CBSE EXAMINATION PAPER-2025

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. Seawater contains many salts dissolved in it. Common salt is separated from these salts. Deposits of solid salt are also found in several parts of the world. These large crystals are often brown due to impurities. This is called rock salt and is mined like coal. The common salt is an important raw material for chemicals of daily use.

(1) Write balanced chemical equations to show the products formed during electrolysis of brine.

[1 Marks]

Answer: During the electrolysis of brine (concentrated sodium chloride solution), the following products are formed: At the anode (positive electrode): Chlorine gas is released. $2Cl^- \rightarrow Cl_2 + 2e^-$ At the cathode (negative electrode): Hydrogen gas is released. $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ Overall reaction: $2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$ Thus, chlorine gas, hydrogen gas, and sodium hydroxide solution are obtained during electrolysis of brine.

Key Points: Electrolysis of brine involves passing electric current through concentrated sodium chloride solution-Anode reaction produces chlorine gas-Cathode reaction produces hydrogen gas-Sodium hydroxide solution is formed as a byproduct-Balanced chemical equations should be given for both anode and cathode reactions and the overall reaction

(2)

A mild non-corrosive basic salt ‘A’, used for faster cooking, is strongly heated to produce a compound ‘B’, that is used for removing permanent hardness of water. Identify A and B and also write the equation for the reaction that occurs when A is heated.

[2 Marks]

Answer:

The mild non-corrosive basic salt ‘A’ used for faster cooking is Sodium Hydrogen Carbonate ($NaHCO_3$), also known as baking soda. When strongly heated, it decomposes to produce Sodium Carbonate (Na_2CO_3), which is compound ‘B’. Sodium Carbonate is used for removing permanent hardness of water. The reaction that occurs when Sodium Hydrogen Carbonate is heated is: 2 $2NaHCO_3$ (s) → Na_2CO_3 (s) + CO_2 (g) + H_2O (g) Here, baking soda decomposes to give washing soda (sodium carbonate), carbon dioxide, and water vapor.

Key Points:

Identify A as Sodium Hydrogen Carbonate (baking soda)-Heating Sodium Hydrogen Carbonate produces Sodium Carbonate (washing soda), CO_2 and water vapor-Sodium Carbonate is used for removing permanent hardness of water-Write the decomposition equation: $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$

(3) List two uses of any one product obtained during electrolysis of brine.

[1 Marks]

Answer: During the electrolysis of brine (a concentrated solution of sodium chloride), several products are obtained. One of the important products is chlorine gas. Two uses of chlorine gas are: 1) It is used to make bleaching powder which is important for cleaning and disinfecting. 2) Chlorine is also used in the manufacture of many chemicals like hydrochloric acid and in water purification.

Key Points: Electrolysis of brine produces chlorine gas-Two uses of chlorine: making bleaching powder and water purification-Chlorine is also used in manufacture of chemicals like hydrochloric acid

(4)

Define water of crystallisation. Give two examples of salts that have water of crystallisation.

[2 Marks]

Answer:

Water of crystallisation is the definite amount of water molecules chemically combined with a salt in its solid crystalline form. These water molecules are an integral part of the salt's structure. For example, copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$) and gypsum ($CaSO_4 \cdot 2H_2O$) contain water of crystallisation.

Key Points: Definition of water of crystallisation - water molecules chemically bound in crystal structure - examples: copper sulfate pentahydrate and gypsum - significance of water presence in crystals

Question 2. The maintenance functions of all living organisms must go on even when they are not doing anything particular. Even when we are just sitting in a class or even asleep, this maintenance job has to go on. These maintenance processes require energy to prevent damage and break-down of cells and tissues, which is obtained by the individual organism from the food prepared by the autotrophs, called producers.

(1) Name and define the process by which green plants prepare food.

[1 Marks]

Answer: The process by which green plants prepare their food is called Photosynthesis. Photosynthesis is the process in which green plants use sunlight, carbon dioxide from the air, and water from the soil to make their own food in the form of glucose. Chlorophyll, the green pigment in leaves, captures sunlight which provides the energy needed for this process.

Key Points: Name of the process-Photosynthesis-Definition of photosynthesis-Photosynthesis uses sunlight, carbon dioxide and water to make food-Occurs in green plants-Role of chlorophyll in capturing sunlight-Energy needed to prepare food

(2)

State in proper sequence the events that occur in synthesis of food by desert plants.

[2 Marks]

Answer: The synthesis of food by desert plants occurs through the following sequence of events: First, the desert plants take in carbon dioxide from the atmosphere through small openings called stomata. Next, they absorb sunlight using chlorophyll present in their leaves or green parts. Water is absorbed from the soil through their roots. Using the energy from sunlight, the plants combine carbon dioxide and water to produce glucose (food) and release oxygen as a byproduct. This process is known as photosynthesis and provides the energy required for the plant's maintenance functions even in harsh desert conditions.

Key Points:

Desert plants take in carbon dioxide through stomata-Absorb sunlight using chlorophyll-Roots absorb water from soil-Photosynthesis combines CO_2 and water using sunlight to form glucose-Food synthesized provides energy for maintenance functions

(3) Write the chemical equation involved in the above process.

[1 Marks]

Answer:

The maintenance processes in living organisms require energy, which ultimately comes from the food prepared by autotrophs (producers) through the process of photosynthesis. The chemical equation for photosynthesis, which is the process that produces this food, is:$6CO_2 + 6H_2O$ + light energy → $C_6H_{12}O_6 + 6O_2$ This means that six molecules of carbon dioxide and six molecules of water, in the presence of light energy, produce one molecule of glucose (food) and six molecules of oxygen.

Key Points:

Energy for maintenance processes is obtained from food prepared by autotrophs-Photosynthesis is the process by which autotrophs prepare food-The chemical equation of photosynthesis: $6CO_2$+ 6HO + light energy → $C_6H_{12}O_6 + 6O_2$-This glucose is the source of energy for living organisms

(4)

Explain giving reasons what happens to the rate at which the green plants will prepare food

(I) during cloudy weather, and

(II) when stomata get blocked due to dust.

[2 Marks]

Answer: (I) During cloudy weather, the rate at which green plants prepare food decreases because there is less sunlight available for photosynthesis. Sunlight is essential as it provides the energy needed for plants to convert carbon dioxide and water into food. Less sunlight means less energy and hence, slower food preparation. (II) When the stomata get blocked due to dust, the rate of food preparation also decreases. Stomata are tiny openings on the surface of leaves that allow carbon dioxide to enter for photosynthesis. If these openings are blocked, carbon dioxide cannot enter efficiently, reducing photosynthesis and thus, slowing down the rate of food production in plants.

Key Points: Photosynthesis needs sunlight energy-Cloudy weather reduces sunlight availability-Reduced energy lowers food production-Stomata allow carbon dioxide entry-Blocked stomata prevent carbon dioxide intake-Less carbon dioxide reduces photosynthesis

Question 3.

In our homes, we receive the supply of electric power through a main supply also called mains, either supported through overhead electric poles or by underground cables. In our country the potential difference between the two wires (live wire and neutral wire) of this supply is 220 V.

(1)

Write the colours of the insulation covers of the line wires through which supply comes to our homes.

[1 Marks]

Answer: The supply of electric power to our homes comes through two line wires. The wire through which current flows to our home is called the live wire, and its insulation cover is red in colour. The other wire, called the neutral wire, has a black coloured insulation cover. These two wires together carry the supply voltage of 220 volts to our homes.

Key Points: Live wire has red insulation-Neutral wire has black insulation-Supply voltage between live and neutral is 220 volts

(2)

What should be the current rating of the electric circuit (220 V) so that an electric iron of 1 kW power rating can be operated ?

[1 Marks]

Answer: The power rating of the electric iron is 1 kW, which means it consumes 1000 watts of electric power. The voltage supplied is 220 V. To find the current rating required, we use the formula: Current (I) = Power (P) / Voltage (V). Substituting the values, I = 1000 watts / 220 volts = 4.54 amperes. Therefore, the electric circuit should have a current rating of about 5 amperes to safely operate the electric iron.

Key Points: Power rating of iron = 1000 W - Voltage supply = 220 V - Use formula Current = Power / Voltage - Calculate current, I = 1000 / 220 = 4.54 A - Current rating needed is approximately 5 A for safe operation

(3)

List two precautions to be taken to avoid electrical accidents. State how these precautions prevent possible damage to the circuit/appliance.

[2 Marks]

Answer: Two precautions to avoid electrical accidents are: 1) Use of fuses in the circuit. A fuse is connected in series with the live wire and it melts to break the circuit if the current exceeds a safe limit. This prevents damage to the wires and connected appliances by stopping excess current flow. 2) Proper insulation of wires. Live wires should always be properly insulated and should not be exposed. This prevents accidental contact with live wires, thus avoiding electric shocks and short circuits, protecting both people and electrical devices.

Key Points: Use of fuse - Fuse melts and breaks the circuit when current is too high - prevents damage to appliances-Proper insulation of wires - prevents accidental contact with live wire - avoids electric shocks and short circuits

(4)

What is the function of the earth wire ? State the advantage of the earth wire in domestic electric appliances such as electric iron.

[2 Marks]

Answer: The earth wire is a safety wire that protects people from electric shocks. Its function is to carry any leakage or fault current safely to the ground. In case of any fault in an appliance like an electric iron, the earth wire provides a path for the electric current to flow directly to the earth, preventing the metal body of the appliance from becoming live. This helps in avoiding electric shocks to the user. Thus, the advantage of the earth wire in domestic appliances like electric irons is that it ensures user safety by protecting against electric shocks when there is a fault.

Key Points: Earth wire is a safety wire-Earth wire carries fault current safely to the ground-It prevents electric shocks by making the appliance body safe-Helps in protecting users in case of electrical faults in appliances like electric iron

Section B

Question 4.

Electrolysis of water is a decomposition reaction. The mass ratio (M_H : M_O) of hydrogen and oxygen gases liberated at the electrodes during electrolysis of water is:

[1 Marks]

(A) 8 : 1

(B) 1 : 2

(C) 1 : 8

(D) 2 : 1

Explanation: The mass ratio of hydrogen to oxygen in water is always 1:8, meaning for every 1 gram of hydrogen, there are 8 grams of oxygen. During electrolysis, water decomposes into hydrogen and oxygen gases maintaining this mass ratio. Therefore, the correct mass ratio (M_H : M_O) of hydrogen to oxygen gases liberated is 1 : 8.

Question 5.

The products formed when Aluminium and Magnesium are burnt in the presence of air respectively are:

[1 Marks]

(A) Al_3O_4 and MgO

(B) Al_2O_3 and MgO

(C) Al_2O_3 and MgO_2

(D) Al_3O_4 and MgO_2

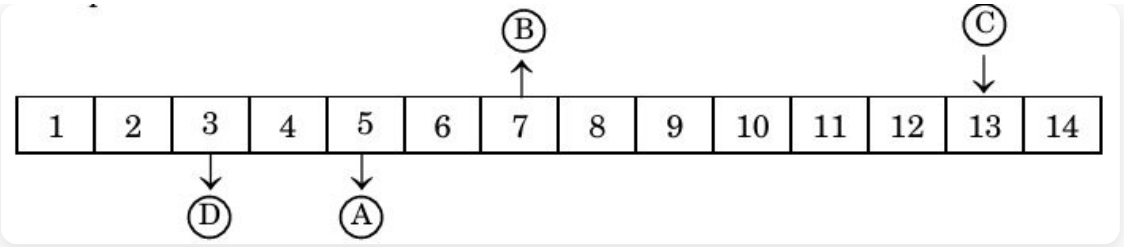
Explanation: When Magnesium burns in air, it reacts with oxygen to form Magnesium oxide (MgO), as confirmed by the provided context. Similarly, Aluminium burns in air to form Aluminium oxide (Al2O3). Therefore, the correct products are Aluminium oxide (Al2O3) and Magnesium oxide (MgO). The other options either have incorrect chemical formulas or incorrect products.

Question 6.

The following table shows the pH values of four solutions A, B, C and D on a pH scale:

The solutions A, B, C and D respectively are of a

[1 Marks]



(A) Weak acid, neutral, strong base, strong acid

(B) Weak acid, neutral, strong base, weak base

(C) Weak acid, neutral, weak base, strong base

(D) Strong acid, weak acid, neutral, strong base

Explanation: According to the pH scale, a pH value of 7 indicates a neutral solution, values less than 7 indicate acidic solutions (weak or strong acids depending on how low the pH is), and values greater than 7 indicate basic solutions (weak or strong bases depending on how high the pH is). Therefore, the solutions A, B, C, and D represent respectively a weak acid (pH slightly less than 7), neutral (pH 7), strong base (pH significantly greater than 7), and strong acid (pH significantly less than 7). This matches the option: Weak acid, neutral, strong base, strong acid.

Question 7.

Consider the following reactions:

(i) Dilute hydrochloric acid reacts with sodium hydroxide.

(ii) Magnesium oxide reacts with dilute hydrochloric acid.

(iii) Carbon dioxide reacts with sodium hydroxide.

It is found that in each case:

[1 Marks]

(A) Salt and water is formed.

(B) Neutral salts are formed.

(C) Hydrogen gas is formed.

(D) Acidic salts are formed.

Explanation: In all three reactions, an acid reacts with a base or an oxide/base to form salt and water. (i) Dilute hydrochloric acid and sodium hydroxide react to form salt (sodium chloride) and water. (ii) Magnesium oxide reacts with dilute hydrochloric acid to form magnesium chloride (a salt) and water. (iii) Carbon dioxide reacts with sodium hydroxide to form a salt (sodium carbonate or sodium bicarbonate) and water. Therefore, the correct answer is 'Salt and water is formed.'

Question 8.

Reaction between two elements A and B forms a compound C. A loses electrons and B gains electrons. Which one of the following properties will **not** be shown by compound C?

[1 Marks]

(A) It has weak electrostatic forces of attraction between its oppositely charged ions.

(B) It has high melting point.

(C) It is highly soluble in water.

(D) It conducts electricity in its molten state or aqueous solution.

Explanation:

Compound C is an ionic compound because element A loses electrons and element B gains electrons, forming ions. Ionic compounds have strong electrostatic forces of attraction between oppositely charged ions, resulting in high melting points, good solubility in water, and they conduct electricity in molten or aqueous states. Therefore, the property that will not be shown by compound C is 'It has weak electrostatic forces of attraction between its oppositely charged ions' because ionic compounds actually have strong electrostatic forces. Hence, the correct option is the one stating the compound has weak electrostatic forces, as this is not true for ionic compounds.

Question 9.

The metals obtained from their molten chlorides by the process of electrolytic reduction are:

[1 Marks]

(A) Calcium and magnesium

(B) Sodium and iron

(C) Aluminium and silver

(D) Gold and silver

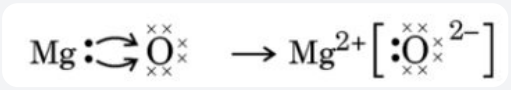
Explanation: The correct option is Calcium and magnesium. These metals, along with sodium, are highly reactive and cannot be extracted by traditional methods like reduction using carbon. They are obtained by electrolytic reduction of their molten chlorides. During this process, the metal ions gain electrons at the cathode to form the metal, while chlorine gas is released at the anode. Therefore, calcium and magnesium are extracted by electrolytic reduction of their molten chlorides.

Question 10.

The formation of magnesium oxide is correctly shown in option:

[1 Marks]

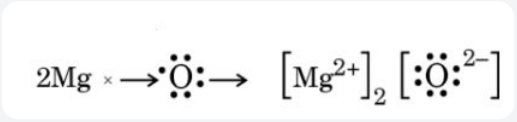
(A)



(B)



(C)



(D)



Explanation: The balanced chemical equation for the formation of magnesium oxide is 2 Mg + O_2 → 2 MgO. This means two atoms of magnesium react with one molecule of oxygen gas to produce two units of magnesium oxide, which is a white solid. This equation correctly represents the reactants and products in this reaction.

Question 11. Secretion of less saliva in the mouth will affect the conversion of:

[1 Marks]

(A) Fats into fatty acids and glycerol

(B) Proteins into amino acids

(C) Starch into simple sugars

(D) Sugars into alcohol

Explanation: Saliva contains the enzyme salivary amylase which breaks down starch, a complex carbohydrate, into simple sugars. If less saliva is secreted, the amount of salivary amylase decreases, resulting in less conversion of starch into simple sugars. Therefore, secretion of less saliva will affect the conversion of starch into simple sugars.

Question 12. The plant hormone whose concentration stimulates the cells to grow longer on the side of the shoot which is away from light is:

[1 Marks]

(A) Cytokinins

(B) Gibberellins

(C) Auxins

(D) Adrenaline

Explanation: The correct answer is Auxins. According to the context, when light comes from one direction, auxin diffuses towards the shady side of the shoot and accumulates there. This higher concentration of auxin causes the cells on the shaded side to elongate more, making the shoot bend towards the light. Cytokinins promote cell division, gibberellins promote stem growth but not specifically in response to light, and adrenaline is not a plant hormone.

Question 13.

The correct/true statement(s) for a bisexual flower is/are:

(i) They possess both stamen and pistil.

(ii) They possess either stamen or pistil.

(iii) They exhibit either self-pollination or cross-pollination.

(iv) They cannot produce fruits on their own.

[1 Marks]

(A) (i) and (iii)

(B) (i) only

(C) (iv) only

(D) (i) and (iv)

Explanation: The correct statements are (i) and (iii). A bisexual flower contains both stamens (male reproductive part) and pistils (female reproductive part), which makes statement (i) true. Such flowers can undergo self-pollination (pollen from the same flower fertilizes the ovule) or cross-pollination (pollen from another flower fertilizes the ovule), so statement (iii) is also true. Statement (ii) describes unisexual flowers which have either stamens or pistils, not both, so it is false for bisexual flowers. Statement (iv) is incorrect since bisexual flowers can produce fruits on their own due to having both reproductive parts.

Question 14.

If pea plants with round and green seeds (RRyy) are crossed with pea plants having wrinkled and yellow seeds (rrYY), the seeds developed by the plants of F_1 generation will be:

[1 Marks]

(A) 75% wrinkled and yellow

(B) 100% round and yellow

(C) 50% round and green

(D) 75% wrinkled and green

Explanation:

When pea plants with genotype RRyy (round and green seeds) are crossed with plants having rrYY (wrinkled and yellow seeds), the F_1 generation will have the genotype RrYy. Since round (R) is dominant over wrinkled (r), and yellow (Y) is dominant over green (y), all the F_1 seeds will be round and yellow. Therefore, the correct option is 100% round and yellow.

Question 15. The breakdown of glucose has taken the following pathway: Glucose (a) → Pyruvate + Energy (b) → Lactic acid + Energy. The sites 'a' and 'b' respectively are:

[1 Marks]

(A) Mitochondria and Oxygen deficient muscle cells

(B) Cytoplasm and Yeast cells

(C) Cytoplasm and Oxygen rich muscle cells

(D) Cytoplasm and Oxygen deficient muscle cells

Explanation: The breakdown of glucose first occurs in the cytoplasm, where glucose is converted into pyruvate through glycolysis. When oxygen is absent or deficient, such as in oxygen-deficient muscle cells, pyruvate is then converted into lactic acid to produce energy. Therefore, the site 'a' is the cytoplasm, and site 'b' refers to oxygen-deficient muscle cells where lactic acid is formed.

Question 16.

Mirror ‘X’ is used to concentrate sunlight in solar furnace and Mirror ‘Y’ is fitted on the side of the vehicle to see the traffic behind the driver. Which of the following statements are true for the two mirrors ?

(i) The image formed by mirror ‘X’ is real, diminished and at its focus.

(ii) The image formed by mirror ‘Y’ is virtual, diminished and erect.

(iii) The image formed by mirror ‘X’ is virtual, diminished and erect.

(iv) The image formed by mirror ‘Y’ is real, diminished and at its focus.

[1 Marks]

(A) (ii) and (iii)

(B) (iii) and (iv)

(C) (i) and (iv)

(D) (i) and (ii)

Explanation: Mirror X is a concave mirror used to concentrate sunlight in a solar furnace. Concave mirrors can form real images which are inverted and can be diminished if the object is beyond the focus, and the image is formed at the focus when the object is at infinity. Therefore, statement (i) is correct. Mirror Y is a convex mirror fitted on the side of vehicles to see traffic behind the driver. Convex mirrors always form virtual, erect, and diminished images regardless of object position. Hence, statement (ii) is correct. Statements (iii) and (iv) are false because mirror X does not form virtual images in this context and mirror Y does not form real images.

Question 17. An old person is suffering from an eye defect caused by weakening of ciliary muscles and diminishing flexibility of the eye lens. If the defect of vision is 'a' which can be corrected by lens 'b', then 'a' and 'b' respectively are:

[1 Marks]

(A) Hypermetropia and convex lens

(B) Myopia and concave lens

(C) Presbyopia and bifocal lens

(D) Myopia and bifocal lens

Explanation: The correct answer is 'Presbyopia and bifocal lens'. Presbyopia is the eye defect caused due to the gradual weakening of ciliary muscles and diminishing flexibility of the eye lens, common in old age. This makes it difficult to see nearby objects clearly. It is often corrected by bifocal lenses, which have two parts: the upper part with a concave lens for distant vision and the lower part with a convex lens for near vision. This matches the description given in the context.

Question 18.

Which of the following groups do not constitute a food chain?

(i) Wolf, rabbit, grass, lion

(ii) Plankton, man, grasshopper, fish

(iii) Hawk, grass, snake, grasshopper, frog

(iv) Grass, snake, wolf, tiger

[1 Marks]

(A) (ii) and (iv)

(B) (ii) and (iii)

(C) (i) and (iii)

(D) (i) and (iv)

Explanation:

A food chain shows a sequence where one organism eats another. The correct food chain sequence follows the flow: producer → primary consumer → secondary consumer → tertiary consumer, etc. (i) Wolf, rabbit, grass, lion: This group is not a proper food chain because the lion cannot eat grass (a producer), and the sequence is not in the correct eating order. (ii) Plankton, man, grasshopper, fish: This group is incorrect because man and grasshopper do not follow a proper sequence. Also, fish and grasshopper belong to different food chains and habitats. (iii) Hawk, grass, snake, grasshopper, frog: This group is incorrect as the hawk would not be at the start, and the order is jumbled. A proper sequence is grass → grasshopper → frog → snake → hawk. (iv) Grass, snake, wolf, tiger: This group does not form a correct food chain since wolves don't typically eat snakes, and this sequence is not linear or connected properly. Therefore, options (i) and (iv) do not constitute a food chain.

Question 19.

The percentage of solar energy which is not converted into food energy by the leaves of green plants in a terrestrial ecosystem is about:

[1 Marks]

(A) 90%

(B) 10%

(C) 1%

(D) 99%

Explanation: Green plants capture only about 1% of the solar energy that falls on their leaves and convert it into food energy. This means that approximately 99% of the solar energy is not converted into food energy by the leaves. Therefore, the correct answer is 99%.

Question 20.

Assertion (A): Decomposition reactions are generally endothermic reactions.

Reason (R): Decomposition of organic matter into compost is an exothermic process.

[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 false, but Reason (R) is true.

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

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

Explanation: The assertion is true because most decomposition reactions require energy (heat, light, or electricity) to break down the compounds, making them endothermic. However, the decomposition of organic matter into compost is an example of an exothermic reaction where heat is released during the process. Therefore, both the assertion and reason are true, but the reason does not explain the assertion.

Question 21.

Assertion (A): A human child bears all the basic features of human beings.

Reason (R): It looks exactly like its parents, showing very little variations.

[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 false, but Reason (R) is true.

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

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

Explanation: The Assertion (A) is true because a human child does have all the basic features of human beings. However, the Reason (R) is false because a child does not look exactly like its parents; there are variations due to genetic inheritance. Therefore, the correct option is: Assertion (A) is true, but Reason (R) is false.

Question 22.

Assertion (A): No two magnetic field lines are found to cross each other.

Reason (R): The compass needle cannot point towards two directions at the point of intersection of two magnetic field lines.

[1 Marks]

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

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

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

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

Explanation: Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). Magnetic field lines never cross each other because if they did, at the point of intersection, a compass needle placed there would point in two different directions simultaneously, which is not possible. Therefore, the compass needle's inability to point in two directions explains why magnetic field lines do not cross.

Question 23.

Assertion (A): The amount of ozone in the atmosphere began to drop sharply in the 1980s.

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

[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) 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: Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). The amount of ozone in the atmosphere began to drop sharply in the 1980s due to the effect of harmful chemicals like CFCs damaging the ozone layer. The Reason (R) describes the formation of ozone when oxygen atoms combine with molecular oxygen, which is a true process but does not explain why the ozone amount dropped sharply.

Section C

Question 24. Draw labelled diagrams to show different stages of budding in Hydra.

[2 Marks]

Answer: Budding in Hydra starts with a small bulge called a bud forming on the side of the parent Hydra. This bud grows gradually, developing tiny tentacles similar to those of the parent. Eventually, the bud fully develops into a miniature Hydra and detaches from the parent body, becoming an independent organism. The stages include the initial bud formation, bud growth with tentacle development, and final detachment.

Key Points: Small bud formation on parent body-Growth of bud with tentacles-Development into full Hydra-Detachment of new Hydra from parent

Question 25. Besides minimising the loss of blood, why is it essential to plug any leak in a blood vessel? Name the component of blood which helps in this process and state how this component performs this function.

[2 Marks]

Answer: Plugging any leak in a blood vessel is essential not only to prevent blood loss but also to maintain blood pressure. Loss of pressure due to leakage can reduce the efficiency of the heart's pumping system, affecting blood circulation. The component of blood responsible for plugging these leaks is called platelets. Platelets circulate throughout the body and immediately gather at the site of injury. They help in clotting the blood by sticking together and forming a plug that seals the wound to stop bleeding and prevent further loss of blood and pressure.

Key Points: Leak in blood vessel causes loss of blood and pressure-Maintaining blood pressure is necessary for efficient heart pumping-Platelets are the component that plugs leaks-Platelets help clot blood by forming plugs at injury sites-This process stops bleeding and maintains pressure

Question 26. An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. Use lens formula to find the position of the image formed in this case.

[2 Marks]

Answer: Given: Object distance u = -60 cm (since the object is in front of the lens), Focal length f = -30 cm (concave lens has negative focal length). Using the lens formula, 1/f = 1/v - 1/u. Substituting values: 1/(-30) = 1/v - 1/(-60). Simplifying, 1/v = 1/(-30) + 1/60 = (-2 + 1)/60 = -1/60. Therefore, v = -60 cm. The negative sign means the image is formed on the same side as the object, at 60 cm from the lens. So, the image is virtual, upright, and reduced in size, located 60 cm in front of the lens.

Key Points: State given values and sign conventions-Apply lens formula clearly-Calculate 1/v stepwise-Interpret the negative value of v-Conclusion about image nature

and position

Question 27. Define electric power. When do we say that the power consumed in an electric circuit is 1 watt?

[2 Marks]

Answer: Electric power is the rate at which electrical energy is consumed or converted into another form of energy in an electric circuit. The SI unit of electric power is watt (W). We say that the power consumed in an electric circuit is 1 watt when the energy consumption rate is one joule per second. Practically, this means a device consuming 1 ampere of current at a potential difference of 1 volt is using power equal to 1 watt.

Key Points: Definition of electric power - Unit of power is watt (W) - Power of 1 watt means energy consumption at the rate of 1 joule per second - Power = 1 watt when current is 1 ampere and potential difference is 1 volt - Electric power is the rate of electric energy consumption

Question 28. 'Excessive use of chemicals and pesticides in agriculture adversely effect the environment.' Justify this statement.

[2 Marks]

Answer: Excessive use of chemicals and pesticides in agriculture causes environmental problems. These chemicals are sprayed on plants or used to treat seeds and soil. When used excessively, they contaminate soil and water bodies as they get washed away by rain. This pollution harms many plant and animal species because these chemicals are often poisonous. Overusing fertilizers destroys soil fertility by killing valuable micro-organisms and reducing organic matter. It also leads to water pollution. Therefore, using too many chemicals in farming adversely affects the environment.

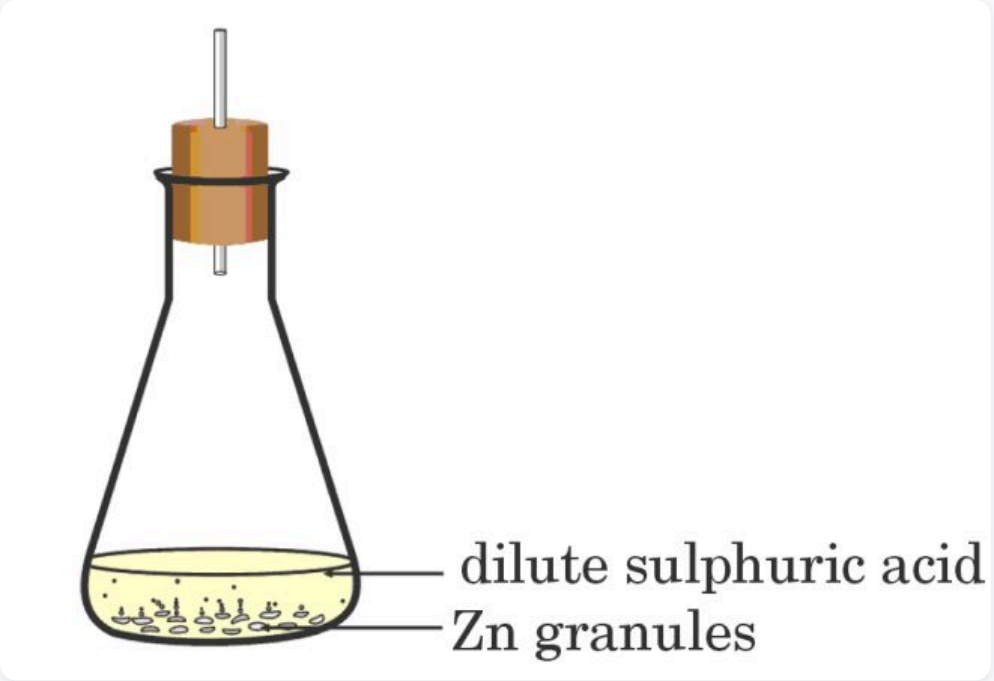
Key Points: Chemicals and pesticides are used to protect crops- Excessive use leads to soil and water pollution- Chemicals are poisonous to plants and animals- Overuse of fertilizers harms soil fertility- Chemicals get washed into water bodies- Pollution affects ecosystem balance- Need to limit chemical use and use organic alternatives

Question 29.

A student performs the following experiment in his school laboratory.

List two observations to justify that in this experiment a chemical change has taken place.

[2 Marks]



Answer: Two observations that justify that a chemical change has taken place in the experiment are: (1) There is a change in colour of the substance, indicating the formation of a new substance. (2) A gas is evolved during the experiment, which shows a chemical reaction is occurring. These observations confirm that a chemical change has occurred as physical changes do not involve such changes.

Key Points: Change in colour-Evolution of a gas-Formation of a new substance indicates chemical change

Question 30.

(i) The transport system in plants is relatively slower than in animals. Give reasons.

(ii) State the role of phloem in the transport of materials in plants.

[2 Marks]

Answer:

(i) The transport system in plants is slower than in animals because plants rely on passive transport mechanisms like diffusion and transpiration pull, which are naturally slower processes. Additionally, plants have rigid cell walls and large vacuoles that limit quick movement, and the transport occurs mainly through xylem and phloem which are less dynamic than animal circulatory systems.

(ii) Phloem is responsible for transporting food, especially sugars produced by photosynthesis in the leaves, to all parts of the plant. It consists of sieve tubes and companion cells that help move nutrients from the leaves to roots, stems, and growing parts, ensuring energy supply throughout the plant.

Key Points: Transport in plants is slower - due to passive transport like diffusion and transpiration pull- plant cells have rigid walls and large vacuoles- transport is through

vascular tissues (xylem and phloem)- Phloem transports food (sun-made sugars)- Phloem consists of sieve tubes and sieve plates- Phloem moves food from leaves to other parts of the plant- Ensures distribution of energy for growth and development

Question 31.

A wire of resistance R is cut into three equal parts. If these three parts are then joined in parallel, calculate the total resistance of the combination so formed.

[2 Marks]

Answer: When a wire of resistance R is cut into three equal parts, each part will have resistance equal to R/3 since resistance is directly proportional to length. Joining these three parts in parallel, the reciprocal of the total resistance (R_total) is the sum of the reciprocals of each of the three resistances: 1/R_total = 1/(R/3) + 1/(R/3) + 1/(R/3). Simplifying, 1/R_total = 3/(R/3) = 9/R. Therefore, R_total = R/9. Hence, the total resistance when the three parts are joined in parallel is one-ninth of the original resistance R.

Key Points: Resistance of each part after cutting is R/3 - Total resistance for parallel resistors is given by 1/R_total = sum of reciprocals - For three equal resistances in parallel 1/R_total = 3/(R/3) = 9/R - Therefore, R_total = R/9

Section D

Question 32.

(a) ‘‘Displacement reactions also play a key role in extracting metals in the middle of the reactivity series.’’ Justify this statement with two examples.

(b) Why can metals high up in the reactivity series not be obtained by reduction of their oxides by carbon ?

[3 Marks]

Answer: (a) Displacement reactions are important in extracting metals, especially those in the middle of the reactivity series. In these reactions, a more reactive metal displaces a less reactive metal from its compound. For example, when aluminium powder is heated with manganese dioxide, aluminium displaces manganese, producing pure manganese metal and aluminium oxide. Another example is zinc displacing copper from copper sulfate solution. Such reactions help in obtaining pure metals from their compounds.

(b) Metals that are high up in the reactivity series, such as sodium, calcium, and aluminium, cannot be obtained by reduction of their oxides using carbon because these metals form very stable oxides and

carbon is not reactive enough to reduce them. Instead, more reactive metals like aluminium are used as reducing agents to extract metals lower in the series. High-reactivity metals require other extraction methods like electrolysis to be obtained in pure form.

Key Points: Displacement reactions involve a more reactive metal displacing a less reactive metal from its compound-They help in extracting metals from their compounds. Examples include aluminium displacing manganese from manganese dioxide and zinc displacing copper in solution-Metals high up in the reactivity series form stable oxides and cannot be reduced by carbon-These metals require stronger reducing agents or electrolysis for extraction

Question 33. With the help of an activity, explain the conditions under which iron articles get rusted.

[3 Marks]

Answer: To understand the conditions under which iron rusts, we can perform a simple activity. Take three test tubes labeled A, B, and C, and place clean iron nails in each of them. In test tube A, pour water; in test tube B, pour water and add some oil to prevent air from reaching the water; in test tube C, leave it dry without water. Observe these test tubes over a few days. The nail in test tube A will start rusting because it is exposed to both water and air, which are necessary for rusting. The nail in test tube B will not rust because the oil layer prevents air from reaching the water, so rusting does not occur. The nail in test tube C will also not rust as there is no moisture present, even though air is present. From this activity, we learn that iron rusts only when both air and water are present. Rusting is a chemical reaction where iron reacts with oxygen and moisture to form hydrated iron oxide, which weakens the iron. Therefore, air (oxygen) and water (moisture) are essential conditions for rust to form on iron articles.

Key Points: Performing an activity with iron nails in test tubes to demonstrate rusting- Test tubes with different conditions: with water, with water and oil, and dry- Observation that rust appears only when water and air are both present- Explanation that rust forms due to reaction of iron with oxygen and moisture- Conclusion that both air and water are essential for rusting to occur

Question 34.

Plants have neither a nervous system nor muscles, even then they respond to stimuli. For example, the leaves of chhui-mui (touch-me-not) plant when touched begin to fold up and droop.

(a) How is the information communicated in ‘‘touch-me-not’’ plants ?

(b) What enables the plant cells to bring out the observable response ?

(c) Differentiate the movement mentioned above from the movement of tendrils in a pea plant.

[3 Marks]

Answer: (a) In touch-me-not plants, when the leaves are touched, the information about the stimulus is communicated from cell to cell by electrical and chemical signals. Even though plants do not have nervous tissue, these signals travel through the cells to reach the parts of the leaf that respond.

(b) The plant cells respond because they can quickly lose water from specialized cells at the base of the leaflets called pulvini cells. The loss of water changes the turgor pressure inside these cells, causing the leaves to fold and droop.

(c) The movement of the touch-me-not plant is a rapid response caused by changes in cell turgor pressure without growth, and it happens quickly after the stimulus. In contrast, the movement of tendrils in a pea plant is a slow movement that involves growth and bending towards support (a directional growth response called tropism), which helps the plant climb.

> **Key Points: Information communicated by electrical and chemical signals from cell to cell-Response by changes in turgor pressure in pulvini cells causing leaf folding-Movement in touch-me-not is rapid and turgor based without growth whereas tendril movement is slow, growth based and a tropic response**

Question 35.

(a) What are chromosomes ?

(b) Explain in brief how stability of DNA content of a species is ensured in sexually reproducing organisms ?

[3 Marks]

Answer:

(a) What are chromosomes?
Chromosomes are thread-like structures located inside the nucleus of cells. They are made of DNA and proteins. Chromosomes carry genetic information in the form of genes, which determine the hereditary traits passed from parents to offspring. Each chromosome consists of two identical sister chromatids joined together after replication.

(b) How is the stability of DNA content ensured in sexually reproducing organisms?
In sexually reproducing organisms, stability of DNA content is maintained through the process of meiosis. Male and female gametes (sperm and egg) are produced with half the number of chromosomes (haploid). When these gametes fuse during fertilization, they restore the full number of chromosomes (diploid) in the new organism. This ensures that each generation has the same chromosome number and maintains genetic stability across generations.

Key Points: Chromosomes carry genetic information-DNA and proteins compose chromosomes-Chromosomes have sister chromatids after replication-Gametes are reproductive cells containing half chromosomes-Meiosis halves chromosome number in gametes-Fertilization restores chromosome number in zygote-DNA content stability maintained generation to generation

Question 36.

Draw ray diagrams to show the nature, position and relative size of the image formed by a convex mirror when the object is placed

(i) at infinity and

(ii) between infinity and pole P of the mirror.

[3 Marks]

Answer:

(i) When the object is at infinity, the rays coming from the object are parallel to the principal axis. After reflection from the convex mirror, these rays diverge as if they are coming from the focus (F) behind the mirror. The image formed is virtual, highly diminished, erect, and located at the focus of the mirror behind the pole.

(ii) When the object is placed between infinity and the pole (P) of the convex mirror, the rays diverge after reflection. By tracing the reflected rays backwards, they appear to come from a point behind the mirror. The image formed is virtual, erect, diminished compared to the object, and located between the focus (F) and the pole (P) behind the mirror.

Thus, in both cases, the image formed by a convex mirror is virtual, erect, and smaller than the object, with its position changing depending on the location of the object.

Key Points: Convex mirror diverges rays-Image formed is virtual and erect-Image is formed behind the mirror-At infinity, image is at focus and highly diminished-At finite distance, image is between focus and pole and diminished

Question 37.

Consider the following electric circuit :

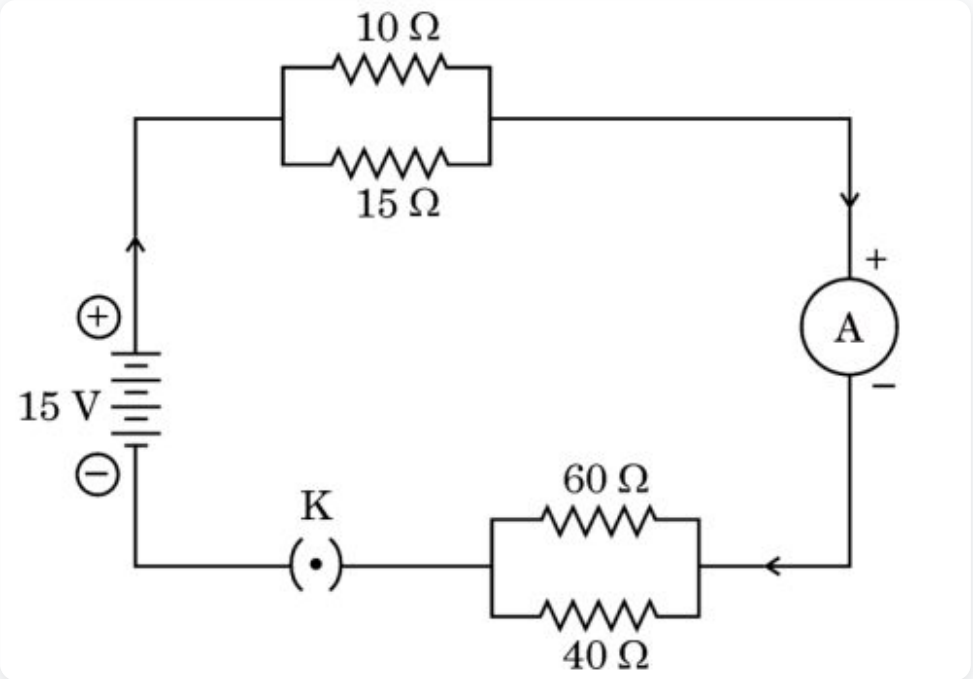
Calculate the values of the following :

(a) The total resistance of the circuit

(b) The total current drawn from the source

(c) potential difference across the parallel combination of 10 Ω and 15 Ω resistors

[3 Marks]



Answer:

(a) To find the total resistance of the circuit, first calculate the equivalent resistance of the resistors in parallel. For the 10 Ω and 15 Ω resistors in parallel, the combined resistance $R_{parallel}$is found using the formula: $1/R_{parallel} = 1/10 + 1/15$. This gives $R_{parallel} = 6\ \Omega$. If this parallel combination is in series with other resistors, add their resistances to $R_{parallel}$ to get the total resistance R_{total}

(b) Using the total resistance found, calculate the total current drawn from the source using Ohm's law: $I_{total} = V / R_{total}$, where V is the voltage of the source.

(c) The potential difference across the parallel combination of 10 Ω and 15 Ω resistors is equal to the voltage drop across $R_{parallel}$. Since resistors in parallel have the same voltage across them, this value can be found by calculating I_{total} multiplied by the resistance of the series resistors before the parallel section, then subtracting from the total voltage to get the voltage across the parallel resistors.

Key Points:

Calculate the equivalent resistance of parallel resistors-Use the formula $1/R_{parallel} = 1/R1 + 1/R2$-Determine total resistance by adding series resistors-Apply Ohm's law to find total current ($I = V/R_{total}$)-Voltage across parallel resistors is same for each resistor-Calculate potential difference using voltage division if series resistors present

Question 38.

(a) Write the relationship between resistivity and resistance of a cylindrical conductor of length l and area of cross-section A. Hence derive the SI unit of resistivity.

(b) Why are alloys used in electrical heating devices ?

[3 Marks]

Answer:

(a) The resistance R of a cylindrical conductor depends on its length l, area of cross-section A, and the material's resistivity ρ. The relationship is given by $R = \rho (l / A)$. This means resistance is directly proportional to length and resistivity, and inversely proportional to the area of cross-section. Here, resistivity ρ is a property of the material which quantifies how strongly it opposes the flow of electric current.

From the formula $R = \rho (l/A)$, we can express resistivity as $\rho = R (A/l)$.

Since resistance R is measured in ohms (Ω), length l in meters (m), and area A in square meters (m^2), the SI unit of resistivity is ohm-meter (Ω·m).

(b) Alloys are used in electrical heating devices because they generally have higher resistivity than pure metals. This higher resistivity allows them to generate heat more efficiently when current passes through. Additionally, alloys do not oxidize or burn easily at high temperatures, making them durable and safe materials for devices like electric irons and toasters.

Key Points: Relationship between resistance, resistivity, length, and area: $R = \rho (l / A)$-Resistivity ρ is a material property representing resistance per unit length and unit area-Expression of resistivity $\rho = R (A / l)$-SI unit of resistivity is ohm-meter (Ω·m)-Alloys have higher resistivity than pure metals-Alloys resist oxidation and burning at high temperatures-Alloys are used in heating elements like irons and toasters for safety and efficiency

Question 39.

(i) Name two metals which react violently with cold water. List any three observations which a student notes when these metal are dropped in a beaker containing water.

(ii) Write a test to identify the gas evolved (if any) during the reaction of these metals with water.

[3 Marks]

Answer:

(i) Two metals which react violently with cold water are sodium and potassium.

When sodium or potassium is dropped into a beaker containing cold water, a student may observe the following:

- Fizzing or bubbling due to the release of gas.
- The metal piece may start to move or float on the water surface.
- In the case of potassium, it often catches fire with a lilac-colored flame.

(ii) The gas evolved during the reaction of these metals with water is hydrogen. To test for hydrogen gas, bring a burning splinter near the mouth of the test tube containing the collected gas. If the gas is hydrogen, it will burn with a characteristic pop sound.

Key Points: Sodium and potassium react violently with cold water-Fizzing or bubbling observed-Metal floats or moves on water surface-Potassium may catch fire producing lilac flame-Hydrogen gas evolved-Test for hydrogen using burning splinter that produces pop sound

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Section E

Question 40.

(i) Draw two isomeric structures of Butene (C_4H_8).

(ii) Name the following compounds :

(I) structure 1,

(II) structure 2.

(iii) Write the chemical equations for the following reactions. Mention one essential condition each for these reactions to take place.

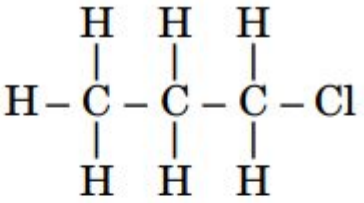
(I) Ethanol undergoes complete oxidation

(II) Propene undergoes hydrogenation

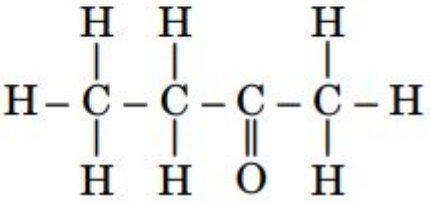
(III) Ethanoic acid reacts with ethanol

[5 Marks]

(I)



(II)



Answer:

(i) Two isomeric structures of Butene (C_4H_8) are:

1. 1-Butene:CH_2=CH–CH_2–CH_3 (Double bond between first and second carbon atoms)
2. 2-Butene: CH_3–CH=CH–CH_3 (Double bond between second and third carbon atoms)

(ii) Names of the given structures:

(I) Structure 1 is 1-Butene
(II) Structure 2 is 2-Butene

(iii) Chemical equations and conditions for reactions:

(I) Ethanol undergoes complete oxidation:
Equation: $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
Condition: Presence of a catalyst like copper or heating with oxygen
This reaction is combustion and complete oxidation of ethanol producing carbon dioxide and water.

(II) Propene undergoes hydrogenation:
Equation:CH_3–CH=CH_2 + H_2 → CH_3–CH_2–CH_3
Condition: Presence of a catalyst such as finely divided nickel, at room temperature
Hydrogenation is the addition of hydrogen to the double bond converting an alkene to an alkane.

(III) Ethanoic acid reacts with ethanol:
Equation: $CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$
Condition: Presence of concentrated sulfuric acid as a catalyst and heating
This is an esterification reaction, where ethyl acetate (an ester) and water are formed.

Key Points: Draw two isomers of butene with double bonds at different positions-Naming of 1-butene and 2-butene-Write the balanced chemical equations for complete oxidation of ethanol, hydrogenation of propene and esterification of ethanoic acid with

ethanol-Mention essential conditions for each reaction such as catalyst or heating-Explain briefly the nature of each reaction (combustion, hydrogenation, esterification)

Question 41.

(i) Write the functions of the following parts of the human female reproductive system:

(I) Ovary,

(II) Fallopian tube,

(III) Uterus.

(ii) State briefly two contraceptive methods used by human males.

[5 Marks]

Answer:

(i) Functions of parts of the female reproductive system:

(I) Ovary: The ovaries are two small, oval-shaped organs located on each side of the uterus. Their main functions are to produce female sex hormones like estrogen and progesterone, which regulate the menstrual cycle and help develop female secondary sexual characteristics. The ovaries also produce and release eggs (ova) through a process called ovulation.

(II) Fallopian tube: Also called the oviduct, the fallopian tubes are narrow tubes that connect the ovaries to the uterus. Their primary function is to transport the released egg from the ovary to the uterus. Fertilization, where sperm meets the egg, usually takes place inside the fallopian tubes.

(III) Uterus: The uterus is a hollow, pear-shaped organ where a fertilized egg implants and develops into a fetus. Each month, its inner lining thickens in preparation to support a fertilized egg. If fertilization does not occur, this lining sheds during menstruation.

(ii) Two contraceptive methods used by human males:

1. Use of condoms: Condoms are a barrier method worn over the penis during sexual intercourse to prevent sperm from entering the female reproductive tract, thereby avoiding pregnancy.

2. Sterilization (vasectomy): This is a surgical procedure where the vas deferens (sperm-carrying tubes) are cut or sealed to prevent sperm from mixing with semen, resulting in permanent contraception.

Key Points: Ovary-produces eggs and female hormones like estrogen and progesterone; regulates menstrual cycle and secondary sexual characteristics-Fallopian tube-transports egg to uterus; site of fertilization-Uterus-supports fertilized egg; thickens lining monthly; sheds lining if no fertilization-Contraceptive methods in males include

condoms that block sperm entry and vasectomy which permanently prevents sperm release

Question 42.

(i) The power of a lens 'X' is – 2·5 D. Name the lens and determine its focal length in cm. For which eye defect of vision will an optician prescribe this type of lens as a corrective lens ?

(ii) ''The value of magnification 'm' for a lens is – 2.'' Using new Cartesian Sign Convention and considering that an object is placed at a distance of 20 cm from the optical centre of this lens, state :

(I) the nature of the image formed;

(II) size of the image compared to the size of the object;

(III) position of the image, and

(IV) sign of the height of the image.

(iii) The numerical values of the focal lengths of two lenses A and B are 10 cm and 20 cm respectively. Which one of the two will show higher degree of convergence/divergence ? Give reason to justify your answer.

[5 Marks]

Answer:

(i) The power of the lens X is –2.5 D. Since the power is negative, the lens is a concave lens. The focal length f of the lens is related to its power P by the formula: f = 100 / P (in cm). Substituting P = –2.5, we get f = 100 / (–2.5) = –40 cm. The negative focal length confirms it is a concave lens. This type of lens is prescribed by an optician to correct myopia (nearsightedness), which occurs either due to the eye lens having too short a focal length or the eyeball being too long. The concave lens diverges the rays before they enter the eye, enabling the image to form on the retina.

(ii) Given magnification m = –2 and object distance u = –20 cm (object distances are negative as per new Cartesian sign convention).

- (I) Nature of the image: Since magnification is negative, the image formed is real and inverted.
- (II) Size of the image: Magnification of –2 means the image is twice the size of the object.
- (III) Position of the image: Magnification m = v/u, so v = m × u = –2 × (–20 cm) = +40 cm. The positive image distance indicates the image is formed on the opposite side of the lens, confirming it is real.
- (IV) Sign of the height of the image: Since magnification is negative, the height of the image is negative, indicating the image is inverted relative to the object.

(iii) Lens A has focal length f_A = 10 cm and lens B has focal length f_B = 20 cm. The degree of convergence or divergence of a lens is inversely proportional to its focal length. The lens with a

smaller focal length will have a higher degree of convergence (if convex) or divergence (if concave). Therefore, lens A with 10 cm focal length has a higher degree of convergence/divergence than lens B with 20 cm focal length because 10 cm is smaller than 20 cm, so lens A bends the light rays more strongly than lens B.

Key Points: Power of lens formula-f=100/Pcm-negative power indicates concave lens-power -2.5D => focal length -40cm-lens used to correct myopia-image characteristics linked to magnification (sign and magnitude)-magnification formula m = v/u-calculation of image position and nature-based on magnification sign-image size related to magnification magnitude-smaller focal length gives higher convergence or divergence-lens A focal length 10 cm smaller than lens B 20 cm-higher bending power means higher convergence/divergence

Question 43.

(i) A carbon compound X is a good solvent. On reaction with sodium, X forms two products Y and Z. Z is used to convert vegetable oil into vegetable ghee. Identify and name X, Y and Z. Also write the equation of reaction of X with sodium to justify your answer.

(ii) Write chemical equation to show what happens when ethanol :

(I) burns in oxygen/air.

(II) is heated at 443 K in excess conc. H_2SO_4.

(III) reacts with acidified potassium dichromate.

[5 Marks]

Answer:

Part (i):
The carbon compound X mentioned is ethanol (C_2H_5OH), which is a good solvent. When ethanol reacts with sodium, it produces sodium ethoxide (Y) and hydrogen gas (Z). Here, sodium ethoxide is the product Y, and hydrogen gas is Z. Hydrogen gas (Z) is used in the hydrogenation process to convert vegetable oil into vegetable ghee.

The reaction is:
$2Na + 2C_2H_5OH \rightarrow 2C_2H_5ONa + H_2$

Part (ii):
(I) When ethanol burns in oxygen/air, it undergoes complete combustion to form carbon dioxide and water.
$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

(II) When ethanol is heated at 443 K in excess concentrated sulfuric acid, it undergoes dehydration to form ethene (an unsaturated hydrocarbon) and water.

$C_2H_5OH \longrightarrow (\text{conc. } H_2SO_4, 443\ K)\ C_2H_4 + H_2O$

(III) When ethanol reacts with acidified potassium dichromate, it gets oxidized to form ethanoic acid (acetic acid). The color of the solution changes from orange to green.

$3C_2H_5OH + 2K_2Cr_2O_7 + 8H_2SO_4 \rightarrow 3CH_3COOH + 2Cr_2(SO_4)_3 + 2K_2SO_4 + 11H_2O$

Key Points:

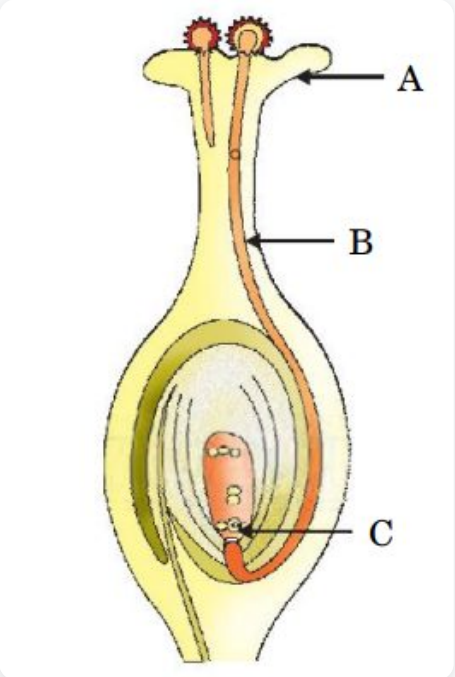
Identify X as ethanol (a good solvent)-Reaction of ethanol with sodium produces sodium ethoxide (Y) and hydrogen gas (Z)-Hydrogen gas is used to hydrogenate vegetable oil into ghee-Write balanced chemical equation for ethanol and sodium reaction-Write combustion reaction of ethanol with oxygen-Write dehydration of ethanol to ethene using concentrated H_2SO_4 at 443 K-Oxidation of ethanol to ethanoic acid using acidified potassium dichromate with color change

Question 44.

(i) Differentiate between self-pollination and cross-pollination.

(ii) Identify A, B and C in the diagram given below and write one function of each.

[5 Marks]



Answer: (i) Difference between Self-pollination and Cross-pollination:

Self-pollination occurs when pollen from the anther of a flower lands on the stigma of the same flower or another flower on the same plant. This means the pollen and stigma belong to the same plant. It

helps in reproduction but results in less genetic variation.

Cross-pollination is the transfer of pollen grains from the anther of one flower to the stigma of a flower on a different plant of the same species. This process increases genetic diversity and helps plants adapt to changing environments.

In brief:
- Self-pollination: Pollen → stigma (same flower or same plant).
- Cross-pollination: Pollen → stigma (different flower on a different plant).

(ii) Identification and Functions of A, B, and C in the diagram:

Assuming the diagram shows parts of a flower involved in pollination:

A: **Anther**
Function: Produces and releases pollen grains, which contain the male reproductive cells.

B: **Stigma**
Function: It is the sticky part on top of the pistil where pollen grains land and germinate.

C: **Pollen grains**
Function: They carry the male reproductive cells (sperm cells) necessary for fertilization of the ovule.

These parts play vital roles in the process of pollination and fertilization in flowering plants.

> **Key Points: Self-pollination: pollen from anther to stigma of the same flower or plant-Cross-pollination: pollen from anther of one flower to stigma of another flower of different plant of same species-Anther produces pollen-Stigma is sticky part where pollen lands-Pollen contains male reproductive cells-Functions of anther, stigma, and pollen grains in reproduction**

Question 45.

(i) Draw a ray diagram to show the refraction of a ray of light through a rectangular glass slab when it falls obliquely from air into glass.

(ii) State Snell's law of refraction of light.

(iii) Differentiate between the virtual images formed by a convex lens and a concave lens on the basis of :

(I) object distance, and

(II) magnification.

[5 Marks]

Answer: (i) Ray Diagram for Refraction through a Rectangular Glass Slab:
When a ray of light traveling from air falls obliquely on the surface of a rectangular glass slab, it bends towards the normal because glass is denser than air. After passing through the slab, the ray bends away from the normal as it enters air again. The ray inside the slab is parallel to the incident ray but laterally shifted.

(ii) Snell's Law of Refraction:
Snell's law states that the ratio of the sine of the angle of incidence (i) to the sine of the angle of refraction (r) is constant for the two given media. Mathematically, it is expressed as:
sin(i) / sin(r) = constant = refractive index

(iii) Difference between Virtual Images formed by Convex and Concave Lens:
(I) Object Distance:
- **Convex Lens:** Virtual image is formed when the object is placed between the optical centre and the principal focus (object distance less than focal length).
- **Concave Lens:** Virtual image is formed for any object position since it always forms virtual images.

(II) Magnification:
- **Convex Lens:** The virtual image formed is magnified (larger than the object).
- **Concave Lens:** The virtual image formed is diminished (smaller than the object).

Key Points: Ray bends towards normal entering a denser medium (glass) and bends away leaving to less dense medium (air)-Snell's law: sin(i)/sin(r) = constant-Refractive index-Convex lens forms virtual image when object distance is less than focal length; concave lens forms virtual image for any object distance-Convex lens virtual image is magnified-Concave lens virtual image is diminished