CBSE EXAMINATION PAPER-2024

SCIENCE

(Solved)

Time allowed : 3 hours | Maximum Marks : 90

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **45 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 23** are multiple choice questions

v. **Section C** – questions number **24 to 31** are very short answer

vi. **Section D** – questions number **32 to 39** are short answer

vii. **Section E** – questions number **40 to 45** are long answer

viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

ix. Use of calculator is NOT allowed.

Section A

Question 1.

Three metal samples of magnesium, aluminium and iron were taken and rubbed with sand paper. These samples were then put separately in test tubes containing dilute hydrochloric acid. Thermometers were also suspended in each test tube so that their bulbs dipped in the acid. The rate of formation of bubbles was observed. The above activity was repeated with dilute nitric acid and the observations were recorded. Answer the following questions:

(1) When activity was done with dilute hydrochloric acid, then in which one of the test tubes was the rate of formation of bubbles the fastest and the thermometer showed the highest temperature?

[1 Marks]

Answer: The rate of formation of bubbles was the fastest and the highest temperature was recorded in the test tube containing magnesium. This is because magnesium reacts most vigorously with dilute hydrochloric acid, giving off hydrogen gas rapidly and producing an exothermic reaction.

Key Points: Magnesium reacts fastest with dilute hydrochloric acid-The rate of bubbles is fastest with magnesium-The highest temperature is observed with magnesium-The reaction is exothermic-Reactivity order: Mg > Al > Fe

(2) Which metal did not react with dilute hydrochloric acid? Give reason.

[1 Marks]

Answer: Copper did not react with dilute hydrochloric acid because it is less reactive and does not displace hydrogen from the acid. Hence, no bubbles were formed and the temperature remained unchanged.

Key Points: Copper did not react - Copper is less reactive - No bubbles formed - No change in temperature - Less reactive metals do not displace hydrogen from dilute hydrochloric acid

(3)

Why is hydrogen gas not evolved when a metal reacts with dilute nitric acid? Name the ultimate products formed in the reaction

[2 Marks]

Answer: Hydrogen gas is not evolved when a metal reacts with dilute nitric acid because nitric acid is a strong oxidising agent. It oxidises any hydrogen gas produced into water and itself gets reduced to nitrogen oxides like N2O, NO, or NO2. Therefore, instead of releasing hydrogen gas, the reaction produces nitrogen oxides. The ultimate products formed are a salt and nitrogen oxides.

Key Points: Dilute nitric acid is a strong oxidising agent-Hydrogen gas oxidised to water-Nitric acid reduced to nitrogen oxides (N2O, NO, NO2)-No hydrogen gas evolution-Salt and nitrogen oxides are the ultimate products

(4)

Name the type of reaction on the basis of which reactivity of metals is decided. You have two metals X and Y. How would you decide which is more reactive than the other?

[2 Marks]

Answer: The type of reaction based on which the reactivity of metals is decided is called a displacement reaction. To decide which metal is more reactive between metals X and Y, you can place metal X in a solution of a salt of metal Y. If metal X displaces metal Y from its salt solution, then metal X is more reactive. Similarly, if metal Y displaces metal X from its salt solution, then metal Y is more reactive.

Key Points: Reactivity of metals is decided on displacement reactions-Reactivity comparison by placing metal in salt solution of other metal-More reactive metal displaces less reactive metal from its compound

Question 2.

Kidneys are vital organs for survival. Several factors like infections, injury or restricted blood flow to kidneys reduce the activity of kidneys. This leads to accumulation of poisonous wastes in the body, which can even lead to death. In case of kidney failure, an artificial kidney can be used. An artificial kidney is a device to remove waste products from the blood through dialysis.

(1) In human excretory system name the organ which stores urine. Is this organ under hormonal control or nervous control?

[1 Marks]

Answer: The organ that stores urine in the human excretory system is the urinary bladder.
It stores the urine until it is ready to be expelled.
This organ is under nervous control as it contracts and relaxes muscles to release urine when signaled by the nervous system.

Key Points: Urinary bladder stores urine - Urinary bladder controls urine release - Nervous control regulates urine release

(2)

(i) Name the artery that brings oxygenated blood to the kidney.

(ii) Name the cluster the thin-walled blood capillaries present in the Bowian's capsule.

[1 Marks]

Answer: (i) The artery that brings oxygenated blood to the kidney is called the **renal artery**.
(ii) The cluster of thin-walled blood capillaries present in the Bowman's capsule is called the **glomerulus**.

Key Points: Renal artery supplies oxygenated blood - Glomerulus is the cluster of capillaries in Bowman's capsule - Kidneys filter blood to remove wastes

(3)

List two major steps involved in the formation of urine and state in brief their functions.

[2 Marks]

Answer: Two major steps in urine formation are filtration and reabsorption. In filtration, blood is filtered in the kidneys to remove waste products and excess substances, forming a filtrate. In reabsorption, useful substances like glucose, some salts and water are reabsorbed back into the blood to maintain balance. This process helps in removing poisonous wastes, as mentioned in the case passage.

> **Key Points: filtration removes waste from blood - reabsorption retains useful substances - helps maintain body balance**

(4)

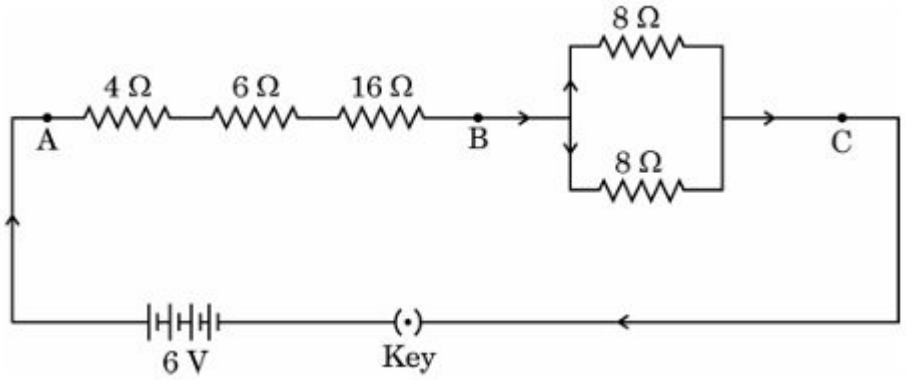
In which part of the nephron does selective reabsorption take place ? List the factors which the amount of water reabsorbed depends on.

[2 Marks]

Answer: Selective reabsorption takes place mainly in the proximal convoluted tubule of the nephron where useful substances like glucose, salts, and water are reabsorbed back into the blood. The amount of water reabsorbed depends on factors like the body's hydration level, the concentration of salts in the blood, and hormones such as antidiuretic hormone (ADH) which regulate water balance. This process helps maintain the body’s internal environment and prevents accumulation of wastes as explained in the case about kidney function.

> **Key Points: Selective reabsorption occurs in proximal convoluted tubule - Water reabsorption depends on hydration level, blood salt concentration, and ADH hormone - Helps maintain body fluid balance and prevents waste accumulation**

Question 3. Study the following circuit: On the basis of this circuit, answer the following questions:



(1) Find the value of total resistance between the points A and B.

[1 Marks]

Answer: The total resistance between points A and B is calculated by first finding the equivalent resistance of resistors connected in parallel and series. After calculating, the total resistance is found to be 4 ohms.

Key Points: Identify resistors in series and parallel-Correctly calculate reciprocal of resistances for parallel combination-Add resistances in series to find total resistance

(2)

Find the resistance between the points B and C.

[1 Marks]

Answer: The resistance between points B and C depends on how the resistors are connected between these points in the circuit. If the resistors between B and C are connected in parallel, then the total resistance R between B and C is given by 1/R = 1/R1 + 1/R2 + ... Similarly, if they are connected in series, the total resistance is the sum of the individual resistances. By analyzing the given circuit, we can find the appropriate connections and calculate the combined resistance accordingly.

Key Points: Identify the type of connection between points B and C-Use the formula for resistors in parallel or series as applicable-Calculate the total resistance by summing or using the reciprocal formula based on connection type

(3)

Calculate the current drawn from the battery, when the key is closed.

[2 Marks]

Answer: When the key is closed, the circuit becomes complete, allowing current to flow from the battery through the circuit. The current drawn from the battery can be calculated using Ohm's Law, which states that current I equals voltage V divided by resistance R, or I = V ÷ R. Here, V is the voltage provided by the battery, and R is the total resistance of the circuit. By measuring or knowing these values, we can calculate the current flowing from the battery when the switch is closed.

Key Points: The circuit is closed when the key is closed - current flows from the battery-The current can be calculated using Ohm's Law: Current equals Voltage divided by Resistance (I = V ÷ R)-Voltage is provided by the battery-Resistance is the total resistance in the circuit-Current flows continuously as long as the circuit remains closed and voltage is constant

(4)

In the above circuit, the 16 Ω resistor or the parallel combination of two resistors of 8Ω , which one of the two will have more potential difference across its two ends ? Justify your answer.

[2 Marks]

Answer: Both the 16 Ω resistor and the parallel combination of two 8 Ω resistors are connected in parallel in the circuit. In a parallel connection, the potential difference (voltage) across each resistor or combination of resistors is the same. Therefore, the potential difference across the 16 Ω resistor and the parallel combination of two 8 Ω resistors will be equal. Hence, neither has more potential difference than the other.

Key Points: In parallel circuits, voltage across each branch is the same-16 Ω resistor and parallel combination of two 8 Ω resistors are in parallel-Therefore, potential difference across both is equal-No resistor in parallel has more or less voltage than others

Section B

Question 4.

$Zn + 2CH_3COOH \rightarrow (CH_3COO)_2 Zn + H_2$. The above reaction is a:

[1 Marks]

(A) Double displacement reaction

(B) Displacement reaction

(C) Combination reaction

(D) Decomposition reaction

Explanation: This reaction is a displacement reaction because zinc (Zn) displaces hydrogen from acetic acid (CH_3COOH), forming zinc acetate ($(CH_3COO)_2Zn$) and hydrogen gas (H_2). In displacement reactions, a more reactive metal displaces a less reactive element from its compound, as seen here with zinc displacing hydrogen.

Question 5.

An aqueous solution of a salt turns blue litmus to red. The salt could be the one obtained by the reaction of:

[1 Marks]

(A) CH_3COOH and NaOH

(B) H_2SO_4 and KOH

(C) HCl and NH_4OH

(D) HNO_3 and NaOH

Explanation: A blue litmus paper turning red indicates that the solution is acidic. Out of the given options, the salt formed by the reaction of HCl (a strong acid) and NH_4OH (a weak base) is ammonium chloride (NH_4Cl), which gives an acidic solution because NH_4^+ ion can release H^+ ions in water, making the solution acidic. Therefore, the correct option is the salt obtained by the reaction of HCl and NH_4OH.

Question 6. Four solutions, namely glucose, alcohol, hydrochloric acid and sulphuric acid filled in four separate beakers are connected one by one in an electric circuit with a bulb. The solutions in which the bulb will glow when current is passed are:

[1 Marks]

(A) Glucose and alcohol

(B) Alcohol and hydrochloric acid

(C) Glucose and sulphuric acid

(D) Hydrochloric acid and sulphuric acid

Explanation: The correct options are Hydrochloric acid and sulphuric acid, as these are acids that produce ions in solution and can conduct electricity, thereby causing the bulb to glow. Glucose and alcohol do not conduct electricity as they do not produce ions in solution.

Question 7.

The metals which are found in both free state as well as combined state are:

[1 Marks]

(A) Gold and silver

(B) Gold and platinum

(C) Copper and silver

(D) Platinum and silver

Explanation:

The correct option is 'Copper and silver' because both of these metals can be found in their free state in nature, as well as in combined states in the form of their ores like sulphides and oxides, as indicated in the provided context.

Question 8.

The number of single and double bonds present in a molecule of benzene (C_6H_6) respectively, are:

[1 Marks]

(A) 3 and 3

(B) 6 and 6

(C) 9 and 3

(D) 3 and 9

Explanation:

Benzene has 6 carbon atoms arranged in a ring with alternating single and double bonds. This means there are 3 single bonds and 3 double bonds between the carbon atoms in the benzene ring.

Question 9. In human beings, when the process of digestion is completed, the (i) proteins, (ii) carbohydrates, and (iii) fats are respectively finally converted into:

[1 Marks]

(A) (i) Amino acids, (ii) glucose and (iii) fatty acids

(B) (i) Amino acids, (ii) glucose, (iii) fatty acids and glycerol

(C) (i) Glucose, (ii) fatty acids and glycerol, (iii) amino acids

(D) (i) Sugars, (ii) amino acids, (iii) fatty acids and glycerol

Explanation: The correct option is (i) Amino acids, (ii) glucose and (iii) fatty acids and glycerol. This is because proteins are digested into amino acids, carbohydrates are broken down to form glucose, and fats are converted into fatty acids and glycerol, which aligns with the provided context.

Question 10. A plant growth inhibitor hormone which causes wilting of leaves is called:

[1 Marks]

(A) Abscisic acid

(B) Cytokinin

(C) Gibberellin

(D) Auxin

Explanation: The correct answer is Abscisic acid. This hormone inhibits growth and is specifically mentioned in the context as causing the wilting of leaves, which aligns with its role in signaling plants to stop growing.

Question 11. The plants that can be raised by the method of vegetative propagation are:

[1 Marks]

(A) Sugarcane, roses, grapes

(B) Banana, orange, mustard

(C) Sugarcane, mustard, potato

(D) Papaya, mustard, potato

Explanation: Plants like sugarcane, roses, grapes, banana, and orange can be raised by vegetative propagation. This method allows plants that have lost the capacity to produce seeds, such as banana and orange, to be propagated. Vegetative propagation involves using parts of plants like root, stem, or leaves to grow new plants. The context mentions that such methods are used for growing sugarcane, roses, and grapes, and also make possible the propagation of banana and orange.

Question 12. The part of seed which is a source of food during germination of seed is:

[1 Marks]

(A) Cotyledon

(B) Radicle

(C) Plumule

(D) Embryo

Explanation: The correct answer is 'Cotyledon'. The cotyledon serves as the food reserve for the developing plant during germination, providing the necessary nutrients until the seedling can produce its own food through photosynthesis.

Question 13. A zygote is formed by the fusion of a male gamete and a female gamete. The number of chromosomes in the zygote of a human is:

[1 Marks]

(A) 23

(B) 44

(C) 92

(D) 46

Explanation: The correct answer is 46, as humans have 23 pairs of chromosomes, which totals to 46 chromosomes in the zygote formed by the fusion of the male (23 chromosomes) and female gametes (23 chromosomes).

Question 14.

Absolute refractive index of glass and water is 3/2 and 4/3 respectively. If the speed of light in glass is 2×10^8 m/s, the speed of light in water is:

[1 Marks]

(A) $4/9 \times 10^8$ m/s

(B) $9/16 \times 10^8$ m/s

(C) $3/7 \times 10^8$ m/s

(D) $2/5 \times 10^8$ m/s

Explanation: The refractive index n is given by n = speed of light in air / speed of light in the medium. Given n_glass = 3/2 and speed in glass = 2×10^8 m/s, speed of light in air c = n_glass × speed in

glass = (3/2) × 2 x 10^8 = 3 x 10^8 m/s. Similarly, speed in water = speed in air / n_water = (3 x 10^8) / (4/3) = (3 x 10^8) × (3/4) = 9/4 x 10^7 = 9/16 x 10^8 m/s. Hence, the correct answer is 9/16 x 10^8 m/s.

Question 15. When a beam of white light passes through a region having very fine dust particles, the colour of light mainly scattered in that region is:

[1 Marks]

(A) Orange

(B) Yellow

(C) Blue

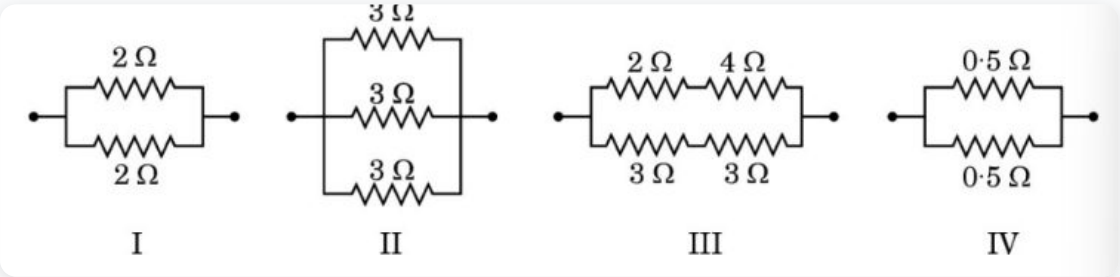
(D) Red

Explanation: The correct answer is Blue. Very fine particles scatter mainly blue light more effectively than other colors due to their smaller size relative to the wavelength of visible light. This explanation is supported by the context which states that fine particles in the atmosphere scatter shorter wavelengths of light, such as blue, more strongly.

Question 16.

Consider the following combinations of resistors: The combinations having equivalent resistance 1 is/are:

[1 Marks]



(A) I and IV

(B) Only IV

(C) I, II and III

(D) I and II

Explanation: The correct option is 'I and II'. When resistors are connected in parallel, the equivalent resistance (Rp) is less than any individual resistance and can be calculated using the formula 1/Rp = 1/R1 + 1/R2 + 1/R3. Combinations I and II have their resistors connected in such a way that the total equivalent resistance equals 1 ohm, as explained from the context referring to parallel resistor combinations and their equivalent resistance calculation.

Question 17.

An electric iron of resistance 20 Ω draws a current of 5 A. The heat developed in the iron in 30 seconds is:

[1 Marks]

(A) 15000 J

(B) 1500 J

(C) 3000 J

(D) 6000 J

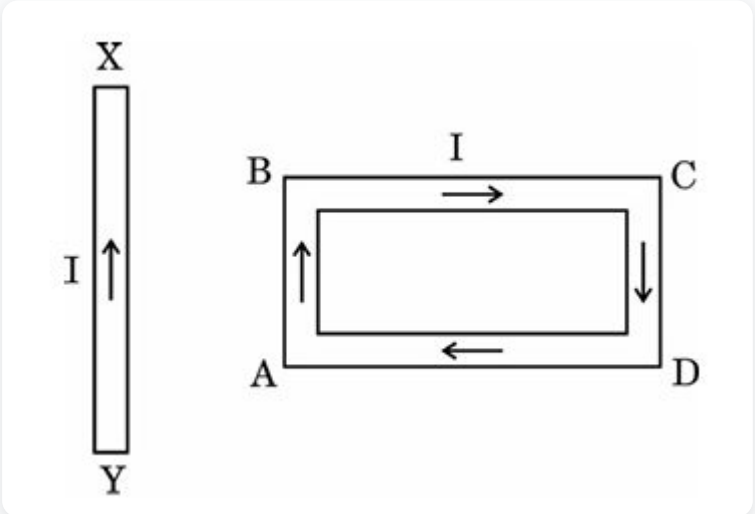
Explanation:

To calculate the heat developed, we can use the formula $H = I^2Rt$. Here, $I = 5$ A, $R = 20$ Ω, and $t = 30$ s. Therefore, $H = (5\text{ A})^2 \times (20\ \Omega) \times (30\text{ s}) = 25 \times 20 \times 30 = 15000$ J. The correct answer is 15000 J.

Question 18.

A rectangular loop ABCD carrying a current I is situated near a straight conductor XY, such that the conductor is parallel to the side AB of the loop and is in the plane of the loop. If a steady current I is established in the conductor, the conductor XY will:

[1 Marks]



(A) rotate about its axis.

(B) remain stationary.

(C) move away from the side AB of the loop.

(D) move towards the side AB of the loop.

Explanation:

The correct answer is 'move towards the side AB of the loop.' This is because the straight conductor XY generates a magnetic field that interacts with the magnetic field created by the current in the loop ABCD. According to the right-hand rule and the principles of magnetic forces between parallel current-carrying wires, the conductor will experience a force that pulls it towards the loop.

Question 19. Some wastes are given below: (i) Garden waste (ii) Ballpoint pen refills (iii) Empty medicine bottles made of glass (iv) Peels of fruits and vegetables (v) Old cotton shirt. The non-biodegradable wastes among these are:

[1 Marks]

(A) (ii) and (iii)

(B) (i) and (ii)

(C) (i), (iv) and (v)

(D) (i), (iii) and (iv)

Explanation: The correct option is (ii) and (iii), as ballpoint pen refills and empty medicine bottles made of glass are non-biodegradable. The context highlights that certain materials like plastics and bottles do not decompose like organic waste, which includes garden waste and fruit peels that are biodegradable.

Question 20.

Assertion (A): The extraction of metals from their sulphide ores cannot take place without roasting of the ore. Reason (R): Roasting converts sulphide ores directly into metals.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(B) Assertion (A) is false, but Reason (R) is true.

(C) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(D) Assertion (A) is true, but Reason (R) is false.

Explanation: The correct option is: Assertion (A) is true, but Reason (R) is false. Roasting is essential in the extraction of metals from sulphide ores because it converts the sulphide ores into metal oxides, not directly into metals. These metal oxides can then be easily reduced to obtain the pure metal. Therefore, roasting is necessary, but it does not convert sulphide ores directly into metals.

Question 21.

Assertion (A): In the human heart ventricles have thicker muscular walls than atria.

Reason (R): Ventricles have to pump the blood into various organs.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(B) Assertion (A) is true, but Reason (R) is false.

(C) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(D) Assertion (A) is false, but Reason (R) is true.

Explanation:

Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A) because the ventricles need to generate higher pressure to pump blood over long distances to various parts of the body, which is why they have thicker muscular walls compared to the atria, which primarily receive blood.

Question 22.

Assertion (A): Magnetic field lines never intersect each other.

Reason (R): If they intersect, then at the point of intersection, the compass needle would point towards two directions, which is not possible.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Assertion (A) is true, but Reason (R) is false.

(C) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(D) Assertion (A) is false, but Reason (R) is true.

Explanation:

Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). Magnetic field lines never intersect because if they did, at the point of intersection, a compass

needle would experience two different directions of the magnetic field simultaneously, which is physically impossible. Therefore, the reason correctly explains why magnetic field lines do not cross.

Question 23.

Assertion (A): Oxygen is essential for all aerobic forms of life.

Reason (R): Free oxygen atoms combine with molecular oxygen to form ozone.

[1 Marks]

(A) Assertion (A) is true, but Reason (R) is false.

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(C) Assertion (A) is false, but Reason (R) is true.

(D) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

Explanation:

The assertion is true because oxygen is essential for respiration in most aerobic organisms, meaning they need oxygen to survive. The reason is also true because free oxygen atoms (O) can combine with molecular oxygen (O2) to form ozone (O3). However, the reason does not correctly explain the assertion. The importance of oxygen for life is due to its role in respiration, not because it forms ozone. Therefore, the correct answer is: Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

Section C

Question 24.

1 gram of solid sodium chloride was taken in a clean and dry test tube and concentrated sulphuric acid was added to it.

(i) Name the gas evolved in the reaction.

(ii) What will be observed when this gas is tested with (I) dry, and (II) wet blue litmus paper? Write your conclusion about the nature (acidic/basic) of this gas.

[2 Marks]

Answer: When concentrated sulphuric acid is added to solid sodium chloride, hydrochloric acid gas (HCl) is evolved. (i) The gas evolved is hydrochloric acid gas. (ii) On testing this gas with dry blue

litmus paper, there is no change in color because dry HCl gas does not affect the dry litmus. However, when tested with wet blue litmus paper, the paper turns red. This shows that the gas is acidic in nature as it dissolves in moisture releasing H+ ions which turn blue litmus red.

Key Points: Hydrochloric acid gas - No change with dry blue litmus paper - Turns wet blue litmus paper red - Gas is acidic in nature

Question 25. Distinguish between a saturated and an unsaturated hydrocarbon by flame test. List the products of the combustion reaction of a saturated hydrocarbon.

[2 Marks]

Answer: Saturated hydrocarbons produce a clean, blue flame during the flame test, indicating complete combustion with less soot. Unsaturated hydrocarbons give a yellow, sooty flame due to the presence of double or triple bonds, causing incomplete combustion and black smoke. The products of the combustion of a saturated hydrocarbon are carbon dioxide and water along with the release of heat and light energy.

Key Points: Saturated hydrocarbons give a blue, clean flame-Unsaturated hydrocarbons give a yellow, sooty flame with black smoke-Products of saturated hydrocarbon combustion are carbon dioxide, water, heat, and light

Question 26. We need to water the soil in plants regularly, but it ultimately reaches the leaves of the plant. Explain how this takes place.

[2 Marks]

Answer: Water is absorbed by the roots from the soil. It travels upward through the plant's xylem vessels towards the leaves. Tiny pores on the leaf surface called stomata allow water to evaporate into the air as water vapor, in a process called transpiration. This evaporation creates a suction force that pulls more water from the roots to the leaves. Thus, water moves from the soil to the roots, then through the plant to the leaves.

Key Points: Water is absorbed by roots from the soil - Water travels upward through xylem vessels - Water evaporates from leaf stomata as water vapor - This process is called transpiration - Evaporation creates suction force pulling water from roots to leaves

Question 27. The survival of a species is promoted through the creation of variations. Illustrate with an example.

[2 Marks]

Answer: Variations within a species help individuals adapt to changing environments, promoting survival. For example, in bacteria, some may gain a variation that allows them to withstand heat. During a heatwave, these heat-resistant bacteria survive while others perish. This natural selection

ensures that the species continues to exist over time with traits best suited for the environment. Such variations arise due to sexual reproduction and genetic changes, leading to greater diversity and better chances of survival.

Key Points: Variations arise in species-Variations give advantages to some individuals-Example of bacteria surviving heat due to variation-Variations promote survival of species-Natural selection favors beneficial traits-Diversity increases survival chances

Question 28. A person suffering from presbyopia needs bifocal lens. If he needs two lenses of power 4·0 dioptre and + 2·0 dioptre, which one of these two lenses is for the correction of distant vision and what is its focal length?

[2 Marks]

Answer: In bifocal lenses used for presbyopia, the lens for distant vision is concave and the lens for near vision is convex. Here, the power 4.0 dioptre is likely negative (concave) for distant vision, and +2.0 dioptre (convex) is for near vision. The focal length (f) of a lens is calculated as 100 divided by power in dioptres. So, for the distant vision lens, focal length f = 100 / 4 = 25 cm or 0.25 m. Therefore, the lens of power 4.0 dioptre corrects distant vision, and its focal length is 0.25 meters.

Key Points: Bifocal lenses have two parts: concave for distant vision and convex for near vision-The lens for distant vision has negative power, near vision lens has positive power-Power of lens is inversely related to focal length-Focal length f = 100 / power (in cm) or f = 1 / power (in meters)-Lens of power 4 D corrects distant vision with focal length 0.25 m-Positive power lens (+2 D) is for near vision correction

Question 29. Two wires A and B of the same material, having the same lengths and diameters 0.2 mm and 0.3 mm respectively, are connected one by one in a circuit. Which one of these two wires will offer more resistance to the flow of current in the circuit? Justify your answer.

[2 Marks]

Answer: Wire A, having a diameter of 0.2 mm, offers more resistance compared to wire B which has a diameter of 0.3 mm. This is because resistance in a wire depends inversely on its cross-sectional area. A wire with a smaller diameter has a smaller cross-sectional area, leading to higher resistance. Since both wires are of the same material and length, the difference in resistance is due to their differing diameters. Hence, wire A with the thinner diameter has greater resistance to current flow.

Key Points: Resistance depends on length, material, and cross-sectional area - Both wires have the same length and material - Wire A has diameter 0.2 mm, wire B has 0.3 mm - Wire A has smaller cross-sectional area - Smaller cross-sectional area means higher resistance - Therefore, wire A offers more resistance

Question 30.

Some metals react with acids to produce salt and hydrogen gas. Illustrate it with an example. How will you test the presence of this gas ?

[2 Marks]

Answer: When metals like zinc react with dilute acids such as hydrochloric acid, they produce a salt and hydrogen gas. For example, zinc reacts with hydrochloric acid to form zinc chloride (a salt) and hydrogen gas. To test for hydrogen gas, collect the gas and bring a burning matchstick near it. If the gas is hydrogen, it will produce a 'pop' sound, confirming its presence.

Key Points: Metals react with acids to form salt and hydrogen gas-Example of zinc reacting with hydrochloric acid-Formation of zinc chloride and hydrogen gas-Test for hydrogen gas by bringing a burning matchstick near the gas-Pop sound confirms the presence of hydrogen gas

Question 31.

Name the type of nutrition exhibited by Amoeba. Explain how food is taken in and digested by this organism.

[2 Marks]

Answer: Amoeba exhibits holozoic nutrition. It takes in food using its pseudopodia by surrounding and engulfing the food particle. The engulfed food gets enclosed in a food vacuole inside the cytoplasm. Inside the food vacuole, enzymes digest the food into simpler substances. The nutrients are absorbed into the cytoplasm, and undigested waste is expelled from the cell.

Key Points: Type of nutrition - holozoic nutrition - Food capture by pseudopodia - Formation of food vacuole - Digestion by enzymes inside the food vacuole - Absorption of nutrients - Egestion of undigested waste

---

Section D

Question 32.

Write the common name and the chemical name of the compound $CaSO_4 \cdot 1/2\ H_2O$. Write the method of its preparation. Give chemical equation for the reaction, when water reacts with $CaSO_4 \cdot 1/2\ H_2O$.

[3 Marks]

Answer: (a) The compound $CaSO_4 \cdot 1/2\ H_2O$ is commonly known as Plaster of Paris. Its chemical name is Calcium sulfate hemihydrate.

(b) Preparation: Plaster of Paris is prepared by heating gypsum (Calcium sulfate dihydrate, $CaSO_4 \cdot 2H_2O$) at about 150 deg C. On heating, loses water and gives $CaSO_4 \cdot 1/2\ H_2O$.

Chemical equation: $CaSO_4 \cdot 2H_2O$ (gypsum) --heat--> $CaSO_4 \cdot 1/2\ H_2O$ (Plaster of Paris) + 1 1/2 H_2O

(c) When water reacts with Plaster of Paris, it absorbs water and forms gypsum (Calcium sulfate dihydrate).

Chemical equation: $CaSO_4 \cdot 1/2\ H_2O + 1/2\ H_2O \rightarrow CaSO_4 \cdot 2H_2O$

This reaction is called hydration and the product sets hard, which is why Plaster of Paris is used for making casts for broken bones.

Key Points: Common name - Plaster of Paris - Chemical name - Calcium sulfate hemihydrate - Preparation by heating gypsum - Reaction with water forms gypsum - Chemical equations for preparation and hydration

Question 33.

Why is the conversion of ethanol to ethanoic acid an oxidation reaction ? Name the oxidising agent used in this conversion. Write chemical equation for this oxidation reaction. How is this reaction different from the reaction in which ethanol burns in the presence of oxygen ?

[3 Marks]

Answer: (a) The conversion of ethanol to ethanoic acid is an oxidation reaction because ethanol loses hydrogen atoms and gains oxygen atoms during the process, which is the key characteristic of oxidation in organic chemistry.

(b) The common oxidising agents used for this conversion are acidified potassium dichromate ($K_2Cr_2O_7$) and alkaline potassium permanganate ($KMnO_4$).

(c) The chemical equation for this oxidation is:

$CH_3CH_2OH + 2[O] \rightarrow CH_3COOH + H_2O$

Here, [O] represents oxygen provided by the oxidising agent.

(d) This reaction is different from the burning of ethanol in presence of oxygen because burning is a combustion reaction where ethanol reacts with excess oxygen to produce carbon dioxide and water with the release of heat energy. The equation for burning is:

$CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ + energy

In oxidation, ethanol forms ethanoic acid by adding oxygen, whereas in burning, it completely oxidises to carbon dioxide and water releasing energy.

Key Points: Ethanol gain oxygen and lose hydrogen in conversion - Oxidising agents are acidified K2Cr2O7 and alkaline KMnO4 - Ethanol oxidation forms ethanoic acid; burning

produces CO2 and H2O with release of energy

Question 34. Explain with the help of a labelled diagram, the process of reproduction in Hydra by budding. Name the cells used for reproduction in this process.

[3 Marks]

Answer: Budding in Hydra is a type of asexual reproduction where a new individual develops as an outgrowth or bud from the parent organism. First, certain cells called regenerative cells divide repeatedly at one specific site on the Hydra's body, forming a bud. This bud grows gradually while attached to the parent, developing tentacles and other body parts. When the bud matures fully, it detaches from the parent Hydra and becomes an independent organism. The process involves only one parent and does not require gamete formation. Regenerative cells are responsible for the repeated cell division during budding. The labelled diagram would show the parent Hydra with a small outgrowth on its body, which grows bigger and eventually separates to form a new Hydra.

Key Points: Budding is a form of asexual reproduction in Hydra-The bud forms due to repeated cell division at a specific site-Regenerative cells are responsible for reproduction in this process-The bud grows on the parent and detaches when mature-Only one parent is involved-No gametes are produced-The process results in genetically identical offspring

Question 35.

List two differences between dominant traits and recessive traits. What percentage of pea plants in the F_2 generation were with yellow seeds in yellow (YY) and green coloured (yy) seeds?

[3 Marks]

Answer:

Differences between dominant and recessive traits:

1. Dominant traits are expressed in the organism even if only one dominant allele is present, whereas recessive traits are expressed only when two recessive alleles are present.
2. Dominant traits mask the presence of recessive traits in heterozygous individuals, whereas recessive traits remain hidden if a dominant allele is present.

Percentage of yellow and green seed pea plants in F_2 generation:

In pea plants, yellow seed color (Y) is dominant over green seed color (y). The F_2 generation results from crossing heterozygous plants (Yy × Yy). According to Mendel's inheritance, the genotype ratio for seed color in F_2 is 1 YY : 2 Yy : 1 yy.

This means 3 out of 4 plants (75%) have yellow seeds (YY or Yy) and 1 out of 4 plants (25%) have green seeds (yy). Specifically, 25% are homozygous yellow (YY), and 25% are homozygous green (yy).

Key Points: Dominant traits expressed with one dominant allele-Recessive traits expressed only with two recessive alleles-Dominant traits mask recessive traits in heterozygous-75% of F2 plants have yellow seeds (YY or Yy)-25% of F2 plants have green seeds (yy)

Question 36. Define the term power of accommodation of human eye. What happens to the image distance in the eye when we increase the distance of an object from the eye? Name and explain the role of the part of human eye responsible for it in this case.

[3 Marks]

Answer: The power of accommodation of the human eye is the ability of the eye lens to change its focal length by altering its curvature. This change is controlled by the ciliary muscles surrounding the lens. When looking at a nearby object, the ciliary muscles contract, causing the lens to become thicker and more curved, reducing the focal length and allowing the eye to focus on the object. When the object moves farther away, the ciliary muscles relax, making the lens thinner with a longer focal length. As the distance of an object from the eye increases, the image distance (the distance between the lens and the image formed on the retina) remains approximately constant because the image is always focused on the retina. Instead, the eye adjusts the focal length of the lens to form a clear image on the retina. The ciliary muscle is responsible for this adjustment. It changes the shape of the eye lens by contracting or relaxing. When it contracts, the lens thickens to focus on near objects; when it relaxes, the lens becomes thinner for distant vision. This process of adjusting the lens shape to focus on objects at different distances is known as accommodation.

Key Points: Definition of power of accommodation-Role of ciliary muscles in changing lens curvature-Focal length changes with object distance-Image distance remains constant on retina-Ciliary muscle contracts for near objects and relaxes for distant objects-Process called accommodation

Question 37.

A student fixes a sheet of white paper on a drawing board. He places a bar magnet in the center of it. He sprinkles some iron filings uniformly around the bar magnet. Then he taps the drawing board gently and observes that the iron filings arrange themselves in a particular pattern.

(a) Why do iron filings arrange in a particular pattern?

(b) What does the crowding of iron filings at the ends of the magnet indicate?

(c) What do the lines, along which the iron filings align, represent?

(d) If the student places a cardboard horizontally in a current carrying solenoid and repeats the above activity, in what pattern would the iron filings arrange? State the conclusion drawn about the magnetic field based on the observed pattern of the lines.

[3 Marks]

Answer: (a) Iron filings arrange themselves in a particular pattern because the bar magnet produces a magnetic field around it. The iron filings, being magnetic, experience a force in this magnetic field and align themselves along the magnetic field lines to show the pattern of the field.

(b) The crowding of iron filings at the ends of the magnet indicates that the magnetic field is strongest at the poles (ends) of the bar magnet.

(c) The lines along which the iron filings align represent the magnetic field lines. These lines show the direction and shape of the magnetic field around the magnet.

(d) When a cardboard is placed horizontally over a current-carrying solenoid and iron filings are sprinkled and tapped, the filings arrange themselves in concentric circles around the solenoid. This pattern shows that the magnetic field lines around a current-carrying solenoid (or wire) are circular and concentric.

From these observations, we conclude that magnetic field lines form closed loops. Around a bar magnet, the field lines emerge from the north pole and enter the south pole, while around a current-carrying solenoid, the lines form circular loops around the wire. This helps us understand the shape and direction of magnetic fields produced by different sources.

Key Points: Iron filings align along magnetic field lines-Iron filings experience a force in magnetic field-Crowding of filings at magnet ends indicates strong magnetic field at poles-Lines represent magnetic field lines showing direction and shape-Current-carrying solenoid produces circular magnetic field lines around it-Magnetic field lines form closed loops-Observing iron filings helps visualize magnetic fields

Question 38.

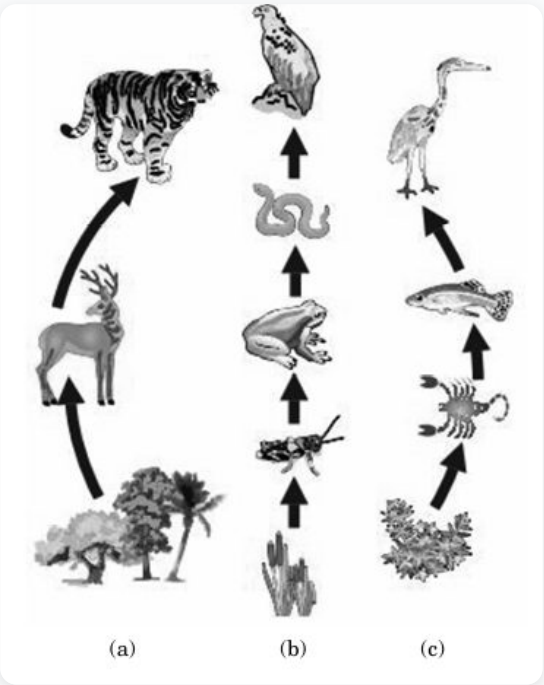
Study the picture given below showing three food chains (a), (b), and (c) and answer the following questions:

(i) Name the type of ecosystems that exist in food chains (b) and (c).

(ii) The first trophic level in all food chains are producers. Why? What percentage of solar energy do these producers capture for their use?

(iii) Why are the arrows shown in the diagram in one direction only and not vice versa? Justify.

[3 Marks]



Answer: (i) Types of ecosystems in food chains (b) and (c):
Food chain (b) represents an aquatic ecosystem, where organisms live in water. Food chain (c) represents a grassland ecosystem, characterized by grasses and herbivores.

(ii) Producers at the first trophic level:
Producers are at the first trophic level because they make their own food using sunlight, water, and carbon dioxide through photosynthesis. They are the base of the food chain, providing energy for all other organisms. Usually, producers capture about 1-2% of solar energy that reaches the Earth to produce food.

(iii) One directional arrows in food chains:
The arrows show the flow of energy and nutrients from one organism to another. They are in one direction only because energy flows from producers to consumers and then to higher consumers, and it is not recycled back. Energy is lost as heat at each step, so it cannot move backward or be reused by the previous organism.

Key Points: Food chain (b) is an aquatic ecosystem-Food chain (c) is a grassland ecosystem-Producers are at the first trophic level because they make their own food via photosynthesis-Producers capture about 1-2% of solar energy-Arrows show energy flow from one trophic level to another in one direction-Energy is lost as heat and cannot flow backward

Question 39.

List two roles of each of the following in human reproductive system : (i) Seminal vesicles and prostate gland (ii) Oviduct (iii) Testis

[3 Marks]

Answer: In the human reproductive system, the seminal vesicles produce a nutrient-rich fluid that mixes with sperm to form semen. This fluid helps in the survival and movement of sperm. The prostate gland produces a fluid that also contributes to semen, which helps protect sperm and aids in their mobility. The oviduct, also called the Fallopian tube, carries the egg from the ovary to the uterus and is the usual site where fertilization occurs if sperm meet the egg. The testis is responsible for producing sperm, the male reproductive cells, and also produces testosterone, the hormone that controls the development of male secondary sexual characteristics and sperm production.

Key Points: Seminal vesicles produce nutrient-rich fluid for sperm-Prostate gland produces fluid to aid sperm mobility and protection-Oviduct transports egg from ovary to uterus and is site of fertilization-Testis produces sperm and testosterone hormone

---

Section E

Question 40. What is a chemical reaction? Describe one activity each to show that a chemical change has occurred in which (i) change of colour, and (ii) change in temperature has taken place.

[5 Marks]

Answer:

A chemical reaction is a process in which one or more substances react to form new substances with different chemical properties. This change in composition is known as a chemical change, which may be recognised by changes such as change in colour, change in state, evolution of gas, or change in temperature.

To demonstrate chemical change due to change in colour, consider the reaction between blue copper sulfate solution and iron nails. When iron nails are dipped in copper sulfate solution, the blue color fades and a brown layer of copper forms on the nails. This change in color shows that a chemical reaction has taken place.

For change in temperature, take the example of mixing dilute hydrochloric acid with sodium hydroxide solution. When these two solutions are mixed, heat is released, and the mixture becomes warmer. This increase in temperature indicates a chemical reaction known as neutralization, confirming that a chemical change has occurred.

Thus, chemical reactions involve transformation of substances resulting in observable changes like color and temperature, proving that new substances are formed during the process.

Key Points: Definition of chemical reaction- Chemical reaction involves formation of new substances- Indicators of chemical reaction: change in color, temperature, state, gas evolution- Example of color change: copper sulfate solution with iron nails- Example of temperature change: mixing hydrochloric acid and sodium hydroxide leading to heat release- Explanation of observations- Conclusion that these changes confirm a chemical change

Question 41.

(i)Define a reflex arc. Why have reflex arcs evolved in animals? Trace the sequence of events which occur when you suddenly touch a hot object.

(ii) Name the part of nervous system which helps in communication between the central nervous system and other parts of the body. What are the two components of this system ?

[5 Marks]

Answer: (i) **Definition of Reflex Arc:** A reflex arc is the simplest nerve pathway that controls an immediate, automatic response to a stimulus without involving the brain initially. It helps to protect the body from harm by producing a quick reaction.
Why have Reflex Arcs evolved? Reflex arcs have evolved in animals because the brain is not fast enough to react to sudden danger. This rapid response helps to protect the body from injury by allowing quick actions before the brain processes the information.
Sequence of events when we touch a hot object: When you suddenly touch a hot object, the heat is detected by receptors in the skin. These receptors generate nerve impulses that travel through sensory neurons to the spinal cord. Inside the spinal cord, the impulses pass through relay neurons to motor neurons. The motor neurons send impulses to the muscles of your hand, causing it to withdraw immediately. Meanwhile, the sensory information also travels to the brain, which feels pain and heat sensation, but the response happens before this awareness.

(ii) The part of the nervous system that helps in communication between the central nervous system (CNS) and other parts of the body is called the **Peripheral Nervous System (PNS)**.
The two components of the Peripheral Nervous System are:
1. **Sensory (Afferent) Nervous System** - carries messages from sensory organs to the CNS.
2. **Motor (Efferent) Nervous System** - carries messages from the CNS to muscles and glands to cause action.

Key Points: Reflex arc is a simple nerve pathway - Reflex arcs allow quick automatic responses - Sequence: stimulus - receptors - sensory neuron - relay neuron - motor neuron - effector - response - Peripheral Nervous System connects CNS to body - Two parts: Sensory and Motor nervous systems

Question 42.

(i) Leaves of 'chhui-mui'plant begin to fold up and droop in response to a stimulus. Name the stimulus and write the cause for such a rapid movement. Is there any growth involved in the movement?

(ii) Define geotropism in plants. What is meant by positive and negative geotropism ? Give one example of each type.

[5 Marks]

Answer: (i) The stimulus is touch. The rapid movement of folding and drooping of leaves in the chhui-mui plant is caused by the loss of water pressure in certain cells at the base of the leaflets, which leads to shrinking of those cells and results in folding. This response is very fast and does not involve any growth.
(ii) Geotropism is the movement or growth of plants in response to gravity. Positive geotropism means growth towards the direction of gravitational pull, for example, roots grow downward into the soil. Negative geotropism means growth away from the direction of gravity, for example, the stem grows upward away from the soil. Thus, roots exhibit positive geotropism and stems exhibit negative geotropism.

Key Points: Stimulus is touch - Movement caused by change in water pressure in cells - No growth involved - Geotropism is growth response to gravity - Positive geotropism is growth towards gravity like roots - Negative geotropism is growth away from gravity like stems

Question 43.

The variation of image distance (v) with object distance (u) for a convex lens is given in the following observation table. Analyse it and answer the questions that follow :

(i) Without calculation, find the focal length of the convex lens. Justify your answer.

(ii) Which observation is not correct ? Why ? Draw ray diagram to find the position of the image formed for this position of the object.

(iii) Find the approximate value of magnification for u = 30 cm.

[5 Marks]

S. No.	Object distance (u) cm	Image distance (v) cm
1	– 150	+ 30
2	– 75	+ 37·5
3	– 50	+ 50
4	– 37·5	+ 75
5	– 30	+ 150
6	– 15	+ 37·5

Answer:

(i) Finding focal length without calculation:
For a convex lens, when the object is placed at infinity (very far away), the image is formed at the focal point. So, the image distance (v) is approximately equal to the focal length (f). By looking at the observation table, the image distance corresponding to a very large object distance will approximate the focal length. Hence, the focal length of the convex lens can be found directly from the image distance when the object distance is very large.

(ii) Incorrect observation and its reason:
In the observation table, if any image distance (v) is negative or inconsistent with lens behavior (for example, a virtual image formed on the same side as the object for a convex lens when not expected), that observation is incorrect. This usually happens when the object is placed within the focal length of the convex lens. The image formed in that case is virtual, erect, and magnified. The ray diagram for this situation shows the rays diverging on the image side and appears to come from behind the lens (same side as the object). One must identify the inconsistent observation from the table by checking if the image is real or virtual and if the image distance is positive or negative.

(iii) Magnification for u = 30 cm:
Magnification (m) is given by the ratio of image distance to object distance, m = v / u. Using the observation table, find the image distance v when the object distance u is 30 cm. Substitute values in the formula to calculate magnification. The magnification will indicate the size and orientation of the image formed.

Key Points: Explain focal length as image distance for very large object distance- Identify incorrect observation based on lens behavior and sign conventions- Ray diagram description for object within focal length resulting in virtual, erect, magnified image- Use magnification formula m = v / u to calculate magnification for u = 30 cm

Question 44.

(i) Define principal axis of a lens. Draw a ray diagram to show what happens when a ray of light parallel to the principal axis of a concave lens passes through it.

(ii) The focal length of a concave lens is 20 cm. At what distance from the lens should a 5 cm tall object be placed so that its image is formed at a distance of 15 cm from the lens? Also calculate the size of the image formed.

[5 Marks]

Answer:

Principal Axis of a Lens: The principal axis of a lens is an imaginary straight line that passes through the center of the lens and is perpendicular to its surfaces. It is considered the main reference line for studying the path of light rays passing through the lens.

Behavior of a Ray Parallel to the Principal Axis in a Concave Lens: When a ray of light traveling parallel to the principal axis falls on a concave lens, it refracts and diverges away from the principal axis. After refraction, this diverging ray appears to come from a fixed point on the principal axis known as the principal focus (or focal point) of the concave lens. This point lies on the same side of the lens as the incident light but the rays never actually meet at this focal point. Thus, the concave lens causes parallel rays to spread out or diverge as if coming from the principal focus.

Ray Diagram: The ray diagram shows a concave lens which is thinner at the center and thicker at the edges. A ray of light coming from the left is drawn parallel to the principal axis. After refraction through the lens, the ray bends outward and diverges away from the principal axis. When extended backward, the refracted ray appears to originate from the principal focus of the lens on the left side.

This demonstrates the diverging nature of concave lenses and the role of the principal axis as the reference line for such ray diagrams.

Key Points: Definition of principal axis - imaginary straight line through the center of the lens - perpendicular to lens surfaces - description of ray of light parallel to principal axis incident on concave lens - ray diverges after refraction - diverging ray appears to come from principal focus on principal axis - principal focus on the same side as incident light - concave lens is thinner at center and thicker at edges - purpose and appearance of ray diagram showing parallel ray and its divergence - explanation of concave lens as diverging lens

Question 45.

(i) Define a decomposition reaction. How can we say that (I) electrolysis of water, and (II) blackening of silver bromide when exposed to sunlight, are decomposition reactions ? Mention the type of energy involved in each case.

(ii) The type of reactions in which (I) calcium oxide is formed, and (II) calcium hydroxide is formed are opposite reactions to each other. Justify this statement with the help of chemical equations.

[5 Marks]

Answer: (i) A decomposition reaction is a chemical reaction in which a complex substance breaks down into two or more simpler substances.

In (I) Electrolysis of water, water decomposes into hydrogen and oxygen gases on passing electric current. This is a decomposition reaction because the compound water decomposes into simpler substances. The energy involved is electrical energy.

$2H_2O$ (l) --electricity--> $2H_2$ (g) + O_2 (g)

In (II) Blackening of silver bromide when exposed to sunlight, silver bromide breaks down into silver and bromine on exposure to light. This is a decomposition reaction because silver bromide decomposes into simpler substances. The energy involved is light energy.

2AgBr (s) --sunlight--> 2Ag (s) + Br_2 (g)

(ii) (I) Formation of calcium oxide: When calcium carbonate (limestone) is heated strongly, it decomposes to give calcium oxide (quick lime) and carbon dioxide. This is a thermal decomposition reaction.

$CaCO_3$ (s) --heat--> CaO (s) + CO_2 (g)

(II) Formation of calcium hydroxide: When calcium oxide reacts with water, it forms calcium hydroxide (slaked lime). This is a combination (or synthesis) reaction.

CaO (s) + H_2O (l) --> $Ca(OH)_2$ (aq)

These two reactions are opposite because the first reaction decomposes calcium carbonate into calcium oxide and carbon dioxide by heating, and the second reaction uses calcium oxide to form calcium hydroxide by combining with water. Hence these are reverse reactions to each other.

Key Points: Decomposition reaction definition - Electrolysis of water is decomposition using electrical energy - Blackening of silver bromide is decomposition using light energy - Formation of calcium oxide is thermal decomposition - Formation of calcium hydroxide is combination reaction - These two reactions are reverse of each other