UP Board Class 10 Science - 824 (CO) - 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. In which of the following mirrors, your image appears erect always?

(A) Concave mirror

(B) Convex mirror

(C) Plane mirror

(D) Both Plane and Convex mirrors

Correct Answer: (C) Plane mirror

Solution:

Step 1: Understanding the mirrors.

- In a **concave mirror**, the image can be either real or virtual, inverted or erect, depending on the object's position. - In a **convex mirror**, the image is always virtual, erect, and diminished, regardless of the object's position. - In a **plane mirror**, the image is always virtual, erect, and of the same size as the object.

Step 2: Conclusion.

Since the question asks for the mirror where the image appears erect always, the correct answer is **(C) Plane mirror**, as it always forms an erect image.

Final Answer:

The correct answer is (C) Plane mirror.

Quick Tip

A plane mirror always produces an erect and virtual image, regardless of the object's position.

Q2. White light ray is incident on two identical prisms as shown in the figure. The emergent light ray from the combination will be

(A) white

(B) red

(C) violet

(D) yellow

Correct Answer: (A) white

Solution:

Step 1: Understanding the behavior of light.

When white light passes through two identical prisms, the light is dispersed into its constituent colors (spectrum). However, if the two prisms are oriented such that the dispersion effect cancels out, the emergent light will remain white.

Step 2: Conclusion.

Thus, when white light passes through two identical prisms, the emergent light ray from the combination will be white.

Final Answer:

The correct answer is (A) white.

Quick Tip

When two prisms are used with their dispersion effects canceled, the emergent light will remain white.

Q3. The image formed by a convex lens of an object, placed in between F and 2F, is:

(A) real, diminished and inverted

(B) virtual, magnified and erect

(C) virtual, magnified and inverted

(D) real, magnified and inverted

Correct Answer: (D) real, magnified and inverted

Solution:

Step 1: Understanding the position of the object.

When the object is placed between **F (focus)** and **2F (twice the focal length)** of a convex lens, the image formed is **real**, **inverted**, and **magnified**. The image is formed on the opposite side of the object, and it is larger than the object.

Step 2: Conclusion.

Thus, when an object is placed between F and 2F, the image is real, magnified, and inverted.

Final Answer:

The correct answer is (D) real, magnified and inverted.

Quick Tip

For a convex lens, when the object is between F and 2F, the image formed is real, inverted, and magnified.

Q4. A concave lens is used to correct which visual defect?

(A) Myopia

(B) Hypermetropia

(C) All of these

(D) None of these

Correct Answer: (A) Myopia

Solution:

Step 1: Understanding Myopia.

Myopia (nearsightedness) is a condition where a person can see nearby objects clearly, but distant objects appear blurred. This occurs when the eye's lens focuses the image in front of the retina.

A **concave lens** is used to correct this condition by diverging the light rays before they enter the eye, causing the image to form on the retina.

Step 2: Conclusion.

Thus, a concave lens is used to correct **myopia** by diverging light rays and allowing the image to focus on the retina.

Final Answer:

The correct answer is (A) Myopia.

Quick Tip

Concave lenses are used to correct nearsightedness (myopia) by diverging light rays before they reach the eye.

Q5. The units of some physical quantities are given in the column (X) and the physical quantities in column (Y). Match the physical quantities given in column (X) and choose the correct alternative.

X		Y	
(1)	ohm-metre	(i)	Resistance
(2)	watt	(ii)	Electric power
(3)	coulomb	(iii)	Resistivity
(4)	ohm	(iv)	Charge

Table 1: Matching Units With Their Corresponding Physical Quantities

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

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

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

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

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

Solution:

Step 1: Matching Units and Quantities - **1 (ohm-metre):** The unit ohm-metre is the unit of **resistivity**, which is a material property that indicates how strongly a material

opposes the flow of electric current. - **2 (watt):** The unit watt is the unit of **electric power**, which represents the rate at which electrical energy is used or generated. - **3 (coulomb):** The unit coulomb is the unit of **charge**, which measures the amount of electricity. - **4 (ohm):** The unit ohm is the unit of **resistance**, which measures how much a material resists the flow of electric current.

Step 2: Conclusion.

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

Final Answer:

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

Quick Tip

Remember that ohm-metre is for resistivity, watt is for power, coulomb is for charge, and ohm is for resistance.

Q6. The current flowing in an electric bulb of 110 watt, joined with an electric supply of 220 V, is:

(A) 2 A

(B) 5 A

(C) 0.2 A

(D) 0.5 A

Correct Answer: (A) 2 A

Solution:

Step 1: Formula for Electric Power The formula for electric power is given by:

$$P = VI$$

Where: P = Power (in watts), V = Voltage (in volts), I = Current (in amperes).

Step 2: Substituting Given Values We are given: - $P = 110\,\text{W}$, - $V = 220\,\text{V}$.

Rearranging the formula to solve for current, we get:

$$I = \frac{P}{V} = \frac{110}{220} = 0.5\,\text{A}.$$

Step 3: Conclusion.

Thus, the current flowing through the electric bulb is 0.5 A.

Final Answer:

The correct answer is (D) 0.5 A.

Quick Tip

To calculate the current in an electric circuit, divide the power by the voltage: $I = \frac{P}{V}$.

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7. The magnetic field inside a long current-carrying conductor is:

(A) zero

(B) uniform

(C) increases at the ends

(D) decreases at the ends

Correct Answer: (C) increases at the ends

Solution:

Step 1: Understanding the magnetic field.

For a long current-carrying conductor, the magnetic field is generated around the conductor due to the moving charges. According to Ampère's law, the magnetic field lines form concentric circles around the conductor. The strength of the magnetic field is directly proportional to the current flowing through the conductor and inversely proportional to the distance from the conductor.

Step 2: Behavior of the magnetic field.

- Inside the conductor, the magnetic field is not uniform, and at the ends of the conductor, the field is stronger. - The magnetic field increases at the ends because of the open ends where the magnetic field lines expand and are not as confined as in the middle.

Step 3: Conclusion.

Thus, the magnetic field increases at the ends of a long current-carrying conductor.

Final Answer:

The correct answer is (C) increases at the ends.

Quick Tip

The magnetic field around a long current-carrying conductor is strongest at the ends and decreases toward the middle.

Q8. Which of the following belong to homogeneous series? (i) CH and CH

(ii) CH and CHOH

(iii) CH and CHOH

(iv) CH and CHCOOH

With reference to the above, the right alternative choice is:

(A) (i) and (iii)

(B) (ii) and (iii)

(C) (i) and (iv)

(D) (i) and (ii)

Correct Answer: (D) (i) and (ii)

Solution:

Step 1: Analyzing the Options

- **CH and CH** are both gases and belong to the same phase, making them homogeneous. - **CH and CHOH** consist of a gas and a liquid, so they are not homogeneous. - **CH and CHOH** are heterogeneous as one is a gas and the other is a liquid. - **CH and CHCOOH** are also heterogeneous, as methane is a gas and acetic acid is a liquid.

Step 2: Conclusion.

Thus, the correct pairs of homogeneous substances are **CH and CH** (i) and **CH and CHOH** (ii), making the correct choice **(D) (i) and (ii)**.

Final Answer:

The correct answer is (D) (i) and (ii).

Quick Tip

A homogeneous series involves components in the same phase, whereas heterogeneous mixtures involve different phases.

Q9. The functional group in Ethanol is:

(A) -COOH

(B) -C=O

(C) -OH

(D) -CHO

Correct Answer: (C) -OH

Solution:

Step 1: Identifying the functional group in Ethanol.

Ethanol is an alcohol, and the characteristic functional group of alcohols is the **hydroxyl group (-OH)**.

Step 2: Understanding the options.

- **(A) -COOH** is the carboxyl group, which is found in carboxylic acids like acetic acid.
- **(B) -C=O** is the carbonyl group, which is found in aldehydes and ketones. - **(C) -OH** is the hydroxyl group, which is the functional group in alcohols like ethanol. - **(D) -CHO** is the aldehyde group, found in compounds like formaldehyde.

Step 3: Conclusion.

The correct functional group in ethanol is **-OH**, which makes the correct answer **(C)**.

Final Answer:

The correct answer is (C) -OH.

Quick Tip

The hydroxyl group (-OH) is the defining functional group of alcohols, like ethanol.

Q10. A solution turns red litmus into blue. The possible pH value of this solution is:

(A) 2

(B) 3

(C) 5

(D) 8

Correct Answer: (D) 8

Solution:

Step 1: Understanding the litmus test.

A solution that turns red litmus paper blue is alkaline in nature, meaning it has a pH greater than 7. A pH value of around 8 indicates a weak base, which would cause red litmus paper to turn blue.

Step 2: Conclusion.

Thus, the correct pH value is **8**, which is slightly alkaline.

Final Answer:

The correct answer is (D) 8.

Quick Tip

A pH greater than 7 indicates an alkaline solution, which turns red litmus paper blue.

Q11. The common name of CaOCl is:

(A) Baking powder

(B) Plaster of Paris

(C) Bleaching powder

(D) Washing soda

Correct Answer: (C) Bleaching powder

Solution:

Step 1: Chemical Identity of CaOCl.

CaOCl is the chemical formula for **calcium oxychloride**, which is commonly known as **bleaching powder**. It is used for bleaching, disinfecting, and purifying water.

Step 2: Conclusion.

The correct common name for CaOCl is **Bleaching powder**.

Final Answer:

The correct answer is (C) Bleaching powder.

Quick Tip

Bleaching powder (CaOCl) is commonly used in water treatment and as a bleaching agent.

Q12. Zinc and Sulphuric acid react to form Zinc sulfate and Hydrogen gas. The reaction is:

(A) Combination reaction

(B) Decomposition reaction

(C) Displacement reaction

(D) Double displacement reaction

Correct Answer: (C) Displacement reaction

Solution:

Step 1: Identifying the reaction type.

When zinc reacts with sulfuric acid, the zinc displaces the hydrogen ions from the sulfuric acid to form hydrogen gas and zinc sulfate. This is a classic example of a **displacement reaction** where one element replaces another in a compound.

Step 2: Conclusion.

Therefore, the reaction between zinc and sulfuric acid is a **displacement reaction**.

Final Answer:

The correct answer is (C) Displacement reaction.

Quick Tip

In displacement reactions, one element displaces another from a compound.

Q13. Which of the following is an amphoteric oxide?

(A) CaO

(B) ZnO

(C) FeO

(D) CuO

Correct Answer: (B) ZnO

Solution:

Step 1: Understanding Amphoteric Oxides.

Amphoteric oxides are oxides that can react both as an acid and as a base, depending on the conditions. **ZnO** (zinc oxide) is an amphoteric oxide because it can react with both acids and bases to form salts and water.

Step 2: Conclusion.

Among the given options, **ZnO** is the only amphoteric oxide.

Final Answer:

The correct answer is (B) ZnO.

Quick Tip

Amphoteric oxides can react with both acids and bases, like zinc oxide (ZnO).

Q10. A solution turns red litmus into blue. The possible pH value of this solution is:

(A) 2

(B) 3

(C) 5

(D) 8

Correct Answer: (D) 8

Solution:

Step 1: Understanding the litmus test.

A solution that turns red litmus paper blue is alkaline in nature, meaning it has a pH greater than 7. A pH value of around 8 indicates a weak base, which would cause red litmus paper to turn blue.

Step 2: Conclusion.

Thus, the correct pH value is **8**, which is slightly alkaline.

Final Answer:

The correct answer is (D) 8.

Quick Tip

A pH greater than 7 indicates an alkaline solution, which turns red litmus paper blue.

Q11. The common name of CaOCl is:

(A) Baking powder

(B) Plaster of Paris

(C) Bleaching powder

(D) Washing soda

Correct Answer: (C) Bleaching powder

Solution:

Step 1: Chemical Identity of CaOCl.

CaOCl is the chemical formula for **calcium oxychloride**, which is commonly known as **bleaching powder**. It is used for bleaching, disinfecting, and purifying water.

Step 2: Conclusion.

The correct common name for CaOCl is **Bleaching powder**.

Final Answer:

The correct answer is (C) Bleaching powder.

Quick Tip

Bleaching powder (CaOCl) is commonly used in water treatment and as a bleaching agent.

Q12. Zinc and Sulphuric acid react to form Zinc sulfate and Hydrogen gas. The reaction is:

(A) Combination reaction

(B) Decomposition reaction

(C) Displacement reaction

(D) Double displacement reaction

Correct Answer: (C) Displacement reaction

Solution:

Step 1: Identifying the reaction type.

When zinc reacts with sulfuric acid, the zinc displaces the hydrogen ions from the sulfuric acid to form hydrogen gas and zinc sulfate. This is a classic example of a **displacement reaction** where one element replaces another in a compound.

Step 2: Conclusion.

Therefore, the reaction between zinc and sulfuric acid is a **displacement reaction**.

Final Answer:

The correct answer is (C) Displacement reaction.

Quick Tip

In displacement reactions, one element displaces another from a compound.

Q13. Which of the following is an amphoteric oxide?

(A) CaO

(B) ZnO

(C) FeO

(D) CuO

Correct Answer: (B) ZnO

Solution:

Step 1: Understanding Amphoteric Oxides.

Amphoteric oxides are oxides that can react both as an acid and as a base, depending on the conditions. **ZnO** (zinc oxide) is an amphoteric oxide because it can react with both acids and bases to form salts and water.

Step 2: Conclusion.

Among the given options, **ZnO** is the only amphoteric oxide.

Final Answer:

The correct answer is (B) ZnO.

Quick Tip

Amphoteric oxides can react with both acids and bases, like zinc oxide (ZnO).

Q14. Which of the following is responsible for the transport of water and minerals?

(A) Xylem

(B) Phloem

(C) Fruit

(D) Seed

Correct Answer: (A) Xylem

Solution:

Step 1: Identifying the transport tissue.

In plants, **xylem** is responsible for the transport of water and minerals from the roots to the other parts of the plant. It consists of specialized cells that form tubes through which water and dissolved minerals travel.

Step 2: Conclusion.

Thus, **xylem** is the correct answer as it transports water and minerals in plants.

Final Answer:

The correct answer is (A) Xylem.

Quick Tip

Xylem is responsible for the upward transport of water and minerals, while phloem transports sugars and nutrients.

Q15. Loss of water in plants is related with:

(A) Stem

(B) Root

(C) Xylem

(D) Stomata

Correct Answer: (D) Stomata

Solution:

Step 1: Understanding water loss in plants.

The loss of water in plants occurs primarily through **stomata**, which are small pores on the surface of leaves. This process is known as **transpiration**, where water evaporates from the plant and is lost to the atmosphere.

Step 2: Conclusion.

Therefore, **stomata** are responsible for the loss of water in plants.

Final Answer:

The correct answer is (D) Stomata.

Quick Tip

Stomata control the loss of water in plants and are involved in the process of transpiration.

Q16. Which of the following is a plant hormone?

(A) Auxin

(B) Gibberellin

(C) Cytokinin

(D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Identifying plant hormones.

Auxins, **gibberellins**, and **cytokinins** are all plant hormones that regulate various growth and developmental processes in plants. - **Auxins** are involved in cell elongation and phototropism. - **Gibberellins** promote growth by stimulating seed germination and stem elongation. - **Cytokinins** promote cell division and delay senescence (aging of plant cells).

Step 2: Conclusion.

All of these are plant hormones, so the correct answer is **(D) All of these**.

Final Answer:

The correct answer is (D) All of these.

Quick Tip

Auxins, gibberellins, and cytokinins are key plant hormones involved in growth regulation.

Q17. Which of the following methods is useful for growing the rose plant?

(A) Vegetative propagation

(B) Budding

(C) Regeneration

(D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Methods for growing rose plants.

Rose plants can be propagated using several methods: - **Vegetative propagation**: Involves taking a part of the plant (like a stem or leaf) and encouraging it to grow roots and become a new plant. - **Budding**: A type of grafting where a bud from a rose plant is grafted onto a different rootstock, promoting growth. - **Regeneration**: Can refer to regenerating new plants from parts of a rose through specialized plant cells.

Step 2: Conclusion.

All of the methods mentioned can be used to grow rose plants, making the correct answer **(D) All of these**.

Final Answer:

The correct answer is (D) All of these.

Quick Tip

Rose plants can be grown using various propagation methods such as vegetative propagation, budding, and regeneration.

Q18. Which of the following is not a part of the excretory system in human beings?

(A) Kidney

(B) Nephron

(C) Bowman's capsule

(D) Neuron

Correct Answer: (D) Neuron

Solution:

Step 1: Understanding the excretory system.

The **excretory system** in humans is responsible for the elimination of waste products from the body. This system includes: - **Kidney**: The organ that filters blood and removes waste as urine. - **Nephron**: The functional unit of the kidney. - **Bowman's capsule**: Part of the nephron where filtration of blood takes place.

Neuron is a part of the nervous system, not the excretory system.

Step 2: Conclusion.

Thus, **neuron** is not part of the excretory system.

Final Answer:

The correct answer is (D) Neuron.

Quick Tip

The excretory system includes organs like the kidney, nephron, and Bowman's capsule, but neurons are part of the nervous system.

Q19. Which of the following genotypes represents pure round seeds?

(A) tt

(B) Tt

(C) Tt

(D) RR

Correct Answer: (D) RR

Solution:

Step 1: Understanding genotype notation.

- **RR** represents a **homozygous dominant** genotype for round seeds, meaning the seeds will always be round. - **Tt** represents a **heterozygous** genotype for round seeds, meaning the seeds can either be round or wrinkled depending on the alleles. - **tt** represents a **homozygous recessive** genotype for wrinkled seeds.

Step 2: Conclusion.

Thus, the genotype **RR** represents pure round seeds.

Final Answer:

The correct answer is (D) RR.

Quick Tip

Pure traits are represented by homozygous genotypes, such as **RR** for round seeds in pea plants.

Q20. Which of the following is a non-biodegradable material?

(A) Green plants

(B) Wood

(C) Vegetables

(D) Plastic bags

Correct Answer: (D) Plastic bags

Solution:

Step 1: Understanding biodegradable and non-biodegradable materials.

- **Biodegradable materials** are those that can be broken down by natural processes (e.g., green plants, wood, vegetables). - **Non-biodegradable materials** are those that cannot be easily broken down by natural processes and remain in the environment for a long time. **Plastic bags** fall into this category.

Step 2: Conclusion.

Thus, **plastic bags** are non-biodegradable.

Final Answer:

The correct answer is (D) Plastic bags.

Quick Tip

Plastic bags are non-biodegradable, unlike natural materials like wood and green plants, which decompose over time.

Part B

Q1. (i) How many types of defects of vision are there?

Solution:

There are **two main types** of defects of vision: 1. **Myopia (Nearsightedness)**: In this condition, distant objects appear blurry while close objects are seen clearly. This occurs when the eyeball is too long or the lens is too curved. 2. **Hyperopia (Farsightedness)**: In this condition, distant objects are seen clearly while close objects appear blurry. This occurs when the eyeball is too short or the lens is too flat.

Final Answer:

There are two types of defects of vision: Myopia and Hyperopia.

Quick Tip

Myopia is corrected with concave lenses, while hyperopia is corrected with convex lenses.

Q1. (ii) Draw a ray diagram for the formation of a real image by a concave mirror.

Solution:

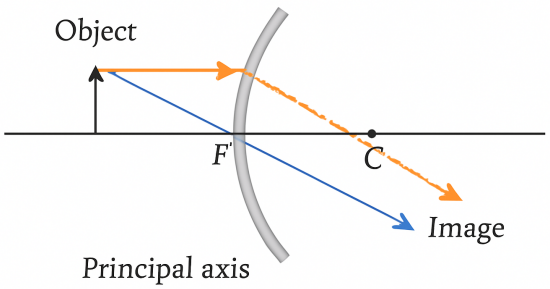
A concave mirror can form a real image when the object is placed beyond the focal point (i.e., at a distance greater than the focal length from the mirror). In such cases, the image formed is real, inverted, and diminished.

Step 1: Ray diagram explanation.

1. A ray parallel to the principal axis is reflected through the focus. 2. A ray passing through the focus is reflected parallel to the principal axis. 3. The intersection of these reflected rays gives the real image.

Step 2: Ray Diagram.

Below is the ray diagram for the formation of a real image by a concave mirror:



Final Answer:

The diagram shows the formation of a real image by a concave mirror.

Quick Tip

The image formed by a concave mirror can be real and inverted when the object is placed beyond the focal point.

Q2. (i) What are the laws of refraction of light?

Solution:

The **laws of refraction** are:

1. **First Law (Snell's Law):** The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant and is known as the refractive index. This law is mathematically expressed as:

$$\frac{\sin i}{\sin r} = n$$

where i is the angle of incidence, r is the angle of refraction, and n is the refractive index of the medium.

2. **Second Law:** The incident ray, the refracted ray, and the normal to the surface at the point of incidence all lie in the same plane.

Final Answer:

The laws of refraction are: Snell's Law and the law of the same plane for the incident and refracted rays

Quick Tip

Refraction occurs when light passes from one medium to another, causing the light to change direction due to a change in speed.

Q2(ii). Find out the magnification of the image formed of an object placed at 10 cm from a concave lens of 15 cm focal length.

Solution:

We are given: - Object distance, $u = -10\,\text{cm}$ (since the object is placed on the same side as the light entering the lens, the object distance is negative for a concave lens), - Focal length, $f = -15\,\text{cm}$ (since the focal length for a concave lens is negative), - We need to find the magnification m.

Step 1: Use the lens formula.

The lens formula is:

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

where v is the image distance. Substituting the values, we get:

$$\frac{1}{-15} = \frac{1}{v} - \frac{1}{-10}$$

Simplifying the equation:

$$\frac{1}{v} = \frac{1}{-15} + \frac{1}{10} = \frac{-2+3}{30} = \frac{1}{30}$$

Thus,

$$v = 30\,\text{cm}$$

Step 2: Find the magnification.

The magnification m is given by the formula:

$$m = \frac{v}{u}$$

Substituting the values:

$$m = \frac{30}{-10} = -3$$

Step 3: Conclusion.

Thus, the magnification of the image formed is **-3**, which means the image is real, inverted, and three times the size of the object.

Final Answer:

$$\boxed{\text{The magnification of the image is -3.}}$$

Quick Tip

For concave lenses, the image formed is always virtual, erect, and diminished in size, except when magnification indicates the real image formed.

Q3. (i) What do you mean by the induced current? What is the law required for finding its direction?

Solution:

Induced Current: Induced current is the current that is produced in a conductor when there is a change in the magnetic field surrounding the conductor. This phenomenon is a result of **Faraday's Law of Induction**.

- When a conductor moves through a magnetic field or when the magnetic field around a stationary conductor changes, an electromotive force (EMF) is induced in the conductor, causing a current to flow. This current is called **induced current**.

Law for finding the direction of induced current: The direction of the induced current is given by **Lenz's Law**, which states that: - The direction of the induced current will be such that it opposes the change in the magnetic flux that caused it.

This is mathematically expressed as:

$$\mathcal{E} = -\frac{d\Phi}{dt}$$

where $\mathcal{E}$ is the induced EMF, and Φ is the magnetic flux.

Final Answer:

Induced current is caused by a change in magnetic flux. The direction is given by Lenz's Law.

Quick Tip

The induced current always opposes the change in magnetic flux, according to Lenz's Law.

Q3(ii). Write down the law for the direction of magnetic field by drawing the diagram of magnetic field produced due to a straight current-carrying conductor.

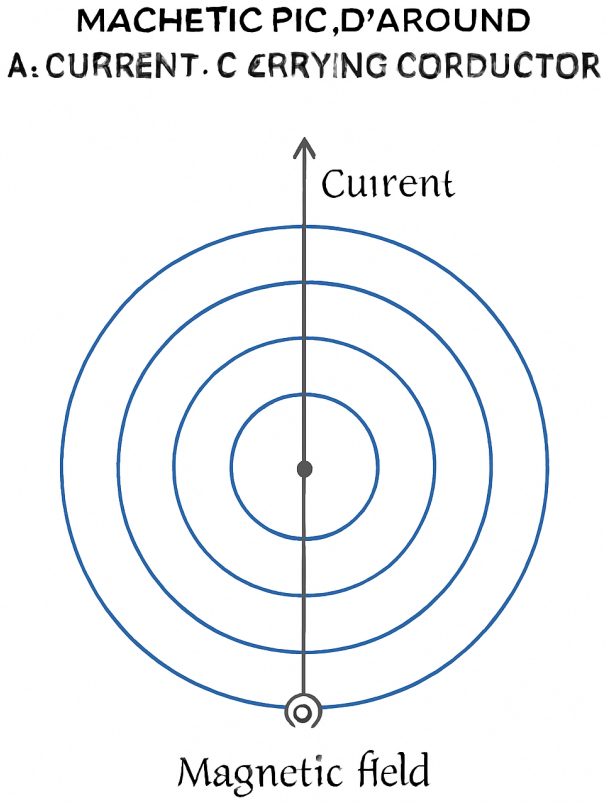
Solution:

Law for the Direction of Magnetic Field: The direction of the magnetic field produced by a straight current-carrying conductor is given by **Ampere's Circuital Law**. The magnetic field lines are concentric circles around the wire.

- The magnetic field direction at any point around the wire can be determined by **the right-hand thumb rule**. According to this rule: - Point the thumb of your right hand in the direction of the current. - The curl of your fingers will show the direction of the magnetic field around the wire.

Step 1: Magnetic field around a straight conductor. - When a current flows through a straight conductor, a circular magnetic field is created around it.

Step 2: Diagram of magnetic field. Below is the diagram showing the magnetic field produced around a straight current-carrying conductor:



Final Answer:

The direction of the magnetic field is determined by the right-hand thumb rule.

Quick Tip

Use the right-hand thumb rule to determine the direction of the magnetic field around a current-carrying conductor.

Q4. (i) The heat produced in a resistance wire of 2 is 200 joule per second. Find out the potential difference between the ends of the resistance.

Solution:

We are given: - Resistance $R = 2\,\Omega$ - Heat produced per second (Power), $P = 200$ J/s (which is the same as watts).

We need to find the potential difference V across the resistance.

Step 1: Use the formula for power. The power dissipated in a resistor is given by:

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

where P is the power, V is the potential difference, and R is the resistance.

Step 2: Rearrange the formula to solve for V.

$$V^2 = P \times R$$

$$V = \sqrt{P \times R}$$

Step 3: Substitute the given values.

$$V = \sqrt{200 \times 2} = \sqrt{400} = 20\,\text{V}$$

Thus, the potential difference across the resistance is **20 volts**.

Final Answer:

The potential difference between the ends of the resistance is 20 volts.

Quick Tip

The power dissipated in a resistor can also be calculated using the formula $P = I^2R$ or $P = \frac{V^2}{R}$, depending on the known quantities.

Q4(ii). On which factors does the resistance of a conductor depend? What is the unit of resistivity?

Solution:

The resistance R of a conductor depends on the following factors:

1. **Length of the conductor (L):** The resistance is directly proportional to the length of the conductor. The longer the conductor, the higher the resistance. Mathematically:

$$R \propto L$$

2. **Cross-sectional area (A):** The resistance is inversely proportional to the cross-sectional area of the conductor. A thicker conductor offers less resistance. Mathematically:

$$R \propto \frac{1}{A}$$

3. **Material of the conductor:** Different materials have different resistivities, which affect the resistance. The resistivity ρ is a material property and is the constant that defines the material's resistance to electric current.

4. **Temperature (T):** The resistance of most conductors increases with temperature. This is because, as temperature increases, the atomic vibrations within the material increase, making it harder for electrons to flow. Mathematically:

$$R_T = R_0(1 + \alpha T)$$

where R_0 is the resistance at reference temperature, α is the temperature coefficient of resistance, and T is the change in temperature.

Unit of Resistivity (ρ): The unit of resistivity is **ohm meter** ($\Omega\,\text{m}$).

Resistivity is defined as the resistance of a unit length of a conductor with a unit cross-sectional area. It is a material constant, which is why different materials have different resistivities.

Final Answer:

The resistance depends on the length, cross-sectional area, material, and temperature of the conductor. T

Quick Tip

The resistance of a conductor increases with length and decreases with the area of cross-section. Resistivity is a property of the material.

Or

Q4. (i) Find out the value of the resistance R from the given circuit, when 6 ampere of current is flowing in the circuit.

Solution:

We are given the following information: - Voltage across the circuit $V = 12\,\text{V}$ - Current in the circuit $I = 6\,\text{A}$ - Resistance $2\,\Omega$ and $6\,\Omega$ are in series, so the total resistance of this part is:

$$R_{\text{total}} = 2\,\Omega + 6\,\Omega = 8\,\Omega$$

- The total resistance of the circuit is $R_{\text{total}} + R$.

We can use Ohm's law to calculate the resistance:

$$V = I \times R_{\text{total}} \quad \Rightarrow \quad R_{\text{total}} = \frac{V}{I}$$

Substitute the given values:

$$R_{\text{total}} = \frac{12\,\text{V}}{6\,\text{A}} = 2\,\Omega$$

This is the total resistance, which is the sum of R_{given} (the $2\,\Omega$ and $6\,\Omega$ resistors in series) and the unknown resistance R. Therefore:

$$R + 8\,\Omega = 2\,\Omega$$

Solving for R:

$$R = 2\,\Omega - 8\,\Omega = -6\,\Omega$$

So, the resistance R is $6\,\Omega$.

Final Answer:

$$\boxed{R = 6\,\Omega}$$

Quick Tip

When resistors are in series, their total resistance is the sum of the individual resistances. Use Ohm's Law $V = I \times R$ to calculate the missing resistance.

Q4(ii). How are ammeter and voltmeter joined in an electrical circuit?

Solution:

Ammeter is a device used to measure current in a circuit. It is always connected in **series** with the load in the circuit because the current is the same throughout a series connection.

Voltmeter is a device used to measure the potential difference (voltage) across a component. It is always connected in **parallel** across the component for which the voltage is to be measured.

Thus: - The **ammeter** is connected **in series** to measure the current through the circuit. - The **voltmeter** is connected **in parallel** to measure the voltage across the component.

Final Answer:

The ammeter is connected in series, and the voltmeter is connected in parallel.

Quick Tip

Remember: The ammeter measures the current and is connected in series, while the voltmeter measures the voltage and is connected in parallel.

Q5(i). Explain combination and displacement reactions by giving examples of inorganic compounds.

Solution:

Combination Reaction: A combination reaction is a type of chemical reaction in which two or more reactants combine to form a single product. The general form of a combination reaction is:

$$A + B \rightarrow AB$$

Example of Combination Reaction: When calcium oxide (CaO) reacts with water (HO), it forms calcium hydroxide (Ca(OH)), a single compound. This is a combination reaction:

$$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$$

Displacement Reaction: A displacement reaction is a reaction in which one element displaces another element from a compound. The general form of a displacement reaction is:

$$AB + C \rightarrow AC + B$$

Example of Displacement Reaction: When zinc metal (Zn) reacts with copper sulfate (CuSO), zinc displaces copper from the compound to form zinc sulfate (ZnSO) and copper metal (Cu). This is a displacement reaction:

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

Final Answer: - Combination reaction example: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ - Displacement reaction example: $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

Quick Tip

In combination reactions, two or more reactants combine to form a single product, while in displacement reactions, one element replaces another in a compound.

Q5(ii). Write chemical equations of two chemical properties of Ethanol.

Solution:

Ethanol, also known as ethyl alcohol (CHOH), exhibits various chemical properties. Below are two chemical properties of ethanol with their respective chemical equations:
1. Ethanol Reacting with Sodium (Na): Ethanol reacts with sodium metal to release hydrogen gas and form sodium ethoxide. This is an example of an acid-base reaction.

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$$

2. Combustion of Ethanol: Ethanol burns in the presence of oxygen to produce carbon dioxide and water. This is a combustion reaction.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$

Explanation: - The first reaction is an example of an alcohol reacting with an alkali metal, sodium, to form an alkoxide and hydrogen gas. - The second reaction is the combustion of ethanol, where it reacts with oxygen to form carbon dioxide and water.

Final Answer: - $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$ - $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

Quick Tip

In reactions with sodium, ethanol forms sodium ethoxide and hydrogen gas. In combustion reactions, ethanol burns to produce carbon dioxide and water.

Q6(i). Write the definition of Acid and Base and explain neutralisation reaction by giving chemical equation.

Solution:
Definition of Acid: An acid is a substance that releases hydrogen ions (H) when dissolved in water. Acids have a sour taste, turn blue litmus paper red, and can be classified as strong or weak depending on the extent of ionization.
Example: - Hydrochloric acid (HCl) dissociates in water as follows:

$$HCl \rightarrow H^+ + Cl^-$$

Definition of Base: A base is a substance that releases hydroxide ions (OH) when dissolved in water. Bases have a bitter taste, turn red litmus paper blue, and can be classified as strong or weak based on their ability to dissociate in water.
Example: - Sodium hydroxide (NaOH) dissociates in water as follows:

$$\text{NaOH} \rightarrow \text{Na}^{+} + \text{OH}^{-}$$

Neutralisation Reaction: A neutralisation reaction occurs when an acid reacts with a base to form water and a salt. This is a double displacement reaction where the H ions from the acid combine with OH ions from the base to form HO. The general equation for a neutralisation reaction is:

$$\text{Acid} + \text{Base} \rightarrow \text{Salt} + \text{Water}$$

Example of a Neutralisation Reaction:
When hydrochloric acid (HCl) reacts with sodium hydroxide (NaOH), the reaction produces sodium chloride (NaCl) and water (HO):

$$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$$

Final Answer: - Definition of Acid: A substance that releases hydrogen ions (H) in water. - Definition of Base: A substance that releases hydroxide ions (OH) in water. - Neutralisation Reaction: When an acid and a base react, they form salt and water. Example:
$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

Quick Tip

In neutralisation reactions, acids and bases react to form salt and water. Always remember the general equation:

$$\text{Acid} + \text{Base} \rightarrow \text{Salt} + \text{Water}$$

Q6(ii). Explain the concept of pH scale.

Solution:

Concept of pH Scale: The pH scale is a measure of the acidity or alkalinity of a solution. It is a scale ranging from 0 to 14, where:

- A pH of 7 is considered neutral, meaning the solution is neither acidic nor basic. Pure water has a pH of 7. - A pH less than 7 indicates an acidic solution, with the concentration of H ions being higher than OH ions. - A pH greater than 7 indicates a basic (alkaline) solution, where the concentration of OH ions is greater than H ions.

The pH scale is logarithmic, meaning each unit change in pH represents a tenfold change in the concentration of H ions. For example, a solution with a pH of 5 is 10 times more acidic than a solution with a pH of 6.

pH Formula: The pH of a solution can be calculated using the formula:

$$\text{pH} = -\log[\text{H}^+]$$

where $[H^+]$ is the concentration of hydrogen ions in the solution.

Final Answer: - pH 7 is neutral (water), pH ¡ 7 is acidic, and pH ¿ 7 is basic. - pH is calculated as $\text{pH} = -\log[\text{H}^+]$.

Quick Tip

Remember, a pH of 7 is neutral. Acids have pH values less than 7, and bases have pH values greater than 7. The pH scale is logarithmic!

Q7(i). Explain hydrogenation by giving an example and write one application.

Solution:

Hydrogenation: Hydrogenation is the process of adding hydrogen (H) to a compound, typically in the presence of a catalyst, to reduce or saturate organic compounds, such as unsaturated fats or oils.

Example: One of the most common examples of hydrogenation is the conversion of vegetable oils into margarine. During this process, hydrogen is added to the double bonds in the unsaturated fatty acids of vegetable oils, converting them into saturated fats.

$$\text{Vegetable oil} + H_2 \xrightarrow{\text{Catalyst}} \text{Margarine}$$

Application: Hydrogenation is widely used in the food industry to solidify oils, such as the production of margarine from vegetable oils, which helps increase the shelf life of the product.

Final Answer: Hydrogenation is the process of adding hydrogen to unsaturated compounds, such as the conversion of vegetable oil into margarine. It is used in the food industry to solidify oils.

Quick Tip

Hydrogenation helps in converting unsaturated fats into saturated fats, commonly used in margarine production.

Q7(ii). Explain precipitation reaction by citing an example.

Solution:

Precipitation Reaction: A precipitation reaction occurs when two soluble salts are mixed in solution and an insoluble salt (precipitate) is formed. The precipitate is a solid that does not dissolve in the solution.

Example: An example of a precipitation reaction is when aqueous solutions of barium chloride (BaCl) and sodium sulfate (NaSO) are mixed. Barium sulfate (BaSO), an insoluble white precipitate, forms as a result.

$$\text{BaCl}_2(aq) + \text{Na}_2\text{SO}_4(aq) \rightarrow \text{BaSO}_4(s) + 2\text{NaCl}(aq)$$

In this reaction, the barium sulfate (BaSO) is the precipitate formed.

Final Answer: A precipitation reaction involves the formation of an insoluble solid (precipitate) when two soluble salts are mixed. Example: BaCl + NaSO $\rightarrow$ BaSO (precipitate) + NaCl.

Quick Tip

In a precipitation reaction, an insoluble salt is formed from two soluble salts.

Q7(iii). Explain the cleansing action of soap.

Solution:

Cleansing Action of Soap: Soap is a surfactant, which means it can reduce the surface tension of water. The cleansing action of soap is due to its ability to form an emulsion with dirt and grease. Soap molecules have a hydrophobic (water-repelling) tail and a hydrophilic (water-attracting) head.

- The hydrophobic tail dissolves in the greasy dirt or oil, while the hydrophilic head stays in contact with water. - As soap is applied, the greasy dirt is trapped in the soap molecules and can be washed away with water.

The soap forms an emulsion, where the greasy dirt is suspended in the water and carried away when rinsed.

Example: When washing hands with soap, the soap molecules attach to the oil and dirt on the skin, forming a micelle, which is a structure where the hydrophobic tails trap the dirt and grease, and the hydrophilic heads face outward, allowing it to mix with water.

Final Answer: Soap molecules have a hydrophobic tail that dissolves in grease and dirt, while the hydrophilic head interacts with water, allowing the dirt to be washed away. This is the basic cleansing action of soap.

Quick Tip

Soap works by reducing surface tension and forming emulsions with oil and dirt, allowing them to be removed with water.

OR

Q7(i). Write a note on saturated and unsaturated hydrocarbons.

Solution:

Saturated Hydrocarbons: Saturated hydrocarbons are those hydrocarbons that contain only single bonds between carbon atoms. They are also known as alkanes. The general formula for saturated hydrocarbons is CH.

Example: Methane (CH), ethane (CH), and propane (CH) are examples of saturated hydrocarbons.

Unsaturated Hydrocarbons: Unsaturated hydrocarbons contain at least one double or triple bond between carbon atoms. They are classified into alkenes and alkynes. The general formula for alkenes is CH, and for alkynes, it is CH.

Example: Ethene (CH) and ethyne (CH) are examples of unsaturated hydrocarbons.

Final Answer: Saturated hydrocarbons have only single bonds between carbon atoms (e.g., methane, ethane). Unsaturated hydrocarbons have double or triple bonds between carbon atoms (e.g., ethene, ethyne).

Quick Tip

Saturated hydrocarbons are alkanes, and unsaturated hydrocarbons include alkenes and alkynes.

Q7(ii). Explain calcination and roasting by giving example.

Solution:

Calcination: Calcination is the process of heating a substance in the absence of air or with limited oxygen, typically to remove volatile components or decompose it. It is commonly used to extract metals from their ores.

Example: The calcination of limestone (CaCO) produces calcium oxide (CaO) and carbon dioxide (CO).

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

Roasting: Roasting is the process of heating a substance in the presence of excess air. It is used to extract metals from their ores by converting them into oxides.

Example: The roasting of zinc sulfide (ZnS) in the presence of oxygen produces zinc oxide (ZnO) and sulfur dioxide (SO).

$$2ZnS + 3O_2 \xrightarrow{heat} 2ZnO + 2SO_2$$

Final Answer: - **Calcination:** Heating a substance in the absence of air to remove volatile substances (e.g., heating limestone to produce calcium oxide). - **Roasting:** Heating a substance in excess air to convert it into an oxide (e.g., roasting zinc sulfide to produce zinc oxide).

Quick Tip

Calcination involves heating in the absence of air, while roasting requires excess air.

Q7(iii). Explain thermal decomposition in short.

Solution:

Thermal Decomposition: Thermal decomposition is a type of chemical reaction in which a single compound breaks down into two or more products when heated. It is also known as pyrolysis.

Example: When calcium carbonate (CaCO) is heated, it decomposes into calcium oxide (CaO) and carbon dioxide (CO).

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

Final Answer: Thermal decomposition involves the breakdown of a single compound into two or more products when heated (e.g., calcium carbonate decomposing to calcium oxide and carbon dioxide).

Quick Tip

In thermal decomposition, heat is used to break down a compound into simpler substances.

Q8. Differentiate between autotrophic nutrition and heterotrophic nutrition with suitable examples.

Solution:

Autotrophic Nutrition: Autotrophic nutrition refers to the process where organisms produce their own food from simple substances like carbon dioxide and water in the presence of sunlight. These organisms are called autotrophs.
Example: Plants, algae, and some bacteria are autotrophs. They use photosynthesis to produce food from sunlight, carbon dioxide, and water.
Heterotrophic Nutrition: Heterotrophic nutrition is the process where organisms depend on other organisms (either plants or animals) for their food. These organisms are called heterotrophs. They cannot synthesize their own food.
Example: Animals, fungi, and some bacteria are heterotrophs. They obtain food by consuming other organisms.

Final Answer: - **Autotrophic Nutrition:** Organisms produce their own food (e.g., plants using photosynthesis). - **Heterotrophic Nutrition:** Organisms depend on other organisms for food (e.g., animals and fungi).

Quick Tip

Autotrophs make their own food, while heterotrophs rely on other organisms for food.

Q9. Describe the process of urine formation in human with suitable diagram.

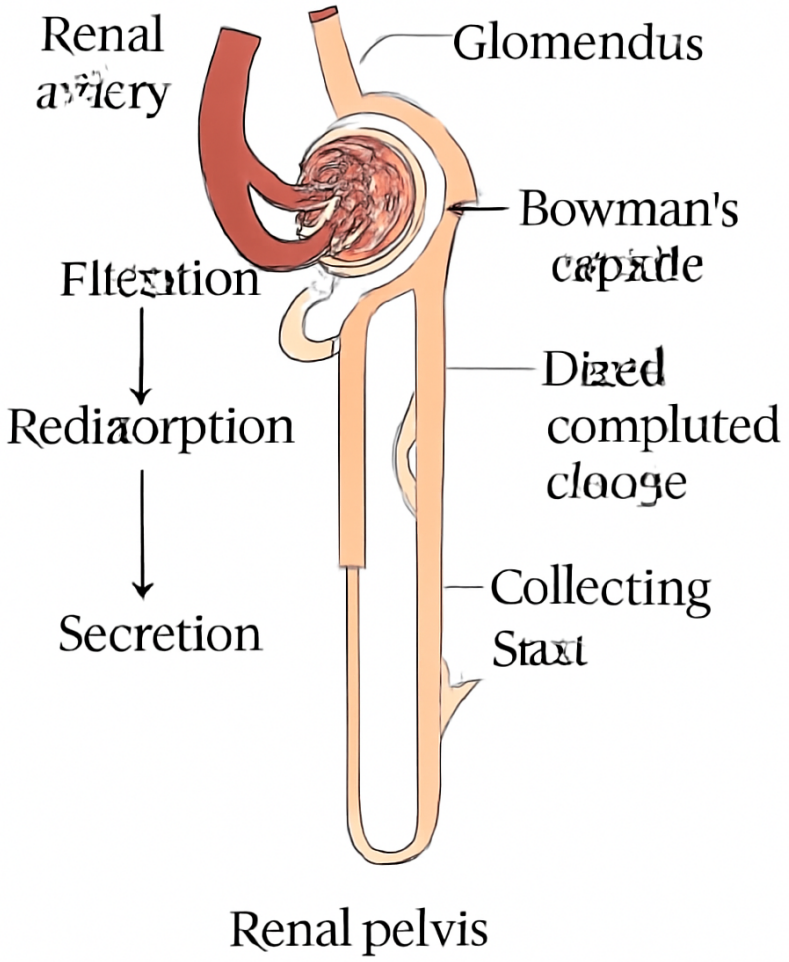
Solution:

Process of Urine Formation in Humans: 1. **Filtration:** Blood enters the kidneys through the renal arteries. In the kidneys, blood flows into tiny capillaries known as glomeruli, where the filtration of waste products from the blood takes place. Water, salts, and small molecules such as urea are filtered out.

2. **Reabsorption:** The filtered fluid then moves into the renal tubules where useful substances like glucose, amino acids, and essential ions are reabsorbed back into the bloodstream. The majority of the water is also reabsorbed.
3. **Secretion:** Finally, the waste products that were not filtered out during the initial process (such as excess potassium and hydrogen ions) are actively secreted into the renal tubules.
4. **Excretion:** The final product, urine, which consists of waste materials like urea, creatinine, and excess water, is then transported to the bladder for storage.
Diagram:

[Insert diagram showing the structure of the kidney and the path of urine formation, including the glome

URINE FORMATION IN HUMANS



Final Answer: Urine formation occurs in the kidneys and involves three main stages: filtration, reabsorption, and secretion.

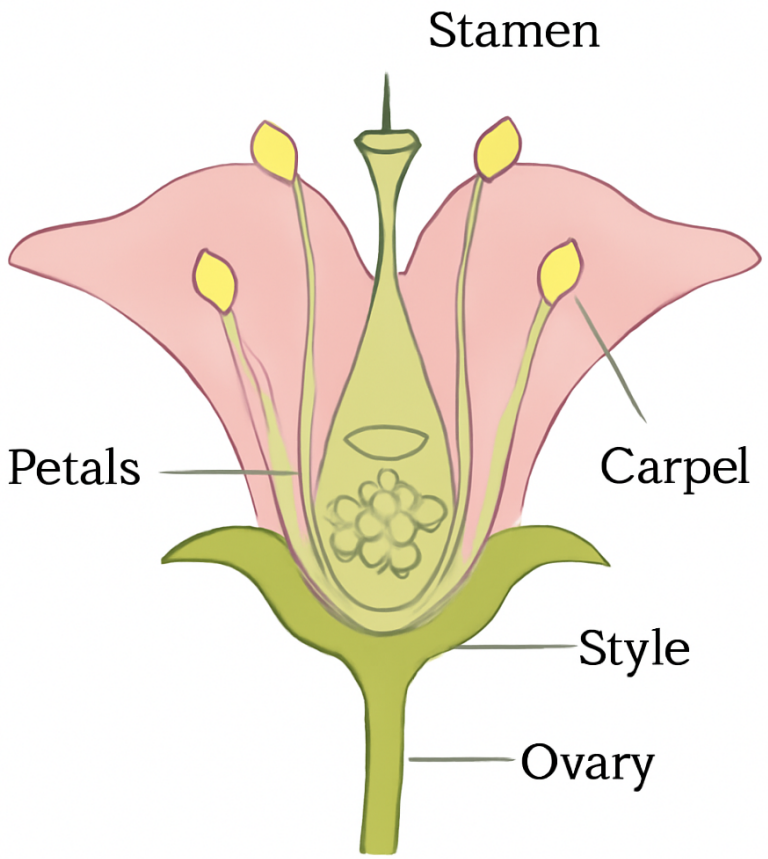
Quick Tip

Urine formation involves filtration in the glomerulus, reabsorption in the renal tubules, and secretion of excess ions into the urine.

Q10. Draw a labelled diagram of the longitudinal section of a flower.

Solution:

A longitudinal section of a flower typically includes the following parts:
- **Stigma:** The sticky part at the top of the pistil where pollen is collected. - **Style:** The stalk-like structure that supports the stigma and connects it to the ovary. - **Ovary:** The swollen part at the base of the pistil that contains ovules. - **Ovules:** The egg cells within the ovary that are fertilized to form seeds. - **Anther:** The part of the stamen that produces pollen. - **Filament:** The thin stalk that supports the anther. - **Petal:** The colored part of the flower that attracts pollinators. - **Sepal:** The leaf-like structure that protects the bud before it opens.



Final Answer: The labelled diagram of the longitudinal section of a flower should include the stigma, style, ovary, ovules, anther, filament, petal, and sepal.

Quick Tip

In a longitudinal section, you can clearly observe the internal structures of the flower like the pistil, stamen, ovary, and ovules.

Q11. Write short notes on any two: (i) Lymph

Solution:

(i) Lymph:

Lymph is a clear, colorless fluid that circulates throughout the lymphatic system. It is similar to blood plasma and is made up of water, proteins, lymphocytes (white blood cells), and waste products. Lymph plays a crucial role in the immune system by transporting lymphocytes and removing waste and toxins from the body. It helps maintain fluid balance, transports nutrients and waste, and is essential for immune responses. Lymph nodes filter and trap pathogens and toxins as part of the body's defense mechanism.

Quick Tip

- Lymph helps in immunity and waste removal.

(ii) Trophic level

(ii) Trophic Level:

A trophic level represents the position of an organism in a food chain or food web. Organisms in a food web are classified into different trophic levels based on their feeding habits: 1. **Primary producers (Trophic Level 1):** These are usually plants and algae that produce their own food through photosynthesis. 2. **Primary consumers (Trophic Level 2):** Herbivores that eat plants. 3. **Secondary consumers (Trophic Level 3):** Carnivores that eat herbivores. 4. **Tertiary consumers (Trophic Level 4):** Apex predators that eat secondary consumers. Energy decreases at each trophic level as it is passed along the food chain.

Quick Tip

- Trophic levels help understand the flow of energy in an ecosystem.

(iii) Managing the garbage.

(iii) Managing the Garbage:

Proper garbage management involves collecting, transporting, and disposing of waste in a way that minimizes environmental damage. It is essential for public health and environmental protection. The process involves: - **Segregation:** Separating waste into categories like biodegradable and non-biodegradable. - **Recycling:** Processing waste materials, like plastics and metals, so they can be reused. - **Composting:** Turning biodegradable waste like food scraps into compost. - **Disposal:** Proper disposal methods include using landfills or incineration, though recycling and composting are more sustainable. Efficient waste management reduces pollution, conserves resources, and helps maintain clean surroundings.

Quick Tip

- Effective waste management reduces pollution and conserves resources.

Or

11. Describe the co-ordination in plants with example.

Solution:

Step 1: Introduction to Coordination in Plants.

Coordination in plants refers to the process by which plants respond to various stimuli from their environment, including light, gravity, temperature, and water. Plants do not have a nervous system like animals, so their coordination mechanisms are largely controlled by chemical signals such as hormones.

Step 2: Plant Hormones and Their Role in Coordination.

Plants use hormones to regulate growth, development, and responses to environmental stimuli. The main types of plant hormones involved in coordination include: - **Auxins:** These hormones are responsible for cell elongation and help the plant grow toward light

(phototropism) or against gravity (gravitropism). - **Gibberellins:** These hormones are involved in seed germination and stem elongation. - **Cytokinins:** These promote cell division and help in the growth of lateral buds. - **Ethylene:** It is involved in fruit ripening and the response to stress. - **Abscisic Acid (ABA):** This hormone helps in closing stomata during water stress.

Step 3: Example of Coordination in Plants - Phototropism.

An example of coordination in plants is **phototropism**, the movement of a plant or its parts in response to light. In this process, auxins play a crucial role: - When a plant is exposed to light from one direction, auxins accumulate on the shaded side of the stem. - The accumulation of auxins on the darker side causes the cells to elongate more than those on the lighted side. - As a result, the stem bends towards the light, optimizing the plant's ability to absorb light for photosynthesis.

Step 4: Conclusion.

Plant coordination, through the use of hormones, allows plants to adapt to their environment, ensuring survival and efficient growth. Phototropism is just one of many examples of how plants coordinate with their surroundings using chemical signals.

Final Answer: Coordination in plants occurs through hormones like auxins, gibberellins, and others, helping plants respond to environmental stimuli, such as light, gravity, and stress. An example is phototropism, where plants grow towards light to maximize photosynthesis.

Quick Tip

Plant hormones play a vital role in helping plants coordinate growth and adapt to their environment through processes like phototropism and gravitropism.
