UP Board Class 10 Science 2024 code : 824 (IO) Question Paper with Solutions

Time Allowed :3 hours	**Maximum Marks :**100	**Total questions :**65

General Instructions

Read the following instructions very carefully and strictly follow them:

1. (i). First **15 minutes** are allotted for the candidates to read the question paper.
2. (ii). The question paper is divided into **two parts – Part A** and **Part B**.
3. (iii). **Part A** and **Part B** are further divided into **three sub-sections**: 1, 2, and 3.
4. (iv). In **Part A** of the question paper, there are **Multiple Choice Type Questions**. Candidates must select the correct alternative and mark it on the **OMR Answer Sheet** using a **blue or black ballpoint pen**. Completely fill the respective circle. **Do not erase, cut, or use a whitener** on the OMR Answer Sheet after marking your answer.
5. (v). Each question in **Part A** carries **1 mark**.
6. (vi). **Part B** contains **descriptive questions**.
7. (vii). The marks allotted for each question are clearly mentioned.
8. (viii). All the questions in **Sub-Sections of Part B** must be attempted **at a time**. Start each Sub-Section from a new page.
9. (ix). **All questions are compulsory.**

PART - A
(Multiple Choice Type Questions)

Sub-Section - (1)

1. Which of the following lenses should be used to read small letters?

(A) Convex lens of 10 cm focal length

(B) Concave lens of 10 cm focal length

(C) Convex lens of 20 cm focal length

(D) Concave lens of 20 cm focal length

Correct Answer: (A) Convex lens of 10 cm focal length

Solutions: A convex lens with a short focal length is used for reading small letters because it functions as a magnifying glass, creating a virtual, upright, and magnified image when the object is positioned within its focal length. The shorter the focal length, the greater the magnification, which makes a convex lens with a focal length of 10 cm more effective than one with a 20 cm focal length.

Quick Tip

Convex lenses with small focal lengths provide high magnification, making them ideal for reading and magnifying objects.

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2. The cause of twinkling of stars is:

(A) Scattering of light

(B) Reflection of light

(C) Atmospheric refraction

(D) None of these

Correct Answer: (C) Atmospheric refraction

Solutions: The twinkling of stars is a result of atmospheric refraction. As light from a star passes through various layers of the Earth's atmosphere, each with different optical densities,

it continuously bends. This bending causes the star's position to appear to shift slightly, leading to fluctuations in brightness, which produce the twinkling effect.

Quick Tip

Atmospheric refraction causes the apparent position of stars to shift, leading to the twinkling effect observed from Earth.

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3. The image by a convex mirror of an object placed at infinity is:

(A) Real and magnified

(B) Virtual and diminished

(C) Virtual and magnified

(D) Real and diminished

Correct Answer: (B) Virtual and diminished

Solutions: A convex mirror consistently forms a virtual, upright, and reduced image of an object, regardless of its position. When an object is located at infinity, the image is formed at the focus (F) of the mirror. Convex mirrors are commonly used as rear-view mirrors in vehicles because they offer a broader field of view.

Quick Tip

Convex mirrors always form virtual, diminished, and erect images, making them ideal for rear-view mirrors.

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4. The colour having the largest angle of deviation on passing white light through a prism will be:

(A) Yellow

(B) Green

(C) Orange

(D) Blue

Correct Answer: (D) Blue

Solutions: When white light passes through a prism, different colors are deviated by different angles because of their varying wavelengths. Blue light, with its shorter wavelength, bends more and undergoes the greatest angle of deviation. In contrast, red light bends the least.

Quick Tip

Shorter wavelengths (e.g., blue, violet) deviate more than longer wavelengths (e.g., red, orange) in a prism.

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5. Choose the correct alternative by matching the physical quantities in column (B) with the units in column (A):

A	B
(1)Ohm	(i)Electric current
(2)Watt	(ii)Electric resistance
(3)Ampere	(iii)Electric power
(4)Volt	(iv)Electric potential difference

(A) (1)-(ii), (2)-(iii), (3)-(i), (4)-(iv)

(B) (1)-(iv), (2)-(ii), (3)-(i), (4)-(iii)

(C) (1)-(iii), (2)-(i), (3)-(iv), (4)-(ii)

(D) (1)-(ii), (2)-(i), (3)-(iii), (4)-(iv)

Correct Answer: (A) (1)-(ii), (2)-(iii), (3)-(i), (4)-(iv)

Solutions:

A	B
Ohm	Electric Resistance
Watt	Electric Power
Ampere	Electric Current
Volt	Electric Potential Difference

Quick Tip

Ohm measures resistance, Watt measures power, Ampere measures current, and Volt measures potential difference.

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6. Two wires of resistances R and 2R are joined first in series and then in parallel. If the total resistances in the two conditions are R_1 and R_2 respectively, then R_1/R_2 will be:

(A) 9

(B) $\frac{1}{9}$

(C) $\frac{9}{2}$

(D) $\frac{2}{9}$

Correct Answer: (C) $\frac{9}{2}$

Solutions: - For series connection: The total resistance is

$$R_1 = R + 2R = 3R$$

- For parallel connection: The total resistance is

$$\frac{1}{R_2} = \frac{1}{R} + \frac{1}{2R} = \frac{2+1}{2R} = \frac{3}{2R}$$

$$R_2 = \frac{2R}{3}$$

- Ratio of resistances:

$$\frac{R_1}{R_2} = \frac{3R}{\frac{2R}{3}} = \frac{3R \times 3}{2R} = \frac{9}{2}$$

Quick Tip

In a series circuit, total resistance is the sum of individual resistances. In parallel circuits, the reciprocal of total resistance is the sum of reciprocals of individual resistances.

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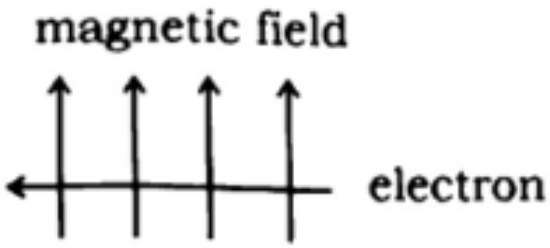
7. The direction of the force acting on the electron entering perpendicular to the magnetic field as shown in the figure, will be:



(A) towards left

(B) towards right

(C) perpendicular to the plane of paper downwards

(D) perpendicular to the plane of paper upwards

Correct Answer: (D) perpendicular to the plane of paper upwards

Solutions: The force on a moving charge in a magnetic field can be determined using Fleming's Left-Hand Rule (for negative charges such as electrons). - The magnetic field is directed upwards (as shown in the figure). - The velocity of the electron is directed towards the left. - By applying Fleming's Left-Hand Rule, the force acts perpendicular to the plane of the paper, directed upwards. Since an electron is negatively charged, the direction of force is opposite to what would be experienced by a positive charge.

Quick Tip

For a negatively charged particle moving in a magnetic field, apply Fleming's Left-Hand Rule and reverse the direction obtained.

Sub-Section - (2)

8. Functional group in propanal is:

(A) -CHO

(B) > C = O

(C) -OH

(D) -COOH

Correct Answer: (A) -CHO

Solutions: Propanal is an aldehyde that contains the -CHO functional group. Aldehydes are characterized by a carbonyl group (C=O) bonded to a hydrogen atom. In propanal (CHCH-CHO), the -CHO group is located at the end of the three-carbon chain.

Quick Tip

Aldehydes always contain the -CHO functional group and are named with the suffix "-al."

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9. The pH value of a neutral solution is:

(A) 7

(B) 14

(C) 1

(D) 5

Correct Answer: (A) 7

Solutions: The pH scale measures acidity or alkalinity of a solution. A neutral solution (such as pure water) has a pH of 7. Solutions with pH less than 7 are acidic, while those with pH greater than 7 are basic.

Quick Tip

A solution with pH 7 is neutral, below 7 is acidic, and above 7 is basic.

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10. The ketone in the following is:

(A) Methanol

(B) Ethanol

(C) Propanone

(D) Propene

Correct Answer: (C) Propanone

Solutions: Ketones contain a C=O (carbonyl) group bonded to two carbon atoms. Propanone (acetone, CHCOCH) is the simplest example of a ketone. In contrast to aldehydes, ketones do not have a hydrogen atom attached to the carbonyl carbon.

Quick Tip

Ketones have a C=O group within the carbon chain and are named with the suffix "-one."

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11. The element producing hydrogen gas with cold water is:

(A) Au

(B) Ag

(C) K

(D) Cu

Correct Answer: (C) K

Solutions: Potassium (K) is a highly reactive alkali metal that reacts strongly with cold water, producing potassium hydroxide (KOH) and hydrogen gas (H). This reaction releases heat and generates bubbles of hydrogen gas.

$$2K + 2H_2O \rightarrow 2KOH + H_2$$

Quick Tip

Highly reactive metals like potassium, sodium, and calcium react with cold water to produce hydrogen gas.

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12. The process for obtaining oxide from carbonate ore by heating at a high temperature in a limited supply of air is:

(A) Calcination

(B) Roasting

(C) Smelting

(D) Concentration of ore

Correct Answer: (A) Calcination

Solutions: Calcination is the process of heating carbonate (or hydrated ores) in the absence of air to remove volatile impurities and convert them into their oxide forms.

Example:

$$CaCO_3 \xrightarrow{heat} CaO + CO_2$$

This process is different from roasting, which is done in the presence of excess air.

Quick Tip

Calcination is used for carbonate ores, whereas roasting is used for sulfide ores.

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13. Chemical reaction $CuSO_4$ + Fe $\rightarrow$ $FeSO_4$ + Cu is:

(A) Combination reaction

(B) Displacement reaction

(C) Decomposition reaction

(D) Double decomposition reaction

Correct Answer: (B) Displacement reaction

Solutions: In the reaction:

$$CuSO_4 + Fe \rightarrow FeSO_4 + Cu$$

Iron (Fe) displaces copper (Cu) from copper sulfate ($CuSO_4$), resulting in the formation of iron sulfate ($FeSO_4$) and copper metal. Since a more reactive metal (iron) replaces a less reactive metal (copper) in a compound, this reaction is classified as a single displacement reaction.

Quick Tip

In a displacement reaction, a more reactive metal displaces a less reactive metal from its compound.

Sub-Section - (3)

14. The autotrophic mode of nutrition requires:

(A) Carbon dioxide and water

(B) Sunlight

(C) Chlorophyll

(D) All of these

Correct Answer: (D) All of these

Solutions: Autotrophic organisms, such as green plants, produce their own food through the process of photosynthesis. This process requires: - Carbon dioxide (CO_2) and water (H_2O) as the raw materials. - Sunlight as the energy source. - Chlorophyll, a green pigment that absorbs sunlight and facilitates the conversion of CO_2 and H_2O into glucose and oxygen.

Quick Tip

Photosynthesis requires CO_2, water, sunlight, and chlorophyll to produce glucose and oxygen.

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15. Which of the following is a plant hormone?

(A) Testosterone

(B) Cytokinin

(C) Adrenaline

(D) Thyroxin

Correct Answer: (B) Cytokinin

Solutions: Cytokinins are plant hormones that stimulate cell division (cytokinesis), as well as promote growth and development. They help delay leaf senescence (aging) and work in conjunction with auxins to regulate plant growth.

Other hormones listed: - Testosterone (A) $\rightarrow$ A male sex hormone found in animals. - Adrenaline (C) $\rightarrow$ A stress hormone produced in animals. - Thyroxin (D) $\rightarrow$ A hormone involved in regulating metabolism in animals.

Quick Tip

Cytokinins stimulate cell division, shoot growth, and delay aging in plants.

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16. The anther contains:

(A) Ovary

(B) Uterus

(C) Pollen grains

(D) Sepals

Correct Answer: (C) Pollen grains

Solutions: The anther is a part of the stamen, which is the male reproductive organ in flowers. It contains pollen sacs that produce pollen grains. These pollen grains are responsible for the transfer of male gametes during pollination.

Incorrect options:

- Ovary (A): Located in the female reproductive organ of flowers.
- Uterus (B): Found in animals, not plants.
- Sepals (D): Green, leaf-like structures that protect the flower bud.

Quick Tip

Anthers produce pollen grains, which contain male gametes for fertilization in plants.

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17. Reproduction by means of regeneration occurs in:

(A) Hydra

(B) Planaria

(C) Bryophyllum

(D) Pigeon

Correct Answer: (B) Planaria

Solutions: Regeneration is the ability of an organism to regrow lost body parts from a fragment. Planaria, a species of flatworm, demonstrates extraordinary regeneration, where a single fragment can regenerate into a complete organism. This process is facilitated by stem cells called neoblasts.

Incorrect options: - Hydra (A): Reproduces mainly by budding. - Bryophyllum (C): Reproduces through vegetative propagation. - Pigeon (D): Reproduces sexually.

Quick Tip

Planaria can regenerate an entire body from just a small fragment due to neoblast cells.

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18. The gap between two neurons is called a/an:

(A) Synapse

(B) Auxin

(C) Gibberellin

(D) Diaphragm

Correct Answer: (A) Synapse

Solutions: A synapse is the connection between two neurons where nerve impulses are transmitted through neurotransmitters such as acetylcholine. It facilitates communication between neurons and is essential for reflex actions and cognitive processes.

Incorrect options:

- Auxin (B) and Gibberellin (C): Plant hormones.

- Diaphragm (D): A muscle involved in breathing, unrelated to neurons.

Quick Tip

A synapse allows neurons to communicate using electrical and chemical signals.

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19. Which one of the following is an example of a producer in an ecosystem?

(A) Lion

(B) Deer

(C) Green plants

(D) Rain

Correct Answer: (C) Green plants

Solutions: Producers are organisms that synthesize their own food through photosynthesis. Green plants convert sunlight into energy via photosynthesis, forming the foundation of the food chain.

Incorrect options: - Lion (A): A secondary consumer. - Deer (B): A primary consumer (herbivore). - Rain (D): A natural phenomenon, not a producer.

Quick Tip

Producers like green plants, algae, and phytoplankton form the base of the food chain.

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20. Which character(s) of the Pea plant has been studied by Mendel in his experiments?

(A) Round/Wrinkled seed

(B) Tall/Dwarf plant

(C) White/Violet flowers

(D) All of these

Correct Answer: (D) All of these

Solutions: Gregor Mendel, known as the father of genetics, conducted experiments on pea plants (*Pisum sativum*) and identified seven contrasting traits:

1. Seed shape - Round vs. Wrinkled 2. Seed color - Yellow vs. Green 3. Flower color - White vs. Violet 4. Pod shape - Inflated vs. Constricted 5. Pod color - Green vs. Yellow 6. Flower position - Axial vs. Terminal 7. Plant height - Tall vs. Dwarf

Since all these traits were examined, the correct answer is (D) All of these.

Quick Tip

Mendel's pea plant experiments led to the discovery of dominant and recessive traits, forming the foundation of modern genetics.

PART - B
(Descriptive Questions)

Sub-Section - (1)

1.(i) State two natural phenomena of scattering of light.

Solutions: The scattering of light occurs when light waves interact with particles in the atmosphere, causing deviation in their paths. Two natural phenomena based on scattering of light are:

1. Tyndall Effect: The scattering of light by colloidal particles, observed in mist, dust, or fog.

2. Blue Sky Appearance: The blue color of the sky is due to the scattering of shorter wavelength blue light by atmospheric particles.

Quick Tip

Scattering of light explains various natural occurrences such as the reddish appearance of the sun during sunrise and sunset.

1.(ii) How many types of defects of vision are there? Write down their names.

Solutions: There are three primary types of vision defects:

1. Myopia (Nearsightedness) – The individual can clearly see nearby objects, but distant objects appear blurry.

2. Hypermetropia (Farsightedness) – The individual can clearly see distant objects, but nearby objects appear blurry.

3. Presbyopia – A condition caused by aging, which makes it difficult to focus on objects that are close.

Quick Tip

Myopia is corrected using a concave lens, while hypermetropia is corrected using a convex lens.

2.(i) Write down two uses each of convex mirror and convex lens.

Solutions: Uses of Convex Mirror:

1. Rear-view mirrors in vehicles, offering a broader field of vision.

2. Security mirrors in stores for surveillance purposes.

Uses of Convex Lens:

1. Magnifying glasses used to enlarge objects.

2. Cameras and projectors that focus light onto a film or screen.

Quick Tip

Convex mirrors are used for wider visibility, while convex lenses are used to focus and magnify images.

2.(ii) Draw a ray diagram of the image of an object formed by a concave lens.

Solutions: A concave lens always forms a virtual, erect, and diminished image irrespective of object placement. The image is formed between the lens and the focal point on the same side as the object. The ray diagram below illustrates this:

A[blue] –[:30] L –[:-30] B[blue]

Quick Tip

Concave lenses are commonly used in spectacles to correct myopia (nearsightedness).

3.(i) How are voltmeter and ammeter joined on passing current in a resistor?

Solutions: 1. Ammeter is always connected in series with the resistor to measure the current flowing through it.

2. Voltmeter is connected in parallel across the resistor to measure the potential difference.

This is because an ammeter has low resistance, allowing current to pass through, whereas a voltmeter has high resistance, preventing it from altering circuit behavior.

Quick Tip

Always connect an ammeter in series and a voltmeter in parallel to measure current and voltage, respectively.

3.(ii) A refrigerator of 500 watts is used for 12 hours every day. How much kilowatt-hour energy is consumed by the refrigerator for 30 days?

Solutions: Given data: Power of refrigerator, $P = 500$ W = 0.5 kW Time used per day, $t = 12$ hours Total days, $d = 30$

Energy Consumption:

$$\text{Energy} = P \times t \times d$$

$$= 0.5 \times 12 \times 30$$

$$= 180 \text{ kWh}$$

Thus, the refrigerator consumes 180 kWh in 30 days.

Quick Tip

Kilowatt-hour (kWh) is the unit of electrical energy used in electricity bills. 1 kWh = 1 unit of electricity.

4.(i) Show by making a diagram for the magnetic lines of force around a bar magnet.

Solutions: The magnetic field lines around a bar magnet originate from the north pole and curve around to enter the south pole. These lines represent the direction of magnetic force and never intersect. Below is the diagram:

$[thick](-1.5,0)rectangle(1.5,0.5); at(-1,0.25)N; at(1,0.25)S; in-2.5,-2,-1.5,-1,-0.5,0,0.5,1,1.5,2,2.$

Quick Tip

Magnetic field lines always originate from the north pole and end at the south pole in closed loops.

4.(ii) On which factors does the magnetic field due to a current-carrying solenoid depend?

Solutions: The magnetic field inside a current-carrying solenoid depends on:

1. Number of turns (N): More turns increase the field strength.
2. Current (I): Higher current increases the field.
3. Core Material: Using soft iron as the core increases the magnetic field.

Quick Tip

A solenoid acts as a bar magnet when current flows through it. The magnetic field inside is strong and uniform.

4.(iii) What is Fleming's Left Hand Rule?

Solutions: Fleming's Left-Hand Rule states that if we stretch the thumb, forefinger, and middle finger of the left hand mutually perpendicular:

1. Forefinger $\rightarrow$ Direction of magnetic field (B)
2. Middle finger $\rightarrow$ Direction of current (I)
3. Thumb $\rightarrow$ Direction of force (motion) (F)

This rule is useful in electromagnetic devices like motors.

Quick Tip

Use Fleming's Left-Hand Rule for motors and Right-Hand Rule for generators.

OR

(i) On which factors does the force acting on a current-carrying conductor placed in a magnetic field depend?

Solutions: The force on a current-carrying conductor in a magnetic field depends on the following factors:

1. **Strength of the Magnetic Field (B):** A stronger magnetic field exerts a greater force.
2. **Current (I):** An increase in current results in a higher force.
3. **Length of the Conductor (L):** A longer conductor experiences a greater force.
4. **Angle between Current and Field ():** The force is maximized when $\theta = 90^\circ$ and becomes zero when the current is parallel to the magnetic field.

Quick Tip

The force on a conductor in a magnetic field is given by F = BIL sin, where is the angle between current and field.

(ii) How many wires are used in domestic electrical circuits? Write the names of each and their colours of insulation.

Solutions:

In a domestic electrical circuit, three primary types of wires are used:

1. **Live Wire:** Transports current from the power supply (Colour: Red or Brown).

2. **Neutral Wire:** Completes the circuit (Colour: Black or Blue).

3. **Earth Wire:** Ensures safety by grounding excess current (Colour: Green or Yellow-Green).

Quick Tip

The live wire carries current, the neutral wire completes the circuit, and the earth wire prevents electric shocks.

Sub-Section - (2)

5.(a) Write IUPAC names of the following compounds:

(i) Acetylene

Solutions: The IUPAC name of Acetylene is Ethyne. It is the simplest alkyne with the molecular formula C_2H_2. It consists of a triple bond between two carbon atoms.

Quick Tip

The suffix -yne in Ethyne indicates the presence of a triple bond in the hydrocarbon.

(ii) Acetic Acid

Solutions: The IUPAC name for Acetic Acid is Ethanoic Acid. It is a member of the carboxylic acid group with the molecular formula CH_3COOH. Ethanoic acid is responsible for the sour taste in vinegar.

Quick Tip

The suffix -oic acid in Ethanoic Acid denotes the presence of a carboxyl (-COOH) group.

6.(a) Explain the process of combustion and write chemical equations of two examples of it.

Solutions: Combustion is a chemical reaction in which a substance reacts with oxygen, releasing energy in the form of heat and light. It is an exothermic process that, in the case of hydrocarbons, produces carbon dioxide and water.

Example 1: Combustion of Methane (CH_4):

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{Energy}$$

Example 2: Combustion of Carbon (C):

$$C + O_2 \rightarrow CO_2 + \text{Energy}$$

Quick Tip

Combustion reactions are widely used in engines, cooking, and electricity generation.

6.(b) Explain reactivity series and write its one use.

Solutions: The Reactivity Series is a list of metals arranged in decreasing order of their reactivity. Highly reactive metals like potassium (K) and sodium (Na) are at the top, while less reactive metals like gold (Au) and silver (Ag) are at the bottom.

Use: It helps in predicting displacement reactions where a more reactive metal can displace a less reactive metal from its compound.

Quick Tip

Metals higher in the reactivity series displace metals lower in the series from their solutions.

7.(a) What do you understand by acid and base? Write two applications of pH in daily life.

Solutions: Acids are substances that release hydrogen ions (H^+) in an aqueous solution, while bases release hydroxide ions (OH^-). Acids have a pH value below 7, whereas bases have a pH value above 7.

Applications of pH in Daily Life:

1. **Soil pH:** Farmers adjust the pH of soil by adding lime to promote optimal crop growth.

2. **Digestion:** Stomach acid (HCl) aids in food digestion, and an imbalance can lead to acidity.

Quick Tip

pH plays a crucial role in chemical reactions, agriculture, and biological processes.

7.(b) Write the chemical equation for the method of obtaining bleaching powder and its two uses.

Solutions: Preparation of Bleaching Powder: Bleaching powder ($CaOCl_2$) is produced by passing chlorine gas over slaked lime ($Ca(OH)_2$):

$$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$$

Uses of Bleaching Powder:

1. Disinfection: It is used to purify drinking water.

2. Textile Industry: It is used for bleaching cotton and linen fabrics.

Quick Tip

Bleaching powder is a strong oxidizing agent and is widely used in sanitation and textile industries.

OR

Write short notes on the following:

(a) Micelle

Solutions: A micelle is a cluster of surfactant molecules suspended in a liquid, forming a spherical shape. These molecules consist of a hydrophilic (water-attracting) head and a hydrophobic (water-repelling) tail. In aqueous solutions, the hydrophobic tails orient inward, trapping oils and grease, while the hydrophilic heads remain in contact with the water. Micelles are essential in cleaning, as they assist in removing dirt and oil from surfaces.

Quick Tip

Micelles are essential in soap and detergent action, allowing oils to be washed away with water.

(b) Corrosion

Solutions: Corrosion is the gradual deterioration of metals due to chemical reactions with environmental factors like air and moisture. Rusting of iron is a common example, where iron reacts with oxygen and water to form hydrated iron oxide ($Fe_2O_3 \cdot xH_2O$). Corrosion weakens structures, causing damage to buildings, bridges, and pipelines. It can be prevented by painting, galvanization, or applying protective coatings.

Quick Tip

Corrosion prevention methods include painting, oiling, galvanization, and using alloys like stainless steel.

(c) Versatile Nature of Carbon

Solutions: Carbon exhibits versatility due to its ability to form strong covalent bonds, long chains, and a variety of complex structures. It can form single, double, and triple bonds, leading to the existence of alkanes, alkenes, and alkynes. Carbon's tetra-valency allows it to bond with various elements, making it the backbone of organic compounds, including hydrocarbons, proteins, and DNA.

Quick Tip

Carbon's versatility is the reason for the vast diversity of organic compounds, essential for life and industry.

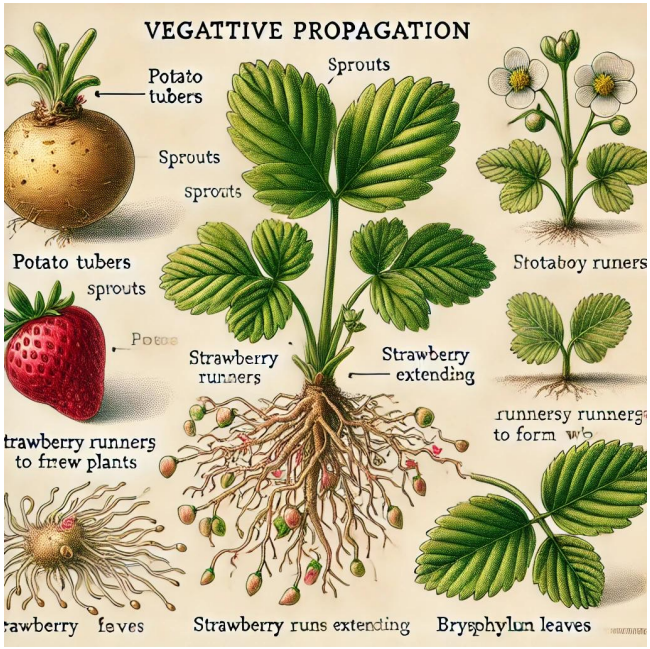
Sub-Section - (3)

8. What is vegetative propagation? Describe it with a suitable example and diagrams.

Solutions: Vegetative propagation is a form of asexual reproduction in plants where new individuals grow from vegetative parts like roots, stems, or leaves rather than seeds. This method ensures rapid growth and identical offspring. It occurs naturally in plants like potatoes (tubers), onions (bulbs), and strawberries (runners). Artificial methods like grafting and layering are also used in horticulture.

Example: A potato tuber contains buds (eyes) that sprout into new plants. Similarly, Bryophyllum reproduces through leaf buds.

Diagram of Vegetative Propagation:



Quick Tip

Vegetative propagation is widely used in agriculture for cloning plants with desirable traits, ensuring high yield and disease resistance.

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9. Write short notes on the following:

9.(a) Photosynthesis

Solutions: Photosynthesis is the process by which green plants, algae, and some bacteria convert light energy into chemical energy. It occurs in the chloroplasts of plant cells, where carbon dioxide and water react in the presence of sunlight to produce glucose and oxygen. The general equation for photosynthesis is:

$$6CO_2 + 6H_2O \xrightarrow{\text{Light}} C_6H_{12}O_6 + 6O_2$$

This process is essential for life on Earth, as it forms the base of the food chain and maintains atmospheric oxygen levels.

Quick Tip

Chlorophyll absorbs sunlight and drives the photosynthesis process.

9.(b) Human Heart

Solutions: The human heart is a muscular organ responsible for pumping blood throughout the body. It has four chambers: the left and right atria and the left and right ventricles. The heart functions through a double circulation system: oxygenated blood is pumped to the body via the aorta, while deoxygenated blood is sent to the lungs for oxygenation. The heartbeat is regulated by the sinoatrial (SA) node, often called the pacemaker.

Quick Tip

The human heart beats about 72 times per minute in a healthy adult.

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10. What is Ozone layer? Highlight its importance for Earth.

Solutions: The ozone layer is a region in Earth's stratosphere that contains a high concentration of ozone (O_3) molecules. It is located approximately 10 to 50 km above the Earth's surface and plays a critical role in absorbing the majority of the Sun's harmful ultraviolet (UV) radiation. The ozone layer shields living organisms from excessive UV radiation, which can cause severe health hazards such as skin cancer, cataracts, immune system suppression, and genetic damage.

The importance of the ozone layer extends beyond human health. It helps maintain ecological balance by protecting terrestrial and aquatic ecosystems. Excessive UV exposure can disrupt the growth of phytoplankton in oceans, which form the base of marine food chains. It also affects plant growth, reducing agricultural productivity.

Human activities, particularly the release of chlorofluorocarbons (CFCs) from industrial products such as refrigerants, aerosols, and solvents, have led to the depletion of the ozone layer. This has resulted in the formation of the ozone hole, primarily over Antarctica. The Montreal Protocol was established to phase out ozone-depleting substances and has contributed significantly to ozone layer recovery.

Quick Tip

The ozone layer acts as Earth's protective shield. Avoiding CFCs and using eco-friendly alternatives like hydrofluorocarbons (HFCs) can help in ozone restoration.

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11. Write notes on the following:

(a) Sex Determination

Solutions: Sex determination is the biological process by which an organism develops into a male or female based on genetic and chromosomal factors. In humans, sex is determined by the presence of sex chromosomes: XX for females and XY for males. The sperm from the father carries either an X or a Y chromosome, while the egg from the mother always carries an X chromosome. If the sperm contributes an X chromosome, the child will be female (XX), and if the sperm contributes a Y chromosome, the child will be male (XY). This is known as the chromosomal theory of sex determination.

Quick Tip

The father's sperm determines the sex of the child, as it carries both X and Y chromosomes, while the mother always contributes an X chromosome.

(b) Mendel's Laws

Solutions: Gregor Mendel, known as the "Father of Genetics," proposed three fundamental laws of inheritance based on his experiments with pea plants:

1. Law of Dominance: When two different alleles are present, one (dominant) expresses itself, while the other (recessive) remains hidden.

2. Law of Segregation: Alleles segregate independently during gamete formation, ensuring each gamete carries only one allele for a trait.

3. Law of Independent Assortment: Genes for different traits assort independently during gamete formation, leading to genetic variation.

Mendel's laws laid the foundation for modern genetics and helped in understanding heredity patterns in organisms.

Quick Tip

Mendel's experiments on pea plants demonstrated predictable patterns of inheritance, forming the basis of classical genetics.

OR

Write an essay on human hormones.

Solutions: Hormones are chemical messengers secreted by endocrine glands that regulate various physiological processes in the human body. They play a crucial role in growth, metabolism, reproduction, mood regulation, and overall homeostasis. Hormones are transported through the bloodstream to target organs, where they exert their effects.

The major endocrine glands in the human body include the pituitary gland, thyroid gland, adrenal glands, pancreas, and gonads (testes and ovaries). Each gland produces specific hormones essential for different bodily functions. For example, the pituitary gland secretes growth hormone (GH), which regulates body growth, while the thyroid gland releases thyroxine, which controls metabolism. The pancreas secretes insulin, which regulates blood sugar levels, and the adrenal glands produce adrenaline, responsible for the body's "fight or flight" response.

Reproductive hormones such as testosterone in males and estrogen and progesterone in females control sexual development and reproductive functions. Hormonal imbalances can lead to health issues such as diabetes, thyroid disorders, and growth abnormalities.

Maintaining hormonal balance is vital for good health. A proper diet, regular exercise, and a healthy lifestyle contribute to optimal hormonal function, ensuring overall well-being.

Quick Tip

Hormones act as messengers, coordinating various body functions. Balanced hormonal levels are essential for maintaining health and preventing disorders.