UNIQUE STUDY POINT

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Class: X	**Subject:** Science	**Session:** 2025-26
Chapter: 01 - Chemical Reactions and Equations	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

Q1. Which of the following is NOT required for balancing a chemical equation?

(a) Counting atoms of each element
(b) Changing the formulae of reactants
(c) Using coefficients
(d) Following law of conservation of mass

Q2. The decomposition of vegetable matter to form compost is an example of:

(a) Endothermic reaction
(b) Exothermic reaction
(c) Displacement reaction
(d) Combination reaction

Q3. Which of the following represents the correct product of the reaction between calcium hydroxide and carbon dioxide?

(a) $CaO + H_2O$
(b) $CaCO_3 + H_2O$
(c) $Ca(HCO_3)_2$
(d) $CaCl_2 + H_2O$

Q4. When water is added to quick lime (CaO), which observation is made?

(a) Temperature decreases
(b) Temperature increases
(c) No change in temperature
(d) Precipitate is formed

Q5. The reaction $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$ is an example of:

(a) Combination reaction
(b) Double displacement reaction
(c) Decomposition reaction
(d) Displacement reaction

Q6. Food items become rancid due to:

(a) Reduction
(b) Oxidation
(c) Corrosion
(d) Displacement

Q7. In the reaction $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$, which element gets oxidized?

(a) Mn
(b) Cl
(c) H
(d) O

Q8. The type of reaction represented by: $AB \rightarrow A + B$ is:

(a) Combination
(b) Decomposition
(c) Displacement
(d) Double displacement

Q9. Which of the following methods can be used to prevent rusting of iron?

(a) Galvanization
(b) Painting
(c) Oiling
(d) All of the above

Q10. The formation of slaked lime from quick lime is:

(a) Exothermic and displacement
(b) Endothermic and combination
(c) Exothermic and combination
(d) Endothermic and decomposition

SECTION B - Short Answer Questions (2 marks each)

Q11. What is meant by a chemical equation? Why is it necessary to balance it?

Q12. When a green iron salt is heated, it changes to brown and a gas having smell of burning sulphur is evolved. Name the iron salt and write the balanced equation.

Q13. Give one example each of thermal, electrolytic and photolytic decomposition with balanced equations.

Q14. Define:
(a) Oxidation
(b) Reduction

SECTION C - Short Answer Questions (3 marks each)

Q15. What is corrosion? How does it damage iron articles? Suggest three methods to prevent corrosion of iron.

Q16. (a) What is a precipitation reaction? Give two examples.
(b) Why are precipitation reactions important in everyday life?

Q17. Explain the activity to show that "In a chemical reaction, mass is neither created nor destroyed." Draw the diagram and write the conclusion.

SECTION D - Long Answer Question (5 marks)

Q18. (a) What are redox reactions? Explain with suitable examples.
(b) Identify the substances oxidized and reduced in the following reactions:

(i) $ZnO + C \rightarrow Zn + CO$

(ii) $CuO + H_2 \rightarrow Cu + H_2O$

(iii) $4Na + O_2 \rightarrow 2Na_2O$

SECTION E - Case Study Based Questions (4 marks each)

Q19. Case Study 1:

During a laboratory experiment, a student mixed solutions of lead nitrate and potassium iodide in a beaker. He observed the formation of a yellow precipitate which settled at the bottom. The other product remained dissolved in the solution.

Answer the following:

(a) Name the yellow precipitate formed. (1 mark)

(b) Write the balanced chemical equation for this reaction. (1 mark)

(c) What type of chemical reaction is this? (1 mark)

(d) Why is the reaction also called a precipitation reaction? (1 mark)

Q20. Case Study 2:

A biology teacher was explaining to students about how plants prepare their food through photosynthesis. She told them that this process requires sunlight, carbon dioxide from air and water from soil. The process produces glucose (food) and oxygen. She also mentioned that this reaction is essential for life on Earth as it provides oxygen and food.

Based on this information, answer:

(a) Write the balanced chemical equation for photosynthesis. (1 mark)

(b) Is photosynthesis an exothermic or endothermic process? Justify. (1 mark)

(c) Name the catalyst involved in this reaction. (1 mark)

(d) What is the source of oxygen released during photosynthesis? (1 mark)

DETAILED ANSWER KEY - PAPER 04

SECTION A - Answers to MCQs

Ans 1. (b) Changing the formulae of reactants

Explanation: While balancing a chemical equation, we can only change the coefficients (numbers before formulae). We must never change the formulae of reactants or products as this would represent a different chemical substance.

Ans 2. (b) Exothermic reaction

Explanation: Decomposition of vegetable matter to compost releases heat energy, making it warm. Hence it is an exothermic reaction. This is why compost pits feel warm.

Ans 3. (b) $CaCO_3 + H_2O$

Explanation: $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$. Calcium hydroxide reacts with carbon dioxide to form calcium carbonate (used in whitewashing) and water.

Ans 4. (b) Temperature increases

Explanation: $CaO + H_2O \rightarrow Ca(OH)_2$ + Heat. This is an exothermic reaction. The beaker becomes hot due to release of heat energy.

Ans 5. (d) Displacement reaction

Explanation: Aluminium being more reactive displaces iron from iron oxide (Fe_2O_3). This is a displacement reaction (also called thermite reaction).

Ans 6. (b) Oxidation

Explanation: Rancidity occurs when fats and oils in food items get oxidized by oxygen present in air. This changes their taste and smell. Oxidation is the main cause of rancidity.

Ans 7. (b) Cl

Explanation: HCl is oxidized to Cl_2. Chlorine changes from -1 oxidation state in HCl to 0 in Cl_2. Loss of hydrogen (or gain of positive charge) is oxidation.

Ans 8. (b) Decomposition

Explanation: In decomposition reactions, a single compound (AB) breaks down into two or more simpler substances (A and B). This is the general form of decomposition.

Ans 9. (d) All of the above

Explanation: All three methods - galvanization (zinc coating), painting, and oiling - prevent rusting by stopping contact of iron with oxygen and moisture, which are necessary for rusting.

Ans 10. (c) Exothermic and combination

Explanation: $CaO + H_2O \rightarrow Ca(OH)_2$ + Heat. Two substances combine to form one product (combination) and heat is released (exothermic).

SECTION B - Answers to Short Answer Questions

Ans 11.

Chemical Equation: A chemical equation is a symbolic representation of a chemical reaction in which the formulae of reactants are written on the left side and formulae of products on the right side, separated by an arrow.

Necessity of balancing:
• To follow the Law of Conservation of Mass
• To ensure that the number of atoms of each element remains the same before and after the reaction
• To represent the correct stoichiometric ratios of reactants and products
• To make the equation scientifically correct and meaningful

Ans 12.

Name of iron salt: Ferrous sulphate ($FeSO_4.7H_2O$) - also called Green vitriol

Observations:
• Green crystals change to brown (ferric oxide)
• Smell of burning sulphur (due to SO_2 and SO_3 gases)

Balanced equation:
$2FeSO_4(s) \xrightarrow{Heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$
(Green) (Brown)

Ans 13.

1. Thermal Decomposition: (Decomposition by heat)
$CaCO_3(s) \xrightarrow{Heat} CaO(s) + CO_2(g)$
Calcium carbonate decomposes on heating to form calcium oxide and carbon dioxide.

2. Electrolytic Decomposition: (Decomposition by electricity)
$2H_2O(l) \xrightarrow{Electricity} 2H_2(g) + O_2(g)$
Water decomposes into hydrogen and oxygen when electric current is passed through it.

3. Photolytic Decomposition: (Decomposition by light)
$2AgCl(s) \xrightarrow{Sunlight} 2Ag(s) + Cl_2(g)$
Silver chloride decomposes in sunlight to form silver and chlorine gas.

Ans 14.

(a) **Oxidation:**
Oxidation is a chemical reaction in which:
• A substance gains oxygen, OR
• A substance loses hydrogen

Example: $2Cu + O_2 \rightarrow 2CuO$ (Copper gains oxygen)

(b) **Reduction:**
Reduction is a chemical reaction in which:
• A substance loses oxygen, OR
• A substance gains hydrogen

Example: $CuO + H_2 \rightarrow Cu + H_2O$ (Copper oxide loses oxygen)

SECTION C - Answers to Short Answer Questions

Ans 15.

Corrosion: Corrosion is the process in which metals are gradually eaten away or damaged by the action of substances around them such as moisture, acids, and air.

How corrosion damages iron:
- Iron reacts with oxygen and moisture present in air
- It forms hydrated iron(III) oxide ($Fe_2O_3.xH_2O$) called rust
- Rust is reddish-brown, soft and porous
- It weakens the iron structure and causes holes
- The article eventually breaks down and loses its strength
- Every year enormous amount of money is spent to replace damaged iron

Methods to prevent corrosion:

1. **Galvanization:**
- Coating iron with a layer of zinc
- Zinc is more reactive and gets oxidized first
- This protects iron from rusting

2. **Painting:**
- Applying paint creates a protective layer
- Prevents contact of iron with air and moisture
- Regular painting keeps iron protected

3. **Making Alloys:**
- Mixing iron with chromium and nickel forms stainless steel
- Stainless steel does not rust
- Used in cutlery, utensils, and surgical instruments

Ans 16.

(a) **Precipitation Reaction:**
A precipitation reaction is a type of double displacement reaction in which two solutions react to form an insoluble solid (precipitate) that separates from the solution.

Examples:

1. $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s)\downarrow + NaNO_3(aq)$
   White precipitate of silver chloride is formed

2. $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s)\downarrow + 2KNO_3(aq)$
   Yellow precipitate of lead iodide is formed

(b) **Importance in everyday life:**
- **Water purification:** Precipitation is used to remove unwanted ions from water
- **Medical diagnosis:** Certain tests use precipitation to detect diseases
- **Photography:** Silver halides precipitate in photographic films
- **Manufacturing:** Production of various chemicals and pigments
- **Qualitative analysis:** Identifying ions present in a solution

Ans 17.

Activity to demonstrate Law of Conservation of Mass:

Materials Required:
• Conical flask with cork
• Small test tube
• Barium chloride solution
• Sodium sulphate solution
• Physical balance

Procedure:
1. Take a conical flask and pour barium chloride solution into it
2. Take sodium sulphate solution in a small test tube
3. Carefully place the test tube inside the conical flask
4. Cork the flask tightly so that nothing can escape
5. Weigh the flask with its contents on a physical balance and record the mass (M_1)
6. Now tilt the flask so that the two solutions mix
7. White precipitate of barium sulphate is formed
8. Weigh the flask again and record the mass (M_2)

Observation:
Mass before reaction (M_1) = Mass after reaction (M_2)

Chemical Equation:
$BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s)\downarrow + 2NaCl(aq)$

Conclusion:
• The total mass remains constant before and after the chemical reaction
• This proves the Law of Conservation of Mass
• Mass is neither created nor destroyed in a chemical reaction
• Atoms are only rearranged during a chemical reaction

SECTION D - Answer to Long Answer Question

Ans 18.

(a) **Redox Reactions:**
Redox reactions are chemical reactions in which oxidation and reduction occur simultaneously. The term "redox" is derived from "reduction-oxidation".

• One substance loses oxygen or gains hydrogen (gets reduced)
• Another substance gains oxygen or loses hydrogen (gets oxidized)
• Both processes occur together in the same reaction

Example 1:
$CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$
• CuO loses oxygen → Reduction
• H_2 gains oxygen → Oxidation

Example 2:
$ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$
• ZnO loses oxygen → Reduction
• C gains oxygen → Oxidation

(b) **Identifying oxidized and reduced substances:**

(i) $ZnO + C \rightarrow Zn + CO$

• **Reduced substance:** ZnO (loses oxygen to form Zn)

• **Oxidized substance:** C (gains oxygen to form CO)

(ii) $CuO + H_2 \rightarrow Cu + H_2O$

• **Reduced substance:** CuO (loses oxygen to form Cu)

• **Oxidized substance:** H_2 (gains oxygen to form H_2O)

(iii) $4Na + O_2 \rightarrow 2Na_2O$

• **Reduced substance:** O_2 (gains electrons from Na, though this is better explained as gaining sodium)

• **Oxidized substance:** Na (gains oxygen to form Na_2O)

SECTION E - Answers to Case Study Based Questions

Ans 19.

(a) The yellow precipitate formed is **Lead iodide (PbI_2)**.

(b) **Balanced chemical equation:**

$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s)\downarrow + 2KNO_3(aq)$

(Lead nitrate) (Potassium iodide) (Yellow ppt) (Potassium nitrate)

(c) **Type of reaction:** This is a **double displacement reaction**.

In this reaction, Pb^{2+} and K^+ exchange their anions (NO_3^- and I^-) to form new compounds.

(d) This reaction is called a precipitation reaction because:

• One of the products (PbI_2) is insoluble in water

• It separates out as a solid precipitate

• The precipitate settles at the bottom of the container

• Any double displacement reaction that produces an insoluble product is called a precipitation reaction

Ans 20.

(a) **Balanced equation for photosynthesis:**

$6CO_2(g) + 6H_2O(l) \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6(aq) + 6O_2(g)$

(Carbon dioxide) (Water) (Glucose) (Oxygen)

(b) Photosynthesis is an **endothermic process**.

Justification:

• It requires energy in the form of sunlight to proceed

• Light energy is absorbed by chlorophyll

• This energy is used to break chemical bonds in CO_2 and H_2O

• Energy is stored in the glucose molecules formed

• Without continuous supply of light energy, the reaction stops

• Energy is absorbed from surroundings (sunlight), not released

(c) The catalyst involved is **Chlorophyll** (the green pigment present in leaves).

(d) The source of oxygen released during photosynthesis is **water (H_2O)**.

• Water molecules are split during photosynthesis

• Oxygen from water is released as O_2 gas

- Hydrogen from water is used to make glucose
- This has been proved by experiments using water labeled with oxygen-18 isotope

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