) Why does a lemon kept in water in a glass tumbler appear to be bigger than its actual size?
- (c) Study the table given below and state the medium in which light ray will travel fastest. Why?

Medium	A	B	C
Refractive index	1.33	1.5	2.4

Ans :

Foreign 2014

- (a) (i) One dioptre is the power of a lens of focal length one metre.
- (ii) Using,

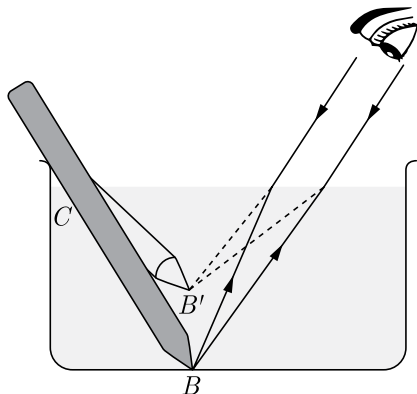
$$P = \frac{1}{f}$$

$$-2.0 \text{ D} = \frac{1}{f(\text{m})}$$

$$f = -0.5 \text{ m}$$

- (b) This is due to the phenomenon of refraction of light. A ray of light starting from the lemon kept in water reaches the water-air interface and bends away from normal. To the observer, it appears as the light ray is coming from the point above the actual point. This apparent position makes them appear bigger in size.

pencil is immersed in water as shown in the figure. Rays of light from tip ( $B$ ) of the pencil bend away from the normal as they go from water to air. The refracted rays appear to come from point  $B'$ . Thus, the immersed portion in water appears  $CB'$ , i.e., bent at water surface.



147. (a) State laws of refraction.  
 (b) A ray of light is incident normally to the surface of a glass slab placed in air. Find the angle of incidence and angle of refraction in this case.

Ans :

OD 2013

- (a) The following are the laws of refraction of light:  
 (i) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.  
 (ii) The ratio of sine of angle of incidence to the sine of angle of refraction is constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction.

If  $i$  is the angle of incidence and  $r$  is the angle of refraction then,

$$\frac{\sin i}{\sin r} = \text{constant}$$

This constant value is called the refractive index of the second medium with respect to the first.

- (b)  $\angle i = 0$ ,  $\angle r = 0$

148. State two uses of concave mirrors.

Ans :

Delhi 2014

Uses of concave mirror are following :

- (i) Concave mirrors are often used as shaving mirrors to see a large image of the face.  
 (ii) The dentists use concave mirrors to see large images of the teeth of patients.

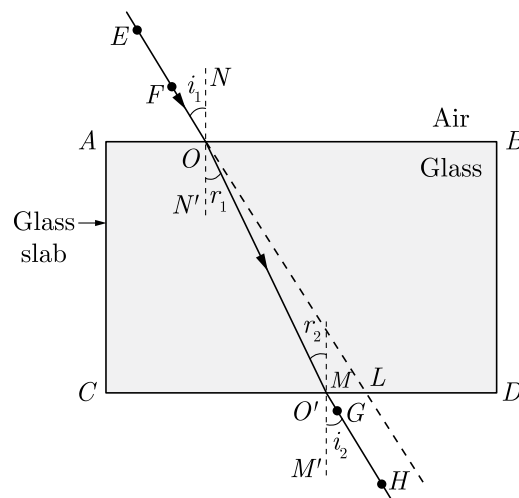
149. (a) Draw a labelled diagram to show the refraction of light through a glass slab.

- (b) Refractive index of the diamond is 2.42. What does it mean ?

Ans :

Delhi 2015

- (a)



- (b) It means the ratio of speed of light in vacuum to the speed of light in diamond is equal to 2.42.

150. (a) State the relationship between focal length and radius of curvature of a spherical mirror.  
 (b) Why is the refractive index of a medium always greater than one ?  
 (c) A lens has  $-4\text{ D}$  power. Is the lens concave or convex?

Ans :

Delhi 2017

- (a) Focal length =  $\frac{\text{Radius of curvature}}{2}$   
 (b)  $n = \frac{c}{v}$  Here  $c > v$  Therefore  $n > 1$  always  
 (c) Concave lens because the focal length is also negative.

151. A transparent medium  $P$  floats on another transparent medium  $Q$ . When a ray of light travels obliquely from  $P$  to  $Q$ , the refracted ray bends away from the normal. Which of the two media  $P$  or  $Q$  is optically denser and why ?

Ans :

AI 2011

- (b)  $P \rightarrow$  Denser.

Reason : After refraction, the ray bends away from the normal.

152. What is lateral displacement? State two factors on which it depends.

Ans :

Comp 2009

In case of refraction, the emergent ray is shifted sideways from the direction of original incident ray. This is called lateral displacement.

It depends upon :

- (i) thickness of the glass slab.  
 (ii) refractive index.

$$m = \frac{-36}{-18} = 2$$

$$2 = \frac{h_i}{3}$$

$$h_i = 6 \text{ cm}$$

The image height will be 6 cm.

- 181.** The image of a candle flame placed at a distance of 30 cm from a mirror is formed on a screen placed in front of the mirror at a distance of 60 cm from its pole. What is the nature of the mirror? Find its focal length, if the height of the flame is 2.4 cm, find the height of its image. State whether the image formed is erect or inverted.

**Ans :**

Foreign 2010

The nature of the mirror is concave since the image formed is real.

$$u = -30 \text{ cm}, v = 60 \text{ cm}, h = 2.4 \text{ cm}$$

Using mirror formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{60} - \frac{1}{-30}$$

$$= \frac{1}{60} + \frac{1}{30}$$

$$= \frac{3}{60} = \frac{1}{20}$$

$$f = 20 \text{ cm}$$

Magnification,  $m = -\frac{v}{u}$

or  $\frac{v}{u} = \frac{60}{-30} = \frac{h'}{2.4}$

$$h' = -\frac{60}{30} \times 2.4$$

$$= -4.8 \text{ cm}$$

The required height of an image is  $-4.8 \text{ cm}$ . The image formed by the mirror is inverted.

- 182.** If the image formed by a lens for all positions of an object placed in front of it is always erect and diminished, what is the nature of the lens? Draw a diagram to justify your answer. If the numerical value of the power of this lens is 10 D, What is its focal length in the cartesian system?

**Ans :**

OD 2017

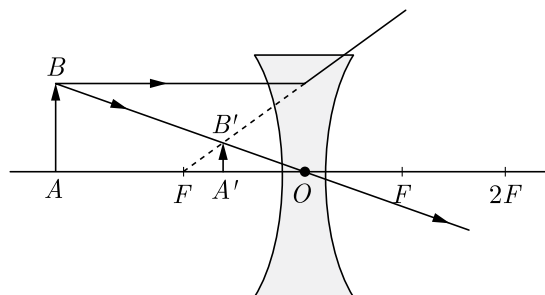
If the image formed by a lens for all positions of the object in front of it is always virtual, erect and diminished, the lens is concave.

$$\text{Power} = -\frac{1}{f}$$

$$10 = -\frac{1}{f}$$

$$f = \frac{-1}{10} = -0.1 \text{ m}$$

$$f = 0.1 \text{ m}$$

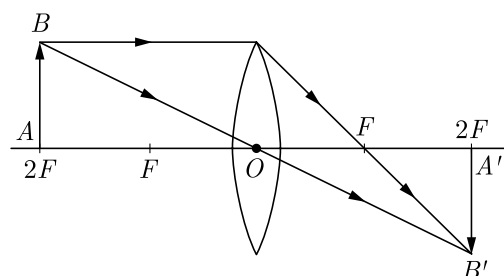


- 183.** Draw ray diagram to show the formation of three times magnified (i) real and (ii) virtual image of an object by a converging lens. Mark the position of O, F and 2F in each diagram.

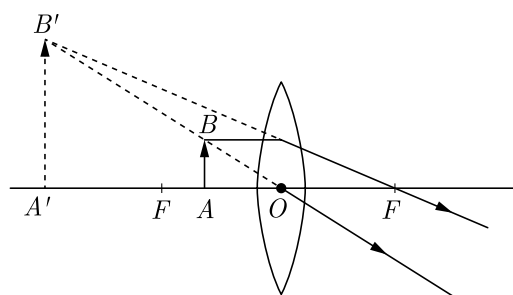
**Ans :**

OD 2010

(i)



(ii)



- 184.** (i) Define optical centre of a spherical lens.  
 (ii) A divergent lens has a focal length of 20 cm. At what distance should an object of height 4 cm from the optical centre of the lens be placed so that its image is formed 10 cm away from the lens. Find the size of the image also.  
 (iii) Draw a ray diagram to show the formation of image in above situation.

**Ans :**

OD 2016

- (i) **Optical centre :** It can be defined as the central point of the lens through which a ray of light passes without suffering any deviation.



as it moves in pair A and in pair B respectively.

	Medium	Refractive Index
1.	Water	1.33
2.	Benzene	1.50
3.	Turpentine	1.47
4.	Alcohol	1.36

- (b) Find refractive index of benzene with respect to water.

Ans :

OD 2014

- (a) As light moves from denser to rarer medium, its speed increases from medium 2 to 1, i.e., benzene to water.  
From medium 3 to 4, i.e., turpentine to alcohol.

- (b) Refractive index of benzene w.r.t., water

$$= \frac{\text{Refractive index of benzene}}{\text{Refractive index of water}}$$

$$= \frac{1.5}{1.33} = 1.125$$

158. (a) Give two conditions in which a ray of light passes without bending while entering from one medium to another.  
(b) How is refractive index of a medium related to velocity of light in the medium ?

Ans :

Delhi 2016

- (a) (i) Light is incident normally on a boundary of two media.  
(ii) Light is incident on the boundary that separates the two media which have equal refractive indices.  
(b) Refractive index of medium ( $n$ )

$$= \frac{\text{Velocity of light in vacuum } (c)}{\text{Velocity of light in medium } (v)}$$

159. A point object is placed at a distance of 12 cm from a convex lens on its principal axis. Its image is formed on the other side of the lens at a distance of 18 cm from the lens. Find the focal length of the lens. Is the image magnified ? Justify your answer.

Ans :

Foreign 2012

Given,  $u = -12 \text{ cm}$ ,  $v = 18 \text{ cm}$ ,  $f = ?$

As we know that,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{18} - \frac{1}{-12} = \frac{1}{f}$$

$$= \frac{1}{18} + \frac{1}{12} = \frac{1}{f}$$

$$= \frac{2+3}{36} = \frac{1}{f}$$

$$= \frac{5}{36} = \frac{1}{f}$$

$$f = 7.2 \text{ cm}$$

(Image formed on the other side of the object means it is real. As  $f = 7.2 \text{ cm}$  and  $u = -12 \text{ cm}$ , object is between  $f$  and  $2f$ , so image is magnified and is formed beyond  $2f$ ) or  $m = \frac{v}{u} = \frac{18}{(-12)} = -\frac{3}{2}$ .

As  $\frac{3}{2} > 1$  and hence image is magnified.

160. A convex lens of focal length 20 cm is placed at a distance of 24 cm from the screen. How far from the lens should an object be placed so as to form a real image on the screen ? Also find the nature and magnification of the image produced by the lens.

Ans :

Delhi 2017

Given,

$$f = 20 \text{ cm}, v = 24 \text{ cm}, u = ?, m = ?$$

As we know that,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$-\frac{1}{u} = \frac{1}{f} - \frac{1}{v}$$

$$= \frac{1}{20} - \frac{1}{24}$$

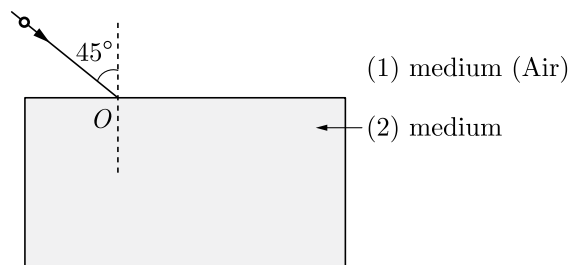
$$= \frac{6-5}{120}$$

$$u = -120 \text{ cm}$$

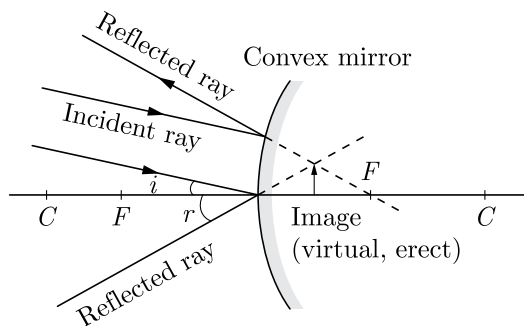
$$\text{Using, } m = \frac{v}{u} = \frac{24}{-120} = -0.2$$

Negative sign indicates that the image is real and inverted.

161.



- (a) A ray of light is incident at an angle of  $45^\circ$  at the interface of medium (1) and medium (2) as shown in the above diagram. Redraw this diagram in the answer book and complete it. If the angle of refraction is  $30^\circ$  find the refractive index of medium (2) with respect to medium (1).  
(Given that  $\sin 45^\circ = \frac{1}{\sqrt{2}}$  and  $\sin 30^\circ = \frac{1}{2}$ )



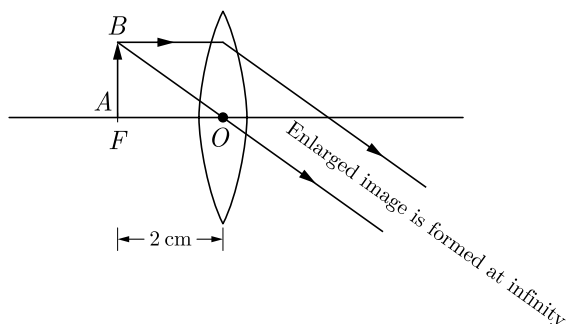
188. You are given a convex lens of focal length 10 cm. Where will you place an object to get a real, inverted and highly enlarged image of the object. Draw a ray diagram.

Ans :

Delhi 2013

We know, the real, inverted and highly enlarged image of an object is made by a convex lens if the object is placed at the focus of the lens. That is, the distance of the object from the optical centre of the lens is equal to the focal length of the lens = 10 cm.

Ray diagram is shown in figure given below. Here, scale : 5 cm = 1 cm.

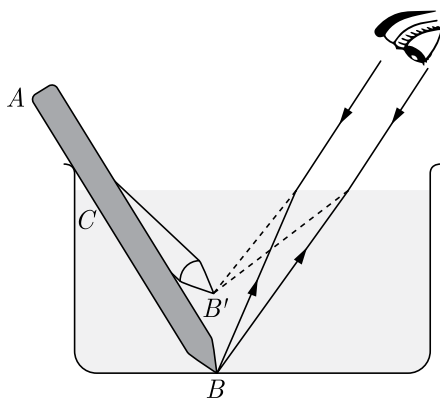


189. Explain with the help of diagram why a pencil partly immersed in water appears to be bent at the water surface.

Ans :

OD 2016

It is due to the refraction of light.



Consider a pencil  $AB$ , such that  $CB$  portion of the pencil is immersed in water as shown in figure. Rays of light from the tip ( $B$ ) of the pencil bend away from the normal as they go from water to air. The refracted rays appear to come from point  $B'$ . Thus, the immersed portion of pencil in water appears as  $CB'$ . Hence, the pencil appears to be bent at the water surface. Moreover, the immersed portion of the pencil in water also appears to be shorter than the actual length of the pencil.

## FIVE MARKS QUESTIONS

190. (a) Draw a labelled ray diagram to show the path of a ray of light incident obliquely on one face of a glass slab.  
 (b) Calculate the refractive index of the material of a glass. Given that the speed of light through the glass slab is  $2 \times 10^8$  m/s and in air is  $3 \times 10^8$  m/s.  
 (c) Calculate the focal length of a lens, if its power is  $-2.5$  D.

Ans :

Comp 2020

(a)

(b) Speed of light in glass slab

$$(v) = 2 \times 10^8 \text{ m/s}$$

$$\text{Speed of light in air } (c) = 3 \times 10^8 \text{ m/s}$$

Refractive index of glass ( $n$ ) = ?

$$n = \frac{c}{v}$$

$$n = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

Hence, refractive index of material of glass slab is 1.5.

(c) Power,  $P = -2.5$  D

Total length,  $f = ?$

$$P = \frac{1}{f}$$

$$f = \frac{1}{P} \text{ or } \frac{1}{-2.5} \text{ or } \frac{100 \text{ cm}}{-2.5}$$

$$= -40 \text{ cm or } -0.4 \text{ m}$$

The focal length of a lens of power  $-2.5$  D is  $-0.4$  m or  $-40$  cm

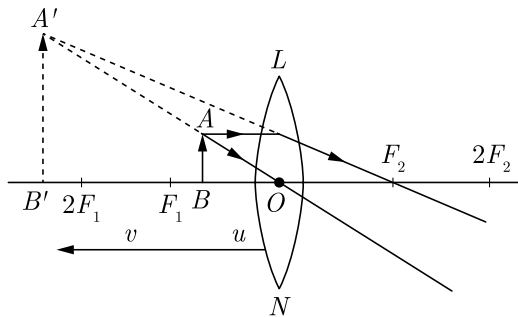
- (c) The light ray will travel fastest in medium A because it is the medium with least refractive index.

178. (a) Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.  
 (b) In the above ray diagram mark the object-distance ( $u$ ) and the image-distance ( $v$ ) with their proper sign ( $f$  +ve or -ve as per the new cartesian sign convention) and state how these distances are related to the focal length ( $f$ ) of the convex lens in this case.  
 (c) Find the power of a convex lens which forms a real and inverted image of magnification  $-1$  of an object placed at a distance of 20 cm from optical centre.

Ans :

SQP 2016

- (a)  $u$  and  $v$  are -ve,  $f$  is +ve.



- (b) Lens formula :

$$-\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

This is the relation between object distance ( $u$ ) image distance ( $v$ ) and focal length ( $f$ ) of a lens.

- (c) Magnification,

$$m = -1$$

$$u = -20 \text{ cm}$$

$$m = \frac{v}{u}$$

$$\text{or } -1 = \frac{v}{-20}$$

$$\text{or } v = +20 \text{ cm}$$

From lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{20} - \frac{1}{-20} = \frac{1}{f}$$

$$\text{or } f = 10 \text{ cm}$$

$$= 0.1 \text{ m}$$

$$P = \frac{1}{f(\text{in m})}$$

$$= \frac{1}{0.1} = +10 \text{ D}$$

179. An object 4 cm in height is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed to obtain a sharp image of the object. Calculate the height of the image.

Ans :

Delhi 2017

$$\text{Given, } u = -15 \text{ cm}$$

$$f = -10 \text{ cm}$$

Using the mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{v} + \frac{1}{-15} = \frac{1}{-10}$$

$$\frac{1}{v} = \frac{1}{-10} + \frac{1}{15}$$

$$= \frac{-15 + 10}{150} = \frac{-5}{150}$$

$$v = -30 \text{ cm}$$

$$\text{Magnification, } m = -\frac{v}{u} = \frac{h_i}{h_o}$$

$$m = \frac{-30}{+15} = -2$$

$$-2 = h_i/4$$

$$h_i = -8 \text{ cm}$$

The image height will be 8 cm.

180. A 3 cm tall object is placed 18 cm in front of a concave mirror of focal length 12 cm. At what distance from the mirror should a screen be placed to see a sharp image of the object on the screen. Also calculate the height of the image formed.

Ans :

OD 2014

$$\text{Given, } u = -18 \text{ cm, } f = -12, u' = ?$$

As we know that,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{v} + \frac{1}{-18} = \frac{1}{-12}$$

$$\frac{1}{v} = -\frac{1}{12} + \frac{1}{18}$$

$$= \frac{(-3 + 2)}{36} = \frac{-1}{36}$$

$$v = -36 \text{ cm}$$

$$\text{Magnification, } m = -\frac{v}{u}$$

$$\text{Also, } m = \frac{h_i}{h_o}$$

$\triangle CFM$  is an isosceles triangle

$$CF = FM \quad \dots(3)$$

When  $M$  is at  $P$ , then

$$FM = PF \quad \dots(4)$$

From (3) and (4),

$$CF = PF \quad \dots(5)$$

Now,  $CP = CF + PF$

$$R = PF + PF \quad [\text{from (5)}]$$

$$= 2PF$$

$$R = 2f$$

- 194.** An object is kept in front of a concave mirror of focal length 20 cm. The image is three times the image of the object. Calculate two possible distances of the object from the mirror.

**Ans :**

OD 2016

Given,  $f = -20$  cm

$$h_2 = 3h_1$$

For real image,  $m = \frac{-v}{u}$

$$m = \frac{-v}{u} = -3$$

$$3u = +v$$

Now,  $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{+3u} + \frac{1}{u} = \frac{1}{-20}$$

$$\frac{1+3}{3u} = \frac{1}{-20}$$

$$3u = -80$$

$$u = \frac{-80}{3}$$

$$u = -26.66 \text{ cm}$$

For virtual image,  $m = +3$

$$+3 = \frac{-v}{u}$$

$$v = -3u$$

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-3u} + \frac{1}{u} = \frac{1}{-20}$$

$$\frac{2}{3u} = \frac{1}{-20}$$

$$u = \frac{-40}{3} = -13.33 \text{ cm}$$

(ii) will always give virtual image of same size of an object.

(iii) will always give virtual and diminished image of an object.

(iv) is used by a doctor for examining teeth.

- (b) With the help of a ray diagram explain the use of concave mirror as solar concentrators.

**Ans :**

AI 2007

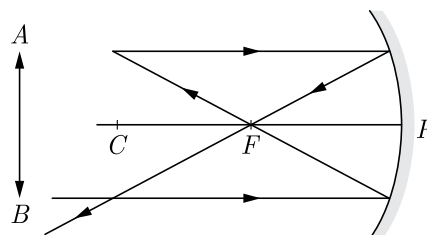
(a) (i) concave mirror,

(ii) plane mirror,

(iii) convex mirror,

(iv) concave mirror.

- (b) The solar concentrators are placed at the focus of large concave mirror which focus the Sun's heat rays on concentrators and high temperature is achieved.



Ray coming parallel to principal axis will pass through focus after reflection.

- 196.** (i) Under what conditions, a concave mirror produces a virtual and magnified image? Draw a labelled ray diagram to show the formation of image in the above case. Also state the position of object to produce magnified and real images.
- (ii) A ray of light moving along principal axis is falling on a concave mirror. Draw the path of reflected ray. Also state the values of angles of incidence and reflection in this case.

**Ans :**

Delhi 2012

- (i) When an object lies between focus and pole of mirror or within focus of concave mirror, it produces a virtual and magnified image.

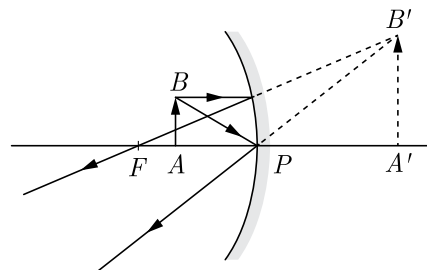


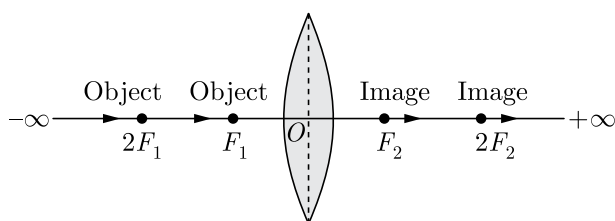
Image formed will be real and magnified when object is placed between  $P$  and  $F$ .

- 195.** (a) Name the mirror that :

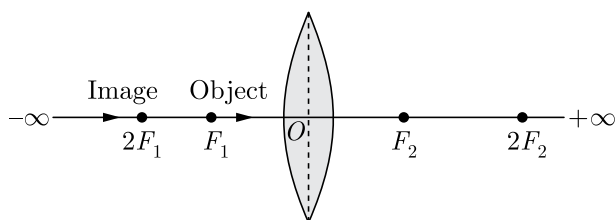
- (i) can give real as well as virtual image of an object.

- 225.** The image formed by a convex lens depends on the position of the object in front of the lens. When the object is placed anywhere between focus and infinity, the image formed by convex lens is real and inverted. The image is not obtained on the screen why the object is placed between the focus and the lens. The distance between the optical centre  $O$  of the convex lens and the focus point  $F_1$  and  $F_2$  is its focal length.

When the object shifts from  $-\infty$  to  $F_1$ , the image moves from  $F_2$  to  $+\infty$ .



When the object shifts from  $F_1$  to  $O$ , the image moves  $-\infty$  to  $O$ .



A student did an experiment with a convex lens. He put an object at different distances from the lens. In each case, he measured the distance of the image from the lens. The results were recorded in the following table.

Object distance (in cm)	Image distance (in cm)
25	100
30	24
40	60
60	30
120	40

Unfortunately, his results are written in the wrong order.

- What is the focal length of this lens ?
- Rewrite the image distances in the correct order.
- What is the minimum distance between an object and its real image formed by a convex lens ?

**Ans :**

- When the object distance equals the image distance, they are at twice the focal length from the lens.

When,  $2F = 60 \text{ cm}$

$F = 30 \text{ cm}$

When an object is placed at focus ( $F = 30 \text{ cm}$ ) of a convex lens, the image formed is at infinity. But infinity is not any observation in the given table.

Hence,  $F = 30 \text{ cm}$  is not possible.

Now, when,  $2F = 40 \text{ cm}$

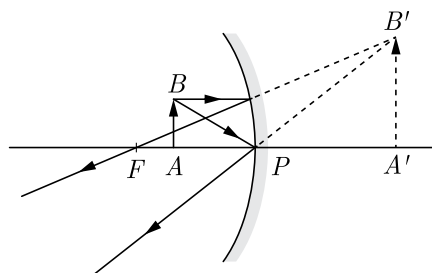
$F = 20 \text{ cm}$

- Correct order : 100, 60, 40, 30, 24
- 4f

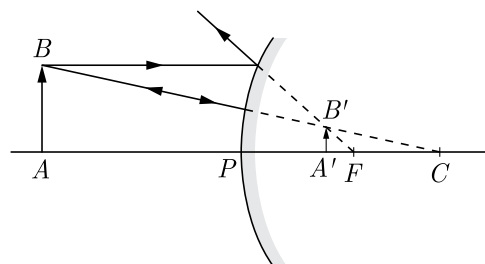
- 226.** Study the following table for a convex lens for different positions of object and answer the following questions:

Position of object	Position of image	Relative size of image
At infinity	At focus $F_2$	Highly diminished point sized
Beyond $2F_1$	Between $F_2$ and $2F_2$	Diminished
At $2F_1$	At $2F_2$	Same size
Between $F_1$ and $2F_1$	Beyond $2F_2$	Enlarged
At focus $F_1$	At infinity	Infinitely large or highly enlarged
Between focus $F_1$ and optical centre $O$	On the same side of the lens as the object	Enlarged

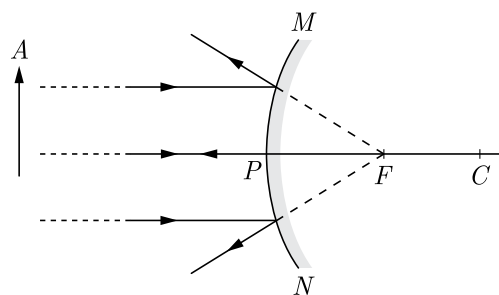
- What is the nature of the image, if an object is placed at infinity ?
- Identify the nature of the image for which the object is between focus and optical centre.
- What is position of image, when object is placed at focus ( $f_1$ ) ?
- What is the focal length of a lens for an object placed 50 cm from the lens producing virtual image at a distance of 10 cm in front of the lens.
  - 12 cm
  - 12.5 cm
  - 5 cm
  - 5 cm



(iv)



(v)



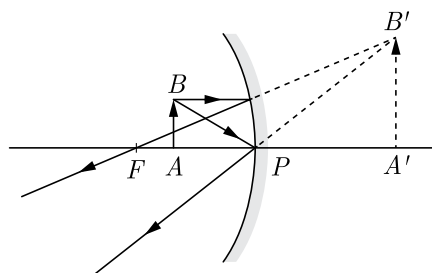
**200.** Draw a ray diagram in each of the following cases to show the position and nature of image formed when the object is placed :

- between pole and focus of a concave mirror.
- between focus and centre of curvature of a concave mirror.
- at the centre of curvature of a concave mirror.
- between infinity and pole of a convex mirror.
- at infinity from a convex mirror.

**Ans :**

Comp 2013

(i)



**201.** State the types of mirrors required to get :

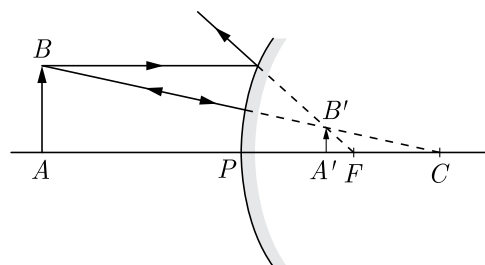
- virtual and diminished image of an object.
- real and inverted image of an object.

Show image formation in both the above cases in the form of ray diagrams. Which of the above mirrors can also form (i) real and magnified (ii) virtual and magnified image, of the object ? Draw ray diagrams to justify your answer.

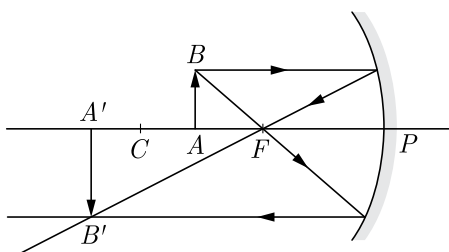
**Ans :**

Delhi 2010

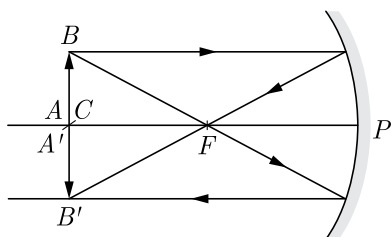
(i) Convex mirror.



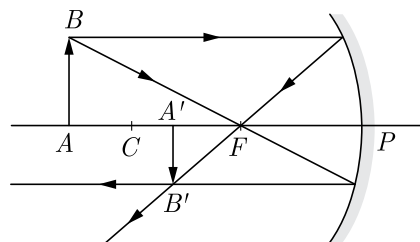
(ii)



(iii)



(ii) Concave mirror





(ii) Given,

$$f = -20 \text{ cm}, h_o = 4 \text{ cm}, v = -10 \text{ cm},$$

$$u = ?, h_i = ?$$

As we know that,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{u} = \frac{-1}{10} + \frac{1}{20}$$

$$= -\frac{1}{10} + \frac{1}{20}$$

$$= \frac{-2+1}{20}$$

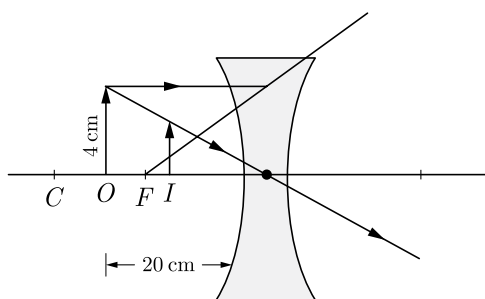
$$= -\frac{1}{20}$$

$$u = -20 \text{ cm}$$

$$h_i = \frac{v}{u} h_o$$

$$= \frac{-10 \text{ cm}}{-20 \text{ cm}} \times 4 = 2 \text{ cm}$$

(iii)

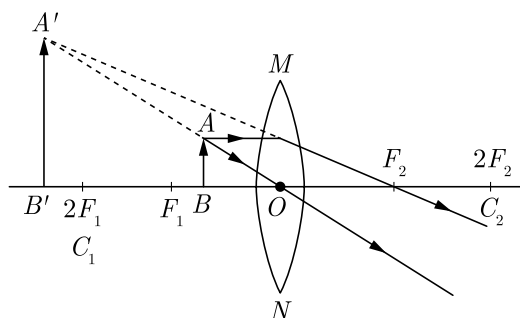
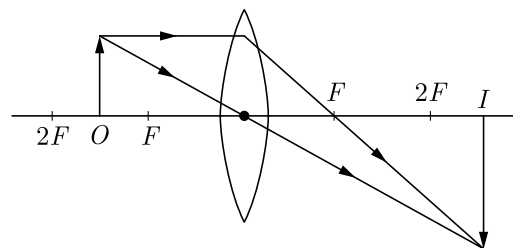


185. "A lens can form a magnified erect image as well as magnified inverted image of an object placed in front of it." State the nature of this lens and draw ray diagrams to justify the above statement. Mark the positions of  $O$ ,  $F$  and  $2F$  in the diagram.

**Ans :**

Delhi 2006

Convex lens used to form a magnified erect image as well as magnified inverted image of an object.

**Magnified and erect image :****Magnified and Inverted Image :**

186. The image formed by a spherical mirror is real, inverted and is of magnification  $-2$ . If the image is at a distance of  $30 \text{ cm}$  from the mirror, where is the object placed? Find the focal length of the mirror. List two characteristics of the image formed if the object is moved  $10 \text{ cm}$  towards the mirror.

**Ans :**

Foreign 2012

Given,

$$m = -2,$$

$$v_o = -30 \text{ cm}, u = ?$$

As we know that,

$$m = -\frac{v}{u}$$

$$-2 = \frac{-(-30)}{u}$$

$$u = \frac{-30}{2}$$

$$u = -15 \text{ cm}$$

The object is at  $15 \text{ cm}$ .

By using mirror formula,

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$-\frac{1}{30} - \frac{1}{15} = \frac{1}{f}$$

$$\frac{-15-30}{40} = \frac{-45}{450} = \frac{-1}{10} = \frac{1}{f}$$

$$f = -10 \text{ cm}$$

The focal length is  $10 \text{ cm}$ . If the object is moved  $10 \text{ cm}$  towards the mirror, the image will be of the nature virtual and erect and the size will be enlarged.

187. A mirror is fitted in a wall of the AGRA FORT. When you stand at a proper location, a full-size image of the Taj Mahal can be seen in this mirror.
- What kind of mirror is it?
  - Draw a ray diagram for such a mirror when the object is at infinity.

**Ans :**

Comp 2007

- The mirror is a convex mirror.
- The ray diagram for such a mirror is shown below:

- 205.** An object of 4.0 cm size is placed at a distance of 25 cm from a concave mirror of focal length 15 cm. At what distance from the mirror should a screen be placed to obtain a sharp image of the object ? Find the nature and size of the image formed.

**Ans :**

OD 2009

Given,  $u = -25$  cm,  $f = -15$  cm,  $h_o = 4$  cm

Using the mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

Putting the values of  $u$  and  $f$ , we get :

$$\frac{1}{v} = -\frac{1}{15} + \frac{1}{25}$$

$$\frac{1}{v} = \frac{-5 + 3}{75}$$

$$= \frac{-2}{75}$$

or 
$$u = \frac{-75}{2}$$

$$= -37.5 \text{ cm}$$

Nature of the image : Real

$$m = \frac{-v}{u} = \frac{h_i}{h_o}$$

or 
$$\frac{-75}{2 \times (-25)} = \frac{h_i}{4}$$

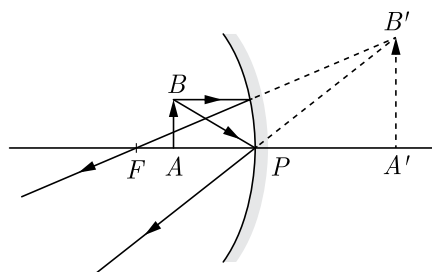
or 
$$h_i = 6 \text{ cm}$$

- 206.** (a) Draw ray diagrams to show the formation of virtual image in case of the following mirror :  
 (i) concave mirror  
 (ii) convex mirror  
 (b) How can concave mirror help in harnessing Sun's energy ?

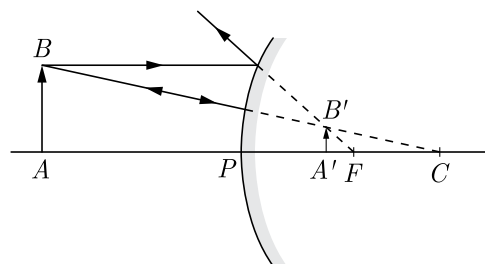
**Ans :**

Comp 2014

(a) (i)



(ii)



- (b) Concave mirrors are used in solar furnace to generate electricity.

**Principle :** It works on the principle that when the rays of light fall parallel to the principal axis, after reflection from the concave mirror, they meet at one point which is the focus of the mirror. Whole of the energy gets concentrated at that point and can be used as alternative sources of energy.

- 207.** (a) State the laws of refraction.  
 (b) What is meant by the term absolute refractive index ? The speed of light in a transparent medium is 0.6 times that of the speed in vacuum. Find refractive index of the medium.  
 (c) How should a ray of light be incident on a rectangular glass slab so that it comes out from the opposite side of the slab without being displaced ? Draw a ray diagram to illustrate your answer.

**Ans :**

OD 2016

- (a) The following are the laws of refraction of light:  
 (i) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.  
 (ii) The ratio of sine of angle of incidence to the sine of angle of refraction is constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction.

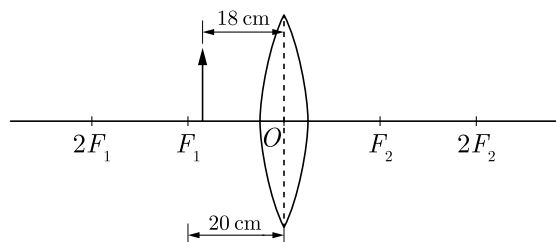
If  $i$  is the angle of incidence and  $r$  is the angle of refraction then,

$$\frac{\sin i}{\sin r} = \text{constant}$$

This constant value is called the refractive index of the second medium with respect to the first.

- (b) (i) The absolute refractive index of a medium is defined as the ratio of speed of light in vacuum to the speed of light in the medium.  
 (ii) The speed of light in vacuum =  $c$   
 The speed of light in a medium =  $0.6c$

191. (a) Complete the following ray diagram :

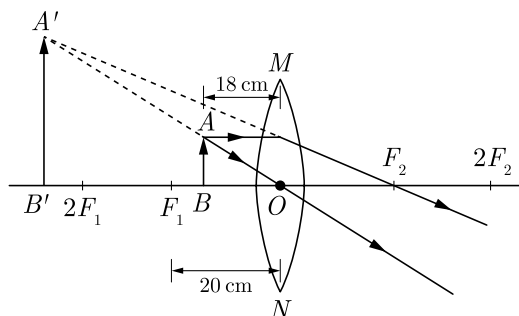


- (b) Find the nature, position and size of the image formed.  
 (c) Use lens formula to determine the magnification in this case.

Ans :

Comp 2020

(a)



- (b) Nature of image  
 On the same side of the lens as the object.  
 Position of image = virtual and erect  
 Size of image = Enlarged (10 times to that of an object)  
 (c) Convex lens,

$$f = +20 \text{ cm}$$

$$h = -18 \text{ cm}$$

By using lens formula.

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} - \frac{1}{-18} = \frac{1}{20}$$

$$\frac{1}{v} = \frac{1}{20} - \frac{1}{18}$$

$$\text{or } \frac{9-10}{180} = -\frac{1}{180}$$

$$v = -180 \text{ cm}$$

$$m = \frac{v}{u}$$

$$\text{or } \frac{-180}{-18} = 10$$

Magnification in this case is 10.

192. A person suffering from myopia (near-sightedness) was advised to wear corrective lens of power  $-2.5 \text{ D}$ . A spherical lens of same focal length was taken in the laboratory. At what distance should a student place an object from this lens so that it forms an image at a distance of 10 cm from the lens ?

Ans :

Comp 2020

We have

$$P = -2.5 \text{ D}$$

$$f = ?$$

$$P = \frac{1}{f}$$

$$\text{or } f = \frac{1}{P} = \frac{1}{-2.5 \text{ D}} = -0.4 \text{ m or } -40 \text{ cm}$$

$$f = -40 \text{ cm}$$

$$v = -10 \text{ cm}$$

$$u = ?$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-10} - \frac{1}{-40}$$

$$= \frac{1}{-10} + \frac{1}{40} = \frac{-4+1}{40}$$

$$= \frac{-3}{40}$$

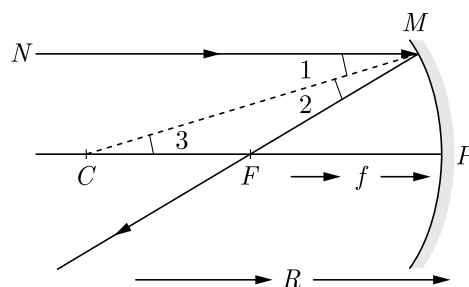
$$u = \frac{-40}{3} \text{ or } -13.33 \text{ cm}$$

The object should be placed  $-13.33 \text{ cm}$  from the lens so that forms an image at a distance of 10 cm from the lens.

193. Prove that for a concave mirror the radius of curvature is twice its focal length.

Ans :

SQP 2018



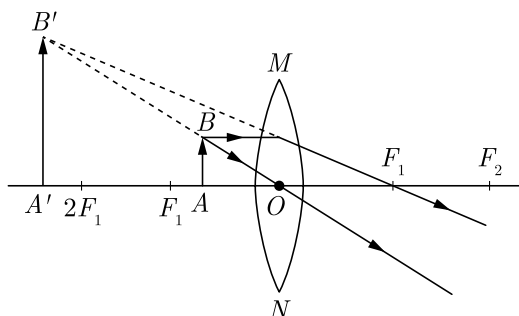
Let  $NM$  is a ray, made incident to mirror parallel to principal axis and after reflection it passes through  $F$ .  $CM$  is normal at  $M$ .

$$\angle 1 = \angle 2 \text{ (laws of reflection) } \dots(1)$$

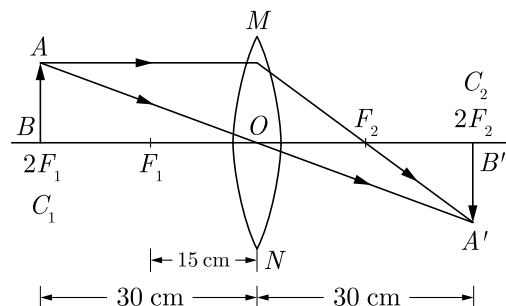
$$\angle 1 = \angle 3 \text{ (alternate interior angles) } \dots(2)$$

$$\angle 3 = \angle 2 \text{ [from (1) and (2)]}$$

Within the focal length :



(iii) Ray diagram for the third set where  $u = 30$  cm,  $v = 30$  cm :



- (c) (i) There would be no effect on the focal length of the lens.  
 (ii) Intensity would be reduced.

**210.** A student focused the image of a candle flame on a white screen by placing the flame at various distances from a convex lens. He noted his observation in the following table :

Distance of the flame from lens (cm)	Distance of the screen from lens (cm)
60	20
40	24
30	30
24	40
12	70

Analyse the above table and answer the following questions :

- (i) What is the focal length of convex lens ?  
 (ii) Which set of observation is incorrect and why ?  
 (iii) Draw a ray diagram to show the image formation for any correct set of observation.

**Ans :**

OD 2010

- (i) For  $u = -60$  cm ;  $v = 20$  cm

$$\begin{aligned} \frac{1}{f} &= \frac{1}{20} + \frac{1}{60} \quad \left( \text{Using } \frac{1}{f} = \frac{1}{v} - \frac{1}{u} \right) \\ &= \frac{3+1}{60} \\ &= \frac{4}{60} = \frac{1}{15} \end{aligned}$$

or  $f = 15$  cm

Focal length of the convex lens = 15 cm

- (ii) The set  $u = 12$  cm and  $v = 70$  cm is incorrect as in all other sets, we get  $f = 15$  cm by using the given values of  $u$  and  $v$  but in this set, the value of  $f$  is different.

**211.** A student focused the image of a candle flame on a white screen using a convex lens. He noted down the position of the candle, screen and the lens as under :

- (i) Position of candle = 12.6 cm  
 (ii) Position of convex lens = 51.8 cm  
 (iii) Position of screen = 91.0 cm  
 (a) Calculate the focal length of the lens.  
 (b) Where will the image be formed if he shifts the candle towards the lens at a position of 32.2 cm?  
 (c) What will be the nature of the image formed if he further shifts the candle towards the lens ?  
 (d) Draw a ray diagram to show the formation of the image in case (c) as said above.

**Ans :**

Foreign 2013

- (a) As we know that,

$$f = \frac{39.2}{2} = 19.6 \text{ cm}$$

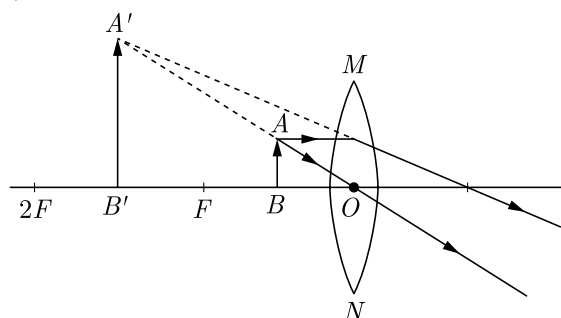
$$u = 39.2 \text{ cm ; } v = 39.2 \text{ cm}$$

$$u = v = 2f = 39.2 \text{ cm}$$

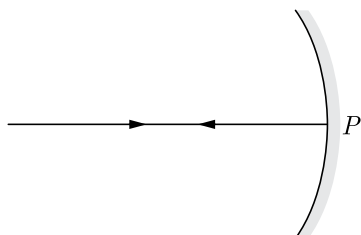
$$f = 19.6 \text{ cm}$$

- (b) At infinity  
 (c) Virtual and erect.

- (d)



- (ii) Angle of incidence,  $\angle i = 0^\circ$ ,  
Angle of reflection,  $\angle r = 0^\circ$ .

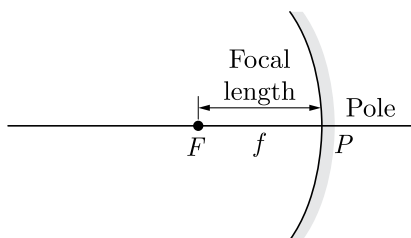


197. (a) State two characteristics of image formed by a convex mirror.  
(b) With the help of a diagram, define (i) pole, (ii) focal length of a concave mirror.  
(c) Convex mirror is used as a rear-view mirror in vehicles. Give reason.

Ans :

OD 2010

- (a) Erect and diminished.  
(b)



**Pole :** Pole of the mirror is the geometrical centre of the mirror.

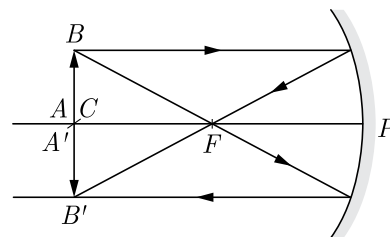
**Focal length ( $f$ ) :** Focal length ( $f$ ) is the distance between the principal focus and the pole of the mirror.

- (c) The image formed by a convex mirror is highly diminished. It can give a wider field view of the traffic behind.
198. (a) Draw ray diagrams for the following and state the nature, size and position of the image formed in each case :  
(i) For a concave mirror, object at  $2F$ .  
(ii) For a concave mirror, object between  $F$  and  $P$ .  
(iii) For a convex mirror, object between  $P$  and infinity.  
(b) Write the mathematical expression for magnification produced by mirrors. When do we say magnification produced is  $-1$  ?

Ans :

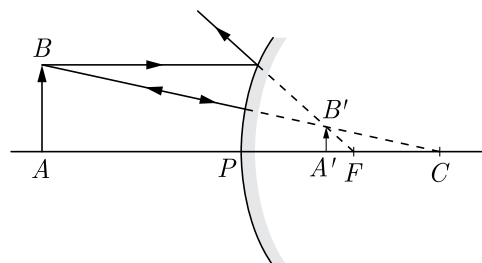
Foreign 2009

- (a) (i) Nature of image : Real and inverted.  
Size of images : Same size as that of object.  
Position of image : At  $2F$ .



- (ii) Nature of image : Virtual and erect. Size of image : Diminished.

Position of image : Between  $P$  and  $F$  behind the mirror.



$$(b) \quad m = \frac{h_i}{h_o} \text{ or } m = -\frac{v}{u}.$$

Magnification produced is  $-1$ , when image formed is of the same size but real and inverted.

199. Name the types of mirror(s) that should be used :

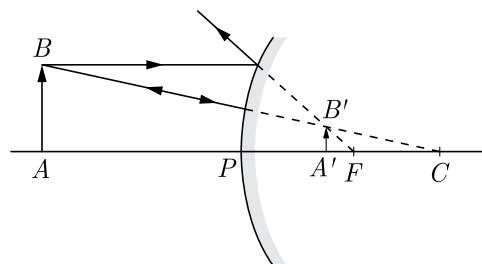
- (i) as a rear-view mirror  
(ii) by the dentists.

Also draw ray diagram(s) and mention the reason(s) for their use.

Ans :

Comp 2011

- (a) (i) Convex mirror,  
(ii) Concave mirror.  
(b) (i) Convex mirror is used as a rear-view mirror as it always gives erect and diminished image, thus covers large area of the traffic behind the vehicle.



- (ii) When an object (tooth) is placed close to a concave mirror, its erect and magnified image is formed, which makes it convenient for a dentist to examine teeth.

**Ans :**

Given :

Object size,	$h = 2.0 \text{ cm}$
Focal length of convex lens,	$f = 10 \text{ cm}$
Object distance,	$u = -15 \text{ cm}$
Image distance,	$v = ?$
Image height,	$h' = ?$

Solution :

Formula,  $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

As  $\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$$= \frac{1}{10} - \frac{1}{15} = \frac{1}{30}$$

So  $v = 30 \text{ cm}$

Magnification:  $m = \frac{h'}{h} = \frac{v}{u}$

$$\frac{h'}{2.0} = \frac{30}{-15}$$

$$h' = -4.0 \text{ cm}$$

Nature of the image is real, inverted and enlarged, formed at a distance of 30 cm on the right side of the lens.

- 215.** A needle placed 45 cm from a lens forms an image on a screen placed 90 cm on the other side of the lens. Identify the type of lens. Determine its focal length and the power. What is the size of image, if needle is 5 cm in height ?

**Ans :**

Comp 2010

Since image formed is on the other side of the lens, it is a convex lens.

Here,  $u = -45 \text{ cm}$  ;  $v = 90 \text{ cm}$

As we know that,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$= \left(\frac{1}{90}\right) - \left(\frac{1}{-45}\right)$$

$$= 30 \text{ cm} = 0.30 \text{ m}$$

Power  $= \frac{1}{f} = \frac{1}{0.30 \text{ m}} = +3.33 \text{ D}$

$$m = \frac{v}{u} = \left(\frac{90}{-45}\right)$$

$$m = -2$$

$$= \frac{h_i}{h_o} = -2 = \frac{h_i}{5}$$

$$h_i = -10 \text{ cm}$$

SQP 2011

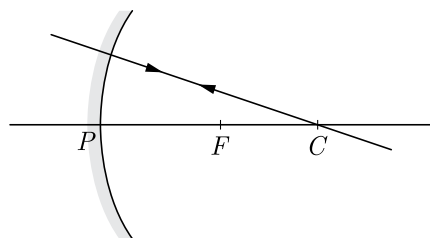
- 216.** (i) To construct a ray diagram we use two rays which are so chosen that it is easy to know their directions after reflection from the mirror. List two such rays and state the path of these rays after reflection in case of concave mirrors. Use these two rays and draw ray diagrams to locate the image of an object placed between pole and focus of a concave mirror.
- (ii) A concave mirror produces three times magnified image on a screen. If the object is placed 20 cm in front of the mirror, how far is the screen from the object.

**Ans :**

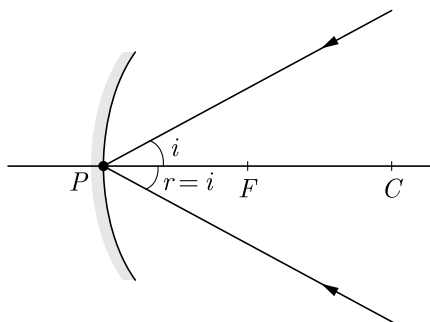
Delhi 2017

- (i) Two light rays whose path of reflection are known are :

- (a) The incident ray passes through the centre of curvature : Light after reflecting from the concave mirror moves back in the same path.



- (b) The ray incident obliquely to the principal axis : The incident ray will be reflected back by the reflecting surface of the concave mirror obliquely and making equal angle with the principal axis.



Let an object is placed between the focus and pole of the concave mirror image of the candle can be located as shown figure.



- 212.** (a) Define 1 dioptre power of lens.  
 (b) A 2 cm long pin is placed at a distance of 16 cm from a convex lens of focal length 12 cm. Find the position, size and nature of the image formed.

**Ans :**

AI 2006

- (a) One dioptre is the power of a lens of focal length one metre.

Using,  $P = \frac{1}{f}$

$$-2.0 \text{ D} = \frac{1}{f} (\text{m})$$

$$f = -0.5 \text{ m}$$

- (b) Given,

$$u = -16 \text{ cm}, f = +12 \text{ cm}, h_o = 2 \text{ cm}$$

Lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{u+f}{fu}$$

$$v = \frac{fu}{f+u} = \frac{12 \times (-16)}{12 + (-16)} = 48 \text{ cm}$$

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

$$m = \frac{48}{-16} = -3$$

$$m = -3$$

Real, inverted and magnified image is formed at 48 cm from the lens.

$$m = \frac{h_i}{h_o}$$

$$h_i = m \times h_o$$

$$= -3 \times 2 = -6 \text{ cm}$$

$$h_i = -6 \text{ cm}$$

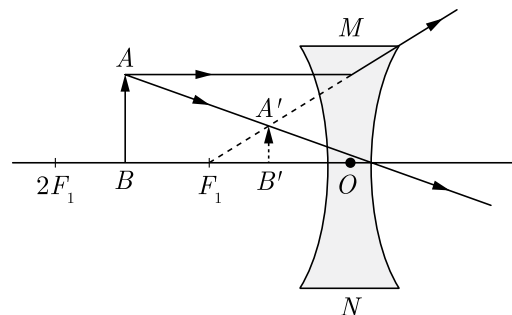
- 213.** State the type of lens used to get;  
 (i) Virtual and diminished image of an object.  
 (ii) Real and diminished image of an object.

Justify your answers in the above two cases by drawing ray diagrams. Which of the above lens can also form (i) real and magnified and (ii) virtual and magnified image of an object? Draw a ray diagram to justify your answer.

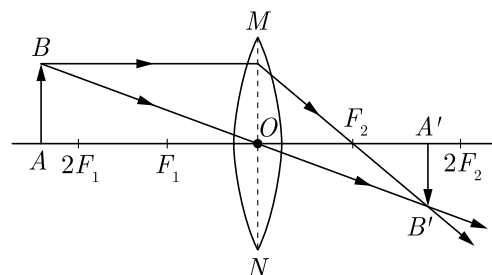
**Ans :**

OD 2016

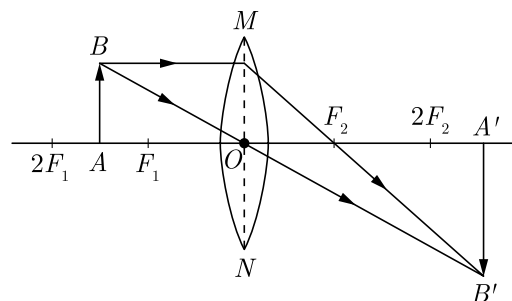
- (i) Concave lens.



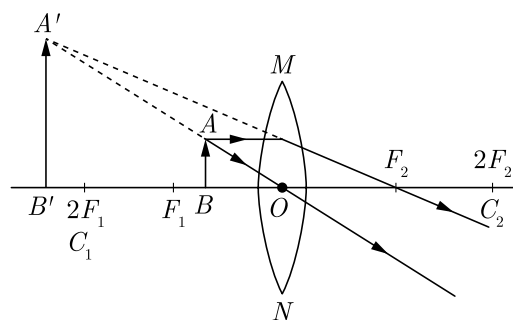
- (ii) Convex lens.



Convex lens can form a real and magnified image as well as a virtual and magnified image of an object.



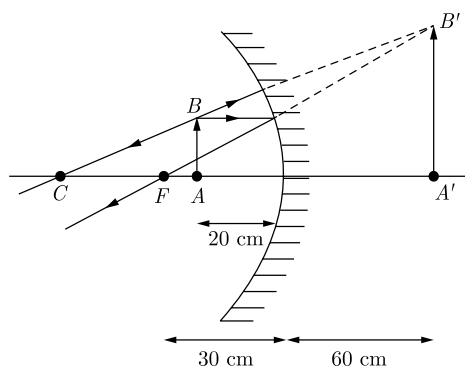
Real and magnified image.



Virtual and magnified image.

- 214.** A 2.0 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 10 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image formed.

Nature of image is virtual and erect and it is magnified.



- (iv) Given  $u = -18$  cm  
 $f = -12$  cm

From mirror formula

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{(-12)} - \frac{1}{(-18)}$$

$$\frac{1}{v} = -\frac{1}{36}$$

$$v = -36 \text{ cm}$$

- 219.** Student took three concave mirrors of different focal lengths and formed the experiment to see the image formation by placing an object different distances with these mirrors as shown in the following table:

Case No.	Object-distance	Focal length
I.	45 cm	20 cm
II.	30 cm	15 cm
III.	20 cm	30 cm

Now answer the following questions:

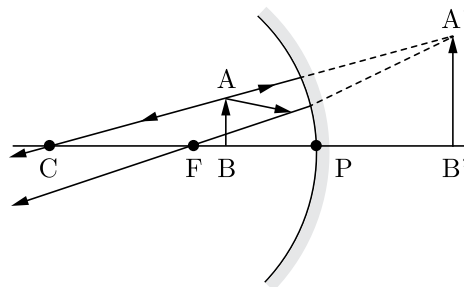
- List two properties of the image formed in Case I.
- In which one of the cases given in the table the mirror will form real image of same size and why?
- Name the type of mirror used by dentists. Give reason why do they use such type of mirrors.
- Look at the table and identify the situation (object distance and focal length) which resembles the situation in which concave mirrors are used as shaving mirrors? Draw a ray diagram to show the image formation in this case.

**Ans :**

OD 2023

- In case I, image is formed between F and C. It is real, inverted, and smaller in size.

- In Case II, since, the object is placed at centre of curvature.
- Dentists use concave mirrors to see teeth and other areas in the mouth. This is because a concave mirror forms a virtual, erect and enlarged image when the object is placed within focus.
- In case a) can be used as having mirror because, when object is placed between P and F, we get virtual, erect and magnified image.



- 220.** A concave mirror forms image of an object thrice in its size on a screen. Magnification of a mirror gives information about the size of the image relative to the object. It is defined as the ratio of size of image to the size of object. It is represented by  $m$ .

$$m = \frac{\text{Size of image}}{\text{Size of object}}$$

Sign of magnification by mirror gives the information about the nature of the image produce by it.

- Describe the nature of image formed.
- If the object  $x$  distance from the pole of mirror, then find image distance from the pole.
- If the radius of curvature of mirror is  $R$ , then write the relation between object distance, image distance and focal length of the mirror.
- Give one use of concave mirror.

**Ans :**

- Since, image is formed on screen. So, it must be real.
- Here,

$$u = -x$$

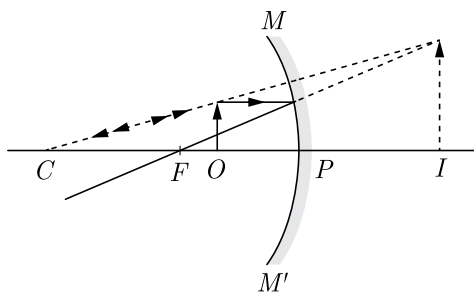
$$m = \frac{-v}{u}$$

or  $-3 = \frac{-v}{-x}$

$$v = -3x$$

$$\text{(iii) } \frac{1}{3x} + \frac{1}{x} = \frac{2}{R} \quad [f = R/2]$$

- It is used in search light and headlight of automobiles.

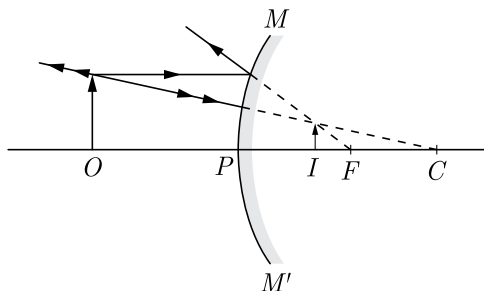


217. (i) If the image formed by a mirror for all positions of the object placed in front of it is always diminished, erect and virtual, state the type of the mirror and also draw a ray diagram to justify your answer. Write one use such mirrors and put to and why ?
- (ii) Define the radius of curvature of spherical mirrors. Kind the nature and focal length of a spherical mirror whose radius of curvature is +24 cm.

Ans :

OD 2015

- (i) A convex mirror forms an erect, diminished and virtual image for all the positions of the object placed in front of it.



Convex mirrors are commonly used as rear-view mirrors in vehicles as they always give an erect, though diminished image.

- (ii) The radius of the sphere of which the reflecting surface of spherical mirror forms a part is called the radius of curvature of the mirror.

$$f = \frac{R}{2}$$

$$R = 24 \text{ cm}$$

$$f = \frac{24}{2} = 12 \text{ cm}$$

Thus, the focal length of a convex spherical mirror is 12 cm.

## CASE BASED QUESTIONS

218. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors:

Case	Mirror	Focal Length (cm)	Object Distance (cm)
1	A	20	45
2	B	15	30
3	C	30	20

- (i) In which one of the above cases the mirror will form a diminished image of the object? Justify your answer.
- (ii) List two properties of the image formed in case 2.
- (iii) What is the nature and size of the image formed by mirror C?  
Draw ray diagram to justify your answer.
- (iv) An object is placed at a distance of 18 cm from the pole of a concave mirror of focal length 12 cm. Find the position of the image formed in this case.

Ans :

OD 2024

- (i) In the case-1 object distance is greater than radius of curvature of the mirror i.e., object is placed beyond centre of curvature of the mirror. Hence image formed by the mirror is diminished, real and inverted.
- (ii) As we know that Centre of curvature  $R = 2f$

$$R = 2 \times 15$$

$$= 30 \text{ cm}$$

Hence, object is placed on the centre of curvature of the mirror. The size of image is same as that of the object and it is real and inverted.

- (iii) In case-3

Given  $u = -20 \text{ cm}$

$$f = -30 \text{ cm}$$

By mirror formula

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} + \frac{1}{(-20)} = \frac{1}{-30}$$

$$v = 60 \text{ cm}$$

- 223.** Convex mirror is used as a rear view mirror in vehicles. Since the image of the object formed is small in size, the field of view is increased. Convex mirror is also used in street lights to diverge light over a large area.



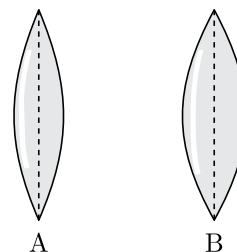
- In driver's mirror, what type of image is formed behind the vehicle ?
- What can you say about field of view of a convex mirror ?
- A convex mirror is used to form the image of an object. What is the nature of formed image ?

**Ans :**

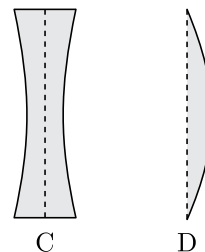
- Convex mirror forms an erect and diminished image of an object behind the vehicle.
- The field of view of a convex mirror is large.
- The image is real.

- 224.** Lenses are objects made of transparent materials such as glass or clear plastic that has curved surfaces. Diverging lenses are thicker at their edges than at their centres and makes light rays passing through them spread out. Converging lenses are thicker in their middle than at their edges and make light rays passing through them focus at a point. These are used in spectacles to help people with poor vision see better. The converging lenses magnify by bending the rays of light that pass through them to meet at a point called focus. Thicker the converging lens is at its centre, the more it magnifies and closer the focus is to the lens.

- Ravi uses two lenses A and B of same size and same material as shown.  $P_1$  and  $P_2$  are the powers of A and B. An object is kept at the same distance from the lens between F and 2F of each lens on the principal axis in turn. Let  $I_1$  and  $I_2$  be the image formed by two lenses respectively. What is the relation of image distances of both lens ?



- Distance of image  $I_2$  will be less than distance of  $I_1$  from the lens.
  - Distance of image  $I_2$  will be greater than distance of  $I_1$  from the lens.
  - Size of image  $I_1$  will be equal to size  $I_2$ .
  - Size of image  $I_2$  will be less than size  $I_2$ .
- Write down the relation between the power of lens of both lenses ?
  - Meenakshi uses above two lenses A and B along with another two lenses C and D, as shown :



She is able to see the subject matter on the black board while sitting in the front row in the classroom but is unable to see the same matter while sitting in the last row.

Which of the above four lenses will she require to correct the defect in her vision? Why ?

- Natasha places an object on the principal axis of above given lens A. One end of this object coincides with the focus F and the other end with 2F. What will be the nature of the image formed by the lens on the other side ?

**Ans :**

- Distance of image  $I_2$  will be less than distance of  $I_1$  from the lens.
- $P_1 < P_2$
- She will require lens C. Because, she is suffering from myopia and in myopia concave lens is required to correct it.
- The nature of the image formed will be infinite in size.

- 221.** A concave lens is thick at the edges and thin at the centre, while a convex lens is thick at the centre and thin at the edges. We can distinguish between a concave lens and a convex lens without touching them. For this keep a book close to a lens and observe the image of the text of the book through the lens. If the letters appear enlarged, then it is a convex lens and if the letters appear diminished then it is a concave lens.

Convex lens converges light rays and hence known as converging lens. Similarly, concave lens diverges light rays and is known as diverging lens. Linear magnification produced by a lens is equal to the ratio of the image distance to the object distance. Power of a lens is defined as the reciprocal of its focal length.

- What type of image is always made by a concave lens ?
- If magnification produced by a spherical lens is  $+0.75$ , then what is the nature of the lens ?
- What is the power of a convex lens with focal length  $80\text{ cm}$  ?
- What kind of lens is present in human eye ?

**Ans :**

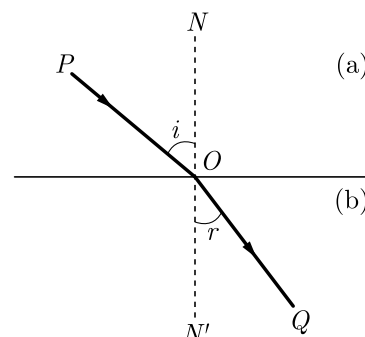
- Concave lens always forms virtual, erect and diminished image of an object.
- Here,  $m = 0.75$  (less than 1) so the image formed is smaller than the object or diminished. A virtual, erect and diminished image can be formed only by a concave lens, so the nature of the lens is concave.
- Power of the convex lens

$$P = \frac{1}{f} = \frac{1}{80} \times 100$$

$$= 1.25\text{ D}$$

- Converging lens is present in human eye.

- 222.** When light ray goes from one transparent medium to another transparent medium, it suffers a change in direction, into second medium. The extent of the change in direction suffered by the phenomenon of change in the path of light rays when going from one medium to another medium is known as refraction. Ray is a given pair of media can be expressed in terms of refractive index. The refractive index is related to an important physical quantity in the relative speed of light in different media.



- When light goes from one medium to another, which of the three parameters, frequency, wavelength, velocity change ?
- A ray of light enters into the glass from air. Does it bend towards normal ?
- Light enters from air to glass having refractive index  $1.50$ . What is the speed of light in the glass? The speed of light in vacuum is  $3 \times 10^8\text{ ms}^{-1}$ .
- What is the unit of refractive index ?

**Ans :**

- Two parameters change. They are wavelength and velocity.
- Yes, it bends towards normal.
- Refractive index of a medium is given by,

$$n_m = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

Speed of light in vacuum,

$$c = 3 \times 10^8\text{ ms}^{-1}$$

Refractive index of glass,

$$n_g = 1.50$$

Speed of light in the glass,

$$v = \frac{c}{n_g}$$

$$= \frac{3 \times 10^8}{1.50}$$

$$= 2 \times 10^8\text{ ms}^{-1}$$

- No unit

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Ans :

- (i) When the object is at infinity, nature of the image will be real, inverted, highly diminished, point sized.
- (ii) Virtual and erect
- (ii) Infinity
- (iv) Given,

$$\begin{aligned}
 \text{Object distance, } u &= -50 \text{ cm} \\
 \text{Image distance, } v &= -10 \text{ cm} \\
 \text{As we know that, } \frac{1}{v} - \frac{1}{u} &= \frac{1}{f} \\
 -\frac{1}{10} - \frac{1}{-50} &= \frac{1}{f} \\
 \frac{-5+1}{50} &= \frac{1}{f} \\
 f &= -\frac{50}{4} \\
 &= -12.5 \text{ cm}
 \end{aligned}$$

- 227.** Is there a relationship between the radius of curvature  $R$ , and focal length  $f$ , of a spherical mirror ? For spherical mirrors of small apertures, the radius of curvature is found to be equal to twice the focal length. We put this as  $R = 2f$ . This implies that the principal focus of a spherical mirror lies midway between the pole and centre of curvature.
- (i) Write relation between radius of curvature and focal length.
  - (ii) For which type of mirrors above relation is verified?
  - (iii) What should be size of the aperture ?
  - (iv) Where is the principle focus of a spherical mirror lies?

Ans :

- (i)  $R = 2f$
- (ii) Spherical
- (iii) Small
- (iv) Midway between the pole and centre of curvature

- 228.** “Change in path of a light ray as it passes from one medium to another medium is called refraction of light.”

When light travels from a rarer medium to a denser one, it bends towards the normal ( $i > r$ ) and when travels from a denser medium to a rarer one. it bends away from the normal ( $i < r$ ).

Where,  $i$  = Angle of incidence

and  $r$  = Angle of refraction

We can see refraction in our daily life, some of the examples are given below :

The bottom of a tank or pond containing water

appears to be raised due to refraction of light which takes place when light rays pass from the pool of water into the air. The letters appear to be raised when viewed through a glass slab placed over the document because of refraction of light.

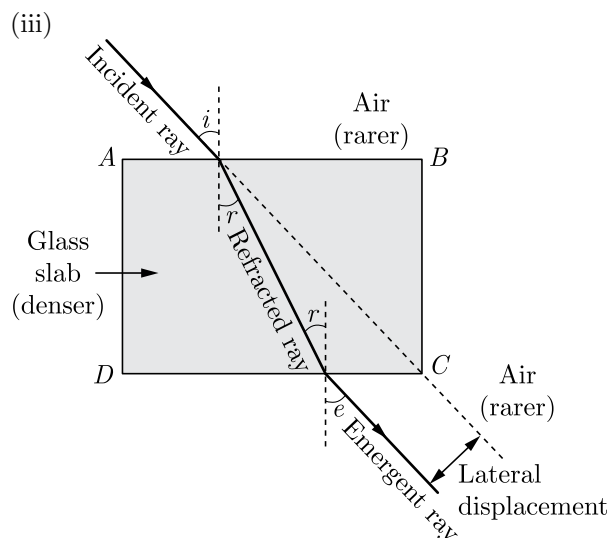
When a light ray enters in a glass slab, then the emergent ray is parallel to the incident ray but it is shifted sideward slightly.

In this case, refraction takes place twice, first when ray enters glass slab from air and second when exits from glass slab to air.

- (i) What do you mean by optically rarer and denser medium ?
- (ii) What is the cause of refraction ?
- (iii) Draw a ray diagram showing refraction through a glass slab.
- (iv) Give one example of refraction from our daily life experience other than the two examples given above.

Ans :

- (i) A medium in which the speed of light is more, is known as optically rarer medium and the medium in which speed of light is lesser is known as optically denser medium.
- (ii) Speed of light is different in different media. It is lesser in denser medium and higher in rarer medium. So, when light enters a denser medium, its speed reduces and it bends towards the normal and when it enters rarer medium, its speed increases and it bends away from the normal



Where,

$i$  = Angle of incidence,

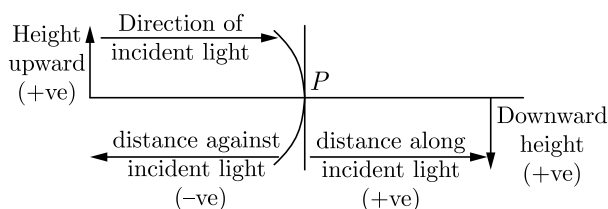
$r$  = Angle of refraction

$e$  = Angle of emergence



- (iv) A lemon kept in water in a glass tumbler appears to be bigger than its actual size, when viewed from the sides.

**229.** While dealing with the reflection of light by spherical mirrors, we shall follow a set of sign conventions called the New Cartesian Sign Convention. In this convention, the pole (P) of the mirror is taken as the origin. The principal axis of the mirror is taken as the  $x$ -axis of the coordinate system. In a spherical mirror, the distance of the object from its pole is called the object distance ( $u$ ). The distance of the image from the pole of the mirror is called the image distance ( $v$ ). Magnification produced by a spherical mirror gives the relative extent to which the image of an object is magnified with respect to the object size. It is expressed as the ratio of the height of the image to the height of the object. It is usually represented by the letter ( $m$ ).



- How can you calculate the magnification of a spherical mirror?
- What does a negative sign in the value of magnification indicate?
- Find the focal length of a convex mirror whose radius of curvature is 32 cm.
- Why does the height of the object is taken to be positive?

**Ans :**

- If  $h$  is the height of the object and  $h'$  is the height of the image, then the magnification  $m$  produced by a spherical mirror is given by

$$m = \frac{\text{Height of the image } (h')}{\text{Height of the object } (h)}$$

$$m = \frac{h'}{h}$$

- A negative sign in the value of the magnification indicates that the image is real.
- Radius of curvature ( $R$ ) of a convex mirror = 32 cm.

$$\text{Radius of curvature } (R) = 2 \times \text{Focal length } (f)$$

$$\text{So, Focal length, } (f) = \frac{R}{2} = \frac{32}{2}$$

$$f = 16$$

The focal length of a convex mirror will be 16 cm.

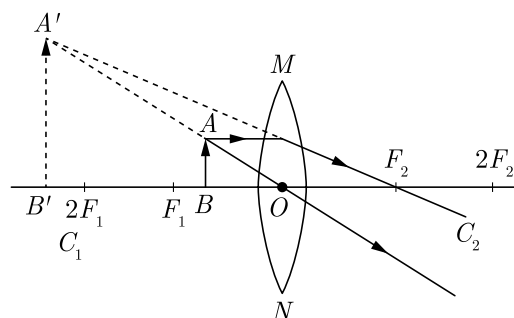
- As the object is usually placed above the principal axis so the height of the object is taken to be positive.

**230.** Harish is a student of class X. He is very passionate about doing science experiment. Recently, he visited Delhi with his parents to witness science fair. He purchased different types of lenses, mirrors and other articles. One day, during games period, a student of same class fell down and lips started bleeding. On observation, it was found by Physical Education teacher that very fine pieces of glass, difficult to observe, stranded over there. Harish immediately rushed to Physics Lab and bought a lens. The bigger image of stranded glass pieces eased the first aid job.

- Name the lens and mirror bought by Harish.
- Draw the ray diagram showing formation of very big image of object by lens. What should be the position of object to get such image?

**Ans :**

- Harish will bring the double convex lens because it forms the magnified image, thus it will help to see the fine pieces of glass.
- 



**231.** In a small town fair Amit took his friend and showed him a mirror in which his image showed upper half body very fat and lower body very thin. Amit's friend got upset but Amit explained him by showing his similar image in the mirror.

- Name two mirrors used in this fair shop.
- Name the mirror in which the size of image is small.

**Ans :**

- Concave and convex mirror.
- Convex mirror gives small size image.

- 232.** Analyse the following observation table showing variation of image distance ( $v$ ) with object distance ( $u$ ) in case of convex lens and answer the questions that follow, without doing any calculations.

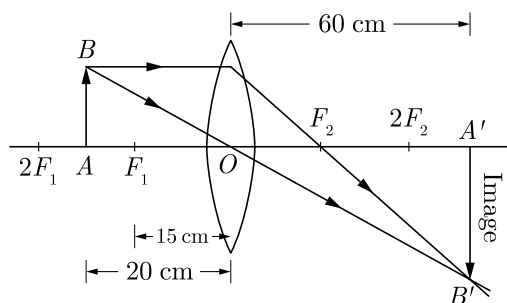
	Object distance $u$ (cm)	Image distance $v$ (cm)
1.	-90	+18
2.	-60	+20
3.	-30	+30
4.	-20	+60
5.	-18	+90
6.	-10	+100

- What is the focal length of the convex lens ? Give reason in support of your answer.
- Write the serial number of that observation which is not correct. How did you arrive at this conclusion?
- Take an appropriate scale to draw ray diagram for the observation at S. No. 4 and find the approximate value of magnification.

**Ans :**

Foreign 2012

- From S. No. 3 we can say that the radius of curvature of the lens is 30 cm because when an object is placed at the centre of curvature of a convex lens, its image is formed on the other side of the lens at the same distance from the lens. We know that focal length is half of the radius of curvature. Thus, the focal lengths of the lens is +15 cm.
- S. No. 6 is not correct as the object distance is between focus and pole, so for such cases the image formed is always virtual but in the case a real image is forming as the image distance is positive.
- Approximate value of magnification for distance object -20 cm and image distance +60 cm is 3.



# CHAPTER 10

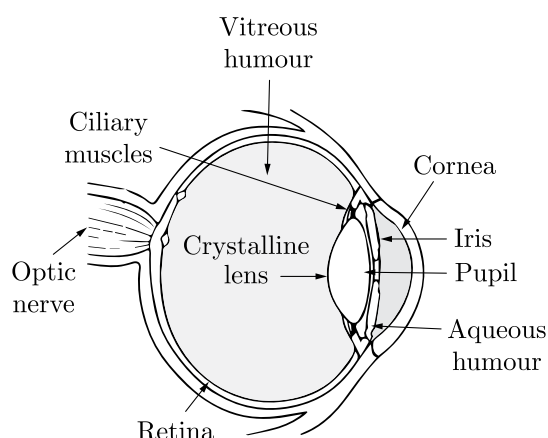
## The Human Eye and the Colourful world

### 1. HUMAN EYE AND ITS CONSTRUCTION

The nature has given us eye as one of the most valuable and sensitive sense organs. The eye consists of an approximately spherical eyeball of about 2.3 cm diameter. The front portion of eyeball is covered by a transparent protective membrane cornea. Most of the refraction of light rays entering the eye occurs at cornea itself.

The iris, a coloured muscular diaphragm, is situated behind the cornea and there is a small hole called pupil. Pupil appears black as any light falling on it goes into the eye. The amount of light entering into eye is controlled by varying the size of pupil. When light intensity is more, the iris contracts the pupil in order to allow less light to go in. When the light intensity is low, the iris increases the size of pupil in order to allow more light to go in.

The eye lens, a transparent crystalline structure, works like a biconvex lens. The curvature and hence, focal length of eye lens can be altered by ciliary muscles.



Retina covers the inside of the rear part of the eyeball, where the light is focussed after refraction from eye lens. So, retina acts as a screen in forming image in the eye. Retina contains a large number

of light sensitive cells called receptors. These cells generate electrical signals when light is falling on them. Optic nerve connects the retina to brain and transmits the image formed on the retina to brain. The brain receives the information through electrical signals and perceives the object as it is.

### 2. POWER OF ACCOMMODATION OF EYE

The ability of eye lens to adjust its focal length in order to see objects located at different distances from the eye is called accommodation of eye. When eye is focussed on a distant object, ciliary muscles are fully relaxed and focal length of eye lens is maximum and parallel beam coming from distant object is focussed on the retina. When eye is focussed on a nearby object, ciliary muscles contract so that eye lens becomes thicker and its focal length decreases. Therefore, the image of a nearby object is focussed on the retina.

### 3. FAR AND NEAR POINT OF VISION

On account of power of accommodation, a normal eye can see any object situated between 25 cm from the eye and infinity. The minimum distance  $D$  at which an object can be seen distinctly by the eye is called the least distance of distinct vision or near point. For a normal eye,  $D = 25$  cm.

The farthest point up-to which an eye can see objects distinctly is called far point of eye. For normal eye, the far point is at infinity.

### 4. NEAR-SIGHTEDNESS OR MYOPIA

A person suffering with myopia (near-sightedness) can see nearby objects clearly but is not able to see distant objects distinctly. For a myopic eye, the near point is situated correctly at 25 cm from the eye but the far point is not at infinity. The far point of defective eye has shifted to point  $O$  at a distance  $x$  from the eye. Image formation in myopic eye and its correction are given below:

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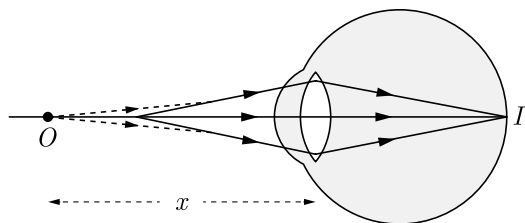


Figure: (a) Far point of a myopic eye

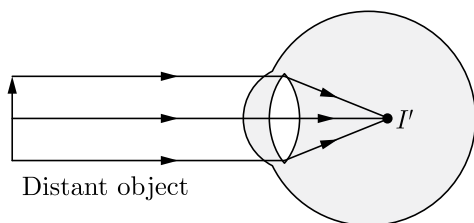


Figure: (b) Myopic eye

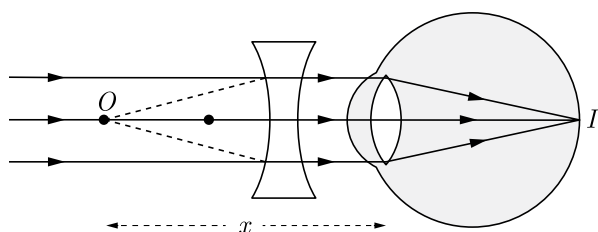


Figure: (c) Correction for myopia

Two causes of myopic defect are (a) shortening of focal length of eye lens because of its excessive curvature, and (b) elongation of eyeball.

The myopic defect is corrected by using of a concave lens of suitable power. The concave lens forms a virtual image of the distant object at the far point  $O$  of the defective eye and eye lens can see it clearly.

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## 5. LONGSIGHTEDNESS OF HYPERMETROPIA

A person suffering with hypermetropia (longsightedness) can see distant objects distinctly but is not able to see nearby objects clearly. For a hypermetropic eye, the far point is situated at infinity but the near point has shifted away from  $D = 25$  cm. The near point of defective eye has shifted to point  $N'$  at a distance  $x > 25$  cm. Image formation in hypermetropic eye and its correction are given below.

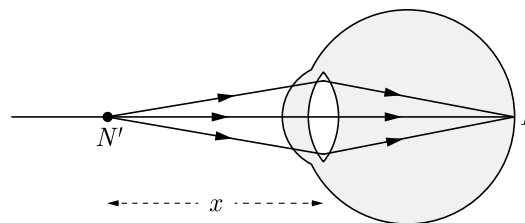


Figure: (a) Near point of a hypermetropic eye

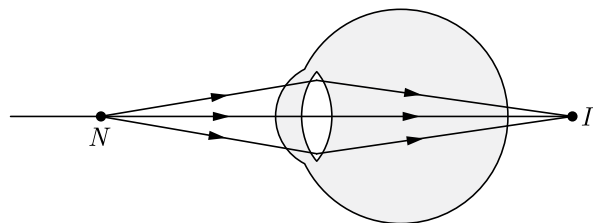


Figure: (b) Hypermetropic eye

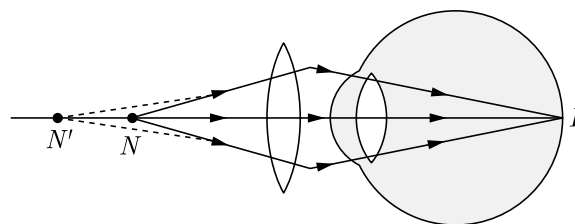


Figure: (c) Correction for hypermetropia

Two causes of hypermetropic defect are (a) increase in focal length of eye lens because of less curvature of the eye lens, and (b) shortening of eyeball.

The hypermetropic defect can be corrected by using a convex lens of suitable power. For an object situated at least distance of distinct vision  $D = 25$  cm, the convex lens forms a virtual image at the near point  $N'$  of defective eye and the defective eye lens can see it clearly.

## 6. PRESBYOPIA

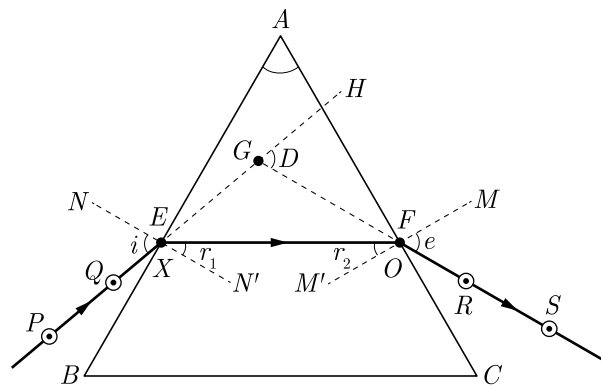
The flexibility of eye lens goes on decreasing and ciliary muscles are also weakened with ageing of a person. So, accommodation power of eye decreases and a person finds it difficult to see nearby objects comfortably and distinctly. This defect of vision, called presbyopia which can be corrected by using convex lens of suitable power.

Old persons may suffer from myopia and hypermetropia and require corrective bifocal lenses.

If cornea of the eye becomes cloudy either due to a disease or an infection or injury of any person, the vision of the eye is reduced or may even be lost completely, called corneal blindness. This defect

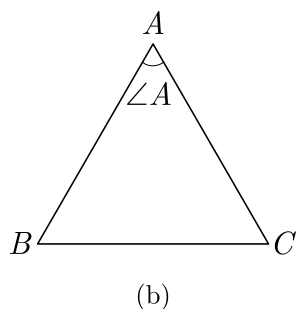
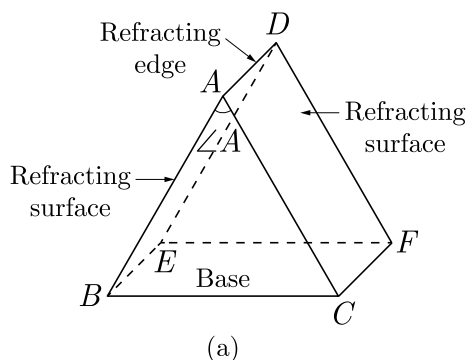
cannot be corrected by using lenses or medicines. However, lost sight due to corneal blindness can be restored through a corneal transplantation in which an eye surgeon replaces the damaged cornea by a good one obtained through eye donation. So, we should pledge to donate our eyes after death and motivate others to do the same.

Sometimes, the crystalline lens of a person becomes cloudy with age due to which he/she cannot see clearly. This is called cataract. A cataract removal surgery is performed to cure cataract.



## 7. ANGLE OF PRISM

A triangular prism is a homogeneous, transparent refracting medium bound by two non-parallel refracting surfaces inclined at some angle ( $\angle A$ ) called the angle of prism. A section of the prism is a triangle  $ABC$  as shown in the figure.



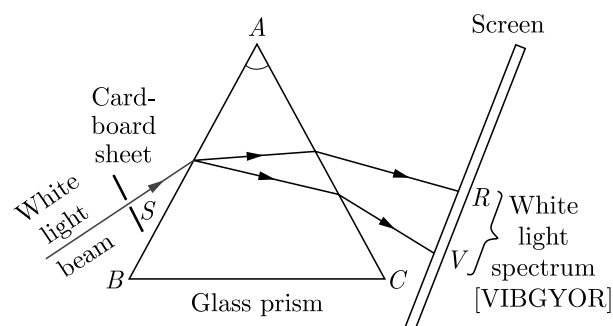
## 8. INCIDENT, REFRACTED AND EMERGENT RAYS

Refraction through a prism is shown in the given figure. In this figure,  $PQE$  is the incident ray,  $EF$  the refracted ray and  $FRS$  the emergent ray.  $\angle i$  is the angle of incidence,  $\angle e$  the angle of emergence and  $\angle D$  the angle of deviation suffered by light ray due to refraction at the glass prism.

## 9. DISPERSION OF LIGHT

When a narrow beam of white light passes through a prism, it splits up into a band of seven colours. Splitting of white light into its seven constituent (acronym VIBGYOR) colours on passing through a dispersive medium, i.e., the glass prism is called dispersion of light.

Out of seven colours, the violet deviates maximum and red deviates minimum. As a result, the coloured band obtained on the screen is called spectrum.



1. Dispersion is caused by the difference in deviation angles for light rays of different wavelengths. The violet light has minimum wavelength, so, it deviates the maximum. The red light has maximum wavelength, so, it deviates the minimum.
2. The seven constituent colours of white light splitted by a glass prism can be recombined to form white light by passing them through another identical prism fixed in an inverted position.
3. Rainbow forms after rains because of dispersion on light and the internal reflection caused by tiny water droplets suspended in air. Thus, the tiny water droplets act as prisms.

A rainbow always forms in a direction opposite to that of the sun. In a rainbow, the innermost arc is violet and the outermost arc is red.

## 10. ATMOSPHERIC REFRACTION

The refraction of light by the Earth's atmosphere is known as atmospheric refraction. Atmospheric refraction is caused by the bending of light rays when they pass through the layers of the earth's atmosphere, which are of different optical densities.

1. Stars twinkle in night sky due to atmospheric refraction. The apparent positions of a star appears slightly higher than its actual position.
2. Due to atmospheric refraction, the sun is visible to us 2 minutes before actual sunrise. Again, the sun remains visible for 2 minutes even after actual sunset. So, apparent duration of time from sunrise to sunset is 4 minutes more than the actual duration.
3. Due to atmospheric refraction, the shape of the sun at the time of sunrise or sunset appears to be of oval shape.

## 11. SCATTERING OF LIGHT

The process due to which light gets deflected and diffused all over as a result of its interplay with tiny matter particles is called scattering of light. The tiny particle which causes scattering of light is called the scatterer particle.

1. The colour of the scattered light is based upon the size  $a$  of the scattering particle as compared to wavelength  $\lambda$  of the light. If  $a \ll \lambda$ , then light of shorter wavelengths is scattered much more than light of longer wavelengths. According to Rayleigh's law of scattering, the intensity  $I$  of scattered light is inversely proportional to fourth power of its wavelength, i.e.,  $I \propto 1/\lambda^4$  (when  $a \ll \lambda$ ).
2. The phenomenon of scattering of light by suspended particles present in the medium (through which a light beam is passing) and making the path of the light beam visible, is called Tyndall effect. The path of a light beam passing through a colloidal solution becomes visible because of scattering of light caused by colloidal particles. When light beam from the headlight of an automobile comes through mist and fog, then particles become visible because of Tyndall effect. The particles scatter the light beam and become visible.

3. Air molecules have a size much smaller than the wavelength of light. Hence, they scatter blue-violet light of smaller wavelengths much more than red-orange light of longer wavelengths. Consequently, clear sky appears to be blue. But when looking the sky from a spaceship, it appears to be dark as there are no air particles in space to cause scattering of light.
4. Danger signals are always red in colour. This is because red colour has the maximum wavelength and hence is scattered the least by atmospheric particles. Thus, red signal is visible from a longer distance.

## OBJECTIVE QUESTIONS

1. In bifocal lenses used for the correction of presbyopia:
  - (a) the upper portion is of convex lens for the near vision and lower part is of concave lens for the distant vision.
  - (b) the upper portion is of convex lens for the distant vision and lower part is of concave lens for the near vision.
  - (c) the upper portion is of concave lens is for the near vision and lower part is of convex lens for the distant vision.
  - (d) the upper portion is of concave lens for the distant vision and lower part is of convex lens for the near vision.

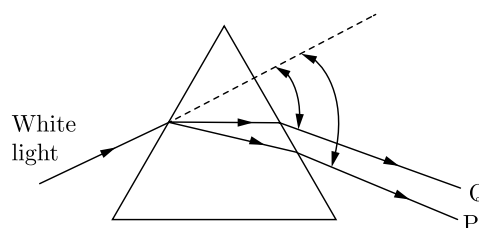
Ans :

OD 2024

The upper portion of the bifocal lens is a concave lens so as to focus the distant objects and the lower portion of the bifocal lens is a convex lens so as to focus the nearby objects.

Thus (d) is correct option.

2. In the following diagram showing dispersion of white light by a glass prism, the colours 'P' and 'Q' respectively are -



- (a) Red and Violet
- (b) Violet and Red

151. (a) What is hypermetropia ? State two causes of hypermetropia. Draw a labelled ray diagram to show how this defect may be corrected using spectacles of appropriate focal length.
- (b) The near point of a hypermetropia eye is 1.0 m. Find the power of the lens required to correct this defect. The least distance of distinct vision for a normal eye is 25 cm.

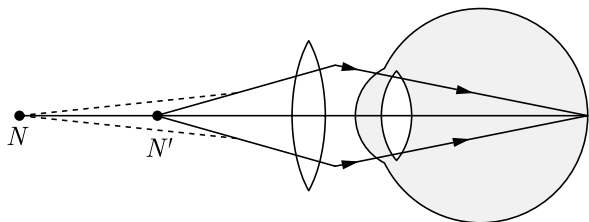
Ans :

Foreign 2015

- (a) Hypermetropia or far-sightedness is a defect of vision in which the affected person can see distant objects clearly but cannot see nearby objects distinctly.

**Causes of hypermetropia :**

- Increase in focal length of eye lens for near view.
- Eye ball becomes smaller.



Correction for hypermetropic eye

- (b)  $u = -25 \text{ cm}$ ,  $v = -100 \text{ cm}$

$$\begin{aligned} \frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ &= \frac{v - u}{uv} \\ &= \frac{(-25 \text{ cm}) - (-100 \text{ cm})}{(-25 \text{ cm}) \times (-100 \text{ cm})} \\ &= \frac{3}{100 \text{ cm}} \\ &= \frac{3}{1 \text{ m}} \\ P &= +3 \text{ D} \end{aligned}$$

152. (a) What is myopia ? State two causes of myopia. With the help of a labelled ray diagram show the correction of myopia using appropriate lens.
- (b) The near point of a myopic eye is 1 m. Find the power of the lens required to correct this defect. Assume that near point of the normal eye is 25 cm.

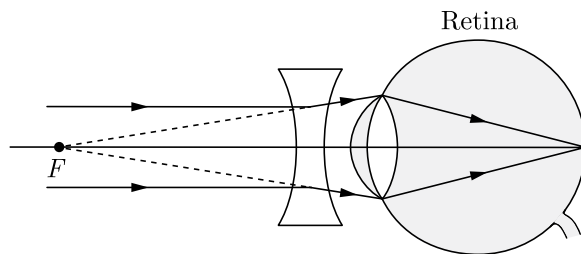
Ans :

SQP 2018

- (a) Myopia is a defect of vision in which eye can only see nearby objects.

**Causes :**

- Elongation of eye ball.
- Focal length of eye lens becomes too short.



- (b)  $u = -25 \text{ cm}$  (Normal near point)

$$\begin{aligned} v &= -1 \text{ m} \\ &= -100 \text{ cm} \end{aligned}$$

$$f = ?$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\text{or } -\frac{1}{100} - \frac{1}{-25} = \frac{1}{f}$$

$$\text{or } f = \frac{100}{3} = 33.3 \text{ cm}$$

$$\begin{aligned} P &= \frac{1}{f} \\ &= +3 \text{ D Convex lens} \end{aligned}$$

153. (a) A student suffering from myopia is not able to see distinctly the objects placed beyond 5 m. List two possible reasons due to which this defect of vision have arisen. With the help of rays diagrams, explain :
- Why the student is unable to see distinctly the objects placed beyond 5 m from his eyes.
  - The type of the corrective lens used to restore proper vision and how this defect is corrected by the use of this lens.
- (b) If in this case, the numerical value of the focal length of the corrective lens is 5 m, find the power of the lens as per the new cartesian sign convention.

Ans :

OD 2017

- (a) (i) The student is unable to see distinctly the object placed beyond 5 m from his eyes as he is suffering from myopia wherein a person can see nearby objects clearly but cannot see distant objects distinctly.
- (ii) Concave lens can be used as the corrective lens to restore proper vision. A concave lens of suitable power will bring the image back on the retina and thus the defect is corrected.

Ans :

(c) Refraction, dispersion and internal reflection

8. Twinkling of stars is due to atmospheric
- (a) dispersion of light by water droplets
  - (b) refraction of light by different layers of varying refractive indices
  - (c) scattering of light by dust particles
  - (d) internal reflection of light by clouds

Ans :

(b) refraction of light by different layers of varying refractive indices

9. The clear sky appears blue because
- (a) blue light gets absorbed in the atmosphere.
  - (b) ultraviolet radiations are absorbed in the atmosphere.
  - (c) violet and blue lights get scattered more than lights of all other colours by the atmosphere.
  - (d) light of all other colours is scattered more than the violet and blue colour lights by the atmosphere.

Ans :

(c) violet and blue lights get scattered more than lights of all other colours by the atmosphere.

10. Which of the following statements is correct regarding the propagation of light of different colours of white light in air ?
- (a) Red light moves fastest
  - (b) Blue light moves faster than green light
  - (c) All the colours of the white light move with the same speed
  - (d) Yellow light moves with the mean speed as that of the red and the violet light.

Ans :

(c) All the colours of the white light move with the same speed

11. The danger signals installed at the top of tall buildings are red in colours. These can be easily seen from a distance because among all other colours, the red light
- (a) is scattered the most by smoke or fog
  - (b) is scattered the least by smoke or fog
  - (c) is absorbed the most by smoke or fog
  - (d) moves fastest in air

Ans :

(b) is scattered the least by smoke or fog

12. The bluish colour of water in deep sea is due to
- (a) the presence of algae and other plants found in water
  - (b) reflection of sky in water
  - (c) scattering of light
  - (d) absorption of light by the sea

Ans :

(c) scattering of light

13. When light rays enter the eye, most of the refraction occurs at the
- (a) crystalline lens
  - (b) outer surface of the cornea
  - (c) iris
  - (d) pupil

Ans :

(b) outer surface of the cornea.

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14. The focal length of the eye lens increases when eye muscles
- (a) are relaxed and lens becomes thinner
  - (b) contract and lens becomes thicker
  - (c) are relaxed and lens becomes thicker
  - (d) contract and lens becomes thinner

Ans :

(a) are relaxed and lens becomes thinner

15. Which of the following statement is correct ?
- (a) A person with myopia can see distant objects clearly
  - (b) A person with hypermetropia can see nearby objects clearly
  - (c) A person with myopia can see nearby objects clearly
  - (d) A person with hypermetropia cannot see distant objects clearly.

Ans :

(c) A person with myopia can see nearby objects clearly.



16. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Inverted crown-flint Glass prism	(p)	Deviation $\propto \frac{1}{\text{dispersive power}}$
(B)	Achromatism	(q)	Deviation without dispersion
(C)	Hollow prism	(r)	Absence of chromatic aberration
(D)	Glass slab	(s)	Dispersion without deviation

	A	B	C	D
(a)	q	r	p	s
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

A-s, B-r, p, C-q, D-q

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17. Column II gives lens that can be use to correct the defect of vision given in column I, match them correctly.

	Column I		Column II
(A)	Myopia	(p)	Convex lens
(B)	Hypermetropia	(q)	Concave lens
(C)	Astigmatism	(r)	Cylindrical lens
(D)	Presbyopia	(s)	Bi-focal lens

	A	B	C	D
(a)	q	r	p	s
(b)	p	q,	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

A-q, B-p, C-r, D-s

18. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Spectrometer	(p)	Refraction
(B)	Mirage	(q)	Deviation without dispersion
(C)	Hollow prism	(r)	To measure angle of prism
(D)	glass slab	(s)	To measure the dispersion
		(t)	Dispersion without deviation

	A	B	C	D
(a)	s, r	r, p	q	q
(b)	s	p	q	r, t
(c)	p, q	s	r, s, t	q
(d)	q, s	q, r	s	s, t

Ans :

(a) A-s, r, B-r, p, C-q, D-q

19. **Assertion (A)** : The rainbow is a natural spectrum of sunlight in the sky.

**Reason (R)** : Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
 (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).  
 (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

Ans :

OD 2024

A rainbow is always formed in a direction opposite to that of the sun. Rainbow forms after rains because of dispersion of light and the internal reflection caused by tiny water droplets suspended in air. In a rainbow the innermost are is violet and outermost are is red.

Thus (c) is correct option.

20. **Assertion** : Planets do not twinkle.

**Reason** : Planets do not show the phenomenon of scattering.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

Planets are much closer to the earth and are thus seen as extended sources. If we consider a planet as a collection of a large number of point sized sources of light, the total variation in the amount of light entering our eye from all the individual point sized sources will average out to zero. Thereby, nullifying the twinkling effect. Hence, assertion is true but reason is false.

- 21. Assertion :** When a light ray is refracted through a glass prism, emergent ray is parallel to incident ray.

**Reason :** Two sides of prism doing refraction are parallel to each other.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (d) Both Assertion and Reason are false.

The two refracting surfaces of a glass prism are inclined to each other at an angle, so emergent ray is not parallel to incident ray. Hence, both assertion and reason are false.

- 22. Assertion :** A rainbow is a natural spectrum appearing in the sky after a rain shower.

**Reason :** It is caused by reflection of sunlight by tiny water droplets present in the atmosphere.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

A rainbow is caused by dispersion of sunlight by tiny water droplets, present in the atmosphere. Assertion is true but reason is false.

- 23. Assertion :** Different colour of light bends through different angles with respect to the incident ray when they pass through a prism. The red light bends the least while violet the most.

**Reason :** Different colour of light bends through different angles with respect to the incident ray when they pass through a prism. The red light bends the least while violet the most.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Red light has maximum wavelength so it deviates least, and violet light due to minimum wavelength deviates most. Both assertion and reason are true and reason explains assertion.

- 24. Assertion :** A prism deviates a ray of light towards its base.

**Reason :** Both refracting sides scatter the light.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

**Ans :**

- (c) Assertion is true but Reason is false.

A ray of light is deviated by prism towards its base as light ray suffers refractions at both surface and their surfaces are not parallel to each other but inclined at an angle. Assertion is true but reason is false.

- 25. Assertion :** Sun is visible to us 2 minutes after the actual sunrise and about 2 minutes before the actual sunset.

**Reason :** It is caused due to rotation and revolution of earth.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Both Assertion and Reason are false.

- (c) Red and Blue  
(d) Orange and Green

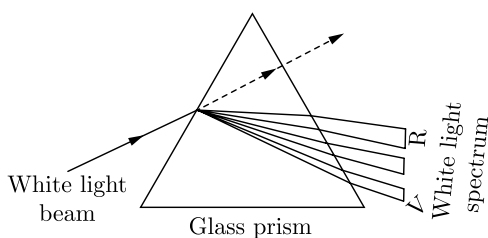
Ans :

OD 2023

When a narrow beam of white light passes through a prism, it splits up into a band of seven colours. Splitting of white light into its seven constituent (acronym VIBGYOR) colours on passing through a dispersive medium, i.e., the glass prism is called dispersion of light.

The order of deviation of colour from most to least is: Violet > Indigo > Blue > Green > Yellow > Orange > Red

Thus, here the colour P is Violet and colour Q is Red.



Thus option (b) is correct option.

3. In human eye the part which allows light to enter into the eye is:

- (a) Retina (b) Pupil  
(c) Eye lens (d) Cornea

Ans :

OD 2023

Iris is the ring of pigmented tissue surrounding the pupil that varies in colour from person to person, it contract and dilates to control the amount of light entering the eye through the pupil. The pupil is the opening in the centre of the iris where light enters the eye.

Thus option (b) is correct option.

4. A person cannot see distinctly objects kept beyond 2 m. This defect can be corrected by using a lens of power

- (a) +0.5 D (b) -0.5 D  
(c) +0.2 D (d) -0.5 D

Ans :

- (b) -0.5 D

5. A student sitting on the last bench can read the letters written on the blackboard but is not able to read the letters written in his text book. Which of the following statements is correct?

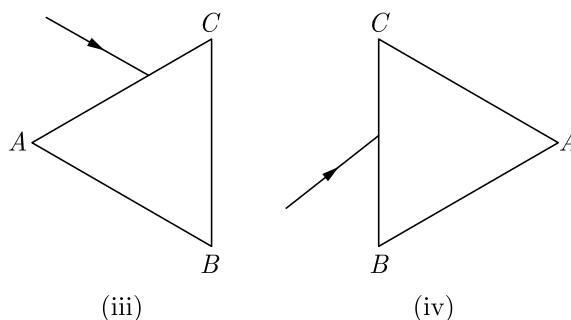
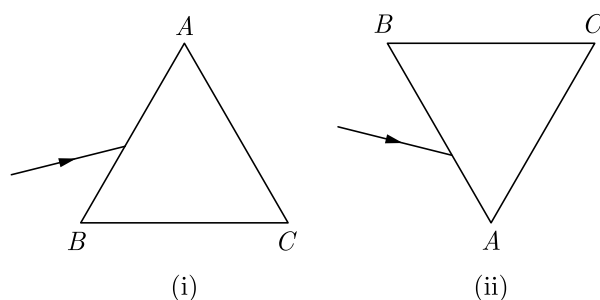
- (a) The near point of his eyes has receded away

- (b) The near point of his eyes has come closer to him  
(c) The far point of his eyes has come closer to him  
(d) The far point of his eyes has receded away

Ans :

- (a) The near point of his eyes has receded away.

6. A prism  $ABC$  (with  $BC$  as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in Figure. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky?



- (a) (i) (b) (ii)  
(c) (iii) (d) (iv)

Ans :

- (b) (ii)

7. Which of the following phenomena of light are involved in the formation of a rainbow ?

- (a) Reflection, refraction and dispersion  
(b) Refraction, dispersion and total internal reflection  
(c) Refraction, dispersion and internal reflection  
(d) Dispersion, scattering and total internal reflection.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

The rainbow is formed when light at the inner surface of the water drop gets internally reflected if the angle between the refracted ray and normal to the drop surface is greater than the critical angle.

- 31. Assertion :** Secondary rainbow is fainter than primary rainbow.

**Reason :** Secondary rainbow formation is three step process and hence, the intensity of light is reduced at the second reflection inside the rain drop.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.  
 (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.  
 (c) Assertion is true but Reason is false.  
 (d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Primary rainbow is a result of three-step process.

1. Refraction at the first surface of raindrop.
2. Total internal reflection from the second surface of raindrop.
3. Again refraction from the first surface of raindrop from where the light finally emerges out. The intensity of light is reduced at the second reflection and hence, the secondary rainbow is fainter than the primary rainbow.

## ONE MARK QUESTIONS

- 32.** What is the function of retina in the human eye ?

**Ans :**

Comp 2021

Retina acts as screen for the images formed by the eye lens.

- 33.** What is pupil ?

**Ans :**

Comp 2020

Pupil is a narrow hole through which light enters in eye and falls on eye lens.

- 34.** Name the cells responsible for colour perception.

**Ans :**

Delhi 2017

Cone cells are responsible for colour perception.

- 35.** Name the cells responsible for intensity of light.

**Ans :**

OD 2011

Rod cells present on retina are responsible for intensity of light.

- 36.** What is the function of ciliary muscles ?

**Ans :**

SQP 2013

Ciliary muscles can increase or decrease the focal length of eye lens to focus the images at retina.

- 37.** What do you mean by accommodation of eye ?

**Ans :**

SQP 2018

The ability of eye lens to adjust its focal length is called accommodation.

- 38.** What is blind spot ?

**Ans :**

AI 2016

It is a part of retina where if the image of any object is formed, the sensation of formation of image is conveyed by optic nerves to the brain.

- 39.** What is colour blindness ?

**Ans :**

Foreign 2012

If some cone cells are absent from retina, the person is not able to distinguish the colours of the object. It is called colour blindness.

- 40.** Name the part of the human eye that helps in changing the focal length of the eye lens.

**Ans :**

OD 2011

Ciliary muscles.

- 41.** What is the role of pupil in a human eye ?

**or**

What is the function of pupil in human eye ?

**Ans :**

OD 2019

Pupil regulates and controls the amount of light entering the eye.

- 42.** Name the part of the eye :

- (a) that controls the amount of light entering into the eye.  
 (b) that has real, inverted image of the object formed on it.

**Ans :**

Delhi 2011

- (a) Pupil,  
 (b) Retina.

- (ii) Two phenomena associated with the formation of rainbow are :

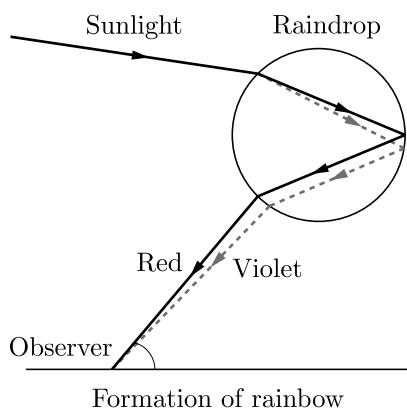
- Dispersion of sunlight by water droplets present in the atmosphere.
- Total internal reflection.

97. Describe the formation of rainbow in the sky with the help of a diagram.

Ans :

SQP 2011

A rainbow is always formed in a direction opposite to that of the Sun. The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the droplet. Due to the dispersion of light and internal refraction, different colours reach the observer's eye.



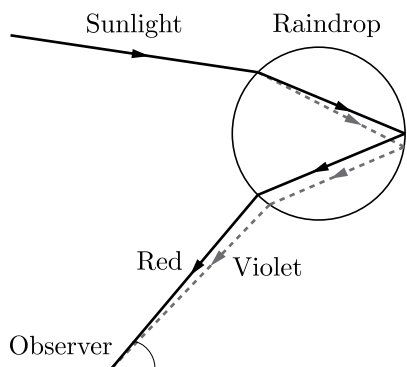
98. (i) Show the formation of rainbow with the help of a ray diagram.

- (ii) What are the conditions to observe rainbow ?

Ans :

AI 2015

- (i) Formation of rainbow :



- (ii) One can observe a rainbow if Sun shines at the back of the observer during or after rainfall.

99. (i) When white light is incident on a glass prism surface, it splits into constituent colours. Why ?  
 (ii) Write the colours in the order as they appear in the spectrum.

- (iii) Draw a ray diagram to show dispersion of white light as it passes through a glass prism.

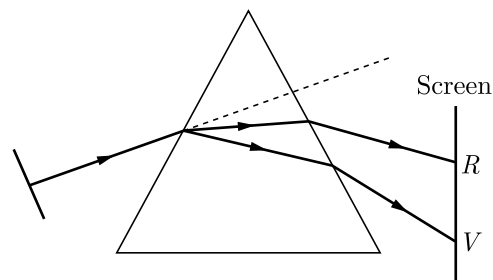
Ans :

OD 2013

- (i) Speed of light in a medium depends upon its wavelength. Light of red colour has longest wavelength while light of violet colour has the shortest wavelength. Therefore, different colours are refracted by different amounts. This is the reason when a ray of white light passes through a prism, splitting takes place.

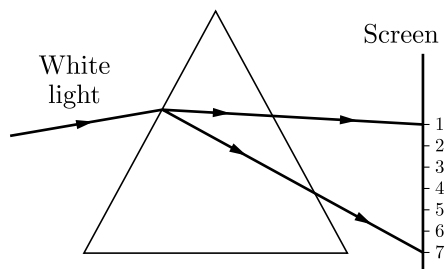
- (ii) Red, Orange, Yellow, Green, Blue, Indigo and Violet (VIBGYOR or ROYGBIV).

- (iii) Ray diagram :



100. A beam of white light falling on a glass prism gets split up into seven colours. A student makes the statement :

- The colour at positions marked 1 and 3 are similar to the colour of 'turmeric' and the colour of 'chilli powder' respectively. Is the above statement correct or incorrect ? Justify.
- Which two positions correspond to the colour of solution of copper sulphate and signal used to move the vehicles ?
- Light of colour of chilli powder bends the most while the light of colour of brinjal bends the least. Is the statement correct ? Justify.



Ans :

Delhi 2017

- Incorrect.  
 3 – Turmeric (Yellow)  
 1 – Chilli powder (Red)
- The colour of solution of copper sulphate is blue which is at position 5, while the signal used to move the vehicles is green in colour which is at position 4.

**62.** Which liquid fills the space behind the cornea ?

**Ans :** OD 2012  
Aqueous humour.

**63.** Which part of the eye controls the amount of light entering the eye ?

**Ans :** OD 2015  
The pupil.

**64.** What is eye lens made of ?

**Ans :** OD 2013  
It is made of a jelly like material.

**65.** How is the sense of vision carried from the eye to the brain ?

**Ans :** AI 2010  
Through the optic nerve.

**66.** A person is advised to wear spectacles with concave lenses. What type of defect of vision is he suffering from ?

**Ans :** OD 2016  
Myopia.

**67.** What is meant by least distance of distinct vision ?

**Ans :** OD 2019  
The minimum distance at which objects can be seen most distinctly without strain is called the least distance of distinct vision.

**68.** What kind of lens is used in the spectacles of a person suffering from myopia?

**Ans :** Foreign 2014  
Concave lens.

**69.** Name the component of eye that is responsible for the adjustment of eye lens ?

**Ans :** OD 2016  
Ciliary muscles.

**70.** A person suffering from an eye defect uses lenses of power 1 D. Name the defect he is suffering from and the nature of lens used.

**Ans :** Delhi 2013  
Defect – Hypermetropia.  
Nature of lens – Convex lens.

**71.** Name the defect of vision in which eye-lens loses its power of accommodation due to old age.

**Ans :** SQP 2010  
Presbyopia.

**72.** Name the process which is involved in the formation of a rainbow ?

**Ans :** Comp 2007  
Dispersion of light.

**73.** Atmospheric refraction causes advance sunrise and delayed sunset. By how much time is

(a) Sunrise advanced ?

(b) Sunset delayed.

**Ans :** AI 2012  
(a) Sunrise is advanced by about 2 minutes.  
(b) Sunset is delayed by about 2 minutes.

**74.** State one function of iris in human eye.

**Ans :** OD 2016  
It controls the size of the pupil.

**75.** What is the nature of the image formed on the retina?

**Ans :** Foreign 2014  
Real, inverted and same-sized.

**76.** What is meant by dispersion of light ?

**Ans :** Foreign 2010  
The splitting of light into its component colours is called dispersion of light.

**77.** Name the type of particles which acts as a prism in the formation of rainbow in the sky.

**Ans :** OD 2016  
Water droplets present in the atmosphere.

**78.** Which coloured component bends the least during the dispersion of white light through prism ?

**Ans :** Delhi 2013  
Red.

**79.** The ciliary muscles of a normal eye are in their :

(i) most relaxed,

(ii) most contracted state.

In which of the two cases is the focal length of the eye lens more ?

**Ans :** OD 2009  
The focal length of eye-lens is more when the ciliary muscles of a normal eye are in their most relaxed state.

**80.** Name the outermost layer of the eye. What is its function ?

**Ans :** Comp 2014  
Sclerotic. It protects and holds the eye.



**Ans :**

(d) Both Assertion and Reason are false.

Due to refraction of light through layers of air, sun is visible two minutes before actual sunrise and two minutes after actual sunset. Both assertion and reason are false.

- 26. Assertion :** The stars twinkle while the planet do not.

**Reason :** The stars are much lesser in size than the planets.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

As planets are of larger size than stars and much closer to the earth, planets can be considered as a collection of large number of point sized sources of light. The total variation in the amount of light entering our eye from all these individual point sized sources will average out to zero which nullify the twinkling effect of each other. Therefore, planets do not twinkle.

- 27. Assertion :** Blue colour of sky appears due to scattering of blue colour.

**Reason :** Blue colour has longest wave length in visible spectrum.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(c) Assertion is true but Reason is false.

During the day time, sky appears blue. This is because the size of the particles in the atmosphere is smaller than the wavelength of visible light, so they scatter the light of shorter wavelengths. The scatter blue light enters our eye.

- 28. Assertion :** The light of violet colour deviates the least and the light of red colour the most, while passing through a prism.

**Reason :** For a prism material, refractive index is highest for red light and lowest for the violet light.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(d) Assertion is false but Reason is true.

The light of violet colour deviates most and the light of red colour the least, while passing through a prism. For a prism material refractive index is highest for violet light and lowest for the red light.

- 29. Assertion :** Sunlight reaches us without dispersion in the form of white light and not as its components.

**Reason :** Dispersion takes place due to variation of refractive index for different wavelength but in vacuum the speed of light is independent of wavelength and hence vacuum is a non-dispersive medium.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

**Ans :**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

In vacuum speed of light is independent of wavelength, Hence, no dispersion takes places in vacuum. Thus, vacuum is a non-dispersive medium in which all colours travel with the same speed.

- 30. Assertion :** In case of rainbow, light at the inner surface of the water drop gets internally reflected.

**Reason :** The angle between the refracted ray and normal to the drop surface is greater than the critical angle.

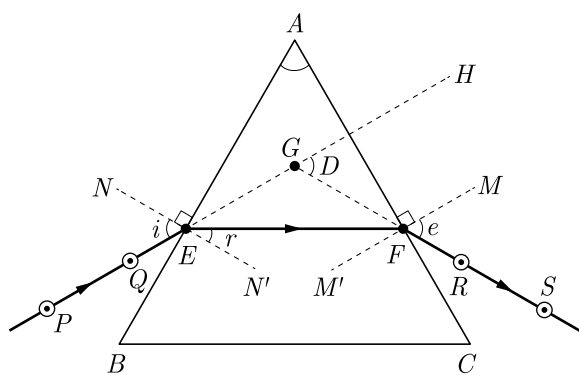
- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

(or different wavelengths) travel at the same speed in vacuum or air. However, they travel with different speeds in a refractive medium like glass. Violet coloured ray travels with least speed and red ray with maximum speed. Thus refractive index of glass for violet colour is maximum and that for red is minimum. As a result, the different coloured rays bend differently on entering glass. Violet ray is deviated the most and the red the least, giving rise to dispersion phenomenon.

91. Draw a neat diagram to show the refraction of a light ray through a glass prism and label on it the angle of incidence and angle of deviation.

Ans :

Comp 2011



$PE$  – Incident ray  $\angle i$  – Angle of incidence

$EF$  – Refracted ray  $\angle r$  – Angle of refraction

$FS$  – Emergent ray  $\angle e$  – Angle of emergence

$\angle A$  – Angle of the prism

$\angle D$  – Angle of deviation

92. What is angle of deviation ?

Ans :

Delhi 2016

When monochromatic ray is passed through prism it emerges finally towards the base of prism. The angle between direction of incident ray and direction of emergent ray is called angle of deviation.

93. Which component of white light deviates (i) the least and (ii) the most while passing through a glass prism? State the reason of this difference in deviation.

Ans :

AI 2011

(i) Least — Red.

(ii) Most — Violet.

**Reason :** Due to the variation in their wavelengths and difference in refractive indices of the media, the difference in deviation has taken place.

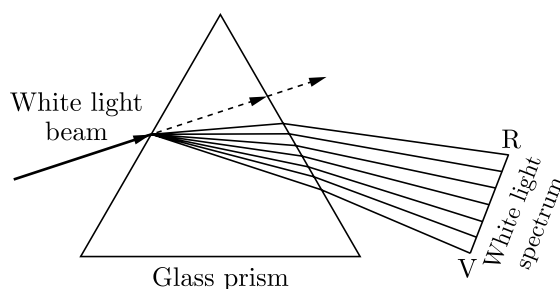
94. (i) What happens to a narrow beam of white light when it passes through a glass prism ?  
(ii) Draw a labelled diagram to illustrate it.

Ans :

OD 2014

- (i) When a narrow beam of white light passes through a glass prism, dispersion of white light takes place. White light splits into its seven constituent colours which is known as a spectrum.

- (ii) **Diagram :**

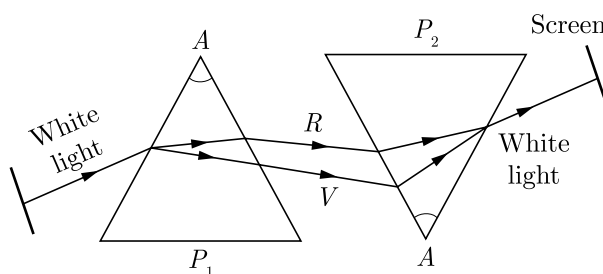


95. How did Newton show that white light of Sun contains seven colours using two prisms ? Draw a ray diagram when two prisms are arranged together.

Ans :

Delhi 2010

Newton placed two identical but inverted prisms together and passed a beam of white light through first prism. After emerging from the beam the white beam gave seven different colours. These colours when emerged after passing through the second (inverted) prism, got united to give single white beam of light.



96. (i) Why do parallel rays of different colours deviate differently while passing through a glass prism ?  
(ii) Name any two phenomena associated with the formation of rainbow.

Ans :

OD 2017

- (i) Parallel rays of different colours deviate differently while passing through a glass prism because angles of refraction of different colours are different.

43. Write the value of near point of distinct vision for normal eye.

Ans :

Comp 2014

25 cm

44. What is the range of vision of a normal human eye ?

Ans :

AI 2015

25 cm to infinity.

45. Name the condition of eye in which the person cannot see near and far objects clearly.

Ans :

SQP 2013

Presbyopia.

46. What is the focal length of the eye lens ?

Ans :

Delhi 2017

25 cm in relaxed state.

47. A man uses glasses of power 1 dioptre and cannot see clearly beyond 1 m. Name the defect of vision.

Ans :

SQP 2019

Myopia.

48. A person is advised to wear spectacles with convex lenses. State the defect of vision he is suffering from.

Ans :

Delhi 2011

Hypermetropia.

49. What is the angle between the two lateral faces of a prism called ?

Ans :

Comp 2015

The angle between the two lateral faces of a prism is called angle of the prism.

50. Why refractive index of glass is different with respect to different colours of light ?

Ans :

AI 2012

It is due to different velocities of components of light in glass.

51. Which light ray has the maximum velocity in glass ?

Ans :

Foreign 2010

Red.

52. Which light ray has the minimum velocity in glass ?

Ans :

Foreign 2016

Violet.

53. Define dispersion.

Ans :

Comp 2013

The splitting of white light into its seven constituent

colours, if white light is passed through prism is called dispersion.

54. What does VIBGYOR refer to ?

Ans :

AI 2009

VIBGYOR refers to  $V$  = Violet,  $I$  = Indigo,  $B$  = Blue,  $G$  = Green,  $Y$  = Yellow,  $O$  = Orange and  $R$  = Red.

55. What is angle of dispersion ?

Ans :

OD 2017

The angle between red light and violet light after dispersion by prism is called angle of dispersion.

56. Which light is deviated more red or violet ?

Ans :

Delhi 2014

Red light is deviated least and violet light is deviated more.

57. Which coloured component bends the least during the dispersion of the white light through prism ?

Ans :

Foreign 2011

Red.

58. Name the optical phenomenon due to which stars twinkle.

Ans :

Comp 2017

Atmospheric refraction of light.

59. When a light ray passes obliquely through the atmosphere in an upward direction, how does its path generally change ?

Ans :

Delhi 2010

The light ray will bend away from its normal direction.

60. How would the sky appear in the absence of earth's atmosphere ?

Ans :

OD 2006

Scattering by molecules of gases in atmosphere makes sky appear blue. In absence of atmosphere on earth, no scattering occurs. So, the sky appears black.

61. Name the essential parts of human eye.

Ans :

Delhi 2016

- (i) Cornea,
- (ii) Iris,
- (iii) Pupil,
- (iv) Eye lens,
- (v) Ciliary muscles,
- (vi) Retina.

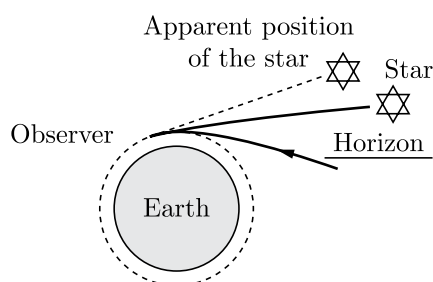
- (c) Incorrect. Violet bends the most and red bends the least.

**101.** A star appears on the horizon. What is the true position of the star ? Explain with the help of a diagram.

**Ans :**

OD 2019

True position of the star is below the horizon. Incident rays from star, travel through earth's atmosphere and reach observer's eye. These incident rays travel from rarer atmosphere to denser atmosphere and bend towards the normal. Thus, they appear to come from different position which is slightly upwards.



**102.** What is the scattering of light ? Explain with the help of an example.

**Ans :**

SQP 2016

The phenomenon of change in the direction of propagation of light caused by the large number of particles present in the atmosphere is called scattering of light.

Example : The path of a beam of light becomes visible through a colloidal solution due to scattering of light.

**103.** Why does the clear sky appear blue ?

or

Why does the colour of the sky appear blue ? Explain in brief.

or

Why does the sky looks blue on a clear sunny day ?

**Ans :**

SQP 2018

The molecules of air and other fine particles in the atmosphere have smaller size than the wavelength of visible light.

These are more effective in scattering light of shorter wavelengths at the blue end than the light of longer wavelength at the red end. Thus, the blue colour is due to the scattering of sunlight through fine particles in air.

**104.** Give reason :

- Danger signals are red.
- We cannot see an object clearly if it is placed very close to the eyes.

**Ans :**

Delhi 2016

- As red colour has the longest wavelength, it scatters the least. As a result, it reaches the eye easily. So, danger signals are made red in colour.
- The least distance of distinct vision is 25 cm. So, object kept closer to it can't be seen clearly.

**105.** Name the phenomenon associated with the following

- The sky appears blue.
- Formation of a rainbow in the sky.
- Twinkling of stars.

**Ans :**

Delhi 2010, 12

- Atmospheric refraction.
  - Scattering of blue colour. (Tyndall effect)
- Dispersion.
  - Internal reflection.
  - Refraction.
- Atmospheric refraction.
  - Change in the density of the atmosphere due to temperature and other conditions.

**106.** A person is not able to see distinctly the objects placed beyond 90 cm from him. Giving reasons to identify the defect in his eye. Determine the nature of lens used to correct this defect.

**Ans :**

OD 2016

It is because the image of a distant object is formed in front of the retina and not at the retina itself.

Defect in his eye is Myopia. Concave lens is used to bring the image back onto the retina and thus the defect is corrected.

**107.** A student sitting at the back seat of a class is not able to see what is written on the blackboard. He however, sees it clearly when sitting on the front seat at an approximate distance of 1.5 m from the blackboard. Draw ray diagrams to illustrate the image formation of the blackboard writing by his eye-lens when he is seated at the (i) back seat (ii) front seat.

**Ans :**

Foreign 2011, 18

He is suffering from Myopia.

- When he is seated at the back seat.

**TWO MARKS QUESTIONS**

81. What is meant by “far point of eye” ?

Ans :

Comp 2021

The maximum distance from the eye upto which the eye can see object clearly is called the far point of the eye. It is infinity for a normal eye.

82. What is meant by near point of a human eye ?

Ans :

OD 2011

By near point of a human eye, we mean the nearest position of an object from a human eye so that its sharp image is formed on the retina. It is 25 cm for a person with normal vision.

83. Why can a chicken see only in bright light ? Explain.

Ans :

Comp 2020

A chicken has mostly cone cells on the retina of its eye which respond to bright light. This is why a chicken can see only in bright light.

84. How do we see colours ?

Ans :

SQP 2021

There are rod and cone cells present on the retina. Among cone cells some respond to red colour, some blue colour and some green colour. Due to different colours of light these cells become active and help in perception of colours.

85. Write the role of the following parts of an eye :

- (a) Pupil,
- (b) Retina,
- (c) Optic nerve.

Ans :

SQP 2020

- (a) **Pupil** : The amount of light is controlled by the size of pupil. In dim light, it opens completely and in bright light, it becomes very small.
- (b) **Retina** : Retina is a light sensitive surface of the eye where the real image is formed.
- (c) **Optic nerve** : It carries the electrical signals from the light sensitive eye cells to the brain.

86. State in brief the functions of following parts of human eye :

- (a) Iris
- (b) Cornea
- (c) Ciliary muscles
- (d) Pupil.

Ans :

Delhi 2011

- (a) Iris : It controls the size of the pupil.

- (b) Cornea : It acts as protective layer against maximum refraction of light that enters in the eye.

- (c) Pupil : It regulates and controls the amount of light entering the eye.

- (d) Ciliary muscles : They help in adjusting the focal length of eye-lens.

87. Why does it take some time to see the objects in a dim-lit room when we enter the room from bright sunlight outside ?

or

Why does it take some time to see objects in a cinema hall when we just enter the hall from bright sunlight? Explain in brief.

Ans :

SQP 2016

In bright light, the size of the pupil is small to control the amount of light entering the eye.

When we enter a dim-lit room or a cinema hall, it takes some time so that the pupil expands and allows more light to enter the eye and thus helps to see things clearly.

88. (a) What is meant by least distance of distinct vision?

- (b) How does the thickness of the eye lens change when we shift looking from a distant tree to reading a book ?

Ans :

Delhi 2014

- (a) The minimum distance of object from the eye to see the image of object clearly is called least distance of a distinct vision. It is 25 cm for a healthy person.

- (b) Eye lens is comparatively thicker, while reading a book.

89. What is cataract ?

Ans :

OD 2017

Due to the development of membrane over the eye lens, the eye becomes ineffective or the image becomes hazy. This problem is called cataract.

90. What do you mean by dispersion of light ? What is its cause ?

Ans :

Foreign 2013

When a white light is passed through a glass prism, it splits into its seven constituent colours (VIBGYOR). This phenomenon is called dispersion.

**Cause of dispersion** : Light rays of different colours

all. In that case no light from the sky would have entered our eyes and the sky would have looked dark and black to us.

- 118.** A student uses spectacles of focal length  $-60$  cm. Name the defect of vision he is suffering from? Which lens is used for the correction of this defect? Compute the power of this lens.

**Ans :**

AI 2014

The student is suffering from myopia defect. A diverging lens is used for correction of this object.

Power of the lens,

$$P = \frac{1}{f(\text{in m})} = \frac{100}{f(\text{in m})} \\ = \frac{100}{(-60)} = -1.67 \text{ D}$$

- 119.** Draw a neat labelled diagram of human eye.

**Ans :**

SQP 2017

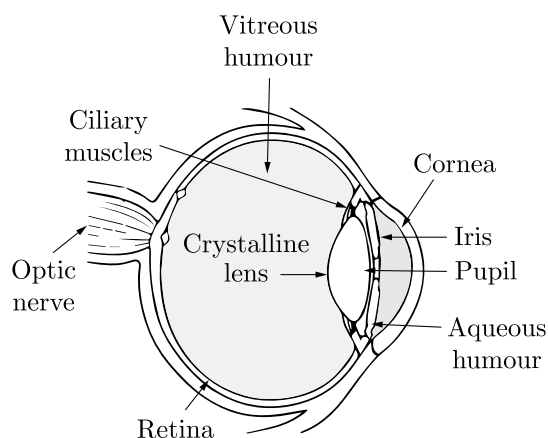


Figure: Human eye.

- 120.** Why does it takes sometime to see objects in a Cinema hall when we just enter the hall from bright sunlight? Explain.

**Ans :**

OD 2014

The pupil regulates and controls the amount of light entering the eye. In bright sunlight, the size of the pupil is small and when we enter the cinema hall it takes sometime for the pupil to expand in size due to dim light.

- 121.** The far point of a myopic person is  $80$  cm in front of the eyes. What is the nature and power of the lens required to enable him to see very distant objects clearly?

**Ans :**

Delhi 2016

For a myopic eye the correcting lens is concave.

Distance of far point,  $x = 80$  cm,  $P = ?$

For viewing distant objects, focal length of corrective lens.

$$f = -x = -80 \text{ cm}$$

Now power,

$$P = \frac{1}{f} = \frac{100}{f} \\ = \frac{100}{-80} = -1.25 \text{ D}$$

- 122.** A glass prism is able to produce a spectrum when white light passes through it but a glass slab does not produce any spectrum. Explain. Why it is so?

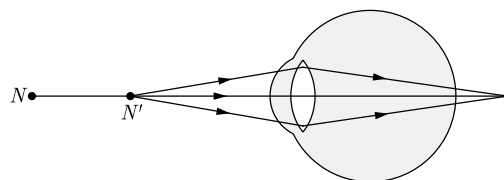
**Ans :**

OD 2011

When white light enters the glass slab, dispersion of light takes place. The angle of refraction for, violet colour is more than for red colour on entering the glass slab. But all colours of light return to the original direction of propagation while refraction from other side of the glass slab and thus white light emerges out of the glass slab. Hence, glass slab does not produce any spectrum.

## THREE MARKS QUESTIONS

- 123.** Study the diagram given below and answer the questions that follow :



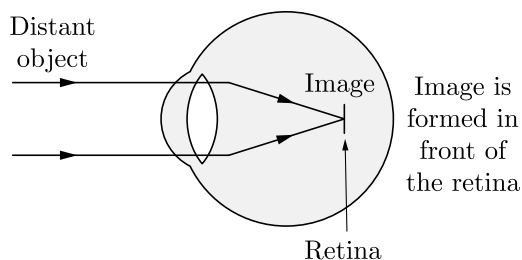
- Name the defect of vision represented in the diagram. Give reason for your answer.
- List two causes of this defect.
- With the help of a diagram show how this defect of vision is corrected.

**Ans :**

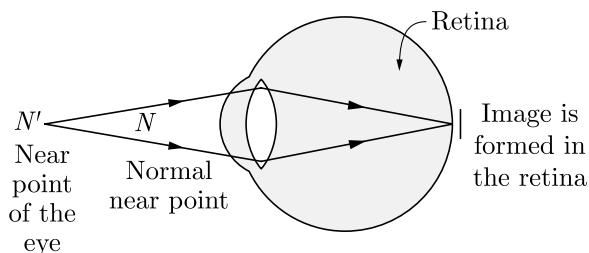
OD 2024

- Name of the defect is hyper-metropia because for point is situated at infinity but the near point has shifted away from  $D = 25$  cm.
- Causes of hypermetromia :
  - Focal length of eye lens is too long.
  - Eye ball has become too small.
- Convex lens of suitable focal length is required to correct this defect. Diagram for correction :





(ii) When he is seated at the front seat.



- 108.** Name the part of eye where images formed in a normal human eye. State how the image position changes in myopia and hypermetropia.

**Ans :**

OD 2016

Retina. Concave lens in myopia brings image back on retina, convex lens in hypermetropia brings image on retina.

- 109.** Why there is no dispersion of light refracted through a rectangular glass slab.

**Ans :**

OD 2017

After refraction at two parallel faces of a glass slab, a ray of light emerges in a direction parallel to the direction of incidence of white light. As rays of all colours emerge in the same direction i.e., the direction of the incidence of white light, there is no dispersion. However, there is lateral displacement.

- 110.** Why is it difficult to drive on a foggy day ?

**Ans :**

AI 2009

On a foggy day, most of the light gets scattered by the particles in the fog and the visibility reduces, so it is dangerous to drive on a foggy day.

- 111.** Mention the factor on which scattering of light depends. Why does the sky appear dark in space ?

**Ans :**

AI 2011

It depends on the presence of atmosphere containing smoke particles, tiny water droplets and suspended particles of dust and molecules of air. When a beam of light strikes such fine particles, the path of the beam becomes visible. It is because in space there are no air molecules to scatter light.

- 112.** How can change of size of eye-ball be one of the reason for :

- (a) Myopic  
(b) Hypermetropic eye ?

**Ans :**

Comp 2016

- (a) **Myopic Eye :** The eye ball is longer than normal, due to this the image formed by the eye lens lies in front of the retina.  
(b) **Hypermetropia eye :** The eye ball is shorter than normal, due to this the image formed by the eye lens lies behind the retina.

- 113.** What type of spectacles should be worn by a person having the defects of myopia as well as hypermetropia? How does it help ?

**Ans :**

OD 2013

A person suffering from myopic as well as hypermetropia uses spectacles having bi-focal lenses in which upper part consists of a concave lens (to correct myopia) used for distant vision and the lower part consists of a convex lens (to correct hypermetropia) used for reading purposes.

- 114.** Seema prefers to sit in the front row as she finds it difficult to read the black board from the last desk of her class room. State the defect of vision, she is suffering from. How is this defect corrected ?

**Ans :**

Delhi 2015

Seema is suffering from myopia. She must use concave lenses of appropriate power to correct the defect.

- 115.** No rainbow could be observed from the surface of the moon by the astronauts. Give reason.

**Ans :**

Foreign 2012

The moon does not have any blanket of air or atmosphere and consequently, in the absence of water droplets, no dispersion of sun rays is possible. Therefore, rainbow could not be observed from the surface of the moon by the astronauts.

- 116.** What is meant by near point and far point of an eye ? State their values of the normal human eye.

**Ans :**

OD 2010

The nearest point to the eye at which an object is visible distinctly is called the near point (25 cm). The maximum distance up-to which the normal eye can see things is called the far point (infinity).

- 117.** What would the sky look if the earth had no atmosphere ? Why ?

**Ans :**

OD 2016

If the earth had no atmosphere consisting of air, there would have been no scattering of sunlight at

- (a) (i) When a narrow beam monochromatic light passes through a glass slab, it deviates from the actual path but the direction of incident ray and the emergent ray are parallel to one another.
- (ii) Light passes through a glass prism, it deviates from the actual path but the direction of incident ray and the emergent ray of light are not parallel to each other.
- (b) (i) When a narrow beam of white light passes through a glass slab, the white light does not split it into its constituent colours. The direction of incident ray and the emergent ray of light is parallel to each other.
- (ii) When a narrow beam of white light passes through a glass prism, the white light splits into its constituents seven colours. The incident ray and the emergent ray of light is not parallel to each other.

**127.** Explain, how the power of accommodation of human eye is achieved.

**Ans :**

Delhi 2011

The eye lens of human eye is made up of a crystalline lens of variable focal length. The focal length of human eye can be changed by the action of ciliary muscles to form the images of the objects of different positions on the retina by relaxing the ciliary muscles for distant object and contracting the ciliary muscles for nearby object.

**128.** While sitting in the last row, a student has difficulty in reading the blackboard clearly. State the defect of vision the student is suffering from. Mention two causes of this defect. Suggest a suitable lens for the correction of this defect.

**Ans :**

SQP 2018

- (i) The student is suffering from myopia or short-sightedness.
- (ii) Causes of myopia :
- (a) The distance of the retina from the eye lens increases.
- (b) The focal length of eye lens becomes small.
- (iii) Correction of myopia : This defect can be corrected by using a concave lens of approximate focal length.
- 129.** A person suffering from short-sightedness can see clearly only upon a distance of 2 metres. Find the nature and power of the lens required to correct his vision.

**Ans :**

OD 2016

A concave lens can be used to correct the vision of a myopic person.

Given

Power of the correcting lens :

$$v = -2 \text{ m}$$

$$u = \infty$$

As we know that,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-2} - \frac{1}{\infty} = \frac{1}{f}$$

$$f = -2 \text{ m}$$

$$P = \frac{1}{f} = -\frac{1}{2} = -0.5 \text{ D}$$

**130.** A person cannot see clearly objects beyond a distance of 1.2m. Name the defect of vision he is suffering from. What would be the power of correcting lens used to restore proper vision ?

**Ans :**

OD 2019

Name of the defect of vision is myopia.

Given, Power of the correcting lens :

$$v = -1.2 \text{ m}; u = \infty$$

Using lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Substituting values of  $u$  and  $v$ ,

$$\frac{1}{-1.2} - \frac{1}{\infty} = \frac{1}{f}$$

$$f = -1.2 \text{ m}$$

$$P = \frac{1}{f} = \left( \frac{1}{-1.2} \right) \text{ D}$$

$$= -0.83 \text{ D}$$

**131.** A boy uses spectacles of focal length  $-60 \text{ cm}$ . Name the defect of vision he is suffering from. Which lens is used for the correction of this defect ? Compute the power of this lens.

**Ans :**

OD 2017

Myopia.

Concave lens.

As we know that ,

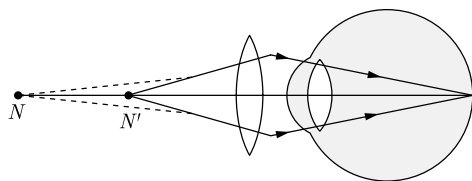
Power of lens is given by

$$P = \frac{1}{f}$$

Here,

$$f = 60 \text{ cm or } \frac{60}{100} \text{ m} = 0.6 \text{ m}$$

$$P = \left( \frac{1}{-0.6} \right) \text{ D}$$



124. (a) Ravi kept a book at a distance of 10 cm from the eyes of his friend Hari. Hari is not able to read anything written on the book. Explain why ?
- (b) A lens of focal length 5.0 cm is being used by a student in the laboratory as a magnifying glass. His least distance of distinct vision is 25 cm. What magnification is the student getting ?

Ans :

Comp 2021

- (a) Because least distance of distinct vision is 25 cm.

- (b)  $u = ?$ ,  $v = -25$  cm,  $f = 5$  cm

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

$$\frac{1}{u} = \frac{1}{-25} - \frac{1}{5} = \frac{-1-5}{25} = \frac{-6}{25}$$

$$u = \frac{-25}{6} \text{ cm}$$

$$m = \frac{v}{u} = \frac{-25 \times 6}{-25}$$

$$m = 6$$

125. Why is Tyndall effect shown by colloidal particles ? State four instances of observing the Tyndall effect.

Ans :

Comp 2020

Tyndall effect is shown by colloidal particles as they scatter light.

Scattering of light is the change in the direction of light on striking an obstacle (atom, molecule, dust particles, smoke, water droplets etc.). When a beam of light strikes such fine particles, the path of light becomes visible. The phenomenon of scattering of light by colloidal particles is Tyndall effect.

Four instances where we can observe Tyndall's effect are :

1. When a fine beam of sunlight enters a smoke filled room, smoke particles become visible due to scattering of light by these particles.
2. When sunlight passes through a canopy of a dense forest, tiny water droplets in the water scatter light.
3. Milk is a colloid that contains globules of fat and protein. When a beam of light is directed at a glass of milk the light is scattered. That is a great example of the Tyndall effect.

4. Blue colour of clear sky : The scattering of blue component of white an light by air molecules present in the atmosphere causes the blue colour of the sky.



126. Differentiate between a glass slab and a glass prism. What happens when a narrow beam of (a) a monochromatic light and (b) white light passes through (i) glass slab and (ii) glass prism ?

Ans :

Comp 2020

Differences between a glass slab and a glass prism.

	Glass Slab	Glass Prism
1.	A glass slab has six parallel refracting surfaces.	A glass prism has two triangular bases and three rectangular lateral surfaces. These surfaces are inclined to each other at some suitable angle, which is called angle of prism.
2.	The ray of light incident on one surface of the slab undergoes two refractions and emerges from the other surface of slab in a direction parallel to the incident ray, However, it is slightly displaced laterally.	The deviation of a ray on passing through a prism depends on angle of prism and angle of incidence of the ray one face of the prism.
3.	Slab does not split the incident white light into a band of colours.	Prism splits the incident white light into a band of colours.

(ii)

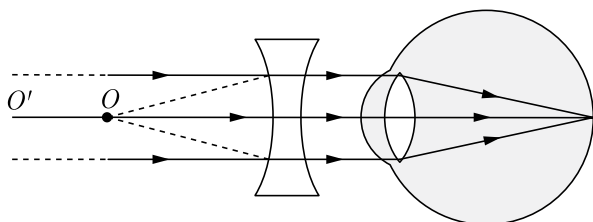
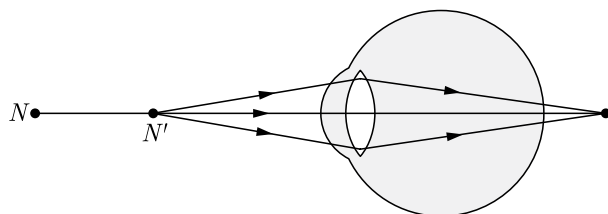


Figure: (b) Correction for myopia

- 137.** Study the diagram below and answer the following questions :

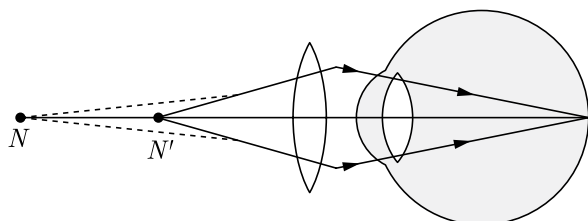


- Name the defect of vision depicted in the diagram.
- List two causes of the above defect.
- Draw a ray diagram for the correction of the above defect using an appropriate lens.

**Ans :**

Delhi 2017

- Name of the defect is hypermetropia.
- He is suffering from hyper-metropia. Convex lens of suitable focal length is required to correct this defect.  
Causes of hypermetromia :  
(a) Focal length of eye lens is too long.  
(b) Eye ball has become too small.
- Diagram for correction :



- 138.** The near point of a person suffering from hypermetropia is 75 cm. Calculate the focal length and power of the lens required to enable him to read the newspaper which is kept at 25 cm from the eye.

**Ans :**

SQP 2019

Given,  $u = -25 \text{ cm}$ ,  $v = -75 \text{ cm}$

As we know that,

$$\begin{aligned}\frac{1}{v} - \frac{1}{u} &= \frac{1}{f} \\ \left(\frac{-1}{75}\right) + \left(\frac{1}{25}\right) &= \frac{1}{f} \\ \frac{(-1+3)}{75} &= \frac{1}{f} \\ \frac{2}{75} &= \frac{1}{f} \\ f &= \frac{75}{2} = 37.5 \text{ cm} \\ \text{So, } P &= \left(\frac{1000}{375}\right) \\ &= 2.6 \text{ D}\end{aligned}$$

- 139.** (i) Least distance of distinct vision of a long-sighted person is 40 cm. He wishes to reduce it to 25 cm by using spectacles. Find the power and nature of the lens used by him.  
(ii) Draw a ray diagram to show the correction of the defect by using an appropriate lens.

**Ans :**

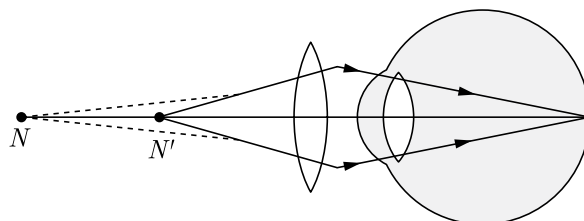
SQP 2016

(i) Given,  $u = -25 \text{ cm}$ ,  $v = -40 \text{ cm}$

As we know that,

$$\begin{aligned}\frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ &= \frac{1}{-40} - \frac{1}{-25} \\ &= \frac{1.5}{100} \\ f &= \frac{200}{3} \text{ cm} \\ \text{Power, } P &= \frac{1}{f} \\ &= \frac{100 \times 3}{200} = \frac{3}{2} = +1.5 \text{ D}\end{aligned}$$

(ii) Convex lens :



- 140.** Due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens a certain defect of vision arises. Write the name of this defect. Name the type of lens required by such persons to improve the vision. Explain the structure and function of such a lens.

$$P = \frac{1}{f}$$

$$= -\frac{10}{6} = \left(-\frac{5}{3}\right) \text{ D}$$

$$P = -1.66 \text{ D}$$

- 132.** A person wears spectacles of power  $-2.5 \text{ D}$ . Name the defect of vision he is suffering from. Draw the ray diagram for (i) the defective eye, (ii) its correction after using a suitable lens.

**Ans :**

OD 2011

Since power of lens is negative lens used is concave lens. The person is suffering from myopia or short-sightedness.

(i)

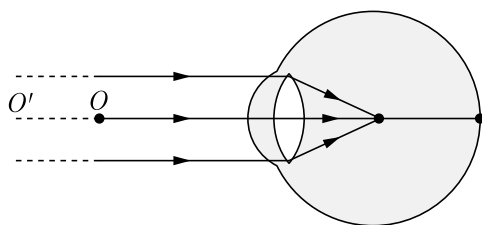


Figure: (a) Myopic eye

(ii)

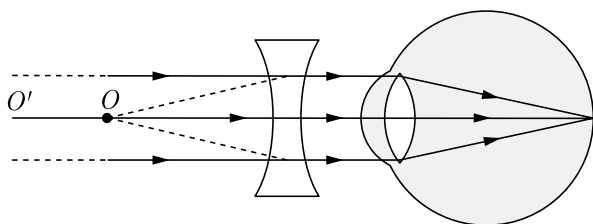


Figure: (b) Correction for myopia

- 133.** A person can read the number plate of a distant bus clearly but he finds difficulty in reading a book. What type of defect of vision he is suffering from? Name the type of lens he needs to correct this defect. Write the causes of this defect.

**Ans :**

Foreign 2015

- He is suffering from hyper-metropia.
- Convex lens of suitable focal length is required to correct this defect.
- Causes of hypermetropia :
  - (i) Focal length of eye lens is too long.
  - (ii) Eye ball has become too small.

- 134.** (a) State two main causes of developing far-sightedness.

(b) How can this defect of vision be corrected ?

**Ans :**

AI 2012

- (a) (i) The eye ball is too small.
- (ii) The focal length of eye lens is too large.
- (b) This eye defect is corrected by using a convex lens of suitable focal length.

- 135.** What are the causes of the following defects of vision and how can they be corrected ?

- (a) Cataract
- (b) Presbyopia.

**Ans :**

Comp 2014

- (a) Cataract : Sometimes the crystalline lens becomes milky and cloudy in old age. This causes partial or complete loss of eyesight.  
Correction : Through a cataract surgery.
- (b) Presbyopia : The power of accommodation of eye decreases with age. So, the near point reaches away. It is due to weakening of ciliary muscles and diminishing flexibility of the eye lens. In this defect a person may suffer from both myopia and hypermetropia.  
Correction : By wearing spectacles having bifocal lens.

- 136.** A child is able to read his book comfortably but is unable to read the matter written on the blackboard at certain distance.

- (a) Name the defect of vision he is suffering from.
- (b) With the help of labelled ray diagram show :
  - (i) The above mentioned defect of vision.
  - (ii) Correction of the above mentioned defect using a suitable lens.

**Ans :**

AI 2016

- (a) Myopia.
- (b) Since power of lens is negative lens used is concave lens. The person is suffering from myopia or short-sightedness.

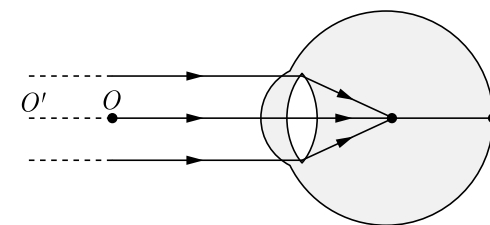


Figure: (a) Myopic eye

image distance is equal to distance from the centre of the eye lens to the retina.

144. State the cause of dispersion of white light by a glass prism. How did Newton using two identical glass prism, show that white light is made of seven colours ? Draw a ray diagram to show the path of a narrow beam of white light through a combination of two identical prisms arranged together in inverted position with respect to each other when it is allowed to fall obliquely on one of the faces of the first prism of the combination ?

Ans :

OD 2017

Light is formed of different colours which travel at their own speed inside a prism. The light bends through different angles with respect to the incident ray, as they pass through a prism. The red light bends the least while the violet the most causing dispersion.

Newton showed that the reverse of dispersion of light is also possible. He kept two prisms close to each other in erect position and the other in an inverted position. The light gets dispersed when passes through the first prism. The second prism receives all the seven coloured rays from first prism and combines into original white light. This proves that white light is made of seven colours.

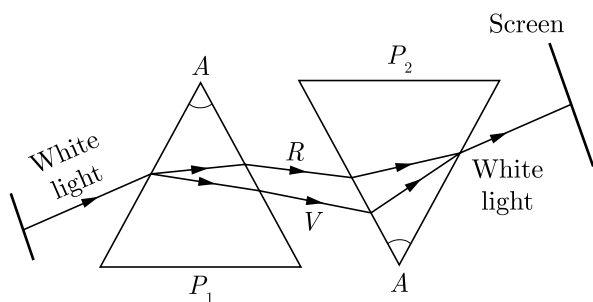


Figure: Recombination of the spectrum of white light.

145. What is dispersion of white light ? State its cause. Draw a ray diagram to show the dispersion of white light by a glass prism.

Ans :

OD 2014

**Dispersion of white light :** When a beam of white light is passed through a triangular glass prism, the white light splits up to form a band of seven colours on a white screen. This splitting of white light into seven colours on passing through a transparent medium like a glass prism is called dispersion of light.

The dispersion of white light occurs because the angle of refraction (or angle of deviation) of light of different colours is different when passing through the glass prism. So, when white light consisting of seven colours passes through a glass prism, each colour of it is refracted (or deviated) by a different angle with the result that seven colours are spread out to form a spectrum.

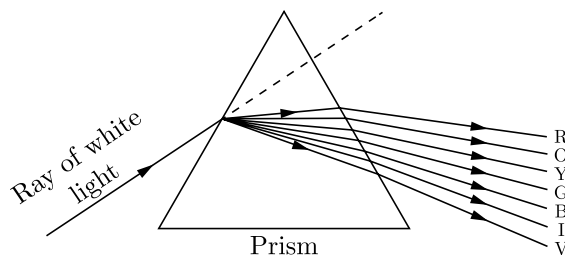


Figure: Dispersion of white light by a glass prism.

## FIVE MARKS QUESTIONS

146. Explain the common defects of eye, their causes and methods of correction.

Ans :

Comp 2021

The four most common types of defects of vision are :

- (a) **Myopia or near-sightedness :**

**Causes of myopia :** This defect arises due to either of the following two reasons :

- The distance of the retina from the eye lens increases.
- The focal length of eye lens becomes small.

**Correction of myopia :** This defect can be corrected by using a concave lens of approximate focal length.

- (b) **Hypermetropia or far-sightedness :**

**Causes of hypermetropia :** This defect arises due to either of the following two reasons :

- The distance of retina from the eye lens decreases.
- The focal length of the eye lens becomes large.

**Correction of hypermetropia :** This defect can be corrected by convex lens of appropriate power (or focal length).

- (c) **Presbyopia :**

**Causes of presbyopia :** This defect arises because the power of accommodation of the eye decreases due to the gradual weakening of the



**Ans :**

Comp 2017

The defect caused due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens is presbyopia.

The type of lens required by such person to improve the vision is bifocal lens.

A bifocal lens consists of both convex lens and concave lenses. The convex lens used in bi-focal lens is used to correct for hypermetropia and concave lens is used to correct myopia.

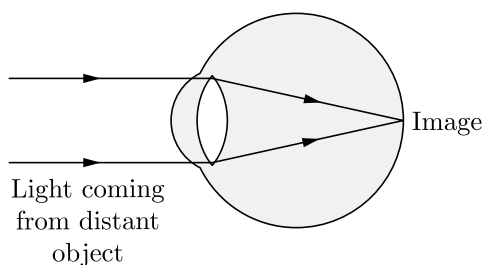
- 141.** With the help of ciliary muscles the human eye can change its curvature and thus alter the focal length of its lens. State the changes that occur in the curvature and focal length of the eye lens while viewing (i) a distance object, (ii) nearby object.

Explain, why a normal eye is not able to see distinctly the objects placed closer than 25 cm, without putting any strain on the eye.

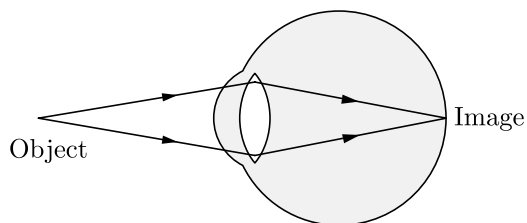
**Ans :**

OD 2017

- (i) When we see distant objects, the ciliary muscles relax to decrease the curvature and thereby increase the focal length of the lens. Hence, the lens becomes thin. This enables us to see the distant object clearly. Thus, the focal length of the eye lens increases while seeing distant objects.



- (ii) To see nearby objects clearly, the focal length of the lens should be shorter. For this, the ciliary muscles contract to increase the curvature and thereby decrease the focal length of the lens. Hence, the lens becomes thick. This enables you to see in nearby objects clearly.



A normal eye is not able to see distinctly the

objects placed closer than 25 cm, without putting any strain on the eye. This is because the ciliary muscles of eyes are unable to contract beyond a certain limit if the object are placed at a distance less than 25 cm from the eye, then the objects appear blurred because light rays coming from the object meet beyond the retina.

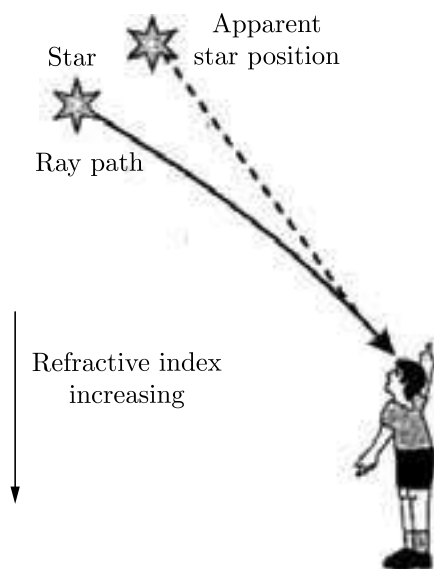
- 142.** The apparent altitude of stars appears to be generally more than their true altitudes. Explain, how.

**Ans :**

Delhi 2010

As we go up and up in earth's atmosphere, it goes on becoming rarer and more rarer. As a result, the atmospheric layer near the earth's surface has maximum refractive index and the refractive index gradually decreases with increase in height.

When light ray from a star enters into earth's atmosphere, it travels from rarer to denser medium and hence continues to bend towards the normal. As a result, an observer on earth consider the apparent position of star to be at a higher altitude as shown in Figure.



- 143.** Write about power of accommodation of human eye. Explain why the image distance in the eye does not change when we change the distance of an object from the eye ?

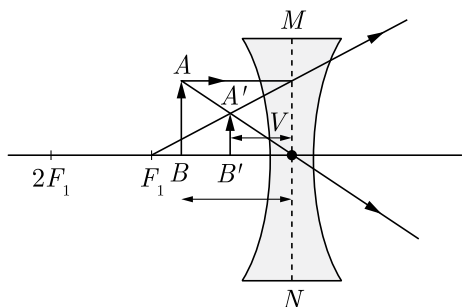
**Ans :**

Delhi 2017

The ability of the eye lens to adjust its focal length is called power of accommodation.

The focal length of the eye lens is adjusted so that the image distance does not change. Thus, the

(b)



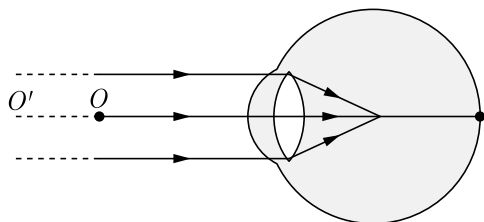
149. A student finds the writing on the blackboard as blurred and unclear when sitting on the last desk of the classroom. He however sees clearly when sitting on the front desk at an approximate distance 2 m from the blackboard.

- Draw the ray diagram to illustrate the formation of image of the blackboard writing by his eye lens when he sits at the :
  - last desk
  - front desk
- Name the defect of vision the student is suffering from. Also list two causes of this defect.
- Name the kind of lens that would enable him to see clearly when he is seated at the last desk. Draw the ray diagram to illustrate how this lens helps him to see clearly.

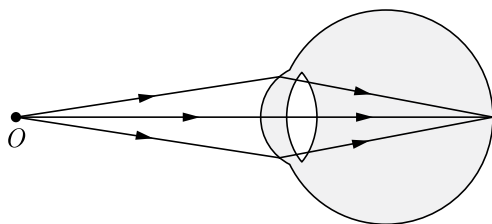
Ans :

Delhi 2016

- (i)



- (ii)

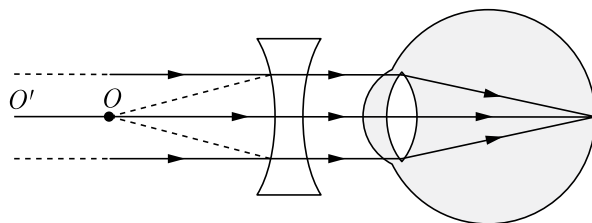


- The student is suffering from myopia.

**Causes :**

- Elongation of eye ball.
- Excessive curvature of cornea.

- Concave lens of suitable focal length can be used for correction.



150. A person cannot see the objects distinctly, when placed beyond 2 m.

- Identify the eye defect.
- Give two reasons for this defect.
- Calculate the power and nature of the lens he should be using to see the distant objects clearly.
- Draw the ray diagrams for the defective and the corrected eyes.

Ans :

OD 2011

- Myopia.

- Reasons for this defect :**

- Either the power of the eye; lens has become more than its normal value due to excessive curvature of the cornea, or
- Elongation of the eye ball due to some genetic defect.

- $P = \frac{1}{-2\text{ m}} = -0.5\text{ D}$

- Diagrams for the 'defective and the corrected eyes:

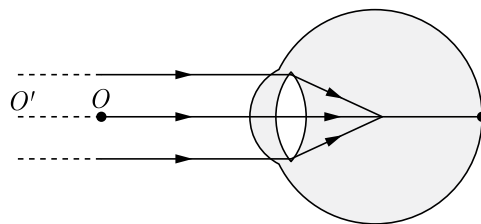


Figure: (a) Myopic eye

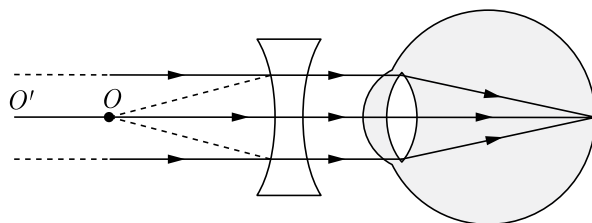


Figure: (b) Correction for myopia

ciliary muscles and diminishing of flexibility of the eye lens.

**Correction of presbyopia :** This defect can be corrected by using bi-focal lenses. Its lower part consists of a convex lens which is used for reading purposes, whereas the upper part consists of a concave lens which is used for distant vision.

(d) **Astigmatism :**

**Causes of astigmatism :** This defect is usually due to the cornea which is not perfectly spherical and has different curvatures for horizontally and vertically lying objects.

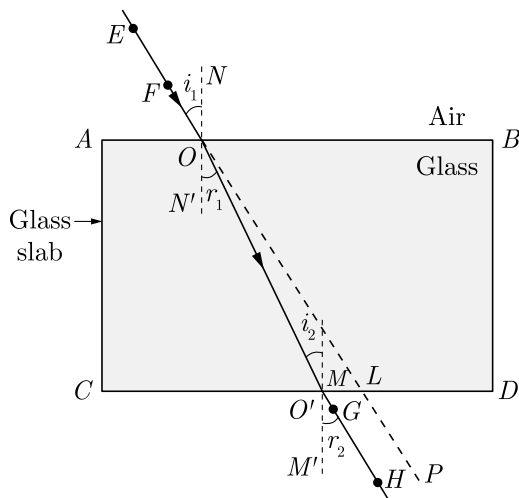
**Correction of astigmatism :** It can be corrected by using cylindrical lenses.

147. (a) Draw a labelled ray diagram to show the path of a ray of light incident obliquely on one face of a glass slab.
- (b) Calculate the refractive index of the material of a glass slab. Given that the speed of light through the glass slab is  $2 \times 10^8$  m/s and in air is  $3 \times 10^8$  m/s.
- (c) Calculate the focal length of a lens, if its power is  $-2.5$  D.

Ans :

Comp 2020

(a)



(b) Speed of light in glass slab

$$(V) = 2 \times 10^8 \text{ m/s}$$

Speed of light in air,

$$(c) = 3 \times 10^8 \text{ m/s}$$

Refractive index of glass,

$$(n) = ?$$

$$n = \frac{c}{v}$$

$$n = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

Hence, refractive index of material of glass slab is 1.5.

$$(c) \text{ Power, } P = -2.5 \text{ D}$$

Total length,  $f = ?$

$$P = \frac{1}{f}$$

$$f = \frac{1}{P} \text{ of } \frac{1}{-2.5} \text{ or } \frac{100 \text{ cm}}{-2.5}$$

$$= -40 \text{ cm or } -0.4 \text{ m}$$

The focal length of a lens of power  $-2.5$  D is  $-0.4$  m or  $-40$  cm.

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148. (a) A person suffering from myopia (near sightedness) was advised to wear corrective lens of power  $-2.5$  D. A spherical lens of same focal length was taken in the laboratory. At what distance should a student place an object from this lens so that it forms an image at a distance of  $10$  cm from the lens ?

- (b) Draw a ray diagram to show the position and nature of the image formed in the above case.

Ans :

Comp 2020

$$(a) \quad P = -2.5 \text{ D}$$

$$f = ?$$

$$P = \frac{1}{f}$$

or

$$f = \frac{1}{P} = \frac{1}{-2.5 \text{ D}}$$

$$= -0.4 \text{ m or } -40 \text{ cm}$$

$$f = -40 \text{ cm}$$

$$v = -10 \text{ cm}$$

$$u = ?$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

$$= \frac{1}{-10} - \frac{1}{-40}$$

$$= \frac{1}{-10} + \frac{1}{40}$$

$$= \frac{-4 + 1}{40} = \frac{-3}{40}$$

$$u = \frac{-40}{3} \text{ or } -13.33 \text{ cm}$$

The object should be placed  $-13.33$  cm from the lens so that it forms an image at a distance of  $10$  cm from the lens.

(b) Given  $u = -\infty$ ,  $v = -5$  m

$$\begin{aligned}\frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ &= \frac{1}{-5} - \frac{1}{-\infty} \\ &= \frac{1}{-5} - 0 \\ f &= -5 \text{ m} \\ P &= \frac{1}{f} \\ &= \frac{1}{-5} = 0.2 \text{ D}\end{aligned}$$

154. What is atmospheric refraction? Use this phenomenon to explain the following natural events :

- (a) Twinkling of stars,  
(b) Advanced sun-rise and delayed sun-set.

Draw diagrams to illustrate your answers.

Ans :

OD 2016

**Atmospheric Refraction :** The refraction of light caused by the earth's atmosphere (having air layers of varying optical densities) is called atmospheric refraction.

- (a) **Twinkling of Stars :** Atmospheric pressure keeps on decreasing considerably with altitude. As layers of atmosphere are optically rarer than lower layers. The rays of light suffer refraction at each layer of atmosphere and bend slightly. Thus, each ray of light from the star follows a curved path to reach the observer. As can be seen in the figure the ray of light from a star at  $X$  appears to come from a star at  $X'$ .

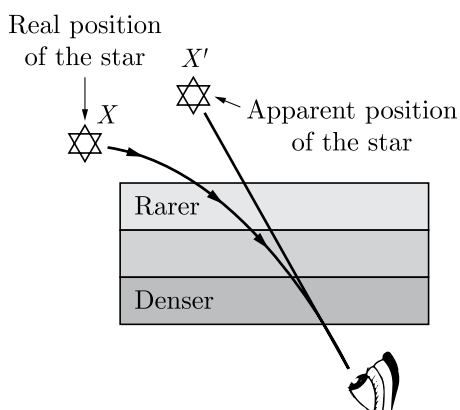


Figure: Stars appear higher as a result, they twinkle in the sky and twinkling.

Thus the star appears to be higher in the sky. Due to wind and convection currents, density of atmospheric layers keep on changing. So, the position of star keeps on fluctuating

from its mean position. This fluctuating image of the star makes it appear as twinkling to the observer.

- (b) **Advance Sunrise and Delayed Sunset :** Sun is visible before the actual sunrise and after the actual sunset, air near the earth is optically denser than that at higher altitude. The sun rays, thus while travelling to reach the surface of the earth, suffer refraction at each layer travelling from a rarer to a denser medium. So, due to these bent rays, the sun appears higher in the horizon than it actually is as shown in figure. Therefore the sun becomes visible about 2 minutes before its actual sunrise and remains visible for about 2 minutes after its actual sunset.

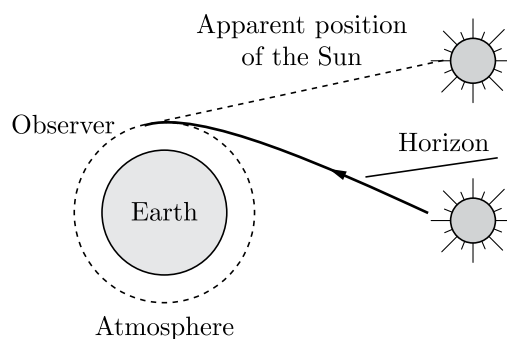


Figure: Atmospheric refraction effects at sunrise and sunset.

155. (a) What is meant by dispersion of white light ? Describe the formation of rainbow in the sky with the help of a diagram.  
(b) What is hypermetropia ? Draw ray diagrams to show the image formation of an object by :  
(i) Hypermetropic eye.  
(ii) Correction made with a suitable lens for hypermetropic eye.

Ans :

OD 2019

- (a) **Dispersion :** The process of splitting of white light into its seven constituent colours is called as dispersion.

The band of seven colours formed on a screen due to the dispersion of white light is called spectrum of visible light or spectrum of white light.

**Rainbow :** The rainbow is the spectrum of sun light in nature. When the atmosphere is moisture laden heavily (at time of rain), spherical water droplets act as prism and refract the sunlight to lead to the formation of rainbow.

Parallel beams of light coming from sun get dispersed at the first surface of water

droplet, suffer total internal reflection at the second surface to produce a cone of rays at the observer's eye. The rainbow therefore appears as an arc of circle for an observer on earth.

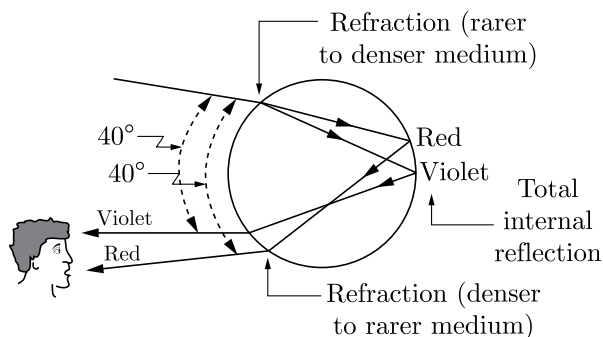


Figure: Refraction of sunlight by a spherical raindrop leading to the formation of the rainbow.

- (b) **Hypermetropia or long sightedness :** It is the defect of human eye in which a person can see clearly objects at large distances from it, but cannot see nearby objects clearly.

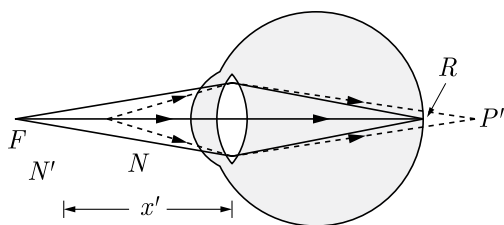


Figure: (a) Hypermetropic Eye [Blurred image of object at  $N$  (near point) sharp image of object at  $M$ ]

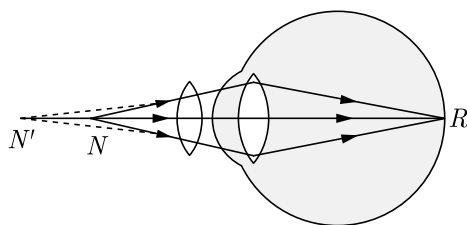


Figure: (b) Corrected Hypermetropic Eye (Sharp image of object at  $N$ )

**Correction :** It is corrected by using spectacles having convex lens, which converges and shifts the image to retina from beyond.

A person suffering from both myopia

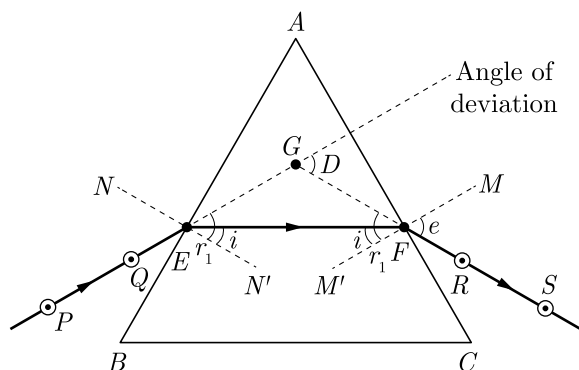
and hypermetropia has to wear spectacles for correction having bifocal lenses. The upper half is a concave lens for distant vision and lower half is a convex lens for reading.

156. (i) Draw a ray diagram to explain the term angle of deviation.  
 (ii) Why do the component colours of incident white light split into a spectrum while passing through a glass prism, explain.  
 (iii) Draw a labelled ray diagram to show the formation of a rainbow.

Ans :

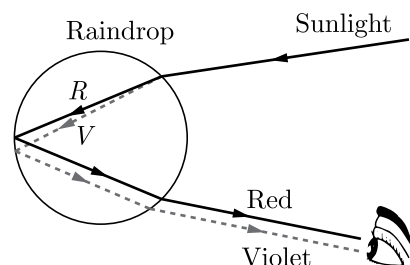
Delhi 2015

- (i) Emergent ray bends at an angle to the direction of the incident ray and the angle of between them is known as angle of deviation.



- (ii) The splitting of the light ray occurs because of the different angles of bending of each colour. Hence, each colour passing through the prism bends at different angles with respect to the incident beam. This gives rise to the formation of the colour spectrum.

- (iii) **Rainbow formation :**



157. A student finds the writing on the black board as blurred and unclear when sitting on the last desk on a classroom. He however, sees it clearly when sitting on the front desk at an approximate distance of 2 m from the black board.

- (a) Draw ray diagram to illustrate the formation of image of the black board writing by his eye-lens

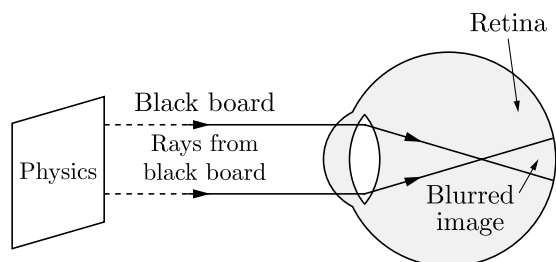
when he is seated at the (i) last desk, (ii) front desk.

- (b) Name the kind of lens that would help him to see clearly even when he is seated at the last desk. Draw a ray diagram to illustrate how this lens helps him to see clearly.

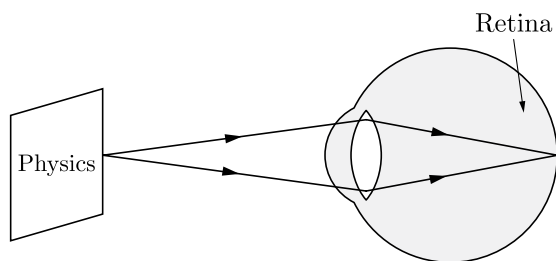
Ans :

Foreign 2014

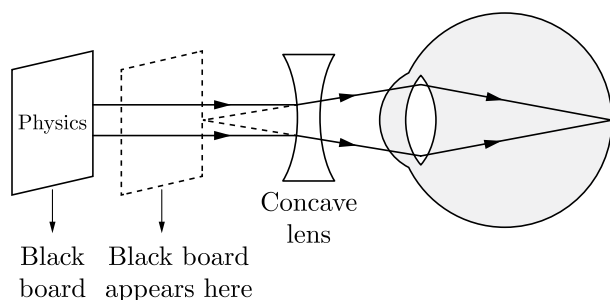
- (a) (i) Formation of image of the black board writing by the eye-lens of the student sitting at the last desk is shown in Figure.



- (ii) Formation of image of the black board writing by the eye-lens of the student sitting at the front-desk is shown in Figure.

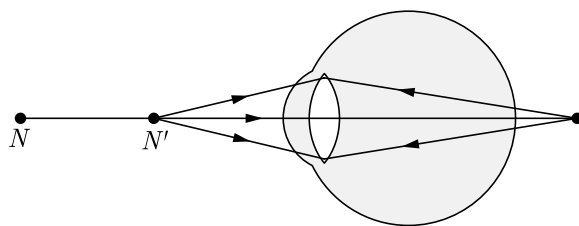


- (b) Student is suffering from Myopia, so his eye defect can be corrected by using a concave lens as shown in Figure.



## CASE BASED QUESTIONS

158. A person is suffering from hypermetropia (long sightedness). It is a defect in which a human eye can see far off object clearly, but is unable to see nearby object distinctly. The near point of the person is 1.5 m. Assume that the near point of the normal eye is 25 cm.



- What type of lens should be used in his spectacles?
- What should be the focal length of the lens he used ?
- What will be the power of the lens ?
- Write one possible cause of this defect.

Ans :

- (i) Convex lens is to be used in his spectacles.

- (ii) Here,

$$d = 150 \text{ cm}$$

$$D = 25 \text{ cm}$$

$$v = -150 \text{ cm}$$

$$u = -25 \text{ cm}$$

Using lens formula,

$$\begin{aligned} \frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ &= \frac{1}{-150 \text{ cm}} - \frac{1}{-25 \text{ cm}} \\ &= \frac{-1 + 6}{150 \text{ cm}} = \frac{5}{150 \text{ cm}} \end{aligned}$$

$$\text{or } f = 30 \text{ cm}$$

- (iii) Power of the lens,

$$P = \frac{100}{f} D = \frac{100}{30} D = 3.3 \text{ D}$$

- (iv) Increase in focal length of the eye lens, when the eye is fully relaxed is the cause of hypermetropia.

159. A near sighted person wears eye glass with power of  $-5.0 \text{ D}$  for distant vision. Soon, he started having difficulties in viewing nearby objects also. His doctor prescribes a correction of  $+1.5 \text{ D}$  in near vision section of his bi-focal, which is measured relative to main part of the lens.



- (i) Find the focal length of his distant viewing part of lens.
- (ii) Find the focal length of near vision section of the lens.
- (iii) What type of lens is to be used in this spectacles for near vision ?
- (iv) What is the reason of hypermetropia ?

**Ans :**

- (i) Given,

$$\text{Power} = -5.0 \text{ D}$$

$$\begin{aligned}\text{Focal length} &= \frac{1 \text{ m}}{P} \\ &= \frac{100 \text{ cm}}{-5.0} = -20 \text{ cm}\end{aligned}$$

- (ii) Here, power of the lens suggested by doctor for correction is +1.5 D.

$$\text{Focal length} = \frac{1 \text{ m}}{P} = \frac{100 \text{ cm}}{-1.5} = 66.7 \text{ cm}$$

- (iii) Convex lens

- (iv) Reason of hypermetropia are :

- (a) Decrease in length of the eye ball.
- (b) Increase in focal length of the eye lens.

- 160.** White light is a mixture of seven colours i.e., violet, indigo, blue, green, yellow, orange and red. Every colour has its own characteristic wavelength. Different colours with their wavelengths are given below in the table.

S. No.	Colour	Wavelength
1.	Red	7900 Å
2.	Orange	6000 Å
3.	Yellow	5800 Å
4.	Green	5400 Å
5.	Blue	4800 Å
6.	Indigo	4500 Å
7.	Violet	4000 Å

The phenomenon of splitting white light into seven colours when it passes through a glass prism is called dispersion of white light.

- (i) Name the phenomenon occurring in nature due to dispersion of light.
- (ii) Light of two colours 'A' and 'B' pass through a glass prism. 'A' deviates more than 'B' from its path of incidence. Which colour has a higher speed in the prism ?
- (iii) On which factor speed of light depends ?

**Ans :**

- (i) Rainbow
- (ii) Colour 'B' has higher speed than that of colour 'A'.
- (iii) wavelength

- 161.** The lens of the eye does little of the bending of the light rays. Most of the refraction is done at the front surface of the cornea which also acts as a protective covering. The lens acts as a fine adjustment for focussing at different distances. This is accomplished by the ciliary muscle, which change the curvature of the lens so that its focal length is changed. To focus on a distant object, the muscles are relaxed and the lens is thin and parallel rays focus at the focal point (on the retina). To focus on a nearby object, the muscles contract, causing the centre of the lens to be thicker, thus shortening the focal length so that images of nearby objects can be focused on the retina, behind the focal point. This focusing adjustment is called accommodation.

The closest distance at which the eye can focus clearly is called the near point of the eye. A given person's far point is the farthest distance at which an object can be seen clearly. To check your own near point, place this book close to your eye and slowly move it away until the type is sharp.

A large part of the population have eyes that do not accommodate within the normal range of 25 cm to infinity, or have some other defect. Two common defects are near-sightedness and far-sightedness. Both can be corrected to a large extent with lenses—either eyeglasses or contact lenses.

- (i) The ciliary muscle muscles of a normal eye are in their (i). most relaxed (ii). most contracted state. In which of the two cases is the focal length of the eye-lens more ?
- (ii) What is persistence of vision ?
- (iii) What is the least distinct of vision of young man?

**Ans :**

- (i) In most relaxed state
- (ii) The impression or sensation of the image remains on the retina for about  $1/16^{\text{th}}$  of a second. It is called persisence of vision.
- (iii) 25 cm

- 162.** Newton found that when a beam of white light passes through a prism it is spread out by the prism into a band of all the colours of the rainbow from red to violet. The band of colours is called a spectrum and the separation of the colours by the prism is

known as dispersion. He concluded that white light is a mixture of light of various colours and identified red, orange, yellow, green, blue, indigo and violet.

All colours of light travel at the same speed in a vacuum. When they enter a transparent substance like glass, they all slow down but by different amounts. Because they slow down, they are refracted but because they slow down by different amounts, different colours are refracted through different angles.

- Where in nature can you find evidence that white sunlight may be made of different colours?
- When a monochromatic light passes through a prism, will it show dispersion?

**Ans :**

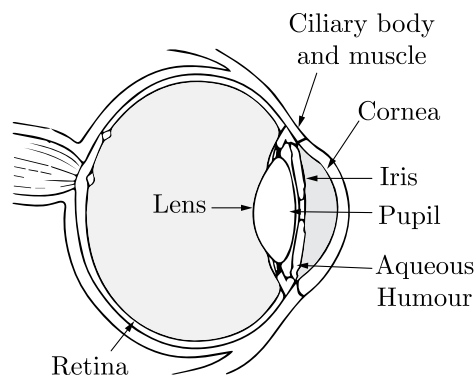
- Formation of rainbow in the sky
- No, it will not show any dispersion but will show deviation.

**163.** The ciliary muscle muscles of eye control the curvature of the lens in the eye and hence can alter the effective focal length of the system. When the muscles are fully relaxed, the focal length is maximum. When the muscles are strained the curvature of lens increases (that means radius of curvature decreases) and focal length decreases. For a clear vision the image must be on retina. The image distance is therefore fixed for clear vision and it equals the distance of retina from eye-lens. It is about 2.5 cm for a grown-up person.

A person can theoretically have clear vision of objects situated at any large distance from the eye. The smallest distance at which a person can clearly see is related to minimum possible focal length, The ciliary muscles are most strained in this position. For an average grown-up person minimum distance of object should be around 25 cm.

A person suffering for eye defects uses spectacles (Eye glass). The function of lens of spectacles is to form the image of the objects within the range in which person can see clearly. The image of the spectacle-lens becomes object for eye-lens and whose image is formed on retina.

The number of spectacle-lens used for the remedy of eye defect is decided by the power of the lens required and the number of spectacle-lens is equal to the numerical value of the power of lens with sign. For example power of lens required is +3D (converging lens of focal length 100/3 cm) then number of lens will be +3.



For all the calculations required you can use the lens formula and lens maker's formula. Assume that the eye lens is equiconvex lens. Neglect the distance between eye lens and the spectacle lens.

- What do you mean by the ciliary muscles ?
- What is the minimum focal length of eye lens of a normal person ?
- What is the maximum focal length of eye lens of normal person ?
- A near-sighted man can clearly see object only up-to a distance of 100 cm and not beyond this. What is the number of the spectacles lens necessary for the remedy of this defect ?

**Ans :**

- The muscles which are used to the change in the focal length of eye lens by changing radii of curvature is known ciliary muscle muscles.
- 25/11 cm
- 2.5 cm
- As we know that

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

Here  $v = 2.5$  (Distance of retina as positions of image is fixed)

$$u = -x$$

$$\frac{1}{f} = \frac{1}{2.5} + \frac{1}{x}$$

For  $f_{\min}$  :  $x$  is minimum,

$$\frac{1}{f_{\min}} = \frac{1}{2.5} + \frac{1}{25}$$

For  $f_{\max}$  :  $x$  is maximum,

$$\frac{1}{f_{\max}} = \frac{1}{2.5} + \frac{1}{\infty}$$

For near sighted man lens should make the image of the object within 100 cm range

For lens  $u = -\infty$

$$v = -100$$

$$\frac{1}{f_{\text{lens}}} = \frac{1}{-100} - \frac{1}{-\infty}$$

- 164.** The human eye is like a camera. Its lens system forms an image on a light-sensitive screen called the retina. Light enters the eye through a thin membrane called the cornea. It forms the transparent bulge on the front surface of the eyeball as shown in the figure. The crystalline lens merely provides the finer adjustment of focal length required to focus objects at different distances on the retina. We find a structure called iris behind the cornea. Iris is a dark muscular diaphragm that controls the size of the pupil. The pupil regulates and controls the amount of light entering the eye.

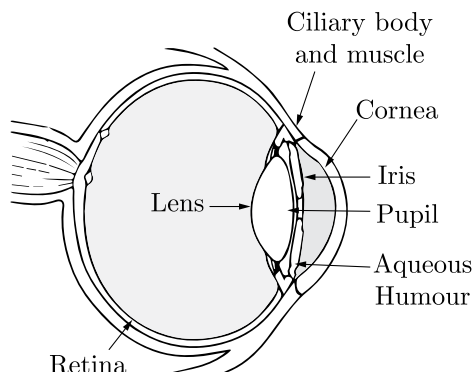


Figure: The Human Eye

There are mainly three common refractive defects of vision. These are (i) myopia or near-sightedness, (ii) hypermetropia or far-sightedness, and (iii) Presbyopia. These defects can be corrected by the use of suitable spherical lenses.

- (i) What is the function of pupil in the human eye ?
- (ii) What is the far point and near point of human eye with normal vision ?
- (iii) A student has difficulty reading the blackboard while sitting in the last row. What could be the defect the child is suffering from ?
- (iv) What is the function of iris in human eye ?

**Ans :**

- (i) The pupil regulates and controls the amount of light.
- (ii) The far point is infinity and near point is about 25 cm of the normal human eye.
- (iii) The student is suffering from short-sightedness or myopia.
- (iv) Iris is a dark muscular diaphragm that controls the size of the pupil.

# CHAPTER 11

## Electricity

### 1. ELECTRIC CURRENT AND CIRCUIT

It is the rate of flow of electric charge through a conductor. It is also defined as the time ratio of flow of electric charges through a conductor.

Electric current,  $I = \frac{\text{Charge flowing } (Q)}{\text{Time } (t)}$

The SI unit of electric current is ampere ( $A$ ). The current flowing through a conductor is said to be 1 ampere, if the rate of flow of electric charge through it is 1 coulomb per second.

The direction of flow of current is taken to be the direction of flow of positive charge. In other words, the direction of conventional current  $I$  is taken to be opposite to the direction of flow of electrons. An electric current, a scalar quantity, is measured by an ammeter. An ammeter is an instrument always connected in series with the conducting circuit current flowing through which is to be measured.

An electric circuit is a closed, continuous and conducting path which has a source of electricity, some circuit elements or load and a switch or a key. When the switch is ON (key is plugged), then an electric current flows through the circuit and the circuit is said to be a closed circuit. On the other hand, when the switch is OFF (key is unplugged), then no electric current flows through the circuit and the circuit is said to be an open circuit.

### 2. ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE

An electric potential is the amount of work required to move a unit from a reference point to a specific point inside the field without producing an acceleration.

Potential difference between two points in an electric circuit is the amount of work done for moving a unit positive charge from one point to another. If  $W_{AB}$  is the work done to move  $+Q$  charge from point  $A$  to point  $B$  in an electric circuit, then Potential difference between these two points,

$$V = V_A - V_B = \frac{W_{AB}}{Q}$$

The SI unit of potential difference is volt ( $V$ ). Potential difference between two points is said to be 1 volt if a work of 1 joule is to be done to move 1 coulomb of charge between these two points.

- For maintaining a flow of electric charge, i.e., flow of current through a conductor, a potential difference must be maintained between its ends. Positive charge (or conventional current) flows from higher potential to lower potential.
- A cell or a battery is used to maintain potential difference needed for current flow in a circuit. A cell maintains a constant potential difference between its terminals because of chemical reactions taking place within the cell.
- Potential difference between two points is measured by voltmeter. A voltmeter is an instrument connected in parallel, across those two points of an electric circuit between which potential difference is to be measured.

In circuit diagram of an electric circuit different components of the circuit are represented by specific symbols.

### 3. OHM'S LAW

According to Ohm's law, at constant temperature, the potential difference ( $V$ ) across the conductor in an electric circuit is directly proportional to the electric current ( $I$ ) flowing through it.

So,  $V \propto I$  or  $V = RI$

where  $R$  is a constant known as the resistance of the conductor.

### 4. RESISTANCE

It is the property of the conductor due to which it resists the flow of electric current through it. The resistance  $R$  of a conductor is the ratio of potential difference  $V$  across its ends to the current  $I$  flowing through it.

Hence,  $R = \frac{V}{I}$

- The SI unit of resistance is ohm ( $\Omega$ ). Resistance of a conductor is said to be  $1\Omega$ , if, on applying a potential difference of 1 V across its ends, a current of 1 A flows through it.
- A conductor, which allows an electric current to flow through it but offers some resistance for the flow, is called a resistor. A resistor, which obeys Ohm's law, is termed as an ohmic resistor. Wires of pure metals and their alloys are ohmic resistors.

#### 4.1 Factors on which the resistance of a Conductor Depends

At a given temperature, the resistance of a conductor is directly proportional to its length and inversely proportional to its cross-section area, i.e.,  $R \propto l$  or  $R \propto \frac{1}{A}$  or  $R = \rho \frac{l}{A}$ .

Where  $\rho$  (rho) is a constant of proportionality and known as the resistivity of the material of the material of the conductor.

Resistivity of a substance is the characteristic property of its material, on which the resistance of a substance depends. If length,  $l = 1\text{ m}$  and area of cross-section  $A = 1\text{ m}^2$ , then

$$R = \frac{\rho \times 1}{1} = \rho$$

Thus, resistivity of the material of a conducting substance is mathematically defined as the resistance offered by the substance of that material having unit length and a unit area of cross-section.

The resistance of a conductor and the resistivity of the material of a conductor increase on increasing its temperature.

### 5. COMBINATION OF RESISTANCES

There are two methods of connecting the resistors together which are as given below.

#### 5.1 Series Combination of Resistors

When two or more resistors  $R_1, R_2, R_3, \dots$  are joined in series, same current  $I$  flows through all the resistors in the circuit.

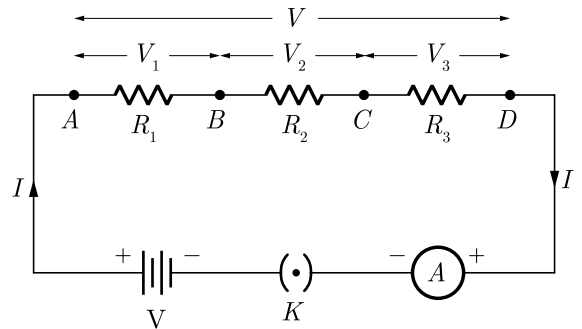
The total potential difference across the combination is equal to the sum of potential differences across individual resistors, i.e.,

$$V = V_1 + V_2 + V_3 + \dots$$

The equivalent resistance  $R_s$  of a series combination is equal to sum of individual resistances,

i.e.,

$$R_s = R_1 + R_2 + R_3 + \dots$$



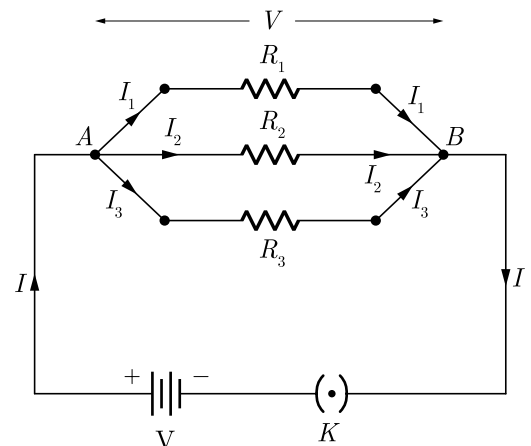
In a series combination (arrangement), the equivalent resistance is greater than even the highest individual resistor.

#### 5.2 Parallel Combination of resistors

When two or more resistors  $R_1, R_2, R_3, \dots$  are joined in parallel, potential difference  $V$  across each resistor is exactly same as the potential difference across the combination.

The total current passing through the parallel combination is equal to the sum of individual currents passing through various resistors, i.e.,

$$I = I_1 + I_2 + I_3 + \dots$$



In a parallel arrangement, the reciprocal of equivalent resistance  $R_p$  is equal to the sum of reciprocal of individual resistances, i.e.,

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

In a parallel arrangement, the equivalent resistance is less than even the least individual resistor.

Generally, parallel grouping of resistances is preferred in our household electric circuit where all the appliances are connected in parallel because

equivalent resistance in parallel arrangement is reduced and we can draw more current from the electric supply. Each appliance will draw current as per its need and separate ON or OFF switch can be used in it.

## 6. HEATING EFFECT OF ELECTRIC CURRENT

When an electric current flows through a resistive circuit, heat is produced in the resistor. The phenomenon involved is known as the heating effect of electric current.

If, on applying a potential difference  $V$  across the ends of a resistor  $R$ , a current  $I$  flows in the circuit for time  $t$ , then

Amount of heat produced in joule,

$$H = VIt = I^2 R t = \frac{V^2}{R} t$$

Hence, heat produced is (a) directly proportional to the square of electric current, i.e.,  $H \propto I^2$ , (b) directly proportional to resistance of a conductor, i.e.,  $H \propto R$ , and (c) directly proportional to time for which current flows, i.e.,  $H \propto t$ .

### 6.1 Practical Applications of Heating Effect of Electric Current

Heating effect of electric current is most commonly observed in electric iron, electric toaster, electric oven, electric heater, etc.

Electric fuse and filament of electric bulb are also based on heating effect of electric current.

## 7. ELECTRIC POWER

Power in an electric circuit is the rate at which the electrical energy is being dissipated in the electric circuit.

So, electric power,  $P = VI = I^2 R = \frac{V^2}{R}$

The SI unit of electric power is watt.

$$1 \text{ watt} = 1 \text{ volt} \times 1 \text{ ampere}$$

The electrical energy consumed in a circuit is general measure in 'kilowatt hour' (kWh) units.

Energy consumed (in kWh)

$$= \frac{\text{Power } P \text{ (in watts)} \times \text{time } t \text{ (in hours)}}{1000}$$

Here,  $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$

## OBJECTIVE QUESTIONS

1. State whether the currents and potential difference in all the bulbs will be same or different when in a circuit three bulbs of :

- (a) same wattage are connected in series.
- (b) same wattage are connected in parallel.
- (c) different wattage are connected in series.
- (d) different wattage are connected in parallel.

Ans :

OD 2024

- (a) All the three bulbs have same current and same potential difference.
- (b) All the three bulbs have same current and same potential difference.
- (c) All the three bulbs have same current but different potential differences.
- (d) All the three bulbs have different currents but same potential difference.

2. When a 4 V battery is connected across an unknown resistor, there is a current of 100 mA in the circuit. The value of the resistance of the resistor is

- (a)  $4 \Omega$
- (b)  $40 \Omega$
- (c)  $400 \Omega$
- (d)  $0.4 \Omega$

Ans :

Delhi 2020

Given,

$$\text{Voltage} = 4 \text{ V}$$

$$I = 100 \text{ mA} = 100 \times 10^{-3} \text{ A} = 0.1 \text{ A}$$

According to ohm's law,

$$R = \frac{V}{I} = \frac{4}{0.1} = 40 \Omega$$

Thus (b) is correct option.

3. **Assertion :** A fuse wire is always connected in parallel with the mainline.

**Reason :** If a current larger than the specified value flows through the circuit, fuse wire melts.

- (a) Both Assertion and Reason are true and Reason is correct explanation of the assertion.
- (b) Both Assertion and Reason are true but Reason is not the correct explanation of the assertion.
- (c) Assertion is true but Reason is false.
- (d) Assertion is false but Reason is true.

Ans :

OD 2020

A fuse wire is connected in series with main line so that if current over flow it may disconnect the line. Thus (d) is correct option.

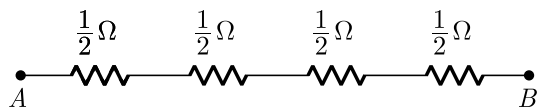
4. The maximum resistance which can be made using four resistors each of resistance  $\frac{1}{2} \Omega$  is :

- (a)  $2 \Omega$  (b)  $1 \Omega$   
(c)  $2.5 \Omega$  (d)  $8 \Omega$

Ans :

OD 2020

To get the maximum resistance, all the resistance are connected in series.



$$R_{eq} = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$$

$$= \frac{1+1+1+1}{2} = \frac{4}{2} = 2 \Omega$$

Thus (a) is correct option.

5. **Assertion :** Alloys are commonly used in electrical heating devices like electric iron and heater.

**Reason :** Resistivity of an alloy is generally higher than that of its constituent metals but the alloys have low melting points than their constituent metals.

- (a) Both Assertion and Reason are true and Reason is correct explanation of the assertion.  
(b) Both Assertion and Reason are true but Reason is not the correct explanation of the assertion.  
(c) Assertion is true but Reason is false.  
(d) Assertion is false but Reason is true.

Ans :

OD 2020

Melting point of an alloy is higher than melting points of their constituent metals.

Thus (a) is correct option.

6. At the time of short circuit, the electric current in the circuit :

- (a) vary continuously  
(b) does not change  
(c) reduces substantially  
(d) increases heavily

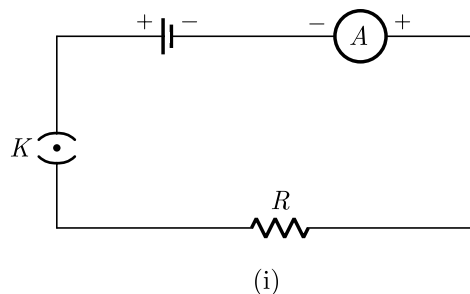
Ans :

Delhi 2020

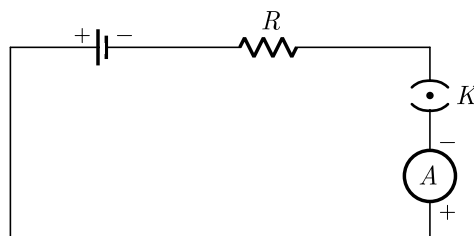
A short circuit occurs when the current in the circuit rises rapidly and the electrical connection draws an excessive amount of current from the supply.

Thus (d) is correct option.

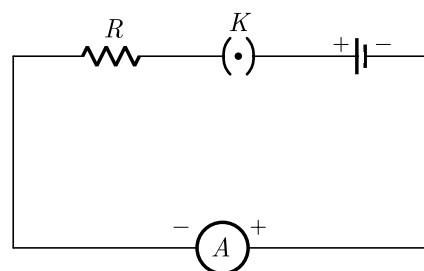
1. A cell, a resistor, a key and ammeter are arranged as shown in the circuit diagrams of Figure. The current recorded in the ammeter will be



(i)



(ii)



(iii)

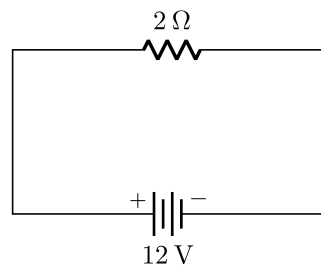
- (a) maximum in (i)  
(b) maximum in (ii)  
(c) maximum in (iii)  
(d) the same in all the cases

Ans :

Delhi 2019

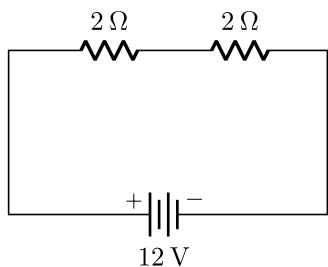
(d) the same in all the cases

2. In the following circuits (Figure), heat produced in the resistor or combination of resistors connected to a 12 V battery will be

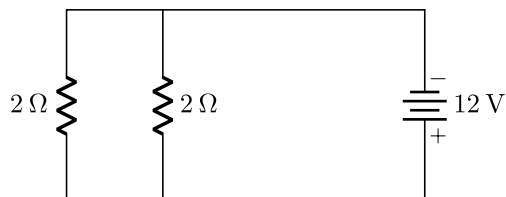


(i)

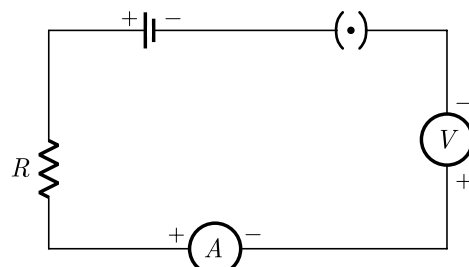




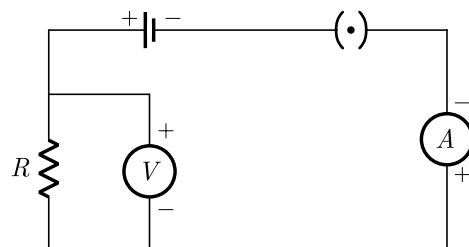
(ii)



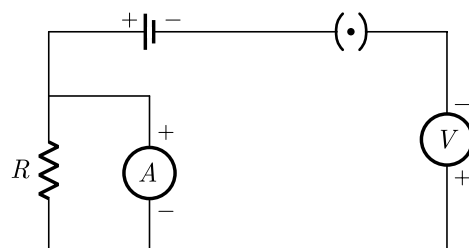
(iii)



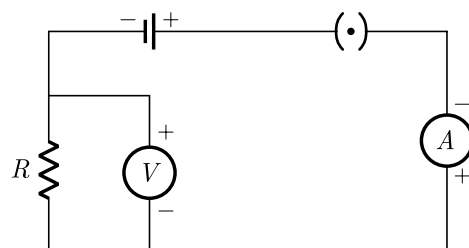
(i)



(ii)



(iii)



(iv)

- (a) same in all the cases  
 (b) minimum in case (i)  
 (c) maximum in case (ii)  
 (d) maximum in case (iii)

Ans :

OD 2010, Delhi 2014

- (d) maximum in case (iii)

3. Electrical resistivity of a given metallic wire depends upon

- (a) its length  
 (b) its thickness  
 (c) its shape  
 (d) nature of the material

Ans :

OD 2014, SQP 2014

- (d) nature of the material

4. A current of 1 A is drawn by a filament of an electric bulb. Number of electrons passing through a cross section of the filament in 16 seconds would be roughly

- (a)  $10^{20}$  (b)  $10^{16}$   
 (c)  $10^{18}$  (d)  $10^{23}$

Ans :

- (a)  $10^{20}$

5. Identify the circuit (Figure) in which the electrical components have been properly connected.

- (a) (i) (b) (ii)  
 (c) (iii) (d) (iv)

Ans :

- (b) (ii)

6. What is the maximum resistance which can be made using five resistors each of  $1/5 \Omega$ ?

- (a)  $1/5 \Omega$  (b)  $10 \Omega$   
 (c)  $5 \Omega$  (d)  $1 \Omega$

Ans :

(d)  $1\ \Omega$ 

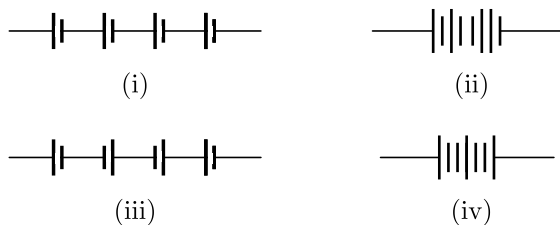
7. What is the minimum resistance which can be made using five resistors each  $1/5\ \Omega$  ?

(a)  $1/5\ \Omega$  (b)  $1/25\ \Omega$   
(c)  $1/10\ \Omega$  (d)  $25\ \Omega$

Ans :

(b)  $1/25\ \Omega$ 

8. The proper representation of series combination of cells (Figure) obtaining maximum potential is



(a) (i) (b) (ii)  
(c) (iii) (d) (iv)

Ans :

(a) (i)

9. Which of the following represents voltage ?

(a)  $\frac{\text{Work done}}{\text{Current} \times \text{Time}}$   
(b) Work done  $\times$  Charge  
(c)  $\frac{\text{Work done} \times \text{Time}}{\text{Current}}$   
(d) Work done  $\times$  Charge  $\times$  Time

Ans :

(a)  $\frac{\text{Work done}}{\text{Current} \times \text{Time}}$ 

10. A cylindrical conductor of length  $l$  and uniform area of cross-section  $A$  has resistance  $R$ . Another conductor of length  $2l$  and resistance  $R$  of the same material has area of cross section

(a)  $A/2$  (b)  $3A/2$   
(c)  $2A$  (d)  $3A$

Ans :

OD 2020

As we know that,

$$\text{Resistance, } R = \rho \frac{l}{A} \quad \dots(1)$$

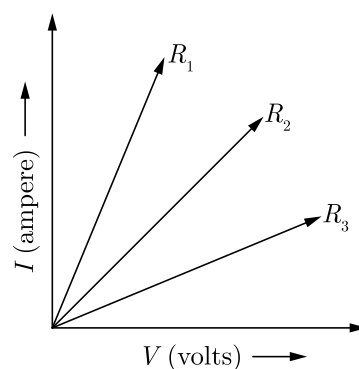
Now according to the question

New length of the wire,  $l' = 2l$ New resistance  $R' = R$ Now,  $R' = \frac{\rho(2l)}{A'}$ Since  $R' = R$ ,  $\frac{\rho(2l)}{A'} = \frac{\rho l}{A}$ 

$$A' = 2A$$

Thus (c) is correct option.

11. A student carries out an experiment and plots the  $V$ - $I$  graph of three samples of nichrome wire with resistances  $R_1$ ,  $R_2$  and  $R_3$  respectively (Figure). Which of the following is true ?



(a)  $R_1 = R_2 = R_3$  (b)  $R_1 > R_2 > R_3$   
(c)  $R_3 > R_2 > R_1$  (d)  $R_2 > R_3 > R_1$

Ans :

(c)  $R_3 > R_2 > R_1$ 

12. If the current  $I$  through a resistor is increased by 100% (assume that temperature remains unchanged), the increase in power dissipated will be

(a) 100% (b) 200%  
(c) 300% (d) 400%

Ans :

(c) 300%

13. The resistivity does not change if

(a) the material is changed  
(b) the temperature is changed  
(c) the shape of the resistor is changed  
(d) both material and temperature are changed

Ans :

(c) the shape of the resistor is changed

14. In an electrical circuit three incandescent bulbs A, B and C of rating 40 W, 60 W and 100 W respectively are connected in parallel to an electric

source. Which of the following is likely to happen regarding their brightness?

- (a) Brightness of all the bulbs will be the same
- (b) Brightness of bulb A will be the maximum
- (c) Brightness of bulb B will be more than that of A
- (d) Brightness of bulb C will be less than that of B

**Ans :**

- (c) Brightness of bulb B will be more than that of A

- 15.** In an electrical circuit two resistors of  $2\Omega$  and  $4\Omega$  respectively are connected in series to a  $6\text{ V}$  battery. The heat dissipated by the  $4\Omega$  resistor in  $5\text{ s}$  will be

- (a)  $5\text{ J}$  (b)  $10\text{ J}$
- (c)  $20\text{ J}$  (d)  $30\text{ J}$

**Ans :**

- (c)  $20\text{ J}$

- 16.** An electric kettle consumes  $1\text{ kW}$  of electric power when operated at  $220\text{ V}$ . A fuse wire of what rating must be used for it?

- (a)  $1\text{ A}$  (b)  $2\text{ A}$
- (c)  $4\text{ A}$  (d)  $5\text{ A}$

**Ans :**

OD 2014, Delhi 2012

- (d)  $5\text{ A}$

- 17.** Two resistors of resistance  $2\Omega$  and  $4\Omega$  when connected to a battery will have

- (a) same current flowing through them when connected in parallel
- (b) same current flowing through them when connected in series
- (c) same potential difference across them when connected in series
- (d) different potential difference across them when connected in parallel

**Ans :**

- (b) same current flowing through them when connected in series.

- 18.** Two bulbs of  $100\text{ W}$  and  $40\text{ W}$  are connected in series. The current through the  $100\text{ W}$  bulb is  $1\text{ A}$ . The current through the  $40\text{ W}$  bulb will be :

- (a)  $0.4\text{ A}$  (b)  $0.6\text{ A}$
- (c)  $0.8\text{ A}$  (d)  $1\text{ A}$

**Ans :**

OD 2020

In the series combination same current will flow in the both bulb. Hence current through the  $40\text{ watt}$  bulb will be  $1\text{ A}$ .

Thus (d) is correct option.

- 19.** Unit of electric power may also be expressed as

- (a) volt ampere (b) kilowatt hour
- (c) watt second (d) joule second

**Ans :**

OD 2020

$$\text{Power} = \text{voltage} \times \text{current}$$

SI unit of voltage is volt and SI unit of current is ampere, Hence the SI unit of power may also be expressed as volt-ampere.

Thus (a) is correct option.

- 20.** Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Ohm	(p)	$\frac{\rho L}{A}$
(B)	Resistance	(q)	$\frac{1\text{ volt}}{1\text{ ampere}}$
(C)	Resistivity	(r)	zero resistance
(D)	Super conductor	(s)	ohm-meter

	A	B	C	D
(a)	q	r	p	s
(b)	q	p	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

**Ans :**

- (b) A-q, B-p, C-s, D-r

- 21.** Match the column I to column II and select the correct answer using the codes given below:

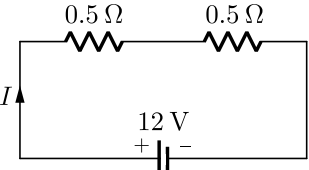
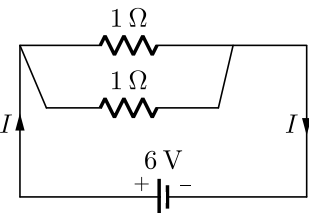
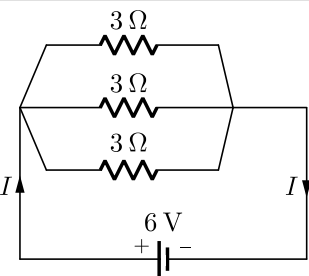
	Column I		Column II
(A)	Ohm's Law	(p)	Direct proportional to area
(B)	Resistivity	(q)	Voltage $\propto$ current
(C)	For Ohmic-conductor	(r)	$\frac{\text{charge}}{\text{time}}$
(D)	Electric current	(s)	$V = IR$

	A	B	C	D
(a)	q, s	p	q, s	D
(b)	p, q	q, s	r	q, r
(c)	p, s	q	r, s, t	r
(d)	p	q, r	r	r, s

Ans :

(a) A-q, s, B-p, C-q, s D-r

22. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)		(p)	$R_{eq} = 1 \Omega$ , $I = 12 \text{ A}$
(B)		(q)	$\infty$ Length
(C)	Resistance	(r)	$R_{eq} = 1 \Omega$ , $I = 6 \text{ A}$
(D)		(s)	$\propto \frac{1}{\text{Area}}$

	A	B	C	D
(a)	p	p	s, q	r
(b)	p, q	q, s	r	q, r
(c)	p	p	s, q	r
(d)	s, r	r	p, q	r, s

Ans :

(a) A-p, B-p, C-s, q, D-r

23. Match the column I to column II and select the correct answer using the codes given below:

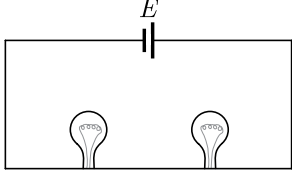
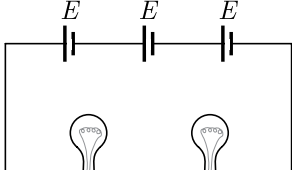
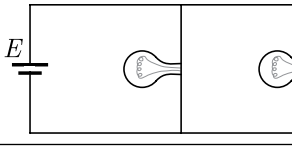
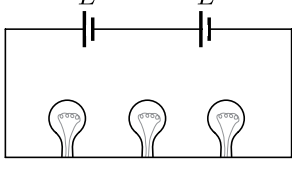
	Column I		Column II
(A)	Ohm	(p)	1 Volt/1 Amp
(B)	Current	(q)	Depends on matter of conductor
(C)	Resistivity	(r)	$\frac{\text{charge}}{\text{time}}$
(D)	Super conductor	(s)	$\frac{\text{Resistance}}{\text{Zero}}$

	A	B	C	D
(a)	p, r	p	r, s,	r
(b)	p	q, r	q	s
(c)	s, q	p, s	r	q
(d)	s, r	r	p, q	r, s

Ans :

(b) A-p, B-q, r, C-q, D-s

24. For the circuit shown in the adjoining figure, match the entries of column I with the entries of column II.

	Column I		Column II
(A)		(p)	Current drawn from the battery is maximum
(B)		(q)	Current drawn from the battery is the least
(C)		(r)	Bulbs will lit the brightest
(D)		(s)	Bulbs will lit with brightness lying between maximum and minimum value

	A	B	C	D
(a)	q	r	p, s	s
(b)	p, q	q, s	r	q, r
(c)	s, r	r	p, q	r, s
(d)	p	p	s, q	r

**Ans :**

(a) A-q, B-r, C-p, s, D-s

- 25. Assertion :** The connecting wires are made of copper.

**Reason :** The electrical conductivity of copper is high.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Copper conducts the current without offering much resistance due to high electrical conductivity.

- 26. Assertion :** When the length of a wire is doubled, then its resistance also gets doubled.

**Reason :** The resistance of a wire is directly proportional to its length.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

The resistance of wire,

$$R = \rho \frac{l}{A}$$

i.e.  $R \propto l$

Since, the resistance of a wire is directly proportional to its length, i.e. when the length of a wire is doubled/halved then its resistance also gets doubled/halved.

- 27. Assertion :** The 200 W bulbs glow with more brightness than 100 W bulbs.

**Reason :** A 100 W bulb has more resistance than 200 W bulb.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

$$\text{The resistance, } R = \frac{V^2}{P}$$

$$R \propto \frac{1}{P}$$

i.e. Higher the wattage of a bulb, lesser is the resistance and so it will glow bright.

- 28. Assertion :** Heater wire must have high resistance will be melting point.

**Reason :** If resistance is high, the electric conductivity will be less.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Heater wire must have high resistance and high melting point, because in series current remains same, therefore according to Joule's law,  $H = I^2 R t$ , heat produced is high if  $R$  is high melting point must be high, so that wire may not melt with increase in temperature.

$$\text{Energy} = P \times t = 440t \quad \dots(1)$$

Mass of water,  $m = 1 \text{ kg}$

Change in temperature,

$$\Delta t = (70 - 20)^\circ\text{C} = 50^\circ\text{C}$$

Heat energy,  $Q = ms \Delta t$

$$= 1 \times 4186 \times 50$$

$$= 209300 \text{ Joule} \quad \dots(2)$$

From (1) and (2), we get :

$$440t = 209300$$

$$t = \frac{209300}{440} = 475.6 \text{ s}$$

- 248.** State Joules law of heating. List two special characteristics of a heating element wire.

An electric iron consumes energy at the rate of 880 W when heating is at the maximum rate and 440 W when the heating is at the minimum rate. The applied voltage is 220 V. Calculate the current and resistance in each case.

**Ans :**

Foreign 2017

**Joules law :** In accordance with Joules law of heating, if a current  $I$  flows through a resistor of resistance  $R$  for a time  $t$ , then the heat produced across the resistor is

$$H = I^2 R t \text{ Joules}$$

**Two characteristics are :**

- It must not melt at high temperature.
- It has high resistivity.

Maximum power,  $P_{\max} = 880 \text{ W}$

Minimum power,  $P_{\min} = 440 \text{ W}$

Voltage,  $V = 220 \text{ V}$

Current,  $I = ?$

Resistance,  $R = ?$

$$\text{Net Power} = P_{\max} - P_{\min} = VI$$

$$880 - 440 = 220 \times I$$

$$440 = 220 \times I$$

$$I = 2 \text{ A}$$

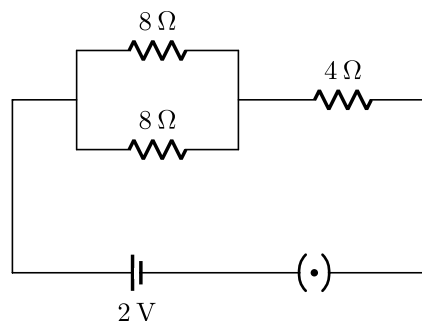
$$V = IR$$

$$220 = 2 \times R$$

$$R = 110 \Omega$$

- 249.** Study the given electric circuit and calculate :

- the current flowing through the  $4 \Omega$  resistor and
- potential difference across the combination of two resistor of  $8 \Omega$  each.



**Ans :**

Delhi 2017

- (i) As we know that,

$$V = IR$$

$$2\text{V} = I \times 4 \Omega$$

$$I = 0.5 \text{ A}$$

- (ii) Two  $8 \Omega$  resistors are in parallel, so then equivalent resistance.

$$\frac{1}{R_{\text{eq}}} = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} \Omega = \frac{1}{4} \Omega$$

$$R_{\text{eq}} = 4 \Omega$$

Now, two  $4 \Omega$  resistors are in series.

So, total resistance,

$$R_{\text{Total}} = 4 \Omega + 4 \Omega = 8 \Omega$$

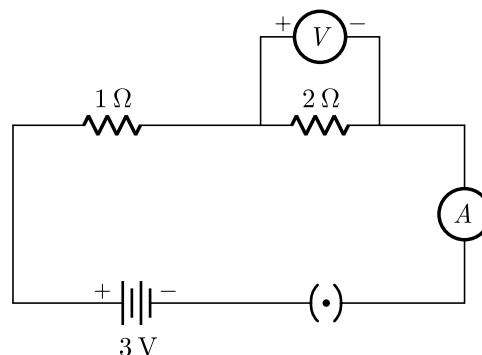
Total current,

$$I_{\text{Total}} = \frac{V}{R} = \frac{2}{8} = \frac{1}{4} \text{ A}$$

Voltage across equivalent resistance of two  $8 \Omega$  resistors

$$V = \frac{I_{\text{Total}}}{R_{\text{eq}}} = \frac{1}{4} \times 4 = 1 \text{ V}$$

- 250.** What would be the reading of ammeter and voltmeter in the given circuit?



**Ans :**

Delhi 2016

Here,

$$R_1 = 1 \Omega, R_2 = 2 \Omega$$

The resistance are connected in the series combination hence the equivalent resistance is given

reason (R) is not the correct explanation of assertion (A).

- (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

$$\text{Power loss} = i^2 R = \left(\frac{P}{V}\right)^2 R$$

[P = Transmitted power]

- 34. Assertion :** Resistance of 50 W bulb is greater than that of 100 W.

**Reason :** Resistance of bulb is inversely proportional to rated power.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

$$P = \frac{V^2}{R}$$

$$R \propto \frac{1}{P} \text{ (Same rated voltage)}$$

- 35. Assertion :** 40 W tube light give more light in comparison to 40 w bulb.

**Reason :** Light produced is same from same power.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(d) Assertion (A) is false but reason (R) is true.

In tube light majority portion of radiation comes

under visible region while bulb radiation consists of visible, ultraviolet, infrared radiation giving less visible part.

- 36. Assertion :** A resistor of resistance R is connected to an ideal battery. If the value of R is decreased, the power dissipated in the circuit will increase.

**Reason :** The power dissipated in the circuit will increase.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Here,  $P = \frac{E^2}{R}$ , so  $P \propto R$  only when I is constant.

Here I increases as R is decreased. Hence the reason is wrong.

- 37. Assertion :** A torch bulb give light if operated on AC of same voltage and current as DC.

**Reason :** Heating effect is common to both AC and DC.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

- 38. Assertion :** A tube light emits white light.

**Reason :** Emission of light in a tube takes place at a very high temperature.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).



- 29. Assertion :** When a battery is short-circuited, the terminal voltage is zero.

**Reason :** In the situation of a short-circuit, the current is zero

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

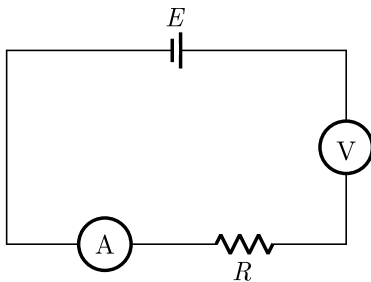
In the case of a short-circuited battery, the current

$$I = \frac{E(\text{e.m.f. of the battery})}{r(\text{internal resistance})} \neq 0$$

Terminal voltage,  $V = IR = I(0) = 0$

Where,  $R = \text{external resistance} = 0$

- 30. Assertion :** All electric devices shown in the circuit are ideal. The reading of each of ammeter (a) and voltmeter (V) is zero.



**Reason :** An ideal voltmeter draws almost no current due to very large resistance, and hence (V) and (a) will read zero.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

(a) will read zero but (V) will read E

- 31. Assertion :** If  $\rho_1$  and  $\rho_2$  be the resistivity of the materials of two resistors of resistances  $R_1$  and  $R_2$  respectively and  $R_1 > R_2$ .

**Reason :** The resistance  $R = \rho \frac{l}{A} \Rightarrow \rho_1 > \rho_2$  if  $R_1 > R_2$

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

$\rho$  is the characteristic of the material of resistors. It does not depend on the length and cross-sectional area of resistors. But R depends on the length and the cross-sectional area of the resistor.

So,  $R_1$  may be greater than  $R_2$  even when  $\rho_1 \leq \rho_2$ .

- 32. Assertion :** The product of resistivity and conductivity of a conductor depends on the material of the conductor.

**Reason :** Because each of resistivity and conductivity depends on the material of the conductor.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

$$\text{Conductivity} = \frac{1}{\text{Resistivity}}$$

$$\text{Conductivity} \times \text{resistivity} = 1$$

- 33. Assertion :** Long distance power transmission is done at high voltage.

**Reason :** At high voltage supply power losses are less.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but

50. On the basis of resistance, how can you differentiate between a conductor and an insulator ?

Ans :

SQP 2017

A good conductor has a low resistance (a poor conductor has a high resistance), whereas a good insulator of the same size has a very high resistance.

51. If the charge on an electron be  $1.6 \times 10^{-19} \text{ C}$ , find the approximate number of electrons in  $1 \text{ C}$  ?

Ans :

Comp. 2016

As we know that,

Charge,  $q = ne$

Here,  $e = 1.6 \times 10^{-19} \text{ C}$

$q = 1 \text{ C}$

or  $n = \frac{q}{e}$

$$= \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}$$

52. What is a voltmeter ?

Ans :

Delhi 2017

It is an instrument to measure the potential difference across two points in an electric circuit.

53. List any two factors on which resistance of a conductor depends.

Ans :

SQP 2016

Length and area of cross-section of conductor.

54. What is the S.I. unit of electric current ?

Ans :

Delhi 2017, OD 2015

Ampere

55. How much work is done when one coulomb of charge moves against a potential difference of one volt ?

Ans :

OD 2016

1 joule of work is done.

(Work = Charge  $\times$  Potential difference)

56. Classify the following according to their resistivity : Insulators, metals, alloys.

Ans :

Delhi 2017

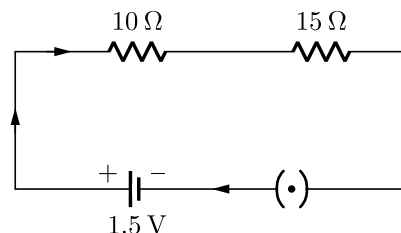
Metals and alloys have very low resistivity. Insulators have very high resistivity.

57. Draw a schematic diagram of a circuit consisting of a cell of  $1.5 \text{ V}$ ,  $10 \Omega$  resistor and  $15 \Omega$  resistor and a

plug key all connected in series.

Ans :

Delhi 2014



58. Define the S.I. unit of potential difference.

Ans :

Delhi 2017

If amount of work done in bringing one coulomb charge from one point to the other is 1 joule then potential difference between two points is said to be 1 volt.

59. Name the device that helps to maintain a potential difference across a conductor.

Ans :

Foreign 2016

A battery is used to maintain potential difference across a conductor.

60. Express mathematically the potential difference.

Ans :

OD 2017

Potential difference ( $V$ ) between points  $A$  and  $B$

$$= \frac{\text{Work done (} W \text{)}}{\text{Charge (} Q \text{)}}$$

61. Define resistance of a conductor.

Ans :

OD 2016

Resistance is the property of a conductor to resist the flow of charge through it.

62. What is e.m.f. ?

Ans :

Delhi 2017

It is electromotive force or the potential difference between the electrodes of a cell or battery in an open circuit (i.e., when the electric circuit is not closed by the key).

63. Write the relation between resistance ( $R$ ) of filament of a bulb, its power ( $P$ ) and constant voltage  $V$  applied across it.

Ans :

Delhi 2016, OD 2014

$$R = \frac{V^2}{P}$$

64. Which is having more resistance a 220 V, 100 W bulb or a 220 V, 60 W bulb ?

Ans :

Foreign 2017

60 W bulb, because  $R \propto \frac{1}{P}$ .

65. Larger the cross-sectional area of a conductor of a given material of a fixed length, the lower is its resistance. Give reason.

Ans :

SQP 2016

As we know that,

$$\text{Resistance, } R = \rho \frac{l}{A}$$

$$R \propto \frac{1}{A}$$

If  $A$  is more then resistance of conductor is lower.

66. What is the better way to connect lights and other electrical appliances in domestic wiring series circuits or parallel circuits ?

Ans :

OD 2015

Parallel circuits.

67. What is electric potential difference ?

Ans :

Delhi 2014

Potential difference between two points on a current-carrying conductor can be defined as the work done in moving a unit charge from one point to the other.

or

The amount of work done in moving a unit charge from one point ( $A$ ) to another point ( $B$ ) is known as the potential difference between the two points.

68. How many joules are equal to 1 Watt hour ?

Ans :

Delhi 2015

$$1 \text{ Watt-hour} = 3.6 \times 10^3 \text{ J}$$

69. What is cell ?

Ans :

Foreign 2014

Cell is a device to maintain the potential difference between the ends of a conductor for a long time.

70. When is potential difference between two points said to be 1 volt ?

Ans :

Foreign 2015, Delhi 2011

Potential difference between two points is said to be one volt, if a work of 1 joule is done to move a charge of 1 coulomb between the two points.

71. How will you define ampere from the definition of current ?

Ans :

Foreign 2014

One ampere current is produced when one coulomb of charge flows through a conductor for one second.

72. How does the resistance of a wire vary with its cross-sectional area ?

Ans :

OD 2015

It varies inversely with the cross-sectional area. ( $A$ ) i.e.,  $R \propto \frac{1}{A}$ .

73. How is resistance expressed ?

Ans :

Delhi 2015

$$R = \frac{V}{I} \text{ or } \frac{\text{Volt}}{\text{Ampere}}$$

74. State Ohm's law.

Ans :

SQP 2015

Physical conditions remaining same, the electric current flowing through a conductor is directly proportional to the potential difference across the two ends of the conductor.  $I \propto V$

75. What is a circuit diagram ?

Ans :

Comp. 2015

It is a diagram of the arrangement of different components of electric circuit using symbols for the components.

76. What will happen to the current flowing through a conductor, if the potential difference is doubled ?

Ans :

Delhi 2015, Delhi 2011

The current is also doubled.

77. What is the S.I. unit of resistance ?

Ans :

Delhi 2014

The S.I. unit of resistance is Ohm  $\Omega$ .

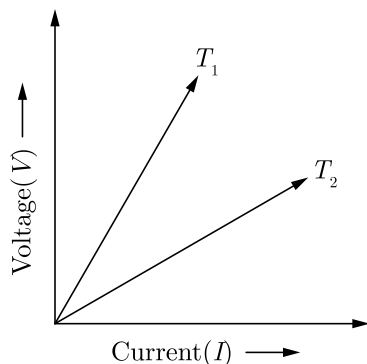
78. How does the resistance of a wire change when its diameter is doubled ?

Ans :

Foreign 2015

Its resistance becomes one-fourth.

79. The voltage-current ( $V-I$ ) graph of a metallic circuit at two different temperatures  $T_1$  and  $T_2$  is shown, which of the two temperatures is higher and why ?



**Ans :**

Foreign 2014

$T_2 > T_1$  as  $R \propto T$ .

- 80.** Does a voltmeter have a low resistance or a high resistance ?

**Ans :**

SQP 2014

A voltmeter has a high resistance so that it takes a very small (negligible) current from the circuit.

- 81.** How will the resistivity of a conductor change when its length is tripled by stretching it ?

**Ans :**

Comp 2014

The resistivity of a metallic conductor does not depend on the length of the wire, so it will remain same.

- 82.** Write S.I. unit of resistivity.

**Ans :**

OD 2015

The S.I. unit of resistivity is ohm-meter ( $\Omega - m$ ).

- 83.** What type of resistance should an ammeter have ?

**Ans :**

OD 2014

An ammeter should have a very low resistance so that it does not change the value of the current flowing in the circuit.

- 84.** Write the relation between heat energy produced in a conductor when a potential difference  $V$  is applied across its terminals and a current  $I$  flows through it for time  $t$ .

**Ans :**

Delhi 2015

$$H = VIt$$

- 85.** Name the scientist after whom the S.I. unit of resistance is named.

**Ans :**

Delhi 2014

German physicist, Ohm.

- 86.** Mention one reason why tungsten is used for making filament of electric lamp.

**Ans :**

Foreign 2015, OD 2013

It has low resistivity and high melting point.

- 87.** What is meant by 1 ohm resistance?

**Ans :**

Foreign 2014

The resistance of a conductor is said to be 1 ohm if under a potential difference of 1 volt a current of one ampere flows through the conductor.

- 88.** What is the relation between electrical energy and electrical power?

**Ans :**

OD 2013

Electrical energy = Electrical power  $\times$  Time.

- 89.** What do we mean when we say that 1 unit of electricity costs 2 rupees?

**Ans :**

OD 2012

We mean that 1 kilowatt hour of electrical energy costs 2 rupees.

- 90.** What is the conventional direction taken to represent current ?

**Ans :**

Delhi 2013

Conventionally, the direction of current is taken as opposite to the direction of the flow of negative charges, i.e., from the positive to the negative terminal of cell.

- 91.** Write a smaller unit of current.

**Ans :**

SQP 2012

Milliampere  $\left(1 \text{ mA} = \frac{1}{1000} \text{ A}\right)$ .

- 92.** How is water pipe analogous to an electric conductor?

**Ans :**

Foreign 2013

Water flows from higher level to lower level. Current flows from higher potential to lower potential.

- 93.** What is the S.I. unit of potential ?

**Ans :**

Foreign 2012, Delhi 2010

Volt.

- 94.** How much work is done in moving a charge of 3 coulomb from a point at 115 volts to a point at 125 volts ?

**Ans :**

SQP 2013

Potential difference,

$$V = 125 - 115$$

$$= 10 \text{ volts}$$

Charge,

$$Q = 3 \text{ coulomb}$$

$$V = \frac{W}{Q}$$

$$W = V \times Q$$

$$= 10 \times 3 = 30 \text{ joules}$$

- 95.** What are perfect conductors and perfect insulators ?

**Ans :**

SQP 2012

A perfect conductor is one whose resistivity is zero.  
A perfect insulator has infinite resistivity.

- 96.** What is the mathematical expression for resistance?

**Ans :**

Comp 2013

$$R = \rho \frac{l}{A} \text{ ohm.}$$

- 97.** Which of the following has higher resistivity and why?

Constantin or Copper.

**Ans :**

SQP 2013

Constantin, because it is an alloy of copper.

- 98.** Nichrome is used to make the element of electric heater. Why ?

**Ans :**

OD 2013

Nichrome is an alloy with high resistivity and high melting point.

- 99.** What is electrical resistivity ? In a series electrical circuit comprising a resistor made up of a metallic wire, the ammeter reads 5 A. The reading of the ammeter decreases to half when the length of the wire is doubled. Why?

**Ans :**

Foreign 2013

Constant  $\rho$  is known as electrical resistivity. Using the formula,  $R = \rho l/A$  and  $V = RI$ . When  $R$  is doubled while  $V$  remains unchanged, then the current  $I$  becomes half.

- 100.** Which pure metal has the minimum resistivity ?

**Ans :**

Delhi 2012

Mercury has the minimum resistivity  $94 \times 10^{-8} \Omega \text{ m}$

- 101.** Which alloy has the minimum resistivity ?

**Ans :**

Foreign 2012

Nichrome (alloy of Ni, Cr, Mn and Fe). Its resistivity is  $100 \times 10^{-6} \Omega \text{ m}$ .

- 102.** Which insulator has the maximum resistivity ?

**Ans :**

Foreign 2013, Delhi 2011

Ebonite has the maximum resistivity  $10^{15} - 10^{17} \Omega \text{ m}$

- 103.** What happens to resistance of a conductor when temperature is increased ?

**Ans :**

Foreign 2012

The resistance of a conductor with increasing temperature.

- 104.** Which of the following has more resistivity :

A metal or an alloy made from the same metal ?

**Ans :**

OD 2013

An alloy has greater resistivity.

- 105.** Alloys are used in electrical heating devices rather than pure metals. Give one reason.

**Ans :**

Delhi 2012

Alloys do not oxidise readily at high temperature, so it is more resistant to corrosion.

- 106.** What do we mean when we say that the resistivity of aluminium is  $2.63 \times 10^{-8} \text{ ohm-metre}$  ?

**Ans :**

Delhi 2013

This means that if we take an aluminium rod of 1 metre length and 1 square metre area of cross-section, then its resistance will be  $2.63 \times 10^{-8} \text{ ohms}$ .

- 107.** A wire of resistivity  $\rho$  is pulled to double its length. What will be its new resistivity?

**Ans :**

Delhi 2012

Resistivity remains the same i.e.,  $\rho$  itself.

- 108.** What is the resistance of an air gap ?

**Ans :**

OD 2011

An air gap has infinite resistance.

- 109.** Why do we use copper and aluminium wire for transmission of electric current ?

**Ans :**

Foreign 2012

Copper and aluminium have low resistivities and they are good conductors of electricity.

- 110.** What is the value of current if the resistors are connected in series ?

**Ans :**

OD 2011

If the resistors are connected in series, current is the same in every part of the circuit.

111. What is the total voltage of the combination when the resistors are in series ?

Ans :

OD 2010

The total voltage across the combination is equal to the sum of the voltage drops across the separate resistors.

112. In incandescent lamp which energy converts into other forms of energy ?

Ans :

Delhi 2011

In incandescent lamp electrical energy converts into heat and light energy.

113. Two resistors of  $20\ \Omega$  and  $40\ \Omega$  are connected in parallel in an electric circuit. How does the current passing through the two resistors compare ?

Ans :

Delhi 2010

Current in  $20\ \Omega$  resistor is two times that of  $40\ \Omega$  resistor.

114. What is the S.I. unit of electrical energy ?

Ans :

Foreign 2011

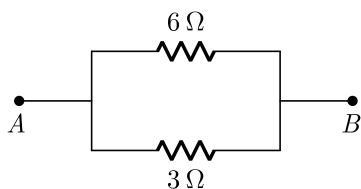
Joules.

115. You have two metallic wires of resistances 6 ohms and 3 ohms. How will you connect these wires to get the effective resistance of 2 ohms ?

Ans :

SQP 2010

We will connect these wires in parallel connection.



$$R_{eq} = \frac{6 \times 3}{6 + 3} = \frac{18}{9} = 2\ \Omega$$

116. How is heat produced when a current flows through a wire ?

Ans :

Comp 2011

Heat is produced due to the opposition motion of electrons through the wire.

117. What are the factors on which the heat produced in a wire depends ?

Ans :

OD 2010, Delhi 2010

Two factors are (a) material of the wire and (b) the resistance, i.e., if resistance is less or a high

current is allowed to pass through the wire, the rate of heating would increase.

118. At what temperature does the tungsten filament of incandescent lamp (or bulb) operates ?

Ans :

OD 2011

Tungsten filament operates at  $2700^\circ\text{C}$ .

119. If the current through a resistor is made three times its initial value, how will the rate of heat produced change ?

Ans :

OD 2010

The heat produced will become 9 times. ( $H = I^2 R t$ )

120. What is the resistance of combination if the resistors are connected in series ?

Ans :

Delhi 2011

The resistance of the combination is equal to the sum of the individual resistances.

121. Write a mathematical expression for Joule's law of heating. Name one device which works on this principle.

Ans :

Foreign 2010

$$H = I^2 R t$$

Iron heater or geyser works on Joule's law of heating.

122. In which devices heating effect of current is undesirable?

Ans :

Foreign 2011

Electric motors, generators and transformers are some devices in which heating effect of current is undesirable (i.e., not good for functioning).

123. Why is tungsten metal selected for making filaments of incandescent lamp bulbs ?

Ans :

Comp. 2010

This is because tungsten does not oxidise readily at high temperature since the resistivity of tungsten changes less rapidly with changes in the temperature.

124. Why is heat generated in the long electric cables is much less than in filaments of electric bulbs ?

Ans :

SQP 2011

This is because the resistance in long electric cables is less as compared to the filaments of electric bulbs and heat is directly proportional to resistance.

125. What is the S.I. unit of electric power ?

Ans :

SQP 2012, OD 2008

The unit of electric power is watt.

**126.** Define watt.

**Ans :**

OD 2011

1 watt is the power consumed when 1 A of current flows at the potential difference of 1 volt.

$$\text{Watt} = \text{Volt} \times \text{Ampere}$$

**127.** What is the relation between watt and kilowatt ?

**Ans :**

OD 2010

$$1 \text{ kilowatt} = 1000 \text{ watt.}$$

**128.** What is the relation between electric power, potential difference and resistance ?

**Ans :**

Delhi 2011

$$\text{Electric power, } P = \frac{V^2}{R}$$

**129.** Why an ammeter is likely to burn out if you connect it in parallel ?

**Ans :**

Delhi 2010

Ammeter has very low resistance. If it is connected in parallel, large voltage across it will produce large current which may burn the coil of ammeter.

**130.** Why are alloys like nichrome used in heating devices like electric iron, toasters, etc. ?

**Ans :**

Comp 2010, Delhi 2007

Because the resistivity of alloys is higher than that of pure metals (which form the alloys). Resistivity changes less rapidly with changes in temperature. Also, alloys do not oxidise readily at high temperature.

**131.** When do you say that the resistance of a wire is  $1 \Omega$ .

**or**

“The resistance of a conductor is  $1 \Omega$ .” What is meant by this statement ?

**Ans :**

Foreign 2010

If a current of one ampere flows through a wire on applying a potential difference of one volt across it then the resistance of the wire is said to be  $1 \Omega$ .

**132.** Why is it not advisable to handle high voltage electrical circuit with wet hands?

**Ans :**

OD 2009

The resistance of dry skin human body is about  $50000 \Omega$ . When the skin is wet, the resistance gets lowered to about  $10000 \Omega$ . If a person with wet hands touches the electrical circuit, high current will flow through the body causing risk to life.

**133.** What is the value of equivalent resistor if three

resistances are connected in parallel ?

**Ans :**

OD 2008

The sum of the reciprocals of the separate resistances is equal to the reciprocal of equivalent resistor i.e.,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

**134.** What type of combination of resistance is used to decrease the resistance of a device ?

**Ans :**

Delhi 2009, OD 2011

Parallel combination

**135.** Name and define the SI unit of current.

**Ans :**

Delhi 2008

Ampere is the SI unit of current.

1 Ampere current can be defined as a unit charge flowing per second in the circuit.

$$1 \text{ amp} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

**136.** Should the resistance of a voltmeter be low or high? Give reason.

**Ans :**

Foreign 2009

The resistance of a voltmeter should be high, because voltmeter is connected parallel to the component of a circuit and it also takes negligible current from the circuit in order to measure the potential difference accurately.

**137.** What is the voltage across each resistor when connected in parallel ?

**Ans :**

Foreign 2008

The voltage across each resistor of a parallel combination is the same and is also equal to the voltage across the whole arrangement (or group) as one unit.

**138.** Though the same current flows through line wires or the filament of a bulb, yet only the latter glows. Why?

**Ans :**

Comp 2009, Delhi 2007

The filament of electric lamp has high resistance whereas the line wires are of negligible resistance. Since, amount of heat generated is proportional to the resistance, the filament generates much more heat and so it starts glowing.

**139.** Which has higher resistance : a 50 W lamp bulb or a 25 W lamp bulb and how many times ?

**Ans :**

Comp 2008

$R = \frac{V^2}{P}$ , i.e., resistance is inversely proportional to power. Hence, a 25 W lamp bulb will have higher resistance. It will have twice the resistance of a 50 W lamp.



- 140.** Explain two disadvantages of series arrangement for household circuit.

**Ans :**

OD 2009

- Current is constant in series combination, so it is impractical to connect a bulb and an electric heater in series.
- When one component fails, the circuit is broken and more of the components not work.

- 141.** Name the most convenient and widely used form of energy. What is the practical advantage of this form of energy ?

**Ans :**

SQP 2009

- Electricity.
- The practical advantage of electricity as a form of energy is that it can be readily transmitted over considerable distances with the relatively small loss in energy. This makes it possible to supply electricity from a central generating plant to any location.

- 142.** The potential difference between two points carrying a current of 4 A is 220 V. What is its resistance ?

**Ans :**

SQP 2008

$$\begin{aligned} \text{Potential difference, } V &= 220 \text{ Volt} \\ \text{Current, } I &= 4 \text{ A} \\ R &= \frac{V}{I} = \frac{220}{4} = 55 \text{ A} \end{aligned}$$

## TWO MARKS QUESTIONS

- 143.** Two identical resistors of  $24 \Omega$  each are connected to a battery of 6 V. Calculate the ratio of the power consumed by the resulting combinations with

- minimum resistance and
- maximum resistance.

**Ans :**

OD 2024

$$\begin{aligned} \text{Here } R_{\max} &= 24 + 24 = 48 \Omega \\ R_{\min} &= \frac{24 \times 24}{24 + 24} = 12 \Omega \end{aligned}$$

$$\text{Now, we have } P = \frac{V^2}{R}$$

$$\text{Therefore } \frac{P_p}{P_s} = \frac{6^2}{12} = \frac{48}{12} = 4 : 1$$

- 144.** Let the resistance of an electrical device remain constant, while the potential difference across its two ends decreases to one fourth of its initial value. What change will occur in the current through it? State the law which helps us in solving the above stated question.

**Ans :**

OD 2023

According to the Ohm's law

$$V = IR$$

Since the resistance is constant and the potential difference is decreased to one-fourth of the initial value. Thus, the current through the component will also decrease to one fourth of its initial value.

According to Ohm's law, at constant temperature, the potential difference ( $V$ ) across the conductor in an electric circuit is directly proportional to the electric current ( $I$ ) flowing through it.

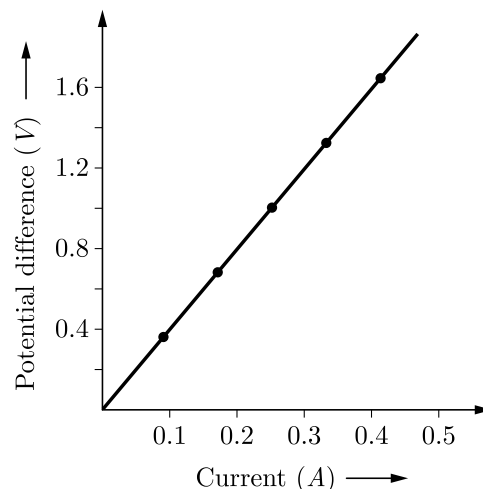
- 145.** Why are the heating elements of electric toasters and electric irons made of an alloy rather than a pure metal?

**Ans :**

OD 2019, OD 2012

The resistivity of an alloy is generally higher than that of its constituent metals. Alloys do not oxidise (burn) readily at higher temperatures. Therefore, conductors of electric heating devices, such as toasters and electric irons, are made up of an alloy rather than pure metal.

- 146.** A  $V$ - $I$  graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtain such a graph.



**Ans :**

Delhi 2020

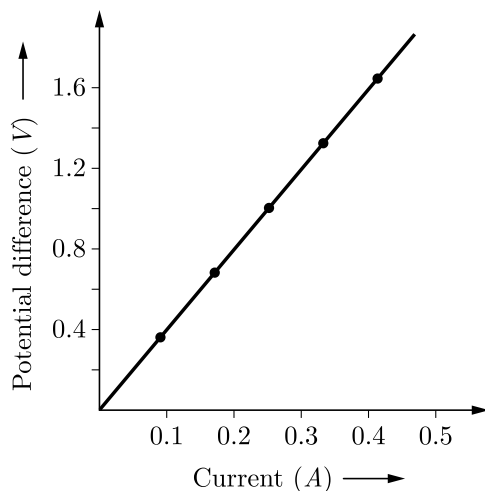
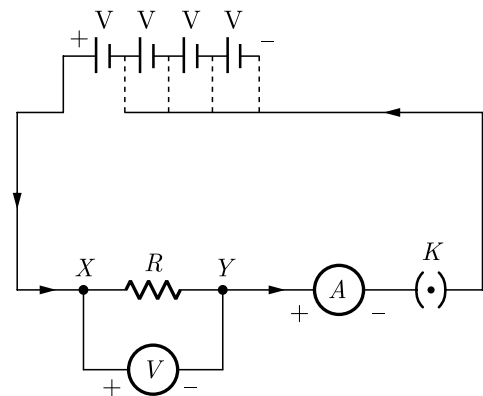
From the graph, we infer that as the current in the

- 282.** (a) State Ohm's law.  
 (b) Draw a circuit diagram for the verification of ohm's law. Also plot graphically the variation of current with potential difference.  
 (c) Calculate the resistance of a wire, when a potential difference of 2 V is maintained for 1 A current to flow through it.

Ans :

Comp 2017, Delhi 2014

- (a) The ohm's law states that the current carrying in a conductor is directly proportional to the voltage applied across the ends of the conductor, keeping the resistance constant.  
 (b) Circuit diagram :



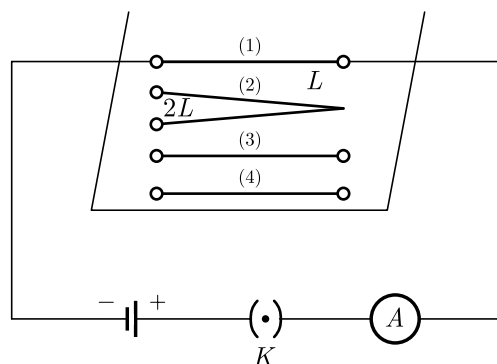
V-I graph for verification of Ohm's law

(c)  $R = \frac{V}{I} = \frac{2}{1} = 2 \Omega$

- 283.** Describe an experiment to study the factors on which the resistance of a conducting wire depends. What is the effect of temperature on the resistance of a given conductor ? For a given material, which of the two wires, thick or thin (having the same length), has less resistance ? Why ?

Ans :

Foreign 2016



- (a) Connect a circuit consisting of a cell, an ammeter, a wire of a material of high resistance, for example, nichrome of length  $L$  (marked 1 in Fig.) and a key as shown in Fig. Insert the key and note the current in the ammeter. Replace the wire by another one having the same thickness but of the length  $2L$  (marked 2 in Fig.). We will note that the current has now decreased to one half. Now, if we take a thicker nichrome wire, i.e., of a larger cross-sectional area but having the same length  $L$  (marked 3), we will find that the current in the ammeter has increased this time, indicating thereby that the flow of current depends on the cross-sectional area of the wire. Now, instead of taking a nichrome wire, if we take a wire of another material having the same length and the same cross-sectional area as that of the nichrome wire (marked 4), we will find that the current in the ammeter has changed. This shows that the flow of the current from the same source also depends on the material of the wire.  
 (b) The resistance of all pure metals increases on raising the temperature and decreases on lowering the temperature, provided the length, cross-sectional area and the material of the conductor remain the same.  
 (c) Thicker wire will have lesser resistance than the thinner wire because resistance is inversely proportional to the area of cross-section of the wire.

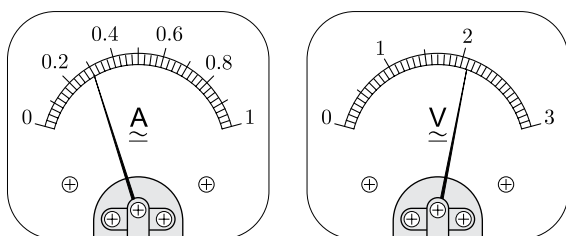
- 284.** Two resistances when connected in series give resultant value as  $9 \Omega$ . The same resistances connected in series give resultant when connected in parallel give resultant value of  $2 \Omega$ . Calculate the value of each resistance.

Ans :

SQP 2016, Delhi 2008

Let  $R_1$  and  $R_2$  be the two resistances.

developed across its ends are shown in the given ammeter and voltmeter. Find the least count of the voltmeter and ammeter. What is the voltage and the current across the given resistor?



**Ans :**

Delhi 2019

$$\text{Least count of ammeter} = \frac{0.2}{10} \text{ A} = 0.02 \text{ A}$$

$$\text{Least count of voltmeter} = \frac{1}{10} \text{ V} = 0.1 \text{ V}$$

$$\text{Current} = 15 \times 0.02 \text{ A}$$

$$= 0.3 \text{ A}$$

$$\text{Potential difference} = 21 \times 0.1 \text{ V} = 2.1 \text{ V}$$

- 153.** (a) State Ohm's law. Write a mathematical expression for it.

**or**

State the law that relates current through a conductor and the potential difference between its ends. Represent the law mathematically.

- (b) What kind of graph is obtained by plotting values of  $V$  and  $I$ ? why?

**Ans :**

OD 2017

- (a) At a constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends. It is known as Ohm's law.

Mathematically,

$$V \propto I$$

$$\text{or} \quad \frac{V}{I} = \text{constant} = R$$

$$\text{or} \quad V = IR$$

- (b) The  $V$ - $I$  graph of a conductor is a straight line

$$\text{as} \quad V \propto I$$

$$\text{or} \quad \frac{V}{I} = \text{constant}$$

- 154.** State Ohm's law? How can it be verified experimentally? Does it hold good under all conditions? Comment.

**Ans :**

OD 2016, Delhi 2013

At a constant temperature, the current flowing

through a conductor is directly proportional to the potential difference across its ends. It is known as Ohm's law

If we draw the  $V$ - $I$  graph of a conductor on a graph paper, it is a straight line that passes through the origin of the paper. This verifies the Ohm's law.

No, it holds good only at constant temperature.

- 155.** State the factors on which the heat produced in a current carrying conductor depends. Give one practical application of this effect.

**Ans :**

Delhi 2016

Heat produced in a current carrying conductor depends upon :

- Square of the current ( $I^2$ ).
- Resistance of the conductor ( $R$ ).
- Time for which the current flow ( $t$ ).

This effect is applicable in electric heating like electric iron.

- 156.** Give two reasons why the nichrome alloy is used for making the heating elements of electrical appliances.

**Ans :**

Foreign 2017

Reasons are :

- Nichrome has very high resistivity due to which the heating element made of nichrome has a high resistance and produces a lot of heat on passing current.
- Nichrome does not undergo oxidation (or burn) easily even at high temperature. Due to this nichrome can be kept red-hot without burning or breaking in air.

- 157.** In a given ammeter, a student sees that needle indicates 17 divisions in ammeter while performing an experiment to verify Ohm's law. If ammeter has 10 divisions between 0 and 0.5A, then what is the value corresponding to 17 divisions?

**Ans :**

Foreign 2016, Delhi 2011

An ammeter has 10 divisions between 0 to 0.5A.

$$\text{So, Least count of ammeter} = \frac{0.5 - 0.0}{10} = 0.05 \text{ A}$$

Reading of ammeter shows needle at 17 divisions.

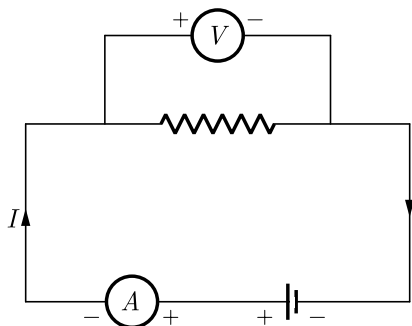
$$\text{So, value of current} = 0.05 \times 17 = 0.85 \text{ A}$$

- 158.** You have following material:

An ammeter (0-1 A), a voltmeter (0-3 V), a resistor of  $20 \Omega$ , a key, a rheostat, a battery of 3 V and seven connecting wires.

Using this material draw a labelled circuit diagram

nichrome wire increases, the potential difference across it increases linearly. Thus, the graph follows the ohm's law.



147. Why does the cord of an electric oven not glow while its heating element does?

Ans :

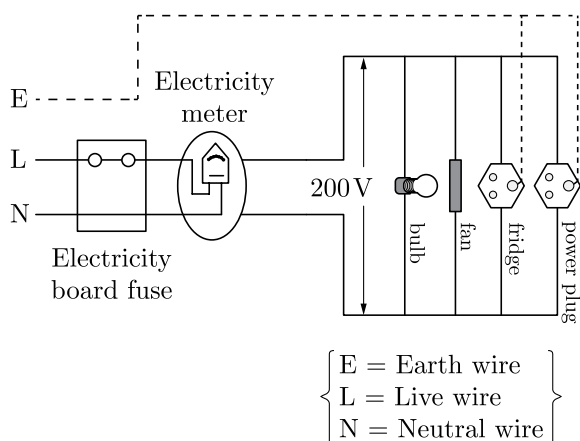
OD 2019

The resistance of heating element of an electric oven is very high. As the current flows through the heating element it becomes too hot and glows red. On the other hand cord of an electric oven have low resistance hence it does not become red during the flow of current.

148. Suppose your parents have constructed a two room house and you want that in the living room there should be a provision of one electric bulb, one electric fan, a refrigerator and a plug point for appliances of power up to 2 kilowatt. Draw a circuit diagram showing electric fuse and earthing as safety devices.

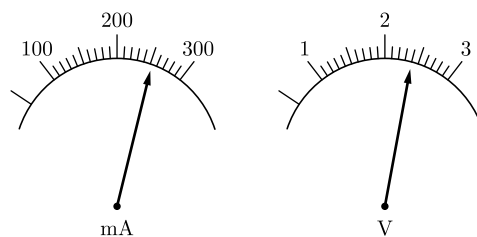
Ans :

2020



149. The current flowing through a resistor connected in a circuit and the potential difference developed across its ends are as shown in the diagram by milliammeter and voltmeter readings respectively :
- (a) What are the least counts of these meters?

- (b) What is the resistance of the resistor?



Ans :

OD 2019

- (a) 10 mA and 0.1 V

- (b) Given,  $V = 2.4$  volt  
 $I = 250$  mA  
 $= 0.25$  A

As we know that,

$$R = \frac{V}{I}$$

$$= \frac{2.4}{0.25} = 9.6 \Omega$$

150. Write the importance of electricity in our everyday life.

Ans :

Delhi 2017

Electricity is used for :

- (a) Domestic purposes : It is used for lighting, heating, and for operating various electrical appliances like cooler, geyser, washing machine, T.V., etc.
- (b) Transportation : In running electric trains, trams, etc.
- (c) Running various machines in factories, industries, food storage plants, etc. Electricity is also used in shops, hospitals, hotels, offices, banks, etc.

151. What would you suggest to a student if while performing an experiment he finds that the pointer/needle of the ammeter and voltmeter do not coincide with the zero marks on the scales when circuit is open? No extra ammeter/voltmeter is available in the laboratory.

Ans :

Delhi 2019, OD 2013

This is called the zero error of the scale of ammeter or voltmeter. If there is a zero error then this error is subtracted from the value that depicts when the circuit is closed otherwise accurate readings will not be recorded.

152. The current flowing through a resistor connected in an electrical circuit and the potential difference

blown off.

- 165.** A current of 5 amperes is passed through conductor of 12 ohms for 2 minutes. Calculate the amount of heat produced.

**Ans :**

SQP 2016

As we know that,

$$H = I^2 R t$$

Here,

$$I = 5 \text{ A}, R = 12 \Omega$$

$$t = 2 \text{ minutes}$$

$$= 2 \times 60 = 120 \text{ sec}$$

$$H = (5)^2 \times 12 \times 120$$

$$= 25 \times 12 \times 120$$

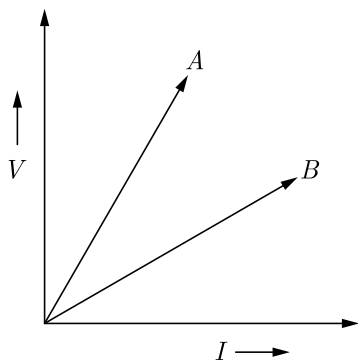
$$= 36000$$

$$= 3.6 \times 10^4 \text{ Joule}$$

- 166.**  $V$ - $I$  graph for the two wires  $A$  and  $B$  are shown in the figure. If we connect both the wires one by one to the same battery which of the two will produce more heat per unit time? Give justification for your answer.

**Ans :**

OD 2016



The slope of wire  $A$  is more than wire  $B$ .

Resistance of wire  $A$  will be more than wire  $B$ .

$H$  is directly proportional to  $R$ , more heat will be produced in  $A$  wire.

- 167.** Can you run an electric geyser with power rating 2 kW, 220 V on a 5 A line? Give reason to justify your answer.

**Ans :**

OD 2016, Delhi 2014

As we know that,

Power,  $P = VI$

$$P = 2 \text{ kW} = 2000 \text{ W}$$

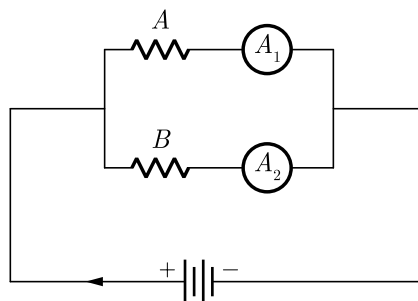
$$I = \frac{P}{V} = \frac{2000}{220} = 9.09 \text{ A}$$

Since the line given is of 5 A, which is less than 9.09 A, so the geyser should not run on the line.

- 168.** In the circuit diagram shown the two resistance wires  $A$  and  $B$  are of same lengths and same material; but  $A$  is thicker than  $B$ . Which ammeter  $A_1$  or  $A_2$  will indicate higher reading for current. Give reason.

**Ans :**

Comp 2017



Ammeter  $A_1$  will show higher reading. Because, as wire  $A$  is thicker than  $B$ ,  $A$  has lesser resistance. So current drawn by  $A_1$  from the battery will be more. So current drawn by  $A$  from the battery will be more and hence ammeter  $A_1$  will show higher reading.

- 169.** Give reasons for the following :

- What do you understand by the term fuse in an electric circuit?
- Fuse wire is placed in series with the device.

**Ans :**

SQP 2015

- Fuse is the weakest link placed in series in an electric circuit which melts when the circuit gets over loaded or short circuited.
- It melts and stops the flow of any unduly high electric current and breaks the circuit.

- 170.** An electric lamp is marked 220 V, 100 W. It is used for 5 hours daily, calculate:

- its resistance while glowing.
- energy consumed in kWh/day.

**Ans :**

Delhi 2017, OD 2013

- Electric lamp is marked 220 V, 100 W.

Hence, Power of the lamp

$$P = 100 \text{ W}$$

Potential difference applied = 220 V

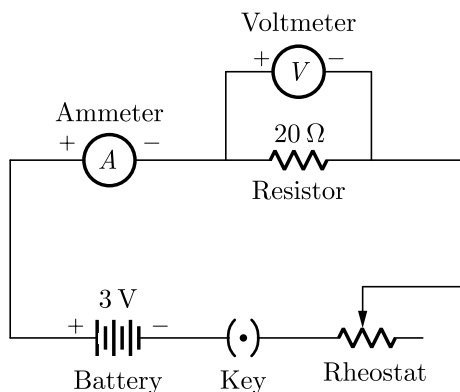
Resistance of electric lamp while glowing

to study the dependence of potential difference ( $V$ ) across a resistor on the current ( $I$ ) passing through it.

**Ans :**

OD 2017

An ammeter (0-1 A), a voltmeter (0-3 V), a resistor of  $20\ \Omega$ , a key, a rheostat, a battery of 3 V and seven connecting wires.



- 159.** Calculate the number of electrons that would flow per second through the cross-section of a wire when 1 A current flows in it.

**Ans :**

Foreign 2016

Given,

Current,

$$I = 1\text{ A}, t = 1\text{ s}$$

Charge,

$$Q = I \times t \\ = 1\text{ A} \times 1\text{ s} = 1\text{ C}$$

Number of electrons,

$$n = \frac{Q}{e} = \frac{1\text{ C}}{1.6 \times 10^{-19}\text{ C}} \\ = 0.625 \times 10^{19} \\ = 6.25 \times 10^{18}$$

- 160.** List two distinguishing features between the resistance and resistivity of a conductor.

**Ans :**

Delhi 2017

	Resistance	Resistivity
1.	It is the property of conductor to resist the flow of charges.	It is a measure of material's ability to oppose electric current.
2.	Its S.I. unit is ohm ( $\Omega$ ).	Its S.I. unit is ohm-metre ( $\Omega\text{-m}$ ).

- 161.** How many 40 W, 220 V lamps can be safely connected to a 220 V, 5A line ? Justify your answer.

**Ans :**

Delhi 2016

Let  $x$  = Number of light bulbs.

$$P = 40\text{ W} \times n \quad [x = \text{No. of light bulbs}]$$

$$P = 40x, I = 5\text{ A}, V = 200\text{ V}$$

$$P = VI$$

$$40x = 220 \times 5$$

$$x = 27.5$$

So, the maximum number of light bulbs would be 27.

- 162.** How much will an electric iron draw from a 220 V source if the resistance of its elements when hot is 55 ohms ? Calculate the wattage of the electric iron when it operates on 220 volts.

**Ans :**

SQP 2017, Delhi 201

Given,

$$V = 220\text{ Volt}, R = 55\ \Omega$$

As we know that,

$$V = IR$$

$$220 = I \times 55$$

$$I = 4\text{ A}$$

Now,

$$P = VI = 220 \times 4 = 880\text{ W}$$

- 163.** 400 Joules of heat is produced per second in a  $16\ \Omega$  resistor. Find the potential difference across the resistor.

**Ans :**

Foreign 2016, Delhi 2014

Given,

Heat,

$$H = 400\text{ J}$$

Resistance,

$$R = 16\ \Omega$$

Potential difference,

$$V = ?$$

Time,

$$t = 1\text{ s}$$

As we know that,

$$H = I^2 Rt$$

$$400 = I^2 \times 16 \times 1$$

$$I^2 = 25$$

$$I = 5\text{ A}$$

Now,

$$V = IR$$

$$= 5 \times 16 = 80\text{ V}$$

- 164.** (i) Why are electric bulbs filled with chemically inactive nitrogen or argon ?  
(ii) What is meant by the statement that the rating of a fuse in a circuit is 5 A ?

**Ans :**

OD 2017

(i) To prolong the life of filament.

(ii) The maximum current that should flow in the circuit is 5 A. If it exceeds this, the fuse will be

177. What is the potential difference between the terminals of a battery if 250 joules of work is required to transfer 25 coulombs of charge from one terminal of the battery to the other ?

Ans :

Delhi 2015, Foreign 2014

Work done,  $W = 250$  joules

Charge,  $Q = 25$  coulombs

$$V = \frac{W}{Q} = \frac{250}{25} = 10 \text{ volts}$$

178. A resistance of 0.05 ohm has a current of 3 amperes flowing in it. Calculate the potential difference across its ends.

Ans :

Foreign 2015

Given,

Resistance,  $R = 0.05 \Omega$

Current,  $I = 3 \text{ A}$

$$R = \frac{V}{I}$$

$$V = R \times I = 0.05 \times 3 = 0.15$$

Volt

179. What is an electric circuit ? Distinguish between an open and a closed circuit.

Ans :

Delhi 2014

A continuous conducting path along which an electric current flows is called an electric circuit.

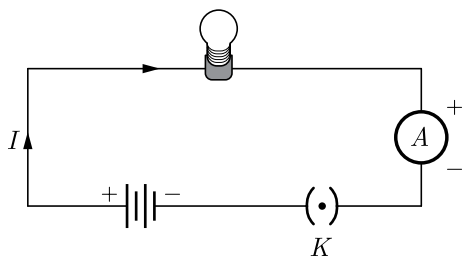


Figure: Electric Circuit.

	Closed circuit	Open circuit
(i)	In this, plug key is closed.	In this, plug key is open.
(ii)	In this circuit, current flows continuously.	In this circuit, there is no flow of current.

180. How does resistance of a wire affect the flow of current?

Ans :

Comp 2013

The flow of current is due to the flow of electrons, but the electrons in a conductor cannot move freely

because of the attraction of atoms among which they move. This results in retardation in the flow of electrons or in other words, resistance of the conductor affects the flow of current.

181. (a) What material is used in making the filament of an electric bulb ?  
(b) Name the characteristics which make it suitable for this.

Ans :

SQP 2013

- (a) Tungsten is used in making the filament of an electric bulb.  
(b) Tungsten has high melting point.  
Tungsten has high resistivity to retain much heat.

182. In an electric circuit with a resistance wire and a cell, the current flowing is  $I$ . What would happen to this current if the wire is replaced by another thicker wire of same material and same length. Give reason.

Ans :

OD 2015

Current flowing through the thicker wire increases. It is due to, when the wire is replaced by a thicker one, its resistance will decrease and consequently current increases.

183. In an experiment to study the relationship between the potential difference across a resistor and the current through it, a student recorded the following observations :

Potential difference (V)	Current (A)
2	0.08
3	0.12
4.5	0.15
5	0.20
6	0.24

Find in which one of the above sets of reading the trend is different from others and must be rejected. Calculate the mean value of resistance of the resistor based on the remaining sets of readings.

Ans :

OD 2014, OD 2012

From,  $R = \frac{V}{I}$

$$R_1 = \frac{2 \text{ V}}{0.08 \text{ A}} = 25 \Omega$$

Similarly,  $R_2 = R_4 = R_5 = 25 \Omega$ , therefore, mean resistance =  $25 \Omega$



$$R = \frac{V^2}{P}$$

$$= \frac{220 \times 220}{100} = 484 \Omega$$

(b) Time,  $t = 5$  hours daily

Energy consumed per day

$$E = P \cdot t$$

$$= 100 \text{ W} \times 5 \text{ h} = 500 \text{ Wh}$$

$$= \frac{500}{1000} \text{ kWh} = 0.5 \text{ kWh}$$

- 171.** 40 joules of work is done in moving a charge from a point at 230 volts to another point at 240 volts. Find the quantity of the charge.

**Ans :**

Delhi 2016

Given,

Potential difference,  $V = 240 - 230 = 10$   
volts

Work done,  $W = \frac{Q}{V}$

$$Q = \frac{W}{V}$$

$$= \frac{40}{10} = 4 \text{ coulomb}$$

- 172.** The filament of an electric lamp draws a current of 0.5 amperes, which lights for 4 hours. Calculate the amount of charge that flows through the circuit.

**Ans :**

Foreign 2017

Current,  $I = 0.5 \text{ A}$

Time,  $t = 4$  hours

$$= 4 \times 60 \times 60 = 14400 \text{ s}$$

Charge,  $Q = I \times t$

$$Q = 0.5 \times 14400$$

$$= 7200 \text{ Coulomb}$$

- 173.** Calculate the current in the wire if a charge of 1800 coulombs flows through it in 3 minutes.

**Ans :**

Foreign 2016

Charge,  $Q = 1800 \text{ coulomb}$

Time,  $t = 3 \text{ minutes} = 3 \times 60 = 180 \text{ s}$

$$I = \frac{Q}{t}$$

$$I = \frac{1800}{180} = 10 \text{ A}$$

- 174.**  $10^{21}$  electrons, each having a charge of  $1.6 \times 10^{19} \text{ C}$ , pass from a point  $P$  towards another point  $Q$  in

0.1 s. What is the current ? What is the direction of conventional current ?

**Ans :**

OD 2015

(i) Given,

Number of electrons  $= 10^{21}$

Charge on one electron  $= 1.6 \times 10^{-19} \text{ C}$

Total charge = Number of electrons  $\times$  charge on one electron

$$= 10^{21} \times 1.6 \times 10^{-19} \text{ C}$$

$$Q = 160 \text{ C}$$

Time  $= 0.1 \text{ s}$

$$I = \frac{Q}{t}$$

$$I = \frac{160}{0.1} = 1600 \text{ A}$$

(ii) The direction of the current is from  $Q$  to  $P$ .

- 175.** A TV set shoots out a beam of electron. The beam current is  $10 \mu\text{A}$ . How many electrons strike the TV screen in each second ? How much charge strikes the screen in a minute?

**Ans :**

Delhi 2015

Given,  $I = 10 \mu\text{A} = 10 \times 10^{-6} \text{ A}$

$t = 1 \text{ second}$

$$I = \frac{Q}{t} = \frac{ne}{t}, \text{ we have}$$

Number of electrons,

$$n = \frac{It}{e} = \frac{10 \times 10^{-6} \times 1}{1.6 \times 10^{-19}}$$

$$= 6.25 \times 10^{13} \text{ electrons}$$

and amount of charge,

$$Q = It = 10 \times 10^{-6} \times 60$$

$$= 600 \times 10^{-6} = 600 \mu\text{C}$$

- 176.** The potential difference between two ends of a wire is 150 mV. The wire has a resistance of  $50 \Omega$ . Find the current flowing through the wire.

**Ans :**

OD 2014, Delhi 2011

Potential difference,

$$V = 50 \text{ mV} = \frac{150}{1000} = 0.150 \text{ V}$$

Resistance,  $R = 50 \Omega$

$$I = \frac{V}{R}$$

$$= \frac{0.150}{50} = 0.003 \text{ A}$$

**Ans :**

Comp. 2015

$A$  has low resistivity, therefore, it has very high conductivity. Hence,  $A$  is a good conductor, while  $B$  is an insulator due to its high resistivity.

- 191.** Distinguish between the term over loading and short-circuiting as used in domestic circuits.

**Ans :**

OD 2014

- (i) Short-circuiting occurs when a live wire comes in contact with a neutral wire. Overloading occurs when many electrical appliances of high power ratings are operated at the same time.
- (ii) In short-circuiting a large current flows through the circuit because the resistance of the circuit formed when two wires touch each other is very small. In overloading, a large current is drawn from the electric supply due to use of many electrical appliances.

- 192.** A piece of wire of resistance  $20\ \Omega$  is drawn out so that its length is increased to twice its original length. Calculate the resistance of the wire in the new situation.

**Ans :**

Delhi 2015, Delhi 2013

Let length of the wire be  $l$ , then the resistance,

$$R_o = \rho \frac{l}{A}$$

According to the question,

New length of wire,  $l' = 2l$

The volume of wire remains constant.

$$Al = A'l'$$

$$A' = \frac{Al}{l'} = \frac{Al}{2l} = \frac{A}{2}$$

Then the new resistance,

$$R_n = \rho \frac{l'}{A'}$$

$$R_n = \rho \frac{2l}{A/2} = 4 \left( \rho \frac{l}{A} \right)$$

$$R_n = 4R_o \text{ (Originally, } R_o = 20\ \Omega \text{)}$$

$$R_n = 4 \times 20\ \Omega = 80\ \Omega$$

- 193.** A copper wire has a diameter of 0.5 mm and a resistivity of  $1.6 \times 10^{-6}$  ohm-cm. How much of this wire would be necessary to make a resistance of 10 ohm ?

**Ans :**

Delhi 2014, OD 2012

Given, Radius of the wire,

$$r = \frac{d}{2}$$

$$= \frac{0.5}{2} = 0.25\ \text{mm} = 0.025\ \text{cm}$$

and its resistance  $R = \rho \frac{l}{A}$

$$\begin{aligned} l &= \frac{RA}{\rho} = \frac{R\pi r^2}{\rho} \\ &= 10 \times \frac{22}{7} \times \frac{(0.025)^2}{1.6 \times 10^{-6}} \\ &= 122.67\ \text{cm} \end{aligned}$$

- 194.** A copper wire of length 3 m and the area of cross section  $1.7 \times 10^{-6}\ \text{m}^2$  has a resistance of  $3 \times 10^{-2}$  ohms. Calculate the resistivity of copper.

**Ans :**

Foreign 2015

Given, length of the wire  $l = 3\ \text{m}$ . Area of cross-section,  $A = 1.7 \times 10^{-6}\ \text{m}^2$ .

Resistance of wire,  $R = 3 \times 10^{-2}\ \Omega$

$$R = \rho \frac{l}{A}$$

Resistivity,

$$\begin{aligned} \rho &= \frac{RA}{l} \\ &= \frac{3 \times 10^{-2} \times 1.7 \times 10^{-6}}{3} \\ &= 1.7 \times 10^{-8}\ \Omega\text{m} \end{aligned}$$

- 195.** (a) What is meant by electric resistance of conductor?
- (b) A wire of length  $L$  and resistance  $R$  is stretched so that the length is doubled and area of cross section halved. How will (i) resistance change and (ii) resistivity change.

**Ans :**

Foreign 2014

- (a) Resistance of a conductor means obstruction in flow of current through it.
- (b) Initial length of the wire  $= L$ . So, its new length  $L' = 2L$  and area of its cross-section  $= A$

New area,  $A' = A/2$

Now,  $R = \rho \frac{L}{A}$  and  $R' = \rho \frac{L'}{A'}$

(i) and new resistance,

$$R' = \rho \frac{2L}{A/2}$$

$$R' = 4\rho \frac{L}{A}$$

$$R' = 4R$$

(ii) Resistivity of the wire will be same.

- 196.** How currents in different resistors vary if they are connected in parallel ?

**Ans :**

OD 2013, Delhi 2010

The currents in the different resistors (when they are connected in parallel) are inversely proportional

Reading of trend (4.5 V; 0.15 A) *i.e.*,

$$R_3 = \frac{4.5 \text{ V}}{0.15 \text{ A}}$$

= 30  $\Omega$  which is different from

others, so it must be rejected.

- 184.** (a) How much current will an electric bulb draw from a 220 V source if the bulb filament is 1200  $\Omega$ .  
 (b) How much current will an electric heater will draw from a 220 V source if the resistance of the heater is 100  $\Omega$ .

**Ans :**

Delhi 2015

(a) Given,  $R = 1200 \Omega$ ,  $V = 220 \text{ volt}$

$$I = \frac{V}{R} = \frac{220 \text{ V}}{1200 \Omega} = \frac{11}{60} \text{ A}$$

(b) Given,  $R = 100 \Omega$ ,  $V = 220 \Omega$

The current flows through the bulb is given by

$$I = \frac{V}{R} = \frac{220 \text{ V}}{100 \Omega} = 2.2 \text{ A}$$

- 185.** A copper wire of length 2 m has a resistance of  $2 \times 10^{-2} \text{ ohm}$ . If the resistivity of copper is  $1.7 \times 10^{-8} \Omega \text{ m}$ , find the area of the cross-section of the wire.

**Ans :**

Delhi 2014

Given, Length of wire,  $L = 2 \text{ m}$

Resistance of wire,  $R = 2 \times 10^{-2} \Omega$

Resistivity of wire,  $\rho = 1.7 \times 10^{-8} \Omega \text{ m}$

$$R = \frac{\rho L}{A}$$

$$A = \frac{\rho L}{R}$$

$$A = \frac{1.7 \times 10^{-8} \times 2}{2 \times 10^{-2}}$$

$$A = 1.6 \times 10^{-6} \text{ m}^2$$

- 186.** The resistance of a metal wire of length 2 meters and area of cross-section  $1.55 \times 10^{-6} \text{ m}^2$  is 0.036  $\Omega$ . Calculate the resistivity of the metal.

**Ans :**

Foreign 2015, OD 2010

Given, Length of wire,  $L = 2 \text{ m}$

Area of cross-section,  $A = 1.55 \times 10^{-6} \text{ m}^2$

Resistance of wire,  $R = 0.036 \Omega$

$$R = \frac{\rho L}{A}$$

$$\rho = \frac{RA}{L}$$

$$\rho = \frac{0.036 \times 1.55 \times 10^{-6}}{2}$$

$$\rho = 0.0279 \times 10^{-6}$$

$$\rho = 2.79 \times 10^{-8} \Omega \text{ m}$$

- 187.** What is electrical resistivity? In a series electrical circuit comprising a resistor made up of a metallic wire, the ammeter reads 5 A. The reading of the ammeter decreases to half when the length of the wire is doubled. Why ?

**Ans :**

OD 2015

The electrical resistivity of a material is defined as the resistance offered to current flow by a conductor of unit length having area of cross section.

If the length of the wire is doubled then its new length  $l' = 2l$ , then from  $R = \rho \frac{l}{A}$  and  $I = \frac{V}{R}$ , we have

Current flowing through the wire is given by

$$I = \frac{VA}{\rho l'} = \frac{1}{2} \frac{VA}{\rho l} = \frac{1}{2} I$$

- 188.** Aluminium wire has radius 0.25 mm and length of 75 m. If the resistance of the wire is 10  $\Omega$ , calculate the resistivity of aluminium.

**Ans :**

Foreign 2014

$$\begin{aligned} \text{Resistance, } R &= \frac{\rho l}{A} = \rho \frac{l}{\pi r^2} = \frac{R \pi r^2}{l} \\ &= \frac{10 \times 3.14 \times (0.25 \times 10^{-3})^2}{75 \text{ m}} \\ &= 2.8 \times 10^{-8} \Omega \text{ m} \end{aligned}$$

- 189.** The following table gives the resistivity of three samples.

Samples	Resistivity
A	$1.6 \times 10^{-8} \Omega \text{ m}$
B	$5.2 \times 10^{-8} \Omega \text{ m}$
C	$100 \times 10^{-6} \Omega \text{ m}$

Which of them is suitable for heating elements of electrical appliances and why ?

**Ans :**

SQP 2015

Sample C has higher resistivity, so it is suitable for heating elements of a electrical appliances.

- 190.** The table given below gives the resistivity of three samples (in  $\Omega$ ):

Samples	Resistivity
A	$1.6 \times 10^{-8}$
B	$7.2 \times 10^{17}$
C	$44 \times 10^{-6}$

Which of them is a good conductor ?

And which is an insulator ? And why ?

(a) The current  $I_1$ , through the resistor,

$$I_1 = \frac{V}{R_1} = \frac{12 \text{ V}}{5 \Omega} = 2.4 \text{ A}$$

The current  $I_2$ , through the resistor,

$$I_2 = \frac{V}{R_2} = \frac{12 \text{ V}}{10 \Omega} = 1.2 \text{ A}$$

The current  $I_3$ , through the resistor,

$$I_3 = \frac{V}{R_3} = \frac{12 \text{ V}}{30 \Omega} = 0.4 \text{ A}$$

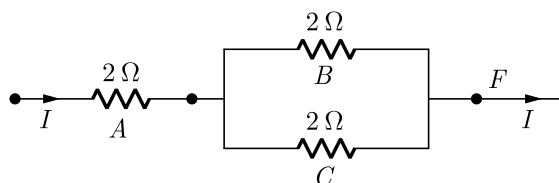
(b) The total current in the circuit

$$\begin{aligned} I &= I_1 + I_2 + I_3 \\ &= (2.4 + 1.2 + 0.4) \text{ A} \\ &= 4 \text{ A} \end{aligned}$$

(c) The total resistance,  $R$ , is given by

$$\begin{aligned} \frac{1}{R} &= \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \\ &= \frac{1}{5} + \frac{1}{10} + \frac{1}{30} = \frac{1}{3} \\ R &= 3 \Omega \end{aligned}$$

- 201.** Three  $2 \Omega$  resistors  $A$ ,  $B$  and  $C$  are connected as shown in figure. Each of them dissipates energy and can withstand a maximum power of  $18 \text{ W}$  without melting. Find the maximum current that can flow through the three resistors.



**Ans :**

OD 2013, OD 2011

Maximum current through resistor  $A$  can be calculated by

$$I = \sqrt{\frac{P}{R}} = \sqrt{\frac{18}{2}} \text{ A} = 3 \text{ A}$$

Also, resistors  $B$  and  $C$  are connected in parallel combination and they have equal resistance.

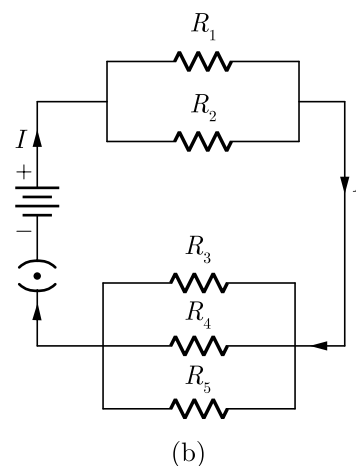
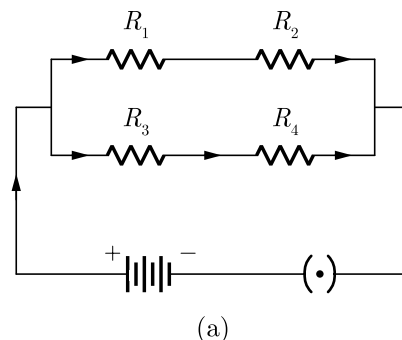
Thus, the maximum current through resistors  $B$  and  $C$  each is  $3 \times \frac{1}{2} \text{ A} = 1.5 \text{ A}$ .

- 202.** Is it possible to connect the different resistors in both combinations (i.e., series and parallel) together ? Draw a diagram to illustrate it.

**Ans :**

Foreign 2012

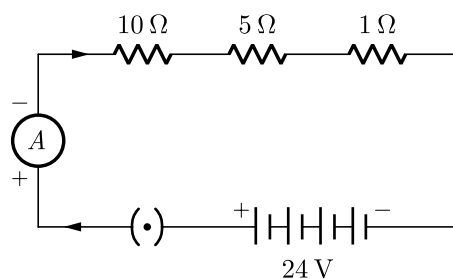
Yes, it is possible to have resistors in both combinations together.



- 203.** Draw a schematic diagram of a circuit consisting of  $24 \text{ V}$  battery, a  $10 \text{ ohm}$  resistor, a  $5 \text{ ohm}$  resistor, a  $1 \text{ ohm}$  resistors, an ammeter and a plug key, all connected in series. Calculate the ammeter reading in this circuit.

**Ans :**

Delhi 2012, OD 2009



All the resistances are connected in the series combination. Hence the equivalent resistance of circuit,

$$\begin{aligned} R &= 10 + 5 + 1 \\ &= 16 \Omega \\ V &= 24 \text{ Volt} \end{aligned}$$

to the resistances, i.e., higher the resistance of a branch, the less is the current or/and total current is the sum of the currents flowing in different branches.

- 197.** If five resistances each of value 0.5 ohm are connected in series, what will be the resultant resistance ?

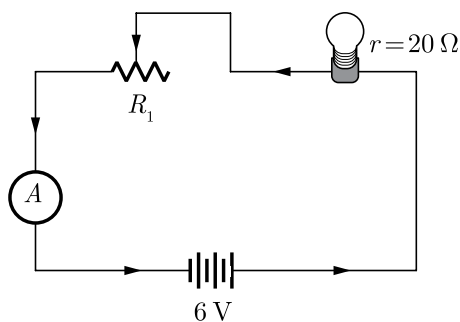
**Ans :**

OD 2012

Resultant resistance,

$$\begin{aligned} R &= R_1 + R_2 + R_3 + R_4 + R_5 \\ &= (0.5 + 0.5 + 0.5 + 0.5 + 0.5) \Omega \\ &= 2.5 \Omega \end{aligned}$$

- 198.** Suppose a 6 volt battery is connected across a lamp whose resistance is 20 ohm through a variable resistor as shown in the given Fig. If the current in the circuit is 0.25 A, find out the resistance.



**Ans :**

Delhi 2013

Given, voltage across the battery,

$$V = 6 \text{ Volt}$$

Current in the circuit,  $I = 0.25 \text{ A}$

Let  $R_1$  be the resistance required from the variable resistor.

Then the total resistance in the circuit,

$$R = r + R_1$$

Now, by Ohm's law,  $I = \frac{V}{R}$

$$0.25 \text{ A} = \frac{6 \text{ V}}{(20 \Omega + R_1)}$$

$$20 + R_1 = \frac{6}{0.25}$$

$$20 + R_1 = 24$$

$$R_1 = 4 \text{ ohm}$$

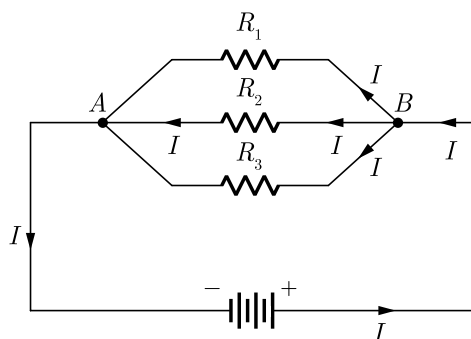
- 199.** How are three resistors joined in parallel ?

What is the potential difference across each resistor joined in parallel?

**Ans :**

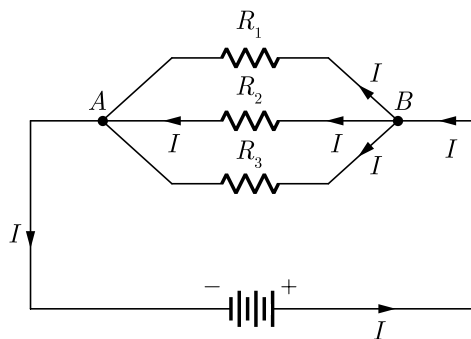
Delhi 2012

- (a) Three resistors are said to be joined in parallel when one end of all the three resistors is joined to one terminal of battery and other end is joined to the other terminal of battery.



- (b) The potential difference between points A and B is the same across each resistor.

- 200.** In the given circuit diagram suppose the resistors  $R_1$ ,  $R_2$  and  $R_3$  have the values 5  $\Omega$ , 10  $\Omega$ , 30  $\Omega$  respectively, which have been connected to a battery of 12 volt. Calculate



- (a) the current through each resistor,  
(b) the total current in the circuit and  
(c) the total circuit resistance.

**Ans :**

Foreign 2013, Delhi 2011

Given,  $R_1 = 5 \Omega$ ,  $R_2 = 10 \Omega$  and  $R_3 = 30 \Omega$

Voltage across the battery = 12 V

This is also the voltage across each of the resistors, therefore, to calculate the current in the resistors, we use Ohm's law.

$$(b) \quad I = I_1 + I_2 + I_3 \\ = 1.2 + 0.6 + 0.2 = 2 \text{ A}$$

(c) Total effective resistance,

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \\ = \frac{1}{5} + \frac{1}{10} + \frac{1}{30} \\ = \frac{6+3+1}{30} = \frac{10}{30} = \frac{1}{3} \Omega \\ R_p = 3 \Omega$$

**208.** Two resistors of resistances  $3 \Omega$  and  $6 \Omega$  respectively are connected to a battery of  $6 \text{ V}$  so as to have :

(a) Maximum resistance,

(b) Maximum current.

- (i) How will you connect the resistances in each case ?  
 (ii) Calculate the strength of the current in the circuit in both cases.

**Ans :**

SQP 2012, Delhi 2010

(a) For maximum resistance, resistors are to be connected in series.

$$R_s = R_1 + R_2 = 3 + 6 = 9 \Omega$$

Current in series,

$$I_s = \frac{V}{R_s} = \frac{6 \text{ V}}{9 \Omega} = 0.67 \text{ A}$$

(b) For maximum current, resistance has to be minimum and so resistors are to be connected in parallel.

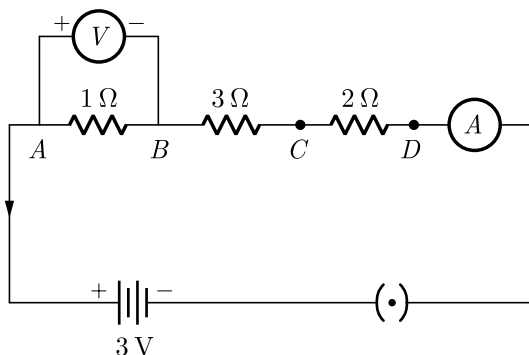
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2} \Omega$$

$$R_p = 2 \Omega$$

Current in parallel,

$$I_p = \frac{V}{R_p} = \frac{6 \text{ V}}{2 \Omega} = 3 \text{ A}$$

**209.** What would be the readings of ammeter and voltmeter in the given circuit ?



**Ans :**

OD 2012

In the given circuit, all resistors are connected in series so equivalent resistance,  $R$  is given by

$$R = R_1 + R_2 + R_3 \\ = 1 + 3 + 2 = 6 \Omega$$

Also, voltage  $V = 3 \text{ Volt}$

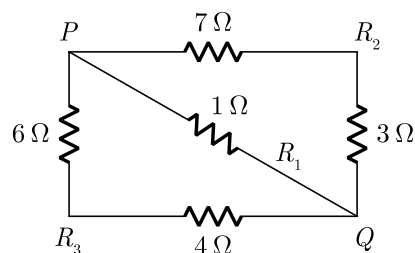
$$\text{So, } I = \frac{V}{R} = \frac{3}{6} = \frac{1}{2} \text{ A}$$

Reading of ammeter will be  $0.5 \text{ A}$ .

and  $V = IR = 0.5 \times 1 = 0.5 \text{ V}$

Reading of voltmeter will be  $0.5 \text{ V}$ .

**210.** Calculate the effective resistance between  $P$  and  $Q$ .



**Ans :**

Comp 2013, OD 2011

(i) In series :

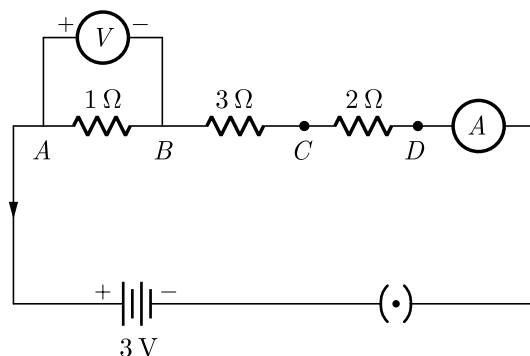
$$R_2 = 7 \Omega + 3 \Omega = 10 \Omega$$

$$R_3 = 6 \Omega + 4 \Omega = 10 \Omega$$

(ii) In parallel :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \\ = \frac{1}{1} + \frac{1}{10} + \frac{1}{10} \\ = \frac{10+1+1}{10} = \frac{12}{10} = \frac{6}{5} \\ R = \frac{5}{6} \Omega$$

**211.** How would the reading of voltmeter change if it is connected between  $B$  and  $C$  ?



As we know that,

$$\begin{aligned} I &= \frac{V}{R} \\ &= \frac{24}{16} = \frac{3}{2} \\ &= 1.5 \text{ A} \end{aligned}$$

- 204.** A wire is cut into three equal parts and then connected in parallel. How will its :

- (a) resistance  
(b) resistivity get effected ?

**Ans :**

OD 2012, Delhi 2010

- (a) Let resistance of a wire be  $R \Omega$ .

When it is cut into three equal parts Resistance of each part

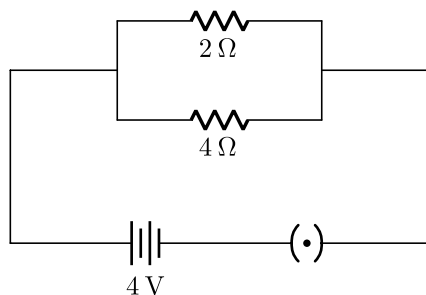
$$= \frac{R}{3} \Omega$$

When these are connected in parallel equivalent resistance,  $R_p$  is given by

$$\begin{aligned} \frac{1}{R_p} &= \frac{1}{R/3} + \frac{1}{R/3} + \frac{1}{R/3} = \frac{9}{R} \\ R_p &= \frac{R}{9} \end{aligned}$$

- (b) Resistivity will remain same.

- 205.** Calculate the current flowing through the resistors.



**Ans :**

Delhi 2013

In the given circuit, resistors  $R_1 = 2 \Omega$  and  $R_2 = 4 \Omega$  are connected in parallel combination.

So, equivalent resistance  $R$  is given by :

$$\begin{aligned} \frac{1}{R} &= \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{2} + \frac{1}{4} = \frac{2+1}{4} = \frac{3}{4} \\ \frac{1}{R} &= \frac{3}{4} \text{ thus } R = \frac{4}{3} \Omega \end{aligned}$$

Now, the current flowing through the resistors is given by :

$$I = \frac{V}{R} = \frac{4}{4/3} = 3 \text{ A}$$

- 206.** (a) What is the total resistance of  $n$  resistors each of resistance  $R$  connected in :

- (i) Series,  
(ii) Parallel.

- (b) Calculate the resultant resistance of 3 resistors  $3 \Omega$ ,  $4 \Omega$  and  $12 \Omega$  connected in parallel.

**Ans :**

Foreign 2013

- (a) Total resistance of  $n$  identical resistors each of resistance  $R$  in series is

$$R_s = R + R + R + \dots + R \quad (\text{upto } n \text{ times})$$

$$= nR$$

Also, total resistance of  $n$  identical resistors each of resistance  $R$  in parallel is

$$\frac{1}{R_p} = n \left( \frac{1}{R} + \frac{1}{R} + \dots + \frac{1}{R} \right)$$

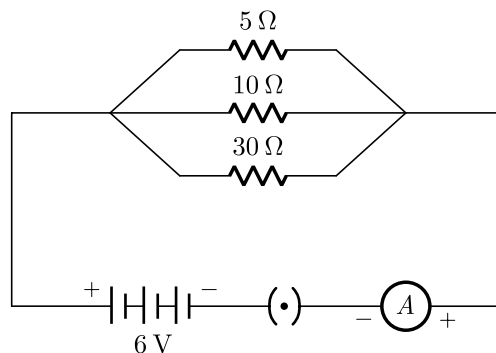
$$R_p = \frac{R}{n}$$

- (b)  $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{3} + \frac{1}{4} + \frac{1}{12}$

$$\frac{1}{R} = \frac{4+3+1}{12} = \frac{8}{12}$$

$$R = \frac{12}{8} = 1.5 \Omega$$

**207.**



In the above circuit diagram calculate :

- (a) the value of current through each resistor.  
(b) the total current in the circuit.  
(c) the total effective resistance of the circuit.

**Ans :**

SQP 2013

Let,

$$R_1 = 5 \Omega, R_2 = 10 \Omega, R_3 = 30 \Omega$$

and voltage,

$$V = 6 \text{ Volt}$$

- (a)  $I_1 = \frac{V}{R_1} = \frac{6}{5} \text{ A} = 1.2 \text{ A}$

$$I_2 = \frac{V}{R_2} = \frac{6}{10} \text{ A} = 0.6 \text{ A}$$

$$I_3 = \frac{V}{R_3} = \frac{6}{30} \text{ A} = 0.2 \text{ A}$$



$$= 8 + 10 = 18 \Omega$$

(b) Total flowing current,

$$I = \frac{V}{R} = \frac{12}{18} = \frac{2}{3} \text{ A}$$

**215.** Write the applications of the heating effect of current.

**Ans :**

Foreign 2013

(a) The heating effect of current is utilized in many electrical appliances like room heater, electric iron, electric toaster, electric lamps, etc.

(b) It is also used in electric fuse.

**216.** How much work is done during the flow of current for a given time in a wire ?

**Ans :**

Foreign 2012

Since a conductor offers resistance to the flow of current, work is done continuously to move the electrons or maintain the flow of current.

Work done in carrying a charge  $Q$  through potential difference  $V$  is given by

$$W = Q \times V$$

We know that (relation),

$$Q = I \times t$$

$$W = V \times I \times t$$

By Ohm's law,  $V = IR$

or  $W = I^2 R t$

We know that energy is the capacity of doing work, therefore, we can also say that

Electric energy,  $H = I^2 R t$

**217.** Express joules law of heating mathematically. What is the resistance of 12 m wire having radius  $2 \times 10^{-4}$  m specific resistivity  $3.14 \times 10^{-8} \Omega \text{ m}$  ?

**Ans :**

OD 2011

Joule's law of heating effect :

In accordance with Joules law of heating, if a current  $I$  flows through a resistor of resistance  $R$  for a time  $t$ , then the heat produced across the resistor is

$$H = I^2 R t \text{ Joules}$$

$$\begin{aligned} R &= \rho \frac{l}{A} = \rho \frac{l}{\pi r^2} \\ &= \frac{12 \times 3.14 \times 10^{-8}}{3.14 \times 4 \times 10^{-8}} = 3 \Omega \end{aligned}$$

**218.** Study the following circuit and answer the following questions :

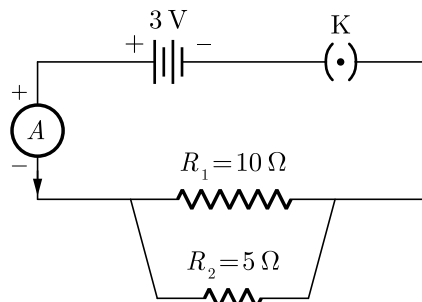
(a) State the type of combination of the two resistors in the circuit.

(b) How much current is flowing through :

(i)  $10 \Omega$  and through,

(ii)  $15 \Omega$  resistors.

(c) What is the ammeter reading ?



**Ans :**

Foreign 2012

(a) Parallel combination.

$$(b) (i) \quad I_1 = \frac{V}{R_1} = \frac{3}{10} = 0.3 \text{ A}$$

$$(ii) \quad I_2 = \frac{V}{R_2} = \frac{3}{15} = 0.2 \text{ A}$$

(c) Current flowing in the circuit is

$$I_1 + I_2 = 0.3 + 0.2 = 0.5 \text{ A}$$

Ammeter reading will be 0.5 A.

**219.** Calculate the electrical energy consumed by a 1200 W toaster in 20 minutes.

**Ans :**

OD 2010, Delhi 2006

Energy consumed = power  $\times$  time

$$\begin{aligned} E &= P \times t \\ &= 1200 \text{ W} \times 20 \times 60 \text{ s} \\ &= 1200 \times 1200 \text{ Ws} \\ &= 1.44 \times 10^6 \text{ J} \end{aligned}$$

**220.** An electric bulb is marked 60 W. What does this mean. How much energy does it consume if used for 1 hour ?

**Ans :**

Delhi 2011

A 60 W marked electric bulb indicates that it consumes 60 J of energy in one second.

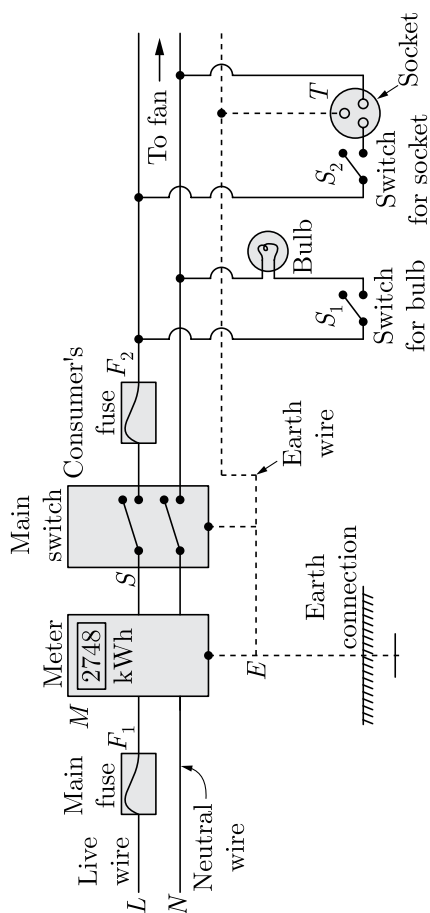
Energy consumed in one hour

$$\begin{aligned} E &= P \times t \\ &= 60 \text{ W} \times 1 \text{ hr} \\ &= 60 \text{ Wh} = 0.06 \text{ kWh} \end{aligned}$$

**221.** The rating of an electric heater is 1100 W; 220 V. Calculate its resistance when it operates at 220 V. Also calculate the energy consumed in kWh in the

- 296.** Read the following case based passage and answer the questions given after passage.

In household electric circuits, the mains supply is delivered to our homes using three core cable. The cable consists of three wires, live wire, neutral wire and earth wire. The live wire is at potential difference of 220 V for the domestic supply and the potential difference between live and neutral wire is 220 volts. The live wire is connected to electric meter through a fuse or a circuit breaker of higher rating. The neutral wire is connected directly to the electric meter.



- What is a short circuit?
- How switches are connected in the circuit?
- What is usual current rating of the fuse wire in the line if electric iron, geysers, room heater etc. are in use?
- Why is earthing of all electrical appliances recommended?

**Ans :**

- The condition when the live wire comes in direct contact with the neutral wire, a high current flows.

- Switches are connected in the live wire because when the switch is in the off position, no point of the connected electrical appliance will be at higher potential (220 V).
- A fuse of rating 15 A is usually used for appliance electric iron, geysers and room heater etc.
- The earthing of any electrical appliance is done to protect the user from any accidental electrical shock due to leakage of current.

- 297.** Study the table and answer the following questions. The following apparatus is available in a laboratory which is summarised in tabular form.

Battery	adjustable from 0 to 4.5 V
Resistors	3 $\Omega$ and 6 $\Omega$
Ammeters	A <sub>1</sub> of range 0 to 3 A least count 0.1 A A <sub>2</sub> of range 0 to 1 A least count 0.05 A
Voltmeters	V <sub>1</sub> of range 0 to 10 V least count 0.5 V V <sub>2</sub> of range 0 to 5 V least count 0.1 V

- For what purpose an ammeter is used?
- If we require the maximum resistance from a number of given resistors, we connect :
  - all in series.
  - all in parallel.
  - less resistors in series and more in parallel.
  - more resistor in series and loss in parallel.
- The best combination of voltmeter and ammeter for finding the equivalent resistance of the resistors in series would be :
  - ammeter A<sub>1</sub> and voltmeter V<sub>1</sub>
  - ammeter A<sub>1</sub> and voltmeter V<sub>2</sub>
  - ammeter A<sub>2</sub> and voltmeter V<sub>1</sub>
  - ammeter A<sub>2</sub> and voltmeter V<sub>2</sub>
- For the experiment to find the equivalent resistance of the parallel combination of the two given resistors, the best choice would be :
  - ammeter A<sub>1</sub> and voltmeter V<sub>1</sub>
  - ammeter A<sub>1</sub> and voltmeter V<sub>2</sub>
  - ammeter A<sub>2</sub> and voltmeter V<sub>1</sub>
  - ammeter A<sub>2</sub> and voltmeter V<sub>2</sub>

$$R_2 = \frac{V^2}{P_2}$$

$$= \frac{200 \times 200}{25} = 1600 \Omega$$

Total resistance,  $R = \frac{1}{R_1} + \frac{1}{R_2} = \frac{R_1 R_2}{R_1 + R_2}$

$$= \frac{1600 \times 400}{2000} = 320 \Omega$$

Current drawn,  $I = \frac{V}{R} = \frac{200}{320} = 0.63 \text{ A}$

- 227.** A torch bulb is rated 5.0 V and 500 mA. Calculate (i) its power, (ii) resistance and (iii) energy consumed when it is lighted for four hours.

**Ans :**

OD 2010, Delhi 2009

Potential difference,  $V = 5.0 \text{ Volt}$

Current,  $I = 500 \text{ mA}$

$$= \frac{500}{1000} = 0.5 \text{ A}$$

(i) Power,  $P = I \times V$

$$= 0.5 \times 5 = 2.5 \text{ W}$$

(ii) Resistance,  $R = \frac{V}{I} = \frac{5}{0.5} = 10 \Omega$

(iii) Energy,  $E = \text{Power} \times \text{Time}$

$$= \frac{2.5}{1000} \times 4$$

$$= 0.01 \text{ kWh}$$

- 228.** What is electric power ?

**Ans :**

Delhi 2011

The rate at which the electrical energy is converted into heat is known as electric power.

$$P = \frac{W}{t} = \frac{I^2 R t}{t} = I^2 R$$

Also,  $P = I \times V$

i.e., Power = Current  $\times$  Potential difference

- 229.** If 0.18 ampere of current is drawn by an electric bulb when it is connected to a source of 220 volts, find the power of the bulb.

**Ans :**

Delhi 2010, Delhi 2008

Given,

Current,  $I = 0.18 \text{ ampere}$

Potential difference,  $V = 220 \text{ volts}$

Power,  $P = V \times I$

$$= 220 \times 0.18 = 39.6$$

$$= 40 \text{ watt (approximately)}$$

- 230.** What is the commercial unit of electrical energy ?

**Ans :**

Foreign 2011

Since watt is a very small unit of power, the unit which is used is kilowatt.

$$1 \text{ kilowatt} = 1000 \text{ watts}$$

As we know, electrical energy

$$= \text{power} \times \text{time}$$

Commercial unit of electrical energy.

$$= \text{kW} \times \text{h} = \text{kWh (kilowatt hour)}$$

- 231.** An electric motor operates on a 50 V supply and draws a current of 13A. If the motor yields a mechanical power of 130 W, what is the percentage efficiency of the motor ?

**Ans :**

Foreign 2010, Delhi 2007

Given,

Potential difference,  $V = 50 \text{ volts}$

Current,  $I = 13 \text{ A}$

Input power,  $P = V \times I$

$$= 50 \times 13 = 650 \text{ Watt}$$

Output power = 130 W

$$\text{Efficiency} = \frac{\text{Output power}}{\text{Input power}} \times 100$$

$$= \frac{130}{650} \times 100 = 20 \%$$

- 232.** Two identical resistors, each of resistance  $50 \Omega$  are connected (i) in series (ii) in parallel, in turn, to a battery of 10 V. Calculate the ratio of power consumed in the combination of resistors in the two cases.

**Ans :**

Comp 2011

(i) The effective resistance of two resistors connected in series is given by

$$R_s = R_1 + R_2$$

$$= 50 \Omega + 50 \Omega = 100 \Omega$$

and power in series,

$$P_s = \frac{V^2}{R_s} = \frac{10^2}{100} = 1 \text{ W}$$

(ii) The effective resistance of two resistors connecting in parallel is

$$P_p = \frac{R_1 R_2}{R_1 + R_2}$$

$$= \frac{50 \times 50}{100} = 25 \Omega$$

Power in parallel,  $P_p = \frac{V^2}{R_p} = \frac{10^2}{25} = 4 \text{ W}$

Required ratio :  $\frac{P_s}{P_w} = \frac{1 \text{ W}}{4 \text{ W}} = 1 : 4$

Case (2) Parallel combination

$$\text{Net current } (I_{\text{equ}}) = \frac{3V}{R}$$

Current will get equally divided in three bulbs (I)

$$= \frac{I_{\text{equ}}}{3} = \frac{3V}{R \times 3} = \frac{V}{R}$$

$$\text{As, Power } (P) = \frac{V^2}{R}$$

therefore P is inversely proportional to R.

Hence, bulbs in case (2) will glow with great brightness as because power is 3 times more than that in case (1)

- (ii) In case (1), if one bulb gets fused, rest of bulbs will not glow because in series circuit the voltage across the circuit is the sum of the voltages across each bulb.

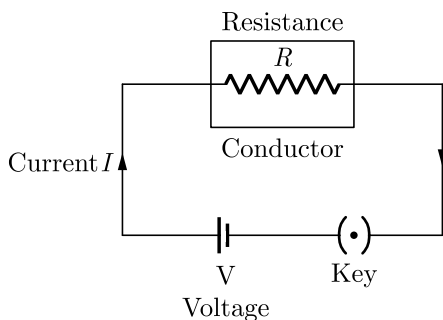
But in case (2), parallel combination, the voltage across each bulb is the same so, all other bulbs will glow as voltage eruption in the fused bulb does not affect the voltage of other bulbs. 1+1

260. (i) Draw a labelled circuit diagram of the circuit used to show the variation of potential difference across the ends of a resistor with current flowing through it. If you use this circuit, what relation would you find between the voltmeter reading,  $V$  and the ammeter reading,  $I$ ?
- (ii) A wire of given material having length  $l$  and area of cross-section  $A$  has a resistance of  $4 \Omega$ . Find the resistance of another wire of the same material having length  $l/2$  and area of cross-section  $2A$ .

Ans :

SQP 2021

- (i) The ohm's law states that the current carrying in a conductor is directly proportional to the voltage applied across the ends of the conductor, keeping the resistance constant.



According to ohm's law;  $V \propto I$

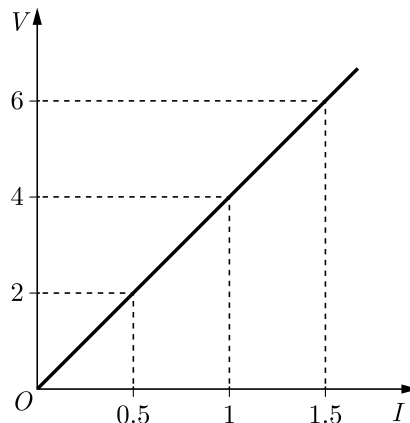
Mathematically;  $V = IR$  where

$V$  = Voltage applied in volts

$I$  = Current flowing in circuit in amperes.

$R$  = Resistance of conductor (proportionality constant)

Graphically; slope of will determine resistance of conductor.



- (ii) For first wire,

$$R_1 = \rho \frac{l}{A} = 4 \Omega$$

Now for second wire,

$$R_2 = \rho \frac{l/2}{2A} = \frac{1}{4} \rho \frac{l}{A}$$

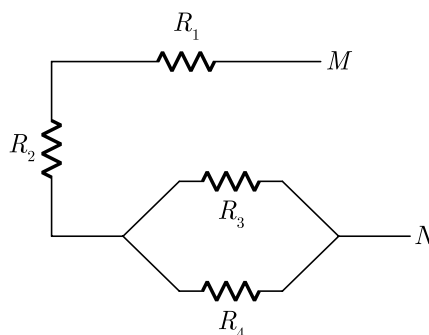
$$R_2 = \frac{1}{4} R_1$$

$$R_2 = 1 \Omega$$

The resistance of the new wire is  $1 \Omega$ .

261.

For the combination of resistors shown in the following figure, find the equivalent resistance between  $M$  and  $N$ .



- (b) State Joule's law of heating.
- (c) Why we need a 5 A fuse for an electric iron which consumes 1 kW power at 220 V?
- (d) Why is it impracticable to connect an electric bulb and an electric heater in series?

Ans :

OD 2020

- (a) In the above diagram  $R_1$  and  $R_2$  are connected in series and  $R_3$  and  $R_4$  are connected in parallel

- 237.** (a) Write the mathematical expression for Joule's law of heating.  
 (b) Compute the heat generated while transferring 96000 coulomb of charge in two hours through a potential difference of 40 V.

Ans :

Delhi 2020, OD 2014

- (a) According to the Joule's law of heating, heat produced in a resistor is directly proportional to the :
- square of current  $I$  for a given resistance.
  - resistance  $R$  for a given current.
  - the time  $t$  for which the current flows through the resistor.
- Mathematical form of Joule's law of heating is:

$$H = I^2 R t$$

- (b) Given, charge,

$$q = 96000 \text{ C}$$

Time,

$$t = 2 \text{ hrs}$$

$$= 120 \text{ min} = 7200 \text{ s}$$

Potential difference,

$$V = 40 \text{ volt}$$

We know that,

Heat  $H = VIt$ , where  $I$  is current ... (1)Also,  $I = \frac{q}{t}$  where  $q$  is charge and  $t$  is time in seconds. ... (2)Substituting  $I = \frac{q}{t}$  in equation (1) we get,

$$H = \left( V \times \frac{q}{t} \right) \times t$$

$$= \frac{Vqt}{t} = Vq$$

$$= 40 \times 96000$$

$$= 3840000 \text{ Joule}$$

$$= 3840 \text{ kJ}$$

- 238.** Two electric lamps rated 100 W, 220 V and 25 W, 220 V are connected in parallel. Calculate the total electric current in the circuit.

Ans :

Delhi 2011, OD 2008

For the first bulb,

$$\text{Resistance, } R_1 = \frac{V^2}{P_1}$$

$$R_1 = \frac{(220)^2}{100} = 484 \Omega$$

For the second bulb,

$$\text{Resistance, } R_2 = \frac{V^2}{P_2}$$

$$R_2 = \frac{(220)^2}{25} = 1936 \Omega$$

When connected in parallel, resultant resistance is given by,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{484} + \frac{1}{1936}$$

$$\frac{1}{R} = \frac{4+1}{1936} = \frac{5}{1936}$$

$$R = \frac{1936}{5} = 387.2 \Omega$$

Current,

$$I = \frac{V}{R}$$

$$I = \frac{220}{387.2} = 0.56 \text{ A}$$

- 239.** Calculate the total cost of running the following electrical devices in the month of September, if the rate of 1 unit of electricity is ₹ 6.00.

- Electric heater of 1000 W for 5 hours daily.
- Electric refrigerator of 400 W for 10 hours daily.

Ans :

SQP 2018

- (i) Energy consumed by electric heater,

$$= P \times t = 1000 \times 5 = 5000 \text{ Wh}$$

- (ii) Energy consumed by refrigerator,

$$= P \times t = 400 \times 10 = 4000 \text{ Wh}$$

Total energy consumed in one day,

$$= 5000 \text{ Wh} + 4000 \text{ Wh}$$

$$= 9000 \text{ Wh} = \frac{9000}{1000} \text{ kWh} = 9 \text{ kWh}$$

Total energy consumed in the month of September,

$$= 30 \times 9 = 270 \text{ kWh} = 270 \text{ units}$$

Cost of 1 unit of electricity is = ₹ 6

Thus cost of 270 units of electricity,

$$= 6 \times 270 = ₹ 1,620$$

- 240.** (a) In a given ammeter, a student saw that needle indicates 12th division in ammeter while performing an experiment to verify Ohm's law. If ammeter has 10 divisions between 0 to 0.5 A, then what is the ammeter reading corresponding to 12th division ?  
 (b) How do you connect an ammeter and a voltmeter in an electric circuit ?

month of November if the heater is used daily for four hours at the rated voltage.

**Ans :**

Delhi 2010

$$\begin{aligned}\text{Power, } P &= \frac{V^2}{R} \\ R &= \frac{V^2}{P} \\ R &= \frac{220 \text{ V} \times 220 \text{ V}}{1100 \text{ W}} \\ &= 44 \Omega\end{aligned}$$

Energy consumed by the heater in the month of November,

$$\begin{aligned}E &= P \times t \\ &= 1100 \text{ W} \times (4 \text{ h} \times 30) \\ &= 1100 \times 4 \times 30 \text{ Wh} \\ &= \frac{1100 \times 4 \times 30}{1000} \text{ kWh} \\ &= 132 \text{ kWh}\end{aligned}$$

- 222.** (a) Electric fuse is an important component of all domestic circuits. Why ?  
 (b) An electric oven of rating 2 kW, 220 V is operated in a domestic circuit with a current rating of 5 A. What result would you expect ? Explain.

**Ans :**

Foreign 2011, OD 2010

- (a) Electric fuse is a safety device which prevents electrical fires. So, it is an important component of domestic circuit.  
 (b) The rating current drawn is given by

$$I = \frac{P}{V} = \frac{2000 \text{ W}}{220 \text{ V}} = 9.09 \text{ A}$$

Since, current drawn by the oven is more than 5 A, therefore, the fuse wire will melt.

- 223.** An electric iron consumes energy at a rate of 840 W when heating is at the maximum rate and 360 W when the heating is at the minimum. The voltage is 220 V. What are the current and the resistance in each case ?

**Ans :**

Foreign 2010

$$\begin{aligned}\text{From, } P &= VI \\ \text{we have, } I &= \frac{P}{V} \\ \text{(a) When heating is at maximum rate.} \\ \text{Current, } I &= \frac{840 \text{ W}}{220 \text{ V}} = 3.82 \text{ A} \\ \text{and resistance, } R &= \frac{V}{I} = \frac{220}{3.82} = 57.6 \Omega\end{aligned}$$

- (b) When heating is at the minimum rate.

$$\text{Current, } I = \frac{360 \text{ W}}{220 \text{ V}} = 1.64 \text{ A}$$

$$\text{and resistance, } R = \frac{V}{I} = \frac{220 \text{ V}}{1.64 \text{ A}} = 134.15 \Omega$$

- 224.** Express the electrical energy in Joules.

**Ans :**

SQP 2011

$$\begin{aligned}1 \text{ kWh} &= 1000 \text{ Watts} \times 60 \text{ min} \\ &= 1000 \times 60 \times 60 \text{ s} \\ &= 3.6 \times 10^6 \text{ Watts seconds} \\ &= 3.6 \times 10^6 \text{ Joules}\end{aligned}$$

- 225.** (a) What precaution should be taken to avoid the overloading of domestic electric circuits ?  
 (b) An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V), that has a current rating 5 A. What result do you expect ? Explain.

**Ans :**

SQP 2011, Delhi 2006

- (a) Following precautions should be taken to avoid overloading :  
 (i) Too many high power rating electrical appliances (electric iron, geyser, A.C.) should not be switched on at the same time.  
 (ii) Do not operate too many electrical appliances on a single socket.

$$\begin{aligned}\text{(b) } P &= 2 \text{ kW} = 2000 \text{ W} \\ V &= 220 \text{ Volt} \\ P &= V \times I \\ I &= \frac{P}{V} = \frac{2000}{220} = 9 \text{ A}\end{aligned}$$

Current drawn in electric oven is more than 5 A. So, the fuse will melt and the power supply in this circuit would cut off.

- 226.** In a household electric circuit different appliances are connected in parallel to one another. Give two advantages of such connections.

Two bulbs rated 100 W, 200 V and 25 W, 200 V are connected in parallel to a 200 V supply. What will be the current drawn from the supply line ?

**Ans :**

OD 2011

- (a) Each appliance can draw the required current.  
 (b) Each appliance can be controlled individually.

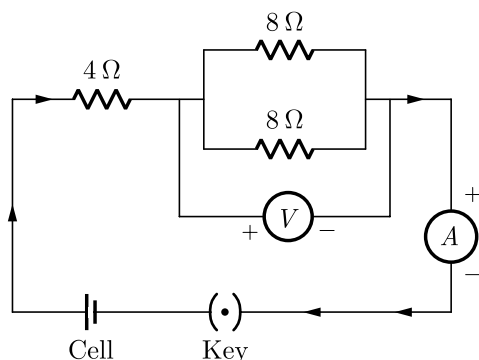
$$\begin{aligned}R_1 &= \frac{V^2}{P_1} \\ &= \frac{200 \times 200}{100} = 400 \Omega\end{aligned}$$

$8\Omega$  each) in parallel and a voltmeter across parallel combination. Each of them dissipate maximum energy and can withstand a maximum power of  $16\text{W}$  without melting. Find the maximum current that can flow through the three resistors.

**Ans :**

Delhi 2018

We know,  $P = I^2 R$



$$P = 16 \text{ W}$$

Now,  $I = \sqrt{\frac{P}{R}}$

So, maximum Current of  $4\Omega$  resistor,

$$I = \sqrt{\frac{16}{4}} = 2 \text{ A}$$

So, current through each  $8\Omega$  resistor will be,

$$= \frac{1}{2} \times 2 = 1 \text{ A}$$

- 245.** State the factors on which the resistance of a cylindrical conductor depends. How will resistance of a conductor change if it is stretched so that its length is doubled ?

**Ans :**

OD 2017

The resistance of a cylindrical conductor is directly proportional to its length ( $l$ ) and inversely proportional to the area of cross-section ( $A$ ). That is,

$$R \propto l \text{ and } R \propto \frac{1}{A}$$

On combining, we have

$$R \propto \frac{l}{A}$$

$$R = \rho \frac{l}{A} \quad \dots(1)$$

Now according to the question

New length,  $l' = 2l$

As we know that volume of wire remains constant,

$$Al = A'l'$$

$$Al = A'(2l)$$

$$A' = A/2$$

New resistance,  $R_1 = \rho \frac{2l}{\frac{A}{2}} = 4\rho \frac{l}{A} = 4R$

i.e., it is 4 times of original resistance.

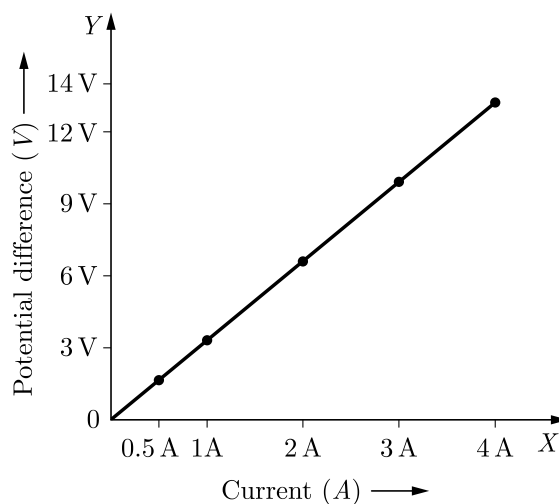
- 246.** The values of current  $I$  flowing in a given resistor for the corresponding values of potential difference  $V$  across the resistor are given below:

$I$ (ampere)	0.5	1.0	2.0	3.0	4.0
$V$ (volt)	1.6	3.4	6.7	10.2	13.2

Plot a graph between  $V$  and  $I$  and calculate the resistance of the resistor.

**Ans :**

2018



From the graph, we can take values of  $V$  and  $I$ .

$$V = (6.7 - 3.4) = 3.3 \text{ Volt}$$

$$I = (2.0 - 1.0) = 1.0 \text{ A}$$

$$R = \frac{V}{I} = \frac{3.3}{1.0} = 3.3 \Omega$$

So, Resistance =  $3.3 \Omega$  (ohm)

- 247.** A metallic coil, connected to a  $220 \text{ V}$  supply, has a resistance of  $110 \text{ ohm}$  (while hot). How long will it take for this coil to heat  $1 \text{ kg}$  of water from  $20^\circ\text{C}$  to  $70^\circ\text{C}$  ? Assume that whole of the heat produced by the coil is taken up by water. (Specific heat of water =  $4186 \text{ J/kg}^\circ\text{C}$ )

**Ans :**

OD 2016, Delhi 2008

Potential difference,  $V = 220 \text{ Volt}$

Resistance,  $R = 110 \Omega$

Power,  $P = \frac{V^2}{R} = \frac{(220)^2}{110} = 440 \text{ W}$



- (i) What is the mathematical relation between voltage and current ?
- (ii) Which student measurement is wrong in the table B?
- (iii) In the following measurement of student Y. Which measurement is wrong?
- (a)  $I = 4$ ,  $V = 4$                       (b)  $I = 3$ ,  $V = 6$
- (c)  $I = 4$ ,  $V = 8$                       (d) None of these
- (iv) The value of resistance from the measurement of student A is
- (a)  $2\Omega$                                       (b)  $3\Omega$
- (c)  $4\Omega$                                       (d)  $1\Omega$

Ans :

- (i) According to the ohm's Law, current is directly proportional to voltage ( $V$ ). i.e.,  $i \propto V$ .
- (ii) Student Y
- (iii) (a)  $I = 4$ ,  $V = 4$
- (iv) (a)  $2\Omega$

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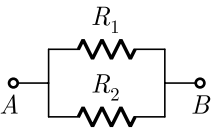
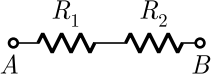
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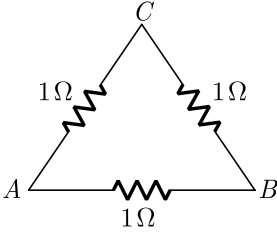
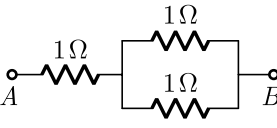
- 304.** Read the following case based passage and answer the questions given after passage.

Two table given below study these table related to equivalent resistance and answer the question that follows.

**Table -A Combination of resistance**

Combination	Circuit	Equivalent resistance
Parallel		$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$
Series		$R_{eq} = R_1 + R_2$

**Table -B**

Student	Circuit	Equivalent resistance
Student A	 Circuit - 1	$1\Omega$
Student B	 Circuit - 2	$1.5\Omega$

- (i) Which student measured the wrong equivalent resistance in Table-B?
- (ii) In which configuration of resistance, the potential difference across each resistance remains same?
- (iii) The value of equivalent resistance of circuit-1 is?
- (a)  $1\Omega$                                       (b)  $2\Omega$
- (c)  $0.4\Omega$                                       (d)  $0.6\Omega$
- (iv) In which configuration of resistance the current across each resistances remain same?
- (a) Series combination
- (b) Parallel combination
- (c) Mixed combination
- (d) None of these

Ans :

- (i) Student A
- (ii) Parallel combination.
- (iii) (d)  $0.6\Omega$

$$R' = R_{AC} + R_{CB}$$

$$= 1 + 1 = 2\Omega$$

$$R_{eq} = \frac{R' \times 1\Omega}{R' + 1\Omega}$$

$$= \frac{2 \times 1}{2 + 1} = \frac{2}{3}$$

$$= 0.6\Omega$$

- (iv) (a) Series combination

- 305.** Read the following case based passage and answer the questions given after passage.

Given table provides the resistivity of conductors,

by

$$R = R_1 + R_2 = 1 + 2 = 3 \Omega$$

$$I = \frac{V}{R} = \frac{3}{3} = 1 \text{ A}$$

Ammeter reading = 1 A

Voltmeter Reading =  $IR = 1 \times 2 = 2 \text{ V}$

Voltmeter reading = 2 V

**251.** (a) Define the term volt.

(b) State the relation between work, charge and potential difference for an electric circuit.

Calculate the potential difference between the terminals of a battery if 100 joules of work is required to transfer 20 coulombs of charge from one terminal of the battery to the other.

**Ans :**

Foreign 2016, OD 2011

(a) The term volt is the S.I. unit of potential difference. Potential difference is said to be volt if one joule work is to be done to carry 1 coulomb positive charge from one point to another.

(b) The relation between work ( $W$ ), charge ( $Q$ ) and potential difference ( $V$ ) for an electric circuit is

$$V = \frac{W}{Q}$$

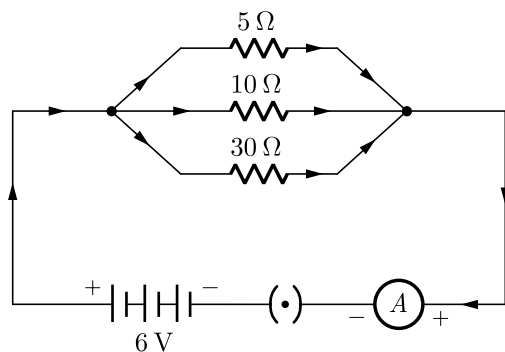
Given:  $W = 100 \text{ J}$ , and  $Q = 20 \text{ C}$

Potential difference,

$$V = \frac{W}{Q} = \frac{100 \text{ J}}{20 \text{ C}} = 5 \text{ V}$$

**252.** For the circuit diagram given below, calculate :

- the value of current through each resistor.
- the total current in the circuit.
- the total effective resistance of the circuit.



**Ans :**

Comp 2017

- Since the three resistances, shown in the circuit have been joined in parallel, hence voltage across each of them is same having a value 6 V. Current  $I_1$  through resistance  $R_1 = 5 \Omega$ ,

$$I_1 = \frac{V}{R_1} = \frac{6}{5} = 1.2 \text{ A}$$

Current  $I_2$  through resistance  $R_2 = 10 \Omega$ ,

$$I_2 = \frac{V}{R_2} = \frac{6}{10} = 0.6 \text{ A}$$

and current  $I_3$  through resistance  $R_3 = 30 \Omega$ ,

$$I_3 = \frac{V}{R_3} = \frac{6}{30} = 0.2 \text{ A}$$

(b) Total current in the circuit

$$I = I_1 + I_2 + I_3 \\ = 1.2 + 0.6 + 0.2 = 2.0 \text{ A}$$

(c) Total effective resistance of the circuit

$$R_{\text{eq}} = \frac{V}{I} = \frac{6}{2.0} = 3.0 \Omega$$

**253.** (a) Two conductors  $A$  and  $B$  of resistances  $5 \Omega$  and  $10 \Omega$  respectively can be arranged in parallel and later on in series. In each arrangement, the total voltage applied across it is 20 volts. In which arrangement will the voltage across  $A$  and  $B$  be the same and in which case will the current flowing through  $A$  and  $B$  be the same ?

(b) Calculate the total resistance for each arrangement.

**Ans :**

OD 2017

(a) Voltage across  $A$  and  $B$  will be the same in parallel.

Current flowing through  $A$  and  $B$  will be the same in series.

(b) Equivalent resistance in series

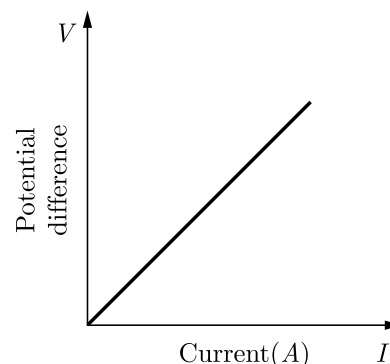
$$= (5 + 10) \Omega = 15 \Omega$$

Equivalent resistance in parallel,

$$\frac{1}{R} = \frac{1}{5} + \frac{1}{10} = \frac{3}{10}$$

$$R = \frac{10}{3} = 3.33 \Omega$$

**254.**  $V$ - $I$  graph for a conductor is as shown in figure.



- 233.** A wire of resistance 20 ohm is bent in the form of a closed circle. What is the effective resistance between the two points at the ends of any diameter of the circle ?

**Ans :**

SQP 201, Delhi 2008

Each semi-circle of wire has resistance = 10 ohms

Effective resistance,  $R$  is given by,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

where  $R_1$  and  $R_2$  are resistances in each semi-circle.

$$\frac{1}{R} = \frac{1}{10} + \frac{1}{10}$$

$$\frac{1}{R} = \frac{2}{10} = \frac{1}{5}$$

$$R = 5 \text{ ohms}$$

- 234.** Two resistors with resistances  $10 \Omega$  and  $15 \Omega$  are to be connected to emf 12 V so as to obtain : (i) minimum current (ii) maximum current. How will you connect the resistance in each case ? Calculate the strength of the total current in the circuit in the two cases.

**Ans :**

OD 2010

- (i) To obtain minimum current, the two resistors should be connected in series so that the equivalent resistance,

$$R_s = 10 \Omega + 15 \Omega = 25 \Omega$$

$$\text{Thus, } I_{\min} = \frac{12 \text{ V}}{25 \Omega} = 0.48 \text{ A}$$

- (ii) To obtain maximum current, the two resistors should be connected in parallel so that the equivalent resistance,

$$R_p = \frac{15 \Omega \times 10 \Omega}{15 \Omega + 10 \Omega} = 6 \Omega$$

$$\text{Thus, } I_{\max} = \frac{12}{6 \Omega} = 2 \text{ A}$$

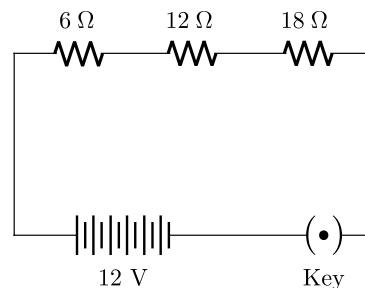
### THREE MARKS QUESTIONS

- 235.** Draw a schematic diagram of a circuit consisting of a battery of six 2 V cells, a  $6 \Omega$  resistor, a  $12 \Omega$  resistor and a  $18 \Omega$  resistor and a plug key all connected in series. Calculate the following (when key is closed):
- Electric current flowing in the circuit.
  - Potential difference across  $18 \Omega$  resistor.
  - Electric power consumed in  $18 \Omega$  resistor.

**Ans :**

OD 2024

The required diagram is shown below.



In the above circuit all the resistances are connected in series. The equivalent resistance is given by

$$R_{eq} = 6 + 12 + 18 = 36 \Omega$$

$$(i) I = \frac{V}{R_{eq}} = \frac{12}{36} = \frac{1}{3} \text{ A}$$

$$(ii) V_{18} = IR = \frac{1}{3} \times 18 = 6 \text{ V}$$

$$(iii) P_{18} = I^2 R = \left(\frac{1}{3}\right)^2 \times 18 = 2 \text{ W}$$

- 236.** (i) What is meant by resistance of a conductor? Define its SI unit.  
 (ii) List two factors on which the resistance of a rectangular conductor depends.  
 (iii) How will the resistance of a wire be affected if its.
- length is doubled, and
  - radius is also doubled ?
- Give justification for your answer.

**Ans :**

OD 2023

(a)

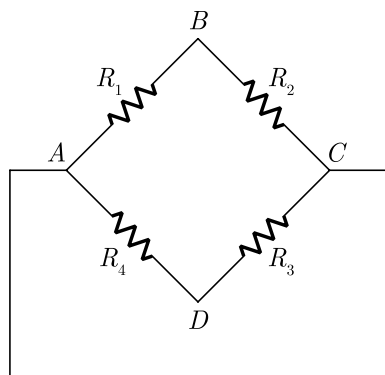
- (i) Resistance is defined as the property of a conductor to resist the flow of charges through it. The resistance of a conductor is numerically given as the ratio of the potential difference across its length to the current flowing through it.

Its SI unit is ohm. The resistance of a conductor is said to be 1 ohm if a current of 1 ampere flows through it when the potential difference across it is 1 volt.

- (ii) Resistance of a conductor depends on :

- Length of the conductor.
- Area of cross section of the conductor.

- (iii) (1) Resistance is directly proportional to the length. Hence, if length is doubled, resistance is also doubled.  
 (2) The resistance of a wire is inversely proportional to the area of cross-section of the wire. Thus, if the radius is doubled, the area increases four times and hence the resistance becomes one-fourth.



$$AB = BC = CD = AD$$

$$R_1 = R_2 = R_3 = R_4$$

$$= \frac{6}{4} = 1.5 \, \Omega$$

Resistance across AC is given by R,

$$\frac{1}{R} = \frac{1}{R'} + \frac{1}{R''} \left[ \begin{array}{l} R' = R_1 + R_2 \\ R'' = R_3 + R_4 \end{array} \right]$$

$$R' = 1.5 + 1.5 = 3 \, \Omega$$

$$R'' = 1.5 + 1.5 = 3 \, \Omega$$

$$\frac{1}{R} = \frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

$$R = \frac{3}{2} = 1.5 \, \Omega$$

- 258.** A hot plate of an electric oven, connected to a 200 V line. It has two resistance coils A and B each of the  $30 \, \Omega$  which may be used separately, in series or in parallel. Find the value of the current required in each of the three cases.

**Ans :**

Comp. 2016

Given,  $V = 220 \text{ Volt}$

Resistance of coil A ( $R_A$ ) = Resistance of coil B ( $R_B$ )  
 $= 30 \, \Omega$

- (i) When coil A and B is used separately, then

$$I = V/R = 220/30 = 7.33 \text{ A}$$

- (ii) When the coils are connected in series, the total resistance is

$$R_s = R_A + R_B = 30 + 30 = 60 \, \Omega$$

Hence, current,

$$I_s = V/R_s = 220/60 = 3.67 \text{ A}$$

- (iii) When the coils are connected in parallel, the total resistance is

$$\frac{1}{R_P} = \frac{1}{R_A} + \frac{1}{R_B} = \frac{1}{30} + \frac{1}{30} = \frac{1}{15}$$

or

$$R_P = 15$$

Hence, current is

$$I = V/R = 220/15 = 14.67 \text{ A}$$

## FIVE MARKS QUESTIONS

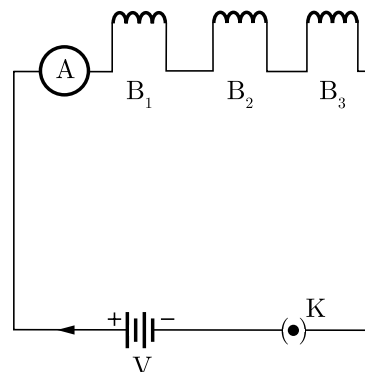
- 259.** In an electric circuit three bulbs of 100 W each are connected in series to a source. In another circuit set of three bulbs of the same wattage are connected in parallel to the same source.

- (i) Will the bulb in the two circuits glow with the same brightness? Justify your answer.  
 (ii) Now, let one bulb in both the circuits get fused. Will the rest of the bulbs continue to glow in each circuit? Give reason for your answer.

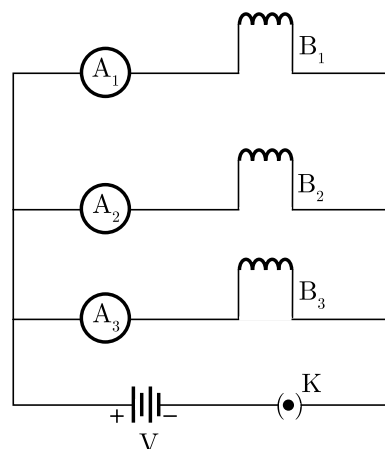
**Ans :**

OD 2023

**Case (1) :**



**Case (2) :**



- (i) Let us assume that resistance of each bulb is R and the source of voltage is V.

Case (1) Series combination

$$R_{equ} = R + R + R = 3R$$

$$\text{Current in each bulb (I)} = \frac{V}{3R}$$

**Ans :**

Delhi 2019

- (a) The ammeter is having 10 division in between  $0 - 0.5 \text{ A}$ .

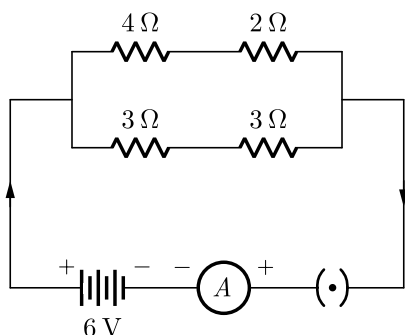
$$\text{Least count of ammeter} = \frac{0.5 - 0}{10} = 0.05 \text{ A}$$

Hence, the reading of 17 division will be

$$= 17 \times 0.05 = 0.85 \text{ A}$$

- (b) Ammeter is connected in series combination and voltmeter is connected in the parallel combination.

- 241.** In the given circuit, find :



- (a) Total resistance of the network of resistors  
(b) Current through ammeter  $A$

**Ans :**

OD 2019

- (a) In the given circuit diagram  $4\Omega$  and  $2\Omega$  resistances are connected in series combination and  $3\Omega$  and  $3\Omega$  resistance are also connected in the series combination.

$$R_1 = 4 + 2 = 6\Omega$$

$$R_2 = 3 + 3 = 6\Omega$$

Now the equivalent resistance of circuit

$$\begin{aligned} \frac{1}{R_{eq}} &= \frac{1}{R_1} + \frac{1}{R_2} \\ &= \frac{1}{6} + \frac{1}{6} = \frac{2}{6} \end{aligned}$$

$$R_{eq} = \frac{6}{2} = 3\Omega$$

- (b) According to ohm's law,

$$V = IR_{eq}$$

$$I = \frac{V}{R_{eq}} = \frac{6}{3} = 2 \text{ A}$$

- 242.** While studying the dependence of potential difference  $V$  across a resistor on the current  $I$  passing through it, in order to determine the resistance of the resistor, a student took 5 readings for different values of current and plotted a graph between  $V$  and  $I$ . He got a straight line graph passing through the origin. What does the straight line signify?

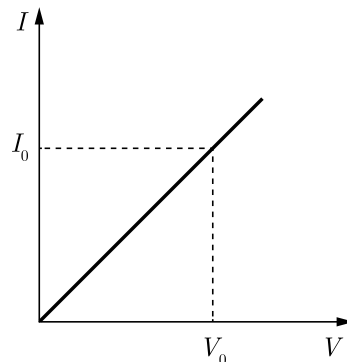
Write the method of determining resistance of the resistor using this graph.

**Ans :**

Comp. 2019

The straight line in the graph signify that potential difference and current are directly proportional to each other.

The method of determining resistance of resistor using the graph is by Ohm's law,  $V = IR$  and by calculating the slope from the points mentioned on the graph.



$$R = \frac{1}{\text{Slope of } V-I \text{ graph}}$$

- 243.** (a) List the factors on which the resistance of a conductor in the shape of wire depends.  
(b) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.  
(c) Why are alloys commonly used in electrical heating devices? Give reason.

**Ans :**

Comp. 2018

- (a) Resistance of a conductor depends directly on its length, inversely proportional to the area of cross-section, directly proportional to the temperature and it depends on the nature of the conductor.  
(b) Metals have free electrons which can move and conduct electricity, whereas glass does not have free electrons which can flow freely to conduct electricity.  
(c) The resistivity of an alloy is generally higher than that of pure metal. Alloys do not oxidise (burn) readily at higher temperatures. Therefore, conductors of electric heating devices, such as toasters and electric irons, are made of an alloy rather than pure metal.

- 244.** Draw a circuit diagram of an electric circuit containing a cell, a key, an ammeter, a resistor of  $4\Omega$  in series with a combination of two resistors (

combination.

$$(R_1 + R_2) + \left( \frac{R_3 \times R_4}{R_3 + R_4} \right)$$

- (b) Joule's law of heating implies that heat produced in a resistor is (i) directly proportional to the square of current for a given resistance, (ii) directly proportional to resistance and (iii) directly proportional to the time for which the current flows through the resistor.

$$H = I^2 R t$$

where,  $I$  = Current

$R$  = Resistance

$T$  = Time taken

- (c) For an electric iron which consumes 1 kW electric power when operated at 220 V, a current of  $(1000/220)$  A, i.e., 4.54 A will flow in the circuit. In this case, a 5 A fuse must be used.
- (d) In a series circuit the current is constant throughout the electric circuit. Thus, it is obviously impracticable to connect an electric bulb and an electric heater in series, because they need currents of widely different values to operate properly.

- 262.** (a) Derive the relation for the equivalent resistance when three resistors of resistances  $R_1$ ,  $R_2$  and  $R_3$  are connected in parallel.
- (b) Find the minimum resistance that can be made using four resistors, each of  $20 \Omega$ .

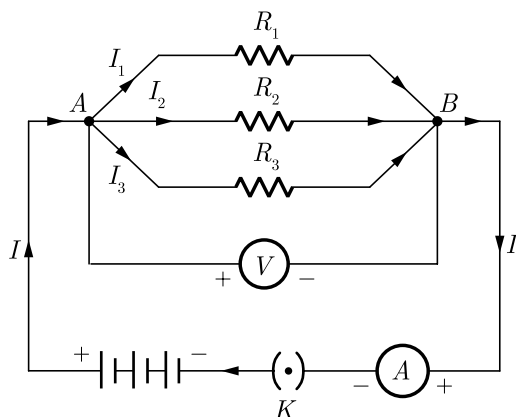
**Ans :**

Delhi 2020, OD 2014

- (a) It is observed that total current  $I$  is equal to the sum of separate currents.

$$I = I_1 + I_2 + I_3 \quad \dots(1)$$

Let  $R_p$  be the equivalent resistance of the parallel combination of resistors.



So, by applying ohm's law

$$I = \frac{V}{R_p}$$

$$I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2} \text{ and } I_3 = \frac{V}{R_3}$$

So, now from equation (1), we have

$$\frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\text{and } \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Hence, if  $n$  resistors are connected in parallel, then the equivalent resistance of the circuit is given by -

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_n}$$

- (b) To get the minimum resistance all the resistors are connected in the parallel combination. Hence the equivalent resistance is given by

$$\frac{1}{R} = \frac{1}{20} + \frac{1}{20} + \frac{1}{20} + \frac{1}{20}$$

$$\frac{1}{R} = \frac{4}{20}$$

$$R = \frac{20}{4} = 5 \text{ ohm}$$

- 263.** (a) Define power and state its SI unit.
- (b) A torch bulb is rated 5 V and 500 mA. Calculate its
- Power
  - Resistances
  - Energy consumed when it is lighted for  $2\frac{1}{2}$  hours.

**Ans :**

OD 2020

- (a) Power is defined as the rate of doing work, it is the work done in unit time. The SI unit of power is Watt (W) which is joules per second (J/s).
- (b) Given, Potential difference,

$$V = 5 \text{ Volt}$$

$$\text{Current, } I = 500 \text{ mA}$$

$$= \frac{500}{1000} \text{ A} = 0.5 \text{ A}$$

$$(i) \text{ Power} = V \times I = 5 \times 0.5$$

$$= 5 \times \frac{5}{10} = 2.5 \text{ W}$$

- (ii) Resistances  $R = ?$

By Ohms law :

$$V = IR$$

$$R = \frac{V}{I}$$

$$R = \frac{5}{0.5} = \frac{50}{5} = 10 \text{ ohms}$$

(which is an alloy of copper, manganese and nickel) is about 25 times more than that of copper; and the resistivity of constantan (which is an alloy of copper and nickel) is about 30 times more than that of copper metal. It is due to their high resistivities that manganin and constantan alloys are used to make resistance wires (or resistors) used in electronic appliances to reduce the current in an electrical circuit. Another alloy having a high resistivity is nichrome. This is an alloy of nickel, chromium, manganese and iron having a resistivity of about 60 times more than that of copper.

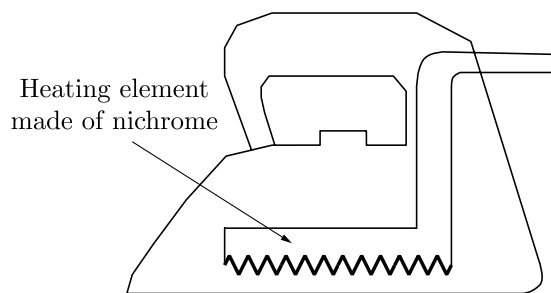


Figure: An electric iron

The heating elements (or heating coils) of electrical heating appliances such as electric iron and toaster, etc., are made of an alloy rather than a pure metal because (i) the resistivity of an alloy is much higher than that of pure metal, and (ii) an alloy does not undergo oxidation (or burn) easily even at high temperature, when it is red hot. For example, nichrome alloy is used for making the heating elements of electrical appliances heaters (geysers), and hair dryers, etc., because:

- Nichrome has very high resistivity (due to which the heating element made of nichrome has a high resistance and produces a lot of heat on passing current)
- Nichrome does not undergo oxidation (or burn) easily even at high temperature. Due to this nichrome wire can be kept red-hot without burning or breaking in air.

Answer following questions.

- What is use of metals which have less resistance?
- What are applications of metals which have high resistance ?
- Nichrome alloy is used for making the heating elements of electrical appliances heaters (geysers), and hair dryers, etc. Why ?
- Name the alloys which have very high resistivity as compare to copper.

Ans :

- Conducting wires
- Heating elements, resistors
- Nichrome has very high resistivity (due to which the heating element made of nichrome has a high resistance and produces a lot of heat on passing current).
  - Nichrome does not undergo oxidation (or burn) easily even at high temperature. Due to this nichrome wire can be kept red-hot without burning or breaking in air.
- Manganin, constantan, nichrome

311. Read the following case based passage and answer the questions given after passage.

We find that of all the metals, silver has the lowest resistivity (of  $1.60 \times 10^{-8} \Omega \text{ m}$ ), which means that silver offers the least resistance to the flow of current through it. Thus, silver metal is the best conductor of electricity. It is obvious that we should make electric wires of silver metal. But silver is a very costly metal. The resistivity of most of the metals increases with temperature. On the other hand, the resistivity of insulators like ebonite, glass and diamond is very high and does not change with temperature.

Semiconductors	1. Germanium 2. Silicon	0.6 $\Omega \text{ m}$ 2300 $\Omega \text{ m}$
Insulators	1. Glass 2. Paper (Dry) 3. Diamond 4. Hard rubber 5. Ebonite	$10^{10}$ to $10^{14} \Omega \text{ m}$ $10^{12} \Omega \text{ m}$ $10^{12}$ to $10^{13} \Omega \text{ m}$ $10^{13}$ to $10^{16} \Omega \text{ m}$ $10^{15}$ to $10^{17} \Omega \text{ m}$

The resistivity of semi-conductors like silicon and germanium is in-between those of conductors and insulators and decreases on increasing the temperature. Semiconductors are proving to be of great practical importance because of their marked change in conducting properties with temperature, impurity, concentration, etc. Semiconductors are used for making solar cells and transistors.

Answer the following questions using the above data:

- How does resistivity of diamond change with increase in temperature ?
- Name any two substance which have great change in conducting properties with impurity, concentration.
- Silver is better conductor than copper but we use copper. Why ?



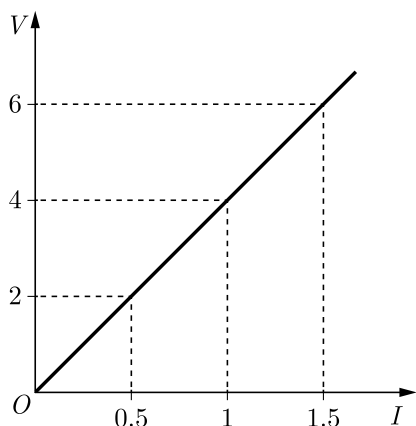
current flowing through it is 0.35 A when the potential difference across it is 1.4 V.

Ans :

Comp. 2020

- (a) The ohm's law states that the current carrying in a conductor is directly proportional to the voltage applied across the ends of the conductor, keeping the resistance constant.

Graphically; slope of will determine resistance of conductor.



- (b) Given, current flowing through conductor

$$I = 0.35 \text{ A}$$

Potential difference across conductor,

$$V = 1.4 \text{ Volt}$$

According to ohm's law,  $V = IR$

Thus,  $1.4 \text{ V} = 0.35 \times R$

$$R = \frac{1.4}{0.35} = 4 \Omega$$

Therefore, resistance of conductor is 4 ohms.

- 267.** (i) Consider a conductor of resistance  $R$ , length  $L$ , thickness  $d$  and resistivity  $\rho$ . Now this conductor is cut into four equal parts. What will be the new resistivity of each of these parts? Why?
- (ii) Find the resistance if all of these parts are connected in:
- (a) Parallel
- (b) Series
- (iii) Out of the combinations of resistors mentioned above in the previous part, for a given voltage which combination will consume more power and why?

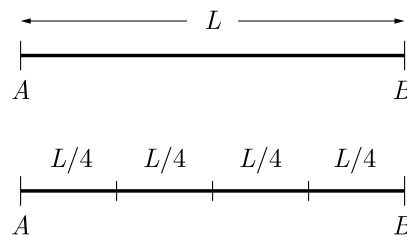
Ans :

OD 2020

- (i) The resistivity will not change as it depends on the nature of the material of the conductor and temperature. It does not depend on the length of the conductor.

- (ii) Let length of the conductor,  $AB = L$

When the conductor is cut into four equal parts the length of each part  $= \frac{L}{4}$



We know,  $R = \frac{\rho L}{A}$

Resistance of each part,

$$R' = \frac{\rho L}{4A} = \frac{1}{4} \left( \frac{\rho L}{A} \right)$$

$$R' = \frac{1}{4} \times R = \frac{R}{4}$$

- (a) When all parts are connected in parallel

$$\frac{1}{R_p} = \frac{1}{R'} + \frac{1}{R'} + \frac{1}{R'} + \frac{1}{R'}$$

$$\frac{1}{R_p} = \frac{1}{\frac{R}{4}} + \frac{1}{\frac{R}{4}} + \frac{1}{\frac{R}{4}} + \frac{1}{\frac{R}{4}}$$

$$\frac{1}{R_p} = \frac{4}{R} + \frac{4}{R} + \frac{4}{R} + \frac{4}{R} = \frac{16}{R}$$

$$R_p = \frac{16}{R} \Omega$$

- (b) When all parts are connected in series:

$$R_s = \frac{R}{4} + \frac{R}{4} + \frac{R}{4} + \frac{R}{4}$$

$$R_s = \frac{R + R + R + R}{4} = \frac{4R}{4} = R$$

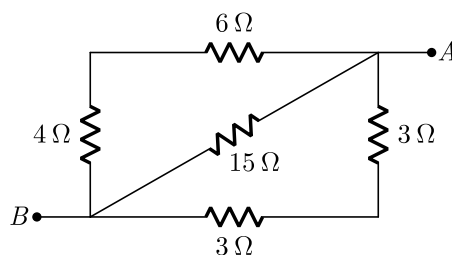
$$R_s = R \Omega$$

- (iii)  $P = \frac{V^2}{R_{\text{eqv}}}$

If  $R_{\text{eqv}}$  is less, power consumed will be more.

In the given case,  $R_{\text{eqv}}$  is lesser in the parallel combination and power consumed will be more.

- 268.** (a) List two disadvantages of using a series circuit in homes.
- (b) Calculate the effective resistance between A and B in the circuit given below:



(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

- 39. Assertion :** 40 W tube light give more light in comparison to 40 w bulb.

**Reason :** Light produced is same from same power.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(d) Assertion (A) is false but reason (R) is true.

In tube light majority portion of radiation comes under visible region while bulb radiation consists of visible, ultraviolet, infrared radiation giving less visible part.

- 40. Assertion :** A resistor of resistance R is connected to an ideal battery. If the value of R is decreased, the power dissipated in the circuit will increase.

**Reason :** The power dissipated in the circuit is directly proportional to the resistance of the circuit.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Here,  $P = \frac{E^2}{R}$ , so  $P \propto R$  only when  $I$  is constant.

Here  $I$  increases as  $R$  is decreased. Hence the reason is wrong.

## ONE MARK QUESTIONS

- 41.** Name the instrument used to detect the presence of a current in a circuit ?

**Ans :**

SQP 2021

Galvanometer.

- 42.** What is the function of galvanometer in a circuit?

**Ans :**

Delhi 2019

Galvanometer is a device that detects the presence of current in a circuit. It is also used for measuring the amount of current in the circuit.

- 43.** Write the function of voltmeter in an electric circuit.

**Ans :**

OD 2019

Voltmeter measures the potential difference across two points in a circuit. It is always connected in parallel in the circuit.

- 44.** Name the scientist after whom the unit of current is called ampere.

**Ans :**

OD 2017

Andre-Marie Ampere.

- 45.** Name the instrument used for measuring potential difference.

**Ans :**

Delhi 20016, OD 2016

Voltmeter

- 46.** What is a battery ?

**Ans :**

Delhi 2017

When a number of cells are joined together to produce greater potential difference, the arrangement is called a battery.

- 47.** Is potential difference a scalar quantity or a vector quantity ?

**Ans :**

Delhi 2016

Potential difference is a scalar quantity.

- 48.** What is an ammeter ?

**Ans :**

OD 2017

It is an instrument to measure electric current.

- 49.** How is an ammeter connected in a circuit to measure current flowing through it ?

**Ans :**

Foreign 2016

In series in a circuit through which the current is to be measured.

$$= 3 + \frac{6 \times 6}{6 + 6} = 3 + \frac{36}{12}$$

$$= 3 + 30 = 6 \Omega$$

(b) Current through the ammeter  $A$  is given by

$$V = IR_{eq}$$

$$I = \frac{V}{R_{eq}} = \frac{6}{6} = 1 \text{ A}$$

(c) Potential across  $3 \Omega$  resistor is given by

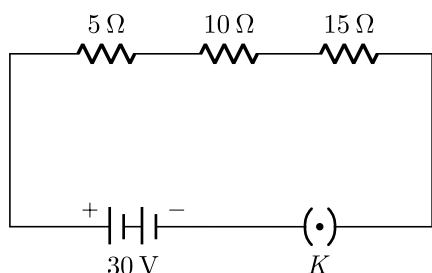
$$V_1 = 1 \times 3 = 3 \text{ V}$$

Potential across  $6 \Omega$  resistor

$$V_2 = 1 \times 6 = 6 \text{ V}$$

**271.** (a) How will you infer with the help of an experiment that the same current flows through every part of a circuit containing three resistors in series connected to a battery?

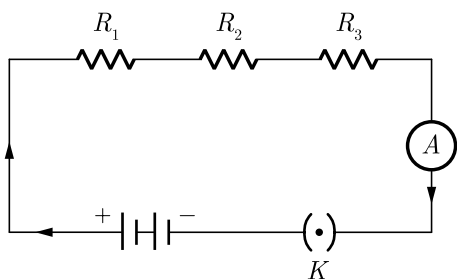
(b) Consider the given circuit and find the current flowing in the circuit and potential difference across the  $15 \Omega$  resistor when the circuit is closed.



**Ans :**

OD 2019

(a) Let three resistors  $R_1, R_2$  and  $R_3$  are connected in series which are also connected with a battery an ammeter and a key as shown in figure.



When key is closed, the current starts flowing through the circuit. Take the reading of ammeter. Now change the position of ammeter to anywhere in between the resistors and take its reading. We will observe that in both the cases reading of ammeter will be same showing same current flows through every part of the circuit above.

(b) Given,

$$R_1 = 5 \Omega, R_2 = 10 \Omega,$$

$$R_3 = 15 \Omega, V = 30 \text{ Volt}$$

In the above circuit  $R_1, R_2$  and  $R_3$  are connected in the series combination. Hence the equivalent resistance is given by

$$R = R_1 + R_2 + R_3$$

$$= 5 + 10 + 15 = 30 \Omega$$

Potential difference,  $V = 30 \text{ Volt}$

Current in the circuit,  $I = ?$

From Ohm's law.  $I = \frac{V}{R} = \frac{30 \text{ V}}{30 \Omega} = 1 \text{ A}$

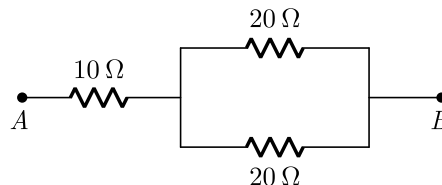
Current flowing in the circuit =  $1 \text{ A}$

Potential difference across  $15 \Omega$  resistors =  $IR_3$

$$= 1 \text{ A} \times 15 \Omega = 15 \text{ V}$$

**272.** (a) Three resistors  $R_1, R_2$  and  $R_3$  are connected in parallel and the combination is connected to a battery, ammeter, voltmeter and key. Draw suitable circuit diagram and obtain an expression for the equivalent resistance of the combination of the resistors.

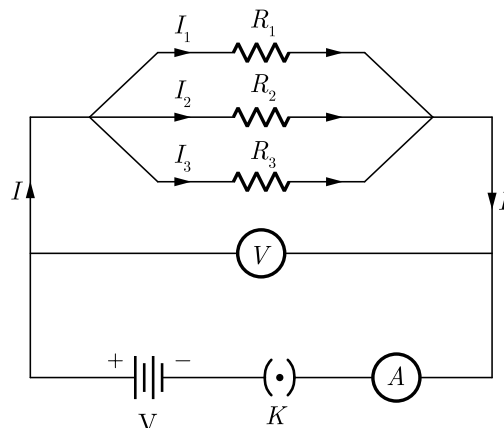
(b) Calculate the equivalent resistance of the following network :



**Ans :**

OD 2019, Delhi 2017

(a)  $R_1, R_2$  and  $R_3$  are three resistance connected in parallel to one another and  $R$  is the equivalent resistance of the circuit. A battery of  $V$  volts has been applied across the ends of this combination. When the switch of the key is closed, current  $I$  flows in the circuit such that,



- (i) What do you infer from this graph ?  
 (ii) State the law expressed here  
 (iii) Name the physical quantity represented by the slope of this graph and its unit.

**Ans :**

SQP 2017

- (i) Inference from graph  $V \propto I$   
 (ii) The law states the current passing through a conductor is directly proportional to the potential difference across the ends, provided the physical conditions like temperature, density, etc., remain unchanged. This is Ohm's law.  
 (iii) The slope of the graph represents the resistance and the unit of resistance is ohm.

- 255.** State the formula co-relating the electric current flowing in a conductor and the voltage applied across it. Also show this relationship by drawing a graph.

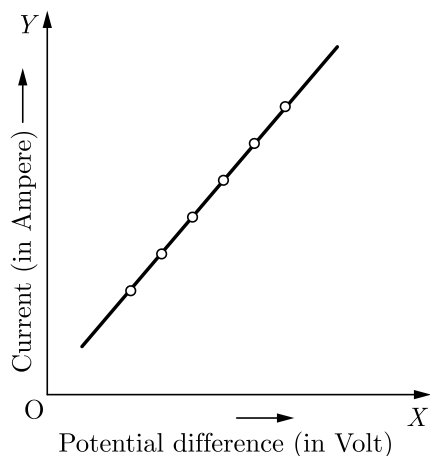
What would be the resistance of a conductor if the current flowing through it is 0.35 ampere when the potential difference across it is 1.4 volt ?

**Ans :**

Foreign 2016

It states that "Physical conditions remaining same the current flowing through a conductor is directly proportional to the potential applied across its two ends."

The graph is as shown below :



Given  $V = 1.4$  Volt,  $I = 0.35$  A. Now, resistance is given by the expression

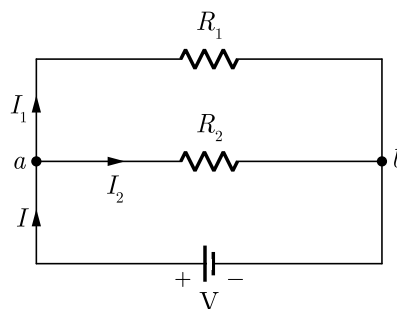
$$R = \frac{V}{I} = \frac{1.4}{0.35} = 4 \Omega$$

- 256.** Derive an expression for equivalent resistance when two resistors of resistance  $R_1$  and  $R_2$  are connected in parallel.

**Ans :**

Delhi 2017, OD 2011

Consider two resistance  $R_1$  and  $R_2$  connected in parallel as shown in Figure. When the current  $I$  reaches point  $a$ , it splits into two parts  $I_1$  going through  $R_1$  and  $I_2$  going through  $R_2$ .



Since charge must be conserved, therefore, that current  $I$  that enters point  $a$  must be equal to the current that leaves that point. Therefore, we have

$$I = I_1 + I_2 \quad \dots(1)$$

Since the resistors are connected in parallel, therefore, the potential across each must be same, hence by Ohm's law, we have

$$I_1 = \frac{V}{R_1} \text{ and } I_2 = \frac{V}{R_2}$$

Substituting in equation (i), we have

$$I = \frac{V}{R_1} + \frac{V}{R_2} \quad \dots(2)$$

Let  $R_p$  be the equivalent resistance of the parallel combination, then by Ohm's law, we have

$$I = \frac{V}{R_p} \quad \dots(3)$$

Hence, from equations (2) and (3), we have

$$\frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2}$$

$$\text{or} \quad \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \quad \dots(4)$$

- 257.** A wire of resistance  $6 \Omega$  is bent to form a closed square. What is the resistance across a diagonal of the square ?

**Ans :**

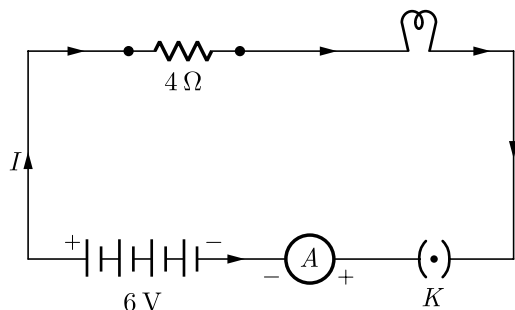
SQP 2017, OD 2011

Total resistance of the wire =  $6 \Omega$

$$\frac{6}{6} = I$$

$$I = 1 \text{ ampere.}$$

- 274.** An electric lamp of resistance  $20 \Omega$  and a conductor of resistance  $4 \Omega$  are connected to a  $6 \text{ V}$  battery as shown in the circuit. Calculate :



- the total resistance of the circuit,
- the current through the circuit,
- the potential difference across the (i) electric lamp and (ii) conductor, and
- power of the lamp.

**Ans :**

Delhi 2019

- (a) Given,

$$R_1 = 20 \Omega, R_2 = 4 \Omega$$

Since, in Series,

$$R = R_1 + R_2$$

Total resistance of circuit,

$$R = 20 + 4 = 24 \Omega$$

- (b) Current through circuit,

$$V = 6 \text{ Volt}, R = 24 \Omega$$

According to ohm's law,

$$V = IR$$

$$\text{So, } I = \frac{V}{R} = \frac{6}{24} = \frac{1}{4} = 0.25 \text{ ampere}$$

- (c) (i) Potential difference across electric lamp,

$$I = \frac{1}{4} \text{ A}, R = 20 \Omega$$

$$V_1 = IR_1 = \frac{1}{4} \times 20 = 5 \text{ V}$$

- (ii) Potential difference across conductor,

$$V_2 = IR_2 = \frac{1}{4} \times 4 = 1 \text{ V}$$

- (d) Power of lamp,

$$P = I^2 R_1$$

$$= \left(\frac{1}{4}\right)^2 \times 20 = \frac{1}{4} \times \frac{1}{4} \times 20$$

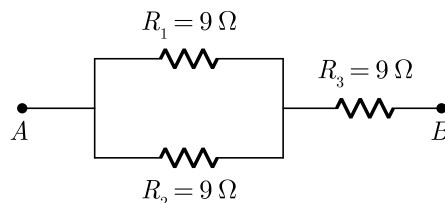
$$= \frac{5}{4} = 1.25 \text{ watt}$$

- 275.** Show how would you join three resistors, each of resistance  $9 \Omega$  so that the equivalent resistance of the combination is (a)  $13.5 \Omega$  (b)  $6 \Omega$ ?

**Ans :**

Comp. 2018

- (a) To get an equivalent resistance of  $13.5 \Omega$ , the resistances should be connected as shown in the figure given below :



So,

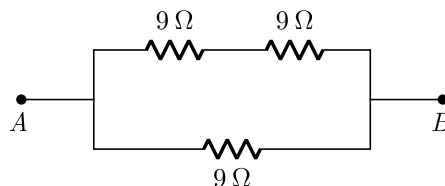
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{9} + \frac{1}{9} = \frac{2}{9}$$

$$R_p = \frac{9}{2} = 4.5 \Omega$$

Now,

$$R_{eq} = R_3 + R_p = 9 + 4.5 = 13.5 \Omega$$

- (b) To get an equivalent resistance of  $6 \Omega$ , the resistances should be connected as shown in the figure given below :



$$R_s = R_1 + R_2 = 9 + 9 = 18 \Omega$$

Now both the resistors are in parallel with each other so,

$$\frac{1}{R_p} = \frac{1}{9} + \frac{1}{18} = \frac{3}{18}$$

$$R_p = \frac{18}{3} = 6 \Omega$$

- 276.** (a) Write Joule's law of heating.  
 (b) Two lamps, one rated  $100 \text{ W}; 220 \text{ V}$  and the other  $60 \text{ W}; 220 \text{ V}$ , are connected in parallel to electric mains supply. Find the current drawn by two bulbs from the line, if the supply voltage is  $220 \text{ V}$ .

**Ans :**

Delhi 2018

- (a) According to Joule's law of heating, the heat produced in a wire is directly proportional to  
 (i) square of current  $I^2$ ,  
 (ii) resistance of wire  $R$ ,

- (iii) Energy consumed when it is lighted for  $2\frac{1}{2}$  hours.

$$\text{Energy} = \text{Power} \times \text{Time}$$

$$t = 2.5 \times 60 \times 60 \text{ sec.}$$

So, 
$$\begin{aligned} \text{Energy} &= 2.5 \times 2.5 \times 60 \times 60 \\ &= 22500 \text{ Joules/sec.} \end{aligned}$$

- 264.** (a) An electric bulb is rated at 200 V; 100 W. What is its resistance?  
 (b) Calculate the energy consumed by 3 such bulbs if they glow continuously for 10 hours for complete month of November.  
 (c) Calculate the total cost if the rate is 6.50 per unit.

**Ans :**

OD 2020, Delhi 2016

- (a) Here, potential difference across the bulb,  
 $V = 200 \text{ Volt}$

Power of the bulb,

$$P = 100 \text{ W}$$

As, 
$$P = \frac{V^2}{R}, R = \frac{V^2}{P} = \frac{(200 \text{ V})^2}{100 \text{ W}}$$

$$= \frac{4 \times 10^4}{100} \Omega = 400 \Omega$$

- (b) Electric energy consumed by 1 bulb in 10 hours for 30 days, i.e.,

$$W = Pt$$

$$= 100 \text{ W} \times 10 \times 30 = 30000 \text{ Wh}$$

Electric energy consumed by 3 bulbs

$$= 30000 \times 3 = 90000 \text{ Wh}$$

$$= 90 \text{ KWh} = 90 \text{ unit}$$

- (c) Cost of 90 units of electric energy  
 $= 90 \times 6.50 = ₹ 585$

- 265.** (a) What is meant by the statement, "The resistance of a conductor is one ohm"?  
 (b) Define electric power. Write an expression relating electric power, potential difference and resistance.  
 (c) How many  $132 \Omega$  resistors in parallel are required to carry 5 A on a 220 V line?

**Ans :**

SQP 2020, OD 2014

- (a) Ohm's law states that current flowing through a conductor is directly proportional to the potential difference maintained across the two ends of a conductor at constant temperature and pressure.

Let current flowing through a conductor is  $I$ ,  $V$  is the potential difference maintained across the two ends of a conductor.

As per Ohm's law,

$$V \propto I$$

Thus,

$$V = IR$$

Here  $R$  is a proportionality constant called resistance.

As per the question, the resistance of a conductor is 1 ohm.

Let  $V = 1$  volt and  $I = 1$  A, then  $R = 1$  ohm  
 Hence, the resistance is said to be 1 ohm if 1 ampere of current flows through a circuit due to the potential difference of 1 volt.

- (b) Electric power is the rate at which work is done or energy is transformed in an electrical circuit. The formula for electric power is given by :

$$P = VI$$

where,

$P$  is the power,

$V$  is the potential difference in the circuit

$I$  is the electric current.

Power can also be written as

$$P = I^2 R$$

$$P = \frac{V^2}{R}$$

The above two expressions are got by using Ohm's law, where, voltage, current and resistance are related by the following relation.

Where,  $R$  is the resistance in the circuit.

- (c) For  $x$  number of resistors of resistance  $132 \Omega$ .

Supply voltage,  $V = 220 \text{ Volt}$

Current,  $I = 5 \text{ A}$

Equivalent resistance of the combination  $= R$ , given as

$$\frac{1}{R} = x \times \left( \frac{1}{132} \right)$$

$$R = \frac{132}{x}$$

From Ohm's law : 
$$\frac{132}{x} = \frac{220}{5}$$

$$\frac{132}{x} = 44$$

$$132 = 44x$$

$$x = \frac{132}{44} = 3$$

So, answer is 3 resistors

- 266.** (a) State the relation correlating the electric current flowing in a conductor and the voltage applied across it. Also draw a graph to show this relationship.  
 (b) Find the resistance of a conductor if the electric

equal to one watt.

### Derivation of Electric Power :

We know that electric work done,

$$W = V \times I \times t$$

or 
$$P = \frac{VIt}{t}$$

$$P = VI$$

Electric power in watts = Volts  $\times$  ampere

Also, 
$$V = IR \quad (\text{Ohm's Law})$$

So, 
$$P = IR \times I$$

$$P = I^2 R$$

Now 
$$I = \frac{V}{R}$$

$$P = \left(\frac{V}{R}\right)^2 \times R = \frac{V^2}{R} \text{ Watt.}$$

The joint resistance is now  $1/16^{\text{th}}$  part of the original resistance.

**280.** A household uses the following electric appliances :

- refrigerator of rating 400 W for 10 hours each day.
- two electric fans of rating 80 W each for 6 hours daily.
- six electric tubes of rating 18 W each for 6 hours daily.

Calculate the electricity bill for the household for month of June, if cost of electrical energy is ₹ 3.00 per unit.

**Ans :**

Delhi 2016, OD 2011

Energy consumed per day by refrigerator

$$= 0.4 \text{ kW} \times 10 \text{ h}$$

$$\text{Power of refrigerator} = 400 \text{ W} = \frac{400}{1000} \text{ kW} = 0.4 \text{ kW}$$

$$= 4 \text{ kW}$$

Energy consumed per day by fans

$$= 2 \times 0.08 \text{ kW} \times 6$$

$$\text{Power of each} = 80 \text{ W} = \frac{80}{1000} = 0.08 \text{ kW}$$

$$= 0.96 \text{ kWh}$$

Energy consumed by lights

$$= 6 \times 0.018 \text{ kW} \times 6 \text{ h}$$

$$= 0.648 \text{ kWh}$$

Total energy consumed per day

$$= 4 + 0.96 + 0.648$$

$$= 5.608 \text{ kWh}$$

Energy consumed in 30 days

$$= 30 \times 5.608 = 168.24 \text{ kWh}$$

Cost of 168.24 units @ ₹ 3.00

$$= 168.24 \times 3 = ₹ 504.72$$

**281.** The values of current  $I$  flowing in a given resistor for the corresponding values of potential difference  $V$  across the resistor are given below :

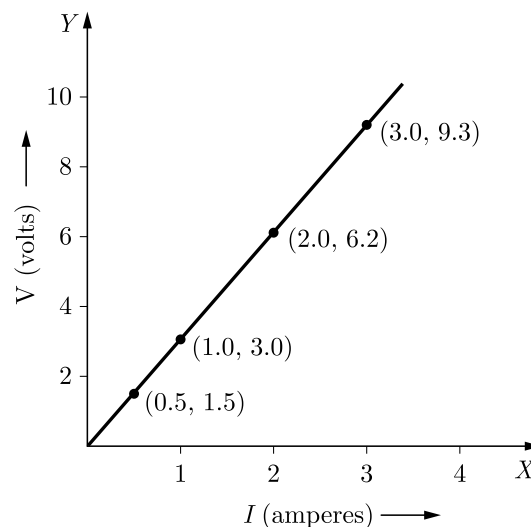
$I$ (ampere)	0.5	1.0	2.0	3.0
$V$ (Volts)	1.5	3.0	6.2	9.3

- Plot a graph between  $V$  and  $I$ .
- Calculate the resistance of that resistor.
- What does the graph represent ?

**Ans :**

Foreign 2017, Delhi 2014

- Take  $I$  on  $X$ -axis and  $V$  on  $Y$ -axis to plot the graph.



- Resistance from graph,

$$R = \frac{V_2 - V_1}{I_2 - I_1}$$

$$R_1 = \frac{3.0 - 1.5}{1.0 - 0.5} = \frac{1.5}{0.5} = 3 \Omega$$

$$R_2 = \frac{6.2 - 3.0}{2.0 - 1.0} = \frac{3.2}{1} = 3.2 \Omega$$

$$R_3 = \frac{9.3 - 6.2}{3.0 - 2.0} = \frac{3.1}{1} = 3.1 \Omega$$

Mean,

$$R = \frac{R_1 + R_2 + R_3}{3}$$

$$= \frac{3 + 3.2 + 3.1}{3} = \frac{9.3}{3} = 3.1 \Omega$$

- Graph shows that current is directly proportional to potential difference.



Ans :

Delhi 2020

- (a) (i) Current is constant in series combination, so it is impractical to connect a bulb and an electric heater in series.
- (ii) When one component fails, the circuit is broken and none of the components work.
- (b) In the above circuit 4 ohm and 6 ohm resistance are connected in the series combination

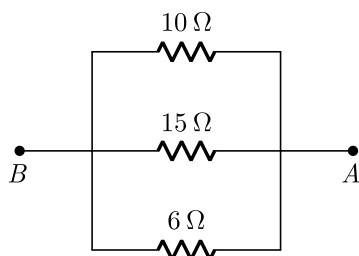
Equivalent resistance is given by

$$R = 6 + 4 = 10 \text{ ohm}$$

and the resistance 3 ohm and 3 ohm are connected in the series combination. Hence the equivalent resistance is given by

$$R = 3 + 3 = 6 \text{ ohm}$$

Now the circuit diagram becomes as follow



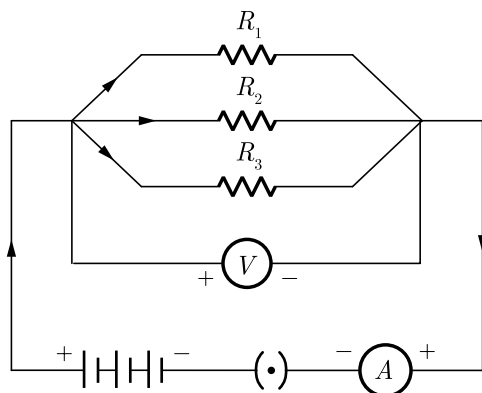
All the resistances are connected are in parallel combination hence the equivalent resistance between A and B is given by

$$\frac{1}{R} = \frac{1}{10} + \frac{1}{6} + \frac{1}{15}$$

after solving the equation we get

$$R = 3 \text{ ohm}$$

- 269.** In the circuit given below, the resistors  $R_1$ ,  $R_2$  and  $R_3$  have the values  $10 \Omega$ ,  $20 \Omega$  and  $30 \Omega$  respectively, which have been connected to a battery of  $12 \text{ V}$ .



Calculate

- (a) the current through each resistor,  
 (b) the total circuit resistance, and  
 (c) the total current in the circuit.

Ans :

Delhi 2019

Given,  $R_1 = 10 \Omega$ ,  $R_2 = 20 \Omega$ ,  $R_3 = 30 \Omega$

Voltage,  $V = 2 \text{ Volt}$

- (i) Current in each resistor,

$$I_1 = \frac{V}{R_1} = \frac{12}{10} = \frac{6}{5} \text{ A}$$

$$I_2 = \frac{V}{R_2} = \frac{12}{20} = \frac{6}{10} = \frac{3}{5} \text{ A}$$

$$I_3 = \frac{V}{R_3} = \frac{12}{30} = \frac{6}{15} = \frac{2}{5} \text{ A}$$

- (ii) All the resistors are connected in the series combination. Hence the equivalent resistance is given by

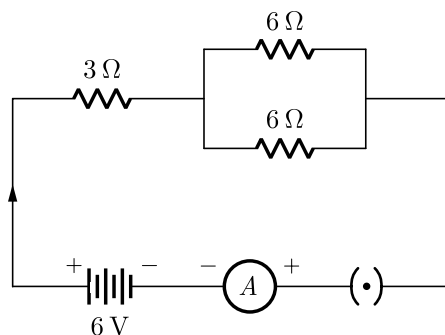
$$\begin{aligned} \frac{1}{R_P} &= \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \\ &= \frac{1}{10} + \frac{1}{20} + \frac{1}{30} = \frac{6+3+2}{60} = \frac{11}{60} \end{aligned}$$

$$R_P = \frac{60}{11} \Omega$$

- (iii) Total current in the circuit,

$$\begin{aligned} I_1 &= I_1 + I_2 + I_3 \\ &= \frac{6}{5} + \frac{3}{5} + \frac{2}{5} = \frac{11}{5} \text{ A} \end{aligned}$$

- 270.** In the given circuit, find :



- (a) Total resistance of the network of resistors  
 (b) Current through ammeter A, and  
 (c) Potential difference across  $3 \Omega$  and  $6 \Omega$  resistors

Ans :

SQP 2019, OD 2014

- (a) Equivalent resistance of circuit is given by

$$R_{eq} = R_1 + \frac{R_2 \times R_3}{R_2 + R_3}$$

Here,

$$R_1 = 3 \Omega$$

$$R_2 = 6 \Omega$$

$$R_3 = 6 \Omega$$

$$R_1 + R_2 = 9 \quad \dots(1)$$

$$\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{2} \quad \dots(2)$$

$$\frac{R_1 + R_2}{R_1 R_2} = \frac{1}{2}$$

From equation (1),

$$\frac{9}{R_1 R_2} = \frac{1}{2}$$

$$R_1 R_2 = 18$$

$$\begin{aligned} \text{Now, } (R_1 - R_2)^2 &= (R_1 + R_2)^2 - 4R_1 R_2 \\ &= (9)^2 - 4 \times 18 \\ &= 81 - 72 = 9 \end{aligned}$$

$$\text{Thus } R_1 - R_2 = 3 \quad \dots(3)$$

Adding equation (1) and (2), we get

$$2R_1 = 12$$

$$R_1 = 6 \Omega$$

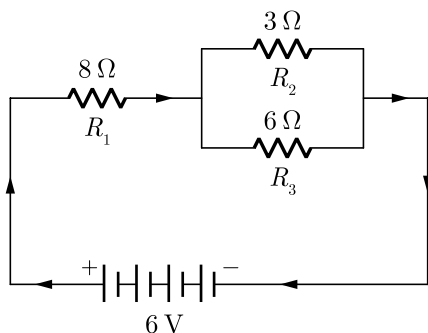
Substituting the value of  $R_1$  in equation (1), we get

$$6 + R_2 = 9$$

$$R_2 = 9 - 6 = 3 \Omega$$

**285.** In the following circuit diagram, find :

- the total resistance of the circuit.
- the total current flowing in the circuit.
- the potential difference across resistance  $R_1$ .



**Ans :**

(a) Resistance,  $R_1 = 8 \Omega$

Resistance,  $R_2 = 3 \Omega$

Resistance,  $R_3 = 6 \Omega$

Let resultant resistance in parallel be  $R_4$ .

$$\frac{1}{R_4} = \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_4} = \frac{1}{3} + \frac{1}{6} = \frac{2+1}{6} = \frac{3}{6} = \frac{1}{2}$$

$$R_4 = 2 \Omega$$

Equivalent resistance of the circuit,

$$R = R_1 + R_4 = (8 + 2) \Omega = 10 \Omega$$

(b) Potential difference,  $V = 6$  Volt

Equivalent resistance,  $R = 10 \Omega$

$$V = IR$$

$$I = \frac{V}{R}$$

$$I = \frac{6}{10} = 0.6 \text{ A}$$

(c) Resistance,  $R_1 = 8 \Omega$

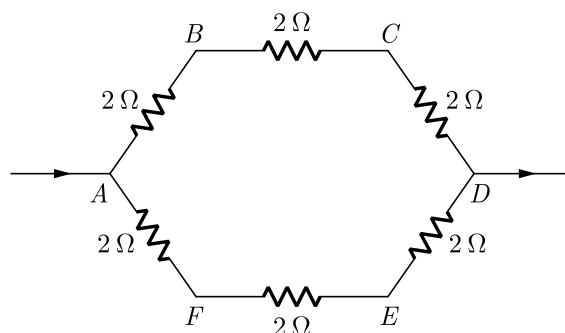
Current through  $R_1$ ,

$$I = 0.6 \text{ A}$$

$$V = R \times I$$

$$V = 8 \times 0.6 = 4.8 \text{ V}$$

**286.** In the following circuit diagram, calculate the resistance offered by the combination if the current enters at  $A$  and leaves at  $D$ .



**Ans :**

OD 2016, Delhi 2011

Resistances  $AB$ ,  $BC$  and  $CD$  are in series.

The equivalent resistance is given by,

$$R_1 = (2 + 2 + 2) \Omega = 6 \Omega$$

Also, resistances,  $AF$ ,  $FE$  and  $ED$  are in series.

The equivalent resistance is given by,

$$R_2 = (2 + 2 + 2) \Omega = 6 \Omega$$

Resistances  $R_1$  and  $R_2$  are in parallel.

The equivalent resistance is given by,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$$

$$R = 3 \Omega$$

**287.** (a) Resistors are given as  $R_1 = 10 \Omega$ ,  $R_2 = 20 \Omega$  and  $R_3 = 30 \Omega$ . Calculate the effective resistance when they are connected in series. Also calculate the current flowing when the combination is connected to a 6 V battery.

From Ohm's law,

$$I = \frac{V}{R} \quad \dots(1)$$

$$I_1 = \frac{V}{R_1} \quad \dots(2)$$

$$I_2 = \frac{V}{R_2} \quad \dots(3)$$

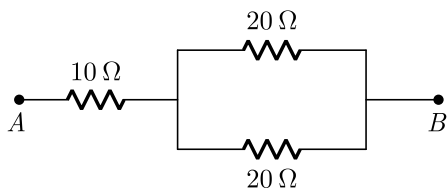
$$I_3 = \frac{V}{R_3} \quad \dots(4)$$

$$I = I_1 + I_2 + I_3 \quad \dots(5)$$

Substituting the values of  $I$ ,  $I_1$ ,  $I_2$  and  $I_3$  in equation (v), we have

$$\begin{aligned} \frac{V}{R} &= \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} \\ V\left(\frac{1}{R}\right) &= V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) \\ \frac{1}{R} &= \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \end{aligned}$$

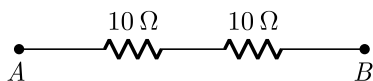
(b) Let  $R_p$  is the equivalent resistance of resistors ( $20\ \Omega$  and  $20\ \Omega$ ) connected in parallel.



Equivalent resistance of resistors in parallel :

$$\begin{aligned} \frac{1}{R_p} &= \frac{1}{20} + \frac{1}{20} \\ \frac{1}{R_p} &= \frac{1+1}{20} = \frac{2}{20} = \frac{1}{10} \\ R_p &= 10\ \Omega \end{aligned}$$

Now, equivalent circuit becomes.



$10\ \Omega$  and  $10\ \Omega$  are connected in series.

Equivalent resistance of the circuit

$$= 10\ \Omega + 10\ \Omega = 20\ \Omega$$

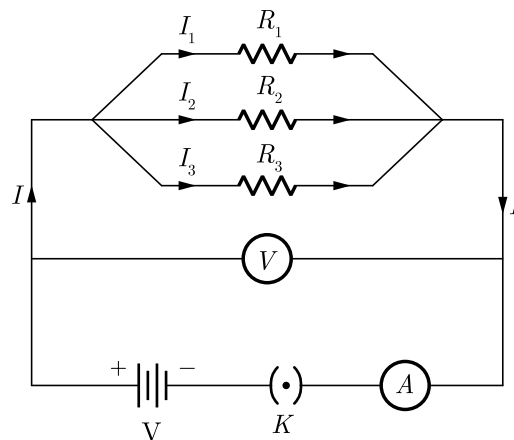
**273.** (a) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to the sum of the reciprocals of the individual resistances.

(b) In an electric circuit two resistors of  $12\ \Omega$  each are joined in parallel to a  $6\ \text{V}$  battery. Find the current drawn from the battery.

Ans :

Comp. 2019

(a)  $R_1$ ,  $R_2$  and  $R_3$  are three resistance connected in parallel to one another and  $R$  is the equivalent resistance of the circuit. A battery of  $V$  volts has been applied across the ends of this combination. When the switch of the key is closed, current  $I$  flows in the circuit such that,



From Ohm's law,

$$I = \frac{V}{R} \quad \dots(1)$$

$$I_1 = \frac{V}{R_1} \quad \dots(2)$$

$$I_2 = \frac{V}{R_2} \quad \dots(3)$$

$$I_3 = \frac{V}{R_3} \quad \dots(4)$$

$$I = I_1 + I_2 + I_3 \quad \dots(5)$$

Substituting the values of  $I$ ,  $I_1$ ,  $I_2$  and  $I_3$  in equation (v), we have

$$\begin{aligned} \frac{V}{R} &= \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} \\ V\left(\frac{1}{R}\right) &= V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) \\ \frac{1}{R} &= \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \end{aligned}$$

(b) Given, Two resistors of  $12\ \Omega$  connected in parallel.

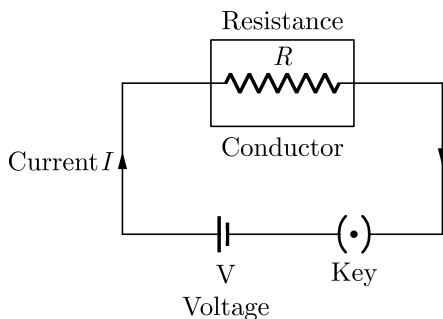
$$V = 6\ \text{V}$$

$$\begin{aligned} \frac{1}{R_{eq}} &= \frac{1}{R_1} + \frac{1}{R_2} \\ &= \frac{1}{12} + \frac{1}{12} = \frac{2}{12} \\ R_{eq} &= \frac{12}{2} = 6\ \Omega \end{aligned}$$

According to ohm's law,

$$V = IR$$

$$6 = I \times 6$$



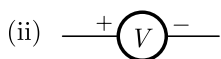
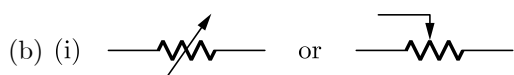
According to ohm's law;  $V \propto I$

Mathematically;  $V = IR$  where

$V$  = Voltage applied in volts

$I$  = Current flowing in circuit in amperes.

$R$  = Resistance of conductor (proportionality constant)



(c) Resistance of the bulb can be calculated as

$$R = \frac{V^2}{P}$$

$$= \frac{220 \text{ V} \times 220 \text{ V}}{100 \text{ W}} = 484 \Omega$$

and the power consumed by bulb when it is operated on 110 V is given by

$$P = \frac{V^2}{R} = \frac{110 \times 110}{484} = 25 \text{ W}$$

**290.** A piece of wire having resistance  $R$  is cut into four equal parts.

- How will the resistance of each part compare with the original substance ?
- If four parts are placed in parallel, how will the joint resistance compare with the resistance of the original wire.

**Ans :**

Delhi 2017

(a) We know that  $R \propto l$ .

So, when the wire is cut into four equal parts, the resistance of each part is  $1/4^{\text{th}}$  of the original substance.

Hence,  $R_1 = \frac{R}{4}, R_2 = \frac{R}{4}$

$R_3 = \frac{R}{4}, \text{ and } R_4 = \frac{R}{4}$

(b) When these 4 parts are joined in parallel, we get

$$\frac{1}{R'} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$$

$$\frac{1}{R'} = \frac{4}{R} + \frac{4}{R} + \frac{4}{R} + \frac{4}{R} = \frac{16}{R}$$

$$R' = \frac{R}{16}$$

**291.** A current of 1 ampere flows in a series circuit containing an electric lamp and a conductor of  $5 \Omega$  when connected to a 10 V battery. Calculate the resistance of the electric lamp. Now, if a resistance of  $10 \Omega$  is connected in parallel with this series combination, what change (if any) in current flowing through  $5 \Omega$  conductor and potential difference across the lamp will take place ? Give reason. Draw circuit diagram.

**Ans :**

Delhi 2016

In series circuit,  $I = 1 \text{ A}$

$$R_1 = 5 \Omega$$

$$V = 10 \text{ Volt}$$

$$R_2 = ?$$

$$V = IR$$

or

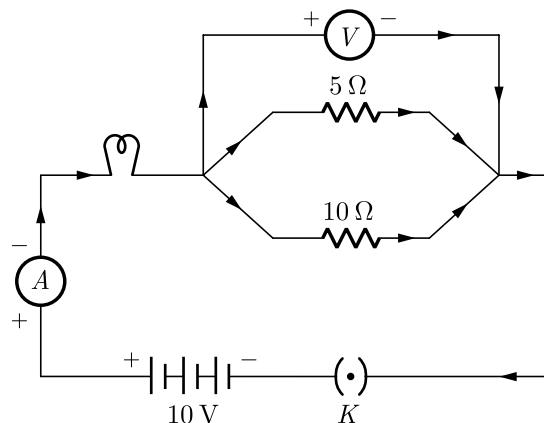
$$V = I(R_1 + R_2)$$

or

$$R_2 = \frac{V}{I} - R_1$$

$$R_2 = 10 - 5 = 5 \Omega$$

If a resistance of  $10 \Omega$  is connected with the above series circuit,



Equivalent resistance of the circuit,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_s}$$

or

$$\frac{1}{R} = \frac{1}{10} + \frac{1}{10}$$

$$(\text{Here, } R_s = 5 + 5 = 10 \Omega)$$

$$R = 5 \Omega$$

Hence, there will be no change of current through  $5 \Omega$  conductor.

(iii) time  $t$  for which current is passed.

Thus, the heat produced in the wire by current  $I$  in time  $t$  is

$$H \propto I^2 R t$$

$$H = I^2 R t$$

(b) We know that,

$$P = VI$$

$$I = \frac{P}{V}$$

**First lamp :**

$$P_1 = 100 \text{ W}, V = 220 \text{ volt}$$

$$I_1 = \frac{P_1}{V} = \frac{100}{220} = 0.45 \text{ A}$$

**Second lamp :**

$$P_2 = 60 \text{ W}, V = 220 \text{ volt}$$

$$I_2 = \frac{P_2}{V} = \frac{60}{220} = 0.27 \text{ A}$$

So, Total current  $= I_1 + I_2$

$$= 0.45 + 0.27 = 0.72 \text{ A}$$

- 277.** The values of current ( $I$ ) flowing through a given resistor of resistance ( $R$ ), for the corresponding values of potential difference ( $V$ ) across the resistor are given below :

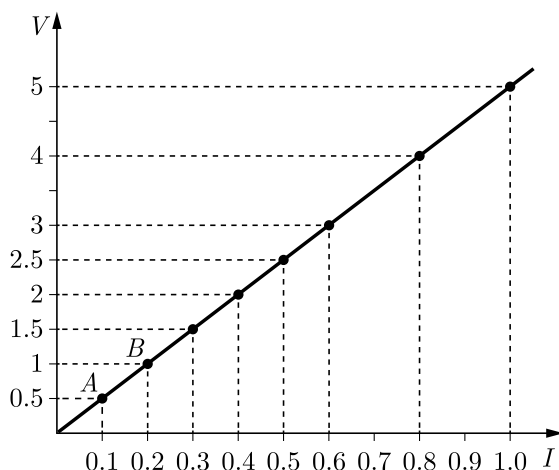
(V) (in volts)	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
(I) (in amperes)	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0

Plot a graph between current ( $I$ ) and potential difference ( $V$ ) and determine the resistance ( $R$ ) of the resistor.

**Ans :**

SQP 2018, OD 2016

We know that,  $V = IR$



From the curve,

Resistance of conductor,

$$R = \text{Slope of curve}$$

$$= \frac{V_B - V_A}{I_B - I_A}$$

$$= \frac{1 - 0.5}{0.2 - 0.1} = \frac{0.5}{0.1} = 5 \Omega$$

- 278.** (a) Define electric current. Write down the formula which relates electric current, electric charge and time.
- (b) An electric bulb draws a current of 0.75 A for 15 minutes. Calculate the amount of electric charge that flows through the circuit.

**Ans :**

OD 2017

- (a) The electric current is a flow of electric charges called electrons in a conductor such as a metal wire. The magnitude of electric current in a conductor is the amount of electric charge passing through a given point of the conductor in one second. If a charge of  $Q$  coulombs flows through a conductor in time  $t$  seconds, then the magnitude  $I$  of electric current flowing through it is given by:

$$\text{Current, } I = Q/t$$

- (b) Current,  $I = 0.75 \text{ A}$

$$\text{Charge, } Q = ?$$

$$\begin{aligned} \text{Time, } t &= 15 \text{ min} \\ &= 15 \times 60 \text{ s} = 900 \text{ s} \end{aligned}$$

$$\text{Now, } t = \frac{Q}{I}$$

$$0.75 = \frac{Q}{900}$$

$$\text{or } Q = 0.75 \times 900$$

Therefore charge,  $Q = 675$  coulombs.

- 279.** Define electric power. Write and define. S.I. unit of electric power. Derive the formula for electric power.

**Ans :**

OD 2016

The electric work done per unit time is called electric power.

$$\text{Electric power} = \frac{\text{Electric work done}}{\text{Time taken}}$$

$$\text{or } P = \frac{W}{t}$$

Electric power is also defined as the electric energy consumed per unit time.  $P = \frac{E}{t}$

S.I. unit of electric power is Watt. When one joule of energy is used for one second, electric power is

Ans :

(i) For each tube light,

$$\text{Power, } P = 40 \text{ W} = \frac{40}{1000} \text{ kW}$$

Energy consumed by each tube light in a day is,

$$= P \times t \\ = \left( \frac{40}{1000} \text{ kW} \right) \times 5 \text{ h} = 0.2 \text{ kWh}$$

(ii) Energy consumed by tube light in a day is,

$$= 0.2 \text{ kWh}$$

Energy consumed by the fan in a day is,

$$= \frac{80}{1000} \text{ kW} \times 12 \text{ h} = 0.96 \text{ kWh}$$

Energy consumed by the TV in a day is,

$$= \frac{60}{1000} \text{ kW} \times 8 \text{ h} = 0.48 \text{ kWh}$$

Total energy consumed in a day is,

$$= 2 \times 0.2 \text{ kWh} + 0.96 \text{ kWh} + 0.48 \text{ kWh}$$

$$= 1.84 \text{ kWh}$$

(iii) Energy consumed in a day

$$= 1.84 \text{ kWh}$$

Energy consumed in a day

$$= 30 \times 1.84 \text{ kWh}$$

$$= 55.2 \text{ kWh}$$

The cost of electricity

$$= ₹ 3.1 \times 55.2 = ₹ 171.12$$

(iv) The rate at which energy is delivered is determined by :

(a) the potential difference across the conductor.

(b) the current flowing in the circuit.

**295.** Read the following case based passage and answer the questions given after passage.

In the series combination, the resistances are joined end to end. For a series combination of resistors,  $R_s = \sum R_i$  and current through each resistor is same but their potential difference between their ends are different according to their resistance. When two or more resistors are combined in such a way that their first ends are connected to one point and the second ends to another point. In a parallel combination of resistors,  $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$  and potential drop across

each resistor is same but current in different resistances are different.

(i) If we connect  $n$  bulbs each with a rated power

$P$  in series, what is the total power consumed by combination at rated current?

(ii) If we connect  $n$  bulbs each with a rated power  $P$  in parallel, what is the total power consumed by combination at rated voltage?

(iii) The power consumed by  $n$  equal resistance in parallel is  $x$  times that of power consumed in series, if the voltage supply is same. Find the value of  $x$ .

(iv) If resistors,  $4 \Omega$ ,  $5 \Omega$  and  $6 \Omega$  are connected in series with  $5\text{V}$  battery, calculate the total power consumed by the combination?

Ans :

(i) When resistors are in series combination, then

$$R_s = R_1 + R_2 + \dots + R_n$$

$$\frac{V^2}{P_s} = \frac{V_1^2}{P_1} + \frac{V_2^2}{P_2} + \dots + \frac{V_n^2}{P_n}$$

When bulbs are of equal power, then

$$\frac{V^2}{P_s} = \frac{nV^2}{P}$$

$$P_s = \frac{P}{n}$$

(ii) When resistors are in parallel combination, then

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$$

$$\text{or } \frac{P_p}{V^2} = \frac{P_1}{V^2} + \frac{P_2}{V^2} + \dots + \frac{P_n}{V^2}$$

$$P_p = P_1 + P_2 + \dots + P_n$$

$$\text{or } P_p = nP$$

(iii) Power consumed in series,

$$P_s = \frac{V^2}{nR}$$

$$\text{and in parallel, } P_p = \frac{V^2}{(R/n)}$$

$$P_p = xP_s$$

$$\frac{V^2}{(R/n)} = x \frac{V^2}{(nR)}$$

$$n = \frac{x}{n}$$

$$x = n^2$$

(iv) Power consumed;

$$P = \frac{V^2}{R_q} = \frac{V^2}{R_1 + R_2 + R_3} \\ = \frac{(5)^2}{4 + 5 + 6} = \frac{5}{3} \text{ W}$$

**Ans :**

OD 2013, Delhi 2007

In the given circuit,  $R_1 = 1\ \Omega$ ,  $R_2 = 2\ \Omega$  and  $R_3 = 3\ \Omega$  are connected in series, so

$$R = R_1 + R_2 + R_3 \\ = 1 + 2 + 3 = 6\ \Omega$$

Now, from  $V = IR$ , we have

$$I = \frac{V}{R} = \frac{3}{6} = \frac{1}{2}\ \Omega$$

Voltage across the resistor,

$$R_1 = 1\ \Omega$$

$$V_1 = IR = \frac{1}{2} \times 1 = 0.5\ \text{V}$$

and voltage across the resistor,

$$R_2 = 3\ \Omega$$

$$V_2 = IR = \frac{1}{2} \times 3 = \frac{3}{2}\ \text{V}$$

- 212.** An electric heater connected to a 220 V line has two resistance coils of 22 Ohms each.

Calculate the current if these coils are used

- Separately
- In series
- In parallel.

**Ans :**

Delhi 2012, OD 2010

- Separately :

Current,  $I = \frac{V}{R} = \frac{220}{22} = 10\ \text{A}$

- In series :

$$R = R_1 + R_2 \\ = 22\ \Omega + 22\ \Omega = 44\ \Omega$$

$$I = \frac{V}{R} = \frac{220}{44} = 5\ \text{A}$$

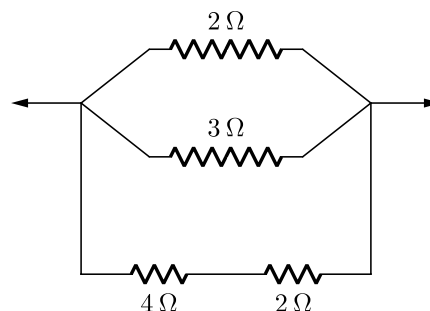
- In parallel :

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \\ = \frac{1}{22}\ \Omega + \frac{1}{22}\ \Omega = \frac{1}{11}\ \Omega$$

$$R = 11\ \Omega$$

$$I = \frac{V}{R} = \frac{220}{11} = 20\ \text{A}$$

- 213.** Calculate the equivalent resistance from the following combination of resistors.

**Ans :**

Delhi 2013

In the given circuit  $4\ \Omega$  and  $2\ \Omega$  are connected in series. Hence the equivalent resistance is given by

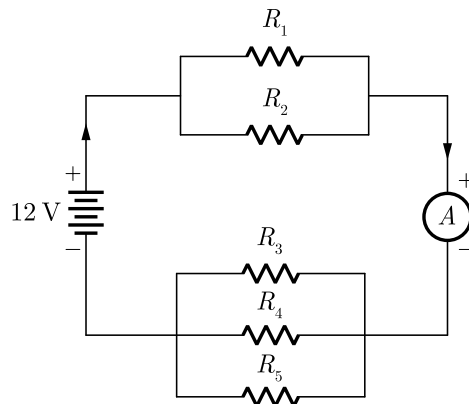
$$R_s = R_1 + R_2 \\ = 4\ \Omega + 2\ \Omega = 6\ \Omega$$

Also, equivalent resistance in parallel is :

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\text{or } R_p = \frac{1}{\frac{1}{2} + \frac{1}{3} + \frac{1}{6}} = \frac{6}{6} = 1\ \Omega$$

- 214.** If in figure A,  $R_1 = 10\ \Omega$ ,  $R_2 = 40\ \Omega$ ,  $R_3 = 30\ \Omega$ ,  $R_4 = 20\ \Omega$ ,  $R_5 = 60\ \Omega$  and a 12 V battery are connected to the arrangement, calculate :



- Total resistance in the circuit and
- Total current flowing in the circuit.

**Ans :**

Delhi 2012, Delhi 2010

$$\begin{aligned} \text{(a)} \quad \frac{1}{R_A} &= \frac{1}{R_1} + \frac{1}{R_2} \\ \frac{1}{R_A} &= \frac{1}{10} + \frac{1}{40} = \frac{5}{40} \\ R_A &= 8\ \Omega \end{aligned}$$

$$\begin{aligned} \text{Similarly,} \quad \frac{1}{R_B} &= \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5} \\ \frac{1}{R_B} &= \frac{1}{30} + \frac{1}{20} + \frac{1}{60} = \frac{6}{60} \\ R_B &= 10\ \Omega \end{aligned}$$

$$\text{Total resistance, } R = R_A + R_B$$

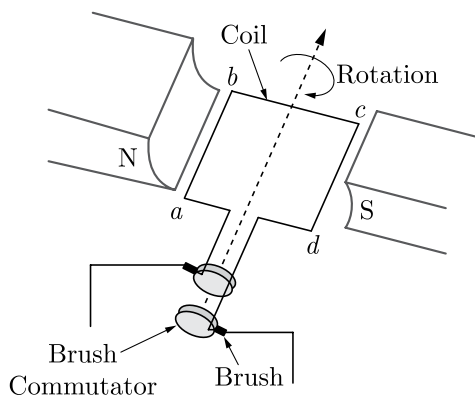


Ans :

- (i) Ammeter is used for measure current in the circuit.
- (ii) (a) all in series.
- (iii) (d) ammeter  $A_2$  and voltmeter  $V_2$
- (iv) (c) ammeter  $A_2$  and voltmeter  $V_1$

**298.** Read the following case based passage and answer the questions given after passage.

A D.C. generator also called a D.C. dynamo converts mechanical energy into electrical energy (D.C.). It works on the principle that when a coil rotates in a uniform magnetic field, a current is induced in the coil. The direction of induced current is determined by Fleming's right hand rule. The schematic diagram of a D.C. generator is as shown in figure.



- (i) The essential difference between an A.C. generator and a D.C. generator is that :
  - (a) A.C. generator has an electromagnetic while a dc generator has permanent magnet.
  - (b) D.C. generator will generate a higher voltage.
  - (c) A.C. generator will generate a higher voltage.
  - (d) A.C. generator has slip rings while the D.C. generator has a commutator.
- (ii) What is the frequency of D.C.?
- (iii) What type of dynamo is used in a bicycle?
- (iv) A D.C. motor is rotating in clockwise direction. How can the direction of rotation be reversed?

Ans :

- (i) (d) A.C. generator has slip rings while the D.C. generator has a commutator.
- (ii) Zero
- (iii) We use a D.C. dynamo in a bicycle.
- (iv) The direction of rotation of the motor can be reversed by reversing the direction of current through the coil. This can be achieved by

interchanging the terminals of the battery connected to the brushes of the motor.

**299.** Read the following case based passage and answer the questions given after passage.

Electrical resistivities of some substances at  $20^\circ\text{C}$  are given below :

**Table-A**

S. No.	Metal	Resistivity (in $\Omega\text{-m}$ )
1.	Silver	$1.60 \times 10^{-8}$
2.	Copper	$1.62 \times 10^{-8}$
3.	Tungsten	$5.20 \times 10^{-8}$
4.	Iron	$10.0 \times 10^{-8}$
5.	Mercury	$94.0 \times 10^{-8}$
6.	Nichrome	$10.0 \times 10^{-8}$

- (i) Among silver and copper, which one is a better conductor?
- (ii) Which material would you advise to be used in electrical heating devices?
- (iii) What do you mean by resistivity ?
- (iv) What is the effect of temperature on resistivity of a substance?

Ans :

- (i) Silver
- (ii) Nichrome
- (iii) Resistivity of a conductor is defined as the resistance of the conductor of unit length and unit area of cross-section.
- (iv) Resistivity of a material changes if its temperature changes.

**300.** Read the following case based passage and answer the questions given after passage.

Resistance of a conductor depends on the length, area of cross-section and nature of the material of the conductor. When a conductor is stretched (increased in its length), then its area of cross-section decreases accordingly but the volume (i.e. area  $\times$  length) of the conductor remains same.

Resistivity of conductor,

$$\rho = \frac{RA}{l}$$

Where,  $A$  = area of cross-section of conductor

$l$  = length of conductor

- (b) Three resistors  $R_1$ ,  $R_2$  and  $R_3$  are connected in series to a battery. Draw the circuit diagram showing the arrangement. Derive an expression for the equivalent resistance of the combination.

Ans :

Comp. 2017, Delhi 2011

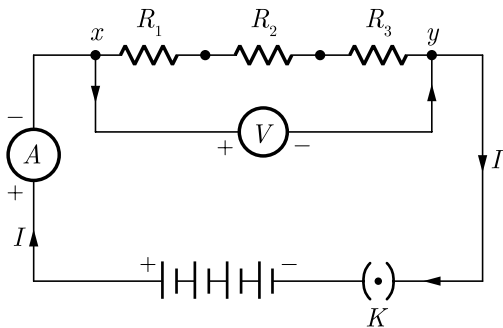
- (a) In series combination effective resistance,

$$\begin{aligned} R &= R_1 + R_2 + R_3 \\ &= 10 + 20 + 30 = 60 \Omega \end{aligned}$$

When this combination is connected to a 6 V battery

The current,  $I = \frac{V}{R} = \frac{6}{60} = \frac{1}{10} \text{ A}$

- (b)



Let the potential difference across the resistors  $R_1$ ,  $R_2$  and  $R_3$  are  $V_1$ ,  $V_2$  and  $V_3$  respectively. In the electric circuit shown above, let  $I$  be the current through the circuit. In this case, the current through each resistor is also  $I$  and the potential difference  $V$  across a combination of resistors is equal to the sum of potential difference across the individual resistors. That is

$$V = V_1 + V_2 + V_3 \quad \dots(1)$$

If the resistors  $R_1$ ,  $R_2$  and  $R_3$  are replaced by an equivalent single resistor  $R$ , such that the potential difference is  $V$  across it, and current  $I$  through the circuit remains same.

Now, applying the Ohm's law to the entire circuit and three resistors separately, we have :

$$V = IR$$

$$V_1 = IR_1, V_2 = IR_2, V_3 = IR_3$$

From equation (1),

$$IR = IR_1 + IR_2 + IR_3$$

or

$$R = R_1 + R_2 + R_3$$

- (b) Name a component used to regulate current without changing the voltage source.  
(c) A  $10 \Omega$  resistance wire is doubled on it, calculate the new resistance of wire.

Ans :

Delhi 2016, Delhi 2013

- (a) As we know that,

$$R = \frac{V}{I} = \frac{220}{20} = 11 \Omega$$

Let  $n$  resistors of  $330 \Omega$  are required.

$$\frac{1}{R_p} = \frac{n}{R}$$

or

$$R_p = \frac{R}{n}$$

or

$$11 = \frac{330}{n}$$

$$n = \frac{330}{11} = 30 \text{ resistances}$$

- (b) Variable resistance or rheostat.  
(c) Originally,

$$R = \rho \frac{l}{A} = 10 \Omega$$

After doubling the wire,

Its length,  $l' = \frac{l}{2}$  and

Area,  $A' = 2A$

So,  $R' = \rho \frac{l'}{A'} = \rho \frac{l/2}{2A} = \frac{1}{4} \rho \frac{l}{A}$

$$R' = \frac{1}{4} R$$

$$= \frac{1}{4} \times 10 = 2.5 \Omega$$

289. (a) State ohm's law. Express it mathematically.  
(b) Write symbols used in electric circuits to represent:  
(i) variable resistance  
(ii) voltmeter.  
(c) An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, what will be the power consumed ?

Ans :

Foreign 2017

- (a) The ohm's law states that the current carrying in a conductor is directly proportional to the voltage applied across the ends of the conductor, keeping the resistance constant.

288. (a) How many  $330 \Omega$  resistance in parallel are required to carry 20 A on 220 V line ?

**302.** Read the following case based passage and answer the questions given after passage.

The table given below shows the resistivity of conductors and alloys.

**Electrical Resistivity of Some Substances at 20°C**

Type of material	Material	Resistivity ( $\Omega$ -m)
Conductors	Silver	$1.60 \times 10^{-8}$
	Copper	$1.62 \times 10^{-8}$
	Aluminium	$2.63 \times 10^{-8}$
	Tungsten	$5.20 \times 10^{-8}$
	Nickel	$6.84 \times 10^{-8}$
	Iron	$10.0 \times 10^{-8}$
	Chromium	$12.9 \times 10^{-8}$
	Mercury	$94.0 \times 10^{-8}$
	Manganese	$1.84 \times 10^{-8}$
Alloys	Constantan (Cu + Ni)	$49 \times 10^{-6}$
	Manganin (Cu+Mn+Ni)	$44 \times 10^{-6}$
	Nichrome (Ni+Cr+Mn+Fe)	$100 \times 10^{-6}$
Insulators	Glass	$10^{10} - 10^{14}$
	Hard rubber	$10^{13} - 10^{16}$
	Ebonite	$10^{15} - 10^{17}$
	Diamond	$10^{12} - 10^{13}$
	Dry paper	$10^{12}$

- (i) Why tungsten is used in the bulb of the filament?  
 (ii) Which among copper and tungsten is the better conductor?  
 (iii) From the above table, the most popular material used in the heater is  
 (a) nickel (b) copper  
 (c) ebonite (d) nichrome  
 (iv) The resistance of a copper wire of length 2m and area of cross-section  $1.7 \times 10^{-6} \text{ m}^2$  is  
 (a)  $1.5 \times 10^{-2} \Omega$  (b)  $2 \times 10^{-2} \Omega$   
 (c)  $1.9 \times 10^{-2} \Omega$  (d)  $1.6 \times 10^{-2} \Omega$

**Ans :**

- (i) Resistivity of tungsten is high and its melting

point is also very high ( $3380^\circ\text{C}$ ). It emits light when it becomes very hot and does not melt at this high temperature. Hence, tungsten is used in the filament of electric lamp.

- (ii) Among copper and tungsten, copper is the better conductor because its resistivity is less than that of aluminium.

- (iii) (d) Nichrome

Nichrome is an alloy which has a higher resistivity than their constituent metals. They do not oxide or burn at higher temperatures as they have high melting point. Thus, they are used to make coils of electric heating devices like electric heater.

- (iv) (c)  $1.9 \times 10^{-2} \Omega$

From the above table,

Resistivity of Cu =  $1.62 \times 10^{-8} \Omega\text{-m}$

$l$  of copper = 2 m

$A$  of copper =  $1.7 \times 10^{-6} \text{ m}^2$

$$\text{As, } R = \frac{\rho l}{A} = \frac{1.62 \times 10^{-8} \times 2}{1.7 \times 10^{-6}} = 1.9 \times 10^{-2} \Omega$$

**303.** Read the following case based passage and answer the questions given after passage.

Two tables given below study these table related to measurement of voltage and current and answer the question that follow

**Ideal measurement (Table – A)**

S.N.	Voltmeter reading (mV)	Ammeter reading (mA)
1.	4	2
2.	6	3
3.	8	4
4.	10	5
5.	12	6

**Table – B**

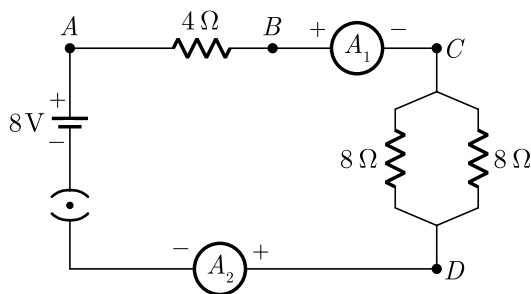
Student	S.No.	Voltmeter reading (mV)	Ammeter reading (mA)
Student–X	1.	2	1
	2.	4	2
	3.	6	3
Student–Y	1.	4	4
	2.	6	3
	3.	8	4

Also, potential difference across the lamp  
 = Potential difference of the circuit  
 = 10 V

So, there will be no change in potential difference across the lamp.

**292.** Find out the following in the electric circuit given in figure :

- Effective resistance of two  $8\ \Omega$  resistors in the combination.
- Current flowing through  $4\ \Omega$  resistor.
- Potential difference across  $4\ \Omega$  resistance.
- Power dissipated in  $4\ \Omega$  resistor.
- Difference in ammeter readings, if any.



**Ans :**

SQP 2017

- Effective resistance of two resistances in parallel combination is given by,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{R_1 + R_2}{R_1 R_2}$$

or

$$R = \frac{R_1 R_2}{(R_1 + R_2)} = \left( \frac{8 \times 8}{8 + 8} \right) = 4\ \Omega$$

- Current flowing through  $4\ \Omega$  resistor,

$$I = \frac{V}{R} = \frac{8}{4} = 2\ \text{A}$$

- Potential difference across  $4\ \Omega$  resistor,

$$V = IR = 2 \times 4 = 8\ \text{V}$$

- Power dissipated in  $4\ \Omega$  resistor,

$$P = I^2 R = 2^2 \times 4 = 16\ \text{W}$$

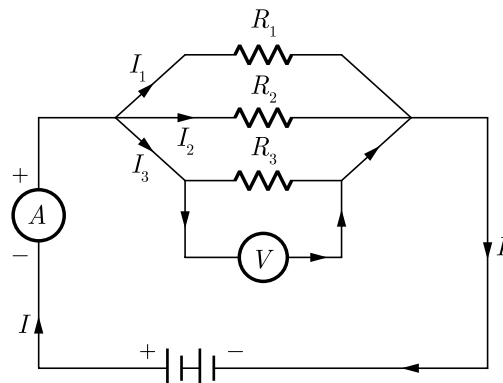
- No difference can be seen in ammeter's reading. As same current flows through each element in a series circuit.

- 293.** (a) Derive an expression for the equivalent resistance of three resistors  $R_1$ ,  $R_2$  and  $R_3$  connected in parallel.
- (b) Fuse of 3 A, 5 A and 10 A are available. Calculate and select the fuse for operating electric iron of 1 kW power at 220 V line.

**Ans :**

SQP 2016, Delhi 2011

(a)



In parallel arrangement, the total current,  $I$  is equal to the sum of the separate currents through each branch of the combination.

$$I = I_1 + I_2 + I_3$$

$$I = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{I}{V} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Let  $R_p$  be the equivalent resistance of the parallel combination of resistors.

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \quad \left[ R_p = \frac{V}{I} \right]$$

(b)

$$P = 1\ \text{kW} = 1000\ \text{W}$$

$$V = 220\ \text{V}$$

$$I = \frac{P}{V} = \frac{1000}{220} = 4.5\ \text{A}$$

So, suitable fuse is 5 A.

## CASE BASED QUESTIONS

**294.** Read the following case based passage and answer the questions given after passage.

A room has two tube lights, a fan and a TV. Each tube light draws 40 W, the fan draws 80 W and the TV draws 60 W on the average, the tube lights are kept on for five hours, the fan for twelve hours and the TV for eight hours every day. The rate for electrical energy is ₹ 3.10 per kWh.

- Calculate the energy consumed by each tube light in a day.
- What is the total energy consumed in a day?
- Find the cost of electricity used in this room in a 30-day month.
- What quantities determines the rate at which energy is delivered by current?

alloy and insulators. Study the table and answer the following questions.

Type of material	Material	Resistivity ( $\Omega \text{ m}$ )
Conductors	Silver	$1.60 \times 10^{-8}$
	Copper	$1.62 \times 10^{-8}$
	Aluminium	$2.63 \times 10^{-8}$
	Tungsten	$5.20 \times 10^{-8}$
	Nickel	$6.84 \times 10^{-8}$
	Iron	$10.0 \times 10^{-8}$
	Chromium	$12.9 \times 10^{-8}$
	Mercury	$94.0 \times 10^{-8}$
	Manganese	$1.84 \times 10^{-6}$
Alloys	Constantan (alloy of Cu and Ni)	$49 \times 10^{-6}$
	Manganin (alloy of Cu, Mn and Ni)	$44 \times 10^{-6}$
	Nichrome (alloy of Ni, Cr, Mn, and Fe)	$100 \times 10^{-6}$
Insulators	Glass	$10^{10} - 10^{14}$
	Hard rubber	$10^{13} - 10^{16}$
	Ebonite	$10^{15} - 10^{17}$
	Diamond	$10^{12} - 10^{13}$
	Paper (dry)	$10^{12}$

- (i) Why among iron is a better conductor than mercury?
- (ii) Which material is the best conductor?
- (iii) The copper and aluminium have
- (a) Low resistivity      (b) high resistivity
- (c) zero resistivity      (d) high energy losses
- (iv) Alloys are commonly used in electrical heating devices due to
- (a) Low resistivity as compare to all substance
- (b) high resistivity as compare to metals
- (c) Low resistivity as compare to metals
- (d) None of these

**Ans :**

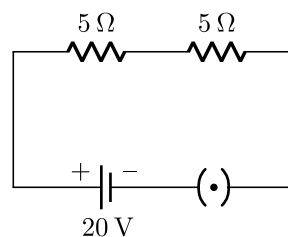
- (i) Iron is a better conductor than mercury because the resistivity of iron ( $= 10 \times 10^{-8} \Omega \text{ m}$ ) is less than the resistivity of mercury ( $= 94 \times 10^{-8} \Omega \text{ m}$ )

- (ii) It can be observed from table that the resistivity of silver is the lowest among the listed materials. Hence, silver is the best conductor.
- (iii) (a) Low resistivity
- (iv) (b) high resistivity as compare to metals

**306.** Read the following case based passage and answer the questions given after passage.

Two  $5 \Omega$  resistances are connected in the series combination as shown in the circuit diagram. In the series combination of resistances, current is same in the all resistance. So the equivalent resistance of series combinations is given by

$$R_{\text{eq}} = R_1 + R_2$$



- (i) Which type of circuit is represented in the above circuit diagram?
- (a) Series circuit      (b) Parallel circuit
- (c) Simple circuit      (d) Both (a) and (b)
- (ii) How much current is flowing through the electrical circuit given above?

**Ans :**

- (i) (a) Series circuit

A resistor of  $5 \Omega$  is connected in series with another resistor of  $5 \Omega$ . Hence, the circuit diagram represents a series circuit.

- (ii) Total Resistance,

$$R = R_1 + R_2 = 5 + 5 = 10 \Omega$$

Potential difference,

$$V = 20 \text{ Volts};$$

Current (I) in circuit = ?

Applying Ohm's law, we get

$$\frac{V}{I} = R \text{ or } I = \frac{20}{10} = 2 \text{ A}$$

**307.** Read the following case based passage and answer the questions given after passage.

Heating effect is very important application of electric current. Heating effect is used to produce light, as in an electric bulb. Now consider current

(i) What do you mean by resistivity ?

(ii) The SI unit of resistivity is

- (a) ohm ( $\Omega$ )
- (b) ohm-metre ( $\Omega$ -meter)
- (c) ohm<sup>2</sup>-metre ( $\Omega^2$ -m)
- (d) ohm-metre<sup>2</sup> ( $\Omega$ -m<sup>2</sup>)

Resistivity,  $\rho = \frac{RA}{l}$

$$= \frac{\text{ohm} \cdot \text{m}^2}{\text{m}} = \text{ohm} \cdot \text{meter}$$

(iii) Write one difference between resistance and resistivity.

(iv) The resistance ( $R$ ) of a wire of length is halved and area of cross-section ( $A$ ) is doubled, its new resistance ( $R'$ ) will be

- (a)  $R$
- (b)  $\frac{R}{2}$
- (c)  $\frac{R}{4}$
- (d)  $\frac{R}{8}$

**Ans :**

(i) Resistivity is defined as the resistance of a conductor of unit length and unit area of cross-section.

(ii) (b) SI unit of resistivity is ohm-metre.

(iii) Resistance is that property of a conductor by virtue of which it opposes or resists the flow of charges through it. Its SI unit  $\Omega$ . Resistivity is the characteristic property of the material of the conductor and varies only if its temperature changes. Its SI unit  $\Omega$ -metre.

(iv) (c)  $\frac{R}{4}$

Initially,  $R = \frac{\rho l}{A}$  ... (1)

( $\rho$  = resistivity)

According to the question,

New length of the wire,

$$l' = \frac{l}{2}$$

nd new area of cross-section,

$$A' = 2A \quad (\text{Given})$$

New resistance,  $R' = \rho \frac{l/2}{2A} = \frac{\rho l}{4A} = \frac{R}{4}$

**301.** Read the following case based passage and answer the questions given after passage.

An electrician is a tradesman specializing in electrical wiring of buildings, transmission lines, stationary machines and related equipment. Electrician may be employed in the installation of new electrical components or the maintenance and

repair of existing electrical infrastructure.

An electrician has made electric circuit of a house in such a way that if a fan is closed, the lamps also stop glowing.

- (i) What is the defect in this type of circuit wiring? Why?
- (ii) Two resistances  $R_1$  and  $R_2$  are connected turn by turn in parallel and in series. In which case, the resultant resistance will be less than either of the individual resistances?
- (iii) Which is the better way to connect lights and other appliances in domestic circuit series connection or parallel connection?
- (iv) In which type of combination different resistors will have equal value of electric current through them?

**Ans :**

- (i) Electrician has made series connection of all the lamps in electric circuit of house because of which, if one lamp gets fused, all the other lamps would stop working. This is due to the fact that when devices are connected in series, then if one device fails, the circuit gets broken and all the devices in that circuit stop working.
- (ii) In parallel, because the resultant resistance in parallel circuit is  $\frac{R_1 R_2}{R_1 + R_2}$  whereas in series the equivalent resistance is  $R_1 + R_2$ . Hence, equivalent resistance is less in parallel circuit.
- (iii) Parallel connection is a better way to connect lights and other appliances in domestic circuit. It is because when we connect a number of devices in parallel combination, each device gets the same potential hence keeps on working even, if other devices stop working.
- (iv) In series combination, different resistors will have equal value of electric current.

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- (iii) Two wires of equal lengths, one of copper and the other of manganin have the same resistance. Which wire will be thicker?
- (iv) Draw  $V-I$  graph for a metal piece at given temperature.

**Ans :**

- (i) Increase with the increase in temperature.
- (ii) Resistance of conductor,  $X$

$$R_X = \frac{\rho L}{\pi r^2} \quad \dots(1)$$

Resistance of conductor,  $Y$

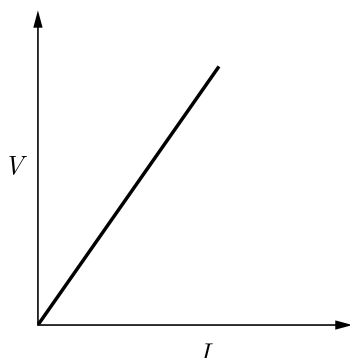
$$R_Y = \frac{\rho(2L)}{\pi(r/2)^2} = \frac{8\rho L}{\pi r^2}$$

From equation (1),

$$R_Y = 8R_X$$

$$\frac{R_X}{R_Y} = \frac{1}{8}$$

- (iii) Manganin wire is thicker than Cu wire
- (iv)



**309.** Read the following case based passage and answer the questions given after passage.

Every electrical appliance like an electric bulb, radio or fan has a label or engraved plate on it which tells us the voltage (to be applied) and the electrical power consumed by it. For example, if we look at a particular bulb in our home, it may have the figures 100 W – 220 V written on it, Now, 100 W means that this bulb has a power consumption of 100 watts and 220 V means that it is to be used on a voltage of 220 volts. The power rating of an electrical appliance tells us the rate at which electrical energy is consumed by the appliance. For example, a power rating of 100 watts on the bulb mean that it will consume electrical energy at the rate of 100 joules per second. If we know the power  $P$  and voltage  $V$  of an electrical appliance, then we can very easily find out the current  $I$  drawn by it. This can be done

by using the formula:  $P = V \times I$ . The usual power-voltage ratings of some of the common household electrical appliances and the current drawn by them are given below.

Power-Voltage Ratings of Some Electrical Appliances

	Electrical appliance	Usual power	Usual voltage
1.	Tube light	40 W	220 V
2.	Electric bulb (or Lamp)	60 W	220 V
3.	Radio set	80 W	220 V
4.	Electric fan	100 W	220 V
5.	T.V. set	120 W	220 V
6.	Refrigerator	150 W	220 V
7.	Electric iron	750 W	220 V
8.	Electric heater	1000 W	220 V
9.	Immersion heater	1500 W	220 V
10.	Washing machine	3000 W	220 V

Answer following questions.

- (i) What is current drawn by an electric fan?
- (ii) An electric heater is used for 2 H at 220 V. What is net energy consumed?
- (iii) What is resistance of electric bulb of 60 W ?
- (iv) What is the net current drawn by a parallel combination of tube light, electric bulb (or Lamp) and a radio set when connected with 220 V power supply.

**Ans :**

- (i) As we know that,

$$P = V \times I$$

$$I = \frac{P}{V} = \frac{100}{220} = 0.45 \text{ A}$$

- (ii) 
$$P = \frac{1000 \times 2}{1000}$$
- $$= 2 \text{ kWh}$$

- (iii) 
$$P = \frac{V^2}{R}$$
- $$R = \frac{V^2}{P} = \frac{(220)^2}{60} \simeq 807 \Omega$$

- (iv) 0.81 A

**310.** Read the following case based passage and answer the questions given after passage.

The resistivity of alloys are much more higher than those of the pure metals (from which they are made). For example, the resistivity of manganin



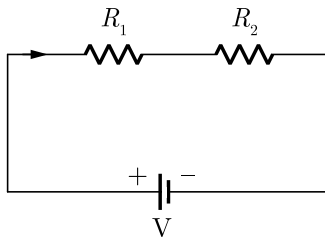
$i$  flowing through a resistor of resistance  $R$ . Let the potential difference across it be  $V$ . Then heat produced in time  $t$  is given as

$$H = Vit = i^2 R t$$

and power consumed,

$$P = Vi = i^2 R$$

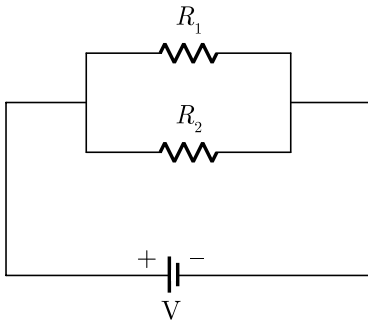
If two resistances are connected in series then power consumed in  $R_1$  and  $R_2$  respectively are  $P_1 = i^2 R_1$  and  $P_2 = i^2 R_2$



i.e., Power consumed  $P \propto R$ .

If the resistances are connected in parallel, then

$$P_1 = \frac{V^2}{R_1} \text{ and } P_2 = \frac{V^2}{R_2}$$



i.e.,  $P \propto \frac{1}{R}$

Answer following questions.

- (i) Two electric bulbs  $B_1$  (100 W – 220 V) and  $B_2$  (60 W – 220 V) are connected in series to a power supply of 220 volts then which bulb will be brighter ?
- (ii) The rating of an electric bulb is given as (100 W – 200 V), then what will be the resistance of filament of the bulb ?
- (iii) An electric iron of resistance 20 ohm takes a current of 5 A. Then calculate the heat developed in 30 sec.

Ans :

- (i)  $B_2$  is brighter than  $B_1$
- (ii) 400  $\Omega$
- (iii) 15 kJ

**308.** Read the following case based passage and answer the questions given after passage.

Current only flows through a component of a circuit if a potential difference (voltage) is put across it. The bigger the potential difference across its ends the bigger the current flow. This is because there is a steeper ‘electric slope’ in place to make the charge slide down... steeper slope-faster slide.

The equation below is used to work out the resistance of a component from measurements of the current flowing through it and the potential difference across its ends.

$$V = IR$$

where,  $V$  = potential difference in volts (V),  $I$  = current in amps (A) and  $R$  = resistance in ohms ( $\Omega$ )

There are four factors that affect the resistance of a wire: length, area, material and temperature.

Resistance is proportional to length. If you take a wire of different lengths and give each a particular potential difference across its ends. The longer the wire the less volts each centimetre of it will get. This means that the ‘electric slope’ that makes the electrons move gets less steep as the wire gets longer, means current decreases with increased length and resistance increases.

Resistance is inversely proportional to cross-section-area. The bigger the cross-sectional area of the wire the greater the number of electrons that experience the ‘electric slope’ from the potential difference. Resistance depends on the material the wire is made of. The more tightly an atom holds on to its outermost electrons the harder it will be to make a current flow. Resistance increases with the temperature of the wire. The hotter wire has a larger resistance because of increased vibration of the atomic lattice.

$R = R_0(1 + \alpha T)$ , where  $\alpha$  is the temperature coefficient of resistance.

Answer following questions.

- (i) How does resistance of the metals change with increase in temperature?
- (ii) There are two conductors  $X$  and  $Y$  of the same material, having length  $L$  and  $2L$  and having radii  $r$  and  $r/2$  respectively. What will be the ratio of their resistance?

- (iv) What are practical applications of semiconductors?

Ans :

- (i) No change  
 (ii) 1. Germanium  
 2. Silicon  
 (iii) Copper is cheaper  
 (iv) Solar cells and transistors

- 312.** Read the following case based passage and answer the questions given after passage.

$$R = \rho \times \frac{l}{A}$$

Some materials have low resistance, whereas some other have much higher resistance. In general, an alloy has higher resistance than pure metals which from the alloy.

Copper, silver, aluminium, etc., have very low resistance.

Nichrome, constantan, etc., have higher resistance. Nichrome is used for making heating elements of heaters, toasters, electric iron, etc.

Read the following information:

- Resistivity of copper is lower than that of aluminium which in turn is lower than that of constantan
- Six wires labelled as A, B, C, D, E, F have designed as per the following parameters:

Wire	Length	Diameter	Material	Resistance
A	$l$	$2d$	Aluminum	$R_1$
B	$2l$	$d/2$	Constantan	$R_2$
C	$3l$	$d/2$	Constantan	$R_3$
D	$l/2$	$3d$	Copper	$R_4$
E	$2l$	$2d$	Aluminum	$R_5$
F	$l/2$	$4d$	Copper	$R_6$

Answer the following questions using the above data:

- (i) Which of the wires has maximum resistance and why?  
 (ii) Which of the wires has minimum resistance and why?  
 (iii) Arrange  $R_1, R_3$  and  $R_5$  in ascending order of their values. Justify your answer.  
 (iv) Nichrome is used for making heating elements of heaters, toasters, electric iron, etc. Why ?

Ans :

- (i) Wire C has maximum resistance because it has maximum length, least thickness and highest resistivity.  
 (ii) Wire F has the minimum resistance since it has least length, maximum thickness and least resistivity. (Using  $R = \rho \frac{l}{A}$ )  
 (iii)  $R_3 > R_5 > R_1$  (Using relation  $R = \rho \frac{l}{A}$  and comparing)  
 (iv) Nichrome has higher resistance.

- 313.** Read the following case based passage and answer the questions given after passage.

There are some important points regarding parallel and series combination of resistances

- When two or more resistors are connected in series, the total resistance of the combination is equal to the sum of all the individual resistances.
- When two or more resistors are connected in series, the same current flows through each resistor.
- When a number of resistors are connected in series, the voltage across the combination (i.e., voltage of the battery in the circuit), is equal to the sum of the voltage drop (or potential difference) across each individual resistor.

Two resistors, with resistances  $5\Omega$  and  $10\Omega$  respectively are to be connected to a battery of emf  $6\text{ V}$ . Find

- (i) In which resistors combination is the value of resistance minimum ?  
 (ii) In which resistors combination is the value of resistance maximum ?  
 (iii) What is the minimum value of current ?  
 (iv) What is the maximum value of current ?

Ans :

- (i) For obtaining minimum current, the two resistors should be connected in series.  
 (ii) For obtaining maximum current, the two resistor should be connected in parallel.  
 (iii) Give,

$$R_1 = 5\Omega, R_2 = 10\Omega \text{ and } V = 6\text{ Volt}$$

For series arrangement, the equivalent resistance

$$R = R_1 + R_2 \\ = 5\Omega + 10\Omega = 15\Omega$$

$$I = \frac{V}{R} = \frac{6\text{ V}}{15\Omega} = 0.4\text{ A}$$

- (iv) For parallel arrangement, the equivalent resistance is given by

$$\begin{aligned}\frac{1}{R} &= \frac{1}{R_1} + \frac{1}{R_2} \\ \frac{1}{R} &= \frac{1}{5} + \frac{1}{10} \\ &= \frac{2+1}{10} = \frac{3}{10} \\ R &= \frac{10}{3} \Omega \\ I &= \frac{V}{R} \\ &= \frac{6 \times 3}{10} = 1.8 \text{ A}\end{aligned}$$

- 314.** Read the following case based passage and answer the questions given after passage.

We have already studied that the source of electrical energy is a battery or a cell. Potential difference within the two terminals of the circuit is generated by the chemical reaction within the cells which sets the electron in motion to flow the current through a resistor or a system of resistor connected to a battery. The resistance wire becomes very hot and produces heat when electric current is passed through a high resistance wire like nichrome wire. This is called heating effect of current. When the electric energy is transformed into heat energy then heating effect of current is obtained. This effect is utilized in devices such as electric heater, electric iron, etc.

- (i) Source of electric energy is  
(a) Battery (b) Cell  
(c) Both (a) and (b) (d) None of the above
- (ii) Which metal is used for making electric heater?  
(a) Copper (b) Nichrome  
(c) Aluminium (d) Nickel

**Ans :**

- (i) (c) Both (a) and (b)  
(ii) (b) Nichrome

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# CHAPTER 12

## Magnetic Effects of Electric Current

### 1. MAGNET

An object which attracts the magnetic substances towards it and resides in north-south direction when suspended freely is called a magnet.

#### 1.1 Magnetism

The property by virtue of which a magnet attracts magnetic substances and rests in north-south direction when suspended freely is called magnetism.

### 2. MAGNETIC FIELD

The region surrounding a magnet where a magnetic force is experienced is called a magnetic field.

### 3. MAGNETIC FIELD LINE

A magnetic field line is a closed and continuous curved path along with a hypothetical free north pole of a magnetic compass needle would tend to move.

#### 3.1 Properties of Magnetic Field Lines:

The properties of magnetic field lines are following :

- They travel from the north to the south pole of a magnet outside the magnet and from south to the north pole inside the magnet.
- They are always closed and continuous curve.
- Magnetic field lines are closest near the pole of a magnet and become wider as they move away from the pole.
- Two magnetic lines never intersect each other.
- They emerge out normally from the magnetised surfaces.

#### 3.2 Uniform Magnetic Field

If the magnetic field lines are parallel and equidistant, the field is uniform magnetic field. Magnetic field is uniform inside a bar-magnet.

#### 3.3 Non-uniform Magnetic Field

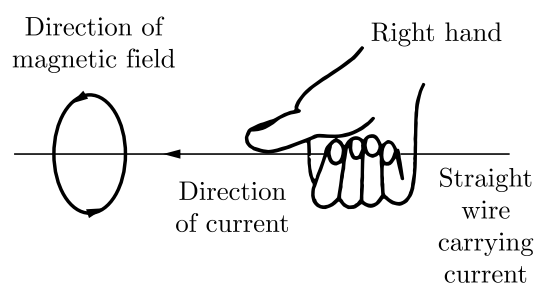
If the magnetic field lines are unequally spaced the field is non-uniform magnetic field.

### 4. MAGNETIC FIELD DUE TO A CURRENT CARRYING CONDUCTOR

When an electric current is passed through a conductor a magnetic field is set up around it which exists so long as the current flows in the conductor. This is called magnetic effect of electric current.

The magnetic field lines around a current carrying conductor are concentric circles whose center lie on the wire

#### 4.1 Right Hand Thumb Rule



**Figure :** Right hand thumb rule

This rule gives the direction of magnetic field due to a straight conductor carrying current. According to the rule, if a current carrying straight conductor is imagined to be held in right hand in such a manner that the thumb points along the direction of current then the direction of the wrapped fingers will give the direction of magnetic field lines.

#### 4.2 Clock Rule

The polarity of ends of current carrying solenoid depends on the direction of current flowing and is given by clock rule. According to this rule, when an end of a current carrying solenoid is seen from the front side and if the current flowing appears anticlockwise then this end will be north pole and the other end will be south pole but if the current is clockwise then this end will be south pole and the other end will be north pole.

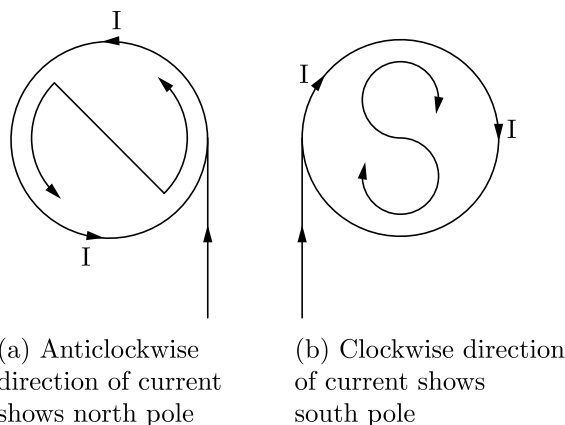


Figure : Clock rule

direction of magnetic field, middle finger points along the direction of current then the thumb will indicate the direction of force acting on the conductor”.

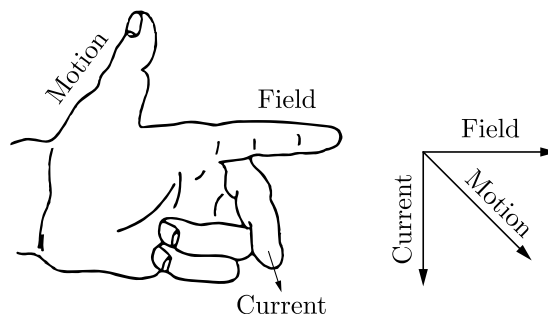


Figure : Fleming's left-hand rule

## 5. MAGNETIC FIELD DUE TO A CURRENT IN SOLENOID

A coil of many turns of copper wire in the shape of a cylinder is called a solenoid.

Factors on which strength of magnetic field produced inside a solenoid carrying current depends are:

- The number of turns in the solenoid.
- The strength (magnitude) of the current flowing through the solenoid.
- Nature of the core material of the solenoid.

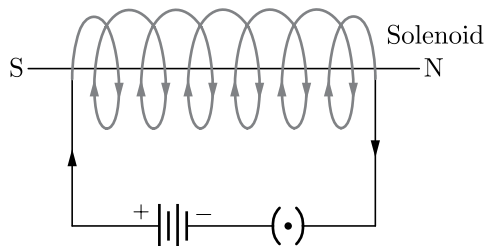


Figure : A solenoid

## 6. ELECTROMAGNET

Electromagnet is a temporary magnet which generates a magnetic field only if the current passes through a bar of soft iron.

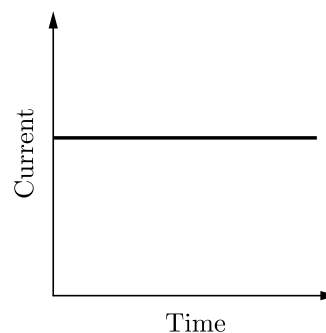
## 7. FLEMING'S LEFT HAND RULE

When a current carrying conductor is placed in a magnetic field then it experiences a force. The direction of force is determined by Fleming's left hand rule. According to this rule, “if the forefinger, the middle finger and the thumb of our left hand are stretched mutually perpendicular to each other in such a way that the forefinger points along the

## 8. DIRECT CURRENT (DC)

A current that always flows in one direction only is called a direct current. The current that we get from a battery or a cell is direct current.

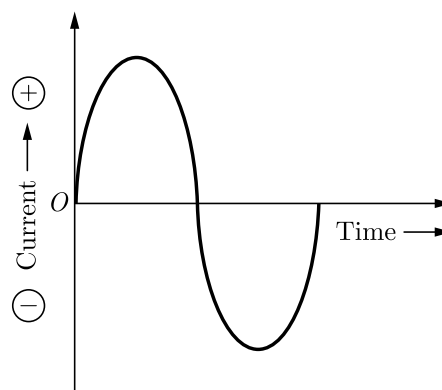
**Graphical representation of a direct current**



A direct current is graphically represented by a straight line parallel to the time axis.

## 9. ALTERNATING CURRENT (AC)

An electric current which changes its direction continuously at a regular interval of time is called an alternating current. It flows first in the positive direction and then in negative direction in a circuit.



## Graphical Representation of An alternating Current

### 9.1 Advantages of AC over DC

- (a) Electric power can be transmitted over long distances without much loss of energy.  
 (b) AC appliances are more durable and convenient.

**Colour convection of three wires used in household electric circuits:**

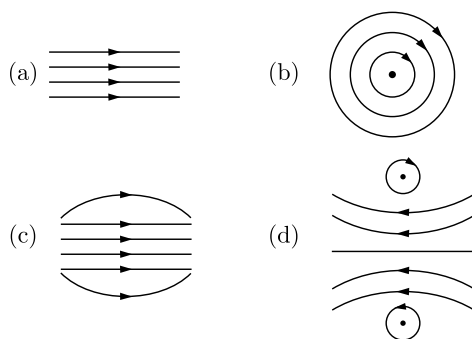
- (a) Old convection:  
 (i) Red - Live wire  
 (ii) Black - Neutral wire  
 (iii) Green - Earth wire  
 (b) New Convection:  
 (i) Brown - Live wire  
 (ii) Light blue - Neutral wire  
 (iii) Green/yellow - Earth wire

### 10. FUSE

It is the most important safety device used for protecting the circuits due to short circuiting or over-loading of the circuits.

## OBJECTIVE QUESTIONS

1. The pattern of the magnetic field produced inside a current carrying solenoid is :



**Ans :**

OD 2024

The magnetic field is nearly uniform inside the solenoid hence the field lines are parallel straight lines inside the solenoid. The magnetic field produced inside a solenoid depends on the number of turns, current and nature of material of solenoid. Thus (a) is correct option.

2. The magnetic field inside a long straight current carrying solenoid:  
 (a) is zero  
 (b) decreases as we move towards its end.  
 (c) increases as we move towards its end  
 (d) is same at all points.

**Ans :**

OD 2023

The magnetic field inside a long straight current-carrying solenoid is uniform which is represented by parallel lines. Hence, the magnetic field inside a long straight solenoid carrying current is the same at all points.

Thus option (d) is correct option.

3. Which of the following statement is not correct about the magnetic field?  
 (a) Magnetic field lines form a continuous closed curve.  
 (b) Magnetic field line do not intersect each other.  
 (c) Direction of tangent at any point on the magnetic field line curve gives the direction of magnetic field at that point.  
 (d) Outside the magnet, magnetic field lines go from South to North pole of the magnet.

**Ans :**

OD 2014

(d) Outside the magnet, magnetic field lines go from South to North pole of the magnet.

Outside the magnet, magnetic field lines go from south to north pole of the magnet is not the correct statement regarding magnetic field.

4. The pattern of the magnetic field produced by the straight current carrying conducting wire is  
 (a) in the direction opposite to the current  
 (b) in the direction parallel to the wire  
 (c) circular around the wire  
 (d) in the same direction of current

**Ans :**

OD 2014

(c) circular around the wire

Magnetic field line around a current carrying straight conductor is represented by concentric circles.

5. The strength of magnetic field around a current carrying conductor is  
 (a) inversely proportional to the current but directly proportional to the square of the distance from wire.  
 (b) directly proportional to the current and inversely proportional to the distance from wire.

- (c) directly proportional to the distance and inversely proportional to the current  
 (d) directly proportional to the current but inversely proportional the square of the distance from wire.

Ans :

OD 2014

- (b) directly proportional to the current and inversely proportional to the distance from wire.

Magnetic field strength increases on increasing the current through the wire and decreases as the distance from the wire increases.

6. The nature of magnetic field line passing through the centre of current carrying circular loop is  
 (a) circular (b) ellipse  
 (c) parabolic (d) straight line

Ans :

OD 2014

- (d) straight line

Magnetic field line at the centre of current carrying loop appears as a straight line.

7. A soft iron bar is introduced inside the current carrying solenoid. The magnetic field inside the solenoid  
 (a) will decrease (b) will remains same  
 (c) will increase (d) will become zero

Ans :

OD 2014

- (c) will increase

Soft iron inside the current carrying solenoid act as an electromagnet.

8. Which of the following factors affect the strength of force experience by a current carrying conduct in a uniform magnetic field?  
 (a) magnetic field strength  
 (b) magnitude of current in a conductor  
 (c) length of the conductor within magnetic field  
 (d) All of above.

Ans :

OD 2014

- (d) All of above.

All the factors affect the strength of magnetic force.

1. Choose the incorrect statement from the following regarding magnetic lines of field  
 (a) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points.  
 (b) Magnetic field lines are closed curves.

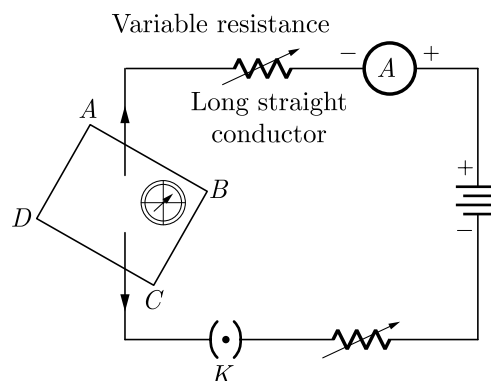
- (c) If magnetic field lines are parallel and equidistant, they represent zero field strength.  
 (d) Relative strength of magnetic field is shown by the degree of closeness of the field lines.

Ans :

Delhi 2016

- (c) If magnetic field lines are parallel and equidistant, they represent zero field strength.

2. If the key in the arrangement taken out (the circuit is made open) and magnetic field lines are drawn over the horizontal plane  $ABCD$ , the lines are



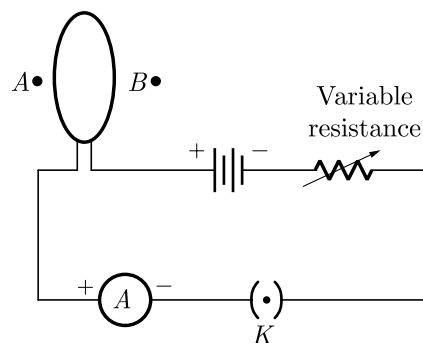
- (a) concentric circles  
 (b) elliptical in shape  
 (c) straight lines parallel to each other  
 (d) concentric circles near the point  $O$  but of elliptical shapes as we go away from it.

Ans :

OD 2013

- (c) straight lines parallel to each other (only earth's magnetic field will be present).

3. A circular loop placed in a plane perpendicular to the plane of paper carries a current when the key is ON. The current as seen from points  $A$  and  $B$  (in the plane of paper and on the axis of the coil) is anti-clockwise and clockwise respectively. The magnetic field lines point from  $B$  to  $A$ . The  $N$ -pole of the resultant magnet is on the face close to



- (a)  $A$   
 (b)  $B$

- (c)  $A$  if the current is small, and  $B$  if the current is large  
 (d)  $B$  if the current is small and  $A$  if the current is large.

Ans :

(a)  $A$  (misconception is that magnetic field lines point from north to south pole. The fact is that they emerge out of North pole and enter into south pole).

4. For a current in a long straight solenoid  $N$  and  $S$ -poles are created at the two ends. Among the following statements, the incorrect statement is

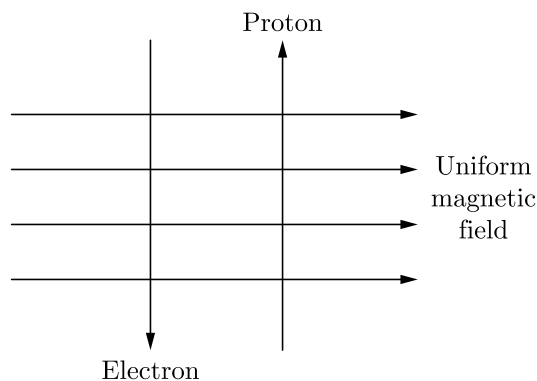
- (a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid.  
 (b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil.  
 (c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.  
 (d) The  $N$  and  $S$ -poles exchange position when the direction of current through the solenoid is reversed.

Ans :

Delhi 2014, OD 2013

(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.

5. A uniform magnetic field exists in the plane of paper pointing from left to right as shown in Figure. In the field an electron and a proton move as shown. The electron and the proton experience.



- (a) forces both pointing into the plane of paper  
 (b) forces both pointing out of the plane of paper

- (c) forces pointing into the plane of paper and out of the plane of paper, respectively.  
 (d) force pointing opposite and along the direction of the uniform magnetic field respectively.

Ans :

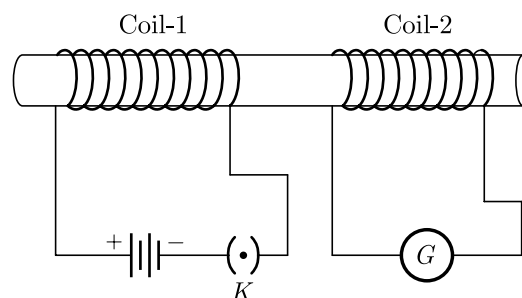
(a) forces both pointing into the plane of paper

6. Commercial electric motors do not use  
 (a) an electromagnet to rotate the armature  
 (b) effectively large number of turns of conducting wire in the current carrying coil  
 (c) a permanent magnet to rotate the armature  
 (d) a soft iron core on which the coil is wound

Ans :

(c) a permanent magnet to rotate the armature

7. In the arrangement shown in Figure, there are two coils wound on a non-conducting cylindrical rod. Initially the key is not inserted. Then the key is inserted and later removed. Then



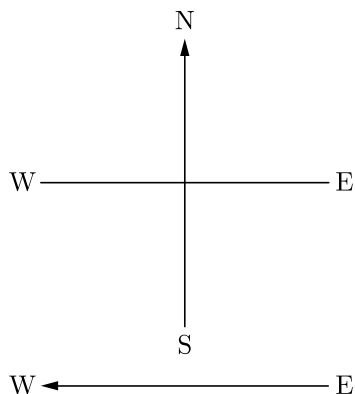
- (a) the deflection in the galvanometer remains zero throughout  
 (b) there is a momentary deflection in the galvanometer but it dies out shortly and there is no effect when the key is removed  
 (c) there are momentary galvanometer deflections that die out shortly; the deflections are in the same direction.  
 (d) there are momentary galvanometer deflection that die out shortly; the deflections are in opposite directions

Ans :

Foreign 2016

(d) there are momentary galvanometer deflection that die out shortly; the deflections are in opposite directions

8. A constant current flows in a horizontal wire in the plane of the paper from east to west as shown in Figure. The direction of magnetic field at a point will be North to South.



- (a) directly above the wire  
 (b) directly below the wire  
 (c) at a point located in the plane of the paper, on the north side of the wire  
 (d) at a point located in the plane of the paper, on the south side of the wire.

**Ans :**

OD 2012

- (b) directly below the wire.

9. The strength of magnetic field inside a long current carrying straight solenoid is

- (a) more at the ends than at the centre  
 (b) minimum in the middle  
 (c) same at all points  
 (d) found to increase from one end to the other

**Ans :**

Delhi 2015

- (c) same at all points

10. The most important safety method used for protecting home appliances from short circuiting or overloading is

- (a) earthing  
 (b) use of fuse  
 (c) use of stabilizers  
 (d) use of electric meter.

**Ans :**

- (b) use of fuse.

11. In magnetic field, for a charged particle, match the entries of column I with the entries of column II.

	Column I		Column II
(A)	Acceleration	(p)	may be zero
(B)	Velocity	(q)	is zero
(C)	Speed	(r)	may be constant
(D)	Kinetic energy	(s)	is constant

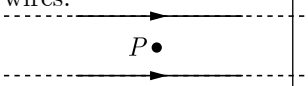
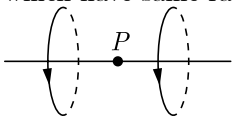
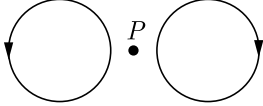
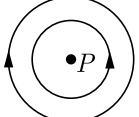
	A	B	C	D
(a)	p	r	s	s
(b)	s	p	q	r
(c)	p, q	s	r, s	q
(d)	q, s	q, r	s	s

**Ans :**

- (a) A-p, B-r, C-s, -D-s

Work done by magnetic force is zero. From work-energy theorem, its speed or kinetic energy is constant.

12. Two wires each carrying a steady current  $I$  are shown in four configurations in Column I. Some of the resulting effects are described in Column II. Match the statements in Column I with the statements in column II.

	Column I		Column II
(A)	Point P is situated midway between the wires. 	(p)	The magnetic fields (B) at P due to the currents in the wires are in the same direction.
(B)	Point P is situated at the mid-point of the line joining the centres of the circular wires, which have same radii. 	(q)	The magnetic fields (B) at P due to the currents in the wires are in opposite directions.
(C)	Point P is situated at the mid-point of the line joining the centers of the circular wires, which have same radii. 	(r)	There is no magnetic field at P.
(D)	Point P is situated at the common center of the wires. 	(s)	The wires repel each other.

	A	B	C	D
(a)	p, r	r, s	q, s,	s
(b)	s	p	q	r
(c)	q, r	p	q, r	q, s
(d)	q, s	q, r	s	s

**Ans :**

(c) A-q, r B-p, C-q, r, D-q, s

The magnetic field at P due to current flowing in AB is perpendicular to the plane of paper acting vertically downward. And the magnetic field at P due to current flowing in CD is perpendicular to the plane of paper acting vertically upwards.

Therefore, q is correct.

As P is the mid point, the two magnetic fields, cancel out each other. Therefore, r is correct.

**B:p**

The magnetic field at P due to current in loop A is along the axial line towards right. Similarly, the magnetic field at P due to current in loop B is also along the axial line towards right.

**C:q, r**

The magnetic field due to current in loop A at P is equal and opposite to the magnetic field due to current in loop B at P.

**D:q, s**

The direction of magnetic field at P due to current in loop A is perpendicular to the plane of paper directed vertically upwards.

The direction of magnetic field at P due to current in loop B is perpendicular to the plane of paper directed vertically downward.

Since the current are in opposite direction the wires repel each other.

- 13. Assertion :** The magnetic field produced by a current carrying solenoid is independent of its length and cross-section area.

**Reason :** The magnetic field inside the solenoid is uniform.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

The magnetic field is independent of length and area. It is uniform inside the solenoid.

- 14. Assertion :** The magnetic field is stronger at a point which is nearer to the conductor and goes on decreasing on moving away from the conductor.

**Reason :** The magnetic field  $B$  produced by a straight current carrying wire is inversely proportional to the distance from the wire.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

The magnitude of magnetic field is

15. Directly proportional to the current  $I$  passing through the wire.  
 16. Inversely proportional to the distance  $r$  from the wire.

The magnetic field is stronger at a point which is nearer to the conductor and goes on decreasing on moving away from the conductor.

- 17. Assertion :** Electric appliances with metallic body have three connections, whereas an electric bulb has two pin connections.

**Reason :** Three pin connections reduce heating of connecting wires.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of



assertion (A).

The metallic body of the electrical appliance is connected to the third pin which is connected to the earth. This is a safety precaution and avoids eventual electric shock. By doing this the extra charge flowing through the metallic body is passed to earth and avoid shocks. There is nothing such as reducing the heating of connecting wires by three pin connections.

- 18. Assertion :** A current carrying conductor experiences a force in a magnetic field.

**Reason :** The force acting on a current carrying conductor in a magnetic field is due to interaction between magnetic field produced by the current carrying conductor and external magnetic field in which the conductor is placed.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

When a current carrying conductor is placed in a magnetic field, it experiences a force except when it is placed parallel to the magnetic field. The force acting on a current carrying conductor in a magnetic field is due to interaction between magnetic field produced by the current carrying conductor and external magnetic field in which the conductor is placed.

- 19. Assertion :** A direction current flows through a metallic rod, produced magnetic field only outside the rod.

**Reason :** There is no flow of charge carriers inside the rod.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

In the case of metallic rod, the charge carries flow through whole of the cross-section. Therefore, the magnetic field exists both inside as well as outside. However, magnetic field inside the rod will go on decreasing as we go towards the axis.

- 20. Assertion :** Force experienced by moving charge will be maximum if direction of velocity of charge is perpendicular to applied magnetic field.

**Reason :** Force on moving charge is independent of direction of applied magnetic field.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

From equation  $F = qvB\sin\theta$ . Force on moving charge will be maximum if direction of velocity of charge is perpendicular to direction of magnetic field (when  $\theta = 90^\circ$ )

- 21. Assertion :** A neutral body may experience a net non-zero magnetic force.

**Reason :** The net charge on a current carrying wire is zero, but it can experience a force in a magnetic field.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

- 22. Assertion :** There is no change in the energy of a charged particle moving in a magnetic field although a magnetic force is acting on it.

**Reason :** Work done by centripetal force is always zero.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Magnetic force is always perpendicular to the direction of motion of charged particle, i.e., work done on the charge particle moving on a circular path in magnetic field zero.

- 23. Assertion :** A solenoid tends to expand, when a current passes through it.

**Reason :** Two straight parallel metallic wires carrying current in same direction attract each other.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(d) Assertion (A) is false but reason (R) is true.

When current flows through a solenoid, the currents in the various turns of the solenoid are parallel and in the same direction. Since the current flowing through parallel wires in the same direction lead to force of attraction between them, the turns of the solenoid will also attract each other and as a result the solenoid tends to contract.

- 24. Assertion :** In a conductor, free electrons keep on moving but no magnetic force acts on a conductor in a magnetic field.

**Reason :** Force on free electrons due to magnetic field always acts perpendicular to its direction of motion.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

In a conductor, the average velocity of electrons is zero. Hence no current flows through the conductor. Hence, no force acts on this conductor.

- 25. Assertion :** A small coil carrying current, in equilibrium, is perpendicular to the direction of the uniform magnetic field.

**Reason :** Torque is maximum when plane of coil and direction of the magnetic field are parallel to each other.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

The torque acting on a coil is given by,

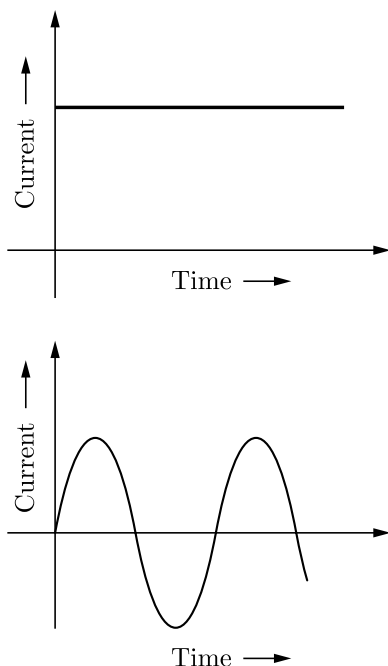
$$\tau = NIA B \sin \theta$$

Where  $\theta$  is the angle between the plane of the coil and the direction of magnetic field. When  $\theta = 90^\circ$ , then  $\tau = 0$ . The coil tries to orient itself in this position. Thus in equilibrium, the coil acquires a position, such that its plane makes an angle  $90^\circ$  with the direction of magnetic field.

(ii) (a) The galvanometer needle deflects momentarily in one direction because when the key is closed, magnetic field lines around coil-2 increases momentarily that causes induced current in coil-2.

(b) The galvanometer needle deflects momentarily but in opposite direction because when the key is opened, magnetic field lines around coil-2 decreases momentarily that causes induced current in coil-2.

168. In our daily life we use two types of electric current whose current time graphs are given below :



- Name the type of current in two cases.
- Identify any one source for each type of current.
- What is the frequency of current in case (b) in our country ?
- On the basis of these graphs list two differences between the two currents.
- Out of the two which one is used in transmitting electric power over long distances and why ?

Ans :

Delhi 2017

- Direct current and alternating current respectively.
- Battery and AC generator respectively.
- Frequency of AC in our country, 50 Hz.
- (a) Magnitude of current in DC remains fixed, while in AC it changes continuously.
- (b) Direction of current in DC remains fixed, while in AC it changes after every  $\frac{1}{2}n$  second, where  $n$  is the frequency of AC.

(v) For transmitting electric power over long distances AC is used instead of DC because loss of energy during transmission is comparatively very small.

169. Describe an activity to draw the magnetic field line around a coil of wire.

or

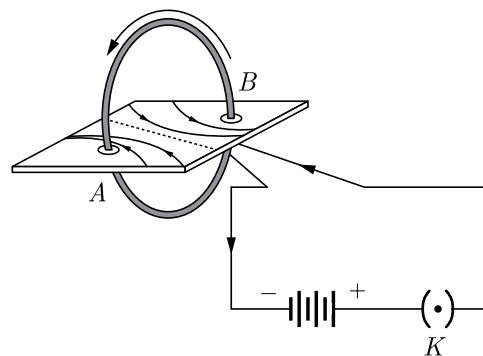
Give an activity to show magnetic field produced by a current carrying circular coil.

Ans :

SQP 2016

An activity to draw the magnetic field line around a coil of wire :

- Take a rectangular cardboard having two holes. Insert a circular coil having large number of turns through them, normal to the plane of cardboard.
- Connect the ends of the coil in series with a battery, a key and a rheostat, as shown in figure given below.



- Sprinkle iron filings uniformly on the cardboard.
- Plug the key.
- Tap the cardboard gently a few times. Note the pattern of the iron filings that emerges on the cardboard. The concentric pattern seen on the cardboard represents magnetic field around the current carrying circular coil.

170. Briefly explain an activity to plot the magnetic field lines around a bar magnet. Sketch the field pattern for the same specifying field directions.

A region A has magnetic field lines relatively closer than another region B. Which region has stronger magnetic field ? Give reason to support your answer.

Ans :

Delhi 2017

Take a small compass and a bar magnet. Place the magnet on a sheet of white paper fixed on a drawing board. Mark the boundary of the magnet. Place the compass near the north pole of the magnet. The south pole of the needle points towards the north

**Ans :**

Foreign 2015

Fleming's left hand rule determines the direction of the force experienced by a straight conductor.

44. What is the frequency of A.C. in India ?

**Ans :**

Delhi 2017, Delhi 2011

50 Hz.

45. What is a solenoid ?

**Ans :**

SQP 2015

Solenoid is a coil of many turns of wire, wrapped in the shape of a cylinder.

46. How do we define the magnitude of magnetic field ?

**Ans :**

Delhi 2014

The force acting per unit current per unit length on a wire placed perpendicular to the direction of magnetic field is called the magnitude of magnetic field.

47. Where will the value of magnetic field maximum due to current carrying circular conductor ?

**Ans :**

OD 2016

At the center of current-carrying circular loop.

48. What will happen to a current-carrying conductor when placed in a magnetic field ?

**Ans :**

OD 2014

A force will be exerted on the current-carrying conductor.

49. Name the scientist who first suggested that a magnet should exert force on a current-carrying conductor.

**Ans :**

Delhi 2015, Delhi 2012

Ampere.

50. What kind of magnetic field is produced by a solenoid?

**Ans :**

Delhi 2014

A uniform magnetic field along the axis of the solenoid.

51. Name the scientist who discovered how to generate electricity by moving a magnet.

**Ans :**

Foreign 2015

Michael Faraday.

52. What kind of magnetic field is produced by a solenoid?

**Ans :**

Comp 2015

A solenoid produces a magnetic field similar to the magnetic field produced by a bar magnet.

53. What will happen to the strength of the magnetic field if the number of turns are decreased in a solenoid?

**Ans :**

OD 2014

If the number of turns are decreased in a solenoid, the strength of the magnetic field also decreases.

54. How does the concentric circles representing the magnetic field around a current-carrying straight wire change as one moves away from it ?

**Ans :**

Delhi 2015

The concentric circles representing the magnetic field around a current-carrying straight wire become larger and larger as one moves away from it.

55. What is the origin of the word magnetism ?

**Ans :**

Foreign 2015

The word magnetism originated from the place Magnesia where natural magnets were first found.

56. What is the S.I. unit of magnetic field ?

**Ans :**

Foreign 2014

The S.I. unit of magnetic field is tesla or weber/m<sup>2</sup>.

57. What will happen to the strength of the magnetic field if a soft iron piece is placed along the axis of the solenoid ?

**Ans :**

Delhi 2012

The strength of the magnetic field of the solenoid will increase on placing a soft iron piece along the axis of the solenoid.

58. Which poles of two magnets attract each other ?

**Ans :**

Delhi 2013

Unlike poles of two magnets attract each other.

59. Is the fuse wire connected in series or in parallel ?

**Ans :**

Foreign 2013

The fuse wire is connected in series.

60. What is the main purpose of earthing an electrical appliance ?

**Ans :**

OD 2012

The main purpose of earthing the metallic body of an electrical appliance is to save ourselves from electric shocks.

98. Write a few uses of magnets.

Ans :

Foreign 2017

Magnets are used :

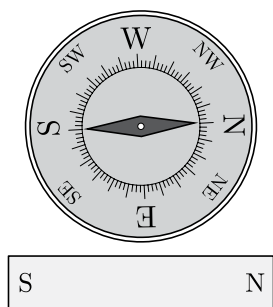
- (i) In radio and stereo speakers.
- (ii) In almirah and refrigerator doors to snap them shut.
- (iii) On audio and video cassette tapes.
- (iv) On the hard discs and floppies for computers and in children's toys.
- (v) In medicine : the MRI scanners expose the inner organs of patients for detail examination by doctors.

99. What is a compass needle ? What happens when a compass needle is placed (a) in a region having no magnetic field, (b) near a bar magnet ?

Ans :

SQP 2016

A compass needle consists of a short and thin magnet pivoted at its center and enclosed in a glass casing as shown in the given figure.



- (a) When a compass needle is placed in a region having no magnetic field, it stays in the north-south direction.
- (b) Compass needle shows deflection when brought near a bar magnet.

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100. What will happen to the iron filings sprinkled around a bar magnet placed on a cardboard ? What does it demonstrate ?

Ans :

OD 2015, Delhi 2010

On slightly tapping the cardboard, the iron filings arrange themselves in a definite pattern. This shows that under the influence of the magnetic field, the filings align themselves along the field lines.

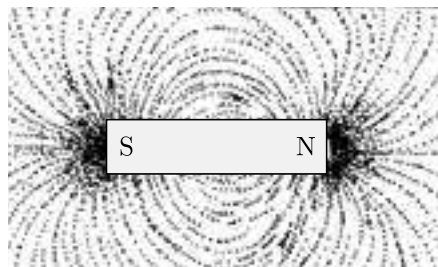


Figure: Iron filings near a bar magnet align themselves along the field lines.

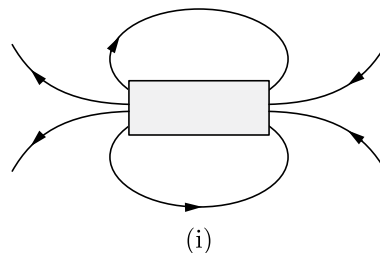
101. How will you locate the current-carrying wire concealed in a wall ?

Ans :

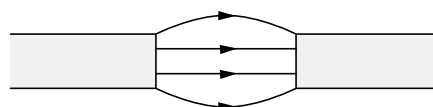
OD 2014

The current-carrying wire concealed in a wall can be located with the help of a compass needle. In the absence of any current, the needle of the magnetic compass stays along the north-south direction. If the current is flowing, the needle deflects from its stationary position.

102. Identify the poles of the magnet in the given Figure (i) and (ii).



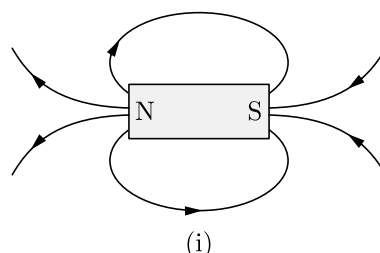
(i)



(ii)

Ans :

Delhi 2015



(i)

74. What is direct current ?

Ans :

Delhi 2011

A current in which the magnitude and the direction do not change with time is called direct current.

75. Write two possible causes of excessive heating of electric wires.

Ans :

Comp 2010

Short circuiting and overloading.

76. Which material is used for making the fuse ?

Ans :

OD 2011

Good quality fuses are made of pure tin or an alloy of tin and copper.

77. Why can we not use copper wire as a fuse wire ?

Ans :

OD 2010

We cannot use copper wire as a fuse wire because it has a high melting point and so will not melt easily when a short circuit takes place.

78. Write the characteristics of a fuse wire.

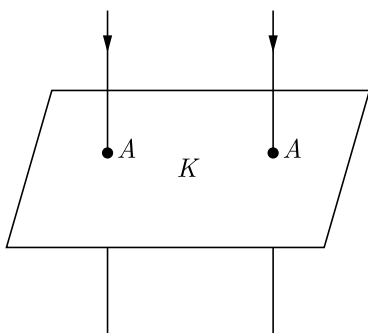
Ans :

Delhi 2009

The fuse wire should have a high resistance and a low melting point.

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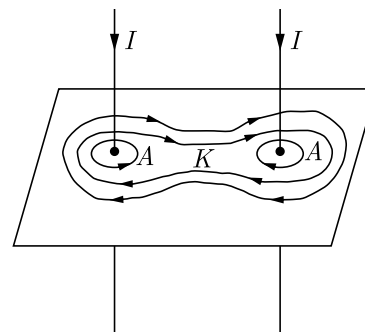
79. The following diagram shows two straight wires carrying current. Copy the diagram and draw the pattern of lines of force around them and mark their directions.



Ans :

Foreign 2011

The pattern of lines is as shown in the Figure.



80. What will happen to the strength of the magnetic field if the numbers of turns in the solenoid are increased ?

Ans :

Delhi 2013

The strength of the magnetic field will increase.

81. How can a magnet be demagnetized ?

Ans :

Comp 2008

A magnet can be demagnetized by :

- (a) heating,
- (b) hammering, and
- (c) keeping in fast alternating current.

82. What is an electromagnet?

Ans :

SQP 2021

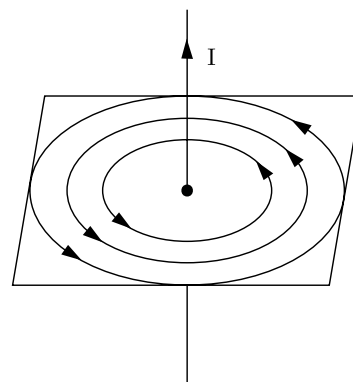
An electromagnet is a temporary magnet which behaves like a magnet when an electric current is passed through the insulated copper wire and loses its magnetism when current is stopped.

## TWO MARKS QUESTIONS

83. Draw the pattern of the magnetic field lines due to a straight current carrying conductor indicating the direction of current in the conductor and the direction of the corresponding magnetic field lines.

Ans :

OD 2024



## ONE MARK QUESTIONS

- 26.** State the observation made by Oersted on the basis of his experiment with current carrying conductors.

**Ans :** OD 2017  
Every current carrying conductor has a magnetic field around it.

- 27.** Name the scientist who discovered the earth's magnetic field.

**Ans :** OD 2016, Delhi 2011  
William Gilbert.

- 28.** How is the strength of the magnetic field at a point near a wire related to the strength of the electric current flowing in the wire ?

**Ans :** Delhi 2017  
The strength of the magnetic field is directly proportional to the strength of the current.

- 29.** Does a stationary charge produce a magnetic field ?

**Ans :** Delhi 2016  
No, only a moving charge produces a magnetic field.

- 30.** When magnetic lines of force are widely separated, what does it indicate ?

**Ans :** OD 2015  
It indicates a weak magnetic field.

- 31.** Which is the sure test of magnetism ?

**Ans :** OD 2017  
Repulsion is the sure test of magnetism.

- 32.** Which poles of two magnets repel each other ?

**Ans :** OD 2017, Delhi 2009  
Like poles of two magnets repel each other.

- 33.** Name the scientist who established a relationship between electricity and magnetism.

**Ans :** Delhi 2016  
H. C. Oersted.

- 34.** What is the shape of the magnetic field produced when current is passed through a straight conductor?

**Ans :** Foreign 2017  
Concentric circles in a plane perpendicular to the direction of the current.

- 35.** State the direction of the magnetic field inside the bar magnet.

**Ans :** OD 2017, Delhi 2008  
From South to North pole.

- 36.** What was the name given to 'Magnetite' in the earlier times ?

**Ans :** OD 2015, Delhi 2008  
Lodestone.

- 37.** Mention the shape of the magnetic field lines around a current carrying straight conductor.

**Ans :** Delhi 2016  
In the form of concentric rings around the straight conductor.

- 38.** Does a neutron moving in a magnetic field experience a force ?

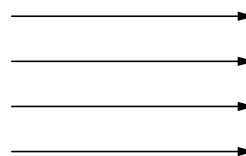
**Ans :** Comp 2013  
No, a neutron moving in a magnetic field does not experience a force because it has no charge.

- 39.** What is the force acting on a charge moving along the direction of the magnetic field ?

**Ans :** OD 2016  
Zero.

- 40.** Draw a diagram to represent a uniform magnetic field in a given region.

**Ans :** Delhi 2017



- 41.** How much force is exerted by a magnetic field on a stationary charged particle ?

**Ans :** SQP 2017  
Zero.

- 42.** What happens when a current-carrying conductor is placed in a magnetic field ?

**Ans :** Delhi 2015  
The current-carrying conductor experiences a force when placed in a magnetic field.

- 43.** Name the law which determines the direction of force experienced by a straight conductor carrying current in the magnetic field of a permanent magnet.



suspended, sets itself in the north-south direction, like a bar magnet.

92. Why does a freely suspended magnet always point in the geographic north-south direction ?

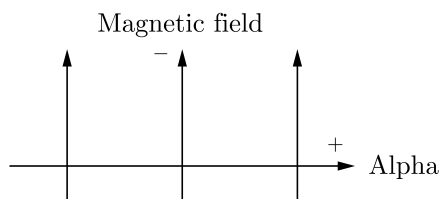
Ans :

Foreign 2017

Earth has a magnetic field around it. It behaves as if a huge bar magnet is placed at its center. North pole of this huge bar magnet lies towards the geographic south pole of the earth, and south pole of this bar magnet lies towards the geographic north pole of the earth.

When a magnet is suspended freely at the surface of the earth, its north pole moves towards magnetic south pole of the earth's magnet, i.e., geographic north pole of the earth, and south pole moves towards magnetic north pole of the earth's magnet, i.e., geographic south pole of the earth.

93. An alpha particle (+ve charged particle) enters a magnetic field at right angle to it as shown in figure. Explain with the help of a relevant rule the direction of force acting on the alpha particle.



Ans :

Comp 2017

According to the Fleming's left hand rule, if the forefinger points in the direction of the magnetic field and the central finger points in the direction of current, the thumb gives the direction of the force acting on the conductor.

So, the force will act in the upward direction on the alpha particle.

94. What precautions should be taken to avoid overloading of domestic electric circuit ?

Ans :

Foreign 2016

- Too many high power rating electrical appliances (such as electric iron, geyser, air conditioner, etc.) should not be switched on at the same-time.
- Too many electrical appliances should not be operated on a single socket.

95. The given magnet is divided into three part A, B and C.

A	B	C
---	---	---

Name the parts where the strength of the magnetic field is :

- maximum, (ii) minimum.

How will the density of magnetic field lines differ at these parts ?

Ans :

OD 2015

- Maximum magnetic field is in the region A and C.
- Minimum magnetic field is in the region B.

This is because A and C are magnetic poles and have maximum number of magnetic field lines which determine the intensity of magnetic field while B is centre of the magnet that has no magnetic field lines. So, intensity of magnetic field near B is almost zero.

96. When a current carrying conductor is kept in a magnetic field, it experiences a force. List the factors on which direction of this force depends.

Ans :

Delhi 2017

It depends upon

- The direction of current through the conductor.
- The direction of the magnetic field in which the conductor is placed.

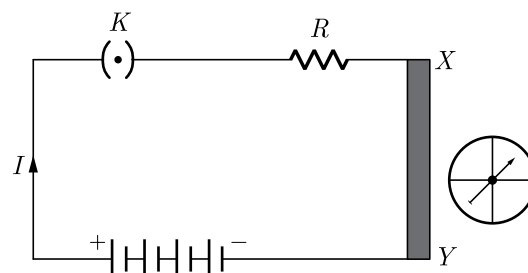
97. Explain the magnetic effects of current for Oersted's experiment with the help of a labeled diagram.

Ans :

Delhi 2016

Oersted arranged an experiment to relate the electricity and magnetism in the following ways :

- He took a straight thick copper wire and placed it between the points X and Y in an electric circuit, as shown in the figure given below :



- He placed a small compass near this copper wire. He did not notice any deflection in compass needle.
- Now, he passed the current through the circuit by inserting the key into the plug. This time he observed that the compass needle got deflected. It means that the electric current through the copper wire has produced a magnetic effect.

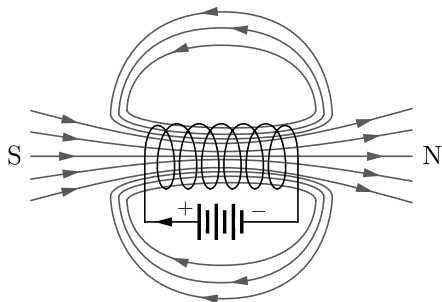
84. What is a solenoid? When does a solenoid behave as a magnet? Draw the pattern of the magnetic field produced inside it showing the directions of the magnetic field lines.

Ans :

OD 2023

A solenoid is a long coil containing a large number of close turns of insulated copper wire.

A solenoid acts as a magnet when a current is supplied through it.



85. Why do two magnetic field lines not intersect each other?

or

Explain why two magnetic field lines do not intersect each other.

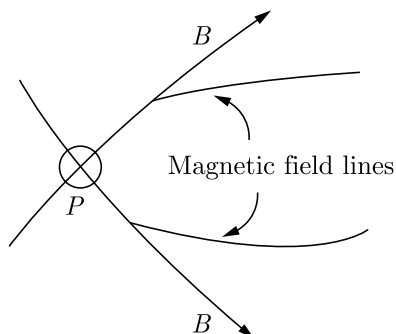
or

No two magnetic field lines can intersect each other. Explain.

Ans :

Comp 2021, OD 2016, SQP 2012

If two field lines intersect each other, at the point of intersection there two tangents with two directions of the magnetic field can be drawn. This is not possible as shown in the figure.



86. What is the function of an earth wire ? Why is it necessary to earth metallic appliances ?

Ans :

OD 2017

The earth wire is connected to a metallic plate deep inside the earth. Thus, the metallic body of

appliance is connected to the earth, which provides a low resistance conducting path for electric current. The user might not get a severe electric shock on touching such as appliance.

87. Why does an electric short circuit occur ?

Ans :

OD 2016

If the plastic insulation of the live wire and neutral wire gets torn, then the two wires touch each other. This touching of the wire touch each other. This touching of the live wire and neutral wire directly is know as short circuit. When the two wires touch each other, the resistance of the circuit so formed is very small. Since the resistance is very small, the current flowing through the wires becomes very large and heats the wires to a high temperature and a fire may be started.

88. (i) A compass needle gets deflected when brought near a current carrying conductor why ?  
(ii) What happens to the deflection of needle when current in the conductor is increased ?

Ans :

Foreign 2017

- (i) Current carrying conductor produces a magnetic field around it.  
(ii) Deflection increases with increase in current.

89. Define a solenoid. How is it different from a coil ?

Ans :

Foreign 2016

- (i) A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.  
(ii) The strength of magnetic field inside a coil vary while in case of solenoid, it is the same.

90. An alternating electric circuit has a frequency of 50 Hz. How many times does it change its direction in one second ? Give reason for your answer.

Ans :

OD 2016

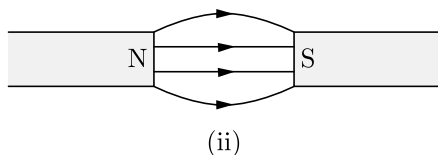
100 times, 50 Hz means 50 cycles per second. One cycle involves two changes of direction. So, 50 Hz AC means current changing its direction 100 times in a second.

91. Compare the pattern of the magnetic field around a solenoid with the magnetic field around a bar magnet.

Ans :

Delhi 2015

Pattern of the magnetic field around a solenoid looks similar to that around a bar magnet. One end of the solenoid behaves as north pole while other as south pole. A current carrying solenoid when freely



- 103.** Describe an activity to draw a magnetic field line outside a bar magnet from one pole to another.

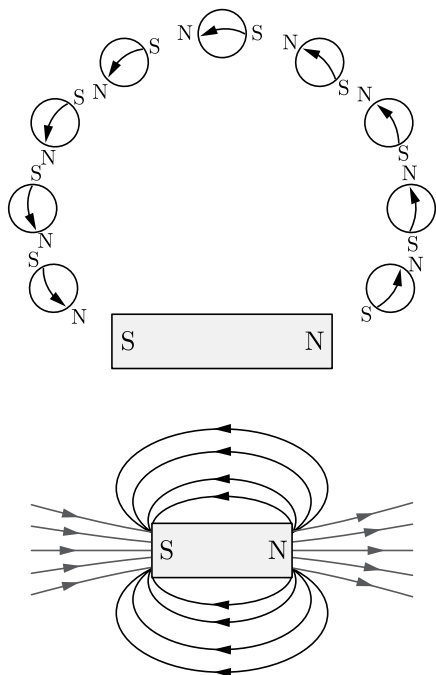
**or**

Describe an activity to draw the magnetic field line around a bar magnet.

**Ans :**

Delhi 2014

- (i) Place a bar magnet on a sheet of paper and place a compass near the north pole.
- (ii) Mark the position of the needle of the compass.
- (iii) Move the needle such that its south pole occupies the space occupied by the north pole previously.
- (iv) Continue till the needle reaches the south pole.
- (v) Join the dots to obtain the field line.



- 104.** Write the properties of a bar magnet.

**Ans :**

Foreign 2015, Delhi 2011

- (i) A bar magnet attracts small pieces of magnetic substances like iron, cobalt, nickel. The attraction is maximum at free ends. These ends are called poles.
- (ii) If a bar magnet is suspended freely in a horizontal plane, it takes the north-south direction. The end which points towards the north is called the

north pole and the end which points towards the south is called the south pole.

- (iii) Like poles repel and unlike poles attract each other.
- (iv) If we break a magnet into two or more smaller pieces, even the smallest possible magnet has both north and south poles.

- 105.** What are permanent magnet and electromagnet ? Give two uses of each.

**Ans :**

Foreign 2014

Those magnets which have constant magnetic fields around it are called permanent magnets.

When a soft iron is placed inside a solenoid and current is passed through it, then soft iron gets magnetized. The magnet so formed is called an electromagnet.

**Uses :** Permanent magnet is used in

- (i) electric generator,
- (ii) loudspeaker.

Electromagnet is used in (i) cranes and (ii) electric bell.

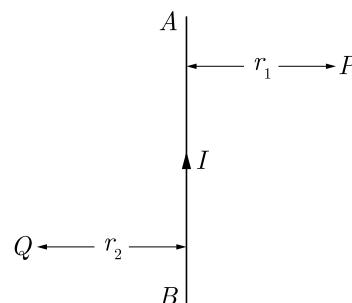
- 106.** What is meant by the magnetic field lines ? List any two properties of magnetic field lines.

**Ans :**

Delhi 2014

- (a) The lines drawn in a magnetic field along which a north pole would move are called magnetic field lines.
- (b) Properties :
  - (i) The magnetic field lines originate from the north pole and merge at the south pole outside the magnet and from south to north inside the magnet.
  - (ii) No two magnetic field lines intersect each other.

- 107.**  $AB$  is a current carrying conductor in the plane of the paper as shown in figure. What are the directions of magnetic fields produced by it at points  $P$  and  $Q$ ? Given  $r_1 > r_2$ , where will the strength of the magnetic field be larger ?



you are not talking, the cell phone is emitting strong signals to keep a link with the base station.

- (ii) Electromagnetic radiations of microwave range are used in mobile phones.
- (iii) Heating effect can alter brain functions and hearing ability also. Other harmful effects such as premature cataract, confusion and loss of memory may also be possible.
- (iv) Head.

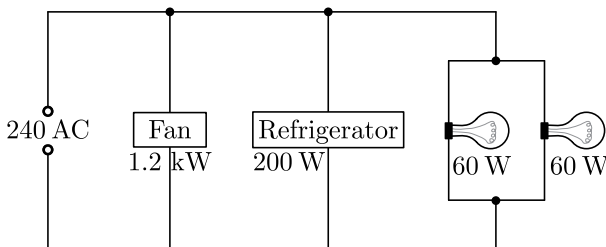
**184.** Read the following case based passage and answer the questions given after passage.

Domestic electric circuits has main board which contains the meter (energy-meter) and the main switch. From the street electric pole a thick rubber insulated cord reaches the main board. It contains two thick copper or aluminium wires, one covered with red and the other covered with black (or brown) plastic covering.

They from the live line wire (L) and neutral line wire (N) respectively. Live line has a potential of 220V whereas the neutral wire has zero potential (with respect to the earth). They enter the main board and are connected to the meter.

Inside the house, connections to all the devices are made in parallel, each having independent switch and fuse (if necessary). Thus, whenever some fault occurs in circuit of one particular device in one room, devices in other rooms do not suffer.

Figure shows a 240V AC mains circuit to which a number of appliances are connected and switched on.



- (i) Calculate the power supplied to the circuit.
- (ii) Find out the value of electric current in the refrigerators.
- (iii) Calculate energy used by the fan in 2 hours.
- (iv) Calculate resistance of the filament of one lamp.

**Ans :**

- (i) Power supplied to the circuit
 
$$= 1.2 \times 1000 \text{ W} + 200 \text{ W} + 60 \text{ W} + 60 \text{ W}$$

$$= 1200 \text{ W} + 200 \text{ W} + 60 \text{ W} + 60 \text{ W}$$

$$= 1520 \text{ W}$$

$$= 1.52 \text{ kW}$$

- (ii) Current in the refrigerators

$$= \frac{\text{Power}}{\text{Voltage}} = \frac{200 \text{ W}}{240 \text{ V}} = 0.83 \text{ A}$$

- (iii) Energy used by the fan in 2 hours

$$= \text{Power} \times \text{Time}$$

$$= 1.2 \text{ kW} \times 2 \text{ h}$$

$$= 1.2 \times 1000 \frac{\text{J}}{\text{s}} \times 2 \times 60 \times 60 \text{ s}$$

$$= 1200 \times 2 \times 3600 \text{ J}$$

$$= 8640000 \text{ J}$$

$$= 8.64 \times 10^7 \text{ J}$$

- (iv) As we know that,

$$\text{Current, } I = \frac{P}{V} = \frac{60}{240} = 0.25 \text{ A}$$

$$\text{Resistance} = \frac{V}{I} = \frac{240}{0.25} = 960 \Omega$$

**185.** Read the following case based passage and answer the questions given after passage.

Though the concepts of both electricity and magnet were discovered earlier, any type of relation between the two was still unknown till the beginning of 19th century. It was in 1819 that Hans Christian Oersted discovered this relation somewhat accidentally. He placed a current carrying over a compass the needle of the compass turned  $90^\circ$  to the axis of the wire. When the direction of the current was reversed the positioned of the needle also reversed. This gave Oersted the idea that the electric current is causing the magnetic effect with specific directional properties. This idea gave birth to the concept of 'Electromagnetism'.

- (i) When the compass is placed over the wire carrying current, the needle of the compass faces in which direction?
  - (a) Parallel to the current flow.
  - (b) Perpendicular to the current flow.
  - (c) Diagonal to the current flow.
  - (d) Is not directly related to the direction of current flow.
- (ii) When the direction of the current flow is reversed, how does it affect the direction of the magnetic field produced
  - (a) It changes  $180^\circ$
  - (b) It changes  $90^\circ$
  - (c) Does not change

decrease in degree of closeness of the lines of field.

(b) Properties :

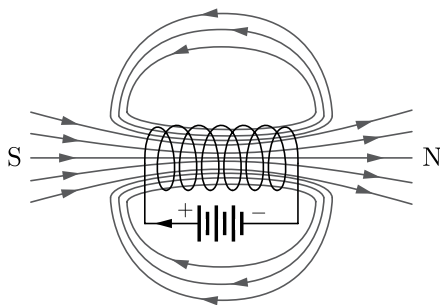
- (i) The magnetic field lines originate from the north pole and merge at the south pole outside the magnet and south to north inside the magnet.
- (ii) No two magnetic field lines intersect each other.

**114.** What is a solenoid ? Draw a diagram to show the magnetic field lines around a solenoid. What is its main use ?

**Ans :**

OD 2015

A solenoid is a long coil containing a large number of close turns of insulated copper wire.

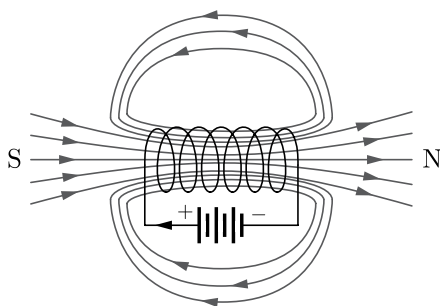


A solenoid is used to magnetize any magnetic material.

**115.** Draw a figure of current carrying solenoid and show magnetic field lines inside and outside it. Compare the pattern of the field with the magnetic field around a bar magnet.

**Ans :**

OD 2014, Foreign 2010



Comparison of field pattern around a solenoid and a bar magnet.

- (a) Pattern of the magnetic field looks similar to the bar magnet.
- (b) One end of the solenoid behave as north pole while other as south pole.

(c) A current carrying solenoid when freely suspended sets itself in the north-south like a bar magnet.

**116.** A circular wire has  $n$  number of turns. What will be the strength of magnetic field due to this coil if magnetic field due to one turn is  $B$  ?

**Ans :**

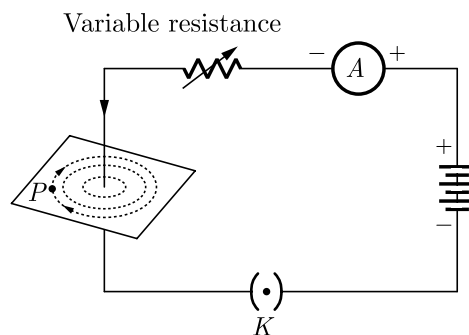
Delhi 2015

The strength of magnetic field due to a coil having  $n$  number of turns will be  $n$  times as large as the magnetic field produced by a single turn, i.e., because the current in each circular turn has the same direction, so the field due to each turn adds up.

**117.** Draw a diagram to show how a magnetic needle deflects when it is placed above or below a straight conductor carrying current depending on the direction of the current in the conductor.

**Ans :**

Foreign 2015



The deflection of the compass needle at above or below a current carrying straight conductor gets reversed on reversing the direction of the current.

**118.** How can we increase the strength of magnetic field produced by a current-carrying circular coil ?

**Ans :**

Delhi 2014

- (i) By increasing the current flowing through the coil.
- (ii) By increasing the number of turns of wire in the coil.
- (iii) By decreasing the radius of the coil.

**119.** A current-carrying straight conductor is placed in east-west direction. What will be the direction of the force experienced by this conductor due to the earth's magnetic field ? How is this force affected on :

- (a) reversing the direction of flow of the current ?
- (b) doubling the magnitude of the current ?

**Ans :**

SQP 2014

The direction of the force will be vertically downward due to the earth's horizontal magnetic field.

- (a) The direction of the force will become vertically upward on reversing the direction of the flow of the current.
- (b) If the magnitude of the current is doubled, the force is doubled but remains in the same direction.
- 120.** How can the strength of the magnetic field of a solenoid be increased ?

**Ans :**

Delhi 2013

The strength of the magnetic field of a solenoid can be increased by :

- (i) increasing the number of turns in the solenoid.
- (ii) increasing the strength of current flowing through the solenoid.
- (iii) placing a soft iron core along the axis of the solenoid.
- 121.** Draw the direction of magnetic field in a circular current loop.

**Ans :**

OD 2013

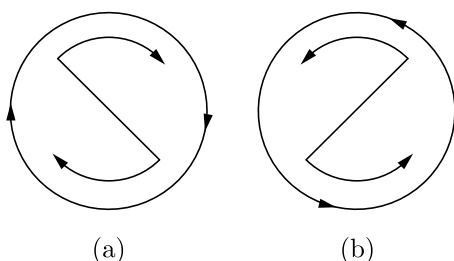


Figure: Direction of magnetic field in a circular current loop.

If the current flows in the clockwise direction, the magnetic field enters into the plane and the face behaves like a south pole.

If the current flows in the anticlockwise direction, the magnetic field comes out of the plane and the face behaves like a north pole.

- 122.** Why does a current-carrying solenoid behave as a bar magnet ?

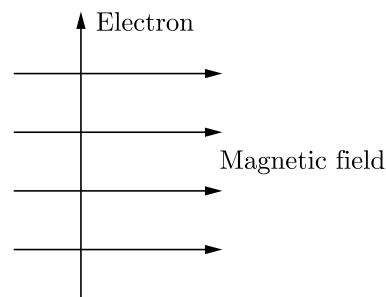
**Ans :**

OD 2012

A current-carrying solenoid behaves as a bar magnet because when the current passes through the solenoid, the magnetic field produced is very much similar to that of a bar magnet. One end of

the coil acts like the south pole and other acts like the north pole.

- 123.** An electron enters a uniform magnetic field at right angles to it as shown in the figure given below. In which direction will this electron move ? State the rule applied by you in finding the direction of motion of the electron.

**Ans :**

Foreign 2012

Perpendicular to the plane of paper and upwards.

The direction of force is perpendicular to the direction of magnetic field and current as given by Fleming's left-hand rule.

- 124.** A student while studying the force experienced by a current carrying conductor in a magnetic field records the following observations :

- (i) The force experienced by the conductor increases as the current is increased.
- (ii) The force experienced by the conductor decreases as the strength of the magnetic field is increased.

Which of the two observations is correct and why ?

**Ans :**

Delhi 2013

Observation (i) is correct.

It is so because force experienced by a current carrying conductor in a magnetic field is proportional to the strength of the current.

- 125.** Why can short circuit lead to fire in the house or building ?

**Ans :**

SQP 2013

When short circuiting occurs, the resistance of the circuit decreases to a very small value. Then, according to Ohm's law, the current increases enormously. It results in heating of the live wires and producing a spark at the place of short circuit, which may cause fire in the building.

- 126.** How will this force get affected on :

- (i) doubling the magnitude of current ?
- (ii) reversing the direction of current flow ?

Ans :

OD 2013, Foreign 2011

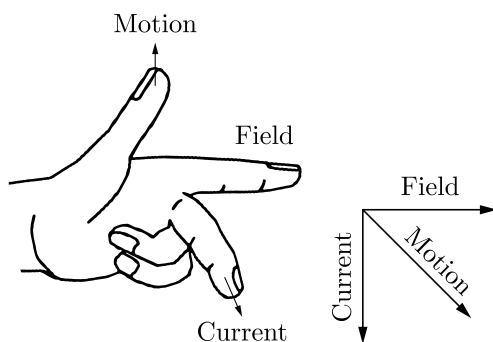
- (i) On doubling the magnitude of the current, force gets doubled.
- (ii) On reversing the direction of the current, direction of force gets reversed.

- 127.** State Fleming's left hand rule. A positively charged particle projected towards west is deflected towards north by a magnetic field. Find the direction of magnetic field.

Ans :

Delhi 2012

According to Fleming's left-hand rule, let the thumb, forefinger and central finger of the left hand be stretched so that they are mutually perpendicular to one another. If the forefinger points in the direction of the magnetic field and the central finger points in the direction of a current, the thumb gives the direction of the force acting on the conductor.



Direction of magnetic field is upward.

- 128.** Write the disadvantages of A.C. over D.C.

Ans :

Foreign 2012

- (i) A.C. is more dangerous than D.C.
- (ii) It cannot be used in the process of electrolysis.

- 129.** Are different electric appliances connected in series or in parallel in a house ?

Ans :

Comp 2013

Each appliance has a separate switch to ON/OFF the flow of current to it. They are connected in parallel to each other so that each appliance gets equal voltage (220 V) and if one of them is switched off, others are not affected.

- 130.** What is the colour convention for live, neutral and earth wires ?

Ans :

SQP 2012

The colour convention for live, neutral and earth wires is as follows :

- (i) Live → Red insulation cover.

- (ii) Neutral → Black insulation cover.
- (iii) Earth → Green insulation cover.

- 131.** Write the advantages of A.C. over D.C.

Ans :

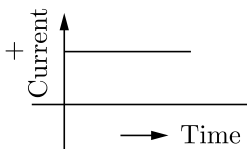
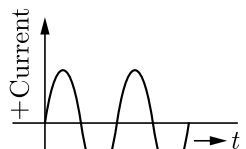
Delhi 2012

- (i) Voltage of A.C. can be controlled without much loss of electric power as compared to D.C.
- (ii) The cost of generation of A.C. is less than the cost of generation of D.C.
- (iii) A.C. can be transmitted over long distances without much loss of energy.
- (iv) A.C. can be easily converted into D.C. but conversion of D.C. into A.C. is not easy.

- 132.** What is the difference between direct current (D.C.) and alternating current (A.C.) ?

Ans :

OD 2013

	Direct Current	Alternating Current
1.	The magnitude and the direction of direct current do not change with time.	Alternating current reverses its direction periodically. In India, A.C. generator changes its direction after every $\frac{1}{100}$ sec., i.e., frequency of A.C. is 50 Hz.
2.	D.C. current is obtained from dry cell or an accumulator.	A.C. current is obtained from generators.
3.	It is represented by 	It is represented by 

- 133.** What do you understand by live and neutral wires ? Do both of them carry high voltage ?

Ans :

Foreign 2013

The electric power line which enters our houses contains two wires. The wire having high potential is called live wire. The other wire which is maintained at zero potential by connecting it to the earth at the power station is called the neutral wire. Potential difference between these two lines is 220 volts in India.

- 134.** Name two safety measures commonly used in electric circuits and appliances, what precautions should be



taken to avoid the overloading of domestic electric circuits.

**Ans :**

Foreign 2012

- (i) Fuse. It cuts off high current.
- (ii) Proper earthing.
  - (a) Avoid connecting many appliances in the same socket.
  - (b) Avoid using faulty devices in the circuit.

**135.** Answer the following questions :

- (i) Why do we connect earth wire in a house ? Give two reasons.
- (ii) What type of current is used in house hold supply?
- (iii) What type of current is given by a cell?
- (iv) To which wire do you connect fuse wire in a house hold circuit ?

**Ans :**

Delhi 2013, Foreign 2010

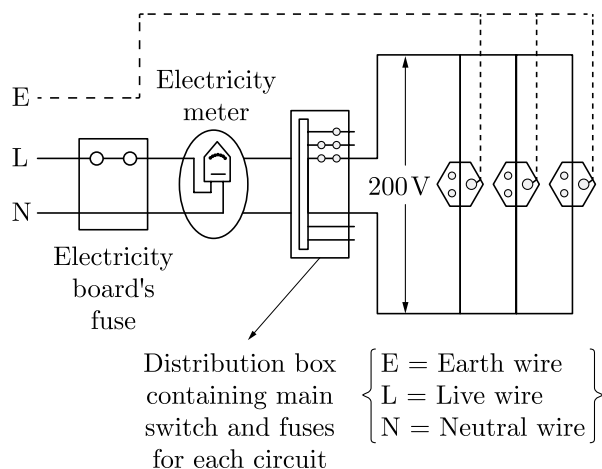
- (i) Earth wire is used :
  - (a) to keep safe our electrical appliances from damage.
  - (b) to save us from electric shock due to leakage of current.
- (ii) AC
- (iii) DC
- (iv) Live wire.

**136.** Draw a schematic labelled diagram of a domestic wiring circuit which includes :

- (i) a main fuse
- (ii) a power meter
- (iii) one light point
- (iv) a power plug

**Ans :**

OD 2010



**137.** Write the characteristics of electricity supplied for domestic use.

**Ans :**

Delhi 2012

- (i) The electricity supplied for domestic use is A.C. of 220 volts having a frequency of 50 Hz.
- (ii) Generally there are two separate circuits within the house, one with 5 A rating for bulbs, etc. and the other with 15 A for appliances with higher power ratings.

**138.** When magnetic field lines for a bar magnet are plotted, lines are closer near the poles than in the middle of the magnet ? Explain.

**Ans :**

Delhi 2011

The degree of closeness of the magnetic field lines depends upon the strength of the magnetic field. The magnetic field is stronger near the poles. That is why the magnetic field lines are closer near the poles than in the middle.

**139.** Why do we use parallel circuit arrangement for domestic wiring ?

**Ans :**

Delhi 2010, Foreign 2007

- (i) In domestic wiring each appliance has equal potential difference.
- (ii) In domestic wiring each appliance has a separate switch to on/off, the flow of current through it, so they are connected parallel to each other.

**140.** What is the capacity of the fuse wire used in our household Circuit ?

**Ans :**

OD 2011

We should use the fuse wire whose capacity is slightly more than the maximum current that can flow in it.

A fuse of capacity 5 Ampere is used in the live wire which supplies electricity to low rating appliances like fan, bulb, etc. and a fuse of capacity 15 Ampere is used in the live wire which supplies electricity to high rating appliances (having power of 1000 watt or more) like geyser, heater, etc.

**141.** How is a fuse wire used to avoid fire due to short circuiting ?

**Ans :**

SQP 2011

A fuse wire is connected in series with the live wire. Current passes through the fuse wire before entering our household circuit.

If there is short circuiting or overloading in the household circuit, a large current is drawn and the fuse wire gets heated and melted. As a result, the circuit breaks and the current stops flowing.

**142.** Why do we use a thin wire as a fuse wire ?

**Ans :**

OD 2011

We use a thin wire as a fuse wire because it has a higher resistance as compared to the other connecting wires. As a result, the heating effect of the current is much more in the fuse wire due to which it melts easily and protects the electrical appliance.

**143.** What is an electric fuse ?

**Ans :**

Foreign 2010

Electric fuse is a piece of wire of material having very low melting point and high resistance. When a high current flows through the circuit due to short circuit or overloading, the fuse wire gets heated and melts. It is a safety device.

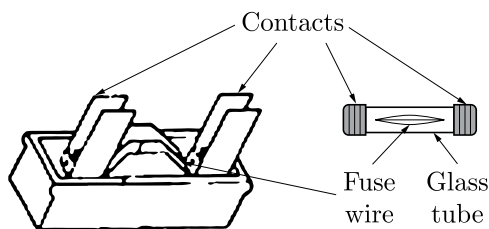


Figure: Two types of electric fuse.

**144.** Describe an experiment to show the working of a fuse.

**Ans :**

OD 2011

Take a thin strip of aluminum foil of about 5 cm length. Fix its two ends to the tips of the two iron nails placed vertically on the table. Now, connect these nails to a battery through a plug key and a small bulb. As we plug in and make the circuit, we find that the strip burns out and the circuit is broken.

**145.** Explain what is short circuiting and overloading in an electric supply.

**or**

Write difference between over-loading and short circuiting.

**Ans :**

Comp 2011

- An electric circuit is said to be short circuited if live wire and neutral wire come in contact with each other.
- Overloading means to connect too many power appliances with single socket and vault device in electrical circuit.

**146.** Why is a spark produced at the place of short circuit? Why is the spark of white colour ?

**Ans :**

Comp 2010

When there is a short circuiting the resistance of the circuit decreases to be very small value. As a result, a sudden flow of very large current takes place.

This heats up the live wire and vapourises the metal. This causes spark.

The metal of the wire becomes very hot. Very hot objects emit white light. That is why, spark appears white.

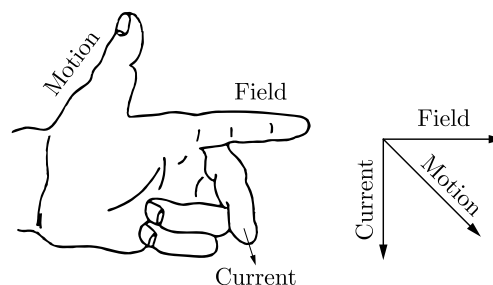
### THREE MARKS QUESTIONS

**147.** State the rule to determine the direction of a (a) magnetic field produced around a straight conductor carrying current and (b) force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it.

**Ans :**

OD 2023

- Maxwell's Right-Hand Thumb Rule can be used to determine the direction of magnetic field lines around a current-carrying conductor. According to right hand thumb rule, imagine a straight conductor in your right-hand such that the thumb points in the direction of current. The direction of curl of fingers of the right-hand gives the direction of magnetic field lines.
- When a current carrying conductor is placed in a magnetic field then it experiences a force. The direction of force is determined by Fleming's left hand rule. According to this rule, "if the forefinger, the middle finger and the thumb of our left hand are stretched mutually perpendicular to each other in such a way that the forefinger points along the direction of magnetic field, middle finger points along the direction of current then the thumb will indicate the direction of force acting on the conductor".

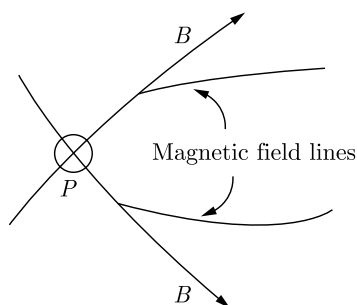


148. (i) Two magnetic field lines do not intersect each other. Why?
- (ii) How is a uniform magnetic field in a given region represented? Draw a diagram in support of your answer.

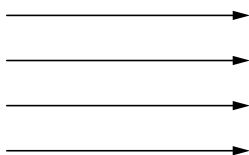
Ans :

OD 2024

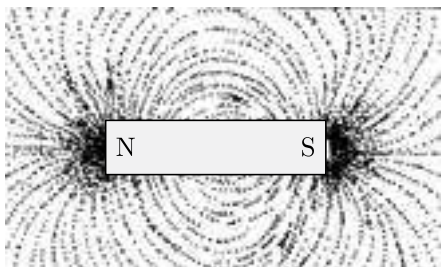
- (i) If two field lines intersect each other, at the point of intersection there two tangents with two directions of the magnetic field can be drawn. This is not possible as shown in the figure.



- (ii) A uniform magnetic field in a region is represented by parallel and equidistant lines, which is the shown in the figure.



149. Study the diagram given below and answer the questions that follow :



- (a) Why do the iron filings arrange in such a pattern?
- (b) What does this pattern demonstrate ?
- (c) Why do the iron filings near the bar magnet seem to align in the shape of closed curves ?

Ans :

Delhi 2020

- (a) The iron fillings arrange themselves in a pattern because they get attracted by the bar magnet.

The pattern that they form can also be called the magnetic field lines of the bar magnet.

- (b) The pattern is demonstrated that the magnetic field is the strong at poles of the magnet and the magnetic field becomes weaker if we goes far from the magnet. Magnetic filed lines emerge from the north pole of the magnet and ends at the south pole of the magnet.
- (c) Iron fillings arrange themselves in closed loops around a bar magnet because magnetic field lines influences it which is closed curved

150. (i) What is the function of earth wire in electrical instruments?
- (ii) Explain what is short circuiting an electric supply.
- (iii) What is the usual current rating of the fuse wire in the line to feed
- (a) Lights and fans?
- (b) Appliances of 2kW or more power?

Ans :

Delhi 2018

- (i) Function of earth wire in electrical instruments. The earth wire is a safety device used in the electric circuits. At the time of leakage of current, most of the electric current goes into the earth, so we get protected from electric shocks and also the appliance is not damaged.
- (ii) Short circuiting an electric supply. When accidentally, live wires and neutral wires of an electric circuit come into direct contact, it is called short circuiting. A very large quantity of electric current then flows through the circuit.
- (iii) (a) 5A, (b) 15A

151. You are given two identical looking iron bars. Just using these two bars how will you identify whether any or both of these bars is/are a magnet ?

Ans :

SQP 2017

Repeatedly tap one of the bars. If it is the iron bar nothing much will change. If it is the magnet bar, it will demagnetize a bit reducing the force between the two bars. If you get no effect after many taps, you could switch to trying the other just to make sure that you get some effect one way or the other.

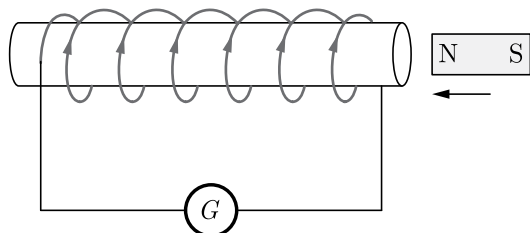
152. Demonstrate that due to motion of a magnet near a solenoid coil an induced current is set up in the coil.

Ans :

OD 2016

Take a solenoid coil of insulated copper wire  $AB$  having a number of turns (about 20 or more).

Connect the ends of coil to a sensitive galvanometer. Now take a bar magnet  $NS$  and rapidly bring the magnet towards the end  $B$  of coil as shown in Figure. The galvanometer suddenly gives momentary deflection in one direction. Now take the magnet away from the coil, the galvanometer again gives momentary deflection but in the opposite direction. It clearly shows that motion of magnet induces, a current in the coil and it is the phenomenon of electro-magnetic induction.



Now fix the magnet in any one position so that it is stationary with respect to the coil. We find that there is no deflection in galvanometer.

Again keep the magnet fixed and gently move the coil  $AB$  either towards the magnet or away from the magnet. We get deflection in galvanometer even now. Thus, it is proved that induced current due to electromagnetic induction is produced whenever there is relative motion between the coil and the magnet.

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**153.** Answer the following questions :

- What is the direction of magnetic field lines outside a bar-magnet ?
- The magnetic field lines in a given region are getting crowded. What does it indicate ?
- State one advantage of AC over DC.

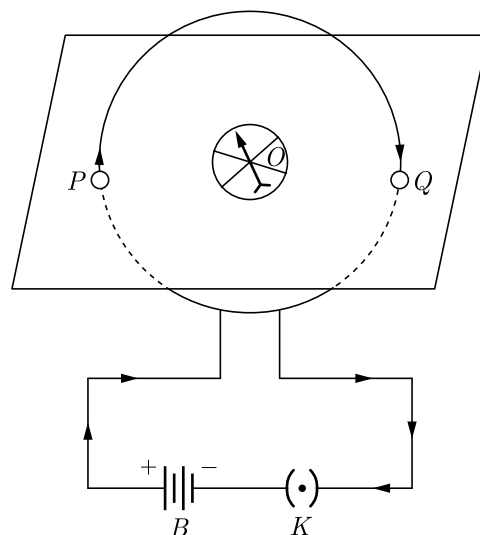
**Ans :**

Delhi 2017

- North pole to south pole.
- The strength of magnetic field is higher in this region.
- AC voltage can be stopped up and transmitted over long distances without much loss of energy.

**154.** The flow of current in a circular loop of wire creates a magnetic field at its center. How may existence of this field be detected ? State the rule which helps to

predict the direction of this magnetic field.



**Ans :**

Delhi 2016, Foreign 2011

Take a cardboard sheet. Drill two fine holes  $P$  and  $Q$  on it along a straight line at a suitable distance. Take an insulated copper wire loop and pass it through the holes so that the loop is in a vertical plane. Connect a 6-12 V battery  $B$  and a plug key  $K$  with the ends of wire loop. Put a sensitive compass at the center point  $O$  of the cardboard. The compass rests in north-south direction. Now put the plug in key  $K$  so that a current begins to flow in the loop as shown in Figure. We observe that the compass needle gets deflected. It shows that a magnetic field is set up at the center of current-carrying circular loop.

The direction of field is given by right-hand rule.

**155.** A coil of insulated copper wire is connected to a galvanometer. What would happen if a bar magnet is :

- Pushed into the coil ?
- Withdrawn from inside the coil ?
- Held stationary inside the coil ?

**Ans :**

SQP 2017

- Due to change in magnitude flux linked with coil, the galvanometer shows deflection (say towards right).
- Due to change in magnetic flux linked with coil, the galvanometer shows deflection [say towards left opposite to that in case (i)].
- As it is stationary, no change in magnetic flux linked with coil, so galvanometer shows no deflection.

156. State different ways to induce current in coil.

Ans :

Comp 2016

- (i) The current can be induced in a coil by rotating it in the magnetic field between the poles of a U-shaped magnet.
- (ii) The current can be induced in a coil by keeping it stationary and rotating a magnet inside it.
- (iii) The current can be induced in a coil by changing the current continuously in 'another coil' kept near it.

157. (a) Give the significance of the following in a domestic circuit:

- (i) electric meter, (ii) earthing.
- (b) List two precautions that should be taken to avoid overloading.

Ans :

OD 2017

- (a) (i) **Electric meter** : It is used to record the consumption of electrical energy in kWh in the circuit.
- (ii) **Earthing** : It prevents electric shock. The earth wire is joined to the metal case of the appliance and provides a low resistance conducting path for the current:
- (b) (i) Too many appliances should not be connected to a single socket.
- (ii) Fuse of current rating 5 A and 15 A should be separately use in the domestic circuit.

158. Explain two ways to induce current in a coil. When is the induced current produced highest ? State the rule used to find direction of induced current.

Ans :

OD 2016

- (i) By moving a magnet towards or away from a coil.
- (ii) By varying current in one coil induced emf is produced in the coil.

The induced current is highest when the direction of motion of coil is perpendicular to the magnetic field.

Fleming's right-hand rule is used to find direction of induced current.

According to this rule, if we stretch the right-hand such that the thumb, first finger, the central finger and the thumb are mutually perpendicular to each other. If the first finger points along the direction of the field and the thumb indicates the direction of motion of the conductor, then the direction of induced current is given by the direction of the central finger.

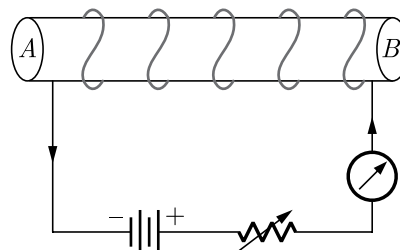
159. Write some precautions in the use of electricity.

Ans :

SQP 2016, Foreign 2007

- (a) Damaged plugs, switches, sockets, etc. should be replaced immediately.
- (b) Plugs, switches or sockets should not be touched with wet hands.
- (c) All electrical appliances should be given earth connections.
- (d) All the connections and joints at different switches and plugs must be tight to avoid sparking.
- (e) Rubber gloves and rubber shoes should be worn while handling a live circuit.
- (f) The main circuit Should be switched off, if there is any sparking or fire in the circuit.
- (g) Water should not be thrown in case of fire due to electric short circuit.

160. Diagram below shows a circuit containing a coil wound over a long and thin hollow cardboard tube. Copy the diagram.



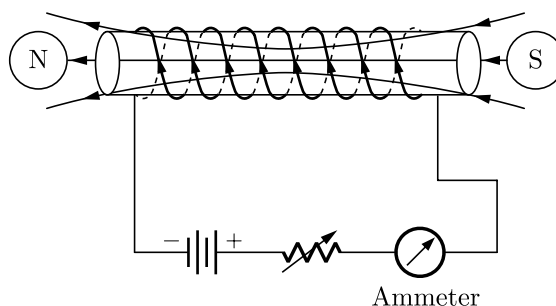
- (i) Show the polarity acquired by each face of the solenoid.
- (ii) Draw the magnetic field lines of force inside the coil and also show their direction.
- (iii) Mention two methods to increase the strength of the magnetic field inside the coil.

Ans :

Foreign 2016

- (i) The polarity acquired by the two ends is as shown below. (A shows North and B shows South polarity).

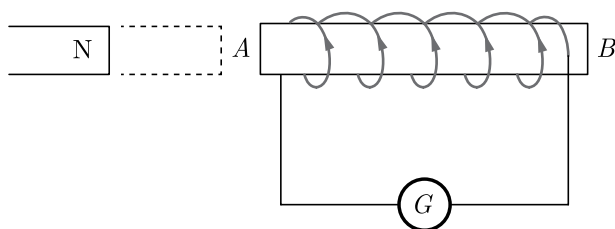
(ii)



- (iii) Increase current, increase the number of turns in the coil, insert soft iron rod in the coil.

**161.** The diagram below shows a coil connected to a center zero galvanometer  $G$ . The galvanometer shows a deflection to the right when the  $N$  pole of a powerful magnet is moved to the right as shown.

- (i) Explain why the deflection occurs in the galvanometer.  
 (ii) Does the direction of current in the coil appear clockwise or anti-clockwise when viewed from end  $A$ ?  
 (iii) State the observation in  $G$  when the coil is moved away from  $N$ .  
 (iv) State the observation in  $G$  when both coil and the magnet, are moved to the right at the same speed.



**Ans :**

SQP 2017

- (i) This is due to the change in magnetic flux in the coil. Due to change in magnetic flux, an induced emf is produced in the coil. Hence a current flows through the galvanometer.  
 (ii) The current appears clockwise when viewed from end  $A$ .  
 (iii) The galvanometer now deflects towards left.  
 (iv) No deflection is observed as there is no relative motion between the magnet and the coil.

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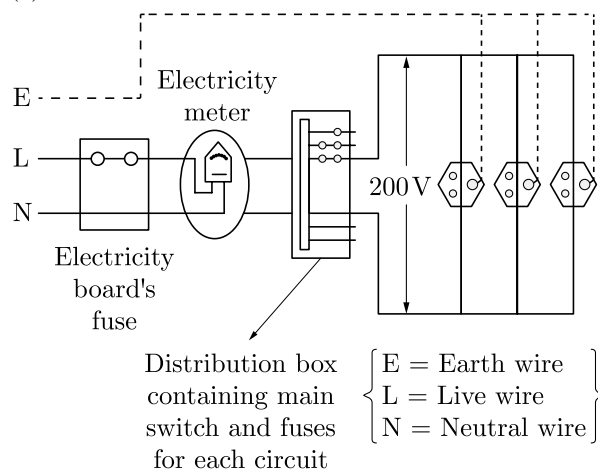
- 162.** (a) Which effect of the electric current is utilised in the working of an electrical fuse ?  
 (b) Is a fuse connected in series or in parallel in household circuit ?  
 (c) Draw a schematic labelled diagram of a domestic circuit which has a provision of a main fuse, meter, one light bulb and a switch/socket.

**Ans :**

Comp. 2017

- (a) Heating effect.  
 (b) In series.

(c)



**163.** Answer the following questions :

- (i) What is the direction of magnetic field lines outside a bar-magnet ?  
 (ii) What is the SI unit of magnetic field ?  
 (iii) What does crowding of magnetic field lines indicate ?  
 (iv) What is the frequency of AC in India ?  
 (v) Name two organs in the human body where magnetic field is quite significant.

**Ans :**

Delhi 2017, Foreign 2015

- (i) North pole to south pole.  
 (ii) Oersted.  
 (iii) Strength of magnetic field.  
 (iv) 50 Hz.  
 (v) Heart and brain.

## FIVE MARKS QUESTIONS

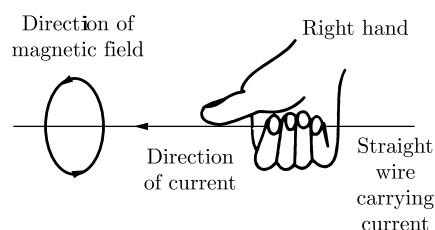
**164.** Name and state the rule to determine the direction of a :

- (i) magnetic field produced around a current carrying straight conductor.  
 (ii) force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it.

**Ans :**

OD 2024

- (i) Right Hand Thumb Rule

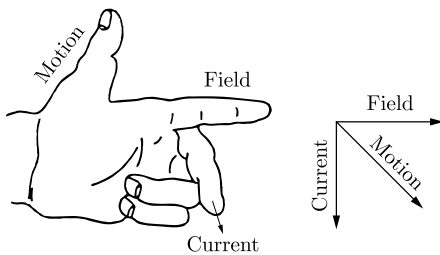




This rule gives the direction of magnetic field due to a straight conductor carrying current. According to the rule, if a current carrying straight conductor is imagined to be held in right hand in such a manner that the thumb points along the direction of current then the direction of the wrapped fingers will give the direction of magnetic field lines.

- (ii) The direction of force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it is given by Fleming's left hand rule.

According to this rule, "if the forefinger, the middle finger and the thumb of our left hand are stretched mutually perpendicular to each other in such a way that the forefinger points along the direction of magnetic field, middle finger points along the direction of current then the thumb will indicate the direction of force acting on the conductor".



165. Although electric kettle and electric toaster were used simultaneously in the kitchen to prepare breakfast for the family, yet the two devices could work efficiently due to 'fuse' used in the electric circuit.

- What is a fuse? Write the material used in fuse wires. How is a fuse connected in an electric circuit ?
- State the ratings of fuse used in electric circuits.
- What is the function of a fuse ? How does it perform its function ?
- A device uses 1 kW electric power when operated at 220 V. Calculate the rating of the fuse to be used.

Ans :

SQP 2021

- An electrical fuse is a low melting point metal wire that breaks due to heat caused by over-voltage or high load to avoid short circuit or failure to the device. Fuse wire is made of alloy of lead and tin having low melting point of  $200^{\circ}\text{C}$ . Fuses are always connected in series with the circuit components to be protected from the over-current in the circuit

- 13-amp fuse
- The main function of the fuse is to provide over-current protection, of either the load or source circuit. Its essential component is a metal wire or strip that melts when too much current flows through it, interrupting the circuit that it connects
- Given,

$$\text{Power} = 1 \text{ kW} = 1000 \text{ W}$$

$$\text{Voltage} = 220 \text{ V}$$

$$P = V \times I$$

$$\text{So, } I = \frac{P}{V}$$

$$I = \frac{1000}{220} = 4.545 \text{ A}$$

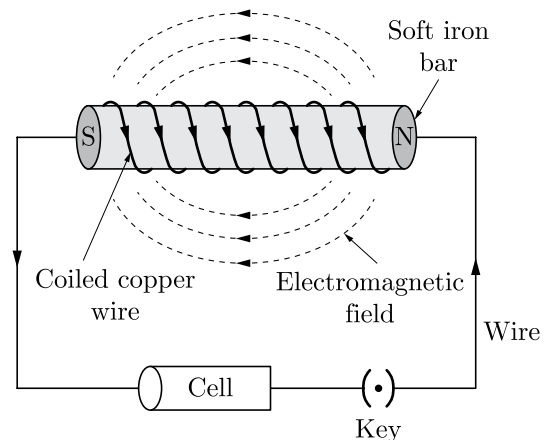
The fuse wire should be able to pass at least 4.545 A current. So, the rating should be 5 A.

166. (a) What is an electromagnet ? List any two uses.  
 (b) Draw a labelled diagram to show how an electromagnet is made.  
 (c) State the purpose of soft iron core used in making an electromagnet.  
 (d) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.

Ans :

Delhi 2020

- An electromagnet is a kind of magnet where the magnetic field is created by an electric current.  
**Uses of electromagnet are :**
  - Generators, motors and transformers.
  - Electric buzzers and bells
- 

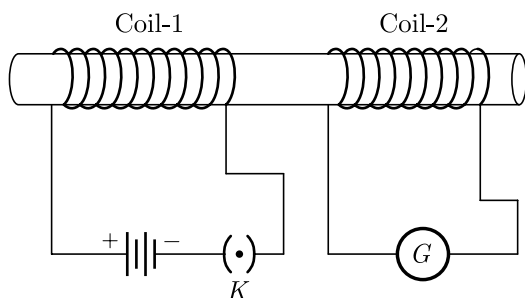




- (c) The soft iron inside the coil makes the magnetic field stronger because it becomes a magnet itself when the current is flowing. Soft iron is used because it loses its magnetism as soon as the current stops flowing. Soft iron is said to form a temporary magnet. In this way, the electromagnet can be switched on and off by turning the electricity on and off.
- (d) The strength of an electromagnet depends on :
- Increasing the strength of the current passing through the coil, the greater the current, the greater the strength.
  - Increasing the number of turns in the coils, the greater the number of turns, the greater the strength.
  - Whether the core is made up of a soft or hard magnetic material. Soft iron will magnetize more readily than steel. Therefore, using a soft core increase the strength of the electromagnet.

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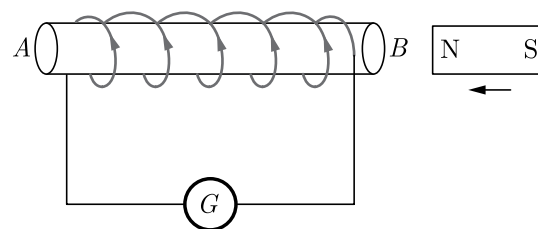
167. (i) With the help of an activity, explain the method of inducing electric current in a coil with a moving magnet. State the rule used to find the direction of electric current thus generated in the coil.
- (ii) Two circular coils-1 and coil-2 are kept close to each other as shown in the diagram. Coil-1 is connected to a battery and key and coil-2 with a galvanometer. State your observation in the galvanometer:



- When key K closed;
  - When key K is opened;
- Give reason for your observations.

Ans :

(i) **Activity :**



- Take a coil of wire AB having a large number of turns.
- Connect the ends of the coil to a galvanometer.
- Take a strong bar magnet and move its north pole towards the end B of the coil.
- There is a momentary deflection in the needle of the galvanometer, say to the right. This indicates the presence of a current in the coil AB. The deflection becomes zero the moment the motion of the magnet stops.
- Now withdraw the north pole of the magnet from the coil. Now the galvanometer is deflected towards the left, showing that the current is now set up in the direction opposite to the previous direction.
- Place the magnet stationary at a point near to the coil, keeping its north pole towards the end B of the coil. We see that the galvanometer needle deflects toward the right when the coil is moved towards the north pole of the magnet. Similarly, the needle moves toward left when the coil is moved away.

When the coil is kept stationary with respect to the magnet, the deflection of the galvanometer drops to zero.

To find the direction of electric current, Fleming's right hand rule is applied. According to it, if we stretch the forefinger, middle finger and thumb of our right hand mutually perpendicular in such a way that thumb points along the direction of motion of conductor, forefinger along the direction of magnetic field; then the middle finger points along the direction of induced current.

Ans :

OD 2015

Magnetic field lines come into the paper at  $P$  and go out of the paper at  $Q$ . Hence, the direction of magnetic field at  $P$  is inwards and at  $Q$  is outwards. The strength of the magnetic field is larger at the point located closer, i.e., at  $Q$ .

108. A student performs an experiment to study the magnetic effect of current around a current carrying straight conductor with the help of a magnetic compass. He reports that :

- the degree of deflection of the magnetic compass increases when the compass is moved away from the conductor.
- the degree of deflection of the magnetic compass increases when the current through the conductor is increased.

Which of the above observations of the student appears to be wrong and why ?

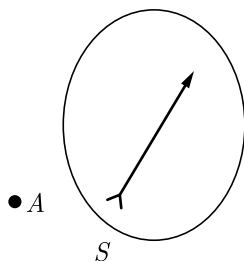
Ans :

Delhi 2015

The first observation is wrong.

Because as the distance from the conductor increases, the strength of the magnetic field decreases. So, the degree of deflection of the compass should decrease instead of increasing.

109. A magnetic compass needle is placed in the plane of paper near point  $A$  as shown in the figure. In which plane should a straight current carrying conductor be placed so that it passes through  $A$  and there is no change in the deflection of the compass ? Under what condition is the deflection maximum and why ?



Ans :

Delhi 2014, Delhi 2011

The current carrying conductor should be placed in the plane of the paper itself. The axis of the compass is vertical and the field due to the conductor is also vertical. It could result in a dip of compass needle which is not possible in this case (dips result only if axis of compass is horizontal).

The deflection is maximum when the conductor through  $A$  is perpendicular to the plane of paper

and the field due to it is maximum in the plane of the paper.

110. What happens to the deflection of the compass needle placed at a point near current carrying straight conductor :

- if the current is increased ?
- if the direction of current in the conductor is changed ?
- if compass is moved away from the conductor ?

Ans :

Foreign 2015

- Deflection of the compass needle increases.
- Direction of deflection in the compass needle changes.
- Deflection of the compass needle decreases.

111. How does the strength of the magnetic field at the center of a circular coil of a wire depend on (a) radius of the coil (b) number of turns of wire in the coil ?

Ans :

Foreign 2014

- Strength of magnetic field ( $B$ ) is inversely proportional to radius of the coil ( $r$ ), i.e.,  $B \propto 1/r$ .
- Strength of magnetic field ( $B$ ) is directly proportional to the number of turns in the coil ( $N$ ) i.e.,  $B \propto N$ .

112. How will the magnetic field produced in a current carrying a circular coil change if we

- increase the value of current ?
- increase the distance from the coil ?
- increase the number of turns of the coil ?

Ans :

Comp 2015

- Magnetic field will increase on increasing the value of the current.
- Magnetic field will decrease on increasing the distance from the coil.
- Magnetic field will increase on increasing the number of turns of the coil.

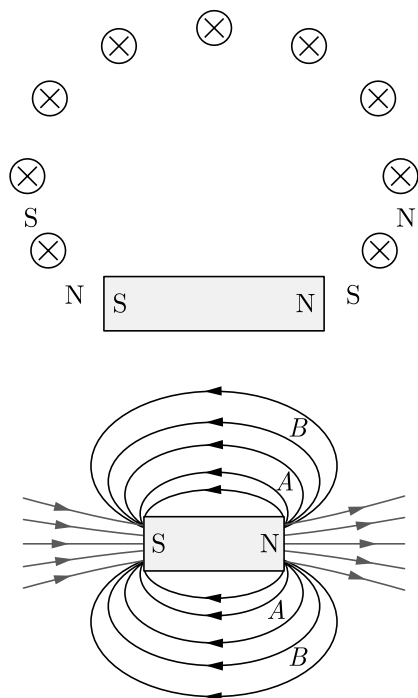
113. (a) Swati draws magnetic field lines of field close to the axis of a current carrying circular loop. As she moves away from the centre of the circular loop she observes that the lines keep on diverging. How will you explain her observation?  
(b) Write two properties of magnetic field lines.

Ans :

OD 2014, Delhi 2010

- Strength of the magnetic field decreases as distance increases. This is indicated by the

pole of the magnet. The north pole of the compass is directed away from the north pole of the magnet. Mark the position of two ends of the needle. Move the needle to a new position such that its south pole occupies the position previously occupied by its north pole. In this way, proceed step by step till reach the south pole of the magnet. Join the points marked on the paper by a smooth curve. This curve represents a field line. These lines represent the magnetic field around the magnet. These are known as magnetic field lines.



Region A has stronger magnetic field.

It is so because the strength of the field is proportional to the relative closeness of field lines.

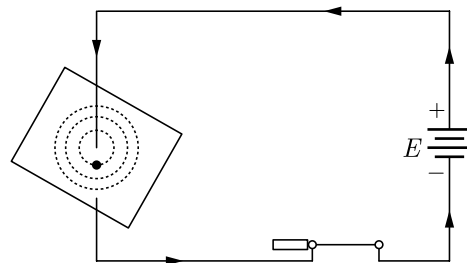
171. Describe in short an activity to (i) demonstrate the pattern of magnetic field lines around a straight current carrying conductor, and (ii) find the direction of magnetic field produced for a given direction of current in the conductor. Name and state the rule to find the direction of magnetic field associated with a current carrying conductor. Apply this rule to determine the direction of the magnetic field inside and outside a current carrying circular loop lying horizontally on a table. Assume that the current through the loop is anticlockwise.

Ans :

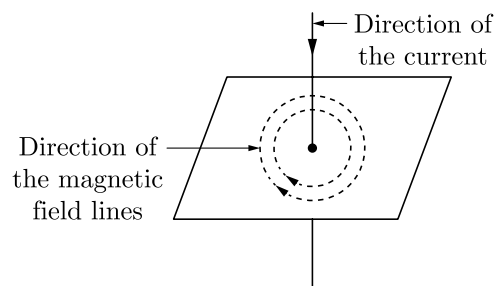
OD 2013

- (i) Take a piece of cardboard. Insert a wire to pass through its centre such that the wire is perpendicular to the plane of the cardboard.

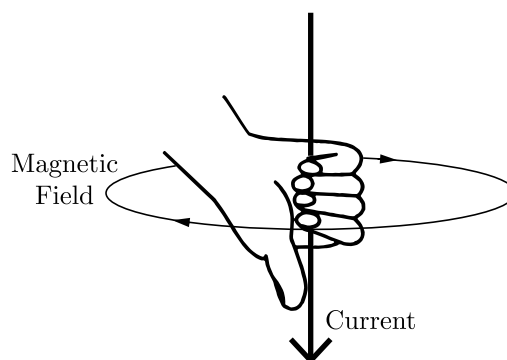
Sprinkle iron filings on the cardboard.



When a current is passed through the wire, the iron filings will arrange themselves in concentric circles around the wire as shown in given figure. These concentric circles on the cardboard represent the field lines of the magnetic field produced due to the current flowing through the conductor.



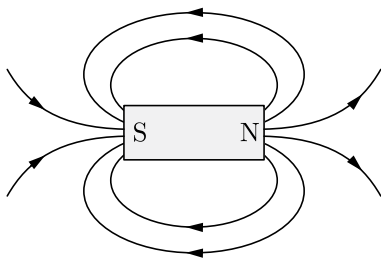
- (ii) Direction of the magnetic field is determined by the right-hand thumb rule. It states that if we hold a current carrying conductor in our right hand such that the thumb points towards the direction of current then the wrapped fingers will give the direction of the magnetic field.



- Inside the loop, direction of field  $\rightarrow$  upward.  
Outside the loop, direction of field  $\rightarrow$  downward.

(iii) (d) Both (a) and (b)

(iv) (a)



(v) (a) Magnetic field is a quantity that has both direction and magnitude.

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**187.** Read the following case based passage and answer the questions given after passage.

In 19th century, Hans Christian Oersted, one of the leading scientists played a crucial role in understanding electromagnetism. In 1820, he accidentally discovered that a compass needle got deflected when an electric current passed through a metallic wire. An electromagnet is a temporary magnet or soft iron which retains magnetism only when the current passes around it.

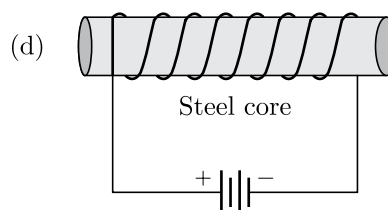
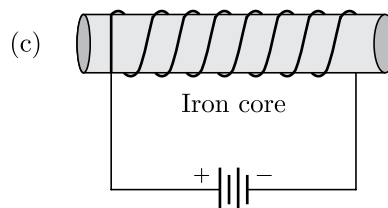
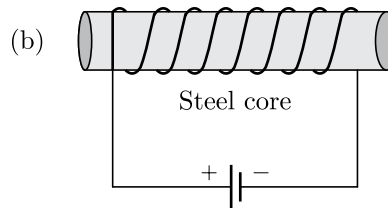
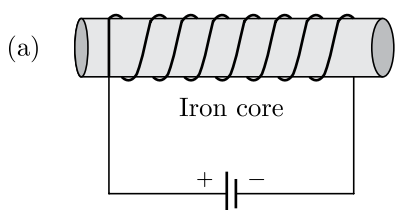
Electromagnets are used in electric bell, telephone, electric motor, etc.

Oersted showed that electricity and magnetism were related phenomena. His research later created technologies such as the radio, television and fibre optics.

(i) Which coil produces the strongest electromagnet for a given flow of current ?

- (a) A 10 cm coil with 100 turns
- (b) A 20 cm coil with 200 turns
- (c) A 10 cm coil with 200 turns
- (d) A 5 cm coil with 200 turns

(ii) Which of the following is the strongest electromagnet ?



(iii) Which of the following is not a part of an electromagnet ?

- (a) Wire
- (b) Iron
- (c) Toothpick
- (d) Power source

(iv) Magnetism of a magnet can be destroyed by

- (a) hammering
- (b) inductive action or another magnet
- (c) heating
- (d) all the above method

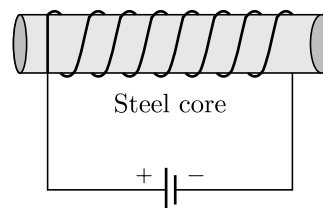
(v) Strength of an electromagnet can be increased by

- (a) increasing the current supply
- (b) increasing the number or turns
- (c) increasing the cross-sectional area
- (d) all the above methods

**Ans :**

(i) (d) A 5 cm coil with 200 turns

(ii) (b)



(iii) (c) Toothpick

(iv) (d) all the above method

(v) (d) all the above methods

- (b) The field lines inside the solenoid are in the form of parallel straight line.  
It indicates that the magnetic field is uniform.
- (c) A solenoid is used to magnetize a soft iron piece to obtain electromagnets.

174. (a) What are factors on which the magnetic field produced by a current carrying conductor depends?

or

Name the factors on which the force on the current carrying conductor depends.

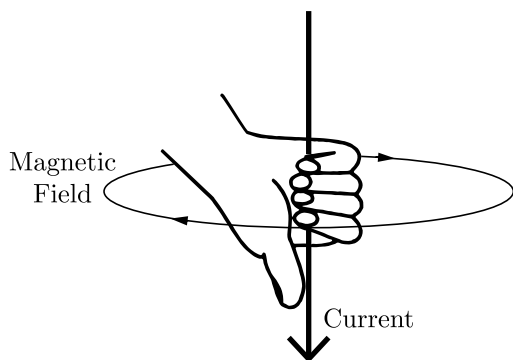
- (b) What happens to the magnetic field lines due to a current carrying conductor when the current is reversed. State the rule which gives this direction and current.

Ans :

Delhi 2017, OD 2011

- (a) (i) The strength of the current.  
(ii) Distance of the point from the conductor.
- (b) The direction of magnetic field lines get reversed on reversing the direction of the current.

**Right-hand thumb rule :** When a current carrying straight conductor is holding in your right hand such that the thumb points towards the direction of current then your fingers will wrap around the conductor in the direction of the field lines of the magnetic field.

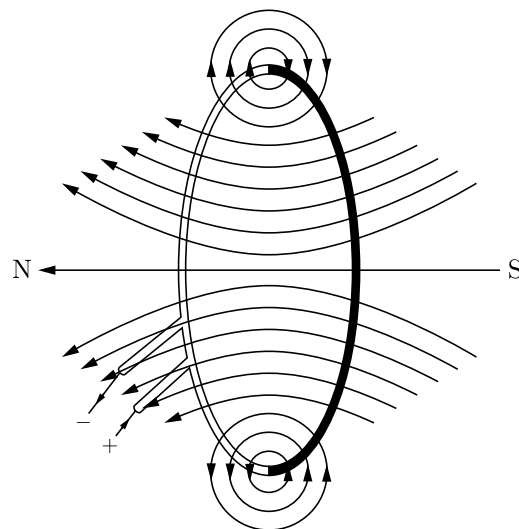


175. (a) A positively charged particle projected towards west is deflected towards north by a magnetic field. What is the direction of the magnetic field ?
- (b) Draw the magnetic field lines of the field produced due to a current carrying circular loop.
- (c) State the law used to find the direction of magnetic field around a straight current carrying conductor.

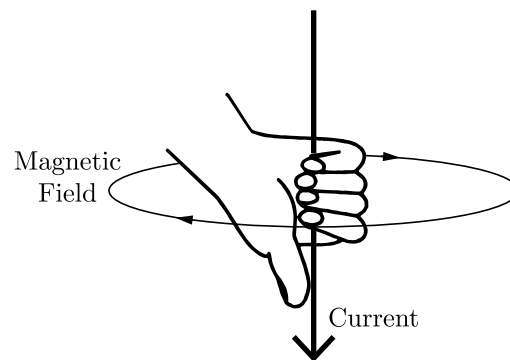
Ans :

Delhi 2016

- (a) The magnetic field is directed towards upward.  
(b)



- (c) **Right-hand thumb rule :** When a current carrying straight conductor is holding in your right hand such that the thumb points towards the direction of current then your fingers will wrap around the conductor in the direction of the field lines of the magnetic field.



176. What is meant by magnetic force ? Name and explain the rule to determine the direction of force experienced by a current carrying conductor in a magnetic field. How does this force gets affected on :
- doubling the magnitude of current.
  - reversing the direction of current flow and
  - reversing the direction of magnetic field?

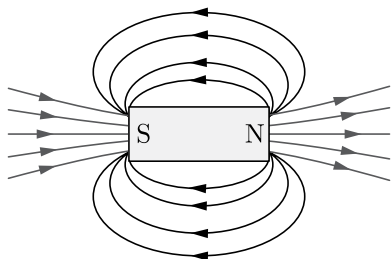
Ans :

SQP 2014, OD 2012

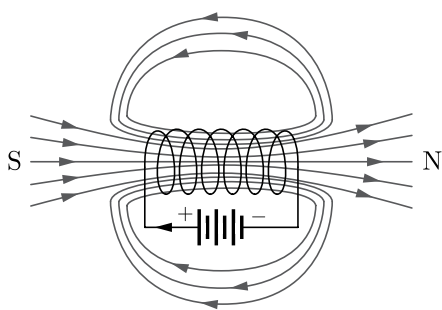
The magnetic field produced by the conductor exerts a force on a magnet placed in the vicinity of the conductor is called magnetic field.

The rule to determine the direction of force

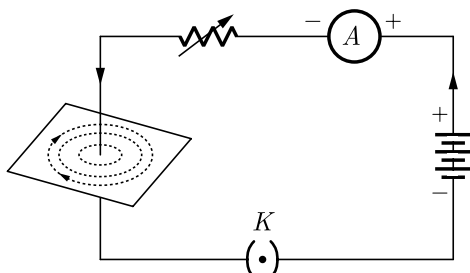
172. Shown in the diagrams (a), (b), (c) and (d) are the magnetic fields around different systems. Identify them. Compare the pattern of the fields in all the four examples. Are they similar ? Why ?



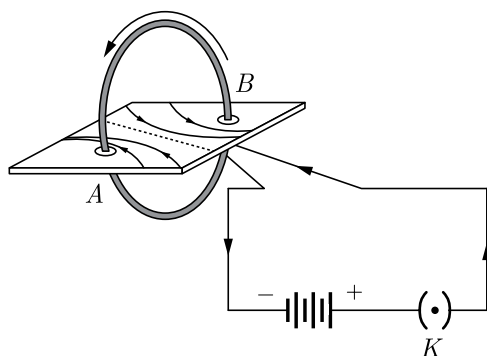
(a)



(b)



(c)



(d)

Ans :

OD 2017

- (a) Magnetic field lines around a bar magnet.
- (b) Magnetic field around a solenoid.
- (c) Magnetic field due to current through a straight current carrying conductor.
- (d) Magnetic field due to current through a circular loop.

The pattern of the magnetic field lines around a current carrying solenoid is same as the magnetic field around a bar magnet and others mention above. In fact, one end of the solenoid behaves as magnetic north pole, while the other behaves as the south pole. The field lines inside the solenoid are in the form of parallel straight lines. This indicates that the magnetic field is the same at all points inside the solenoid. That is, the field is uniform inside the solenoid.

In case of straight current-carrying conductor, the magnetic field is in the form of the concentric circles. These circles represent the field lines of the magnetic field produced due to the current flowing through the conductor.

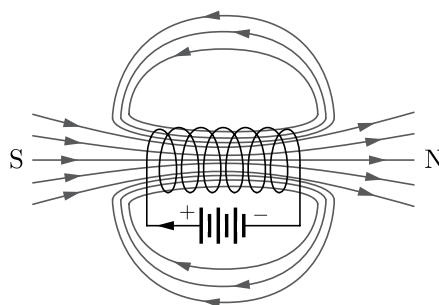
Similarly, at every point of a current-carrying circular loop, the concentric circles representing the magnetic field around it would become larger and larger as we move away from the wire. By the time we reach at the center of the circular loop, the arcs of these big circles would appear as straight line.

173. (a) What is a solenoid ? Draw the pattern of magnetic field lines around a current carrying solenoid.
- (b) What is the pattern of field lines inside a solenoid? What do they indicate ?
- (c) How is the magnetic field produced in a solenoid used ?

Ans :

OD 2016, OD 2014

- (a) A solenoid is a long coil containing a large number of close turns of insulated copper wire.



A solenoid is used to magnetize any magnetic material

II. A charged body placed in this field experiences a force whose direction is given by Fleming's left-hand rule.

III. The magnetic field lines around a current carrying straight conductor are in the form of concentric circles with the conductor as the centre.

The correct statement(s) is/are :

- (a) I only
- (b) III only
- (c) I and II
- (d) I and III

(iv) The strength of magnetic field of a current carrying solenoid is :

- (a) minimum at its ends.
- (b) uniform inside it at all points.
- (c) maximum at its centre.
- (d) zero at its centre.

(v) Which one of the following particles would not experience a force while moving perpendicular to a uniform magnetic field ?

- (a) A neutron
- (b) An alpha particle
- (c) An electron
- (d) A proton

Ans :

SQP 2021

- (i) (d) small bar magnet pivoted at its centre of mass
- (ii) (a) the Earth has two poles.
- (iii) (b) III only
- (iv) (b) uniform inside it at all points
- (v) (a) A neutron

**179.** Read the following case based passage and answer the questions given after passage.

Very weak electric currents are produced in our body by the movement of charged particles called ions. These are called ionic currents. Now, we know that whenever there is an electric current, a magnetic field is produced. So, when the weak ionic currents flow along the nerve cells, they produce magnetic field in our body. The magnetism produced in the human body is very weak as compared to the earth's magnetism. The two main organs of the human body where the magnetic field produced is quite significant are the heart and the brain.

The magnetism produced inside the human body (by the flow of ionic currents) forms the basis

of a technique called Magnetic Resonance Imaging (MRI) which is used to obtain images (or pictures) of the internal parts of our body.

- (i) Name two human body organs where magnetism produced is significant.
- (ii) What produces magnetism in the human body?
- (iii) Name one medical technique which is based on magnetism produced in human body ?

Ans :

- (i) Heart and the brain.
- (ii) Weak ionic currents flow along the nerve cells and they produce magnetic field in our body.
- (iii) Magnetic Resonance Imaging (MRI).

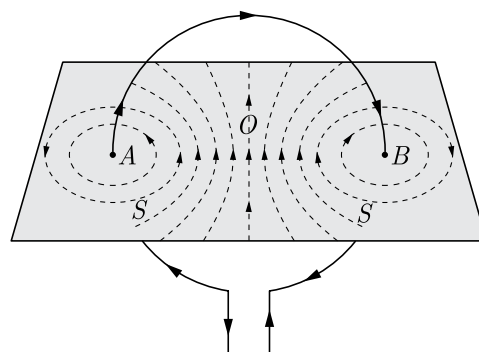
**180.** Read the following case based passage and answer the questions given after passage.

When a current is passed through the circular loop of wire, a magnetic field lines near the coil are nearly circular and concentric. At the centre of the circular loop, the magnetic field lines are straight.

The strength of the magnetic field produced by a current-carrying circular coil (or circular wire) depends on :

- (i) current flowing through the coil.
- (ii) radius of the circular coil.
- (iii) number of turns of wire in the circular coil.

The direction of the field lines can be found by applying Right-Hand Thumb Rule.



- (i) State Right-hand Thumb rule.
- (ii) A long horizontal power line is carrying a current of 100 A in the east-west direction. What is the direction of magnetic field at a point 1.0 m below it ?
- (iii) What type of curve we get, between magnetic field and distance along the axis of a current carrying circular coil ?
- (iv) If a current carrying straight conductor is placed in east-west direction, then find the direction of the force experienced by the conductor due to



- 61.** What name is given to the device which automatically cuts off the electricity supply during short circuiting in domestic wiring ?

**Ans :** Delhi 2011  
Electric fuse.

- 62.** What is the advantage of alternating current ?

**Ans :** OD 2012  
The important advantage of A.C. is that electric power can be transmitted over long distances without much loss of energy because A.C. can be stepped up.

- 63.** On what factors does the magnetic field produced at the center of a circular current-carrying wire depend?

**Ans :** Foreign 2012  
Magnetic field produced at the center of a circular current-carrying wire depends directly on the strength of the current passing through it and inversely on the radius of the circular wire.

- 64.** In the given circuit,  $PQR$  and  $PSR$  are semicircles. What will be the magnetic field at the center  $A$  of the circular loop ?

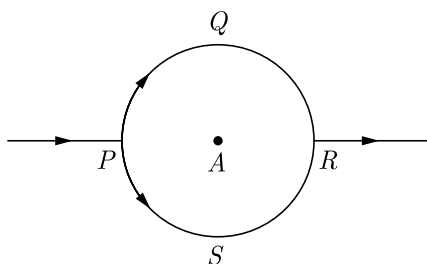


Figure: A circular loop.

**Ans :** SQP 2012  
The magnetic field at  $A$  will be zero because the magnetic fields due to  $PQR$  and  $PSR$  will be equal and opposite.

- 65.** What is the usual rating of an electric fuse used (i) in the lighting circuit, and (ii) in the power circuit, of a small house?

**Ans :** OD 2012, Delhi 2010  
(i) Lighting circuit-5 A  
(ii) Power circuit-15 A.

- 66.** What is the meaning of 50 Hz of AC supply ?

**Ans :** OD 2011  
50 Hz means 50 cycles per second. One cycle involves two changes of direction. So, 50 Hz A.C. means current changing its direction 100 times in a second.

- 67.** Name the physical quantity whose S.I. unit is weber/m<sup>2</sup>.

**Ans :** OD 2010, Delhi 2007  
Magnetic field.

- 68.** Which device is used to protect the electric circuits from overloading and short circuiting ?

**Ans :** Foreign 2011  
Fuse is used to protect the electric circuits from overloading and short circuiting.

- 69.** On which effect of electricity does a fuse work ?

**Ans :** SQP 2011  
A fuse works on the heating effect of electricity.

- 70.** What are the two ways by which we receive the supply of electric power through mains in our homes ?

**Ans :** OD 2010  
We receive the supply of electric power through mains either by underground cables or through overhead electric poles.

- 71.** What is the potential difference between live wire and neutral wire in India ?

**Ans :** Delhi 2011  
In India, the potential difference between live wire and neutral wire is 220 V.

- 72.** What is alternating current?

**Ans :** OD 2011  
If the current changes direction after equal intervals of time, it is called alternating current.

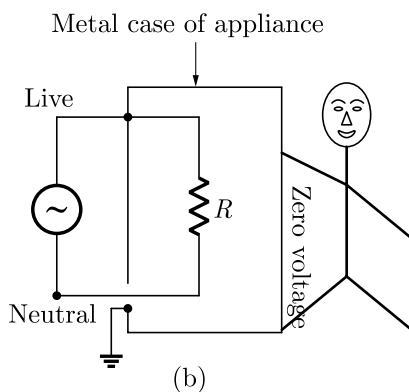
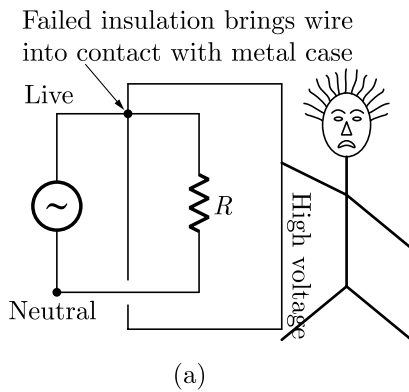
- 73.** What is fuse rating ?

**Ans :** Foreign 2010, Delhi 2008  
The maximum safe current allowed to flow through a fuse before it melts is called fuse rating.

**182.** Read the following case based passage and answer the questions given after passage.

Usually, electric appliances with high power rating such as heaters, irons, etc., have a terminal for connecting the earth wire, in addition to terminals for the live and neutral wires. The earth wire is connected to the metallic body of the appliance. This is done to avoid shocks in case of a fault.

Suppose, due to some reason, the insulation of the live wire inside an electric iron gets burnt at a place. If the metallic body of the iron is in contact with the defective wire, it will be at a potential of 220 V when the iron is in use. If a person accidentally touches the metallic body of the iron, he/she will get an electric shock. However, with the earth wire properly connected to the metallic body, the current will quickly go to the earth and the potential of the metallic body will not rise. Thus, earthing of electric appliances protects us from electric shock.



- What is the application of earth wire ?
- What are different types of wires used in an electric circuit?
- Earth is good conductor or bad conductor of electricity.

**Ans :**

- The earth wire is connected to the metallic body of the appliance. This is done to avoid

shocks in case of a fault.

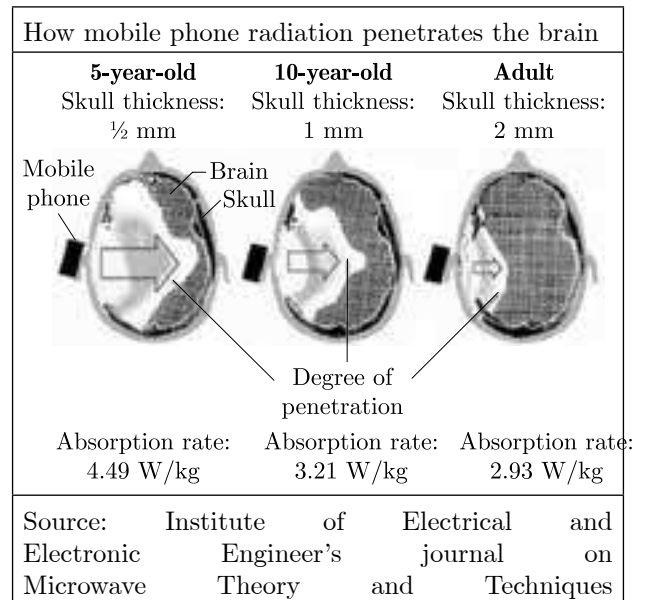
- Live, neutral and earth wire.
- Good.

**183.** Read the following case based passage and answer the questions given after passage.

The mobile phone is an excellent communication device. Mobile phones uses electromagnetic radiation in the microwave range. Part of the radio wave emitted by the mobile phone handset will be absorbed by the head.

Head is in the 'near field' of radiation, so that most of the heating effect occurs in the head.

Temperature in the internal ear, brain increases by 1 degree or more. This adversely affect the functioning of these organs since these have fluid filled cavities. But prolonged heating effect can alter brain functions and hearing ability also. Other harmful effects such as Premature Cataract, Confusion and loss of memory may also be possible. Following figure shows that how mobile phone radiation penetrates the brain.

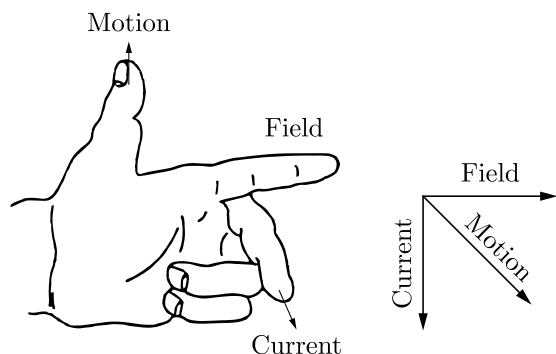


- What precautions should be taken while using mobile phones ?
- Which radiations are used in mobile phones ?
- How does prolonged heating effect due to mobile radiations can effect adversely ?
- In which part of our body, most of the heating effect occurs due to use of mobiles ?

**Ans :**

- Try to consider mobile phone as a communication device and not an entertainment device. Even if

experienced by a current carrying conductor in a magnetic field is



**Fleming's left hand rule :** When the stretch our thumb, forefinger and middle finger so that they are mutually perpendicular to one another, the forefinger points in the direction of the magnetic field and the middle finger points in the direction of the current, the thumb gives the direction of the force acting on the conductor.

- (i) on doubling the magnitude of current, force does not get affected.
- (ii) Reverse the direction of current flow, the direction of force gets reversed.
- (iii) Reverse the direction of magnetic field, the direction of force gets reversed.

177. What are magnetic field lines? How is the direction of a magnetic field at a point determined ?

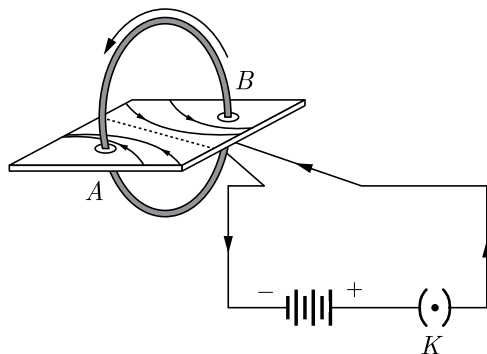
Draw the magnetic field lines (including field directions) of the magnetic field due to a circular coil of current. Name any two factors on which the magnitude of the magnetic field due to this coil depends.

**Ans :**

Foreign 2017

Magnetic field lines are the imaginary lines that represent magnetic field around a magnet.

The direction of the field is along the direction in which north pole of a magnetic compass points (or direction of field at a point is the direction of tangent drawn at that point).



The magnitude of the magnetic field depends on strength of the current, number of loops of the coil, radius of the coil, etc.

## CASE BASED QUESTIONS

178. Read the following case based passage and answer the questions given after passage.

Hans Christian Oersted (1777- 1851) observed that a compass needle suffers a deflection when placed near a metal wire carrying an electric current. This discovery gave the first evidence of a connection between electric and magnetic phenomena. Andre Ampere (1775 - 1836) grasped the significance of Oersted's discovery. He carried out a large series of experiments to explore the relationship between current electricity and magnetism. On the basis of experiments, he hypothesised that all magnetic phenomena are due to circulated electric currents. Later on many devices such as electromagnets, electric motors, microphones, electric generators, etc. were developed on the basis of magnetic phenomena.

- (i) A magnetic needle is a/an :
  - (a) isolated north pole pivoted at its centre of mass.
  - (b) isolated south pole pivoted at its centre of mass.
  - (c) ordinary needle made of soft iron and pivoted at its centre of mass.
  - (d) small bar magnet pivoted at its centre of mass.
- (ii) A freely suspended magnet always rests in geographically north and south direction because:
  - (a) the Earth has two poles.
  - (b) the Earth behaves as a huge magnet.
  - (c) the magnetic north pole of the Earth's magnet is located very close to its south pole.
  - (d) the magnetic south pole of the Earth's magnet is located very close to its south pole.
- (iii) When a current flows through a straight conductor, a magnetic field is produced around it. Consider the following statements about this field:
  - I. The direction of the magnetic field of a current carrying straight conductor is determined by right-hand thumb rule.

- (d) Cannot be determined due to Bohr's indeterminacy

Ans :

- (i) (b) Perpendicular to the current flow.  
(ii) (a) It changes  $180^\circ$

**186.** Read the following case based passage and answer the questions given after passage.

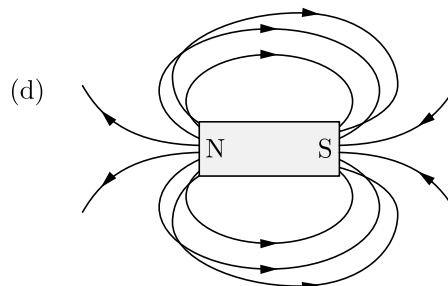
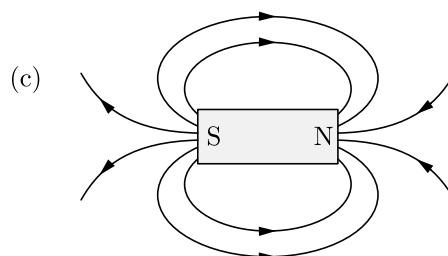
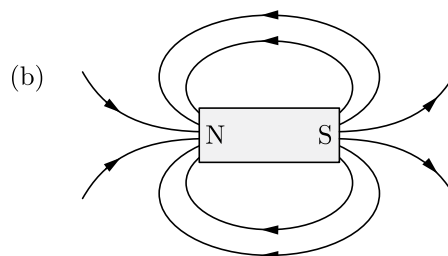
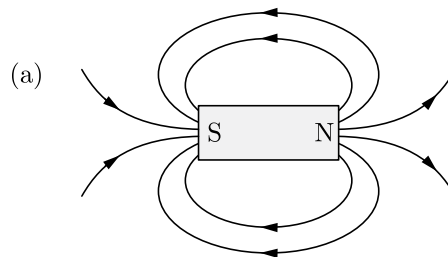
Magnetic field is a quantity that has both direction and magnitude. The direction of the magnetic field is taken to be the direction in which a north pole of the compass needle moves inside it. Therefore, it is taken by convention that the field lines emerge from north pole and merge at the south pole. Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus the magnetic field lines are closed curves.

The relative strength of the magnetic field is shown by the degree of closeness of the field lines. The field is stronger that is, the force acting on the pole of another magnet placed is greater where the field lines are crowded.

No two field-lines are found to cross each other. If they did, it would mean that at the point of intersection, the compass needle would point towards two directions, which is not possible.

- (i) The direction of magnetic field lines inside a magnet is from:
- One end to another end
  - One pole to another pole
  - South pole to north pole
  - North pole to south pole
- (ii) The strength of a magnet is more at the poles than at the middle because:
- The magnetic field lines intersect at the poles but not at the middle of the magnet.
  - There is no magnetic field line at the middle of the magnet.
  - The magnetic field lines are more crowded at the middle than at the poles.
  - The magnetic field lines are more crowded at the poles than at the middle.
- (iii) Which of the following statement is correct about the magnetic lines of force ?
- The magnetic field lines are closed curves
  - No two field lines intersect to each other
  - The field lines emerge from south pole and merge at the north pole
  - Both (a) and (b)

- (iv) Which of the following figure represents the correct representation of magnetic field lines around a bar magnet ?



- (v) Which of the following statement is correct about the magnetic field ?
- Magnetic field is a quantity that has both direction and magnitude.
  - Magnetic field is a quantity that has only direction but no magnitude.
  - Magnetic field is a quantity that has only magnitude but no direction.
  - All of the above.

Ans :

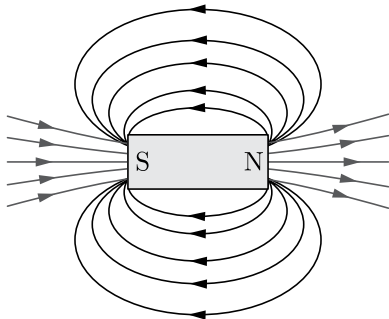
- (i) (c) South pole to north pole  
(ii) (d) The magnetic field lines are more crowded at the poles than at the middle.

earth's magnetic field.

**Ans :**

- (i) According to right hand thumb rule, imagine a straight conductor in your right-hand such that the thumb points in the direction of current. The direction of curl of fingers of the right-hand gives the direction of magnetic field lines.
- (ii) The current flows in the east-west direction. From right-thumb rule, we get the direction of magnetic field as from north to south. The direction of magnetic field will be same at every point below the power line.
- (iii) At smaller distances, the magnetic field will be described by concentric circles around the wire. As the distance increases, the circles become larger and larger. At the centre of the loop/coil, the magnetic field will appear as straight line.
- (iv) The force will act in upward direction perpendicular to both, the direction of current as well as to the field. The direction of force experienced by the conductor gets reversed, i.e., in the downward direction.

**181.** Read the following case based passage and answer the questions given after passage.



The path along which the compass needles are aligned is known as magnetic line of force. Magnetic field is a quantity that has both direction and magnitude. The direction of the magnetic field is taken to be the direction in which a north pole of the compass needle moves inside it. Therefore, it is taken by convention that the field lines emerge from north pole and merge at the south pole. Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus the magnetic field lines are closed curves.

The relative strength of the magnetic field is shown by the degree of closeness of the field lines. The field is stronger, that is, the force acting on the pole of another magnet placed is greater where the field lines are crowded.

No two field-lines are found to cross each other. If they did, it would mean that at the point of intersection, the compass needle would point towards two directions, which is not possible.

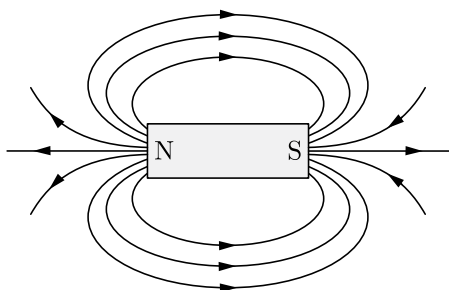
- (i) Which of the following is correct about magnetic field lines ?
  - (a) Magnetic lines of force intersect to each other when emerge from a Pole of magnet.
  - (b) Magnetic lines of force are close to each other at the Poles.
  - (c) Magnetic lines of force are curved inside the magnet.
  - (d) The direction of magnetic lines of force is from north pole to the south pole of the magnet.
- (ii) What would happen to the north pole of the magnetic compass if it is brought near the north pole of a magnet ?
  - (a) Repulsion takes Place
  - (b) Attraction takes Place
  - (c) No deflection occurs in the compass needle
  - (d) Compass needle demagnetises
- (iii) From which pole of the magnet the magnetic field lines emerge ?
  - (a) North pole
  - (b) South pole
  - (c) Either of the pole
  - (d) Centre of the magnet
- (iv) Where is magnetic field strength maximum in a bar magnet ?
  - (a) At the north Pole of the magnet
  - (b) At the south Pole of the magnet
  - (c) At both poles of the magnet
  - (d) At middle of the magnet
- (v) Where is magnetic field strength uniform in a bar magnet ?
  - (a) Inside the bar magnet
  - (b) At the north pole of the bar magnet
  - (c) At the south pole of the bar magnet
  - (d) At the middle of the bar magnet

**Ans :**

- (i) (b) Magnetic lines of force are close to each other at the Poles.
- (ii) (a) Repulsion takes Place
- (iii) (a) North pole
- (iv) (c) At both poles of the magnet
- (v) (a) Inside the bar magnet

- 188.** Read the following case based passage and answer the questions given after passage.

During winters, you would like to sit near a heater or fire place. If you sit nearby heater, you feel more warmth but if you are far away from it, you feel warmth is less. Similarly, a bar magnet has a region or space surrounding it where other substances can experience a force of attraction or repulsion but the magnitude of force depends upon the distance between them as well as on the strength of magnet. The more the distance, the smaller the force. So, the region or space around a magnet where magnetic force can be experienced by other magnetic substance is called magnetic field.



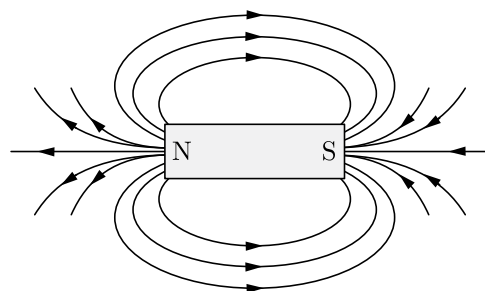
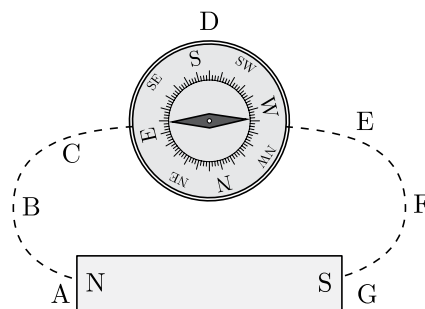
- (i) SI unit of magnetic field is
  - (a) henry
  - (b) weber
  - (c) newton
  - (d) tesla
- (ii) A bar magnet has strongest magnetism
  - (a) at one quarter distance from the poles of the magnet
  - (b) near the poles of the magnet
  - (c) at the centre of the magnet
  - (d) inside of the magnet
- (iii) Magnetic field lines can be used to determine
  - (a) only the relative strength of the magnetic field
  - (b) only the direction of magnetic field
  - (c) both the direction and relative strength of the magnetic field
  - (d) the shape of the magnetic field
- (iv) The magnetism of bar magnet at the centre of magnet is:
  - (a) same as the pole
  - (b) zero
  - (c) maximum
  - (d) minimum
- (v) Magnetic field is produced by the flow of current in a straight wire. The phenomenon was discovered by
  - (a) Faraday
  - (b) Fleming
  - (c) Oersted
  - (d) Maxwell

**Ans :**

- (i) (d) tesla
- (ii) (b) near the poles of the magnet
- (iii) (c) both the direction and relative strength of the magnetic field
- (iv) (d) minimum
- (v) (c) Oersted

- 189.** Read the following case based passage and answer the questions given after passage.

There is a magnetic field in the area around a magnet. In this area there is a force on a magnetic object. If the field is strong the force is big. In a weak field the force is small. The direction of a magnetic field can be found by using a small plotting compass. The compass needle always lies along the direction of the field. Figure shows how you can investigate the field near to a bar magnet, using a compass. We use magnetic field lines to represent a magnetic field. Magnetic field lines always start at a north pole and finish on a south pole. When the field lines are close together then the field is strong. (Magnetic field lines are not real, but they make a useful model which helps us to understand magnetic fields).



The pattern of magnetic field lines close to two (or more) magnets becomes complicated. The magnetic field from the two magnets combine. The field line from the two magnets never cross. If field lines did cross, it would mean that compass would have to

point in two directions at once.

- (i) Magnetic field lines determine
  - (a) only the direction of the field
  - (b) the relative strength of the field
  - (c) both the relative strength and the direction of the field
  - (d) only the shape of the field
- (ii) Magnetic field lines
  - (a) have one direction at a point
  - (b) have no physical reality
  - (c) can be used to indicate the direction of the magnetic field at a point
  - (d) all the above
- (iii) The direction of magnetic field of just a wire in which electrons are moving towards west, will point towards
  - (a) west                      (b) east
  - (c) north                    (d) south
- (iv) The magnetic field produced due to a current carrying circular wire at its centre is
  - (a) at  $45^\circ$  to the plane of the wire
  - (b) at  $60^\circ$  to the plane of the wire
  - (c) perpendicular to the plane of the wire
  - (d) in the plane of the wire

**Ans :**

- (i) (c) both the relative strength and the direction of the field
- (ii) (b) along the axis and parallel to each other
- (iii) (d) south
- (iv) (c) perpendicular to the plane of the wire



# CHAPTER 13

## Our Environment

### 1. INTRODUCTION

The immediate surrounding of an organism is called environment. It has two components :

1. **Abiotic component** : In ecology and biology, abiotic components are non-living chemical and physical factors in the environment which affect ecosystems. Examples air, temperature, sunlight, soil and moisture or water.
2. **Biotic components** : Biotic describes a living component of an ecosystem; for example micro-organisms, fungi, plants and animals including human beings.

### 2. ECOSYSTEM

An ecosystem is a self sustaining system where biotic organisms and abiotic environment of various communities interact with each other and exchange materials.

1. The term 'ecosystem' was given by Tansley (1953).
2. An ecosystem is an open system which requires a regular input of energy and circulation of matter for its sustenance.
3. On the basis of nature, an ecosystem may be Natural ecosystem (self-regulating ecosystem without any interference of man, e.g., terrestrial ecosystems : forest, grassland and desert ecosystems and aquatic ecosystems : ponds, lakes, rivers estuaries and oceans) or Artificial ecosystem (man-made ecosystems, e.g., orchards, gardens, parks, crop fields, aquariums and spaceship).
4. The components of an ecosystem are abiotic components (non-living or physical) - soil, water, air, inorganic substances, water vapour, sunlight, temperature, pressure, humidity, soil texture, etc. and biotic components (living) - producers (green plants), consumers (animals) and decomposers (bacteria and fungi).

### 3. FOOD CHAIN

Food chain is the feeding interaction between organisms at various trophic level.

1. A food chain starts with producers which are autotrophic plants. They introduce solar energy into the food chain through photosynthesis.
2. Producers are eaten by herbivores which are called primary consumers.
3. Herbivores are eaten by carnivores which are called secondary and tertiary consumers.
4. Bacteria and fungi are decomposers. They are called saprophytes. They are considered to be final consumers of the food chain. They are responsible for returning nutrients from biotic world into abiotic world.
5. Each step in a food chain represents a trophic level. The producers form the first trophic level, herbivores second, carnivores third and top carnivores form the fourth trophic level.
6. The green plants absorb 1% of solar energy falling on them and convert it into food.
7. An average of 10% of food eaten by an organism is turned into its own body and made available for next trophic level.
8. A food chain generally consists of 3 or 4 steps (trophic levels) due to little usable energy remains after 4 trophic levels
9. The flow of energy in a food chain is unidirectional and is no longer available to the previous level.
10. Some harmful chemicals enter the body of organisms passing through various levels of food chain and get accumulated at each level. (Biological magnification).
11. Based on trophic levels, a food chain may be  
**Two-step food chain** : Producer → Herbivore  
**Three-step food chain** : Producer → Primary consumer → Secondary consumer  
**Four-step food chain** : Producer → Primary consumer → Secondary consumer → Tertiary consumer or

**Five-step food chain :** Producer → Primary consumer → Secondary consumer → Tertiary consumer → Quaternary consumer

12. Based on habitats, a food chain may be terrestrial food chain (grassland food chain, forest and desert food chain) or aquatic food chain (ponds, pools, lakes, rivers and oceans).

#### 4. A FOOD WEB

A food web is the network of several interconnected food chains.

1. A food web has several alternative pathways for the flow of energy.
2. The food web also starts with producers and ends with top carnivores
3. A particular organism may occupy position in more than one food chains.

#### 5. EFFECTS OF HUMAN ACTIVITIES ON THE ENVIRONMENT

Human activities have changed the environment and created major environmental problems. Some of these are :

##### 5.1 Depletion of Ozone Layer

Ozone is present at the height of 15 km to 60 km in the upper atmosphere and protects us from damaging effects of UV radiations.

1. Ozone is formed in the upper atmosphere (in stratosphere) by the action of ultraviolet radiations from the sun on oxygen.
2. The depletion of ozone layer is due to the use of chlorofluorocarbons (CFCs) and other halons used in refrigeration, fire extinguishers and aerosols.
3. Effects of ozone layer depletion are mutations in plants and animals, decline in photosynthesis, increase in CO<sub>2</sub> concentration leading to global warming and increase in the incidences of skin cancer and cataract in human beings.
4. Measures to protect ozone layer - Montreal Protocol, prepared by United Nations Environment Programme (UNEP) in 1987, was an agreement among industrialised nations to limit the production and use of chlorofluorocarbons to half the level of 1986 and Helsinki Declaration in 1989 was an agreement to phase out CFCs and halons by 2000.

##### 5.2 Waste and its Disposal

1. The useless leftover or discarded materials generated in our daily life are termed as wastes. The wastes may be in the form of gases (exhausts from automobiles, smoke from chimneys of industries and houses), liquids (sewage water, effluents from industries) or solids (waste from vegetable and fruit market, polythene bags, plastic wastes, broken/useless boards, hospital waste, human excreta, cattle dung and farm waste).
2. A solid waste may be biodegradable (waste which is broken down into simple organic and inorganic compounds by the action of decomposers) or non-biodegradable (waste which cannot be broken down into simple organic and inorganic compounds by the decomposers).

##### 5.3 Managing the Garbage

Disposal of waste needs a scientific way. It includes open dumping, land filling, composting, incineration, recycling and reuse.

##### 5.4 Disposable Cups in Trains-An Effort to Save Environment

Few years ago, vendors in trains used to serve tea in disposable plastic cups which were used and thrown away in large numbers. Millions of these non-biodegradable cups posed a problem of their disposal. They could not be burnt as they released toxic gases. Thereafter, kulhads were used as an alternative to disposable plastic cups. However, making millions of kulhads daily resulted in the loss of top fertile soil. Therefore, this practice was discontinued. Now, biodegradable disposable paper cups are being used for the purpose. It is certainly an improvement because paper cups are biodegradable and they can also be burnt down.

#### OBJECTIVE QUESTIONS

1. Identify the food chain in which the organisms of the second trophic level are missing:
  - (a) Grass, goat, lion
  - (b) Zooplankton, Phytoplankton, small fish, large fish
  - (c) Tiger, grass, snake, frog
  - (d) Grasshopper, grass, snake, frog, eagle

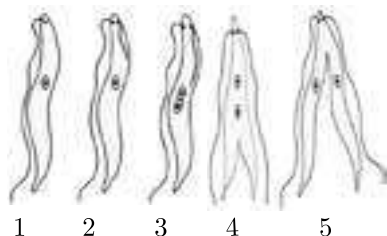
**Ans :**

OD 2024

The herbivores or the primary consumers occupy the second trophic level which is missing in the food chain i.e., tiger, grass, snake, frog.

Thus (c) is correct option.

2. Choose the correct order of the stages of binary fission in Leishmania.



- (a) I, II, III, IV, V                      (b) I, III, II, V, IV  
(c) I, III, V, II, IV                      (d) I, II, IV, V, IV

**Ans :**

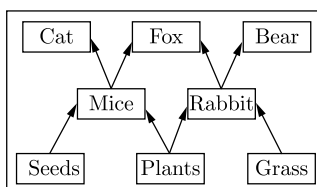
OD 2023

The correct order of stages of binary fission in Leishmania is : I, III, II, V, IV

Leishmania has a whip like structure at one end of the cell. Hence, binary fission occurs in a definite orientation in relation to this structure.

Thus option (b) is correct option.

3. Study the given figure of a Food web and identify the primary consumer in the food web:



- (a) Mice and Bear                      (b) Rabbit and Cat  
(c) Rabbit and Fox                      (d) Mice and Rabbit

**Ans :**

OD 2023

In the given food web, Mice and Rabbit are primary consumers. Primary consumers make up the second trophic level. They are also known as herbivores. They eat primary producers.

Thus option (d) is correct option.

4. Grasshopper in grassland is a  
(a) producer                      (b) herbivore  
(c) carnivore                      (d) none of the above

**Ans :**

Delhi 2014

The plant is the producer and the animals are consumers. The first consumer in the chain is also called the primary consumer, the next one is the secondary consumer and the one after that is the tertiary consumer.

A consumer that eats plants is called as herbivore (grasshopper), and a consumer that eats other animals is called as carnivore (frog and hawk). An omnivore is an animal, that eats both plants and animals.

Thus (b) is the correct option.

5. Vultures in an ecosystem are  
(a) predators                      (b) scavengers  
(c) consumers                      (d) top carnivores

**Ans :**

OD 2014

Vultures are scavenging birds that feed on dead animals. Vultures do not kill their own prey, they feed on dead animals. As scavengers, vultures play an important role in the ecosystem by decomposing the dead animal matter, cleaning the environment and reducing the spread of diseases.

Thus (b) is the correct option.

6. What must be preserved in an ecosystem, if the system needs to be maintained?  
(a) producers and carnivores  
(b) producers and decomposers  
(c) Carnivores and decomposers  
(d) Herbivores and carnivores

**Ans :**

OD 2013

The most important characteristics of any ecosystem are energy flow and cycling of materials. Producers and decomposers are indispensable for any ecosystem. Producers trap solar energy and convert it into usable form as carbohydrates which are passed on to successive levels through food chains and food webs. The other important characteristic of the ecosystem is cycling of materials. This is called as bio-geochemical cycles, in which decomposers are most important because they will release the mineral nutrients back to the environment.

Thus (b) is the correct option.

7. Ozone saves the biosphere by absorbing the high energy radiation called  
(a) infrared                      (b) ultraviolet ray  
(c) X-ray                      (d) gamma ray

**Ans :**

OD 2012

Stratosphere zone of earth's atmosphere contains a layer of ozone ( $O_3$ ) which prevents the earth surface from about 99% of incoming solar UV-radiations.

Thus (b) is the correct option.

8. Which of the following can act as decomposers?

(a) fungi (b) lion  
(c) tiger (d) monkey

**Ans :**

Delhi 2013

Microorganisms are those which we can see only under a microscope such as bacteria, protozoa, and fungi act as decomposers.

Micro-organisms break down organic matter that is present in the bodies of dead and decaying matter and convert it into a simple substances and mixed in the soil.

Thus (a) is the correct option.

9. Which one of the following is an artificial ecosystem?

(a) Pond (b) Crop field  
(c) Lake (d) Forest

**Ans :**

(b) Crop field

10. In a food chain, the third trophic level is always occupied by

(a) carnivores (b) herbivores  
(c) decomposers (d) producers

**Ans :**

Delhi 2013

(a) carnivores

11. An ecosystem includes

(a) all living organisms  
(b) non-living objects  
(c) both living organisms and non-living objects  
(d) sometimes living organisms and sometimes non-living objects

**Ans :**

(c) both living organisms and non-living objects

12. In the given food chain, suppose the amount of energy at fourth trophic level is 5 kJ, what will be the energy available at the producer level ?

Grass → Grasshopper → Frog → Snake → Hawk

(a) 5 kJ (b) 50 kJ  
(c) 500 kJ (d) 5000 kJ

**Ans :**

(d) 5000 kJ

13. Accumulation of non-biodegradable pesticides in the food chain in increasing amount at each higher trophic level is known as

(a) eutrophication (b) pollution  
(c) biomagnification (d) accumulation

**Ans :**

(c) biomagnification

14. Depletion of ozone is mainly due to

(a) chlorofluorocarbon compounds  
(b) carbon monoxide  
(c) methane  
(d) pesticides

**Ans :**

(a) chlorofluorocarbon compounds.

15. Organisms which synthesis carbohydrates from inorganic compounds using radiant energy are called

(a) decomposers (b) producers  
(c) herbivores (d) carnivores

**Ans :**

(b) producers

16. In an ecosystem, the 10% of energy available for transfer from one trophic level to the next is in the form of

(a) heat energy  
(b) light energy  
(c) chemical energy  
(d) mechanical energy

**Ans :**

OD 2011

(c) chemical energy

17. Organisms of a higher trophic level which feed on several types of organisms belonging to a lower trophic level constitute the

(a) food web (b) ecological pyramid  
(c) ecosystem (d) food chain

**Ans :**

(a) food web

18. Flow of energy in an ecosystem is always

(a) unidirectional (b) bidirectional  
(c) multi directional (d) no specific direction

**Ans :**

OD 2014

(a) unidirectional

19. Excessive exposure of humans to UV-rays results in
- (i) damage to immune system
  - (ii) damage to lungs
  - (iii) skin cancer
  - (iv) peptic ulcers
- (a) (i) and (ii)                      (b) (ii) and (iv)  
 (c) (i) and (iii)                    (d) (iii) and (iv)

Ans :

- (c) (i) and (iii)

20. In the following groups of materials, which group(s) contains only non-biodegradable items ?
- (i) Wood, paper, leather
  - (ii) Polythene, detergent, PVC
  - (iii) Plastic, detergent, grass
  - (iv) Plastic, bakelite, DDT
- (a) (iii)                                  (b) (iv)  
 (c) (i) and (iii)                    (d) (ii) and (iv)

Ans :

- (d) (ii) and (iv)

21. Which of the following limits the number of trophic levels in a food chain ?
- (a) Decrease in energy at higher trophic levels
  - (b) Difficient food supply
  - (c) Polluted air
  - (d) Water

Ans :

Delhi 2011

- (a) Decrease in energy at higher trophic levels

22. Which of the statement is incorrect ?
- (a) All green plants and blue green algae are producers
  - (b) Green plants get their food from inorganic compounds
  - (c) Producers prepare their own food from inorganic compounds
  - (d) Plants convert solar energy into chemical energy

Ans :

- (b) Green plants get their food from inorganic compounds.

23. Which group of organisms are not constituents of a food chain?
- (i) Grass, lion, rabbit, wolf
  - (ii) Plankton, man, fish, grasshopper
  - (iii) Wolf, grass, snake, tiger

- (iv) Frog, snake, eagle, grass, grasshopper

- (a) (i) and (iii)                      (b) (iii) and (iv)  
 (c) (ii) and (iii)                    (d) (i) and (iv)

Ans :

OD 2011

- (c) (ii) and (iii)

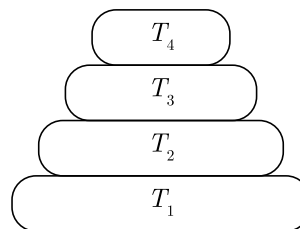
24. The percentage of solar radiation absorbed by all the green plants for the process of photosynthesis is about

- (a) 1%                                      (b) 5%  
 (c) 8%                                      (d) 10%

Ans :

- (a) 1%

25. In the given figure the various trophic levels are shown in a pyramid. At which trophic level is maximum energy available ?



- (a) T<sub>4</sub>                                      (b) T<sub>2</sub>  
 (c) T<sub>1</sub>                                      (d) T<sub>3</sub>

Ans :

- (c) T<sub>1</sub>

26. What will happen if deer is missing in the food chain given below ?

Grass → Deer → Tiger

- (a) The population of tiger increases
- (b) The population of grass decreases
- (c) Tiger will start eating grass
- (d) The population of tiger decreases and the population of grass increases.

Ans :

OD 2013

- (d) The population of tiger decreases and the population of grass increases.

27. The decomposer's in an ecosystem

- (a) convert inorganic material, to simpler forms
- (b) convert organic material to inorganic forms
- (c) convert inorganic materials into organic compounds
- (d) do not breakdown organic compounds

**Ans :**

Delhi 2016

- (i) These herbivores animals belong to primary consumer level, i.e., 2<sup>nd</sup> trophic level.
- (ii) 10% of producers.
- (iii) Soil, air, water and sun light (write any two),
- (iv) Solar energy.

10% of 100 J energy, that is, 10 J energy will transferred to the next trophic level of deer (herbivore). Applying ten percent law again, 10% of 10 J energy, that is 1 J energy will be available to the third trophic level of lion.



- 180.** (a) Write the importance of ozone layer in the environment, why is its protection essential ?  
 (b) Give the full form of CFC. Name two appliances in which it is used. How does CFCs effect the ozone layer ?

**Ans :**

Comp 2017

- (a) Ozone present in the upper region of the atmosphere (stratosphere) protects us from dangerous UV radiations of sun. Its is essential for the following reasons :
  - (i) Due to depletion of ozone layer, UV radiation reaches the earth. These UV radiation causes skin cancer, damage to eyes and immune system.
  - (ii) The depletion of ozone layer may also lead to variations in global rainfall, ecological disturbances and dwelling of global food supplies.
- (b) Full form of CFCs is chlorofluorocarbon compounds.  
 It is used in refrigerators, Fire extinguishers and aerosol sprayers.

Chlorofluorocarbon releases chlorine atom into the air which reacts with ozone (O<sub>3</sub>) gas present in the ozone layer and destroy it gradually. Due to this the ozone layer in the upper atmosphere has become thinner.

- 181.** What is percent law ? Explain with an example.

**Ans :**

Foreign 2017

During the transfer of energy through successive trophic levels in an ecosystem there is a loss of energy all along the path. The studies of transfer of energy in different food chains in a large number of ecosystem have revealed a uniform pattern of transfer of energy. What is given by 10 percent law. According to Lindeman's 10 percent law, only 10 percent of the energy entering a particular trophic level of organisms is available for transfer to the next higher trophic level.

**Example :** Consider the food chain.



Suppose 100 J of energy is available at the grass level (Producer level). Now according to ten percent law,

- 182.** State two differences between a consumer and a producer.

**or**

Give one difference between auto-trophs and heterotrophs.

**Ans :**

Foreign 2016

	<b>Consumers (Heterotrophs)</b>	<b>Producers (Autotrophs)</b>
1.	They cannot make food on their own. They depend on producers for their food.	They can make their food themselves from CO <sub>2</sub> and H <sub>2</sub> O by utilising solar energy.
2.	All animals are Consumers.	All green plants and blue-green bacteria are producers.
3.	They form the second, third and fourth trophic levels of the food chain.	They form the first trophic level of any food chain.

- 183.** Read the following paragraph and answer the questions given after paragraph.

Every tier of the food chain is called a trophic level. The producers are placed at the bottom of the trophic level. The herbivores are at second trophic level. Similarly, carnivores and higher animals are in the next levels. The reason behind the pyramid representation is that with every increasing level, the amount of energy per unit and the number of participants generally decreases.

- (i) At which trophic level are producers placed ?
- (ii) What is the change in the amount of energy per unit with every increasing level ?

**Ans :**

SQP 2016

- (i) The producers are placed at the bottom (first level) of the trophic level.
- (ii) With every increasing level, the amount of energy per unit and the number of participants generally decreases.



	A	B	C	D
(a)	q	r	p	s
(b)	p	q	s,	r,
(c)	s	r,	q,	p
(d)	r	q	s	p

**Ans :**

(c) A-s, B-r, C-q, D-p

- 33. Assertion (A) :** Accumulation of harmful chemicals is maximum in the organisms at the highest trophic level of a food chain.

**Reason (R) :** Harmful chemicals are sprayed on the crops to protect them from diseases and pests.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).  
 (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).  
 (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

**Ans :**

OD 2024

Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

Thus (b) is correct option.

- 34. Assertion (A):** The energy which passes to the herbivores does not come back to autotrophs.

**Reason (R):** The flow of energy in a food chain is unidirectional.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation (A)  
 (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of (A).  
 (c) Assertion (A) is true, but Reason (R) is false.  
 (d) Assertion (A) is false, but Reason (R) is true.

**Ans :**

OD 2023

The flow of energy is unidirectional. The energy that is captured by the autotrophs does not revert to the Sun and the energy which passes to the herbivores does not come back to autotrophs. As it moves progressively through the various trophic levels, it is no longer available to the previous level. Thus option (c) is correct option.

- 35. Assertion :** Aquariums are known as the man-made ecosystems.

**Reason :** Aquariums are created and maintained by

humans.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Aquariums are known as the man-made ecosystems because these are created and maintained by humans.

- 36. Assertion :** Consumers are present at the first trophic level.

**Reason :** Consumers or heterotrophs fix energy making it available for autotrophs.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(e) Both Assertion and Reason are false.

Autotrophs are present at the first trophic level because they fix solar energy, making it available for consumers or heterotrophs.

- 37. Assertion :** Aquatic food chain is the food chain present in water bodies.

**Reason :** The example of aquatic food chain is phytoplankton  $\longrightarrow$  zooplankton  $\longrightarrow$  fish  $\longrightarrow$  shark.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.



- (ii) Plastic
- (iii) In the long run it is much more harmful for life as it is gradually accumulating and polluting the whole planet.
- (iv) These wastes are so harmful that in the long run they make the land infertile and cause diseases like cancer.

**198.** Read the following case based passage and answer the questions given after passage.

Those waste materials which are decomposed or broken down by microorganisms, like bacteria, fungi and by other natural factors, such as air, moisture and temperature into simple molecular compounds are called biodegradable wastes. These waste materials are broken down into simple organic matters, so in a long run they become a part of energy cycle of earth thus causing relatively less harm to nature.

Example: Food material, plant and animal remains, etc.

Although these waste materials are decomposed with time but this time the duration may vary. And during the process they may give support to development of various harmful viruses, bacteria and insects thus causing great harm to the health of living beings in that area.

- (i) What is biodegradable waste ?
- (ii) Give example of biodegradable waste.
- (iii) Name the natural factors which help in decomposition of biodegradable waste.
- (iv) How is human health affected by decomposition of this waste ?

**Ans :**

- (i) Those waste materials which are decomposed or broken down by microorganisms, like bacteria, fungi and by other natural factors, such as air, moisture and temperature into simple molecular compounds are called biodegradable wastes.
- (ii) Examples: Paper, food material, plant and animal remains, etc.
- (iii) Natural factors, such as air, moisture and temperature into simple molecular compounds.
- (iv) During the process of decomposition, development of various harmful fungi, bacteria and insects takes place thus causing great harm to the health of living beings in that area.

**199.** Read the following case based passage and answer the questions given after passage.

Wherever we look, we find plastics-be it a food packet, a toy, storage packing, any furniture or an electronic

item. According to UN estimates, every year the world uses 500 billion plastic bags and half of this plastic is single-use plastic such as plastic bags, straws, cups, plates and bottles. Plastic is currently the biggest environmental concern. Plastic waste takes a lot of time to decompose naturally. It is harmful for animals who might eat it and can cause severe air pollution on burning. In oceans, pollution is mainly caused due to plastic wastes. Each year, at least eight million tonnes of plastic wastes are released into the oceans which means a full garbage truck every minute. This is damaging the marine life and also threatening human health.

- (i) Why has there been huge hue and cry against the use of single-use plastics?
- (ii) The pH of ocean water as measured using pH paper is found to be 5. What does this pH tell us about the ocean water?
- (iii) Based on the data shown in the graph that follows, which industrial sector produces the most plastic waste? Suggest the alternative that can be used in place of plastic in this sector?

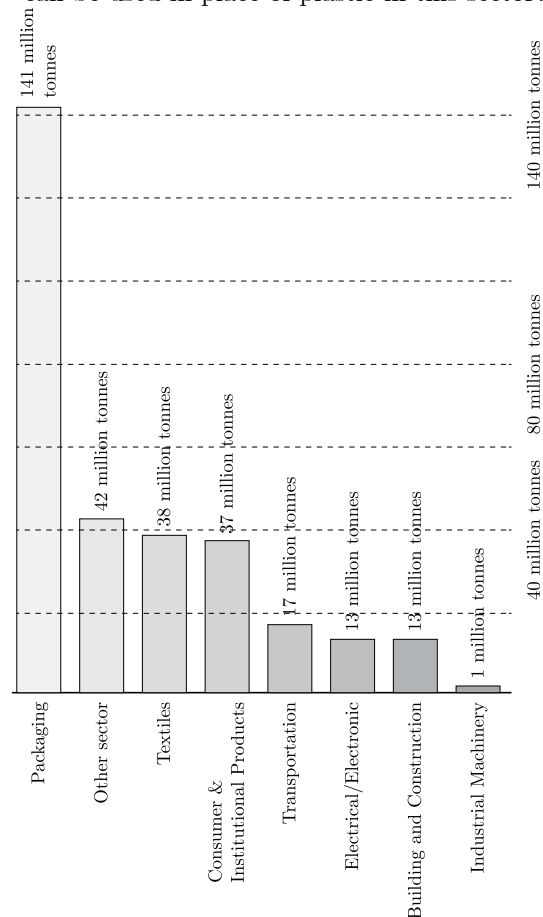


Figure: Plastic waste generation by industrial sector, 2015. Global plastic waste generation by industrial sector, measured in tonnes per year

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Herbivores obtain their food from plants. Hence, are known as first order carnivores. The carnivores like tiger cannot be preyed upon further, lie at the top of food chain and hence termed as top carnivores.

- 43. Assertion :** Flow of energy in a food chain is unidirectional.

**Reason :** Energy captured by autotrophs does not revert back to the solar input and it passes to the herbivores.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

The flow of energy through different steps in the food chain is unidirectional. This means that energy captured by autotrophs does not revert back to the solar input and it passes to the herbivores.

- 44. Assertion :** First trophic level in a food chain is always a green plant.

**Reason :** Green plants are called producers.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Green plants are producers. The first trophic level in a food chain is a producers i.e. those organisms which produce food by photosynthesis.

- 45. Assertion :** Decomposers keep the environment clean.

**Reason :** They recycle matter by breaking down the organic remains and waste products of plants and animals.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Decomposers keep the environment clean by decomposing or consuming the dead remains of other organisms.

- 46. Assertion :** CFCs deplete the ozone layer.

**Reason :** CFCs are used as refrigerants and in fire extinguishers.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Ozone layer is getting depleted at the higher levels of the atmosphere due to effect of chlorofluorocarbons (CFCs) which are used as refrigerants and in fire extinguishers.

## ONE MARK QUESTIONS

- 47. What is an ecosystem ?**

**Ans :**

OD 2017, Delhi 2014

An ecosystem is a self sustaining system where biotic organisms and abiotic environment of various communities interact with each other and exchange materials.

Ans :

(b) convert organic material to inorganic forms

28. If a grasshopper is eaten by a frog, then the energy transfer will be from

- (a) producer to decomposer  
(b) producer to primary consumer  
(c) primary consumer to secondary consumer  
(d) secondary consumer to primary consumer

Ans :

(c) primary consumer to secondary consumer

29. Disposable plastic plates should not be used because

- (a) they are made of materials with light weight  
(b) they are made of toxic materials  
(c) they are made of biodegradable materials  
(d) they are made of non-biodegradable materials

Ans :

(d) they are made of non-biodegradable materials

30. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Tundra	(p)	This area on the planet has permanently frozen soil that does not allow for the growth of large plants.
(B)	Grassland	(q)	This area on the planet has few trees, very fertile soil and usually many species of grasses. The rainfall amounts are low and the rain is more abundant during the summer months.
(C)	Tropical rainforest	(r)	This biome is usually located near the equator. Rainfall amounts are very high, vegetation is dense and soil quality is poor.

	Column I		Column II
(D)	Savanna	(s)	A type of grassland biome that experiences rainy seasons and long periods of drought.

	A	B	C	D
(a)	q	r	p	s
(b)	p	q	r,	s
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

(b) A-p, B-q, C-r, D-s

31. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Grass	(p)	Primary carnivore
(B)	Grasshopper	(q)	Secondary carnivore
(C)	Frog	(r)	Producer
(D)	Hawk	(s)	Primary consumer

	A	B	C	D
(a)	q	r	p	s
(b)	p	q	s,	r,
(c)	r	s,	p,	q
(d)	r	q	s	p

Ans :

(c) A-r, B-s, C-p, D-q

32. Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Eastern Ghats	(p)	Western and Eastern
(B)	Estuarine eco-system	(q)	Rajasthan, Punjab and part of Gujarat
(C)	Indus plains	(r)	West Bengal and Andaman Nicobar
(D)	Arctic zone	(s)	Cape Comorin to Gujarat

- 66.** What will be the amount of energy available to the organisms of the 2nd trophic level of a food chain, if the energy available at the first trophic level is 10,000 joules ?

**Ans :** Delhi 2016  
1000 J.

- 67.** Name two substances which could not be broken down by the action of enzymes or microorganisms.

**Ans :** Foreign 2017  
(a) DDT,  
(b) Plastics.

- 68.** How many atoms of oxygen are there in ozone ?

**Ans :** Delhi 2016  
Three atoms.

- 69.** What are the steps of food chain called ?

**Ans :** OD 2015, OD 2010  
Trophic levels.

- 70.** Which organisms are called producers ?

**Ans :** OD 2014  
Green plants and cyanobacteria.

- 71.** The first trophic level in a food chain is always a green plant. Why ?

**Ans :** Delhi 2015  
Because only autotrophs can utilise the radiant energy of the sun and transform it to chemical form as food during photosynthesis.

- 72.** List two main components of our environment.

**Ans :** SQP 2014  
Abiotic and biotic.

- 73.** List two man-made ecosystems.

**Ans :** Foreign 2015  
Aquarium and Park.

- 74.** Which of the following are always at the second trophic level of food chains ? Carnivores, Autotrophes, Herbivores.

**or**

Which of the following are always at the second trophic level of food chains ? Carnivores, Autotrophs, Herbivores

**Ans :** OD 2014  
Herbivores.

- 75.** What is the self-sustaining unit of environment ?

**Ans :** Delhi 2015  
Ecosystem.

- 76.** Write full form of UNEP.

**Ans :** Comp. 2014  
United Nations Environment Programmer.

- 77.** Name the group of chemical compounds which adversely affect the ozone layer.

**or**

Name the type of compounds which are used as refrigerants and in fire extinguishers and deplete the ozone layer in the atmosphere.

**Ans :** OD 2015, OD 2011  
CFCs (Chlorofluorocarbons).

- 78.** List two biotic components of a biosphere.

**Ans :** OD 2014  
Animals and plants.

- 79.** Which of the following belongs to the first trophic level ? Cockroach, wheat plant, cow, lion.

**Ans :** Delhi 2015  
Wheat plant.

- 80.** Define an ecosystem.

**Ans :** Delhi 2014  
A lake is considered as a natural ecosystem as it consists of both abiotic and biotic components. Which interact with each other.

- 81.** What is environment ?

**Ans :** Foreign 2013  
Environment is the physical, chemical and biological conditions of the region in which an organism resides.

- 82.** We often use the word environment what does it mean ?

**Ans :** OD 2014  
Environment is the physical, chemical and biological conditions of the region in which an organism resides.

- 83.** Which one of the following organisms comprising a food chain will possibly have the maximum concentration of harmful chemicals in its body ? Peacock, Frog, Grass, Snake, Grasshopper.

the aquatic life. If eaten by stray animals, the plastic bags can choke their alimentary canal.

- (b) Stop using polythene bags and start using bags made of cloth or jute.

One must collect the used and discarded items of plastic and send them to the respective industries for making fresh plastic items.

The use of disposable items like cold drink cans, stationary items, glasses should be avoided. Have freshly squeezed juice or eat fruit instead of buying juice in plastic bottles. It is healthier too.

Students should carry tiffin and water in steel containers instead of plastic containers.

Encourage the use of ink pens instead of ball pens made of plastic.

- (c) Students can :

- (i) Create a vibrant school board about the improvement of environment;
- (ii) Holding a recycling challenge to clean the school and design the recycle bin;
- (iii) Students should create and put up signs and posters around the school about the harmful effects of using plastic.;
- (iv) Speeches in morning assembly, debate competitions in the favour of environment safety should be conducted;
- (v) Start an Eco or Sustainable Club; and
- (vi) Make new recycling and composting collection stations in the school and nearby localities.

- 174.** Both the energy and mineral nutrients are continuously being transferred in the biosphere. Do these two differ in their direction of transfer? What special points are noteworthy in respect of transfer of energy at which step ?

**Ans :**

SQP 2017, Delhi 2014

Energy transfer takes place only in one direction. i.e., it is unidirectional. For example, the solar energy is trapped by plants to produce organic nutrients.

For mineral nutrients, the transfer is cyclic. It is transferred from producers to consumers and after their death, to the soil with the help of decomposers. From the soil these are again taken up by the producers.

**Special points about energy transfer :**

- (a) Solar energy is converted into chemical energy by green plants. This is the first trophic level.

- (b) There is a progressive decline in the energy available for transfer along the food chain.
- (c) Only 10% energy is transferred from one trophic level to the other and remaining energy is lost.

- 175.** Describe flow of energy in an ecosystem.

**Ans :**

OD 2017

The energy transfer process can be described in terms of the following steps :

- (a) Green plants called producers absorb solar energy and convert  $\text{CO}_2$  and water into carbohydrates (food) as chemical energy.
- (b) A major part of this energy is used up by the plants for their metabolic activities and also for their growth.
- (c) Herbivores eat these plants and 10% the chemical energy stored in plants as food gets transferred to them. A part of this energy is utilised by herbivores for their own requirements.
- (d) When carnivores eat herbivores, the energy gets transferred to them is also 10%.

At every step of energy transfer, only a part of the total energy is passed to the next trophic level. The unutilised energy is lost to the surroundings as heat energy.

- 176.** "Energy flows in a food chain in unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.

**Ans :**

OD 2016, Delhi 2013

Decomposer decompose the complex organic molecules present in the dead plants and animals to the simple molecular level. Thus, decomposer help the return of various nutrients to the soil/water so that these are available to the producers once again. So, if decomposer are removed from the earth, the soil/water will become deficient in nutrients and the operation of various mineral cycles will get affected.

In a food chain the energy moves progressively through the various trophic levels. It is no longer available to the previous level (autotrophs) and the energy captured by the autotrophs does not go back to the solar input and also quantity of total available energy decreases gradually on each trophic level due to 10% law. Hence, the flow of energy is unidirectional.

**Biological magnification :** Means accumulation of non-biodegradable chemicals like pesticides (DDT) in the living organisms in a food chain. The increase

- 100.** Which two of the following belong to the same trophic level ?

Cockroach, spider, hawk, lizard.

**Ans :**

OD 2012, OD 2007

Lizard and spider.

- 101.** The depletion of ozone layer is a cause of concern. Why ?

**Ans :**

OD 2013

Ozone layer is very important for the existence of life on earth because it prevents harmful ultraviolet radiations coming from the sun to reach the earth.

- 102.** Name two activities which form waste materials.

**Ans :**

Delhi 2013, OD 2010

- (a) Preparation of food.
- (b) Industrial activities.

- 103.** Which one of the following belonging to a food chain is likely to have maximum concentration of harmful non-biodegradable chemicals in its body ?

Phytoplankton, Fish, Kingfisher.

**Ans :**

Foreign 2013

Kingfisher due to being top consumer and effect of biomagnification.

- 104.** Write one negative effect on the environment of affluent life style of few persons of a society.

**Ans :**

Delhi 2012

Affluent life style results in generation of excessive waste materials.

- 105.** Why are green plants called producers ?

**or**

Producers always occupy the first trophic level in any food chain. Why ?

**Ans :**

Comp 2013

Because green plants prepare food by photosynthesis by using solar energy in the presence of chlorophyll.

- 106.** Do the autotrophs (or producers) produce energy ?

**Ans :**

Foreign 2012

No. Producers (or autotrophs) do not produce energy directly. They convert the solar energy into chemical energy as food.

- 107.** “Man is only a consumer.” Justify this statement.

**Ans :**

OD 2011

Man does not produce his own food. He feeds on stored food prepared by plants and on animals and their products, i.e., humans are heterotroph consumers.

- 108.** What are consumers ?

**Ans :**

OD 2012

The organisms which consume food made by producers directly or indirectly are called consumers. Consumers do not make their own food. All animals including human beings are consumers. Common consumers are man, lion, cow, buffalo, etc. The consumers are also termed as heterotrophs.

- 109.** What are omnivores ? Give one example.

**Ans :**

Delhi 2013

Organisms which feed both on plants as well as animals are called omnivores. Man eats both meat (animal), and plants (vegetables and cereals). Therefore, man is an omnivores.

## TWO MARKS QUESTIONS

- 110.** Plants → Deer → Lion

In the given food chain, what will be the impact of removing all the organisms of second trophic level on the first and third trophic level? Will the impact be the same for the organisms of the third trophic level in the above food chain if they were present in a food web? Justify.

**Ans :**

OD 2024

Plants → Deer → Lion

If we remove deer from the second trophic level, the population of plants will drastically increase while the population of lion will decrease.

No, the impact will not be same because a food web contains many other alternatives which increase the stability of the ecosystem. It is easy to overcome a disturbance in it.

- 111.** Write the percentage of

- (i) solar energy captured by the autotrophs and
- (ii) energy transferred from autotrophs to the next level in a food chain.

**Ans :**

OD 2023

- (i) The autotrophs capture about 1% of the solar energy that falls on their leaves for the process of photosynthesis.
- (ii) According to “The 10% Rule” , there is only 10% flow of energy from one trophic level to the next higher level so, only 10% energy will get transferred from autotrophs to the herbivores. next level in a food chain.



48. State one advantage of using disposable paper cups over disposable plastic cups.

**Ans :** OD 2016  
Disposable paper cups are biodegradable whereas, disposable plastic cups are non-biodegradable.

49. What are the two reasons of greater amounts of waste material, generation ?

**Ans :** Delhi 2017  
(a) Improvement in our life style.  
(b) Following western culture.

50. Why has there been a large hue and cry against the use of CFCs ?

**Ans :** OD 2017, Delhi 2012  
It is so because CFCs when reach upper layers of atmosphere cause ozone layer depletion and allows harmful UV rays to enter into earth's lower atmosphere.

51. Why is forest considered a natural ecosystem ?

**Ans :** Foreign 2017, Delhi 2014  
Forests are considered as natural ecosystem because they are natural regions that have species of plants and animals that interact with each other and are interdependent on each other. These are self-sustaining ecosystem free of human interference.

52. Name any two non-biodegradable wastes.

**Ans :** Foreign 2016  
Plastic bottle and polythene.

53. Which of the following belong to the first trophic level?

Grasshopper, Rose plant, Neem plant, Cockroach, Vulture.

**Ans :** SQP 2017, OD 2011  
Rose plant and Neem plant.

54. Why is a lake considered to be a natural ecosystem ?

**Ans :** Delhi 2016  
A lake is considered as a natural ecosystem as its consists of both abiotic and biotic components. Which interact with each other.

55. How do the changes take place in environment ?

**Ans :** OD 2017  
Environment changes occurs both due to some natural events and human activities.

56. Name two instruments or devices in which CFCs are used.

**Ans :** Comp 2016, OD 2011  
(a) Refrigerators,  
(b) Fire extinguishers.

57. In the following food chain, 100 J energy is available to the lion. How much energy was available to the producer ?

Plants  $\longrightarrow$  Deer  $\longrightarrow$  Lion.

**Ans :** Delhi 2017  
Plant (producer) will have 1000 J, while deer will have 100 J.

58. What is the formula of ozone ?

**Ans :** Delhi 2016  
 $O_3$

59. Which of the following materials are biodegradable ?

Glass, Leather, Glucose, Silver foil.

**Ans :** Foreign 2014  
Glucose and leather.

60. In a food chain of frog, grass, insect and snake, assign trophic level to frog.

**Ans :** OD 2016  
Grass  $\xrightarrow{I}$  insect  $\xrightarrow{II}$  Frog  $\xrightarrow{III}$  Snake  $\xrightarrow{IV}$  (Trophic level)

61. What is the nature of ozone

**Ans :** SQP 2017  
It is deadly poisonous and highly reactive oxidant.

62. Select the biodegradable wastes from the following : DDT, Crop's residue, Leather and Glass.

**Ans :** Comp 2016, OD 2012  
Crop's residue and leather.

63. Give one protective function of forests.

**Ans :** OD 2017  
Reduce atmospheric pollution.

64. Give some examples of ecosystem.

**Ans :** Delhi 2015  
Forest, pond, ocean, etc.

65. Name the organisms that form the first trophic level.

**Ans :** Delhi 2017, OD 2013  
Producers such as plants, algae, etc.



- 119.** Aquarium need to be cleaned once in a while whereas ponds or lakes do not require any cleaning : Explain

**Ans :**

SQP 2017

Aquarium need to be cleaned because it is not a self-sustained natural ecosystem. It is man-made or artificial ecosystem

Ponds and lakes are self-sustained natural ecosystem in which nutrient cycle and energy flow occur naturally.

- 120.** If a lake is contaminated with pesticides, which one of the following organisms will contain in its body the maximum concentration of pesticides and why ? Small fish, Pelicans, Zooplanktons, Phytoplanktons, Big fish.

**Ans :**

OD 2016, Delhi 2011

Pelican birds will contain the maximum concentration of pesticides in its body as it is at the highest trophic level (top consumer) in the food chain of the given organisms. It happens due to biomagnification, i.e., amount of harmful chemicals magnifies successively in the higher trophic levels.

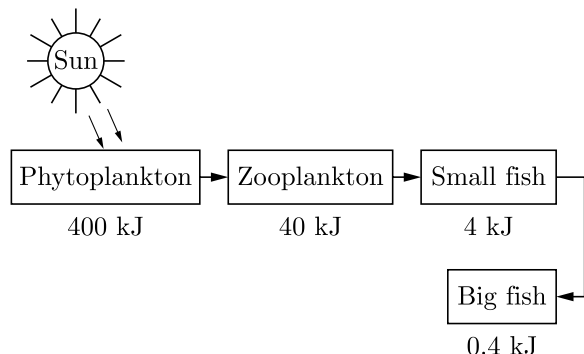
- 121.** Consider the food chain : Grass  $\longrightarrow$  Deer  $\longrightarrow$  Lion. What will happen if lions are removed from the above food chain ?

**Ans :**

Delhi 2016

Removal of lion (carnivorous) from the above food chain will cause disturbance in environmental balance and will increase the number of deer (herbivorous) to much an extent that they will eat up the whole grass. The density of product erst like grass will be very much reduced and this will turn the area into a desert which eventually result in death of all dears due to lack of food.

- 122.** Consider the following figure :



What is depicted in the above mentioned scheme ?

**Ans :**

OD 2017

The given scheme indicates that in a food chain each trophic level transfers only 10% of total energy to next trophic level which gradually decrease the total amount of energy in food chain rapidly according to the Lindeman's 10% law.

- 123.** What are the heterotrophs ?

**Ans :**

Delhi 2017

The organisms which cannot make their own food from the raw materials such as  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  etc. using sunlight are called heterotrophs. Heterotrophs depend on other organisms for their food. All animals including human beings are heterotrophs. Heterotrophs are also termed as consumers.

- 124.** What will happen to the garbage and dead animals and plants in absence of microorganisms ?

**Ans :**

OD 2016

The garbage and dead plants and animals will not decompose if there are no decomposer, i.e., saprophytic bacteria and fungi. The bodies cannot be decayed in the absence of bacteria or fungus and nutrients will not get recycled.

- 125.** In a certain study conducted on occurrence of DDT along food chains in an ecosystem, the concentration of DDT in grass was found to be 0.5 ppm (parts per million), in sheep it was 2 ppm and in man it was 10 ppm. Why was the concentration of DDT maximum in case of man ?

**Ans :**

Foreign 2017

DDT is non-biodegradable chemical which gradually accumulates in fatty tissue at each trophic level. Since man is at the highest trophic level, there is maximum accumulation of DDT in him. It happens due to biological magnification.

- 126.** What are the producers ? Give suitable examples.

or

Define autotrophs.

**Ans :**

OD 2016, OD 2010

Producers or autotrophs are the organisms that can make their own food from carbon dioxide and water in the presence of sunlight and chlorophyll. This process is called photosynthesis in which producers convert sunlight in the form of food (chemical energy).

**Examples :** Green plants and algae are autotrophs or producers.

- Ans :** Comp 2015  
Peacock due to being top consumer and effect of biomagnification.
- 84.** Phytoplanktons → Zooplanktons → Fish → Fish-eating birds.  
In the above food chain, which of the organisms will have :  
(a) Maximum available energy ?  
(b) Maximum concentration of pesticides ?  
**Ans :** Comp 2014, Delhi 2010  
(a) Phytoplanktons.  
(b) Fish-eating birds.
- 85.** Name the disease caused in human beings due to a depletion of ozone layer in the atmosphere.  
**Ans :** OD 2015  
Skin cancer.
- 86.** Mention any two methods of garbage disposal.  
**Ans :** OD 2014  
Recycle and reuse.
- 87.** Give the full form of CFC.  
**Ans :** Delhi 2013  
CFCs (Chlorofluorocarbons).
- 88.** In a food chain, which trophic level has the maximum number of organisms?  
**Ans :** Delhi 2014  
First trophic level.
- 89.** Name two abiotic factors.  
**Ans :** Delhi 2013  
(i) Light,  
(ii) Soil.
- 90.** What is the series formed of organisms feeding one another called ?  
**Ans :** Delhi 2012, OD 2010  
Food chain.
- 91.** Use of paper bags is more environment friendly than the use of polythene bags for packaging. Justify.  
**Ans :** OD 2013, OD 2010  
Because, paper bags are biodegradable while polythene bags are not.
- 92.** Which of the following in a food chain will have maximum concentration of harmful chemicals in its body ?  
Small fish, Zooplankton, Bird, Phytoplankton.  
**Ans :** OD 2012  
Bird.
- 93.** Why are green plants called producers ?  
**Ans :** Delhi 2013  
Because the green plants (autotrophs) prepare food through photosynthesis by using solar energy.
- 94.** Name any two main environmental problems ?  
**Ans :** Delhi 2012  
(a) Depletion of ozone layer.  
(b) Disposal of wastes.
- 95.** How is depletion of ozone layer in the atmosphere responsible for causing skin cancer ?  
**Ans :** Foreign 2013  
Ultraviolet rays of sun are harmful for our DNA and causes unwanted mutation resulting in skin cancer. Which can pass through ozone hole.
- 96.** Is there any exchange of matter and energy between living and non-living components of an ecosystem ?  
**Ans :** SQP 2012  
Yes, the matter and energy are exchanged between the living and non-living components of an ecosystem.
- 97.** Give example of a food chain of four trophic levels that exists in a grassland.  
**Ans :** Delhi 2013  
Food chain :  
Grass → Rabbit → Fox → Tiger  
(i) (ii) (iii) (iv)
- 98.** What is the function of ozone in the upper atmosphere?  
**Ans :** SQP 2011  
Ozone shields the surface of the earth from ultraviolet rays from the sun.
- 99.** Name some of the waste materials.  
**Ans :** OD 2013  
Vegetable and fruits peels, milk packet, polythene, paper, medicine strips, etc.

So, if decomposers are removed from the earth, the soil/water will become deficient in nutrients and the operation of various mineral cycles will get affected.

**137.** Describe the structure of an ecosystem.

or

What are the structural components of an ecosystem?

**Ans :**

Delhi 2015, OD 2013

An ecosystem consists of a non-living (abiotic) environment and a living (biotic) biological community.

The non-living environment of an ecosystem consists of the components like water, soil, light, carbon dioxide, oxygen, nitrogen, phosphorus and other elements.

The living community is made up of plants, animals and micro-organisms.

**138.** Give two examples each of producers, consumers and decomposer.

**Ans :**

Delhi 2015

**Producers :** Green plants such as sugarcane plant, wheat plant, etc.

**Consumers :** Animals such as cow, goat, etc.

**Decomposer :** Certain saprophytic bacteria and fungi. The microorganisms comprising bacteria and fungi breakdown the dead bodies into simpler forms and recycle nutrients in environment. These microorganisms are called decomposer.

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**139.** What are the first order consumers ?

**Ans :**

OD 2015

The animals which eat plants directly as their food, are termed as primary or first order consumers. Therefore, herbivores are first order consumers.

**140.** What are carnivores ? Name a few of them.

**Ans :**

Foreign 2013

The organisms which feed only on animals are called carnivores or carnivorous animals. Lion, jackal, hawks, etc. are carnivorous animals.

**141.** Draw a schematic diagram to show the food chains.

**Ans :**

SQP 2014

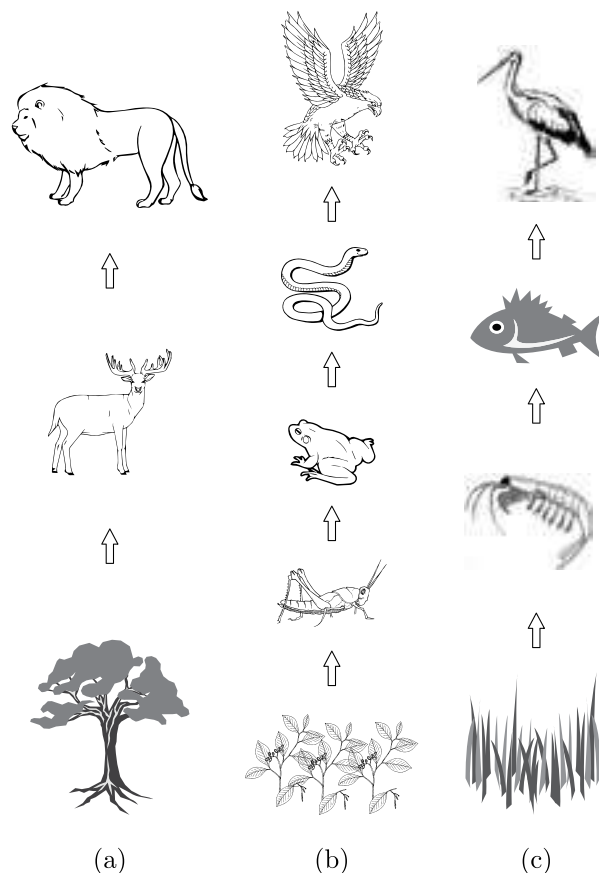


Figure: Food chain in Nature (a) in forest, (b) in grassland and (c) in a pond.

**142.** Name different types of heterotrophs.

**Ans :**

OD 2014

There are four types of heterotrophs. These are,

- Herbivores :** These are also called primary or first order consumers.
- Carnivores :** These are also called secondary or second order consumers.
- Omnivores.
- Parasites.

**143.** Write harmful effects of ultraviolet radiations.

**Ans :**

Delhi 2015

Harmful effects of ultraviolet radiations are as follows:

- It causes skin cancer.
- It causes sun burn.
- It causes eye disease like cataract.

155. (i) Create a terrestrial food chain depicting four trophic levels.  
 (ii) Why do we not find food chains of more than four trophic levels in nature?

Ans :

Delhi 2020

- (i) Terrestrial food chain

Grass  $\xrightarrow{\text{I}}$  Insect  $\xrightarrow{\text{II}}$  Frog  $\xrightarrow{\text{III}}$  Bird  $\xrightarrow{\text{IV}}$

- (ii) According to the 10% law, the amount of the energy available will not be sufficient for the survival of the organism in the 5th trophic level.

156. How will you create an artificial aquatic ecosystem, which is self-sustainable?

Ans :

OD 2020

An artificial aquatic ecosystem:

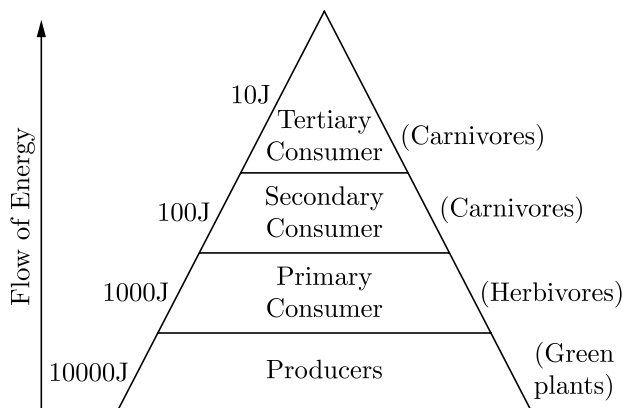
- (i) Take a large jar filled with water, oxygen, food and aquatic plants and animals.  
 (ii) Supply oxygen into water by setting an oxygen pump.  
 (iii) Add some fish food into the jar.  
 (iv) Aquatic plants (like algae) or producers provide  $O_2$  during photosynthesis.  
 (v) Aquatic animals/consumers release  $CO_2$  for the process of photosynthesis.  
 (vi) Decomposers (bacteria and fungi) decompose the dead-decaying organic matter of the plants and animals. These act as natural cleansing agents.

157. Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem.

Ans :

Delhi 2019

Ecosystem refers to the interaction of all the biotic and abiotic components present in a particular area of an environment. Energy flow across the various trophic levels of a food chain follows the Lindeman's 10% law. According to this, only 10% of the energy available to a trophic level is passed on to the next trophic level.



- (i) For example 10,000 J. energy is available to producer.  
 (ii) Then 1000 J energy will be available to primary consumer.  
 (iii) 100 J energy will be available to secondary consumer.  
 (iv) 10 J energy will be available to tertiary consumers.

158. (a) "Improvements in our lifestyle have resulted in greater amounts of waste generation." Give two examples to support the given statement. Suggest one change that we can incorporate in our lifestyle in order to reduce non-biodegradable waste.

- (b) The following organisms form a food chain.  
 Insect, Hawk, Grass, Snake, Frog

Which of these will have highest concentration of non-biodegradable chemicals? Name the phenomenon.

Ans :

Delhi 2018, Delhi 2015

- (a) Now-a-days, changes and improvement in our lifestyle has resulted in more and more use of disposable items like polythene bags, plastic items and paper plates etc. These materials are increasing the generation of wastes.

**Suggestion :** We can reduce non-biodegradable wastes by adopting techniques like recycling and reuse. We must encourage the reuse of plastic and glass containers to store the household items. Packaging materials should be made out of recyclable materials like cloth and paper.

- (b) The proper sequence of this food chain is:  
 Grass  $\rightarrow$  Insect  $\rightarrow$  Frog  $\rightarrow$  Snake  $\rightarrow$  Hawk  
 The last trophic level 'Hawk' will have highest concentration of non-biodegradable chemicals. This phenomenon is called Biomagnification.

159. Explain some harmful effects of agricultural practices on the environment.

Ans :

OD 2017

- (i) Excessive use of fertilizers changes the properties of soil and kills useful microbes.  
 (ii) Excessive use of non-biodegradable chemical pesticides leads to biological magnification.  
 (iii) Extensive cropping causes loss of soil fertility.  
 (iv) Excess use of ground water for agriculture lowers the water table.  
 (v) Damage to natural ecosystem/habitat due to soil and water pollution.

various organisms is called a food web. In ecosystem food chains do not operate independent of each other, but form an interconnected network.

A typical food web is shown in the following Fig.

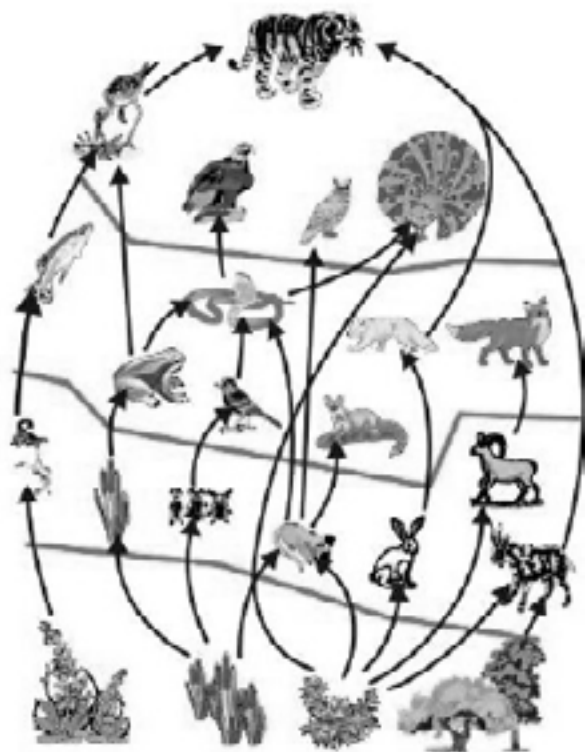


Figure: Food web, consisting of many food chains.

152. Write differences between food chain and food web.

Ans :

OD 2014

	Food chain	Food web
1.	It is a list of organisms showing 'who eats whom'.	It is a network of a large number of food chains existing in an ecosystem.
2.	All food chains begin with a producer green plant (or grass), which is the ultimate source of all foods and end at top consumer.	A food web has many intercrosses and linkages among the various producers and consumers.

153. Observe the food chain :

Plant (1000 kJ)  $\longrightarrow$  Goat  $\longrightarrow$  Lion.

(a) If autotrophs occupying the first trophic level are called producers, what are herbivores called as ?

(b) How much energy does the lion get in the above food chain ?

Ans :

Delhi 2013

(a) Herbivores are called primary consumers.

(b) According to 10% law, energy available to goat

$$= 10\% \text{ of } 1000 \text{ kJ}$$

$$= 100 \text{ kJ}$$

Similarly, energy available to lion

$$= 10\% \text{ of } 100 \text{ kJ}$$

$$= 10 \text{ kJ}$$

### THREE MARKS QUESTIONS

154. A gas 'X' which is a deadly poison is found at the higher levels of atmosphere and performs an essential function.

Name the gas and write the function performed by this gas in the atmosphere. Which chemical is linked to the decrease in the level of this gas? What measures have been taken by an international organization to check the depletion of the layer containing this gas?

Ans :

OD 2024

Ozone gas is present in the stratum of atmosphere called stratosphere. At higher levels of atmosphere, it absorbs most of harmful ultraviolet radiations coming from the Sun.

Chlorofluorocarbons, halogen, carbon tetrachloride, methylbromide, etc. are linked to the decrease in the level of ozone.

**Preventive measures :**

- Use alternative sources of energy instead of fossil fuels.
- Use of CFCs in refrigerators and air-conditioners should be banned. Rather, CFCs should be replaced with alternatives such as hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFC's).
- The products which contain chlorine and harmful ozone-depleting chemicals should be banned.
- Use of eco-friendly biopesticides, bioinsecticides, etc., instead of chlorinated insecticides and pesticides to control various pests and diseases.
- Increase public awareness about the issue.

dry marble chip can be found before and after the experiment. Students who did this experiment also placed marble chips in distilled water overnight.

- (i) Where do sulphur oxides and nitrogen oxides in the air come from?
- (ii) Why did the students put marble in distilled water?
- (iii) If the marble chip being immersed in vinegar as 2.0 g. What will be its mass when it is removed and dried next day?
  - (a) Less than 2.0 g      (b) Exactly 2.0 g
  - (c) Between 2.0 g, and 2.4, (d) More than 2.4 g
- (iv) Write any two eco-friendly activities which are good for environment.

**Ans :**

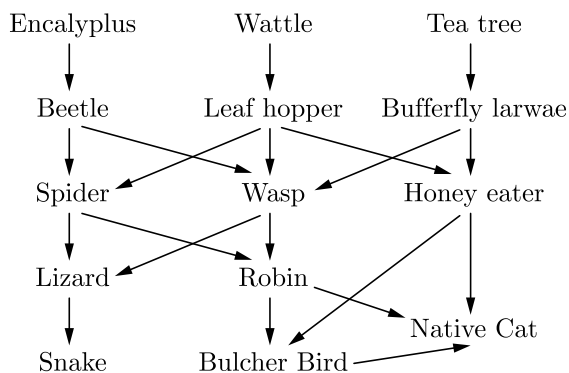
- (i) Car exhausts, factory emissions and burning fossil fuels such as coal release harmful gas that cause air pollution.
- (ii) Students used water to show that acid (vinegar) is necessary for the reaction. It acted as a control.
- (iii) (a) Less than 2.0 g
- (iv) a. Using windmills to generate electric power for irrigation.  
b. Using paper bags instead of polythene bags.

**191.** Read the following case based passage and answer the questions given after passage.

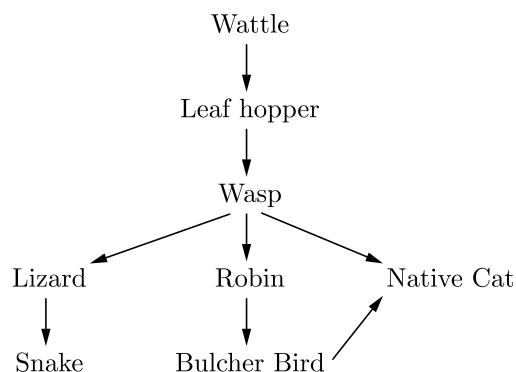
An ecosystem that retains a high biodiversity is much more likely to adapt to human-caused environment change than in one that has little.

Consider the two food webs shown below.

**Food Web A**



**Food Web B**



Food web B represents a situation with very low biodiversity, where at some levels the food path involves only a single type of organism. Food web A represents a more diverse ecosystem, as a result, there are many more alternative feeding pathways. Generally, loss of biodiversity should be regarded a serious issue, not only because the organism that have become extinct represent a big loss but also because the organisms that remain have become more exposed to extinction in the future.

- (i) Food webs A and B are in different locations. If leaf hoppers died out in both locations, what would be the effect on the food webs?
- (ii) The first trophic level in a food chain is always a green plant. Why?
- (iii) In food web A only two animals have three immediate food sources. Which two animals are they?
- (iv) Flow of energy in an ecosystem is always
  - (a) unidirectional
  - (b) bidirectional
  - (c) multi directional
  - (d) no specific direction

**Ans :**

- (i) Both the food webs would be disrupted to some extent because leaf hoppers occupy the first trophic level but that effect would be greater in food web B because the wasp has only one food source in this web.
- (ii) The first trophic level is always a green plant because only plants can utilize the radiant energy of the sun and transform it to chemical form as food during photosynthesis.
- (iii) Native cat and wasps.
- (iv) (a) unidirectional



**160.** You have been selected to talk on “ozone layer and its protection in the school assembly” on “Environment Day”

- (i) Why should ozone layer be protected to save the environment ?
- (ii) List any two ways that you would stress in your talk to bring in awareness amongst your fellow friends that would also help in protection of ozone layer as well as the environment.

**Ans :**

OD 2016

Ozone layer helps in shielding the Earth from the harmful UV radiations coming from sun. If ozone layer gets depleted UV radiations can directly reach the Earth's surface and drastically affect the life on Earth.

**Ozone layer can be protected by :**

- (a) Stop the release of Chlorofluorocarbon.
- (b) Reduce the usage of air conditioner.
- (c) Removing the pollutant nitrogen monoxide.

- 161.** (a) What are decomposers ?  
(b) State in brief the role of decomposers in the environment.

**Ans :**

Delhi 2017

- (a) **Decomposers :** Decomposers decompose the complex organic molecules present in the dead plants and animals to the simple molecular level. Thus, decomposers help the return of various nutrients to the soil/water so that these are available to the producers once again. So, if decomposers are removed from the earth, the soil/water will become deficient in nutrients and the operation of various mineral cycles will get affected.

- (b) **Role of decomposers :** The differences between autotrophs and decomposers are :

	Autotrophs	Decomposers
1.	Autotrophs make their food from CO <sub>2</sub> , H <sub>2</sub> O and minerals in the presence of sunlight e.g., green plants.	Decomposers decompose the complex molecules present in the bodies of the dead plants and animals e.g., saprophytic bacteria and fungi.
2.	Autotrophs convert simple inorganic substances into complex organic substances.	Decomposers breakdown the complex organic substances into simple inorganic substances.

- 162.** Explain the phenomenon of Biological Magnification. How does it affect organisms belonging to different trophic levels particularly the tertiary consumers ?

**Ans :**

Delhi 2016

**Biological magnification :** Means accumulation of non-biodegradable chemicals like pesticides (DDT) in the living organisms in a food chain. The increase in concentration of harmful chemicals in the body of living organisms of each trophic level of a food chain is called biological magnification.

Pesticides such as DDT, when enters the food chain, the plants absorb these harmful chemicals from soil along with water and minerals. They enter the food chain at producer level and then transfers to the next trophic level. In animals, DDT gets accumulate in fatty tissue, thus, continuous consumption of same plants results in higher concentration of DDT in animals. The tertiary consumers or top carnivorous animal get highest levels of these chemicals.

- 163.** Give reason to justify the following:

- (i) The existence of decomposer is essential in a biosphere.
- (ii) Flow of energy in a food chain is unidirectional.

**Ans :**

Foreign 2015, Delhi 2014

- (i) Decomposer decompose the complex organic molecules present in the dead plants and animals to the simple molecular level. Thus, decomposer help the return of various nutrients to the soil/water so that these are available to the producers once again. So, if decomposer are removed from the earth, the soil/water will become deficient in nutrients and the operation of various mineral cycles will get affected.
- (ii) In a food chain the energy moves progressively through the various trophic levels. It is no longer available to the previous level (autotrophs) and the energy captured by the autotrophs does not go back to the solar input and also quantity of total available energy decreases gradually on each trophic level due to 10% law. Hence, the flow of energy is unidirectional.

- 164.** It is said that, there is a need to put a complete ban on the products containing aerosols. What are aerosols ? Why is there a demand to put a ban on them.

**Ans :**

Foreign 2016

Aerosols are the colloidal system of solid or liquid particles in a gas.

Aerosols are the cause of ozone layer depletion which protects us from harmful ultraviolet radiations of



- 112.** What are trophic levels? Why do different food chains in an ecosystem not have more than four to five trophic levels? Give reason.

**Ans :**

OD 2023

**Trophic level:** Various steps or links or organism in a food chain at which transfer of food energy takes place are termed as trophic levels.

There is only 10% flow of energy from one trophic level to the next higher level. The loss of energy at each step is so large that very little usable energy remains after four or five trophic levels. Hence, only 4 to 5 trophic levels are present in each food chain.

- 113.** No, the impact will not be same because a food web contains many other alternatives which increase the stability of the ecosystem. Which of the following are biodegradable?

- (a) Wool, glass, silver foil, leather.
- (b) Leather shoe, earthen pot, silver spoon, jute bag.
- (c) Tomato leaves, aluminium wire, synthetic fibre, wool.

**Ans :**

Foreign 2017

- (a) Wool and leather.
- (b) Leather shoe, earthen pot and jute bag.
- (c) Tomato leaves and wool.

- 114.** Write any two differences between biodegradable and non-biodegradable substances by giving one example of each from our daily life.

**or**

Differentiate between biodegradable and non-biodegradable pollutants. Classify the following under the above two categories :

DDT, Paper, Cotton cloth, Plastic.

**Ans :**

OD 2017

	Biodegradable Substances	Non-Biodegradable Substances
1.	These are broken down into simple and harmless substances by the action of micro-organisms.	There is no effect of micro-organisms on these substance and hence they cannot be broken down into simpler substances.
2.	These are obtained from living things.	These are obtained from non-living things.
3.	They do not cause environmental pollution. <b>Example :</b> Paper, Cotton, Clothes, Vegetable peels etc.	They cause environmental pollution <b>Example :</b> Plastic, Glass, DDT etc.

- 115.** Classify the following ecosystems into natural and artificial ecosystem :

Forest ecosystem, aquarium, Marine ecosystem and crop land ecosystem.

**Ans :**

OD 2016, Delhi 2011

**Natural ecosystem :** Forest ecosystem and marine ecosystem.

**Artificial ecosystem :** Aquarium and cropland ecosystem.

- 116.** Government of India is imposing ban on the use of polythene bags for shopping. List for advantages of using cloth or jute bags over polythene bags.

**Ans :**

Delhi 2017

Advantages of jute and cloth bags are :

- (i) They are re-usable.
- (ii) They are biodegradable.
- (iii) They are stronger than polythene bags and can carry more load.
- (iv) They can be repaired at home if torn.

- 117.** Pesticides like DDT which are sprayed to kill pests on crops are found to be present in the soil, ground water, water bodies etc. Explain how do they reach these places.

**Ans :**

Foreign 2016

**Soil :** Pesticides like DDT are used to protect crops plants from insects and pests. They, in the end, get settled into the soil particles, when used on plants and cause soil pollution.

**Ground water :** Through irrigation these pesticides present in the soil pass into lower layers of soil and reaches ground water and ground water pollution.

**Water bodies :** When the waste water or other agricultural waste is thrown or rain off with rain water in water bodies like rivers, canals, ponds etc the pesticides affect water bodies and polluted it.

- 118.** In the following food chain, 5 J of energy is available to man. How much energy was available at producer level?

Plant → Sheep → Man.

**Ans :**

Delhi 2016

Plant → Sheep → Man.

Energy available to man in the above food chain is 5 J.

According to 10% law, energy available to sheep is 50 J.

Again according to 10% law, energy available to plants, i.e., at produce level is 500 J.

components comprising physical factors like temperature, rainfall, wind, soil and minerals.

- (b) The autotrophs or the producers are at the first trophic level because they prepare their own food by using the solar energy and in turn makes it available for heterotrophs or the consumers, since they depend on them for their food.
- (c) In a grassland food chain, the initial organisms are grass. They are producers which produce food using solar energy. Insects are primary consumers. Who eat plants. They are called herbivores. Frogs are secondary consumers. Who eat insects. They are called carnivores. Snake are tertiary consumers. They are carnivores and eat frogs.

Thus, the correct answer is 'Grass > Insect > Frog > Snake.'

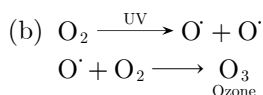
The grass occupies the first trophic level which consists of producers. The second trophic level consists of primary consumers which is Insect and the Frog is assigned the Third trophic level of food chain consisting of secondary consumers.

171. (a) Explain the role of UV radiation in producing ozone layer.  
 (b) Mention the reaction involved.  
 (c) Why is excessive use of CFCs a cause of concern?

Ans :

SQP 2020

- (a) Ozone at the higher levels of the atmosphere is a product of UV radiation acting on oxygen ( $O_2$ ) molecule. The higher energy UV radiations split apart some molecular oxygen ( $O_2$ ) into free oxygen (O) atoms. These atoms then combine with the molecular oxygen to form ozone.



- (c) The use of the chemicals such as CFCs damages the ozone layer and leads to its depletion. At the higher levels of the atmosphere, ozone performs an essential function, it shields the surface of the earth from ultraviolet (UV) radiation from the Sun. This radiation is highly damaging to organisms, since it is known to cause skin cancer in human beings.

172. (a) Write two harmful effects of using plastic bags on the environment. Suggest alternatives to the usage of plastic bags.  
 (b) List any two practices that can be followed to dispose off the waste produced in our homes

Ans :

Delhi 2020, Delhi 2013

- (a) The harmful effects of plastics on the environment are :

- (i) Plastics do not undergo degradation, thus, stay in the soil for many years, which affects the soil fertility and degrades the soil quality.  
 (ii) When plastic artefacts enter the drainage and sewage system, they block the pipes and the drains causing water logging.

**Alternatives to the usage of plastic bags are :**

- (i) We can reduce the use of plastic bags by carrying jute bags and paper bags to carry items from the market.  
 (ii) We can reduce the use of plastic containers for the storing of food and other items and also use more durable materials like metal boxes.  
 (iii) We can avoid using take away food containers.  
 (b) The practices that can be followed at our homes to dispose off wastes are :  
 (i) We can use discarded bottles and jars to store food items and water.  
 (ii) We can use broken artefacts and create something new with our own creativity, for e.g., discarded water bottles can be used as containers for craft, decorative items etc.

173. While teaching the chapter "Our Environment" the teacher stressed upon the harmful effects of burning of fossil fuels, plastic, paper etc. The students noticed the extensive use of plastic and polythene in daily life, which can be avoided and the surroundings can be kept clean. They decided to make their school "plastic and polythene" free and motivated each other for its minimum use.

- (a) Why should the use of polythene and plastic be reduced in daily life?  
 (b) In what ways the students would have avoided the use of plastic and polythene in their school?  
 (c) How the students would have motivated each other for the success of their decision?

Ans :

OD 2018

- (a) Polythene and plastic are non-biodegradable materials which cannot be decomposed by micro-organisms. Burning of plastic in open air leads to environmental pollution due to release of poisonous gases. When polythene is thrown on land it makes the soil less fertile. When thrown in water it chokes our water bodies and harms

127. What happens to the dead bodies ?

Ans :

Comp 2017

The microorganisms comprising bacteria and fungi breakdown the dead bodies into simpler forms and recycle nutrients in environment. These microorganisms are called decomposer.

128. In a food chain comprising frogs, insects, birds and grass, which one of the organisms is likely to have maximum concentration of harmful non-biodegradable chemicals in its body ?

Ans :

SQP 2016

Birds would have maximum concentration of harmful non-biodegradable chemicals in their body as they occupy the top most trophic level in the given food chain. It happens due to biological magnification.

129. Define food chain and write its two functions.

Ans :

OD 2015

The sequence of living organisms in which one organism consumes another to transfer food energy to next trophic level is called a food chain.

Food chain helps;

- (a) in maintaining energy flow and ecological balance,
- (b) in maintaining the interdependence of different organisms.

130. What is biodiversity ? What will happen if biodiversity of an area is not preserved ? Mention one effect of it.

Ans :

OD 2014

Biodiversity is the existence of a wide variety of species of plants, animals and micro-organisms in a natural habitat within a particular environment or existence of genetic variation within a species. Biodiversity of an area is the number of species range of different life forms found there. Forests are biodiversity hotspots.

In ecosystem every living being is dependent on another living being. If biodiversity is not maintained, the various links of the food chains go missing and if one organism goes missing, this will effect all the living beings who are dependent on it and environmental balance will get disturbed.

131. What will happen if all the carnivore are removed from the earth ?

Ans :

Delhi 2017, Delhi 2012

If all the carnivores are removed from the earth, the population of herbivores will increase. Large population of herbivores will overgraze. As a result,

all plants will disappear from the earth surface and ultimately the earth may become a desert and eventually all herbivorous will die to lack of food. Biosphere will get disturbed which will lead to end of life on earth.

132. Which one of the following food habits is better and why ?

- (a) Plant → Man.
- (b) Plant → Goat → Man

Ans :

Delhi 2016

- (a) is better.

**Reason :** According to the ten percent law of nature, in a shorter food chain maximum transfer of energy will take place.

133. Give some examples of terrestrial and aquatic ecosystems.

Ans :

Foreign 2017

- (a) **Terrestrial ecosystem :** A forest, a crop field, etc.
- (b) **Aquatic ecosystem :** A pond, a lake and an aquarium.

134. What will happen to grass-lands if all the grazers/herbivorous are removed from there ?

Ans :

Delhi 2016

If all the grazers/herbivorous are removed from grasslands, grass will grow unchecked. It may help the growth of some organisms harmful to the animals and plants. Further the animals which feed on the grazers will die of starvation. Biogeochemical cycle will stop and ultimately whole biosphere will get disturbed.

135. Name the sources from where the green plants obtain C, H and O.

Ans :

OD 2015

- (a) Green plants get C, i.e., Carbon from the CO<sub>2</sub> present in the atmosphere.
- (b) H (Hydrogen) and O (Oxygen) are obtained from water absorbed from the soil.
- (c) Oxygen is also obtained from air.

136. What would happen if all the decomposers were eliminated from the earth ? Explain.

Ans :

OD 2014

Decomposers decompose the complex organic molecules present in the dead plants and animals to the simple molecular level. Thus, decomposers help the return of various nutrients to the soil/water so that these are available to the producers once again.

in concentration of harmful chemicals in the body of living organisms of each trophic level of a food chain is called biological magnification.

Pesticides such as DDT, when enters the food chain, the plants absorb these harmful chemicals from soil along with water and minerals. They enter the food chain at producer level and then transfers to the next trophic level. In animals, DDT gets accumulate in fatty tissue, thus, continuous consumption of same plants results in higher concentration of DDT in animals. The tertiary consumers or top carnivorous animal get highest levels of these chemicals.

177. How are the biotic components further categorized ?

Ans :

Comp 2016

The biotic components of an ecosystem includes the following three types of organisms :

**Heterotrophs :** The organisms which cannot make their own food from the raw materials such as  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  etc. using sunlight are called hetetrotrophs. Heterotrophs depend on others organisms for their food. All animals including human beings are heterotrophs. Heterotrophs are also termed as consumers.

The differences between auto-trophs and decomposers are :

	Autotrophs	Decomposers
1.	Autotrophs make their food from $\text{CO}_2$ , $\text{H}_2\text{O}$ and minerals in the presence of sunlight e.g., green plants.	Decomposers decompose the complex molecules present in the bodies of the dead plants and animals e.g., saprophytic bacteria and fungi.
2.	Autotrophs convert simple inorganic substances into complex organic substances.	Decomposers breakdown the complex organic substances into simple inorganic substances.

178. Describe with the help of diagram how energy flows through different trophic levels in a food chain ?

Ans :

Delhi 2017

The energy moves progressively through various trophic levels of food chain in the form of food.

Green plants are producers which capture about 2-4% of the energy of sunlight and convert it into food energy.

When green plants are eaten by primary consumers, a great deal of energy is lost as heat to the environment.

According to the lindeman's ten percent law, only 10% of energy entering a particular trophic level of a food chain is available for transfer to the next higher trophic level.

This means that the energy available at each successive trophic level is 10% of the previous level. For example,



As little energy is available for the next level of consumers, food chains generally consists of only three or four steps.

Flow of energy is unidirectional as, energy captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to autotrophs. As energy moves progressively through the various tropic levels, it is no longer available to the previous level.

179. Study the picture given below and comment on the encircled organisms with respect to

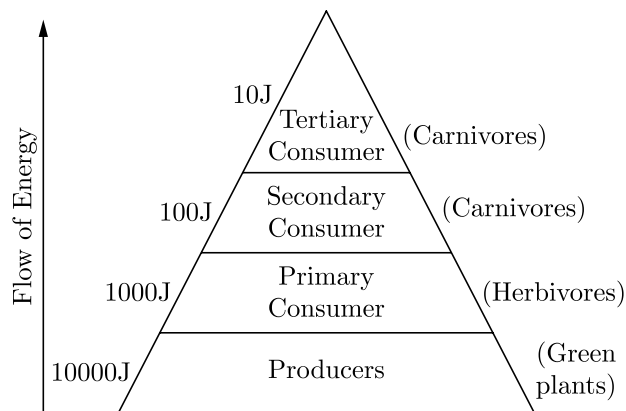


- the category according to the food they eat.
- percentage of energy available at their trophic level.
- two abiotic components of the ecosystem inhabited by them.
- energy used for food production by the producers.

- 144.** Draw a diagram to show energy flow in the food chains.

**Ans :**

Delhi 2015



- 145.** "Energy flow in a food chain is unidirectional." Justify this statement.

**Ans :**

Delhi 2015, Delhi 2010

In a food chain the energy moves progressively through the various trophic levels. It is no longer available to the previous level (autotrophs) and the energy captured by the autotrophs does not go back to the solar input and also quantity of total available energy decreases gradually on each trophic level due to 10% law. Hence, the flow of energy is unidirectional.

- 146.** Suggest some methods of safe disposal of wastes.

**Ans :**

Comp 2014

- The wastes should be classified into biodegradable and non-biodegradable.
- Biodegradable wastes should be converted into manure.
- Non-biodegradable waste should be sent in the factories for recycling.
- Plastics should be melt and mixed with asphalt to make road surface.
- Garbage should be thrown away in the land fill areas.

- 147.** What are herbivores ? Name a few of them.

**Ans :**

Foreign 2015, Delhi 2013

The organisms which consume plants as their food are called herbivores. Goat, cow, deer, etc. are herbivores, and are called herbivorous animals.

- 148.** Define trophic levels ?

**Ans :**

OD 2014

Various steps or links or organism in a food chain at

which transfer of food energy takes place are termed as trophic levels.

In a food chain, each producer or a consumer is considered a trophic level. The trophic levels in a food chain having four levels is shown in the following Fig.

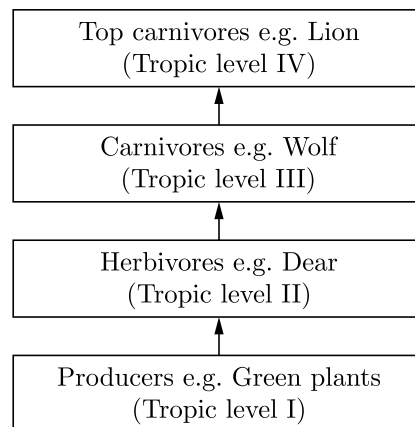


Figure: Various trophic levels in a food chain.

- 149.** What is ten percent law ? Explain by an example.

**Ans :**

Comp 2015, Delhi 2010

According to the lindeman's ten percent law, only 10% of energy entering a particular trophic level of a food chain is available for transfer to the next higher trophic level.

This means that the energy available at each successive trophic level is 10% of the previous level. For example,



- 150.** What conclusions can be derived from the 10 percent law ?

**Ans :**

Comp 2014

- The producer level has the maximum energy.
- Away one is from the producer level, lesser is the energy available.
- Vegetarian food habits help in getting more energy.
- Energy flow is unidirectional.
- Only 10% energy is available for next trophic level in a food chain.

- 151.** Describe a food web. How is it formed ?

**or**

What is a food web ? Show its formation.

**Ans :**

OD 2015

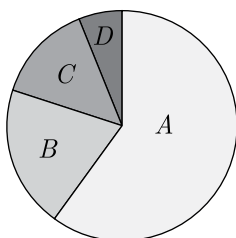
A system of interconnected food chains between



## CASE BASED QUESTIONS

- 184.** Read the following case based passage and answer the questions given after passage.

Carbon dioxide is the most important greenhouse gas emitted by humans, but several other gases contribute to climate change, too. Learn more about the major greenhouse gases by selecting pieces of the pie chart below.



- (i) Identify *A*, *B*, *C*, and *D* in the given pie chart.
- (ii) Explain briefly labelled part *C*.
- (iii) Name the major sources of labelled part *B*.
- (iv) Excessive use of fossil fuel will lead to
  - (a) adding more  $\text{CO}_2$
  - (b) adding more  $\text{N}_2\text{O}$
  - (c) adding more  $\text{CH}_4$
  - (d) adding more  $\text{SO}_2$

**Ans :**

- (i) In the given pie-chart of contribution of different gases to greenhouse effect, *A* is  $\text{CO}_2$  (60%), *B* is  $\text{CH}_4$  (20%), *C* is CFCs (14%) and *D* is  $\text{N}_2\text{O}$  (6%).
- (ii) Chlorofluorocarbons (CFCs) are synthetic gaseous compounds of carbon and halogen which are odourless, non-toxic, non-inflammable, chemically inert propellants used in aerosol cans, jet fuel and refrigerants in air conditioners and refrigerators.
- (iii) Flooded paddy fields, marshes, cattle dung etc. are the major sources of  $\text{CH}_4$ .
- (iv) (a) adding more  $\text{CO}_2$   
Excessive use of fossil fuel is adding more  $\text{CO}_2$  to atmosphere.

- 185.** Read the following case based passage and answer the questions given after passage.

Energy flow in an ecosystem is unidirectional. The main source of energy for an ecosystem is radiant or light energy derived from the sun. From the solar energy reaching the Earth's surface, green plants capture only about 1% of the energy of sunlight

falling on their leaves and convert it into food energy.

- (i) Grass  $\rightarrow$  Grasshopper  $\rightarrow$  Frog  $\rightarrow$  Snake  $\rightarrow$  Hawk. Identify the secondary carnivore in the above food chain.
- (ii) In an ecosystem, a tiger preying on a deer which fed on fresh green grass. What percentage amount of the energy accumulated by the deer would be acquired by the tiger?
- (iii) Who gave the 10% law of energy transfer in food chains?
- (iv) In which of the following food chains, the energy reaching the top consumer would be more?
  - a. Grass  $\rightarrow$  Goat  $\rightarrow$  Man
  - b. Phytoplanktons  $\rightarrow$  Crab  $\rightarrow$  fishes  $\rightarrow$  Man

**Ans :**

- (i) In the given food chain, grass is the producer, grasshopper is the first consumer (herbivore), frog is the first carnivore and snake is the second carnivore.
- (ii) According to 10% energy law, only 10% of the energy is transferred from one trophic level to the subsequent trophic level. Hence, 10% of energy accumulated by the deer would be acquired by the tiger.
- (iii) Lindeman in 1942 gave the 10% law of energy transfer.
- (iv) On an average 90% of the energy is lost at each level in a food chain. This means longer the food chain lesser would be the energy reaching the top consumer of the food chain. Therefore, the energy reaching the top consumer (man), would be more in food chain (a) than (b)
  - (a) Grass (100 J)  $\rightarrow$  Goat (10 J)  $\rightarrow$  Man (1 J)
  - (b) Phytoplanktons (100 J)  $\rightarrow$  Crab (10 J)  $\rightarrow$  Fish (1 J)  $\rightarrow$  Man (0.1 J).

- 186.** Read the following case based passage and answer the questions given after passage.

The atmosphere is a blanket of air and a precious natural resource for sustaining life on the earth. Unfortunately, human activities based on national/personal interests are causing harm to this common resource, notably by depleting the fragile ozone layer, which acts as a protective shield for life on the earth.

Ozone molecules consist of three oxygen atoms. Ozone molecules are exceedingly rare: fewer than ten in every million molecules of air. However, for nearly a billion years, their presence in the atmosphere has

sun.

Aerosols also affect our health adversely. Inhaling aerosols may cause sneezing, coughing, vomiting, diarrhea, slurred speech, double vision, drowsiness and muscle pain.

Therefore, there is demand to put ban on them.

165. Differentiate autotrophs, heterotrophs and decomposer and give one example of each.

Ans :

SQP 2017

**Heterotrophs :** The organisms which cannot make their own food from the raw materials such as  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  etc. using sunlight are called heterotrophs. Heterotrophs depend on other organisms for their food. All animals including human beings are heterotrophs. Heterotrophs are also termed as consumers.

The differences between auto-trophs and decomposers are :

	Autotrophs	Decomposers
1.	Autotrophs make their food from $\text{CO}_2$ , $\text{H}_2\text{O}$ and minerals in the presence of sunlight e.g., green plants.	Decomposers decompose the complex molecules present in the bodies of the dead plants and animals e.g., saprophytic bacteria and fungi.
2.	Autotrophs convert simple inorganic substances into complex organic substances.	Decomposers breakdown the complex organic substances into simple inorganic substances.

166. (i) What is the height of ozone from the equator ?  
 (ii) Name the rays against which ozone layer provides protection.  
 (iii) Name one effect of depletion of ozone.

Ans :

Delhi 2016

- (i) 10 to 16 km.  
 (ii) UV rays of sun.  
 (iii) Skin cancer.

167. Larger animals kill the smaller animals in the forest, eat whatever they can, leave the rest in the forest but the forest is never found full of dead animals. What happens to the bodies of these dead animals?

Ans :

Delhi 2017

The bodies of the dead animals are acted upon by saprophytic bacteria and fungi which break them

down to simple nutrients. These nutrients are later released into the soil which serve as nutrient pool. From this pool, plants again use these nutrients for their growth and thus nutrients get recycled.

168. (a) What is full form of (i) UNEP (ii) CFCs.  
 (b) On what basis are organisms grouped as producers, consumers and decomposer ?  
 (c) Write two problems that would arise if there were no decomposer in an ecosystem.

Ans :

Comp 2016, Delhi 2012

- (a) (i) UNEP : United Nations Environment Programmes  
 (ii) CFCs : Chlorofluorocarbon.  
 (b) Organisms can be grouped as producers, consumers and decomposers according to the manner in which they obtain their nutrition from the environment.  
 (c) Two problems that would arise in absence of decomposer in an ecosystem are :  
 (i) Decomposition of garbage as well as dead plants and animals will not take place.  
 (ii) Recycling of nutrients and natural replenishment of soil will not take place.

169. Give the characteristics of food chain.

Ans :

OD 2017

The characteristics of a food chain are following :

- (i) A food chain is always proceeds in a progressive straight line.  
 (ii) A food chain helps in understanding the food relationship and energy interactions among various organisms in an ecosystem.  
 (iii) It helps to understand the movement of toxic substances in an ecosystem and the problem of their biological magnification.

## FIVE MARKS QUESTIONS

170. (a) Define ecosystem.  
 (b) Autotrophs are at the first level of food chain. Give reason.  
 (c) In a food chain of frogs, grass, insects and snakes assign trophic level to frogs. To which category of consumers do they belong to?

Ans :

OD 2020

- (a) An ecosystem consists of biotic components comprising living organisms and abiotic



S. No.	Name of fuel	Name of fuel	Calorific value (kJ g <sup>-1</sup> )
2.	Liquid Fuels	Alcohol	30
		Diesel	45
		Kerosene oil	48
3.	Gaseous Fuels	Petrol	50
		Bio-gas	35-40
		LPG	55
		Hydrogen	150

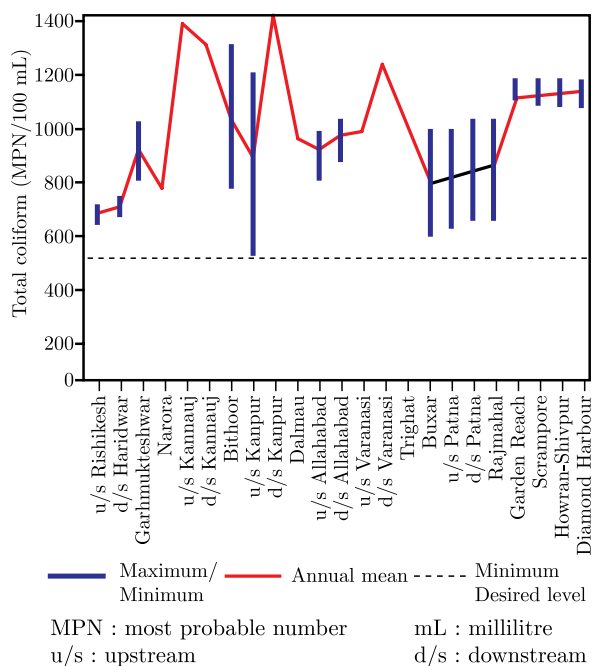
- (i) What does LPG stands for?  
(ii) Among the gaseous fuels, which fuel is ideal for burning?  
(iii) Among the solid fuels, the least calorific value is of:  
(a) Coal (b) Charcoal  
(c) Animal dung cake (d) Anthracite  
(iv) Gas used in vehicles is:  
(a) LPG (b) CNG  
(c) Methane (d) Butane

**Ans :**

- (i) LPG stands for Liquid Petroleum Gas.  
(ii) Hydrogen.  
(iii) (c) Animal dung cake  
(iv) (b) CNG

**189.** Read the following case based passage and answer the questions given after passage.

The given graph which depicts total coliform levels in a river, answer the questions that follow.



- (i) Water of which of the following cities have the highest levels of coliform?  
(a) Haridwar, Kanpur, Patna  
(b) Patna, Varanasi, Narora  
(c) Kannauj, Kanpur, Varanasi  
(d) Patna, Haridwar, Kannauj  
(ii) Water from which of the following cities will have the maximum shelf life?  
(a) Rishikesh, Haridwar  
(b) Serampore, Howrah-Shivpur  
(c) Allahabad, Varanasi  
(d) Diamond Harbour, Garden Reach  
(iii) What do you understand by coliform?  
(iv) What was the need of coliform count method?

**Ans :**

- (i) (c) Kannauj, Kanpur, Varanasi  
Water of Kannauj, Kanpur and Varanasi have the highest levels of coliform. It is somewhere around 1200-1400 (MPN/100 mL).  
(ii) (a) Rishikesh, Haridwar  
Water from Rishikesh and Haridwar will have the maximum shelf life, because the level of coliform in the water of these two cities is the least as compared to the other cities. It is nearly 600-700 (MPN/100 mL).  
(iii) Coliform is a group of bacteria found in human intestine, whose presence in river water indicates sewage contamination.  
(iv) The main need of total coliform count method was to improve the quality of a river.

**190.** Read the following case based passage and answer the questions given after passage.

Statues of Caryatids were built on the Acropolis in Athens more than 2500 years ago. The statues are made of a type of rock called marble. Marble is composed of calcium carbonate. In 1980, the original statues were transferred inside the museum of the Acropolis and were replaced by replicas. The original statues were being eaten by acid rain. The normal rain has become slightly acidic because it has absorbed some carbon dioxide from the air. Acid rain is more acidic than normal rain because it has absorbed gases like sulphur oxides and nitrogen oxides as well. The effect of acid rain on marble can be modelled by placing chips of marble in vinegar overnight. Vinegar and acid rain have about the same acidity level. When a marble chip is placed in vinegar, bubbles of gas form. The mass of the

played a vital role in safeguarding life on earth. The ozone in the troposphere (up to 110 kilometres above the earth's surface) is bad ozone which can damage lung tissues and plants. But about 90 percent of ozone found in the stratosphere (between 10 and 40 kilometres above the earth's surface) is "good" ozone which plays a beneficial role by absorbing dangerous ultraviolet (UV-B) radiations from the sun.

Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultraviolet rays from the sun.

- (i) Ozone is also formed during thunderstorms. It causes the typical smell after such a storm. Is the ozone formed during thunderstorm 'bad ozone' or 'good ozone'? Choose the answer and the explanation.

	Ozone	Explanation
(a)	Bad	It is formed during bad weather.
(b)	Bad	It is formed in the troposphere.
(c)	Good	It is formed in the stratosphere
(d)	Good	It smells good.

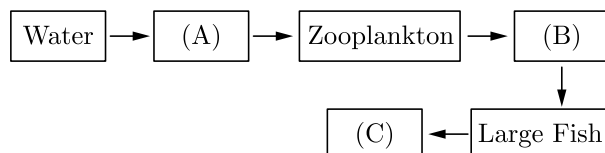
- (ii) How can increased incidence of ultra-violet rays harm humans?
- (iii) Write the full name of the group of compounds mainly responsible for the depletion of ozone layer.
- (iv) What destructive effect do chlorofluorocarbons bring about in the atmosphere?

Ans :

- (i) (b) Bad ozone is formed in the troposphere.
- (ii) It can cause skin cancer and snow-blindness.
- (iii) Chlorofluorocarbons (CFCs).
- (iv) CFSs deplete ozone from ozone shield, resulting in increasing the passage of harmful ultraviolet radiation to the earth.

187. Read the following case based passage and answer the questions given after passage.

The bio-magnification of pesticides in the tissues of organisms in the food chain given below. Study this figure answer the questions that follows:



- (i) Name the given figure and identify the labelled parts *A*, *B* and *C*.
- (ii) Mention harmful non-biodegradable chemicals that enter in the bodies of organisms shown here.
- (iii) Maximum quantity of harmful chemicals are found in  
 (a) (A) and (B)                      (b) (B) and (C)  
 (c) (C) only                              (d) (A) and (C)
- (iv) Which of the following diseases is caused due to the phenomenon shown in the food chain?  
 (a) Minamata diseases  
 (b) Alzheimer's disease  
 (c) Cataract  
 (d) None of these

Ans :

- (i) The given figure is of biomagnification of DDT in an aquatic food chain in which parts *A*, *B* and *C* are respectively phytoplankton, small fish and fish-eating bird or human being.
- (ii) Some harmful non-biodegradable chemicals such as pesticides, e.g., DDT and heavy metals e.g., mercury, arsenic, cadmium, etc. enter the bodies of organisms through the food chains and go on concentrating at each trophic level.
- (iii) (c) (C) only  
 Fish-eating birds/human beings (C) get maximum quantity of harmful chemicals.
- (iv) (a) Minamata diseases  
 Biomagnification of mercury into fish through the food chain was responsible for large number of deaths due to Minamata disease in Japan.

188. Read the following case based passage and answer the questions given after passage.

Calorific value of a fuel is defined as the amount of heat energy released in joule or kilo-joule by the complete burning of 1 gram fuel. Calorific values of different fuels are given below:

Table : Calorific value of some fuels

S. No.	Name of fuel	Name of fuel	Calorific value (kJ g <sup>-1</sup> )
1.	Solid Fuels	Animal dung	8
		cake	17
		Wood	33
		Charcoal	35
		Coal	37
		Anthracite	

192. Read the following case based passage and answer the questions given after passage.

A few biodegradable and non-biodegradable substances are given below

I	Plastic bag
II	Paper cup
III	Hedge trimming
IV	Aluminium
V	Glass plates
VI	Vegetable peel
VII	CFL bulb
VIII	DDT

- Arrange them in group A and group B as biodegradable and non-biodegradable substances, respectively.
- What are biodegradable substances?
- We classify different substance as non-biodegradable when
  - they have a tendency to persist for long time
  - they are toxic and not metabolised
  - not decomposed by microbes
  - All of the above
- Biodegradable wastes usually do not pollute the environment. They are considered a threat only when
  - they are present in small amounts
  - their amount is large
  - they cannot be degraded in nature at right time
  - Both (b) and (c)

Ans :

(i)

Biodegradable substance	Non-biodegradable substances
Paper cup	Plastic bag
Hedge trimmings	Aluminium glass
Vegetable peels	Glass plates
	CFL bulbs
	DDT

- The complex substances which can be broken down to simple forms by enzymic digestion of saprophytic microorganisms such bacteria and fungi are known as biodegradable wastes.

- (c) not decomposed by microbes

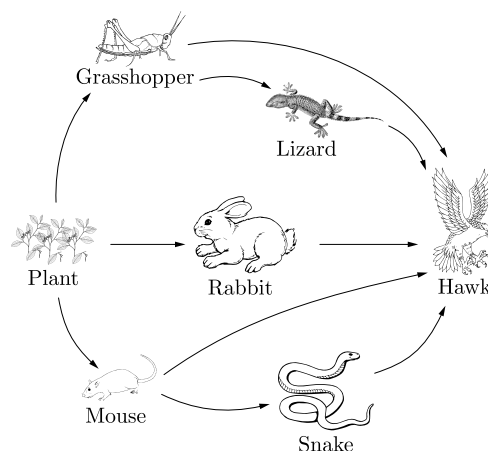
When a substance cannot be broken down by microbial action to simple forms, it is classified as non-biodegradable. They persist in nature for very long time and pollutes it.

- (d) Both (b) and (c)

Biodegradable wastes pollute the environment only their amount is large which cannot be degraded into harmless forms in nature at the right time.

193. Read the following case based passage and answer the questions given after passage.

Study this figure and answer the questions that follows.



- How many food chain are shown in the given figure?
- Write down two characteristics of the procedure shown in the figure.
- If a grasshopper is eaten by a lizard, then the energy transfer will be from
  - producer to decomposer
  - producer to primary consumer
  - primary consumer to secondary consumer
  - secondary consumer to primary consumer
- In the given figure how many food chains are with four trophic levels?
  - 2
  - 3
  - 5
  - 4

Ans :

- This food web has five interconnected food chains. These are:
  - Plant → Grasshopper → Hawk
  - Plant → Grasshopper → Lizard → Hawk
  - Plant → Rabbit → Hawk

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Aquatic food chain is the food chain present in water bodies, e.g. phytoplankton  $\longrightarrow$  zooplankton  $\longrightarrow$  fish  $\longrightarrow$  shark.

- 38. Assertion :** Biomagnification is caused due to the accumulation of biodegradable toxicants in organisms at each successive trophic level.

**Reason :** Biomagnification leads to the maximum accumulation of chemicals in small fishes.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (e) Both Assertion and Reason are false.

Biomagnification is caused due to the accumulation of non-biodegradable toxicants in organisms at each successive trophic level. The maximum concentration of these chemicals gets accumulated in human body because they occupy the topmost place in any food chain.

- 39. Assertion :** Tropical rain forests are disappearing fast from developing countries such as India.

**Reason :** No value is attached to these forests because these are poor in biodiversity.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

Tropical rain forests have disappeared mainly due to man's activities. Due to over population in countries like India, rain forests are cut to make place available for man to live and build houses. To build buildings and factories man has incessantly cut down trees. This has caused the depletion of rain forests.

- 40. Assertion :** Animals adopt different strategies to survive in hostile environment.

**Reason :** Praying mantis is green in colour which merges with plant foliage.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Animals blend with the surroundings or background to remain unnoticed for protection and aggression.

- 41. Assertion :** A network of food chains existing together in an ecosystem is known as food web.

**Reason :** An animal like kite cannot be a part of a food web.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

- (c) Assertion (A) is true but reason (R) is false.

In the food web different food chains are interconnected. Each chain consists of different trophic levels i.e., producers, consumers and detritivores. So, kite can also be a part of food web

- 42. Assertion :** Herbivores are called first order consumers.

**Reason :** Tiger is a top carnivore.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

- (ii) What is the earth's internal heat called?
- (iii) Which device converts sunlight into electric energy?
- (iv) Which is the tool used to trap or concentrate sunlight to be used for energy?

**Ans :**

- (i) Alternate energy sources
- (ii) Geothermal energy.
- (iii) Solar cell
- (iv) Solar panel.

- 196.** Read the following case based passage and answer the questions given after passage.

Air pollution is the contamination of air with undesirable gases and particulate matter. The substances that cause pollution are called pollutants. These pollutants are either gaseous pollutants like oxides of carbon, sulphur, nitrogen, etc., or particulate matter in the form of dust, smoke, fumes or mist. Chimneys of industries fossil fuel burning and exhaust of vehicles are responsible for adding oxides of carbon, sulphur and nitrogen in the atmosphere. These oxides get mixed with rain water.

Air pollution is the fifth largest killer in India taking approx. 6.2 lakhs lives per year.

Table: Status of ambient air quality in five Metropolitan cities of India (Year 2011)

S. N.	Name of the city	State	2011		
			SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>
1.	Delhi	U.T.	6	61	222
2.	Chennai	Tamil Nadu	9	24	92
3.	Hyderabad	Andhra Pradesh	5	28	74
4.	Malappuram	Kerala	2	5	30
5.	Raipur	Chhattisgarh	15	42	310

- (i) List any two ways to minimise air pollution caused by burning of fossil fuels.
- (ii) Out of the three elements - carbon, nitrogen and sulphur; which element has 4 valence electrons and is placed in group 14?
- (iii) In winter season, visibility reduces in heavily polluted cities due to the
  - (a) formation of smog.
  - (b) reduction in humidity.
  - (c) formation of ozone gas.
  - (d) excess of burnt hydrocarbons.

- (iv) Refer to the data represented in the table, select from the following the reason why the people of Raipur are most likely to suffer from respiratory diseases?
  - (a) Concentration of particulate matter is higher than the required amount.
  - (b) Concentration of NO<sub>2</sub> and SO<sub>2</sub> is less than the required amount.
  - (c) Concentration of NO<sub>2</sub> and particulate matter is less than the required amount.
  - (d) Concentration of NO<sub>2</sub> and SO<sub>2</sub> is very high.

**Ans :**

- (i) Two ways to reduce air pollution caused by burning of fossil fuels are:
  - (i) Use of smokeless appliances.
  - (ii) Promoting and encouraging afforestation.
- (ii) Carbon
- (iii) (a) formation of smog.
- (iv) (a) Concentration of particulate matter is higher than the required amount.

- 197.** Read the following case based passage and answer the questions given after passage.

Those materials which cannot be decomposed or broken down by natural factors due to their composition are called non-biodegradable wastes. The most prominent example of this is plastic. Unlike degradable waste, the non-biodegradable waste does not decompose. So, it does not create any kind of foul smell or diseases in the area where it lies. However, in the long run it is much more harmful for life as it is gradually accumulating and polluting the whole planet. Handling the non-degradable waste is a much more challenging task as compared to degradable wastes. These waste materials also include various types of polymers, metals and chemicals made for domestic, industrial and agriculture purposes. These wastes are so harmful that in the long run they make the land infertile and cause diseases like cancer.

- (i) What are non-biodegradable wastes ?
- (ii) Give one example of non-biodegradable waste.
- (iii) What are the consequences of using non-biodegradable wastes in the long run?
- (iv) What are the harmful effects of using non-biodegradable waste ?

**Ans :**

- (i) Those materials which cannot be decomposed or broken down by natural factors and saprophytic microbes due to their artificial composition are called non-biodegradable wastes.

- d. Plant  $\longrightarrow$  Mouse  $\longrightarrow$  Hawk
- e. Plant  $\longrightarrow$  Mouse  $\longrightarrow$  Snake  $\longrightarrow$  Hawk

(ii) Characteristics of the procedure (food web):

- a. Unlike food chains, food webs are never straight. Instead, each food web is formed by interlinking of various food chains.
- b. A food web provides alternative pathways of food availability.

(iii) (c) primary consumer to secondary consumer

Primary consumers are those organisms which directly feed upon producers. As grasshopper eats grass (producer) thus it is primary consumer. Organisms eating primary consumers are called secondary consumers. Thus lizard will be secondary consumer in this food chain and eating of grasshopper by lizard is transfer of energy from primary consumer to secondary consumer.

(iv) (a) 2

**194.** Read the following case based passage and answer the questions given after passage.

CFCs are being added to the environment in steadily increasing amounts. These compounds are chemically inert and may persist in the atmosphere for 40-150 years and are expected to reach 10-30 times the present levels. The photo-dissociation of the CFCs in the stratosphere produces a large number of chlorine atoms which leads to destruction of atmospheric ozone. NASA began measuring the earth's stratospheric ozone layer via satellite in 1979. By the time Montreal protocol came into effect in 1989, ozone levels had significantly declined over the Antarctic region, creating what we know as the ozone hole. According to NASA the levels of ozone have since then stabilised due to the efforts of UNEP and other organisations but recovery is still decades away.

- (i) Write the full form of CFCs.
- (ii) Explain why CFCs are considered harmful for the atmosphere.
- (iii) What would happen if the ozone layer in the atmosphere disappears completely?
- (iv) Based on the information provided, can you elaborate the role of UNEP in reduction or prevention of damages incurred by the ozone layer.

**Ans :**

- (i) Chlorofluorocarbons
- (ii) CFCs released in the atmosphere react with ozone gas in the ozone layer and destroy it gradually.

(iii) If the ozone layer disappears completely, then all extremely harmful UV rays will reach the earth's surface and cause skin cancer, cataracts, snow blindness, etc. in humans, destroy vegetation and crops etc.

(iv) The UNEP (United Nations Environment Programme) forged an agreement among its members to freeze CFC production and try to return ozone layer that of in the year 1986.

**195.** Read the following case based passage and answer the questions given after passage.

A number of different energy sources are used every day. Where does this energy come from? Burning of fossil fuel is a main energy source. Sources other than this fossil fuel are known as alternative energy sources and there are several of them being used every day.

Windmills work in the same manner as a waterwheel. For many years, windmills were usually used mainly for milling grain, pumping water, or both. Today, though, all of that has changed. Windmills are used as wind turbines that can generate electricity. As the wind propels the blades, energy is created and stored to be used to perform work. As long as there is movement, energy can be produced, and the wind is an excellent alternative energy source. In many parts of the Midwest where there is an abundance of wind, energy is produced for homes and businesses.

The internal heat of the earth is another energy source. The interior of the earth is very hot as is evidenced by hot water or steam coming out of the ground in certain places on the Earth. The earth's internal heat is called geothermal energy. Geothermal energy can be used to heat homes and produce electricity. There are homes in Boise, Idaho that have been heated solely by hot springs since the 1890's. Also at the Geysers in California, steam drives turbines that generate electricity. This steam comes from underground water that is heated by geothermal energy.

Every day the sun provides energy. Solar energy is often thought to just be sunlight. Sunlight is full of energy. It is the sunlight that gives water the energy to evaporate and rise into the atmosphere. People are finding new ways to harness the power of sunlight. One major way is to trap or concentrate sunlight with the use of solar panels. This trapped sunlight can be used to heat homes and water. Also solar cells are devices that convert sunlight into electric energy.

- (i) What are sources of energy other than fossil fuel called?



- (iv) Expand the five R's that help in reducing plastic wastes.

**Ans :**

- (i) Because, it is non-biodegradable in nature.  
 (ii) The pH 5 tells us that ocean water has become highly acidic.  
 (iii) Packaging sector produces the maximum plastic waste. Paper and cardboard can be used in place of plastic in this sector as these are reusable, recyclable and biodegradable.  
 (iv) **Refuse** : To say NO to single use plastic bags;  
**Reduce** : To reduce the use of plastic bags;  
**Reuse** : To use plastic bottles, container etc. again and again; **Repurpose** : To use the already used plastic object for any other useful purpose;  
**Recycle** : To collect plastic waste and make new things instead of synthesising fresh plastic.

**200.** Questions are based on the two tables given below and the related studied concepts. Analyse these tables and answer the questions that follow.

**Table A: Amount of air pollutants (microgram per cubic metre)**

Air Pollutants	Microgram per cubic metre
SO <sub>2</sub>	50
NO <sub>2</sub>	40
PM <sub>10</sub>	60

**Table B: Status of ambient air quality in five metropolitan cities of India**

S.No.	Name of the city	State	2011		
			SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>
1.	Banglore	Karnataka	14	28	91
2.	Delhi	U.T.	6	61	777
3.	Gwalior	M.P.	12	20	311
4.	Chennai	Tamil Nadu	9	24	92
5.	Agra	U.P.	3	23	155

- (i) Refer to Table B showing the status of ambient air quality in five metropolitan cities of India. Which city has the maximum risks of respiratory diseases?  
 (ii) Which is the least polluted city among the five metropolitan cities of India and why?  
 (iii) Taj Mahal in Agra is said to be suffering from 'Marble Cancer'. Which of the following statements correctly defines marble cancer?

- (a) Formation of fungus at Taj Mahal  
 (b) Corrosion of marble by acid rain  
 (c) Formation of perforations in Taj Mahal  
 (d) Yellowing of marble by soot particles

- (iv) Which of the following steps should be taken to reduce SO<sub>2</sub> and NO<sub>2</sub> pollutants in the air?  
 (a) Increase the use of fossil fuels  
 (b) Cut a large number of trees  
 (c) Install catalytic converters in the vehicles  
 (d) Use petrol run vehicles for covering short distances

**Ans :**

- (i) The concentration of PM<sub>10</sub> (particulate matter) in air is the highest in Gwalior. Hence the risk of respiratory diseases is maximum in this city.  
 (ii) The air of Chennai, Tamil Nadu, has least concentration of SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub> in city.  
 (iii) (b) Corrosion of marble by acid rain.  
 (iv) (c) Install catalytic converters in the vehicles.

**201.** Read the following case based passage and answer the questions given after passage.

Global warming is a slow process due to which the average temperature of earth is gradually increasing. The lower layers of the atmosphere maintain a constant temperature on earth in both time and space. CO<sub>2</sub> plays an important role in this 'Heat budget'. CO<sub>2</sub> is a greenhouse gas which absorbs the heat and prevents it from leaving the surface. CO<sub>2</sub> constitutes 0.03% of the air and it (with other gases and water vapour) absorbs almost 17% of terrestrial radiation. If the ecological balance is disturbed which in turn disturbs the carbon cycle, then even a slight increase in the percentage of CO<sub>2</sub> in air will increase the average temperature to this extent that soon life on earth will become impossible.

- (i) State the consequence of global warming ?  
 (ii) Which gas plays the major role in 'heat budget' ?  
 (iii) What percentage does CO<sub>2</sub> constitute in air ?  
 (iv) What leads to increase in the average temperature of earth ?

**Ans :**

- (i) Average temperature of earth is gradually increasing  
 (ii) CO<sub>2</sub>  
 (iii) 0.03%



- (iv) A slight increase in the percentage of  $\text{CO}_2$  in air will increase the average temperature to this extent that soon life on earth will become impossible.

**202.** Read the following case based passage and answer the questions given after passage.

Biotic components are the living organisms which actively affect and get affected by the environmental factors. These can be divided into two major categories according to their food dependency patterns and they are as follows.

**Producers :** Producers are those organisms which can make their own food directly from organic compounds with the help of sunlight through photosynthesis and these are known as autotrophs.

**Examples :** Green plants.

**Consumers :** Consumers are living organisms which directly or indirectly depend on the producers for their food and they are called heterotrophs.

- What are biotic components ?
- What are the two categories into which biotic components are divided ?
- What are producers ?
- What are heterotrophs ?

**Ans :**

- Biotic components are the all living organisms which actively affect and get affected by the environmental factors, e.g., plant, animals and microbes.
- Producers and consumers.
- Producers are those organisms which can make their own food directly as organic compound with the help of sunlight through photosynthesis. These are also known as autotrophs.
- Consumers are living organisms which directly or indirectly depend on the producers for their food and are called heterotrophs.

**203.** Read the following case based passage and answer the questions given after passage.

The ozone can be depleted by various substances including  $\text{NO}$ ,  $\text{N}_2\text{O}$ , chlorine and atomic bromine. However, the most common ozone depleting substance (ODS) is chlorofluorocarbons (CFC). The CFC was used in refrigerators and aerosol sprays. In 1978, USA and Canada banned the use of CFC. It was through 'Montreal Protocol' the use of CFC was restricted with commitment to phase it out. Presently, the CFC has been replaced by

hydrofluorocarbons (HFC's) which are not ODS at all. Today the biggest ODS in  $\text{N}_2\text{O}$ .

- What are the substances responsible for ozone depletion ?
- Name the most common ODS.
- What is the replacement of CFC ?
- Name the countries which banned the use of CFC.

**Ans :**

- CFCs,  $\text{NO}$ ,  $\text{N}_2\text{O}$ , chlorine and atomic bromine.
- Chlorofluorocarbons (CFC).
- CFC has been replaced by hydrofluorocarbons (HFC's).
- USA and Canada banned the use of CFC.

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**204.** Read the following case based passage and answer the questions given after passage.

Questions are based on two illustrations and the related studied concepts. Analyse them and answer the questions that follow.

City Level Prevalence of Child Health Outcomes

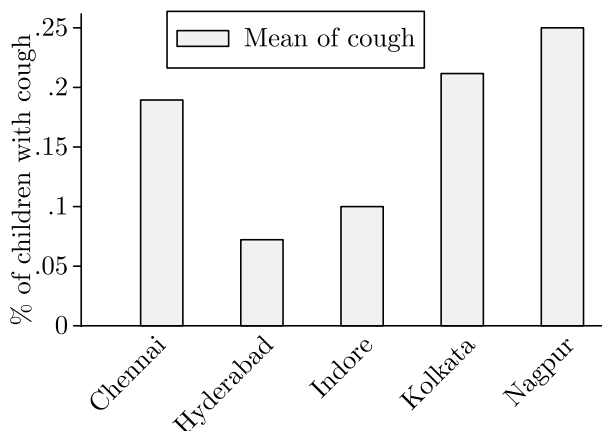





Table: Effect of air pollution in early life of a man

Stage : Age :	New born 0-2 mos	Infant/Toddler 2 mos-2 yrs	Young child 2-6 yrs	School-Age Child 6-12 yrs	Adolescent 12-18 yrs
					
Lung development :	Alveolar development				
	High respiratory rate				
			Increasing lung volume		
Air pollution risks :	Respiratory death				
			Chronic cough and bronchitis		
			Reduced lung function		
		Respiratory symptoms and illnesses	Wheezing and asthma attacks		
			Respiratory-related school absences		

Air pollution exposure has also been more recently linked to respiratory symptoms and illnesses in early life including cough, bronchitis, wheeze and ear infections

- Which city has the maximum number of children with ill health?
- Why do fewer number of children suffer with cough in Hyderabad city?
- List the main pollutants responsible for causing severe health problems in children.
- Write any two respiratory illnesses in adolescent that are caused by air pollution.

**Ans :**

- Nagpur
- Hyderabad must be having a cleaner environment so the children would be healthier there.
- SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub> are the main pollutants responsible for causing severe health problems in children.
- Asthma, wheezing and chronic cough

# CHAPTER 14

## Management of Natural Resources

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### 1. INTRODUCTION

A resource is anything which is useful to man or can be transformed into a more valuable and useful source. A natural resource is one where the source is obtained from nature. Forests, wildlife, water, coal and petroleum are important natural resources.

The natural resources are of two types : inexhaustible natural resources such as air, water, solar radiations, etc. and exhaustible natural resources such as minerals, coal, petroleum, etc.

### 2. NEED TO MANAGE OUR RESOURCES

Natural resources are limited in nature. Hence, we need to manage these resources to meet the needs of increasing population and to prevent environmental damage.

Three R's to save the environment are Reduce, Recycle and Reuse.

1. Reduce means reduction in the use of natural resources for their conservation. For example, saving electricity and water.
2. Recycle means processing of waste materials to convert them into usable forms. For example, recycling of plastic, paper, metal items and glass to make new recycled products.
3. Reuse is the use of already used articles again and again. For example, bottles and cans of jams and pickles can be used for storing other things in the kitchen.

### 3. FORESTS AND WILDLIFE

Forests are an important renewable natural resource. They are biodiversity hotspots. Forests have economic (provide food, wood, etc.), protective (protect soil, give shelter to animals and birds) and regulative (regulate climate) functions.

1. Stakeholder is a person with an interest in something. When we consider the conservation of forests, there are four stakeholders of forests. These are local people (who live in or around

the forest and depend on forest produce for living), forest department (of the Government who owns and controls the resources of forests), industrialists (who use forest products as raw materials for the industries) and nature and wildlife enthusiasts (who want to conserve nature in its original pristine form.)

### 4. SUSTAINABLE MANAGEMENT

Sustainable management is the management that meets the needs of the present generation without compromising the ability of the future generations to meet their needs.

The management of forest resources in a sustainable manner involves following two aspects - Prevention of deforestation and extension of forest wealth.

### 5. PEOPLE'S PARTICIPATION IN THE MANAGEMENT OF FORESTS

Regeneration of sal forests was achieved by the involvement of local people of the West Bengal. In 1972, the forest department realised its failure in reviving degraded sal forests in South Western districts of the state. The far-sighted forest officer, A.K. Benerjee, changed the strategy. He involved local villagers in the protection of 1272 hectares of badly degraded Sal forest. In return, villagers were given employment in silviculture (management of forests for the production of timber and harvesting operations).

### 6. WATER FOR ALL

Water is the basic necessity for all forms of life, i.e., human beings, animals and plants. The various sources of water are rains, rivers, lakes, ponds, wells, etc.

1. Discharge of untreated urban sewage and industrial wastes into rivers and lakes pollutes water and reduces the availability of usable water.

2. Change in the lifestyle of people and pressure of increasing population has resulted in consuming more water.
3. Conservation and management of water has been achieved by building dams, tanks and canals for irrigation, regulated use of stored water and maintenance of irrigation systems.
4. Kulhs in Himachal Pradesh are local irrigation canals developed by the people of Himachal Pradesh about 400 years ago. These kulhs benefited the local people by distributing water among the villages effectively.

## 7. DAMS

Dams are large water reservoirs built across the rivers. The stored water is used to generate electricity by running turbines, provide water over long distances for irrigation, supply water for domestic use and municipal purposes.

1. **Problems** associated with building large dams are social (a large number of peasants and tribal -s are displaced), economic (large dams require a huge amount of money for implementation) and environmental (a vast variety of plants and animals get submerged in the water).
2. **Canal systems** carry large amounts of water from dam to great distances for irrigation and domestic use. For example, Indira Gandhi Canal has brought water to the desert areas of Rajasthan (Jaisalmer and Barmer) all along the way, providing drinking water to thousands of people and irrigation facilities for growing crops.

## 8. RAINWATER HARVESTING

Rainwater harvesting is the collection of rainwater for direct use or recharging into the groundwater for indirect use.

1. Water harvesting provides water round the year for drinking and irrigation, reduces community dependence on groundwater for domestic use, reduces chances of floods during rainy season and recharges groundwater.
2. **Traditional water harvesting systems** in India include khadin, Tanks, Nadis (Rajasthan), Ponds (Jammu region), kulhs (Himachal Pradesh), Bhundhis (Madhya Pradesh and Uttar Pradesh), Ahars and Pynes (Bihar), Bandharas, Tals (Maharashtra), Eris or Tanks (Tamil Nadu), Surangams (Kerala) and Kattas (Karnataka).

## 9. WATERSHED MANAGEMENT

A watershed is a specific bounded area jointly managed by a large number of farmers for the purpose of collecting and storing rainwater or water from rivers, streams, etc. to be used in future for drinking, agriculture and other purposes.

## 10. COAL AND PETROLEUM

Coal and petroleum are fossil fuels. They are exhaustible natural resources. Our domestic and industrial needs of energy are largely met by coal and petroleum reserves.

1. **Pollution by the use of fossil fuels** : On burning, fossil fuels produce carbon monoxide, carbon dioxide, oxides of nitrogen and sulphur, and flyash.
2. **Conservation of fossil fuels** involves using pressure cookers and solar cookers for cooking, energy efficient stoves to save on kerosene and LPG, using of biogas in rural areas, saving electricity and using public transport instead of using one's own vehicle.

## OBJECTIVE QUESTIONS

1. A diagram of traditional water harvesting system is given below :

The statement which defines the system and its parts is



- (a) This is an ideal setting of the Khadin system and  $A$  = Catchment area;  $B$  = Saline area &  $C$  = Shallow dugwell
- (b) This is an ideal setting of the Shallow dugwell system and  $A$  = Catchment area;  $B$  = Saline area and  $C$  = Khadin
- (c) This is an ideal setting of Catchment area and  $A$  = Khadin,  $B$  = Saline area and  $C$  = Shallow dugwell
- (d) This is showing Saline area and  $A$  = Catchment area;  $B$  = Khadin and  $C$  = Shallow dugwell.

	A	B	C	D
(a)	q	r	p	s
(b)	p	q	s,	r,
(c)	r	s,	p,	q
(d)	r	p	s	q

**Ans :**

(d) A-r, B-p, C-s, D-q

- 28. Assertion :** Dams are the barriers constructed across the rivers to hold the water.

**Reason :** These dams ensure the storage of adequate water for different uses.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Dams are the barriers constructed across the rivers to hold the water. They ensure the storage of adequate water for different uses.

- 29. Assertion :** Coal is a combustible organic fuel.

**Reason :** It occurs inside the volcanoes.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Coal is a combustible organic fuel that occurs inside the earth.

- 30. Assertion :** Consumption of coal and petroleum can be reduced by many ways.

**Reason :** One of them is to switch off the lights,

fans, etc.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Consumption of coal and petroleum can be reduced by many ways. One of them is to switch off the lights, fans, television, etc.

- 31. Assertion :** The gases released by burning of coal and petroleum are poisonous.

**Reason :** The oxides of sulphur, nitrogen and carbon monoxide are poisonous at high concentrations.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

The gases released by burning of coal and petroleum (oxides of sulphur, nitrogen and carbon monoxide) are poisonous at high concentrations.

- 32. Assertion :** We need to conserve natural resources.

**Reason :** Natural resources are limited.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Ans :

(c) electricity

2. The most rapidly dwindling natural resource in the world is

(a) water (b) forests  
(c) wind (d) sunlight

Ans :

(b) forests

3. The most appropriate definition of a natural resource is that it is a substance/commodity that is

(a) present only on land  
(b) a gift of nature which is very useful to mankind  
(c) a man-made substance placed in nature  
(d) available only in the forest

Ans :

(b) a gift of nature which is very useful to mankind

4. The main cause for abundant conform bacteria in the river Ganga is

(a) disposal of unburnt corpses into water  
(b) discharge of effluents from electro-plating industries  
(c) washing of clothes  
(d) immersion of ashes

Ans :

Delhi 2007

(a) disposal of unburnt corpses into water

5. The pH of water sample collected from a river was found to be acidic in the range of 3.5–4.5. On the banks of the river were several factories that were discharging effluents into the river. The effluents of which one of the following factories is the most likely cause for lowering the pH of river water ?

(a) Soap and detergent factory  
(b) Lead battery manufacturing factory  
(c) Plastic cup manufacturing factory  
(d) Alcohol distillery

Ans :

(b) Lead battery manufacturing factory

6. The pH range most conducive for life of fresh water plants and animals is

(a) 6.5–7.5 (b) 2.0–3.5  
(c) 3.5–5.0 (d) 9.0–10.5

Ans :

(a) 6.5–7.5

7. The three R's that will help us to conserve natural resources for long term use are

(a) recycle, regenerate, reuse  
(b) reduce, regenerate, reuse  
(c) reduce, reuse, redistribute  
(d) reduce, recycle, reuse

Ans :

OD 2012

(d) reduce, recycle, reuse

8. Given below are a few statements related to biodiversity. Pick those that correctly describe the concept of biodiversity

(i) Biodiversity refers to the different species of flora and fauna present in an area  
(ii) Biodiversity refers to only the flora of a given area  
(iii) Biodiversity is greater in a forest  
(iv) Biodiversity refers to the total number of individuals of a particular species living in an area

(a) (i) and (ii) (b) (ii) and (iv)  
(c) (i) and (iii) (d) (ii) and (iii)

Ans :

(c) (i) and (iii)

9. Among the statements given below select the ones that correctly describe the concept of sustainable development

(i) Planned growth with minimum damage to the environment  
(ii) Growth irrespective of the extent of damage caused to the environment  
(iii) Stopping all development work to conserve the environment  
(iv) Growth that is acceptable to all the stakeholders.

(a) (i) and (iv) (b) (ii) and (iii)  
(c) (ii) and (iv) (d) (iii) only

Ans :

(a) (i) and (iv)

10. In our country, vast tracts of forests are cleared and a single species of plant is cultivated. This practice promotes

(a) biodiversity in the area  
(b) monoculture in the area



- (iv) The mobile phones, camera, TV sets, pair of shoes, etc., can be reused after repairing.

Values : Environmental concern, awareness, being economically wise, knowledgeable and justified, taking right decision, etc.

- 143.** Explain giving example where active involvement of local people lead to efficient management of forest.

Ans :

Delhi 2017

In West Bengal, the sal forests had been very badly degraded. A forest officer involved villagers in protection of sal forest and gave them employment in silvi-culture and harvesting operations. Villagers were allowed to collect firewood and fodder on a nominal payment. Within a period of 10 years the previously worthless forests became valuable.

- 144.** What were the main visions behind “Ganga Action Plan” Which was initiated in 1985 ? What values can be learnt from such plans ?

Ans :

Delhi 2016, OD 2013

Aims of Ganga Action Plan :

- To improve the quality of the river water.
- To prevent the contamination of river water due to discharge of industrial waste and sewage.
- To check the growth of disease causing micro-organisms.

Values learnt from Ganga Action Plan :

- Cleanliness attitude.
- Conservation of water.
- Preservation of cultural values.

- 145.** List three merits of watershed management.

Ans :

Foreign 2017

- Watershed management emphasises scientific conservation of soil and water in order to increase the biomass production.
- It helps in preventing droughts and floods.
- It produces plants and animals resources for use in a manner which will not cause ecological imbalance.

- 146.** Explain with the help of two examples how the participation of local people has led to conservation of forest in the past.

Ans :

OD 2017, Comp 2012

- (a) Chipko Andolan in Reni Garhwal.

The Chipko movement originated in a remote village called Reni in Garhwal, during the early 1970's. On a particular day, when the government contractor's workers appeared in the forest to cut the trees, the women of the

village reached there and hugged the tree trunks thus preventing the workers from felling the trees. This movement quickly spread in other parts of the country and forced the government to rethink priorities in the use of forest produce.

- (b) A.K. Banerjee in Midnapore – W.B. Arabari forest.

In 1970s, the West Bengal forest department with the help of forest officer, A.K. Banerjee, involved local people of Arabari forest range, Midnapore district in protecting 1272 hectares of badly degraded sal forest and were suitably rewarded. A remarkable recovery of value worth Rs. 12.5 crore was made possible.

- 147.** List four stakeholders of forests.

Ans :

SQP 2017

- The people living in or around the forests who are directly dependent on forest product.
- The forest department of the government which owns the land and controls the resources from forests.
- The industrialists who use the forest produce, but are not dependent on the forest of a particular area.
- The wildlife and nature enthusiasts who want to conserve nature in its present form.

- 148.** What types of protected areas have been created for the protection of wild-life ?

Ans :

Comp. 2016

They are of three types of wildlife protection areas :

- Sanctuaries :** These are the areas where wild life is not hunted, nor their habitat is disturbed, but all other normal human activities are permitted in limited area.
- National parks :** These are the areas maintained by the central government. Wild-life is protected from all sorts of exploitation. Human activities are not allowed in National Parks except tourism.
- Biosphere Reserves :** They are multi-purpose protected areas where some human activity is allowed in limited area.

- 149.** List four advantages of water stored in the ground.

Ans :

OD 2017

The advantage of water stored in the ground are following :

- It does not evaporate but spreads out to recharge wells.



**Ans :**

(a) afforestation

- 20.** Opposition to the construction of large dams is due to

(a) social reasons  
 (b) economic reasons  
 (c) environmental reasons  
 (d) all the above

**Ans :**

(d) all the above

- 21.** Khadins, Bundhis, Ahars and Kattas are ancient structures that are examples for

(a) grain storage (b) wood storage  
 (c) water harvesting (d) soil conservation

**Ans :**

(c) water harvesting

- 22.** Pick the right combination of terms which has no fossil fuel.

(a) Wind, ocean, and coal  
 (b) Kerosene, wind and tide  
 (c) Wind, wood, sun  
 (d) Petroleum, wood, sun

**Ans :**

(c) Wind, wood, sun

Delhi 2008

- 23.** Select the eco-friendly activity among the following

(a) Using car for transportation  
 (b) Using poly bags for shopping  
 (c) Using dyes for colouring clothes  
 (d) Using windmills to generate power for irrigation

**Ans :**

(d) Using windmills to generate power for irrigation

- 24.** It is important to make small check dams across the flooded gullies because they

(i) hold water for irrigation  
 (ii) hold water and prevent soil erosion  
 (iii) recharge ground water  
 (iv) hold water permanently  
 (a) (i) and (iv) (b) (ii) and (iii)  
 (c) (iii) and (iv) (d) (ii) and (iv)

**Ans :**

(b) (ii) and (iii)

Foreign 2016

- 25.** Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Kulhs	(p)	Karnataka
(B)	Kattas	(q)	Maharashtra
(C)	Tals	(r)	Rajasthan
(D)	Khadin	(s)	Himachal Pradesh

	A	B	C	D
(a)	q	r	p	s
(b)	p	q	s,	r,
(c)	r	s,	p,	q
(d)	s	p	q	r

**Ans :**

(d) A-s, B-p, C-q, D-r

- 26.** Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Wullvar	(p)	Orissa
(B)	Chilka	(q)	Rajasthan
(C)	Sambhar	(r)	Jammu and Kashmir
(D)	Harike	(s)	Punjab

**Ans :**

	A	B	C	D
(a)	q	r	p	s
(b)	p	q	s,	r,
(c)	r	p,	q,	s
(d)	r	q	s	p

(c) A-r, B-p, C-q, D-s

- 27.** Match the column I to column II and select the correct answer using the codes given below:

	Column I		Column II
(A)	Desertification	(p)	Amrita Devi Bishnoi
(B)	Khejri	(q)	Incomplete combustion
(C)	Khadin	(r)	Deforestation
(D)	Carbon monoxide	(s)	Water harvesting

meant for preserving local bio diversity along with traditional life style of the tribals by allowing them to utilize some normal forest products and involving them in conservation of wildlife.

111. Which natural resource are the biodiversity hotspots. Suggest what happens when there is a loss of biodiversity ?

Ans :

Foreign 2015

Forests are the natural resources known as biodiversity hotspots. When there is a loss of biodiversity, there is a loss of ecological stability.

112. Give any two advantages of water stored underground.

Ans :

Foreign 2014, OD 2010

The advantages are as follows :

- (a) It does not evaporate.
- (b) It provides moisture for vegetation over a large area.

113. "Burning of fossil fuels results in global warming." Justify this statement.

or

Burning of coal and petroleum pollute the environment. Justify this statement.

Ans :

OD 2015

Burning of fossil fuels produces  $\text{CO}_2$ , water and oxides of nitrogen and sulphur. Presence of oxides of sulphur and nitrogen in atmosphere is responsible for acid rain. When combustion takes place in insufficient oxygen, carbon monoxide is formed. CO and  $\text{CO}_2$  are greenhouse gases. High concentration of  $\text{CO}_2$  leads to increase in global temperature causing global warming.

114. Mention any two reasons for which environmentalist protested against raising height of the 'Sardar Sarovar Dam' on river Narmada.

Ans :

SQP 2014

Environmentalists protested against raising height of the 'Sardar Sarovar Dam' on river Narmada because of the following problems :

- (a) Social problems because they displace large number of peasants and tribals without adequate compensation or proper rehabilitation.
- (b) Environment problems because dam swallow up huge amount of land and hold a large volume of water which not only distorts local biodiversity, but also increases risk of earthquake.

115. (a) "The increase in demand for fossil fuels is affecting our environment adversely." Justify this statement.

- (b) Why is LPG considered a better fuel than coal?

Ans :

OD 2015

- (a) The increase in demand for energy leads to over use of fossil fuels causing environmental pollution.
- (b) Burning of coal leaves residues like  $\text{SO}_2$ ,  $\text{NO}_2$ , smoke, etc. which are harmful and cause air pollution, whereas LPG does not produce smoke or ash.

116. (a) "Sun is the ultimate source of energy for fossil fuels," justify this statement.

- (b) Write two disadvantages of using fossil fuels.

Ans :

OD 2014

- (a) Plants trap solar energy in the form of food (chemical energy) through photosynthesis and animals get this energy when they eat them. Further, the fossil fuels are made of dead plants and animals which got synthesised by energy from the Sun.
- (b) (i) They cause air pollution.  
(ii) They are expensive and limited.

117. What is watershed management? How is it helpful to ecosystem?

Ans :

Delhi 2015

Watershed management emphasizes scientific soil and water conservation in order to increase the biomass production.

It is helpful to ecosystem by developing primary resources of land and water to produce secondary resources of plants and animals for use in a manner which will not cause ecological imbalance.

118. How is coal formed ? State the two pollutants which cause acid rain.

Ans :

SQP 2014

The biomass which got buried under the earth millions of years ago leads to the formation of coal due to high temperature and pressure and different types of movements under the earth.

Oxides of nitrogen like  $\text{NO}_2$ ,  $\text{NO}_x$ , etc. and oxides of sulphur like  $\text{SO}_2$ ,  $\text{SO}_3$ , etc. cause acid rain.

119. List four advantages of properly managed watershed management.

Ans :

OD 2015

- (a) Mitigates drought and floods.

- (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

We need to manage natural resources because natural resources are limited. Human population is increasing at a tremendous rate and utilization of natural resources is increasing at an exponential rate. Therefore, we need to conserve resources for future generations.

**33. Assertion :** Reuse is better than recycle.

**Reason :** Recycle prevents environmental pollution.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Reuse is better than recycle because it saves energy by using material again without any changes and also, it prevents environmental pollution.

**34. Assertion :** The development which can be maintained for a long time without can be maintained for a long time without undue damage to the environment is called sustainable development.

**Reason :** It provide the economic well being to the present and future generation.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Sustainable development is the development which can be maintained for a long-time without undue

damage to the environment. It has two main objectives. To provide economic well being to the present and future generation and to maintain a healthy environment and life support system.

**35. Assertion :** Chipko Andolan was done by women of Reni village.

**Reason :** Chipko Andolan was done to protect wild life.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(c) Assertion (A) is true but reason (R) is false.

Chipko movement was started in early 1970s in village in Garhwal by the women of Uttarakhand to stop cutting of forest trees of their area.

**36. Assertion :** Wildlife should be conserved.

**Reason :** Human activities cause several plants and animals to extinct.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
 (c) Assertion (A) is true but reason (R) is false.  
 (d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Wild life is found in forests. Over a period of time, wildlife has become extinct because of certain human activities like deforestation, hunting, poaching etc.

**37. Assertion :** Water is a valuable resource.

**Reason :** Turn off the taps when not in use.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

- (c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Water is a valuable resource. So, we need to conserve it by turning off the taps when not in use.

- 38. Assertion :** Coal and petroleum are categorised as natural resources, so should be used judiciously.

**Reason :** They are formed from the degradation of biomass subjected to various biological and geological processes over a million of years.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Coal and petroleum are formed from the degradation of biomass subjected to various biological and geological processes over a million of years. Thus, cannot be manufactured by humans. Therefore, coal and petroleum are categorised as natural resource.

- 39. Assertion :** Water harvesting is the method to capture every trickle of water that falls on the land.

**Reason :** Water harvesting recharges wells and ground water.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).  
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).  
(c) Assertion (A) is true but reason (R) is false.  
(d) Assertion (A) is false but reason (R) is true.

**Ans :**

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Water harvesting is a technique of capturing rain water when it falls and taking measure to keep the water clean. It recharges wells/ground water and provides moisture for vegetation over a wide area.

## ONE MARK QUESTIONS

- 40.** Write two advantages associated with water harvesting at the community level.

**Ans :**

OD 2019, OD 2015

- (i) Exploitation of water resources will be reduced.  
(ii) It helps to recharge natural wells and the ground water level.

- 41.** Although coal and petroleum are produced by the degradation of biomass, yet we need to conserve these resources. Why?

**Ans :**

OD 2019

We need to conserve coal and petroleum because they are formed in millions of years and are non-renewable also and their rate of consumption is very high. So these are limited and cannot last for longer time.

- 42.** The presence of a particular group of bacteria in water bodies indicates contamination. Identify the group.

**Ans :**

Delhi 2019

Coliform bacteria

- 43.** Tehri dam is built on which river ?

**Ans :**

The Ganga.

- 44.** Mention one reason for discontentment among the people who have been displaced by building dams.

**Ans :**

OD 2017

The people had major discontentment over rehabilitation issues.

- 45.** Name one green-house gas.

**Ans :**

Delhi 2016

Carbon dioxide.

- 46.** Identify two local industries which pollute the local water bodies by throwing untreated sewage.

**Ans :**

Delhi 2017

- (i) Paper industry  
(ii) Sugar industry.

47. Name two ancient water harvesting structures in Maharashtra.

**Ans :** Delhi 2017, SQP 2013  
Bandharas and Tals.

48. Where are coliform bacteria found in human beings ?

**Ans :** Foreign 2017  
Intestine.

49. Name the state in which Indra Gandhi canal has brought greenery.

**Ans :** Delhi 2016  
Rajasthan

50. Why are coal and petroleum called earth resources ?

**Ans :** SQP 2017  
Coal and petroleum are called earth resources because these were formed from the degradation of the bio-mass millions of years ago inside the earth.

51. Why is it necessary to conserve our environment?

**Ans :** Comp 2017  
Conservation of environment is required for preventing damage to environment and depletion of natural resources.

52. Why do we need to use our resources carefully ?

**Ans :** OD 2017  
Because these are not unlimited and with the human population increasing at a tremendous rate due to improvement in health-care, the demand for all resources is increasing at an exponential rate.

53. What are the various natural resources ?

**Ans :** Delhi 2015  
Soil, air, water, forests, wildlife, coal and petroleum are the various natural resources.

54. Name any two wastes which can be recycled and reused.

**Ans :** Delhi 2017  
Old newspapers and Plastics.

55. Mention one drawback of monoculture.

**Ans :** SQP 2016  
To plant monoculture huge areas are first cleared of all vegetation which destroys a large amount of biodiversity.

56. What is coliform ?

**Ans :** Foreign 2017  
It is a group of bacteria found in human intestine.

57. What is sustainable management ?

**Ans :** Delhi 2016  
Sustainable management is a resource management technique which aims to conserve the resource, use them efficiently and avoid their misuse for individual purposes such that they are conserved for future.

58. What are the main sources of energy today ?

**Ans :** Comp 2017  
Today, the main sources of energy are coal and petroleum.

59. Name the tree for which Amrita Devi Bishnoi and others sacrificed their lives.

**Ans :** Delhi 2016  
Khejri trees.

60. What is production plantation ?

**Ans :** OD 2015  
It is growing of commercially important plants over separate piece of land, generally a water land.

61. How is carbon monoxide formed ?

**Ans :** SQP 2016  
When combustion takes place in insufficient air (oxygen), then carbon monoxide is formed instead of carbon dioxide.

62. Why maintaining a biodiversity is important ?

**or**

State any one reason for the conservation of forest and wildlife.

**Ans :** Delhi 2017  
Because experiments and field studies suggest that a loss of biodiversity forest or wildlife may lead to a loss of ecological stability.

63. Name for industries which are based on forest produce.

**Ans :** Delhi 2016  
Timber, paper, lac and furniture industries.

64. What is Kulh ?

**Ans :** Foreign 2017  
It is a local system of canal irrigation evolved in some parts of Himachal Pradesh.

**Ans :**

OD 2020

A khadin is a construction that is designed to harvest surface run off water for agriculture. It was first designed by the Paliwal Brahmins of Jaisalmer, western Rajasthan in the 15th century. This system has great similarity with the irrigation methods of the people (present Iraq) around 4500 BC and later of the Nabateans in the Middle East.

This is an ideal setting of the Khadin system and  $A$  = Catchment area,  $B$  = Saline area and  $C$  = Shallow dugwell.

Thus option (a) is correct.

2. The major ill effect of mono culture practice in forests is on the
- biodiversity which faces large destruction
  - local people whose basic needs can no longer be met from such forests
  - industries
  - forest department

**Ans :**

OD 2020

The major ill effect of monoculture practice in forests is on the biodiversity which faces large destruction. Growing single type of vegetation or trees in the forests lead to loss of biodiversity or loss of variations among the types of animals, plants, insects, birds, etc. Monoculture in the area is promoted by the practice of clearing vast tracts of forests and cultivating a single species of plant. The practice of clearing vast tracts of forests and cultivating a single species of plant is known as monoculture. This devastates the biodiversity in the region as the number of species lower. It likewise upsets or disturbs the natural ecosystem in the area. Hence, it decelerates the growth of the natural forest.

Thus option (a) is correct.

3. Which one of the following is responsible for the sustenance of underground water?
- Loss of vegetation cover.
  - Diversion for high water demanding crops.
  - Pollution from urban wastes.
  - Afforestation.

**Ans :**

Delhi 2020

Sustenance of the ground water means the maintenance of groundwater, which can be achieved by afforestation.

Afforestation is the process of planting trees. Trees roots and trunks will form a barrier for run-off water, it will help seepage of water thus, increasing

the ground water level.

Thus, 'Afforestation' is responsible for the sustenance of ground water

Thus option (d) is correct.

4. Incomplete combustion of coal and petroleum :
- increases air pollution
  - increases efficiency of machines.
  - reduces global warming.
  - produce poisonous gases.
- The correct option is :
- (A) and (B)
  - (A) and (D)
  - (B) and (C)
  - (C) and (D)

**Ans :**

OD 2020, SQP 2017

Incomplete combustion of coal and petroleum results in increased air pollution. Fossil fuels, on incomplete combustion, produce carbon monoxide which is a poisonous gas.

It also increases global warming

Thus option (b) is correct.

5. When we destroy a forest, we destroy
- an ecosystem
  - population of wildlife
  - the environment
  - food and shelter of wild animals

**Ans :**

Copm. 2014

When we destroy a forest we destroy an ecosystem. An ecosystem refers to the geographical area where both biotic and abiotic components are present and all biotic components depend on the abiotic components as well as on each other for survival. The biotic components of an ecosystem are living organisms such as plants, animals, microorganisms, etc. However, water, air, land, soil, atmosphere, etc are the non-living or abiotic components of an ecosystem. A forest harbors all kinds of living organisms like plants, animals, microbes as well as the abiotic components like water, air, soil, atmosphere, etc. Thus, destruction of a forest is equivalent to destroying an ecosystem.

Thus option (a) is correct.

1. From the list given below pick the item that is not a natural resource
- |                 |           |
|-----------------|-----------|
| (a) soil        | (b) water |
| (c) electricity | (d) air   |



## TWO MARKS QUESTIONS

- 82.** Although coal and petroleum are produced by the degradation of biomass, yet we need to conserve these resources. Why?

**Ans :**

OD 2019, Comp. 2013

We need to conserve coal and petroleum because they are formed in millions of years and are non-renewable also and their rate of consumption is very high. So these are limited and cannot last for longer time.

- 83.** List any four stakeholders which may help in the conservation of forests.

**Ans :**

OD 2017, SQP 2012

- (a) Locals living in villages near the forest area.
- (b) Industrialists practising recycling.
- (c) Wildlife and nature enthusiasts.
- (d) Forest department of the government.

- 84.** Why is reuse considered better in comparison to recycle.

**Ans :**

OD 2016

Reuse is better than recycle because :

- (a) Reuse saves energy by using material again without any changes.
- (b) Reuse prevents environment pollution.

- 85.** State two reasons of launching the “Ganga Action Plan”. Which bacteria was found in Ganga water indicating contamination ?

**Ans :**

Delhi 2017

Reasons for launching the “Ganga Action Plan” were:

- (a) Poor quality of the river water.
- (b) Increased presence of disease causing organisms in the water.  
Coliform bacteria found in Ganga water indicates its sewage contamination.

- 86.** Explain how would the involvement of local people be useful for successful management of forests.

**Ans :**

Delhi 2016

The involvement of local people is useful in the following ways :

- (a) People should be aware of the fact that diminishing forest cover would disturb the ecological balance.
- (b) Phenomenon like forest fires must be reported immediately to the forest officers. The sooner

the action taken more will be the area which can be protected.

- 87.** What harm has been caused to alpine meadows since nomadic shepherds have stopped from grazing their cattle in such meadows ?

**Ans :**

Foreign 2017

The establishment of great Himalayan National Park formed had put this practice to an end. This resulted in tall grasses, preventing fresh growth of alpine grasslands in Himalayas.

- 88.** How do advantages of exploiting natural resources with short term gains in mind differ from the advantages of managing our resources with a long-term perspective.

**Ans :**

Delhi 2016

Exploitation of natural resources with short term gains aims at providing all the benefits to the current generation for their growth and development without any consideration for the future.

In case of long term perspective the resources are utilised in a more judicious manner so that they are also conserved for the future generations.

- 89.** What is meant by wild life ? How is it important for us ?

**Ans :**

OD 2017

Wildlife refers to all naturally occurring plants, animals, birds and other life forms which are found in the forests and are not domesticated.

Importance of wild life :

- (a) It is essential to maintain the ecological balance of the nature.
- (b) It provides a great biological diversity in an area.

- 90.** Explain two main advantages associated with water harvesting at the community level.

**Ans :**

SQP 2017

- (a) Due to water harvesting, water does not evaporate instead it percolates into the ground. Therefore, results in the recharging of wells.
- (b) Water harvested at community level can be used for drinking and irrigation purpose.

- 91.** State two advantages of conserving forests and wild life.

**Ans :**

OD 2017

Advantages of conserving forests are :

- (i) Forests maintain balance between abiotic and biotic factors of the environment.



65. The term 'biodiversity hotspots' is coined for which resource and why ?

**Ans :** OD 2016

Forests are called 'biodiversity hotspots' because these provide habitat to a range of wild endemic life forms.

66. Which gas is produced due to incomplete combustion of fossil fuels.

**Ans :** SQP 2015

Carbon monoxide.

67. What are the factors behind the failure of sustaining underground water ?

**Ans :** OD 2014

Over consumption of ground-water, deforestation, lack of rain water harvesting, etc.

68. State one reason for the conservation of forest and wild life.

**Ans :** Delhi 2015, OD 2013

Restoring of ecological balance.

69. Name two water intensive crops.

**Ans :** Delhi 2014

(i) Rice, (ii) Sugarcane.

70. State the places that are referred as biodiversity hotspots.

**Ans :** Foreign 2015

Forest of western ghat and northern Himalayas.

71. List two items which can be easily recycled but we generally throw than in the dustbins.

or

Name any two items which can be easily recycled but are generally thrown in the dustbins by us.

**Ans :** Foreign 2014

Steel cans and paper.

72. Mention the action taken by government to save river Ganga.

**Ans :** SQP 2015

Ganga Action Plan (Namami Gange Project).

73. Give one protective function of forest.

**Ans :** Delhi 2014

Forest is the habitat of many wildlife species of animals ,plants and plays an important role to maintain a balance in biodiversity.

74. Give any two uses of bamboo for local people.

**Ans :** OD 2015

(a) Used to make huts, baskets etc.

(b) Used for agriculture, fishing etc.

75. Which dam is built on river Narmada ?

**Ans :** OD 2014

Sardar Sarovar Dam.

76. What is concept of sustainable development?

**Ans :** Delhi 2015

The concept of sustainable development encourages forms of growth that meet current basic human needs, while preserving the resources for the needs of future generations.

77. How can the pH of water be checked out ?

**Ans :** Comp. 2015

It can be checked out by using universal indicator or a litmus paper.

78. What is meant by biodiversity hotspots ?

**Ans :** Foreign 2015

It is a biogeographic region which is a significant reservoir of biodiversity.

79. List any two measures that you suggest for better management of water resources.

**Ans :** OD 2014, Delhi 2010

(a) The management of water resources requires a long term perspective

(b) The management should ensure equitable distribution of water resources.

80. Name the major programme started to replenish forests.

**Ans :** Foreign 2015

Silviculture.

81. How long will the reserves of coal and petroleum last ?

**Ans :** Comp 2014

At present rates of usage, our known petroleum resources will last for about forty years and the coal resources will last for another two hundred years.

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the help of forest officer, A.K. Banerjee, involved local people of Arabari forest range, Midnapore district in protecting 1272 hectares of badly degraded sal forest and were suitably rewarded. A remarkable recovery of value worth Rs. 12.5 crore was made possible.

- 101.** How forest resources should be used ?

**Ans :**

OD 2017

Forest resources ought to be used in a manner that is both environmentally and developmentally sound. In other words, while the environment is preserved, the benefits of the controlled exploitation go to the local people. A process in which decentralized economic growth and ecological conservation go hand in hand.

- 102.** Forests are “biodiversity spots”. Justify this statement.

**Ans :**

OD 2016, SQP 2014

The measure of biodiversity of an area is the number of species found there. Since, in a forest we can find a range of different life forms of plants and animals, the forests are considered the biodiversity hot spots.

- 103.** What are the advantages of a dam ?

**Ans :**

Delhi 2017

Large dams can ensure the storage of adequate water not just for irrigation, but also for generating electricity. Canal systems leading from these dams can transfer large amounts of water over great distances.

- 104.** What is Chipko movement ?

**Ans :**

OD 2016

The Chipko movement originated in a remote village called Reni in Garhwal, during the early 1970's. On a particular day, when the government contractor's workers appeared in the forest to cut the trees, the women of the village reached there and hugged the tree trunks thus preventing the workers from felling the trees. This movement quickly spread in other parts of the country and forced the government to rethink priorities in the use of forest produce.

- 105.** Why do we need to use our resources carefully ?

**Ans :**

OD 2017, Delhi 2012

We need to use our resources carefully because the resources we use are limited. With the human population increasing at a tremendous rate due to improvement in health-care, the demand for all resources is increasing at an exponential rate. Thus, the management of natural resources is required for

a long term perspective so that these resources will last for the generations to come.

- 106.** How did “Chipko Andolan” ultimately benefit the local people ? Explain briefly.

**Ans :**

Foreign 2016

The government had to rethink their priorities in the use of forest and land use and change their forest and land policies. This ensured a stable availability of the forest to the local villagers. It led to efficient management of forest and also resulted to conservation of soil and water which ultimately benefited the local people.

- 107.** (a) How can development of efficient engines ensuring complete combustion of fossil fuel be useful to us?  
(b) Name the four elements that constitute fossil fuels.

**Ans :**

Delhi 2015

- (a) Complete combustion of fuels in such engines will increase efficiency, reduce air pollution and save fuel.  
(b) Four elements that constitute fossil fuels are carbon, nitrogen, hydrogen and sulphur.

- 108.** How can we save energy ?

**Ans :**

OD 2014

We can save energy in the following ways :

- (a) Instead of using bus/car, we can prefer walking/cycling.  
(b) By using fluorescent tubes instead of bulbs.  
(c) By using the stairs instead of lift.  
(d) By wearing an extra sweater instead of using a heating device in winters.

- 109.** What are non-renewable resources? Give two examples.

**Ans :**

OD 2015, Delhi 2012

These are the resources which, when exhausted cannot be easily synthesized. They take millions of years to be synthesized.

Example : Coal and petroleum.

- 110.** When did the concept of biosphere reserve evolve ? Is it advantageous in the present context ?

**Ans :**

SQP 2014

The concept of biosphere reserve was evolved in 1986 by Man and Biosphere (MAB) programme of UNESCO. These programmes are advantageous for the present as well as future. Biosphere reserves are

- 162.** What is the meaning of Chipko Movement ? Who started it ? State any three objectives of starting it.

**Ans :**

Foreign 2016, Delhi 2014

The meaning of chipko movement is 'hug the trees movement'. It is one of the movements in India to conserve forest and biodiversity and to end the alienation of people from their forests. Sunder Lal Bahuguna started Chipko Movement in hilly areas of Himachal Pradesh.

The objectives of Chipko Movement are:

- (a) To protect existing forest cover.
- (b) Afforestation
- (c) To utilize forest wealth like food, fodder, fuel, fertilizers and fibres for local villagers, while keeping in mind its conservation.

- 163.** What is a dam ? Write two main advantages and two ill-effects of constructing a big dam.

**Ans :**

SQP 2017, OD 2014

**Dams :** Dams are constructed across the rivers to regulate the flow of water. The large reservoir of a dam stores a huge amount of water brought in by the flowing river. The stored water is then allowed to flow downstream at the desired rate.

**Advantages :**

- (a) Water from a dam is supplied to the people in towns and cities through pipelines after suitable treatment. In this way, construction of dams ensures continuous water supply in the region.
- (b) Water from a dam is used for irrigation in fields through a network of canals. Dams ensure round the year water supply to the crop fields and help raise agricultural production.

**Ill-effects :**

- (a) **Social Problems :** Due to the construction of high-rise dams, a large number of human settlements or villages are submerged in the water of large reservoir formed by the dam and many people are rendered homeless.
- (b) **Environmental Problems :** The construction of high-rise dams in the rivers contributes to deforestation and loss of biodiversity. This is because a vast variety of flora and fauna (plants and animals) get submerged in the water of large reservoir formed by the dam and disturb the ecological balance.

- 164.** What is sustainable development ? Explain it with respect to forest, wild-life and water resources.

**Ans :**

OD 2016

It is the development oriented proper management of natural resource to use it wisely and judiciously so that it is available for the future generations also. The growing population is increasing demand for these resources, but they are limited in nature.

The sustainable development would prevent the exploitation of these resources and keep them available for future generations.

**Forest :** Many industries like timber, wood, bidi, tendu leaves etc., are dependent on the trees in the forest. They keep cutting the trees for use. This need to be managed properly and checked that new plantation of trees take place and animals are not harmed and are preserved.

**Wild-life :** All animals in the forest are disturbed due to intervention of people into the forest. They are also killed for trade of skin, fur, tusk horn etc. If the animals in the forest are not managed and taken care of them they will extinct which will disturb the ecological balance of the earth.

**Water Resources :** The main fresh water resources on land are rivers, lake, ponds and under ground water. The sources of water are getting polluted and the underground water is also uncontrollably discharged and used thus, the level of water is declining. Hence the recharge of water under the ground by rain water harvesting is necessary.

- 165.** How industry is affecting the forest ?

**Ans :**

OD 2017, Delhi 2012

Industry considers the forest as merely a source of raw material for its factories and huge interest groups lobby the government for access to these raw materials at artificially low rates. Since these industries have a greater reach than the local people, they are not interested in the sustainability of the forest in one particular area. For example, after cutting down all teak trees in one area, they will get their teak from a forest farther away. They do not have any stake in ensuring that one particular area should yield an optimal amount of some produce for all generations to come.

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- (b) Increase the life of the dams and reservoirs downstream.
  - (c) Increases the biomass production and thereby the income of the watershed community.
  - (d) Helps in maintaining ecological balance by scientific conservation of soil and water.
- 120.** How is the increase in demand of fossil fuels affecting our environment adversely ? Suggest two ways to minimize the problem.

**Ans :**

Foreign 2014, Comp. 2010

- (a) Effect on the environment :
    - (i) causing environmental pollution.
    - (ii) leading to more stress on the natural resources.
  - (b) Solution :
    - (i) utilizing the resources judiciously.
    - (ii) more dependence on alternative sources of energy.
- 121.** The construction of large dams leads to (i) social, and (ii) environmental problems. List two problems in each case.

**Ans :**

Comp 2015, SQP 2014

- (a) Social problems :
    - (i) They displace large number of peasants and tribals without adequate compensation and proper rehabilitation.
    - (ii) This leads to their migration into the cities.
  - (b) Environmental problems :
    - (i) They contribute enormously to deforestation and loss of biological diversity.
    - (ii) They cause soil erosion and increase the risk of earthquake.
- 122.** (a) What is water harvesting?  
(b) Mention any two water harvesting structures.

**Ans :**

Delhi 2014

- (a) Water harvesting : It means capturing of rain water where it falls and taking measures to keep the water clean by not allowing polluting activities to take place.
  - (b) Water harvesting structures : Crescent shaped earthen embankment, check dams made up of concrete and pebbles are some of the water harvesting structures.
- 123.** Suggest any two methods that should be adopted to ensure that the local air and local water bodies are

not polluted.

**Ans :**

Comp.2015

- (a) Filter and recycle various gaseous and liquid waste products of industries instead of dumping into rivers.
  - (b) Adequate sewage and industrial waste treatment in sewage treatment plants before dumping them into water bodies.
- 124.** Suggest two methods by which our consumption of coal and petroleum can be reduced.

**Ans :**

OD 2014

- (a) Judicious use of coal and petroleum products like using public transport, using fluorescent tubes, etc.
  - (b) Use of solar energy and alternative fuels.
- 125.** What are fossil fuels ? How are they formed ?

**Ans :**

Delhi 2015, Comp. 2011

The fuels like coal and petroleum that are formed from the degradation of biomass are called fossil fuels.

Fossil fuels are formed from the biomass, like remains of plants and animals, that got buried under the earth millions of years ago. Due to high temperature and pressure under the earth and also due to different types of movements, degradation of biomass took place and hence it got converted into fossil fuels.

- 126.** What is reuse strategy ? Reuse strategy is considered better than the recycling strategy. Why ?

**Ans :**

Delhi 2014

Reuse is better than recycle because :

- (a) Reuse saves energy by using material again without any changes.
  - (b) Reuse prevents environment pollution.
- 127.** (a) Why are coal and petroleum called fossil fuels ?  
(b) Name any two elements present in fossil fuels in addition to carbon.

**Ans :**

Foreign 2015

- (a) They are formed from the preserved remains of organisms that lived millions of years ago and are used as fuels. Thus, they are called fossil fuels.
- (b) (i) Hydrogen.  
(ii) Nitrogen.

- (ii) They provide us various products in the form of food, medicines, wood and raw materials for different industries.

**92.** State two advantages of conserving wild life.

**Ans :**

Delhi 2016

Advantages of conserving wild life are :

- (a) For protecting biodiversity
- (b) Some wild life is essential for the survival of other animals.

**93.** (a) What is meant by sustainable development ?

(b) Suggest any one method to achieve it.

**Ans :**

SDP 2017

- (a) It is a development which can be maintained for a long time without undue damage to the environment.
- (b) Judicious use of natural resources can lead to sustainable development.

**94.** Why is an equitable distribution of resources essential in a society ? List two forces which are against such distribution.

**Ans :**

Delhi 2016, OD 2011

Equitable distribution of resources is essential in a society because we all are human beings whether rich or poor and have got equal rights on the usage of the natural resources and avoids the division of society to an extent. Two forces which are against such distribution are :

- (a) Lack of awareness of poor people.
- (b) Excessive consumption by the rich.

**95.** What are the various interests of local people living near forests ?

**Ans :**

Foreign 2017

The local people need large quantities of firewood, small timber and thatch. Bamboo is used to make slats for huts, and baskets for collecting and storing food materials. Implements for agriculture, fishing and hunting are largely made of wood. Also, forests are sites for fishing and hunting. In addition to people gathering fruits, nuts and medicines from the forests, their cattle also graze in forest areas or feed on other fodder which is collected from forests.

**96.** Why must we conserve our forests ? List two factors responsible for causing deforestation.

**Ans :**

OD 2016

We must conserve our forests to conserve the biodiversity, ecological stability, habitat for wild

life, purification air and protect the Earth from greenhouse effect.

Factors responsible for causing deforestation :

- (a) Over utilisation of forest wood for human needs.
- (b) Mining.

**97.** An environmentalist on visit to your school, suggested the use of three R's to save the environment. Explain what he meant by three R's and how would you follow his advice.

**Ans :**

Comp 2017

Three R's are meant for :

- (i) Reduce i.e., to use less.
- (ii) Recycle i.e., to collect plastic, paper, glass and metal items and recycle these materials to make required things.
- (iii) Reuse i.e., to use things again and again.

We follow his advice by :

- (a) switching off unnecessary lights and fans.
- (b) using public transport.

**98.** You being an environmentalist are interested in contributing towards the conservation of natural resources. List four activities that you can do on your own.

**Ans :**

Delhi 2016

The four activities that we can do on our own are

- (a) Reduce the use of water
- (b) Recycle the waste materials like paper.
- (c) Avoid the use of non-renewable sources of energy.
- (d) Planting trees.

**99.** List four ways in which management of fossil fuels differs from natural renewable resources of energy.

**Ans :**

OD 2016, Delhi 2012

- (a) Fossil fuels are available in limited quantity so prudent use is required.
- (b) Its equitable distribution is needed because of the limited quantity available.
- (c) They will exhaust in future so looking for new and renewable energy sources is required.
- (d) They pollute environment so this evil is also required to be managed.

**100.** With the help of an example explain how involvement of local people can lead to efficient management of forests.

**Ans :**

Comp 2016

In 1970s, the West Bengal forest department with

- (ii) Segregation of waste into biodegradable and non-biodegradable waste.
- (iii) Conversion of waste into useful components like biogas and then using compost as a fertiliser.

**138.** What is water harvesting? List two main advantages associated with water harvesting at the community level. Write two causes for the failure of sustained availability of groundwater.

**Ans :**

OD 2019

Water harvesting means capturing rain where it falls or capturing the run off in village or town. It can be done by capturing run off from roof tops and local catchments.

Advantages :

- (i) Harvesting water allows capturing better utilization of an energy resource or when there is an immediate need.
- (ii) This water is suitable for irrigation and for recharging the ground water level.

Causes for failure of sustained ground water availability are :

- (i) Increase in agricultural activities leads to depletion or overuse of ground water.
- (ii) Increase in population and industries are also responsible for the same. Which leads to deforestation.

**139.** Why should there be equitable distribution of resources? List three forces that would be working against an equitable distribution of our resources.

**Ans :**

Delhi 2019, Comp. 2013

There should be equitable distribution of the resources so that all the people irrespective of being rich or poor have access and makes use of the resources. Equitable resource distribution also leads to sustainable development.

Three factors that work against equitable distribution of resources are :

- (i) Over exploitation of resources by industrialists for short-term gains.
- (ii) Improper management which has led to access of natural raw material to certain group of people which are either influential. The environmental laws, rules are not implemented properly.
- (iii) Wastage by the people who have indifferent attitude towards environment, use the resources with short term aim hence leading to depletion of resources.

**140.** Three advantages of exploiting resources with short term aims :

- (i) Immediate benefit to few people.
- (ii) Progress in science and technology for development in a country.
- (iii) Urbanisation and Industrialisation of an area.

**Ans :**

SQP 2019

Three advantages of using a long time perspective :

- (i) Resources will be made available for sustainable development.
- (ii) Provides valuable contribution to the socio-economic development.
- (iii) Quality of environment will be conserved.

**141.** Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.

**Ans :**

OD 2017, SQP 2012

**Biodegradable substances** can be broken down into simpler substances in nature by decomposers like bacteria or saprophytes e.g., Human excreta, vegetable peels, etc.

**Non-biodegradable substances** can't be broken down into simpler substances in nature by decomposers. e.g., Plastic, glass, etc.

Habits :

- (i) Use of separate dustbins for biodegradable and non-biodegradable waste,
- (ii) Reuse of things such as poly-bags, etc.,
- (iii) Recycle of waste,
- (iv) Use of cotton/jute bags for carrying vegetables, etc.

**142.** Reuse is better than recycling. Give two examples of reuse strategy. Mention any two values do we attain from this strategy.

**Ans :**

OD 2016

Reuse is better than recycling because even in recycling some energy is used while in reuse, it is merely to use it again and again without consuming energy. e.g.,

- (i) The used envelopes can be reused merely by reversing them.
- (ii) The packaging material and thick polythene carry bags can be used many times.
- (iii) The plastic bottles of jams or pickles after being empty, can be used for storing things in the kitchen.



- 128.** Mention any two factors responsible for the neglect of local irrigation methods.

Ans :

Foreign 2014

- (a) Development of large dams and canals that supply water to large distances.  
(b) The requirement of water has also increased many times due to increase in population which cannot be fulfilled by local irrigation methods.

- 129.** Suggest two important measures to reduce consumption of the various natural resources.

Ans :

OD 2013

- (a) Walk or use cycle instead of taking a motor driven vehicle for a short distance.  
(b) Increase your dependence on renewable sources of energy.

- 130.** We need to use the fossil fuels judiciously. Give two reasons in agreement to the statement.

Ans :

OD 2012

- (a) The indiscriminate use of fossil fuels degrades our environment causing air pollution and green house effect.  
(b) They should be conserved for future generations as these resources are limited in nature.

- 131.** State two disadvantages of converting forests into mono-cultures.

Ans :

Delhi 2013, OD 2009

Converting forests to mono-cultures destroys a large amount of local biodiversity in the area. The varied needs of local people for fodder, medicines, fruits, nuts, etc., cannot be met from such mono-cultures.

- 132.** How did the 'Chipko Andolan' ultimately benefit the local population ? Give any two benefits.

Ans :

Delhi 2012

- (a) The Chipko movement quickly spread across communities and media and forced the government, to whom the forest belongs, to rethink their priorities in the use of forest products.  
(b) Due to the participation of local people, it led to the efficient management of forests.

- 133.** How can we as an individual help in reducing the use of fossil fuels ? Mention two ways.

or

List any four methods of conserving fossil fuels.

Ans :

Foreign 2013

- (a) By saving electricity.  
(b) By forming car pool.

- (c) Conversion into efficient forms like CNG.  
(d) Avoid wastage of fuel.  
(e) Make more use of renewable sources of energy.

- 134.** "Industrialization is one of the main causes of deterioration of environment." List any four reasons in favor of this statement.

Ans :

Foreign 2012

- (a) Industrialization causes noise and air pollution which are disturbing.  
(b) Waste generated by industrial units leads to water pollution.  
(c)  $\text{SO}_2$ ,  $\text{NO}_2$ , etc. emitted by the industries are cause of acid rain.  
(d) Radioactive radiations emitted by nuclear power stations are toxic to living organisms.

- 135.** Building of big dams gives rise to some problems. List three main problems that may arise. Suggest a solution to any one of these problems.

Ans :

SQP 2013

- (a) Social problems  
(b) Economic problems  
(c) Environmental problem.

Solution to these problems would be adequate rehabilitation, compensation to the displaced persons and afforestation.

- 136.** Give two reasons why, there is a need of switching over from fossil fuels to the other sources of energy. Name any two alternative sources of energy.

Ans :

SQP 2012

- (a) (i) Increasing population and limited quantity increasing demand for the fossil fuels.  
(ii) Way of life of most of the people has been changed. They require more and more energy in different forms but cleaner than fossil fuels.  
(b) (i) Solar energy, (ii) Hydro energy.

### THREE MARKS QUESTIONS

- 137.** How can we help in reducing the problem of waste disposal? Suggest any three methods.

Ans :

Delhi 2019

The three methods by which we can reduce the problem of waste disposal are :

- (i) Adopting the 5R approach i.e; -Reduce, Reuse, Recycle, Refuse and Repurpose.



- (b) It does not provide a breeding ground for mosquitoes.
- (c) It is protected from contamination by human and animal waste.
- (d) It provides moisture for vegetation over a wide area.

**150.** What is deforestation ? Give the main reasons for deforestation.

**Ans :**

Delhi 2016

Destruction, reduction or removal of forest cover of a land area is called deforestation.

The main reasons for deforestation are as follows :

- (a) Indiscriminate cutting of trees for the purpose of timber, fuel and industrial demand of wood.
- (b) Overgrazing by a large live stock population.
- (c) Shifting cultivation for agriculture.
- (d) Construction of dams, reservoirs, canals, hydro electric projects, roads and railways.
- (d) Forest fires which can be natural or man made.

- 151.** (a) Water is an elixir of life, a very important natural resource. Your science teacher want you to prepare a plan for a formative assessment activity. "How to save water, the vital natural resource". Write any two ways that you will suggest to bring awareness in your neighbourhood, how to save water.
- (b) Name and explain any one way by which the underground water table does not go down further.

**Ans :**

Delhi 2017, Comp. 2013

- (a) Ways to bring awareness on "how to save water":
- (i) By organising a demonstration of the practices in the households on how we can minimize the wastage of water.
  - (ii) By organising an awareness week every year with poster competitions on how to save water.
- (b) One way by which the underground water table does not go down further is by rain water harvesting. We can collect rain water and store it in the form of pits and lakes ensuring that the water seeps through the soil and recharges the aquifers.

**152.** Now it is established that big dams are causing loss of biodiversity. Give reasons ?

**Ans :**

Delhi 2016

Big dams cause loss of biodiversity in the following ways :

- (a) Because of submergence of large tracts of forest land, they force certain species to migrate else they die.
- (b) Prevent migration of certain species of fish for spawning.
- (c) They cause warming of water and reduce dissolved oxygen content affecting the aquatic plants and animals.
- (d) They cause dislocation of local people due to submergence of big tracts of forest land.

**153.** What is meant by watershed management ? What are its advantages ?

**Ans :**

Foreign 2017

Water shed management emphasises soil and water conservation in order to increase the biomass production.

Advantages :

- (a) The main aim is to develop primary resources of land and water.
- (b) To produce secondary resources of plants and animals for use in a manner which will not cause ecological imbalance.
- (c) Watershed management not only increases the production and income of the watershed community, but also mitigates droughts and floods and increases the life of the downstream dam and reservoirs.

**154.** Why do we need to use coal and petroleum judiciously?

**or**

We should use coal and petroleum judiciously. Why? State any four reasons.

**Ans :**

Delhi 2016, SQP 2012

- (a) They take a very long time for their formation and are available in limited quantity.
- (b) They are huge reservoirs of carbon and if converted to  $\text{CO}_2$ , may cause global warming in atmosphere upto dangerous level.
- (c) On combustion fossil fuels release oxides of C, S and nitrogen which are poisonous gases. Sometimes CO is also released.
- (d) The acidic oxides of nitrogen and sulphur cause acid rain when they react with atmospheric water vapours.

**FIVE MARKS QUESTIONS**

155. (a) What do you understand by “Watershed Management”? List any two advantages of watershed management.
- (b) “Human beings occupy the top level in any food chain.” What are the consequences of this on our body?

Ans :

Delhi 2018, Delhi 2013

- (a) Conservation of soil and water resources in a scientific manner is known as watershed management.
- Two Advantages of watershed management:
- (i) It helps in controlling droughts and floods.
  - (ii) It helps in increasing the production and income of watershed community.
- (b) As human beings are at the last trophic level of the food chain, i.e., humans occupy the top position of such food chains.
- (i) Due to biomagnification phenomenon, maximum amount of non-biodegradable harmful chemicals will be found in the human bodies because of progressive accumulation.
  - (ii) Also, humans get the minimum amount of energy of food as per Ten per cent law of flow of energy through a food chain. Only 10% of the previous energy gets transferred at each trophic level.

156. What is “Sustainable Management of Natural Resources”? Why is it necessary? Which one out of reuse and recycle, would you practice in your daily life and why?

Ans :

OD 2018, Delhi 2016

The development which meets the current basic human needs and also preserves the resources for the needs of future generations is called sustainable management.

It is a system of controlling the use of natural resources in such a way as to avoid their wastage and to use them in the most effective way.

Advantages :

- (i) The resources of the earth are limited. Proper management of these natural resources can ensure that these are used judiciously so that they fulfil the needs of the present generation and also last for the generations to come.
- (ii) The proper management of natural resources takes into consideration long-term perspective and prevents their exploitation to the hilt for

short term gains.

- (iii) Proper management can ensure equitable distribution of natural resources so that all the people can be benefited.
- (iv) Proper management will take into consideration the damage caused to the environment during the extraction or use of the natural resources and find ways and means to minimize the damage.

Reuse is preferred over recycling. The ‘reuse’ strategy is better than ‘recycling’ because even the process of recycling uses some amount of energy. In the reuse strategy, plastic bottles in which we buy various food items like jam and pickle can be used for storing things in the kitchen. Whereas, if we send the discarded plastic bottles for recycling to the industry, we will be using energy sources for the recycling process.

157. What are the irrigation practices used in India and how the British and the later government policy affected it ?

Ans :

OD 2017

Irrigation methods like dams, tanks, arid canals etc. have been used in various parts of India since ancient times. These were generally local interventions managed by local people and assured that the basic minimum requirements for both agriculture and daily needs were met throughout the year. The use of this stored water was strictly regulated and the optimum cropping patterns based on the water availability were arrived at on the basis of decades or centuries of experience. The arrival of the British changed these systems and the conception of large scale projects like large dams and canals traversing large distances were conceived and implemented. This was carried on with no less gusto by our newly formed independent government. These mega-projects led to the neglect of the local irrigation methods. The government also increasingly took over the administration of these systems leading to the loss of control over the local water sources by the local people.

158. (a) List four reasons of conserving forests. How did “Chipko Andolan” help in the conservation of forests ?
- (b) What is wild life ? How is conservation of wildlife related to ecological balance ? Explain.

Ans :

OD 2016

- (a) Forests can be conserved in the following ways :
- (i) By silviculture : Which means reforestation

in a planned way those forest lands from where large number of trees have been cut.

- (ii) By taking the help of the local people in conserving the forests. For example; Sal forests or Arabari forest range of West Bengal were conserved with the help of local people by the Forest Department of that State.
- (iii) By protecting the wild animals and banning the poaching (hunting) of wild animals.
- (iv) By awakening the people and encouraging them not to over-use the materials obtained from the forests.

The Chipko andolan quickly spread across communities and media and forced the government, to whom the forest belongs, to rethink their priorities in the use of forest products.

Due to participation of local people, it led to the efficient conservation and management of forests.

- (b) **Wild Life :** All the naturally occurring animals and plants and their species which are not domesticated or cultivated are forms of wild life.

Conservation of wild life is important in maintaining ecological balance.

- (i) Carnivorous wildlife keeps control over a number of herbivorous animals.
- (ii) It is a storehouse of a number of articles like wood, herbs, lac and honey.

**159. Write a short note on Kulh's.**

**Ans :**

Delhi 2017, SQP 2012

Parts of Himachal Pradesh had evolved a local system of canal irrigation called kulhs, over four hundred years ago. In the system, the water flowing in the streams was diverted into man-made channels which took this water to numerous villages down the hillside. The management of the water flowing in these kulhs was regulated by a common agreement between all the villages. Interestingly, during the planting season, water was first used by the village farthest away from the source of the kulhs, then by villages progressively higher up. These kulhs were managed by two or three people who were paid by the villagers. In addition to irrigation, water from these kulhs also percolated into the soil and fed springs at various points.

- 160.** (a) What are fossil fuels ?
- (b) How are these fuels formed ?
- (c) Why should the fossil be used judiciously ?

**Ans :**

OD 2016

- (a) The fuels which are obtained from the remains of plants and animals are termed as fossil fuels. e.g., Coal and petroleum.
- (b) The remains of plants and animals which get buried beneath the earth millions of year ago changed into coal and petroleum due to excessive heat and high pressure from inside the earth.
- (c) The fossil fuels will be exhausted no matter how carefully it is used, when these fuel are burnt due to their limited quantity.

CO<sub>2</sub>, water oxides of nitrogen and oxides of sulphur are produced.

The oxides of gaseous are poisonous at high concentrations and carbon-dioxide is a green house gas.

These fossil fuels are huge reservoirs of carbon and if this carbon is converted to carbon dioxide then the amount of CO<sub>2</sub> in the atmosphere will increase the global warming.

Thus, we need to use these resources judiciously.

- 161.** How did the British and later the policies of the Governments in independent India cause damage to forest resources ?

**Ans :**

OD 2017, Foreign 2012

Before the British came and took over most of our forest areas, people had been living in these forests for centuries. They had developed practices to ensure that the resources were used in a sustainable manner. After the British took control of the forests (which they exploited ruthlessly for their own purposes), these people were forced to depend on much smaller areas and forest resources were becoming overexploited. The Forest Department in independent India took over management of forests from the British but local knowledge and local needs continued to be ignored in the management practices.

Thus, vast tracts of forests have been converted to monocultures of pine, teak or eucalyptus. In order to plant these trees, huge areas were first cleared of all vegetation. This destroyed a large amount of local biodiversity in the area.

- (c) growth of natural forest
- (d) preserves the natural ecosystem in the area

Ans :

OD 2014

- (b) monoculture in the area

11. A successful forest conservation strategy should involve

- (a) protection of animals at the highest trophic level
- (b) protection of only consumers
- (c) protection of only herbivores
- (d) comprehensive programme to protect all the physical and biological components.

Ans :

- (d) comprehensive programme to protect all the physical and biological components.

12. The important message conveyed by the 'Chipko Movement' is

- (a) to involve the community in forest conservation efforts
- (b) to ignore the community in forest conservation efforts
- (c) to cut down forest trees for developmental activities
- (d) government agencies have the unquestionable right to order destruction of trees in forests

Ans :

Foreign 2012

- (a) to involve the community in forest conservation efforts

13. In our country, there are attempts to increase the height of several existing dams like Tehri and Almati dams across Narmada.

Choose the correct statements among the following that are a consequence of raising the height of dams

- (i) Terrestrial flora and fauna of the area is destroyed completely
- (ii) Dislocation of people and domestic animals living in the area
- (iii) Valuable agricultural land may be permanently lost
- (iv) It will generate permanent employment for people

- (a) (i) and (ii)
- (b) (i), (ii) and (iii)
- (c) (ii) and (iv)
- (d) (i), (iii) and (iv)

Ans :

- (b) (i), (ii) and (iii)

14. Expand the abbreviation GAP

- (a) Governmental Agency for Pollution Control
- (b) Gross Assimilation by Photosynthesis
- (c) Ganga Action Plan
- (d) Government Agency for Animal Protection

Ans :

- (c) Ganga Action Plan

15. Select the incorrect statement

- (a) Economic development is linked to environmental conservation
- (b) Sustainable development encourages development for current generation and conservation of resources for future generations
- (c) Sustainable development does not consider the view points of stakeholders
- (d) Sustainable development is a long planned and persistent development

Ans :

Delhi 2009

- (c) Sustainable development does not consider the view points of stakeholders

16. Which of the following is not a natural resource ?

- (a) Mango tree
- (b) Snake
- (c) Wind
- (d) Wooden house

Ans :

- (d) Wooden house

17. Select the wrong statement

- (a) Forests provide variety of products
- (b) Forests have greater plant diversity
- (c) Forests do not conserve soil
- (d) Forests conserve water

Ans :

- (c) Forests do not conserve soil

18. Arabari forests of Bengal is dominated by

- (a) Teak
- (b) Sal
- (c) Bamboo
- (d) Mangrove

Ans :

- (b) Sal

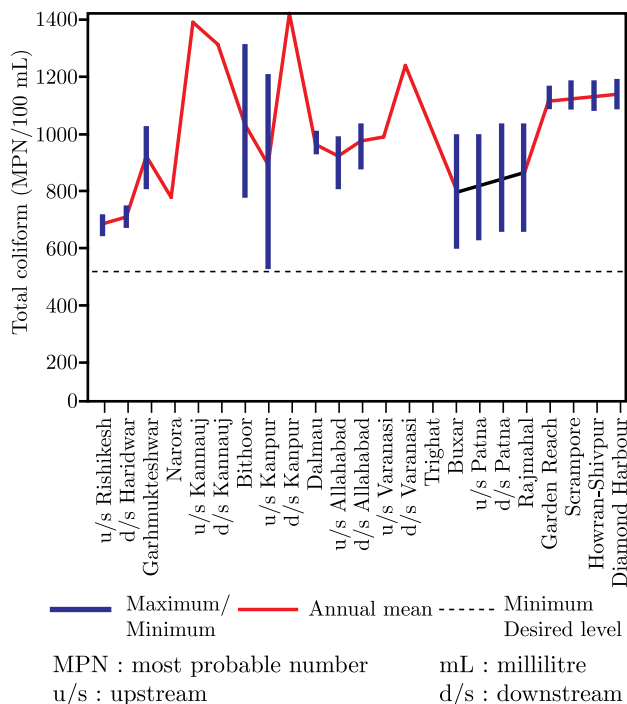
19. Ground water will not be depleted due to

- (a) afforestation
- (b) thermal power plants
- (c) loss of forest, and decreased rainfall
- (d) cropping of high water demanding crops

## CASE BASED QUESTIONS

- 166.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The graph shown above shows the Coliform count level in Ganga.



Based on the above graph, answer the following questions:

- Which state is the closest to the minimum desired level in Coliform count?
  - Bauxar
  - Patna
  - Kanpur
  - Rajmahal
- What does Coliform count in the Ganga signify?
- What is the minimum desired level of the Coliform count in the Ganga water?
- What is Coliform?

**Ans :**

- (c) Kanpur
- The Coliform count in the Ganga signifies the contamination of Ganga water due to the presence of the disease-causing sewage microorganisms.
- Approximately 500 MPN/100 mL.
- Coliform is a class of bacteria which is found in the human intestines and as well as in sewage.

- 167.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

National Mission for Clean Ganga (NMG) was registered as a society on 12th August 2011. It acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment Protection Act, 1986. the objectives of NMG is to accomplish the mandate of National Ganga River Basin Authority (NGRBA).

- To ensure abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral coordination for comprehensive planning and management.
- To maintain minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development.

Based on the above information, answer the following questions:

- Why there was a need of launching NMG?
- Under which act NMG was registered?
- What is the major source of water pollution in industrialized countries?
- How water pollution is influencing the environment?

**Ans :**

- The need of launching NMG was important as the pollution has influenced the flow of Ganga stream in a bad way which further has hampered ecosystem around it.
- Under the Society Registration Act, 1860, NMG was registered.
- The major source of water pollution in industrialized countries is industrial waste and sewage dump in the water bodies.
- Due to water pollution, aquatic life is getting disturbed which disturbs the ecological balance of the environment.

- 168.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

In a recent visit to Ranikhet in Uttarakhand, a student stayed at Chilianaula. He enjoyed the beauty of the vast tracts of chir pines (*Pinus roxburghii*) which was the only species being grown in that area.





Based on the above figure, answer the following questions:

- (i) What is this practice of cultivation called?
- (ii) Define this practice which is shown in the above picture.
- (iii) State one advantage of this type of practice.
- (iv) State one disadvantage of this type of production.

**Ans :**

- (i) Monoculture.
- (ii) The practice of clearing vast tracts of forest and growing large numbers of trees of one kind is called monoculture.
- (iii) This practice is largely done for the industrial production of wood, resin and raw materials for paper.
- (iv) This type of practice destroys a large amount of biodiversity in that area.

- 169.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

Rahul saw a beautiful picture of Sardar Sarovar Dam on the internet which is shown below. He was interested to know more about the dam and had some questions regarding it.



Based on the above figure, answer the following questions:

- (i) On which river is this dam built?
- (ii) Where is this dam located?
- (iii) What are dams?
- (iv) Give another example of dam and on which river is it built.

**Ans :**

- (i) Narmada River.
- (ii) Gujarat
- (iii) A dam is a barrier which is constructed to hold back water river water and is used to generate electricity.
- (iv) Bhakra Nangal Dam on Ganga river.

- 170.** Answer given questions on the basis of your understanding of the following paragraph and the related studies concepts.

The picture shows the famous Chipko Andolan, or Chipko Movement. It was a forest conservation movement which began in 1974 and soon it became a rallying point for many movements done to preserve environment.



- (i) Who started this movement?
- (ii) Where did it start?
- (iii) What was its main effect?
- (iv) What was the aim of the movement?

**Ans :**

- (i) Sunderlal Bahuguna.
- (ii) It started in Tehri-garhwal Uttarakhand, which was then a part of Uttar Pradesh.
- (iii) The main effect of this movement was that the environment became an important agenda in Indian Politics.
- (iv) The main aim of the movement was to protect the forest trees to get cut.

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