CBSE 2025 Science — Set 1 — Answer Key

English Medium

Time Allowed: 3 Hours | Maximum Marks: 80

General Instructions:

1. This question paper contains 39 questions. All questions are compulsory.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 6 questions carrying 2 marks each.
4. Section C has 7 questions carrying 3 marks each.
5. Section D has 3 questions carrying 5 marks each.
6. Section E has 3 case-study based questions carrying 4 marks each.
7. Draw neat diagrams wherever required.

Section A

Multiple Choice Questions (1 mark each)

Q.1 [1 mark]

Electrolysis of water is a decomposition reaction. The mass ratio (M_1 : M_2) of hydrogen and oxygen gases liberated at the electrodes during electrolysis of water is:

(a) 8 : 1

(b) 2 : 1

(c) 1 : 2

(d) 1 : 8 <<

Explanation:

Water electrolysis: $2H_2O \rightarrow 2H_2 + O_2$.

Mass of H_2 : mass of O_2 = (2×2) : 32 = 4 : 32 = 1 : 8, so M_H : M_O = 1 : 8 (option D).

The 2 : 1 ratio is for volumes, not masses.

Q.2 [1 mark]

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

(a) Al_2O_3 and MgO_2

(b) Al_2O_3 and MgO <<

(c) Al_2O_4 and MgO

(d) Al_2O_4 and MgO_2

Explanation:

When aluminium burns in air: $4Al + 3O_2 \rightarrow 2Al_2O_3$ (aluminium oxide).

When magnesium burns in air: $2Mg + O_2 \rightarrow 2MgO$ (magnesium oxide).

So the products are Al_2O_3 and MgO.

Q.3 [1 mark]

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

In the printed pH scale, D is marked at pH 3, A at pH 5, B at pH 7 and C at pH 13.

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

(a) Strong acid, weak acid, neutral, strong base
(b) Weak acid, neutral, weak base, strong base
(c) Weak acid, neutral, strong base, weak base
(d) Weak acid, neutral, strong base, strong acid <<

Explanation:

From the printed scale: A (pH 5) is a weak acid, B (pH 7) is neutral, C (pH 13) is a strong base and D (pH 3) is a strong acid.

So A, B, C, D = weak acid, neutral, strong base, strong acid (option D).

Q.4 [1 mark]

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:

(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, salt and water are formed:

(i) $HCl + NaOH \rightarrow NaCl + H_2O$ (neutralisation)

(ii) $MgO + 2HCl \rightarrow MgCl_2 + H_2O$ (reaction of base with acid)

(iii) $CO_2 + 2NaOH \rightarrow Na_2CO_3 + H_2O$ (reaction of acidic oxide with base)

In each case, a salt and water are produced.

Q.5 [1 mark]

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?

(a) It has high melting point.
(b) It is highly soluble in water.
(c) It has weak electrostatic forces of attraction between its oppositely charged ions. <<
(d) It conducts electricity in its molten state or aqueous solution.

Explanation:

Since A loses electrons and B gains electrons, compound C is an ionic compound.
Ionic compounds have strong electrostatic forces of attraction between oppositely charged ions (not weak).
They have high melting points, are soluble in water, and conduct electricity in molten state or aqueous solution.
Option (C) is incorrect for ionic compounds — ionic bonds involve strong electrostatic forces, not weak.

Q.6 [1 mark]

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

(a) Gold and silver
(b) Calcium and magnesium <<
(c) Aluminium and silver
(d) Sodium and iron

Explanation:

Highly reactive metals like calcium and magnesium (at the top of the reactivity series) cannot be reduced by carbon or other reducing agents.
They are obtained by electrolytic reduction of their molten chlorides.
Gold and silver are found in free state, aluminium is obtained by electrolysis of alumina, and iron is obtained by reduction with carbon.

Q.7 [1 mark]

The formation of magnesium oxide is correctly shown in option:

(a) Mg transfers 2 electrons to O, forming Mg^{2+} and O^{2-} (MgO) <<

(b) Mg transfers 1 electron to O, forming Mg^{+} and O^{-}

(c) Mg transfers 2 electrons to 2 O atoms, forming Mg^{2+} and $(O^{-})_2$

(d) 2Mg transfers electrons to O_2, forming $[Mg^{2+}]_2[O^{2-}]_2$

Explanation:

Magnesium (Mg) has 2 valence electrons and oxygen (O) needs 2 electrons to complete its octet.

Mg transfers its 2 valence electrons to O, forming Mg^{2+} and O^{2-} ions.

These ions are held together by strong electrostatic forces forming MgO.

Option (A) correctly shows this electron transfer.

Q.8 [1 mark]

Secretion of less saliva in mouth will effect the conversion of:

(a) proteins into amino acids

(b) fats into fatty acids and glycerol

(c) starch into simple sugars <<

(d) sugars into alcohol

Explanation:

Saliva contains the enzyme salivary amylase which breaks down starch into simple sugars (maltose).

If less saliva is secreted, the conversion of starch into simple sugars will be affected.

Proteins are digested by pepsin in the stomach, fats by lipase, and sugars into alcohol is fermentation (not digestion).

Q.9 [1 mark]

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

(a) Cytokinins

(b) Gibberellins

(c) Adrenaline

(d) Auxins <<

Explanation:

Auxin is the plant hormone responsible for phototropism.

When light falls on one side of the shoot, auxin diffuses to the shaded side, causing cells on that side to elongate more.

This makes the shoot bend towards light.

Cytokinins promote cell division, gibberellins promote stem growth, and adrenaline is an animal hormone.

Q.10 [1 mark]

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.

(a) (i) only

(b) (iv) only

(c) (i) and (iii) <<

(d) (i) and (iv)

Explanation:

A bisexual flower has both male (stamen) and female (pistil) reproductive organs — so statement (i) is correct.

Since they have both parts, they can undergo self-pollination or cross-pollination — so statement (iii) is correct.

Statement (ii) describes unisexual flowers.

Statement (iv) is wrong as bisexual flowers can produce fruits.

So (i) and (iii) are correct.

Q.11 [1 mark]

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:

(a) 50% round and green
(b) 75% wrinkled and green
(c) 100% round and yellow <<
(d) 75% wrinkled and yellow

Explanation:
RRyy × rrYY: every F_1 plant is RrYy.
Round (R) and yellow (Y) are dominant, so all F_1 seeds are round and yellow: 100% round and yellow (option C).

Q.12 [1 mark]

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

(a) Mitochondria and Oxygen deficient muscle cells
(b) Cytoplasm and Oxygen rich muscle cells
(c) Cytoplasm and Yeast cells
(d) Cytoplasm and Oxygen deficient muscle cells <<

Explanation:
Step (a): Glucose is broken down to pyruvate in the cytoplasm (glycolysis occurs in the cytoplasm).
Step (b): In the absence of oxygen (anaerobic respiration in muscle cells), pyruvate is converted to lactic acid.
This happens in oxygen-deficient muscle cells during vigorous exercise.
So the sites are Cytoplasm and Oxygen deficient muscle cells.

Q.13 [1 mark]

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.

(a) (i) and (ii) <<
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

Explanation:

Mirror X (solar furnace) is a concave mirror — it concentrates parallel sunlight at its focus, forming a real, diminished image at the focus.
So statement (i) is correct.
Mirror Y (vehicle rear-view) is a convex mirror — it forms a virtual, diminished, and erect image with a wider field of view.
So statement (ii) is correct.
Answer: (i) and (ii).

Q.14 [1 mark]

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:

(a) hypermetropia and convex lens
(b) presbyopia and bifocal lens <<
(c) myopia and concave lens
(d) myopia and bifocal lens

Explanation:

The condition described — weakening of ciliary muscles and loss of flexibility of the eye lens in an old person — is presbyopia.
It is corrected using bifocal lenses, which have both concave and convex portions to help see both near and far objects.
Hypermetropia is far-sightedness (corrected by convex lens), and myopia is near-sightedness (corrected by concave lens).

Q.15 [1 mark]

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

(a) (i) and (iv) <<

(b) (i) and (iii)

(c) (ii) and (iii)

(d) (ii) and (iv)

Explanation:

Group (iii) is a valid chain (grass → grasshopper → frog → snake → hawk), so options B and C cannot be right.

Groups (i), (ii) and (iv) each mix organisms that do not feed on one another in sequence, so both A and D fit the printed groups; the key needs confirmation.

Note: this answer could not be confirmed against an official CBSE marking scheme.

Q.16 [1 mark]

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

(a) 1%

(b) 10%

(c) 90%

(d) 99% <<

Explanation:

Green plants (producers) capture only about 1% of the solar energy that falls on them and convert it into food energy through photosynthesis.

So the percentage of solar energy NOT converted is about 99%.

Q.17 [1 mark]

Assertion (A): Decomposition reactions are generally endothermic reactions.
Reason (R): Decomposition of organic matter into compost is an exothermic process.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). <<
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Explanation:

Assertion: Decomposition reactions generally require energy (endothermic) — this is TRUE.
For example, thermal decomposition of calcium carbonate requires heat.
Reason: Decomposition of organic matter into compost is an exothermic process — this is also TRUE (microbial decomposition releases heat).
However, the Reason does not correctly explain the Assertion since composting is a biological process, not a typical chemical decomposition.
So both are true but R is not the correct explanation of A.

Q.18 [1 mark]

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.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false. <<
(d) Assertion (A) is false, but Reason (R) is true.

Explanation:

Assertion (A) is TRUE: A human child bears all basic human features (two eyes, limbs, etc.) due to DNA inheritance.

Reason (R) is FALSE: A child does NOT look exactly like its parents.

Sexual reproduction introduces variations, so offspring show similarities but also differences from parents.

Hence A is true but R is false.

Q.19 [1 mark]

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.

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

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

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

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

Explanation:

Assertion (A) is TRUE: Magnetic field lines never cross each other.

Reason (R) is TRUE and correctly explains A: If two field lines crossed, the compass needle at the intersection would have to point in two directions simultaneously, which is impossible.

So the reason correctly explains why field lines do not cross.

Q.20 [1 mark]

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.

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

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

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

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

Explanation:

Assertion (A) is TRUE: Ozone depletion was sharply noticed in the 1980s due to excessive use of CFCs.

Reason (R) is TRUE: O_3 is formed when nascent oxygen atoms combine with O_2 molecules ($O + O_2 \rightarrow O_3$).

However, R explains how ozone is formed, not why its amount dropped.

The drop was caused by synthetic chemicals like CFCs, not explained by the formation process.

So both are true but R is not the correct explanation of A.

Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

A student performs the following experiment in his school laboratory: Dilute sulphuric acid is added to zinc granules in a test tube. List two observations to justify that in this experiment a chemical change has taken place.

Answer: Observation 1: Vigorous effervescence (bubbling) is observed due to evolution of hydrogen gas (H_2). Observation 2: The zinc granules gradually dissolve and the solution becomes warm (exothermic reaction). The chemical equation is: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

Explanation:

When dilute sulphuric acid reacts with zinc granules, a displacement reaction occurs: $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$.

Two observations indicating a chemical change: (1) Effervescence/bubbles due to evolution of hydrogen gas — a new substance (gas) is formed.

(2) The zinc granules dissolve gradually and the test tube becomes warm, indicating an exothermic chemical reaction has taken place.

Q.22 [2 marks]

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

Answer: Labelled diagrams in sequence: (1) bud appears as an outgrowth on the parent body wall → (2) bud grows and forms tentacles → (3) bud develops a mouth ringed by tentacles → (4) mature bud detaches as a new Hydra.

Explanation:

Budding in Hydra involves the following stages:

Stage 1: A small outgrowth (bud) appears on the body of the parent Hydra.

Stage 2: The bud grows and develops tentacles at its free end.

Stage 3: The bud develops a mouth surrounded by tentacles.

Stage 4: The fully developed bud detaches from the parent body and becomes an independent organism.

The diagram should show the parent Hydra with tentacles, the bud emerging from the body wall, the bud developing its own tentacles, and finally the detached new Hydra.

Q.23 [2 marks]

(a) Besides minimizing 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.

OR

(b) (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.

Answer: (a) Besides minimizing blood loss, it is essential to plug leaks to prevent the entry of germs/microorganisms into the body. Platelets (thrombocytes) help in this process. When a blood vessel is injured, platelets release certain chemicals

that help in the formation of a clot (fibrin mesh) at the site of injury, sealing the wound.

OR

(b) (i) Plants do not have a pumping organ like the heart. They rely on transpiration pull and root pressure for transport of water, which are slower processes. Also, plants do not need rapid transport as they have a lower metabolic rate.
(ii) Phloem transports food (sucrose/amino acids) from leaves (source) to other parts of the plant (sink) — this process is called translocation. It uses ATP energy to transport materials.

Explanation:
(a) Plugging leaks in blood vessels is essential to: (1) prevent blood loss, and (2) prevent entry of disease-causing microorganisms.
Platelets help by releasing clotting factors that form a fibrin mesh/clot, sealing the wound.

OR

(b)(i) Plants lack a heart-like pumping organ and rely on passive processes like transpiration pull and root pressure, making transport slower.
(ii) Phloem transports synthesized food materials (sucrose, amino acids) from leaves to other plant parts through translocation, which requires ATP energy.

OR

Q.23 [2 marks]

(b) (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.

Answer: (i) Plants do not have a pumping organ like the heart. They rely on

transpiration pull and root pressure for transport of water, which are slower processes compared to the circulatory system in animals.

(ii) Phloem transports food (sucrose and amino acids) from leaves (source) to other parts of the plant (sink). This process is called translocation and requires ATP energy.

Explanation:

(i) In animals, the heart pumps blood rapidly through vessels.

Plants lack a pumping organ and use transpiration pull and root pressure which are slower passive processes.

(ii) Phloem is responsible for translocation — the transport of prepared food material (sucrose) from leaves to storage organs and growing parts of the plant.

This process utilizes ATP energy.

Q.24 [2 marks]

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.

Answer: Given: u = -60 cm, f = -30 cm (concave lens). Using lens formula: $1/v - 1/u = 1/f \Rightarrow 1/v = 1/f + 1/u = 1/(-30) + 1/(-60) = -2/60 - 1/60 = -3/60 = -1/20$. Therefore v = -20 cm. The image is formed at 20 cm on the same side as the object.

Explanation:

For a concave lens: f = -30 cm, u = -60 cm.

Lens formula: $1/v - 1/u = 1/f$.

So $1/v = 1/f + 1/u = (-1/30) + (-1/60) = (-2 - 1)/60 = -3/60 = -1/20$.

Therefore v = -20 cm.

The negative sign indicates the image is on the same side as the object.

The image is virtual, erect, and diminished, formed at 20 cm from the lens.

Q.25 [2 marks]

(a) 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.

OR

(b) Define electric power. When do we say that the power consumed in an electric circuit is 1 Watt?

Answer: (a) Each part has resistance R/3. In parallel: 1/R_total = 1/(R/3) + 1/(R/3) + 1/(R/3) = 3/R + 3/R + 3/R = 9/R, so R_total = R/9.

OR

(b) Electric power is the rate at which electrical energy is consumed or dissipated in a circuit: $P = VI = I^2R = V^2/R$. Power consumed is 1 Watt when 1 Joule of energy is consumed per second, i.e. when a potential difference of 1 Volt drives a current of 1 Ampere through the circuit.

Explanation:

(a) When a wire of resistance R is cut into 3 equal parts, each part has resistance R/3.
In parallel: 1/R_total = 1/(R/3) + 1/(R/3) + 1/(R/3) = 3/R + 3/R + 3/R = 9/R.
Therefore R_total = R/9.

OR

(b) Electric power is defined as the rate of consumption of electrical energy.
P = W/t = VI.
The SI unit is Watt (W).
1 Watt is the power consumed when 1 Joule of energy is consumed in 1 second, or equivalently, when 1 V of potential difference drives 1 A of current.

OR

Q.25 [2 marks]

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

Answer: Electric power is the rate at which electrical energy is consumed or dissipated in a circuit. $P = VI = I^2R = V^2/R$. The SI unit of electric power is Watt (W). We say the power consumed is 1 Watt when 1 Joule of electrical energy is consumed per second, i.e., when a potential difference of 1 Volt drives a current of 1 Ampere through the circuit ($1\ W = 1\ V \times 1\ A$).

Explanation:

Electric power is defined as the rate of doing electrical work or the rate of consumption of electrical energy: $P = W/t = VI$.

Its SI unit is Watt.

1 Watt of power is consumed when 1 Volt potential difference causes 1 Ampere current to flow, consuming 1 Joule of energy per second.

Q.26 [2 marks]

"Excessive use of chemicals and pesticides in agriculture adversely affect the environment." Justify this statement.

Answer: Excessive use of chemicals and pesticides: (1) Pollutes soil and water bodies through runoff, making water toxic for aquatic organisms. (2) These non-biodegradable chemicals enter the food chain and undergo biological magnification (biomagnification), increasing in concentration at each trophic level. (3) They kill beneficial organisms like earthworms and nitrogen-fixing bacteria, reducing soil fertility. (4) They contaminate groundwater, affecting human health.

Explanation:

Excessive use of chemicals and pesticides in agriculture adversely affects the environment because: (1) They are often non-biodegradable and persist in the environment for long periods.

(2) Through biological magnification, their concentration increases at each trophic level in the food chain, harming top consumers including humans.

(3) They contaminate soil and water bodies, killing beneficial organisms and reducing biodiversity.

(4) Runoff carrying these chemicals pollutes rivers and groundwater.

Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

(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?

Answer: (a) Metals in the middle of the reactivity series (like iron, zinc, lead) can be extracted by reducing their oxides using carbon (a displacement reaction). Examples:

(i) $ZnO + C \rightarrow Zn + CO$ — Carbon displaces zinc from zinc oxide.

(ii) $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ — Carbon displaces iron from iron oxide.

(b) Metals high up in the reactivity series (like Na, K, Ca, Al) are more reactive than carbon. Since carbon is less reactive than these metals, it cannot displace them from their oxides. These metals are obtained by electrolytic reduction of their molten salts.

Explanation:

(a) Displacement reactions are used to extract moderately reactive metals.

Carbon (coke), being more reactive than metals in the middle of the series, can reduce their oxides.

Examples: (i) $ZnO + C \rightarrow$

$Zn + CO$ (extraction of zinc), (ii) $Fe_2O_3 + 3C \rightarrow$

$2Fe + 3CO$ (extraction of iron).

(b) Metals like Na, K, Ca, Al are more reactive than carbon, so carbon cannot reduce their oxides.

They require electrolytic reduction for extraction.

Q.28 [3 marks]

(a) With the help of an activity, explain the conditions under which iron articles get rusted.

OR

(b) (i) Name two metals which react violently with cold water. List any three observations which a student notes when these metals 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.

Answer: (a) Activity: Take three test tubes. In test tube 1, place iron nails in dry air (using anhydrous $CaCl_2$ to absorb moisture). In test tube 2, place iron nails in boiled water (no dissolved air) with oil on top. In test tube 3, place iron nails in ordinary water exposed to air. After a few days, rusting is observed only in test tube 3. This shows that both air (oxygen) and water (moisture) are necessary for rusting. Iron articles get rusted when exposed to both moisture and oxygen simultaneously.

OR

(b)(i) Sodium (Na) and Potassium (K) react violently with cold water. Observations: (1) The metal piece moves/dashes on the water surface. (2) A hissing sound is produced. (3) The metal catches fire (in case of potassium). (4) The solution becomes alkaline (turns phenolphthalein pink).
(ii) Bring a burning matchstick/splint near the gas. If it burns with a pop sound, the gas is hydrogen.

Explanation:
(a) Rusting requires both moisture and oxygen.
The activity with three test tubes demonstrates: dry air alone (no rust), boiled water

without air (no rust), water with air (rust forms).
Only when both conditions are present does iron rust ($4Fe + 3O_2 + 2xH_2O \rightarrow 2Fe_2O_3.xH_2O$).

OR

(b)(i) Sodium and potassium react vigorously with cold water: $2Na + 2H_2O \rightarrow 2NaOH + H_2$.
Observations: vigorous reaction, heat generation, hydrogen gas evolution, metal moves on water surface, solution turns alkaline.
(ii) Hydrogen gas test: bring a burning splint near the gas — it burns with a pop sound.

OR

Q.28 [3 marks]

(b) (i) Name two metals which react violently with cold water. List any three observations which a student notes when these metals 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.

Answer: (i) Sodium (Na) and Potassium (K) react violently with cold water. Three observations: (1) The metal piece moves vigorously on the water surface. (2) A hissing sound is produced due to evolution of hydrogen gas. (3) The reaction is highly exothermic — the metal may catch fire (potassium burns with a lilac flame). The solution turns alkaline.
(ii) Bring a burning matchstick near the mouth of the test tube collecting the gas. If the gas burns with a pop sound, it confirms the gas is hydrogen (H_2).

Explanation:
Sodium and potassium are highly reactive metals that react vigorously with cold water:
$2Na + 2H_2O \rightarrow$
$2NaOH + H_2\uparrow$.
Observations: vigorous effervescence, metal dashes on water surface, heat produced (may catch fire for K), solution becomes alkaline.

The evolved hydrogen gas is identified by the burning splint test — it burns with a characteristic pop sound.

Q.29 [3 marks]

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.

Answer: (a) In touch-me-not plants, the information is communicated through electrical-chemical signals. When touched, the cells generate an electrical signal that travels from cell to cell. The plant cells change the amount of water in them, causing the movement.

(b) The plant cells change the water content in the cells at the base of the leaves (pulvinus). When water moves out of the cells, they lose turgor pressure, causing the leaves to fold and droop.

(c) Movement in touch-me-not is nastic movement (independent of the direction of stimulus — touch from any direction causes the same response). Movement of tendrils in a pea plant is tropic movement (thigmotropism — directional growth in response to the stimulus of touch/contact with a support).

Explanation:

(a) Touch-me-not plants use electrochemical signals to transmit information when touched.

(b) Plant cells respond by changing their water content (turgor pressure) — cells at the base of leaves lose water and become flaccid, causing leaves to fold.

(c) Touch-me-not shows nastic movement (non-directional, independent of stimulus direction), while tendril movement is tropic (thigmotropism — directional growth response towards the support).

Q.30 [3 marks]

(a) What are chromosomes?

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

Answer: (a) Chromosomes are thread-like structures present in the nucleus of a cell. They are made up of DNA (deoxyribonucleic acid) wrapped around histone proteins. Chromosomes carry genes which are units of heredity and contain genetic information for inheritance of features.

(b) In sexually reproducing organisms, the germ cells (gametes) are formed by meiosis, which halves the chromosome number. Each gamete contains half the number of chromosomes (haploid). During fertilization, two gametes fuse to restore the normal diploid chromosome number. This ensures that the DNA content remains stable across generations. For example, in humans: gametes have 23 chromosomes each, and the zygote has 46 chromosomes.

Explanation:

(a) Chromosomes are long, coiled structures of DNA and proteins found in the nucleus.

They carry hereditary information in the form of genes.

(b) Stability of DNA is maintained because: gametes are produced by meiosis (reducing chromosome number to half — haploid), and during fertilization, two haploid gametes combine to form a diploid zygote, restoring the original chromosome number.

This mechanism ensures consistent DNA amount across generations.

Q.31 [3 marks]

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 pole P and infinity of the mirror.

Answer: See explanation for the ray diagrams.

(i) Object at infinity: Two parallel rays are drawn. After reflection from the convex mirror, they appear to diverge from the focus (F) behind the mirror. Image is

formed at the focus (F), virtual, erect, and highly diminished (point-sized).

(ii) Object between P and infinity: Two rays from the object are drawn — one parallel to the principal axis (reflects as if diverging from F) and one directed towards the centre of curvature (reflects back along the same path). The image is formed between P and F behind the mirror, virtual, erect, and diminished.

Explanation:

(i) When the object is at infinity, parallel rays incident on a convex mirror diverge after reflection and appear to come from the principal focus F behind the mirror.

Image: at F, virtual, erect, highly diminished (point-sized).

(ii) When the object is between pole and infinity, the image is formed between P and F behind the mirror.

Image: virtual, erect, diminished.

In both cases, convex mirrors always form virtual, erect, and diminished images behind the mirror.

Q.32 [3 marks]

Consider the following electric circuit: a 15 V battery with key K and an ammeter in series with a parallel combination of 10 Ω and 15 Ω, and a parallel combination of 60 Ω and 40 Ω. 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.

Answer: (a) 10 Ω and 15 Ω in parallel: 1/Rp = 1/10 + 1/15 = 3/30 + 2/30 = 5/30 = 1/6, so Rp = 6 Ω. 60 Ω and 40 Ω in parallel: 1/Rq = 1/60 + 1/40 = 2/120 + 3/120 = 5/120 = 1/24, so Rq = 24 Ω. The two parallel groups are in series: total resistance = 6 + 24 = 30 Ω.

(b) Total current I = V/R = 15/30 = 0.5 A.

(c) Potential difference across the 10 Ω–15 Ω parallel combination = I × Rp = 0.5 × 6 = 3 V.

Explanation:

Rp(10,15) = 150/25 = 6 Ω;

Rq(60,40) = 2400/100 = 24 Ω;

R = 6 + 24 = 30 Ω;

I = 15/30 = 0.5 A;

V across the 10–15 Ω group = 0.5 × 6 = 3 V.

Q.33 [3 marks]

(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?

Answer: (a) The relationship is: R = ρl/A, where R = resistance, ρ = resistivity, l = length, A = area of cross-section. Rearranging: ρ = RA/l. SI unit of resistivity: ρ = (Ω × m²)/m = Ω·m (ohm-metre).

(b) Alloys are used in electrical heating devices because: (1) They have higher resistivity than pure metals, so they produce more heat. (2) They do not oxidise (burn) easily at high temperatures. (3) They have high melting points.

Explanation:

(a) Resistance R is directly proportional to length l and inversely proportional to area A: R = ρl/A.

Here ρ is resistivity.

To find SI unit: ρ = RA/l = (Ω)(m²)/(m) = Ω·m.

(b) Alloys like nichrome are used in heating devices because they have: (i) high resistivity (generates more heat), (ii) high melting point (doesn't melt at high temperatures), and (iii) resistance to oxidation at high temperatures.

Section D

Long Answer Questions (5 marks each)

Q.34 [5 marks]

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

(ii) Name the following compounds:

(I) $CH_3–CH_2–CH_2–Cl$ (three-carbon chain with Cl on the end carbon)

(II) $CH_3–CH_2–CO–CH_3$ (four-carbon chain with C=O on the third carbon)

(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

OR

(b) (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.

Answer: (a)(i) Two isomers of butene (C_4H_8):

1-Butene: $CH_2=CH–CH_2–CH_3$

2-Butene: $CH_3–CH=CH–CH_3$

(ii)(I) 1-Chloropropane ($CH_3CH_2CH_2Cl$)

(II) Butanone ($CH_3CH_2COCH_3$) — the C=O is on an inner carbon, so it is a ketone

(iii)(I) $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ + Heat (Condition: Ignition/burning)

(II) $CH_3CH=CH_2 + H_2 \rightarrow$(Ni catalyst) $CH_3CH_2CH_3$ (Condition: Nickel catalyst, temperature)

(III) $CH_3COOH + C_2H_5OH \rightarrow$(acid catalyst) $CH_3COOC_2H_5 + H_2O$ (Condition: Conc.

H_2SO_4 as catalyst)

OR

(b)(i) X = Ethanol (C_2H_5OH) — it is a good solvent.
Y = Sodium ethoxide (C_2H_5ONa)
Z = Hydrogen gas (H_2) — used in hydrogenation to convert vegetable oil to ghee.
Reaction: $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2\uparrow$

Explanation:
(a)(i) Butene has structural isomers: 1-Butene ($CH_2=CHCH_2CH_3$) and 2-Butene ($CH_3CH=CHCH_3$).
(ii) Compound I is 1-chloropropane; Compound II is butanone (methyl ethyl ketone).
(iii) Complete oxidation of ethanol produces CO_2 and H_2O;
hydrogenation of propene (with Ni catalyst) gives propane;
esterification of ethanoic acid with ethanol (with conc.
H_2SO_4) gives ethyl ethanoate.

OR

(b) X is ethanol (good solvent), Y is sodium ethoxide, Z is hydrogen (used to hydrogenate oils into ghee).
$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$.

OR

Q.34 [5 marks]

(b) (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 equations 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.

Answer: (i) X = Ethanol (C_2H_5OH) — used as a good solvent.

Y = Sodium ethoxide (C_2H_5ONa)

Z = Hydrogen gas (H_2) — used in hydrogenation of vegetable oils to form ghee.

Reaction: $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2\uparrow$

(ii)(I) $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ + Heat and Light

(II) $C_2H_5OH \rightarrow$(443K, conc. H_2SO_4) $C_2H_4 + H_2O$ (Dehydration to form ethene)

(III) C_2H_5OH + Acidified $K_2Cr_2O_7 \rightarrow CH_3COOH$ (Ethanol is oxidized to ethanoic acid)

Explanation:

(i) X is ethanol (solvent), Y is sodium ethoxide, Z is hydrogen gas (used for hydrogenation).

(ii)(I) Combustion of ethanol: $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$.

(II) Dehydration at 443K with conc. H_2SO_4: $C_2H_5OH \rightarrow CH_2=CH_2 + H_2O$.

(III) Oxidation with acidified $K_2Cr_2O_7$ converts ethanol to ethanoic acid (acetic acid).

Q.35 [5 marks]

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

(I) Ovary

(II) Fallopian tube

(III) Uterus

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

OR

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

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

Answer: (a)(i)(I) Ovary: Produces ova (eggs/female gametes) and secretes female hormones (estrogen and progesterone).
(II) Fallopian tube (Oviduct): Site of fertilization. It carries the ovum from the ovary to the uterus. The inner lining has cilia that help in the movement of the egg.
(III) Uterus: Site of implantation of the fertilized egg (zygote). The developing embryo gets nourishment from the uterus lining. It supports the growth of the fetus during pregnancy.

(ii) Two contraceptive methods used by males:
1. Use of condoms (mechanical/barrier method) — prevents sperm from reaching the egg.
2. Vasectomy (surgical method) — the vas deferens is cut and tied to prevent the passage of sperm.

OR

(b)(i) Self-pollination: Transfer of pollen grains from the anther to the stigma of the same flower or another flower on the same plant. Cross-pollination: Transfer of pollen grains from the anther of one flower to the stigma of another flower on a different plant of the same species.

(ii) In the diagram of a flower:
A = Stigma — receives pollen grains during pollination.
B = Style — connects stigma to the ovary; pollen tube grows through it.
C = Ovule — contains the female gamete (egg cell); develops into seed after fertilization.

Explanation:
(a)(i) Ovary produces eggs and hormones;
Fallopian tube is the site of fertilization and transports the ovum;
Uterus is where the embryo implants and develops.

(ii) Male contraceptive methods include condoms (barrier method) and vasectomy (surgical cutting of vas deferens).

OR

(b)(i) Self-pollination occurs within the same flower/plant;
cross-pollination occurs between different plants of the same species.
(ii) A = Stigma (receives pollen), B = Style (connects stigma to ovary), C = Ovule (contains egg, becomes seed).
Note: this answer could not be confirmed against an official CBSE marking scheme.

OR

Q.35 [5 marks]

(b) (i) Differentiate between self-pollination and cross-pollination.
(ii) Identify A, B and C in the diagram of a flower given below and write one function of each. (A = Stigma, B = Style, C = Ovule)

Answer: (i) Self-pollination: Transfer of pollen from the anther to the stigma of the same flower or another flower on the same plant. It does not require external agents. It reduces genetic variation.
Cross-pollination: Transfer of pollen from the anther of one flower to the stigma of another flower on a different plant of the same species. It requires agents like wind, water, insects. It increases genetic variation.

(ii) A = Stigma: It is the sticky top part of the pistil that receives pollen grains.
B = Style: It is the long tube connecting stigma to the ovary through which the pollen tube grows.
C = Ovule: It contains the female gamete (egg cell). After fertilization, it develops into the seed.

Explanation:
(i) Self-pollination occurs within the same plant (no external agent needed, less genetic variation).
Cross-pollination occurs between different plants (requires agents like insects/wind,

increases genetic diversity).

(ii) A = Stigma (receives pollen), B = Style (tube for pollen tube growth), C = Ovule (contains egg, develops into seed after fertilization).

Note: this answer could not be confirmed against an official CBSE marking scheme.

Q.36 [5 marks]

(a) (i) A lens 'X' has power -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 respectively 10 cm and 20 cm. Which one of the two will show higher degree of convergence/divergence? Give reason to justify your answer.

OR

(b) (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.

Answer: (a)(i) Lens X is a concave lens (negative power). Focal length: P = 1/f (in metres) ⇒ f = 1/P = 1/(-2.5) = -0.4 m = -40 cm. This lens is prescribed for myopia

(short-sightedness/near-sightedness).

(ii) m = -2 (negative magnification means real and inverted image).
(I) Nature: Real and inverted.
(II) Size: Image is 2 times larger than the object (magnified, since |m| = 2).
(III) Position: m = v/u. u = -20 cm. -2 = v/(-20) ⇒ v = 40 cm. Image is at 40 cm on the other side of the lens.
(IV) Sign of height: Negative (image is inverted, so h' is negative).

(iii) Lens A with focal length 10 cm will show a higher degree of convergence/divergence. Power = 1/f. Lens A: P = 1/0.1 = 10 D. Lens B: P = 1/0.2 = 5 D. Shorter focal length means higher power and greater ability to converge/diverge light.

OR

(b)(i) Ray diagram: An incident ray from air hits the glass slab obliquely. It bends towards the normal (since glass is denser). Inside the slab, it travels straight to the other surface. At the second surface, it bends away from the normal as it exits into air. The emergent ray is parallel to the incident ray but laterally displaced.
(ii) Snell's Law: The ratio of sine of angle of incidence to the sine of angle of refraction is constant for a given pair of media: sin i / sin r = n (refractive index). n_1 sin i = n_2 sin r.
(iii)(I) Object distance: Convex lens forms virtual image when object is between F and optical centre (u < f). Concave lens forms virtual image for all object positions.
(II) Magnification: Convex lens virtual image is magnified and erect (m > 1). Concave lens virtual image is diminished and erect (m < 1).

Explanation:
(a)(i) P = -2.5 D means concave lens; f = -40 cm; corrects myopia.
(ii) m = -2 means real, inverted, magnified image at v = 40 cm; height is negative.

(iii) Shorter focal length (lens A, 10 cm) has higher power and greater convergence/divergence.

OR

(b)(i) Light bends towards normal entering glass, away from normal exiting.
Emergent ray is parallel to incident ray but laterally shifted.
(ii) Snell's law: $n_1 \sin i = n_2 \sin r$.
(iii) Virtual image by convex lens: object between O and F, image is magnified.
Virtual image by concave lens: object at any position, image is diminished.

OR

Q.36 [5 marks]

(b) (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.

Answer: (i) Ray diagram: An incident ray from air strikes the glass slab at an angle. At the first surface, the ray bends towards the normal (enters denser medium). The ray travels through the glass slab in a straight line. At the second surface, the ray bends away from the normal (exits to rarer medium). The emergent ray is parallel to the incident ray but laterally displaced.

(ii) Snell's Law: For a given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant. Mathematically: $n_1 \sin i = n_2 \sin r$, or $\sin i / \sin r = n_{21}$ (refractive index of medium 2 with respect to medium 1).

(iii)(I) Object distance: For a convex lens, a virtual image is formed only when the

object is placed between the optical centre and the focus (u < f). For a concave lens, a virtual image is formed for all positions of the object.
(II) Magnification: Convex lens forms a virtual image that is magnified (m > 1) and erect. Concave lens forms a virtual image that is diminished (m < 1) and erect.

Explanation:
(i) The ray diagram shows refraction through a glass slab: ray bends toward normal on entering glass and away from normal on exiting.
The emergent ray is parallel to incident ray but laterally displaced.
(ii) Snell's law: $n_1 \sin i = n_2 \sin r$.
(iii) Convex lens virtual image: object between O and F, image is enlarged.
Concave lens virtual image: any object position, image is diminished.

Q.37(a) [4 marks]

Case Study: 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.

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

Answer: Electrolysis of brine (concentrated NaCl solution):
$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

At cathode: $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$
At anode: $2Cl^- \rightarrow Cl_2 + 2e^-$

The products are: Sodium hydroxide (NaOH), Chlorine gas (Cl_2), and Hydrogen gas (H_2). This process is called the chlor-alkali process.

Explanation:

The electrolysis of brine (saturated NaCl solution) is called the chlor-alkali process.

It produces three important products: NaOH (at cathode), Cl_2 (at anode), and H_2 (at cathode).

The balanced equation is: $2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$.

Q.37(b) [4 marks]

Case Study (continued):

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

Answer: Two uses of Sodium Hydroxide (NaOH):

1. Used in the manufacture of soaps and detergents.
2. Used in the manufacture of paper.

OR Two uses of Chlorine gas (Cl_2):

1. Used for water purification/disinfection.
2. Used in the manufacture of PVC (polyvinyl chloride) and pesticides.

OR Two uses of Hydrogen gas (H_2):

1. Used in the manufacture of ammonia (Haber process).
2. Used as a fuel.

Explanation:

Products of electrolysis of brine: NaOH (soaps, detergents, paper), Cl_2 (water purification, PVC, pesticides, CFC), H_2 (fuel, margarine, ammonia production).

Q.37(c) [4 marks]

Case Study (continued):

(i) 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.

OR

(ii) Define water of crystallisation. Give two examples of salts that have water of crystallisation.

Answer: (i) A = Sodium hydrogen carbonate (Baking soda, $NaHCO_3$) — mild non-corrosive basic salt used for faster cooking.

B = Sodium carbonate (Washing soda, Na_2CO_3) — used for removing permanent hardness of water.

Reaction: $2NaHCO_3 \rightarrow (heat)\ Na_2CO_3 + H_2O + CO_2$

OR

(ii) Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt. These water molecules are chemically bonded to the salt crystal.

Examples:

1. Copper sulphate pentahydrate: $CuSO_4.5H_2O$ (blue vitriol)
2. Gypsum: $CaSO_4.2H_2O$

Explanation:

(i) A = $NaHCO_3$ (baking soda), B = Na_2CO_3 (washing soda).

Heating: $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$.

(ii) Water of crystallisation is the fixed number of water molecules in a formula unit of a crystalline salt.

Examples: $CuSO_4.5H_2O$ (blue vitriol) and $CaSO_4.2H_2O$ (gypsum).

Q.38(a) [4 marks]

Case Study: 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.

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

Answer: The process is called Photosynthesis. It is the process by which green plants prepare food (glucose) using carbon dioxide and water in the presence of sunlight and chlorophyll.

$6CO_2 + 6H_2O \rightarrow$(sunlight, chlorophyll) $C_6H_{12}O_6 + 6O_2$

Explanation:

Photosynthesis is the process by which autotrophs (green plants) synthesize food. They use carbon dioxide from air and water from soil, in the presence of sunlight and chlorophyll, to produce glucose and release oxygen: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$.

Q.38(b) [4 marks]

Case Study (continued):

Write chemical equation involved in the above process.

Answer: $6CO_2 + 6H_2O \rightarrow$(sunlight, chlorophyll) $C_6H_{12}O_6 + 6O_2$

Or: Carbon dioxide + Water →(Sunlight, Chlorophyll) Glucose + Oxygen

Explanation:

The balanced chemical equation for photosynthesis is: $6CO_2 + 6H_2O \rightarrow$(in the presence of sunlight and chlorophyll) $C_6H_{12}O_6 + 6O_2$.

This is an endothermic reaction that converts light energy into chemical energy stored in glucose.

Q.38(c) [4 marks]

Case Study (continued):

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

OR

(iii) 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.

Answer: (i) Desert plants (like cacti) perform photosynthesis differently to conserve water:

1. Stomata open during the night to take in CO_2 (to reduce water loss).
2. CO_2 is stored as an intermediate compound (organic acid) in the cells.
3. During the day, stomata remain closed to prevent water loss.
4. The stored CO_2 is released and used for photosynthesis in the presence of sunlight.
5. This adaptation is called CAM (Crassulacean Acid Metabolism).

OR

(iii)(I) During cloudy weather: The rate of photosynthesis decreases because sunlight (which is essential for the light-dependent reactions) is reduced. Less light energy means less splitting of water molecules and less ATP/NADPH production.
(II) When stomata are blocked by dust: The rate of photosynthesis decreases because CO_2 (a raw material) cannot enter the leaf through the blocked stomata. Without sufficient CO_2, the Calvin cycle slows down.

Explanation:

(i) In desert plants: stomata open at night to absorb CO_2 (stored as organic acids), stomata close during the day to prevent water loss, stored CO_2 is used for photosynthesis during the day in the presence of sunlight.

OR

(iii)(I) Cloudy weather reduces sunlight, slowing down photosynthesis as light is a key requirement.

(II) Blocked stomata prevent CO_2 entry into the leaf, reducing the rate of photosynthesis since CO_2 is a necessary raw material.

Q.39(a) [4 marks]

Case Study: 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.

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

Answer: The live wire has red insulation and the neutral wire has black insulation. The earth wire has green insulation.

Explanation:

In domestic electrical supply in India: Live wire = Red insulation, Neutral wire = Black insulation, Earth wire = Green insulation.

The live wire carries current at high potential (220 V) and the neutral wire is at approximately zero potential.

Q.39(b) [4 marks]

Case Study (continued):

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?

Answer: $P = VI \Rightarrow I = P/V = 1000/220 = 4.55$ A. So a current rating of 5 A should be used for the circuit to safely operate a 1 kW electric iron at 220 V.

Explanation:

Using $P = VI$: $I = P/V = 1000\ W / 220\ V = 4.55\ A$.

The circuit should have a current rating of 5 A to safely handle this load.

A 5 A fuse/MCB should be used.

Q.39(c) [4 marks]

Case Study (continued):

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

OR

(ii) List two precautions to be taken to avoid electrical accidents. State how these precautions prevent possible damage to the circuit/appliances.

Answer: (i) The earth wire provides a low-resistance path for the current to flow to the ground in case of any leakage of current or short circuit. In appliances like electric iron, the metallic body is connected to the earth wire. If the live wire accidentally touches the metallic body, the current flows through the earth wire to the ground instead of passing through the user's body, preventing electric shock.

OR

(ii) Two precautions:

1. Use of fuse/MCB: A fuse wire is connected in series with the live wire. If current exceeds the safe limit (due to short circuit or overloading), the fuse melts and breaks the circuit, protecting appliances from damage.
2. Proper earthing of appliances: The metallic body of appliances should be properly earthed so that any leakage current goes to the ground, preventing electric shock and damage.

Explanation:

(i) Earth wire provides safety by creating a low-resistance conducting path to the ground.

If the live wire touches the metal body of an appliance, current flows through the earth wire instead of through the person, preventing electric shock.

It also causes the fuse to blow, cutting off the supply.

OR

(ii) Precautions: (1) Use fuse/MCB — melts/trips when current exceeds safe limit, breaking the circuit and preventing fire/damage.
(2) Proper earthing — diverts leakage current to ground, preventing shock and triggering fuse to blow for added safety.