

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

Time Allowed :3 Hours 15 Minutes	Maximum Marks :70	Total Questions :31
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. First 15 minutes are allotted for the candidates to read the question paper.
2. The question paper is divided into two parts — Part-A and Part-B.
3. Part-A and Part-B are divided into three Sub-Sections — (1), (2), and (3).
4. In Part-A of the question paper, there are multiple choice questions in which select the correct alternative and then by a blue or black ball-point pen, fill completely in the circle in OMR Answer Sheet. Do not erase, cut or use whitener on the OMR Answer Sheet after answering.
5. 1 mark is allotted for each multiple choice question in Part-A.
6. Part-B has descriptive questions.
7. The allotted marks are given in each question.
8. All the questions of Sub-Sections of Part-B are to be attempted all at a time. Start each Sub-Section from a new page.
9. All the 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 of short focal length is used for reading small letters because it acts as a magnifying glass and forms a virtual, erect, and magnified image when the object is placed within its focal length. The shorter the focal length, the greater the magnification, making a convex lens of 10 cm more effective than 20 cm.

💡 Quick Tip

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

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 caused by atmospheric refraction. Light from a star travels through different layers of the Earth's atmosphere, which have varying optical densities. As a result, the light undergoes continuous bending, making the star's position appear to shift slightly. This fluctuation in brightness creates the twinkling effect.

💡 Quick Tip

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

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 always forms a virtual, erect, and diminished image of an object, irrespective of its position. When an object is placed at infinity, the image is formed at the focus (F) of the mirror. Convex mirrors are commonly used in vehicle rear-view mirrors due to their ability to provide a wider field of view.

💡 Quick Tip

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

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 deviate by different angles due to their different wavelengths. Blue light has a shorter wavelength than other visible colors, causing it to bend more and experience the largest 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.

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.

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

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

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

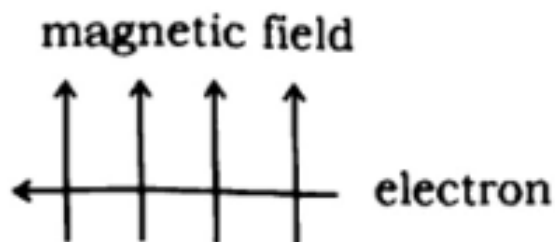
- Ratio of resistances:

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

💡 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.

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 is determined using Fleming's Left-Hand Rule (for negative charges like electrons). - The magnetic field is directed upwards (as per the figure). - The electron's velocity is towards the left. - Applying Fleming's Left-Hand Rule, the force acts perpendicular to the plane of the paper 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 containing the -CHO functional group. Aldehydes are characterized by the presence of a carbonyl group ($C=O$) bonded to a hydrogen atom. In propanal (CH_3CH_2CHO), the -CHO group is attached at the end of the three-carbon chain.

 Quick Tip

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

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.

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, CH₃COCH₃) is the simplest ketone. Unlike aldehydes, ketones do not have a hydrogen attached to the carbonyl carbon.

 Quick Tip

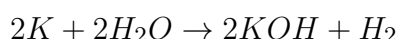
Ketones have a C=O group within the carbon chain and are named with the suffix "-one."

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 vigorously with cold water to form potassium hydroxide (KOH) and hydrogen gas (H₂). This reaction releases heat and produces bubbles of hydrogen gas.



 Quick Tip

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

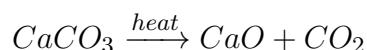
12. The process for obtaining oxide from carbonate ore by heating at a high temperature in a limited supply of air is:

- (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:



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

 Quick Tip

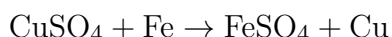
Calcination is used for carbonate ores, whereas roasting is used for sulfide ores.

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 given reaction:



Iron (Fe) displaces copper (Cu) from copper sulfate ($CuSO_4$), forming iron sulfate ($FeSO_4$) and copper metal. Since a more reactive metal (iron) replaces a less reactive metal (copper) in a compound, this 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, use photosynthesis to prepare their own food. This process requires: - Carbon dioxide (CO₂) and water (H₂O) as raw materials. - Sunlight as an energy source. - Chlorophyll, a green pigment that captures sunlight and helps in the conversion of CO₂ and H₂O into glucose and oxygen.

 Quick Tip

Photosynthesis requires CO₂, water, sunlight, and chlorophyll to produce glucose and oxygen.

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 promote cell division (cytokinesis), growth, and development. They help in delaying leaf senescence (aging) and work in coordination with auxins to regulate plant growth.

Other hormones listed: - Testosterone (A) → Male sex hormone in animals. - Adrenaline (C) → A stress hormone in animals. - Thyroxin (D) → A hormone regulating metabolism in animals.

 Quick Tip

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

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 (male reproductive organ) in flowers. It contains pollen sacs, which produce pollen grains. These pollen grains are responsible for male gamete transfer during pollination.

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

 Quick Tip

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

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 type of flatworm, exhibits remarkable regeneration where a single piece can develop into a complete organism. This process occurs through stem cells known as 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.

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 junction between two neurons where nerve impulses are transmitted via neurotransmitters like acetylcholine. It allows communication between neurons and plays a crucial role in reflexes and cognitive functions.

Incorrect options: - Auxin (B) Gibberellin (C): Plant hormones. - Diaphragm (D): A muscle involved in breathing, not related to neurons.

 Quick Tip

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

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 make their own food using photosynthesis. Green plants convert sunlight into energy through photosynthesis, forming the base 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.

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, 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 studied, 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 main types of defects of vision:

1. Myopia (Nearsightedness) – The person can see nearby objects clearly but distant objects appear blurred.
2. Hypermetropia (Farsightedness) – The person can see distant objects clearly but nearby objects appear blurred.
3. Presbyopia – A defect occurring due to aging, making it difficult to focus on nearby objects.

💡 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 to provide a wider field of view.
2. Security mirrors in shops for surveillance.

Uses of Convex Lens:

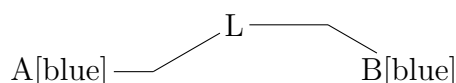
1. Magnifying glasses to enlarge objects.
2. Cameras and projectors to focus light onto a film or screen.

💡 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:



💡 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, $P = 500 \text{ W} = 0.5 \text{ kW}$ Time used per day, $t = 12$ hours Total days, $d = 30$

Energy Consumption:

$$\begin{aligned}\text{Energy} &= P \times t \times d \\ &= 0.5 \times 12 \times 30\end{aligned}$$

$$= 180 \text{ kWh}$$

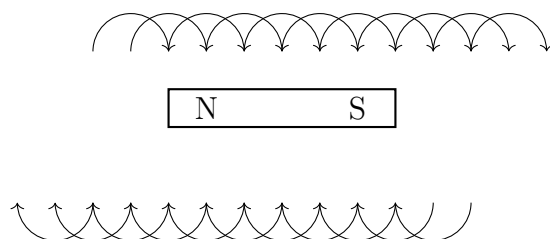
Thus, the refrigerator consumes 180 kWh in 30 days.

💡 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:



💡 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 → Direction of magnetic field (B)
2. Middle finger → Direction of current (I)
3. Thumb → 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 acting on a current-carrying conductor in a magnetic field depends on:

1. Strength of the Magnetic Field (B): A stronger field exerts more force.
2. Current (I): Higher current increases force.
3. Length of the Conductor (L): A longer conductor experiences more force.
4. Angle between Current and Field (θ): Maximum force when $\theta = 90^\circ$, and zero force when parallel.

 Quick Tip

The force on a conductor in a magnetic field is given by $F = BIL \sin \theta$, where θ 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 main types of wires are used:

1. Live Wire: Carries current from the supply (Colour: Red or Brown).
2. Neutral Wire: Completes the circuit (Colour: Black or Blue).
3. Earth Wire: Provides 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 of Acetic Acid is Ethanoic Acid. It belongs to the carboxylic acid group with the molecular formula CH_3COOH . It is responsible for the sour taste of vinegar.

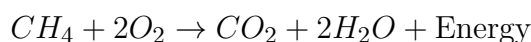
💡 Quick Tip

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 process in which a substance reacts with oxygen to release energy in the form of heat and light. It is an exothermic reaction that produces carbon dioxide and water in the case of hydrocarbon combustion.

Example 1: Combustion of Methane (CH_4):



Example 2: Combustion of Carbon (C):



💡 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, whereas bases release hydroxide ions (OH^-). Acids have a pH below 7, while bases have a pH above 7.

Applications of pH in Daily Life:

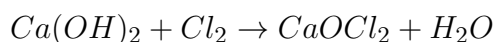
1. Soil pH: Farmers adjust soil pH using lime to ensure proper crop growth.
2. Digestion: Stomach acid (HCl) helps in food digestion; an imbalance can cause acidity.

 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 ($Ca(OH)_2$):



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 an aggregate of surfactant molecules dispersed in a liquid, forming a spherical structure. These molecules have a hydrophilic (water-attracting) head and a hydrophobic (water-repelling) tail. In aqueous solutions, the hydrophobic tails face inward, trapping grease and oil, while the hydrophilic heads remain in contact with water. Micelles play a crucial role in cleaning, as they help in the removal of 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.

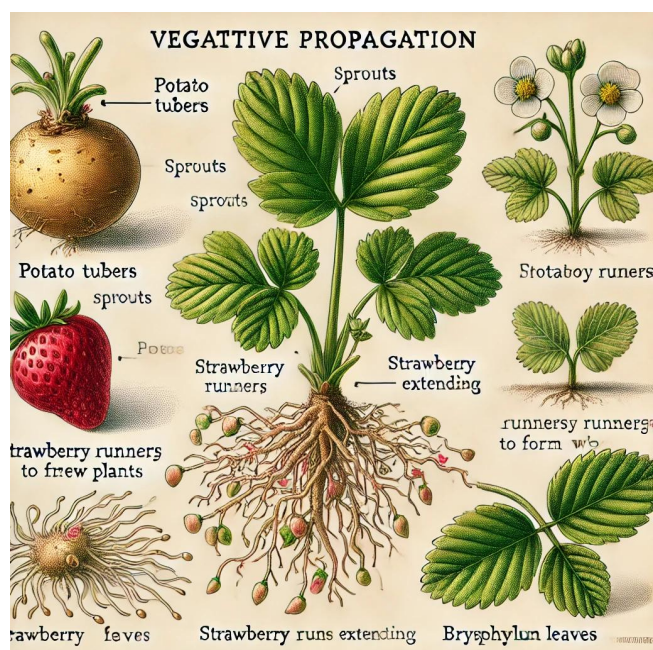
Sub-Section - (3)

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:



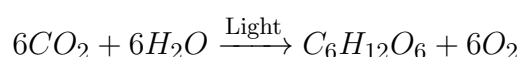
💡 Quick Tip

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

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:



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.

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 (O₃) 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.

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.