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 correctly represents a word equation?

(a) $2H_2 + O_2 \rightarrow 2H_2O$

(b) Hydrogen + Oxygen → Water

(c) H + O → HO

(d) Both (a) and (b)

Q2. In the electrolysis of water, the ratio of volumes of hydrogen and oxygen gases liberated is:

(a) 1:1

(b) 2:1

(c) 1:2

(d) 1:3

Q3. Quick lime is:

(a) $CaCO_3$

(b) $Ca(OH)_2$

(c) CaO

(d) $CaCl_2$

Q4. Which of the following is a redox reaction?

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

(b) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

(c) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

(d) $CaCO_3 \rightarrow CaO + CO_2$

Q5. The reaction $CaO + H_2O \rightarrow Ca(OH)_2$ is:

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

Q6. Which of the following indicates that a chemical reaction has occurred?

(a) Change in color
(b) Evolution of gas
(c) Formation of precipitate
(d) All of the above

Q7. In black and white photography, which reaction is used?

(a) Combination reaction
(b) Decomposition by light
(c) Displacement reaction
(d) Thermal decomposition

Q8. When barium hydroxide reacts with ammonium chloride, the reaction is:

(a) Exothermic
(b) Endothermic
(c) Neither exothermic nor endothermic
(d) Sometimes exothermic, sometimes endothermic

Q9. The process of depositing a layer of zinc on iron is called:

(a) Painting
(b) Galvanization
(c) Rusting
(d) Corrosion

Q10. In the reaction $ZnO + C \rightarrow Zn + CO$, which substance is reduced?

(a) ZnO
(b) C
(c) Zn
(d) CO

SECTION B - Short Answer Questions (2 marks each)

Q11. Why do chips manufacturers fill bags with nitrogen gas? Explain the chemical reason.

Q12. Write two observations when iron nails are kept immersed in copper sulphate solution for few hours. Also write the chemical equation.

Q13. What happens when silver bromide is exposed to sunlight? Write the equation and name the type of reaction.

Q14. Distinguish between a displacement reaction and a double displacement reaction with one example each.

SECTION C - Short Answer Questions (3 marks each)

Q15. (a) What is the significance of writing physical states in a chemical equation?
(b) Write the balanced equation with physical states:
(i) Sodium hydroxide solution reacts with hydrochloric acid to produce sodium chloride solution and water
(ii) Burning of natural gas

Q16. Explain the process of whitewashing with the help of chemical equations. Why does the wall become shiny after two to three days?

Q17. Give three differences between exothermic and endothermic reactions with two examples of each type.

SECTION D - Long Answer Question (5 marks)

Q18. (a) What are the different types of chemical reactions? Define each type.
(b) Give one example with balanced equation for each type.

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

Q19. Case Study 1:

During an experiment, a student heated copper powder in a china dish. The surface of copper powder became coated with a black substance. When hydrogen gas was passed over this heated black substance, the black coating disappeared and a brown substance was obtained.

Based on this, answer the following:

(a) Name the black substance formed. (1 mark)

(b) Write the balanced equation for formation of black substance. (1 mark)

(c) Why does the black coating disappear when hydrogen is passed over it? Write the equation. (1 mark)

(d) Which substance is oxidized and which is reduced in the second reaction? (1 mark)

Q20. Case Study 2:

Radha was preparing food and noticed that the oil she had opened a month ago had a different smell and taste compared to when it was fresh. Her mother explained that this happens when oil is exposed to air for long time.

Based on this situation, answer:

(a) What is this process called when oil/fat develops bad smell and taste? (1 mark)

(b) What is the chemical reason for this change? (1 mark)

(c) Give two methods to prevent this process. (1 mark)

(d) Why are some food packets flushed with nitrogen gas? (1 mark)

DETAILED ANSWER KEY - PAPER 03

SECTION A - Answers to MCQs

Ans 1. (b) Hydrogen + Oxygen → Water

Explanation: A word equation represents a chemical reaction using names of reactants and products instead of chemical formulae. Option (b) correctly uses words, while (a) uses formulae.

Ans 2. (b) 2:1

Explanation: $2H_2O \rightarrow 2H_2 + O_2$. From the equation, 2 volumes of hydrogen are produced for every 1 volume of oxygen. Hence the ratio is 2:1.

Ans 3. (c) CaO

Explanation: Quick lime is calcium oxide (CaO). It is formed by heating limestone ($CaCO_3$). When water is added to it, it forms slaked lime $Ca(OH)_2$.

Ans 4. (a) $CuO + H_2 \rightarrow Cu + H_2O$

Explanation: This is a redox reaction where CuO is reduced (loses oxygen) and H_2 is oxidized (gains oxygen). Reduction and oxidation occur simultaneously.

Ans 5. (c) Combination reaction

Explanation: Two substances (CaO and H_2O) combine to form a single product $Ca(OH)_2$. This is the characteristic of a combination reaction.

Ans 6. (d) All of the above

Explanation: All three - change in color, evolution of gas, and formation of precipitate are observations that indicate a chemical reaction has taken place. Other indicators include change in temperature and change in state.

Ans 7. (b) Decomposition by light

Explanation: $2AgBr \rightarrow 2Ag + Br_2$ (in sunlight). Silver bromide decomposes in light to form silver (appears dark) which is used in black and white photography. This is photolytic decomposition.

Ans 8. (b) Endothermic

Explanation: $Ba(OH)_2 + 2NH_4Cl \rightarrow BaCl_2 + 2NH_3 + 2H_2O$. This reaction absorbs heat from surroundings, making the container cold. Hence it is endothermic.

Ans 9. (b) Galvanization

Explanation: Galvanization is the process of coating iron with a protective layer of zinc to prevent rusting. Zinc, being more reactive, gets oxidized first, thus protecting iron.

Ans 10. (a) ZnO

Explanation: ZnO loses oxygen to form Zn. Loss of oxygen is called reduction. Therefore, ZnO is reduced to Zn. Carbon is oxidized as it gains oxygen to form CO.

SECTION B - Answers to Short Answer Questions

Ans 11.

Chips manufacturers fill bags with nitrogen gas because:

Chemical Reason:
• Chips contain fats and oils which get oxidized when exposed to oxygen in air
• This oxidation makes the chips rancid (bad smell and taste)
• Nitrogen is an inert gas that does not react with food
• By flushing bags with nitrogen, oxygen is removed
• This prevents oxidation and keeps chips fresh and crispy for longer time

Ans 12.

Observations when iron nails are kept in copper sulphate solution:

1. The blue color of copper sulphate solution fades gradually and becomes light green
2. A reddish-brown coating of copper metal is deposited on the surface of iron nails

Chemical equation:
$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$
(Blue solution) (Light green) (Brown coating)

Ans 13.

When silver bromide is exposed to sunlight:
• It decomposes to form silver metal and bromine gas
• The white silver bromide turns grey due to formation of silver
• This property is used in black and white photography

Balanced equation:
$2AgBr(s) \xrightarrow{Sunlight} 2Ag(s) + Br_2(g)$

Type of reaction: Photolytic decomposition (decomposition caused by light energy)

Ans 14.

Displacement Reaction	Double Displacement Reaction
A more reactive element displaces a less reactive element from its compound	Two compounds exchange their ions to form two new compounds
General form: $A + BC \rightarrow AC + B$	General form: $AB + CD \rightarrow AD + CB$
Example: $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ (Zinc displaces copper)	Example: $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ (Exchange of ions)

SECTION C - Answers to Short Answer Questions

Ans 15.

(a) **Significance of writing physical states:**
• It makes the equation more informative and complete

• It helps in understanding the actual conditions of reactants and products
• It indicates whether substances are solid (s), liquid (l), gas (g), or in aqueous solution (aq)
• It is essential for understanding the reaction conditions

(b) **Balanced equations with physical states:**

(i) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

(ii) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) + Heat$

Ans 16.

Process of Whitewashing:

Step 1: Quick lime (CaO) is mixed with water to form slaked lime
$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + Heat$
(Quick lime) (Slaked lime)

Step 2: This slaked lime solution is applied on walls

Step 3: Slaked lime slowly reacts with carbon dioxide from air
$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$
(Slaked lime) (Calcium carbonate)

Why wall becomes shiny:
• After two to three days, a thin layer of calcium carbonate ($CaCO_3$) is formed on the wall
• Calcium carbonate is the same chemical as marble
• This gives a shiny, hard finish to the walls
• The reaction with CO_2 takes 2-3 days to complete, hence the shine appears gradually

Ans 17.

Differences between Exothermic and Endothermic Reactions:

S.No.	Exothermic Reactions	Endothermic Reactions
1.	Heat is released during the reaction	Heat is absorbed during the reaction
2.	Temperature of surroundings increases	Temperature of surroundings decreases
3.	Energy is written on product side	Energy is written on reactant side

Examples of Exothermic Reactions:
1. Burning of natural gas: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + Heat$
2. Respiration: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$

Examples of Endothermic Reactions:
1. Decomposition of limestone: $CaCO_3 + Heat \rightarrow CaO + CO_2$
2. Photosynthesis: $6CO_2 + 6H_2O + Sunlight \rightarrow C_6H_{12}O_6 + 6O_2$

SECTION D - Answer to Long Answer Question

Ans 18.

(a) **Types of Chemical Reactions:**

1. Combination Reaction:
A reaction in which two or more substances combine to form a single product.
General form: A + B → AB

2. Decomposition Reaction:
A reaction in which a single substance breaks down to give two or more simpler substances.
General form: AB → A + B

3. Displacement Reaction:
A reaction in which a more reactive element displaces a less reactive element from its compound.
General form: A + BC → AC + B

4. Double Displacement Reaction:
A reaction in which two compounds exchange their ions to form two new compounds.
General form: AB + CD → AD + CB

5. Oxidation-Reduction (Redox) Reaction:
A reaction in which one reactant is oxidized (gains oxygen/loses hydrogen) and another is reduced (loses oxygen/gains hydrogen).

(b) **Examples with balanced equations:**

1. Combination Reaction:
$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$
Magnesium and oxygen combine to form magnesium oxide

2. Decomposition Reaction:
$2FeSO_4(s) \xrightarrow{Heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$
Ferrous sulphate decomposes on heating

3. Displacement Reaction:
$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$
Zinc displaces copper from copper sulphate

4. Double Displacement Reaction:
$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s)\downarrow + NaNO_3(aq)$
Exchange of ions between silver nitrate and sodium chloride

5. Redox Reaction:
$CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$
CuO is reduced, H_2 is oxidized

SECTION E - Answers to Case Study Based Questions

Ans 19.

(a) The black substance formed is **Copper(II) oxide or Cupric oxide (CuO)**.

(b) **Balanced equation for formation of black substance:**
$2Cu(s) + O_2(g) \xrightarrow{Heat} 2CuO(s)$
(Brown) (Black)

(c) The black coating disappears because:
• Hydrogen reduces copper oxide to copper
• Oxygen is removed from CuO
• Brown copper metal is formed again

Equation:
$CuO(s) + H_2(g) \xrightarrow{Heat} Cu(s) + H_2O(l)$
(Black) (Brown)

(d) • **CuO is reduced** (loses oxygen to form Cu)
• **H_2 is oxidized** (gains oxygen to form H_2O)

Ans 20.

(a) This process is called **Rancidity**.

(b) **Chemical reason:**
• Fats and oils present in food get oxidized when exposed to air (oxygen)
• This oxidation reaction changes the chemical composition of fats/oils
• The oxidized products have unpleasant smell and taste
• This is why the oil develops bad smell and taste

(c) **Methods to prevent rancidity:**
1. **Adding antioxidants:** Substances like BHA and BHT prevent oxidation of fats
2. **Storing in air-tight containers:** Reduces contact with oxygen
3. **Refrigeration:** Low temperature slows down oxidation
4. **Vacuum packaging:** Removes air from the package

(d) Food packets are flushed with nitrogen gas because:
• Nitrogen is an inert (unreactive) gas
• It replaces oxygen inside the packet
• Without oxygen, oxidation cannot occur
• This prevents rancidity and keeps food fresh for longer time
• Nitrogen also prevents growth of aerobic bacteria
