UP Board Class 10 Science - 824 (CN) - 2025 Question Paper with Solutions

Time Allowed :3 Hours	**Maximum Marks :**70	**Total questions :**35

General Instructions

Instruction:

i) *All* questions are compulsory. Marks allotted to each question are given in the margin.

ii) In numerical questions, give all the steps of calculation.

iii) Give relevant answers to the questions.

iv) Give chemical equations, wherever necessary.

Q1. A thin straight rod is placed in between the focus and optical centre of a convex lens. The image of the rod is:

(A) Virtual, erect and diminished

(B) Virtual, erect and magnified

(C) Real, inverted and magnified

(D) Real, inverted and diminished

Correct Answer: (A) Virtual, erect and diminished

Solution:

Step 1: Understanding the situation.

For a convex lens, when an object is placed between the focal point (F) and the optical center (O), the image formed is virtual, erect, and diminished. This happens because the rays diverge and appear to come from a point behind the lens.

Step 2: Conclusion.

Thus, the image formed by placing the rod between the focus and the optical center of the lens will be virtual, erect, and diminished.

Final Answer:

The correct answer is (A) Virtual, erect and diminished.

Quick Tip

For convex lenses, when the object is between the focus and the optical center, the image formed is always virtual, erect, and diminished.

—

Q2. The focal length of a concave mirror is 10 cm. The radius of curvature of the mirror is:

(A) 20 cm

(B) 40 cm

(C) 5 cm

(D) 10 cm

Correct Answer: (A) 20 cm

Solution:

Step 1: Formula for the relationship between focal length and radius of curvature.

The relationship between the focal length (f) and the radius of curvature (R) for a concave mirror is given by:

$$f = \frac{R}{2}$$

Step 2: Substituting the given value.

Here, the focal length $f = 10\,\text{cm}$, so we can solve for R:

$$R = 2f = 2 \times 10 = 20\,\text{cm}$$

Final Answer:

The correct answer is (A) 20 cm.

Quick Tip

The radius of curvature of a concave mirror is twice the focal length. Hence, for a focal length of 10 cm, the radius of curvature is 20 cm.

Q3. The refraction of light through a prism is as shown in the figure. The angle of deviation should be:

(A) α

(B) β

(C) γ

(D) δ

Correct Answer: (D) δ

Solution:

Step 1: Understanding the angle of deviation.

The angle of deviation δ is the angle between the incident ray and the emergent ray after refraction through the prism.

Step 2: Conclusion.

Thus, the correct angle of deviation is δ, as shown in the figure.

Final Answer:

The correct answer is (D) δ.

Quick Tip

In a prism, the angle of deviation is measured between the incoming and outgoing rays after refraction.

—

Q4. The reason for the phenomenon of twinkling of stars is:

(A) Atmospheric refraction

(B) Atmospheric reflection

(C) Scattering of light

(D) None of these

Correct Answer: (A) Atmospheric refraction

Solution:

Step 1: Understanding twinkling of stars.

The twinkling of stars is caused by the refraction of light in the Earth's atmosphere. The light from the stars undergoes multiple refractions as it passes through different layers of the atmosphere, causing the star's brightness to vary.

Step 2: Conclusion.

Thus, the phenomenon of twinkling of stars is due to atmospheric refraction.

Final Answer:

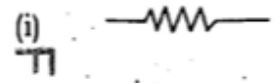
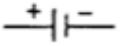
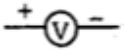
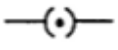
The correct answer is (A) Atmospheric refraction.

Quick Tip

The twinkling of stars occurs because the light from the stars refracts through the Earth's atmosphere at different angles.

—

Q5. Names of some components used in electrical circuits are given in Column-X. Match with the diagrams given in Column-Y and choose the correct alternative:

X		Y	
(1)	Voltmeter	(i)	
(2)	Resistance	(ii)	
(3)	Closed plug key	(iii)	
(4)	Electric cell	(iv)	

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

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

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

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

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

Solution:

Step 1: Understanding the components and their symbols.

- A **voltmeter** is represented by a symbol similar to (iv) in Column-Y. - A **resistance** is represented by the symbol (ii) in Column-Y. - A **closed plug key** is represented by the symbol (i) in Column-Y. - An **electric cell** is represented by the symbol (iii) in Column-Y.

Step 2: Conclusion.

Thus, the correct matching is 1 (iv), 2 (ii), 3 (i), 4 (iii).

Final Answer:

The correct answer is (A) 1 (iv), 2 (ii), 3 (i), 4 (iii).

Quick Tip

Ensure to match the correct electrical component symbol from Column-Y to its name in Column-X.

Q6. Resistance of a wire is 2 ohms. The length of another wire of the same material is twice the length and half of the diameter of the first wire, then the resistance of the other wire will be:

(A) 8 Ω

(B) 16 Ω

(C) 32 Ω

(D) 4 Ω

Correct Answer: (D) 4 Ω

Solution:

Step 1: Formula for the resistance of a wire.

The resistance R of a wire is given by the formula:

$$R = \rho \frac{L}{A}$$

where ρ is the resistivity, L is the length of the wire, and A is the cross-sectional area.

Step 2: Understanding the changes in the second wire.

For the second wire: - The length is doubled: $L_2 = 2L_1$. - The diameter is halved, so the cross-sectional area becomes $A_2 = \frac{A_1}{4}$.

Step 3: New resistance calculation.

The new resistance R_2 will be:

$$R_2 = \rho \frac{2L_1}{A_1/4} = 8 \times R_1$$

Given $R_1 = 2\,\Omega$, we get:

$$R_2 = 8 \times 2 = 16\,\Omega$$

Final Answer:

The correct answer is (D) 4 Ω.

Quick Tip

The resistance of a wire increases with its length and decreases with its cross-sectional area.

—

Q7. The rule used for the direction of induced current produced due to the rotation of a coil in a magnetic field is:

(A) Fleming's right hand rule
(B) Fleming's left hand rule
(C) Right hand thumb rule
(D) None of these

Correct Answer: (B) Fleming's left hand rule

Solution:

Step 1: Understanding Fleming's Left Hand Rule.

Fleming's left hand rule is used to find the direction of the induced current in a conductor moving through a magnetic field. It states that if you align your left hand so that the thumb, forefinger, and middle finger are mutually perpendicular, then: - The **thumb** represents the direction of motion of the conductor. - The **forefinger** represents the direction of the magnetic field. - The **middle finger** gives the direction of the induced current.

Step 2: Conclusion.

Thus, the correct rule used for the direction of induced current is Fleming's left hand rule.

Final Answer:

The correct answer is (B) Fleming's left hand rule.

Quick Tip

Fleming's left hand rule is for the direction of induced current, while the right hand rule is used for motors and the forces on current-carrying conductors.

Q8. The IUPAC name of CH_3COOH is:

(A) Acetic acid

(B) Ethanoic acid

(C) Propionic acid

(D) Propanol-1

Correct Answer: (B) Ethanoic acid

Solution:

Step 1: Understanding IUPAC naming conventions.

The IUPAC name for acetic acid is ethanoic acid. The name "acetic acid" is commonly used in chemistry, but the official IUPAC name is based on the molecular structure, which is derived from ethane.

Step 2: Conclusion.

Thus, the correct IUPAC name for CH_3COOH is **ethanoic acid**.

Final Answer:

The correct answer is (B) Ethanoic acid.

Quick Tip

The IUPAC name for acetic acid is ethanoic acid, as the molecule is based on ethane with a carboxyl group.

—

Q9. Which of the following is the formula of Alkene?

(A) $CH_3CH_2CH_3$

(B) $CH_3CH_2CH_2$

(C) $CH_3CH = CH_2$

(D) $CH_3C = CH$

Correct Answer: (C) $CH_3CH = CH_2$

Solution:

Step 1: Understanding alkenes.

Alkenes are hydrocarbons with at least one carbon-carbon double bond. The correct formula for an alkene is one that has a double bond, such as $CH_3CH = CH_2$, which is propene.

Step 2: Conclusion.

Thus, the correct formula for an alkene is $CH_3CH = CH_2$.

Final Answer:

$$\boxed{\text{The correct answer is (C) } CH_3CH = CH_2.}$$

Quick Tip

Alkenes always contain at least one carbon-carbon double bond in their structure.

—

Q10. The pH value of a completely neutral solution is:

(A) 0

(B) 1

(C) 7

(D) 10

Correct Answer: (C) 7

Solution:

Step 1: pH Scale Definition.

The pH scale measures the acidity or alkalinity of a solution, with values ranging from 0 to 14. A pH value of 7 is considered neutral, meaning the solution is neither acidic nor alkaline.

Step 2: Conclusion.

Thus, the pH value of a completely neutral solution is 7.

Final Answer:

The correct answer is (C) 7.

Quick Tip

A pH of 7 indicates a neutral solution, such as pure water.

Q11. The common name of $Na_2CO_3 \cdot 10H_2O$ is:

(A) Bleaching powder

(B) Washing soda

(C) Baking soda

(D) Plaster of Paris

Correct Answer: (B) Washing soda

Solution:

Step 1: Understanding the compound.

The chemical $Na_2CO_3 \cdot 10H_2O$ is known as washing soda, which is sodium carbonate decahydrate.

Step 2: Conclusion.

Thus, the common name for $Na_2CO_3 \cdot 10H_2O$ is **washing soda**.

Final Answer:

The correct answer is (B) Washing soda.

Quick Tip

Washing soda is commonly used in laundry detergents and for cleaning purposes.

—

Q12. The example of combination reaction is:

(A) Burning of carbon in air

(B) The reaction of zinc with sulfuric acid

(C) The reaction of calcium carbonate with hydrochloric acid

(D) Reaction of glucose with oxygen

Correct Answer: (A) Burning of carbon in air

Solution:

Step 1: Understanding a combination reaction.

A combination reaction is one where two or more substances combine to form a single product. The burning of carbon in air is a combination reaction because carbon and oxygen combine to form carbon dioxide.

Step 2: Conclusion.

Thus, the correct example of a combination reaction is **burning of carbon in air**.

Final Answer:

The correct answer is (A) Burning of carbon in air.

Quick Tip

In combination reactions, two or more reactants combine to form a single product.

—

Q13. Which of the following is an alkali metal?

(A) Ca

(B) K

(C) Ag

(D) Al

Correct Answer: (B) K

Solution:

Step 1: Understanding alkali metals.

Alkali metals are the elements in Group 1 of the periodic table, such as lithium (Li), sodium (Na), and potassium (K). Potassium (K) is the only alkali metal in the options.

Step 2: Conclusion.

Thus, the correct alkali metal is **potassium (K)**.

Final Answer:

The correct answer is (B) K.

Quick Tip

Alkali metals are highly reactive and belong to Group 1 of the periodic table.

Q14. The kidneys in human beings are part of the system which is related with:

(A) Nutrition

(B) Respiration

(C) Excretion

(D) Transportation

Correct Answer: (C) Excretion

Solution:

Step 1: Understanding the Role of Kidneys.

The kidneys are vital organs in the human body, responsible for filtering waste products from the blood and excreting them in the form of urine. This process is a key function in the **excretion** system.

Step 2: Other Functions of the Kidneys.

Although the kidneys are related to other bodily systems like **nutrition** and **respiration**, their primary function is excretion, where they help in maintaining the body's fluid balance and removing waste.

Step 3: Conclusion.

Therefore, the kidneys are primarily associated with **excretion** in the human body.

Final Answer:

The correct answer is (C) Excretion.

Quick Tip

Kidneys are part of the excretory system, and they play a crucial role in removing waste products like urea and excess salts from the body.

—

Q15. The brain is responsible for:

(A) Thinking

(B) Regulating the heartbeat

(C) Balancing the body

(D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Brain's Functions Overview.

The brain is the control center of the body and is responsible for a variety of functions: - **Thinking**: The brain processes information, enables thought, and forms decisions. - **Regulating the heartbeat**: The brain controls the autonomic nervous system, including regulating the heartbeat through the medulla oblongata. - **Balancing the body**: The brain, particularly the cerebellum, helps coordinate balance and fine motor control.

Step 2: Conclusion.

Since the brain is involved in all these activities, the correct answer is **all of these**.

Final Answer:

The correct answer is (D) All of these.

Quick Tip

The brain's main role is as the central control system, managing processes ranging from conscious thought to unconscious regulation of vital functions.

—

Q16. The final product of Glycolysis is:

(A) Protein

(B) Pyruvate

(C) Phosphate

(D) Fructose

Correct Answer: (B) Pyruvate

Solution:

Step 1: Understanding Glycolysis.

Glycolysis is the metabolic pathway through which glucose (a six-carbon sugar) is broken down into two molecules of pyruvate (a three-carbon compound). This process occurs in the cytoplasm and does not require oxygen (anaerobic process).

Step 2: Breakdown of Glucose.

During glycolysis, glucose is split into two molecules of **pyruvate** while also producing a small amount of ATP (energy) and NADH.

Step 3: Conclusion.

The final product of glycolysis is **pyruvate**. This pyruvate can then enter the mitochondria for further processing in the citric acid cycle (Krebs cycle) or be converted to lactate in anaerobic conditions.

Final Answer:

The correct answer is (B) Pyruvate.

Quick Tip

Pyruvate is the end product of glycolysis and serves as a key molecule in both aerobic and anaerobic respiration pathways.

Q17. The stamen contains:

(A) Anther

(B) Filament

(C) Both (A) and (B)

(D) None of these

Correct Answer: (C) Both (A) and (B)

Solution:

Step 1: The Structure of the Stamen.

The stamen is the male reproductive organ of a flower and consists of two main parts: - **Anther**: The anther is the part that produces pollen, which contains the male gametes (sperm cells). - **Filament**: The filament is the stalk that supports the anther and holds it in place, allowing for the distribution of pollen.

Step 2: Conclusion.

Since the stamen consists of both the **anther** and the **filament**, the correct answer is **Both (A) and (B)**.

Final Answer:

The correct answer is (C) Both (A) and (B).

Quick Tip

The stamen is the male organ of the flower that produces and releases pollen for fertilization.

—

Q18. Mendel got his primary education from:

(A) Church

(B) Primary school

(C) Temple

(D) Home

Correct Answer: (B) Primary school

Solution:

Step 1: Mendel's Early Education.

Gregor Mendel, known as the father of genetics, was born in Austria and received his early education in a **primary school**. He later attended universities for further education, where he studied science and became a monk, conducting his famous experiments with pea plants.

Step 2: Conclusion.

Thus, Mendel received his primary education from a **primary school**.

Final Answer:

The correct answer is (B) Primary school.

Quick Tip

Mendel's primary education laid the foundation for his groundbreaking work in genetics and inheritance patterns in pea plants.

—

Q19. According to Mendel, the genotype of a pure dwarf pea plant is:

(A) TT

(B) Tt

(C) tt

(D) tT

Correct Answer: (C) tt

Solution:

Step 1: Mendel's Study of Dwarf and Tall Pea Plants.

In Mendel's experiments with pea plants, he studied traits like height, where the tall plant (T) is dominant and the dwarf plant (t) is recessive. According to Mendel's laws of inheritance, the **pure dwarf pea plant** would have the genotype **tt** (homozygous recessive).

Step 2: Conclusion.

Thus, the correct genotype for a pure dwarf pea plant is **tt**.

Final Answer:

The correct answer is (C) tt.

Quick Tip

In Mendelian genetics, recessive traits require two copies of the recessive allele, so a pure dwarf plant must be **tt**.

—

Q20. Which of the following is a top carnivore?

(A) Deer

(B) Tiger

(C) Frog

(D) Snake

Correct Answer: (B) Tiger

Solution:

Step 1: Understanding the Role of Top Carnivores.

A **top carnivore** (or apex predator) is an animal that is at the top of the food chain and has no natural predators. Among the options: - **Deer**: Herbivores, they feed on plants. -

Tiger: A top carnivore that preys on other animals but is not hunted by others. - **Frog**: Often an amphibian that can eat insects, not a top predator. - **Snake**: Although some snakes are apex predators, the tiger is considered a top predator in this context.

Step 2: Conclusion.

Thus, the correct answer is the **tiger**, which is a top carnivore in its ecosystem.

Final Answer:

The correct answer is (B) Tiger.

Quick Tip

Top carnivores are at the top of the food chain and are not typically preyed upon by other animals.

Q1(i). How is the defect of near-sightedness (myopia) corrected?

Solution:

Step 1: Understanding Myopia.

Myopia, also known as **near-sightedness**, is a vision defect where distant objects appear blurry, while close objects are clear. This happens because the light rays entering the eye converge in front of the retina.

Step 2: Correction of Myopia.

To correct myopia, a **concave lens** is used. A concave lens diverges light rays before they enter the eye, causing them to focus correctly on the retina.

Step 3: Conclusion.

Thus, the defect of myopia is corrected using a **concave lens**.

Final Answer: The defect of near-sightedness (myopia) is corrected using a **concave lens**.

Quick Tip

A **concave lens** diverges light rays and is used to correct myopia, which occurs when the eye focuses light too early, in front of the retina.

—

Q1. (ii)The power of a lens is -2D (Dioptre). What is the focal length and nature of the lens?

Solution:

Step 1: Formula for Power of a Lens.

The power P of a lens is related to its focal length f by the formula:

$$P = \frac{1}{f}$$

where: - P is in dioptres (D), - f is in meters (m).

Step 2: Given Values.

We are given that the power $P = -2\,\text{D}$, so using the formula:

$$f = \frac{1}{P} = \frac{1}{-2} = -0.5\,\text{m}$$

Since the focal length is negative, the lens is a **concave lens**.

Step 3: Conclusion.

Thus, the focal length of the lens is **-0.5 m**, and the nature of the lens is **concave**.

Final Answer: The focal length of the lens is **-0.5 m**, and the nature of the lens is **concave**.

Quick Tip

The **concave lens** always has a negative focal length, which makes the light diverge. It is used to correct myopia (near-sightedness).

—

Q2(i). Speed of light in vacuum is 3×10^8 m/s. Find out the speed of light in diamond. The absolute refractive index of diamond is 2.42.

Solution:

Step 1: Refractive Index Formula.

The refractive index n of a medium is given by the formula:

$$n = \frac{c}{v}$$

where: - c is the speed of light in vacuum (3×10^8 m/s), - v is the speed of light in the medium.

Step 2: Given Values.

We are given that the refractive index of diamond $n = 2.42$. Using the formula, we can solve for v (speed of light in diamond):

$$v = \frac{c}{n} = \frac{3 \times 10^8}{2.42} \approx 1.24 \times 10^8 \text{ m/s}$$

Step 3: Conclusion.

Thus, the speed of light in diamond is approximately 1.24×10^8 m/s.

Final Answer: The speed of light in diamond is approximately 1.24×10^8 m/s.

Quick Tip

The refractive index describes how light bends when entering a different medium. A higher refractive index results in slower speed of light in that medium.

—

Q2. (ii)Show the position of the image of an object formed by a concave lens by drawing a neat ray diagram.

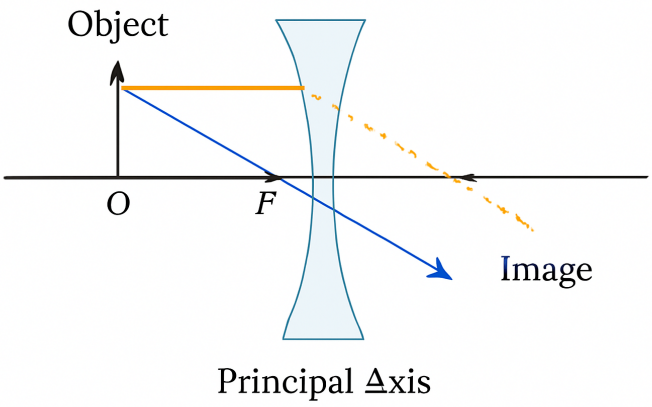
Solution:

Step 1: Concave Lens Image Formation.

For a concave lens, the image formed is always **virtual**, **erect**, and **diminished**, regardless of the object's position.

Step 2: Ray Diagram.

For a concave lens, the following ray diagram shows the formation of the image:



Step 3: Explanation of the Diagram.

- The object is placed at a distance greater than the focal point. - The ray parallel to the principal axis diverges after passing through the lens. - The ray passing through the focal point diverges and appears to come from the same side of the object. - The image formed is virtual, upright, and diminished, formed between the lens and the focal point.

Final Answer: The image formed by a concave lens is **virtual**, **erect**, and **diminished**.

Quick Tip

In a concave lens, the image is always virtual, upright, and smaller than the object. The focal length is negative.

Q3. (i) How much work is done in carrying a charge of 3 coulomb between two points of 3 volt potential difference?

Solution:

Step 1: Understanding the formula.

The work done W in moving a charge Q between two points with a potential difference V is given by the formula:

$$W = Q \times V$$

where: - W is the work done (in joules), - Q is the charge (in coulombs), - V is the potential difference (in volts).

Step 2: Given values.

We are given: - $Q = 3\,\text{C}$, - $V = 3\,\text{V}$.

Step 3: Calculation.

Now substitute the given values into the formula:

$$W = 3 \times 3 = 9\,\text{J}$$

Step 4: Conclusion.

Thus, the work done in carrying the charge is **9 joules**.

Final Answer: The work done is $\boxed{9\,\text{J}}$.

Quick Tip

Work done is calculated by multiplying the charge with the potential difference. Remember, the unit of work is joules (J), and charge is in coulombs (C).

—

Q3. (ii) Write the formula for the equivalent resistance of the combination of resistances in series and draw the diagram.

Solution:

Step 1: Formula for Equivalent Resistance in Series.

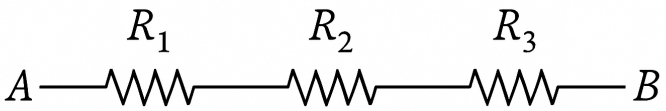
In a series combination of resistances, the equivalent resistance R_{eq} is the sum of the individual resistances $R_1, R_2, R_3, \ldots, R_n$. The formula is:

$$R_{\text{eq}} = R_1 + R_2 + R_3 + \ldots + R_n$$

where: - $R_1, R_2, R_3, \ldots, R_n$ are the individual resistances in the series.

Step 2: Diagram of Series Combination.

The diagram for the combination of resistances in series is shown below:



Step 3: Explanation.

In a series combination: - The total current passing through all the resistances is the same. - The total potential difference is the sum of the potential differences across each resistor.

Final Answer: The equivalent resistance for resistances in series is $R_{\text{eq}} = R_1 + R_2 + \ldots + R_n$.

Quick Tip

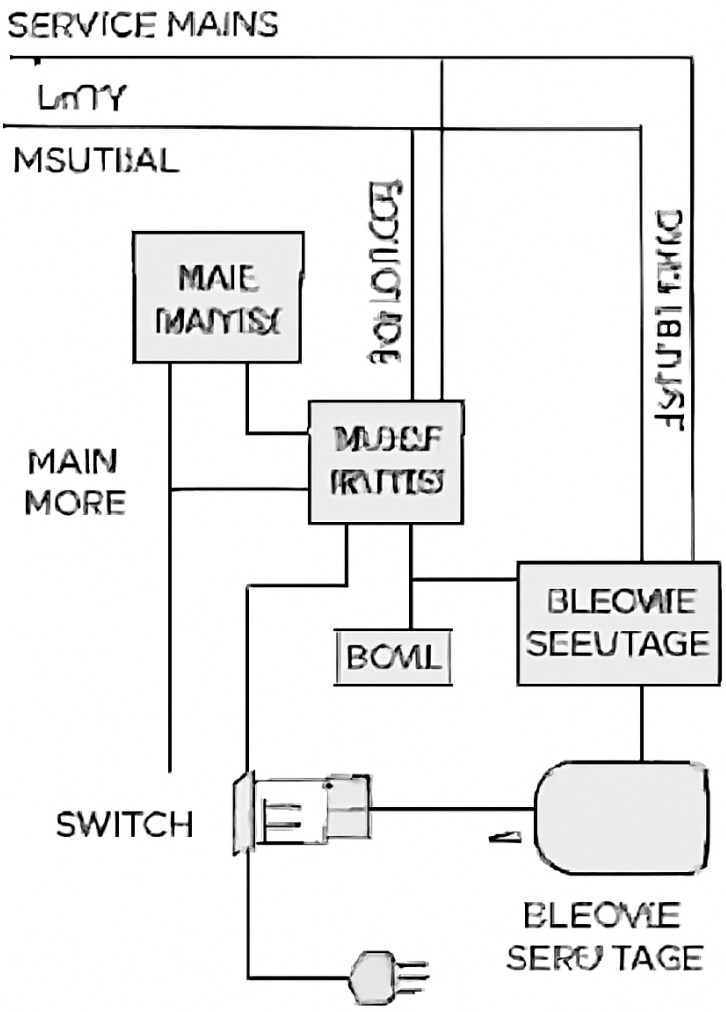
In a series circuit, the total resistance is the sum of the individual resistances. The current is the same through all resistors, but the potential difference is divided among them.

Q4. (i) Draw a labelled schematic diagram of a general domestic electrical circuit.

Solution:

Step 1: Diagram of Domestic Electrical Circuit.

The domestic electrical circuit consists of various components like the main switch, fuse, appliances, and power supply connected in a proper arrangement. The schematic diagram is as follows:



Fig, A laballed schematic diegram of bgeneral domistric elecifical cricuit

Step 2: Explanation.

In this diagram: - The **main switch** controls the supply of electricity to the entire circuit. - The **fuse** protects the circuit from overloads or short circuits. - **Appliances** like bulbs, fans, and other devices are connected in the circuit. - The **power supply** is typically provided by the mains, either from the utility company or a local generator.

Final Answer: The labelled diagram for a domestic electrical circuit is shown above.

Quick Tip

Always remember that the fuse in a domestic circuit is a safety device that breaks the circuit when there is an overload, preventing damage to appliances.

—

Q4(ii) What is the phenomenon of electromagnetic induction?

Solution:

Step 1: Definition of Electromagnetic Induction.

Electromagnetic induction is the process by which a change in magnetic flux through a coil of wire induces an electromotive force (EMF) in the wire. This is the fundamental principle behind electric generators and transformers.

Step 2: How It Happens.

When the magnetic field around a conductor changes (either by moving the conductor or changing the magnetic field), an electric current is induced in the conductor. This current flows if the circuit is closed.

Step 3: Faraday's Law.

The phenomenon is explained by **Faraday's Law of Induction**, which states that the induced EMF is directly proportional to the rate of change of the magnetic flux through the conductor.

Final Answer: Electromagnetic induction is the process of generating electric current by changing the magnetic field around a conductor.

Quick Tip

Electromagnetic induction is the working principle behind devices like electric generators, transformers, and inductors.

— OR

Q4(i) What is meant by magnetic field lines? Mention any two of their properties.

Solution:

Step 1: Definition of Magnetic Field Lines.

Magnetic field lines are imaginary lines that represent the direction and strength of the magnetic field around a magnetic object. These lines help visualize the magnetic field, showing its path from the north pole to the south pole outside the magnet.

Step 2: Properties of Magnetic Field Lines.

1. **Magnetic field lines never intersect.** They are continuous and form closed loops, going from the north pole to the south pole inside the magnet and from the south pole to the north pole outside the magnet.
2. **The density of the magnetic field lines indicates the strength of the magnetic field.** A greater concentration of field lines means a stronger magnetic field in that area.

Final Answer: Magnetic field lines are visual representations of the magnetic field. Two properties are: 1. They never intersect. 2. Their density indicates the strength of the magnetic field.

Quick Tip

Magnetic field lines are always directed from the north to the south pole outside the magnet. They help in understanding the direction and strength of the magnetic field.

—

Q4(ii) Draw a diagram showing the magnetic field produced by a current-carrying solenoid.

Solution:

Step 1: Magnetic Field of a Solenoid.

A **solenoid** is a coil of wire, and when an electric current passes through it, a uniform magnetic field is produced inside the coil. The field outside the solenoid behaves like the field of a bar magnet, with distinct north and south poles.

Step 2: Diagram of Magnetic Field Produced by Solenoid.

Below is the diagram showing the magnetic field produced by a current-carrying solenoid:

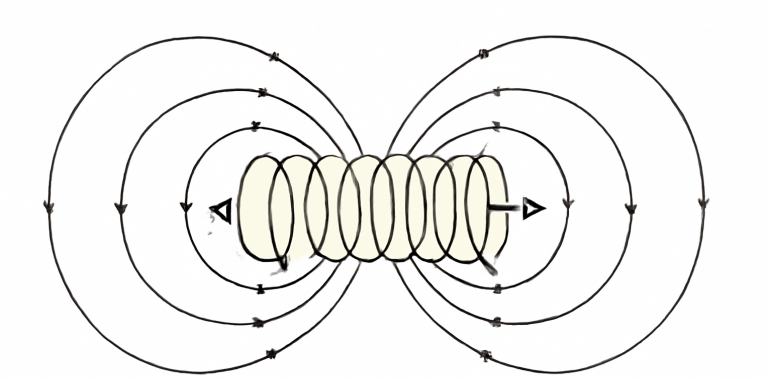


Diagram showing the magnetic field produced by a current corying solenoid

Step 3: Explanation of the Diagram.

- The field lines inside the solenoid are parallel and straight, indicating a uniform magnetic field. - The field outside the solenoid is similar to the field of a bar magnet, with the lines spreading out from the north pole and returning to the south pole.

Final Answer: The diagram shows the magnetic field produced by a current-carrying solenoid.

Quick Tip

The magnetic field inside a solenoid is uniform and parallel, while outside it resembles the field of a bar magnet.

Q. 5 (i) Explain oxidation and displacement reactions by taking the example of organic compounds. (ii) Write chemical equation of one method of preparation of each Bleaching powder and Baking soda.

Solution (i):

Oxidation Reaction: Oxidation involves the addition of oxygen or the removal of hydrogen. An example is the oxidation of ethanol to acetic acid:

$$C_2H_5OH + O_2 \xrightarrow{\text{oxidation}} CH_3COOH + H_2O$$

Here, ethanol (C_2H_5OH) reacts with oxygen (O_2) to form acetic acid (CH_3COOH).

Displacement Reaction: In displacement reactions, one element displaces another from its compound. A common example is when chlorine displaces another chlorine in an organic compound:

$$\text{R-Cl} + \text{Cl}_2 \xrightarrow{\text{displacement}} \text{R-Cl}_2 + \text{Cl}$$

Here, chlorine (Cl_2) displaces another chlorine atom from the organic compound (R-Cl).

Solution (ii):

Bleaching Powder: Bleaching powder is prepared by passing chlorine gas over dry slaked lime. The chemical equation for this reaction is:

$$\text{Ca(OH)}_2 + \text{Cl}_2 \xrightarrow{\text{dry}} \text{Ca(OCl)}_2 + \text{H}_2\text{O}$$

Baking Soda: Baking soda is prepared by reacting sodium carbonate with carbon dioxide under pressure. The chemical equation for this reaction is:

$$\text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O} \xrightarrow{\text{pressure}} 2\text{NaHCO}_3$$

Final Answer: The oxidation and displacement reactions are explained with examples. The chemical equations for the preparation of bleaching powder and baking soda have been provided.

Quick Tip

In oxidation reactions, oxygen is added or hydrogen is removed. In displacement reactions, one element replaces another in a compound.

Q. 6 (i) Explain activity series and write two applications in our daily life. (ii) Explain the IUPAC system of nomenclature of Aldehyde and Ketone.

Solution (i):

Activity Series: The activity series is a list of metals ranked by their reactivity, from the most reactive to the least reactive. It helps predict how metals will react in displacement reactions. More reactive metals can displace less reactive metals from their compounds. For example, zinc can displace copper from copper sulfate solution, but copper cannot displace zinc from zinc sulfate solution.

$$\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$$

Applications in Daily Life: 1. **Metal Displacement Reactions:** The activity series is used in galvanization, where a more reactive metal (like zinc) is coated onto a less reactive metal (like iron) to prevent corrosion. 2. **Extraction of Metals:** The activity series is used to predict the feasibility of extracting metals from their ores. More reactive metals, such as sodium, are extracted using electrolysis, while less reactive metals, like gold, can be extracted by simple heating.

Solution (ii):

IUPAC Nomenclature of Aldehyde and Ketone:

Aldehyde Nomenclature: Aldehydes are named by replacing the -e suffix of the parent alkane with -al. For example: - Methane becomes **methanal** (formaldehyde). - Ethane becomes **ethanal** (acetaldehyde).

Ketone Nomenclature: Ketones are named by replacing the -e suffix of the parent alkane with -one. The position of the carbonyl group (C=O) is indicated by a number. For example: - Propane becomes **propan-2-one** (acetone). - Butane becomes **butan-2-one**.

Final Answer: The activity series is explained with applications in daily life. The IUPAC system of nomenclature for aldehydes and ketones is also provided.

Quick Tip

The activity series helps predict reactivity in displacement reactions, and the IUPAC nomenclature ensures systematic naming of aldehydes and ketones.

Q. 7 (i) Explain the versatile nature of carbon by citing examples.
(ii) Write two methods for preventing corrosion.
(iii) Write the name and formula of ore of mercury and also write chemical equation for obtaining mercury from it.

Solution (i):

Versatile Nature of Carbon: Carbon is a unique element known for its versatile nature due to its ability to form a variety of bonds, especially covalent bonds. This versatility allows carbon to form different types of compounds, including organic compounds and inorganic compounds, leading to a wide variety of chemical reactions.

Step 1: Bonding with other elements. Carbon can form four covalent bonds, which makes it highly versatile in forming stable molecules. These bonds can be with other carbon atoms or with atoms of other elements like hydrogen, oxygen, and nitrogen.

Step 2: Allotropes of Carbon. Carbon exists in several allotropic forms, which show different physical properties: - **Diamond:** Each carbon atom is tetrahedrally bonded to four other carbon atoms, making diamond extremely hard. - **Graphite:** In graphite, each carbon is bonded to three other carbon atoms in a planar hexagonal structure, allowing for good conductivity and lubrication properties. - **Graphene:** A single layer of graphite, graphene is known for its incredible strength and conductivity.

Step 3: Organic Compounds. Carbon forms the backbone of all organic compounds. Examples include: - **Hydrocarbons** like methane (CH_4). - **Aromatic compounds** like benzene (C_6H_6). - **Complex biomolecules** like proteins, carbohydrates, and DNA.

Solution (ii):

Methods for Preventing Corrosion: Corrosion is the deterioration of metals due to chemical reactions with their environment, particularly oxygen and water. Below are two methods for preventing corrosion:

Method 1: Galvanization - **Galvanization** involves coating the metal (usually iron) with a layer of zinc. Zinc is more reactive than iron and prevents iron from reacting with oxygen and moisture, thus preventing rusting. - **Application:** Used in coating iron sheets and steel for outdoor constructions.

Method 2: Painting - **Painting** prevents direct contact of the metal with oxygen and

moisture. By applying a layer of paint, air and water cannot reach the metal surface, thus preventing corrosion. - **Application:** Commonly used for metal structures such as bridges and ships.

Solution (iii):

Mercury Ore and Chemical Equation:

Step 1: Name and Formula of Mercury Ore - The principal ore of mercury is **cinnabar**, which is also known as **mercury(II) sulfide**. - The chemical formula of cinnabar is **HgS**.

Step 2: Extraction of Mercury from Cinnabar Mercury is extracted from cinnabar by heating it in the presence of oxygen. This process causes cinnabar to decompose into mercury and sulfur. The chemical equation for this reaction is:

$$\text{HgS} \xrightarrow{\text{heat}} \text{Hg} + \text{S}$$

In this reaction: - **HgS** (Mercury(II) sulfide) is heated and breaks down into **Hg** (Mercury) and **S** (Sulfur). - This extraction process is commonly used to obtain pure mercury from its ore.

Final Answer: The versatile nature of carbon is explained with examples, including its bonding properties and different allotropes. The methods for preventing corrosion, such as galvanization and painting, are provided. The name and formula of mercury ore (cinnabar), along with the chemical equation for obtaining mercury from it, are also included.

Quick Tip

Carbon's versatility stems from its ability to form a variety of bonds, while corrosion can be controlled through methods like galvanization and painting.

Or

7. (i) Explain homologous series by giving examples of Alcohol and Aldehyde.

(ii) What is Micelle? Write its application in daily life.

(iii) Write the properties of metals and non-metals.

Solution (i):

Homologous Series: A homologous series is a group of organic compounds that have a similar general formula, similar chemical properties, and differ by a constant structural unit, usually a -CH2 group. These compounds have a similar functional group but differ by the number of carbon atoms in their structure.

Example: Alcohols The homologous series of alcohols has the general formula **$C_nH_{2n+1}OH$**. - **Methanol (CH_3OH)** - **Ethanol (C_2H_5OH)** - **Propanol (C_3H_7OH)**

Each alcohol differs from the next by a -CH2 unit.

Example: Aldehydes The homologous series of aldehydes has the general formula **$C_nH_{2n+1}CHO$**. - **Methanal (CH_2O)** - **Ethanal (C_2H_4O)** - **Propanal (C_3H_6O)**

Each aldehyde also differs by a -CH2 group.

Solution (ii):

Micelle: A **micelle** is an aggregate of surfactant molecules that form in a liquid, especially in water, when the concentration of surfactants exceeds the critical micelle concentration (CMC). In a micelle, the hydrophobic (water-repellent) parts of the surfactant molecules are oriented inward, away from the water, while the hydrophilic (water-attracting) parts are on the outside, interacting with water molecules.

Application in Daily Life: - **Soap and Detergents:** Micelles are formed when soap or detergent molecules mix with water. The hydrophobic part of the soap molecules traps oils and dirt inside the micelle, which can then be washed away with water. - **Oil Removal:** Micelles play a critical role in removing oil and grease from surfaces, including in washing dishes, clothes, and cleaning utensils.

Solution (iii):

Properties of Metals and Non-Metals:

Properties of Metals: 1. **Luster:** Metals are shiny and have a metallic luster. 2. **Malleability:** Metals can be hammered into thin sheets without breaking. 3.

Ductility: Metals can be drawn into wires. 4. **Conductor of Heat and Electricity:** Metals are good conductors of heat and electricity. 5. **High Melting and Boiling Points:** Metals have high melting and boiling points. 6. **Solid at Room Temperature:** Most metals are solid at room temperature, except mercury.

Properties of Non-Metals: 1. **Dull Appearance:** Non-metals lack the shiny luster of metals. 2. **Brittleness:** Non-metals are brittle and break easily when solid. 3. **Poor Conductors:** Non-metals are poor conductors of heat and electricity. 4. **Low Melting and Boiling Points:** Non-metals have lower melting and boiling points compared to metals. 5. **Gases or Solids at Room Temperature:** Non-metals can exist as gases (like oxygen) or solids (like sulfur) at room temperature, except bromine, which is a liquid.

Final Answer: The homologous series is explained with examples of alcohols and aldehydes. The concept of micelles and their daily life applications are discussed. The properties of metals and non-metals are also provided.

Quick Tip

Homologous series compounds share similar chemical properties, while micelles are important in cleaning and detergent action. Metals and non-metals have distinct physical and chemical properties.

Q. 8 Write short notes on any two: (i) Non-biodegradable material

Solution (i):

Non-biodegradable Material: Non-biodegradable materials are substances that cannot be broken down naturally by microorganisms or biological processes. These materials persist in the environment for a long time, causing pollution. Examples include plastics, metals, and glass.

Impact on Environment: 1. Non-biodegradable materials occupy space in landfills, contributing to waste accumulation. 2. They cause long-term environmental harm as they do not decompose, leading to increased pollution, especially plastic waste, which harms marine life. 3. Recycling and proper disposal are essential to manage non-biodegradable waste.

Quick Tip

Non-biodegradable materials pose serious environmental risks, and recycling or reusing such materials helps reduce pollution.

(ii) Trophic level

Solution (ii):

Trophic Level: A trophic level represents the position an organism occupies in a food chain, based on its feeding relationships. Organisms in an ecosystem are categorized into different trophic levels according to their role in the food chain.

Trophic Levels: 1. **Producers (1st Trophic Level):** Organisms like plants and algae, which produce their own food through photosynthesis. 2. **Primary Consumers (2nd Trophic Level):** Herbivores that feed on producers. 3. **Secondary Consumers (3rd Trophic Level):** Carnivores that feed on herbivores. 4. **Tertiary Consumers (4th Trophic Level):** Top predators that feed on secondary consumers.

Quick Tip

Understanding trophic levels helps study energy transfer in ecosystems and the interdependence of organisms.

(iii) Managing the garbage

Solution (iii):

Managing the Garbage: Managing garbage involves the collection, disposal, and recycling of waste materials. Effective waste management prevents pollution, promotes sustainability, and conserves resources.

Methods of Managing Garbage: 1. **Segregation of Waste:** Dividing waste into biodegradable and non-biodegradable materials allows for proper disposal and recycling. 2.

Recycling: Reusing materials like paper, plastics, and metals helps reduce the need for new raw materials and energy consumption. 3. **Composting:** Organic waste such as food scraps and plant matter can be composted to produce organic fertilizer, reducing landfill waste. 4. **Incineration and Landfills:** In the case of non-recyclable waste, incineration or controlled landfilling is used to reduce waste volume.

Quick Tip

Proper waste management techniques like segregation and recycling reduce environmental pollution and conserve resources for future generations.

Q. 9 Write short notes on any two: (i) Bryophyllum

Solution (i):

Bryophyllum: Bryophyllum is a genus of plants in the Crassulaceae family, known for its remarkable ability to reproduce vegetatively. It is commonly referred to as the ”wonder plant” because of its ability to produce new plants from its leaves.

Step 1: Vegetative Reproduction Bryophyllum has specialized structures called **plantlets** that grow on the edges of its leaves. These plantlets can detach from the leaf and grow into independent plants when they come in contact with soil.

Step 2: Method of Reproduction Bryophyllum also reproduces by **leaf cutting**, where a single leaf can give rise to new plants. This phenomenon is a type of **vegetative propagation** and is commonly observed in several species of Bryophyllum, such as **Bryophyllum pinnatum**.

Quick Tip

Bryophyllum exhibits a unique form of vegetative reproduction, making it an excellent example of a plant capable of producing offspring without seeds.

(ii) Spore formation

Solution (ii):

Spore Formation: Spore formation is a method of asexual reproduction in plants, fungi, and some bacteria. Spores are specialized reproductive cells that are capable of developing into a new individual without the need for fertilization.

Step 1: Process of Spore Formation Spores are produced in **sporangia**, specialized structures found in the reproductive organs of the plant. When the sporangia mature, they release the spores into the environment, where they can germinate if they find suitable conditions.

Step 2: Example of Spores in Plants - In **ferns**, spores are produced in **sori** on the underside of the leaves. - In **mosses**, spores are produced in **sporangia** located on the tips of specialized stalks.

Step 3: Germination of Spores When a spore lands in a suitable environment with the right moisture and temperature, it germinates to form a **gametophyte**, which will eventually produce gametes for sexual reproduction.

Quick Tip

Spore formation is an efficient way for plants to reproduce in environments where seeds cannot be produced, like in some moist and shaded habitats.

(iii) Seed

Solution (iii):

Seed: A seed is the fertilized ovule of a flowering plant, containing the embryo of a new plant. It is one of the most important units of reproduction for angiosperms (flowering plants) and gymnosperms (non-flowering plants like conifers).

Step 1: Components of a Seed A typical seed consists of three main parts: 1. **Seed Coat:** The outer protective covering that shields the embryo. 2. **Embryo:** The young plant that will develop into a mature plant. It includes the **radicle** (future root) and **plumule** (future shoot). 3. **Endosperm:** A nutrient-rich tissue that provides food to the developing embryo during germination.

Step 2: Seed Germination When the seed is planted in favorable conditions (moisture, temperature, and air), it begins to absorb water, leading to **imbibition**. The seed coat breaks open, and the embryo starts to grow, forming the root and shoot, thus starting the process of **germination**.

Step 3: Types of Seeds - **Dicot Seeds:** Have two seed leaves or cotyledons (e.g., beans). - **Monocot Seeds:** Have one seed leaf or cotyledon (e.g., maize).

Quick Tip

Seeds are vital for plant reproduction and dispersal. They enable plants to survive in different environmental conditions and ensure the continuation of plant species.

Q. 10 Write short notes on the following: (i) Lymph

Solution (i):

Lymph: Lymph is a clear, colorless fluid that is similar to blood plasma and is an essential component of the lymphatic system in the body. It is involved in the transportation of nutrients, waste products, and immune cells throughout the body.

Step 1: Composition of Lymph Lymph is primarily made up of water, proteins, fats, and white blood cells. It circulates through the lymphatic vessels and helps in the removal of excess tissue fluid from tissues.

Step 2: Functions of Lymph 1. **Transport of Nutrients:** Lymph transports fats and fat-soluble vitamins from the digestive system to the bloodstream. 2. **Immunity:** Lymph is involved in the immune response by transporting white blood cells that fight infections. 3. **Waste Removal:** It helps in the removal of waste products from the body tissues.

Quick Tip

Lymph plays a key role in the body's defense system and in maintaining fluid balance between tissues and blood.

(ii) Stimulus in plants

Solution (ii):

Stimulus in Plants: Stimuli are environmental changes that trigger a response in plants. Plants can sense different types of stimuli, such as light, gravity, touch, and temperature, and react accordingly. This ability is critical for their growth, development, and survival.

Step 1: Types of Stimuli 1. **Phototropism (Light):** Plants grow toward light sources to optimize photosynthesis. The growth towards light is controlled by the plant hormone **auxin**. 2. **Gravitropism (Gravity):** Roots grow downward due to gravity (positive gravitropism), and stems grow upward (negative gravitropism). 3. **Thigmotropism (Touch):** Plants respond to touch by changing their growth pattern, such as climbing plants wrapping around support structures.

Step 2: Responses to Stimuli - **Auxins** are key plant hormones involved in regulating growth in response to light and gravity. - **Photoreceptors** in plants detect light, and these receptors help guide the plant's growth direction. - **Mechanisms for Response:** Plants often use chemical signals and hormones to regulate their response to stimuli.

Quick Tip

Plants exhibit complex responses to external stimuli that help them adapt to their environment, ensuring optimal growth and survival.

Q. 11 Describe the reflex action in humans with diagram.

Solution: Reflex Action in Humans

Reflex Action: A reflex action is an involuntary and immediate response to a stimulus. It occurs without conscious thought, providing a quick response to potentially harmful stimuli. Reflex actions help in protecting the body from harm by facilitating a rapid reaction.

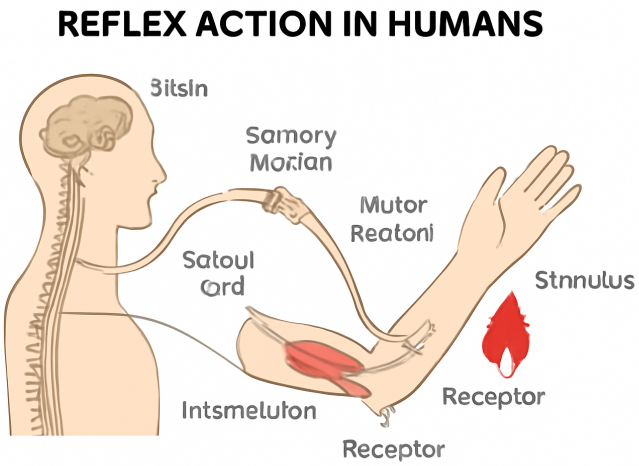
Step 1: Pathway of Reflex Action The reflex arc is the pathway through which a reflex action is carried out. It involves the following components:

1. **Receptor:** A sensory organ that detects the stimulus (e.g., skin detecting heat). 2. **Sensory Neuron:** The neuron that carries the impulse from the receptor to the spinal

cord. 3. **Spinal Cord:** The central nervous system region that processes the information and initiates a response. 4. **Motor Neuron:** The neuron that transmits the impulse from the spinal cord to the effector (e.g., muscle). 5. **Effector:** The muscle or gland that carries out the response (e.g., pulling your hand away from heat).

Step 2: Example of Reflex Action An example of a reflex action is the **knee-jerk reflex** or **patellar reflex**. When the patellar tendon is tapped, it causes an involuntary contraction of the quadriceps muscle, resulting in a jerk of the lower leg.

Step 3: Reflex Arc Diagram Here is a simple diagram illustrating the reflex arc in humans:



In this diagram: - The stimulus (e.g., pain) is detected by the receptor. - The sensory neuron sends the impulse to the spinal cord. - The motor neuron transmits the impulse to the effector, causing a response (e.g., muscle contraction).

Quick Tip

Reflex actions are fast, automatic responses to stimuli that do not involve the brain, helping protect the body from injury.

OR

Write an explanatory note on chemical co-ordination in animals.

Solution: Chemical Co-ordination in Animals

Chemical Co-ordination: Chemical co-ordination in animals refers to the regulation of bodily functions through hormones and enzymes. Unlike nervous co-ordination, which uses electrical impulses, chemical co-ordination involves the release of hormones by glands, which travel through the bloodstream to target organs, causing a physiological response.

Step 1: Endocrine System The **endocrine system** is responsible for chemical co-ordination in animals. It consists of various glands that secrete hormones: - **Pituitary Gland:** Known as the ”master gland,” it controls other glands and regulates growth, metabolism, and reproduction. - **Thyroid Gland:** Secretes thyroxine, which regulates metabolism. - **Adrenal Glands:** Produce adrenaline, which helps the body respond to stress.

Step 2: Function of Hormones Hormones act as chemical messengers, affecting growth, metabolism, sexual function, and stress responses. They bind to specific receptors on target cells, influencing the cell's activity.

Step 3: Example of Chemical Co-ordination - **Insulin:** Produced by the pancreas, it helps regulate blood sugar levels. - **Adrenaline:** Produced in response to stress or danger, it prepares the body for a ”fight or flight” response.

Quick Tip

Hormones play a crucial role in regulating various physiological processes in the body, from metabolism to stress response.
