

CHAPTER 1: CHEMICAL REACTIONS AND EQUATIONS

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Short, clear, and exam-focused notes
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I Chemical Reaction

A **chemical reaction** is a process where one or more substances (**reactants**) transform into new substances (**products**) with different properties.

Example:



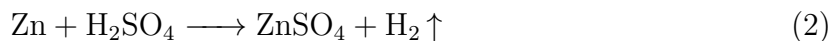
Practice Questions

1. Define a chemical reaction.
2. In the reaction $\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$, identify the reactants and products.
3. List two observations indicating a chemical reaction has occurred.

II Chemical Equation

A **chemical equation** represents a chemical reaction using symbols and formulas.

Example:



- **Reactants:** Substances that react.
- **Products:** Substances formed after the reaction.

Practice Questions

1. Write the chemical equation for the reaction between zinc and hydrochloric acid.
2. What do the symbols (s), (l), (g), and (aq) represent in a chemical equation?

III Balanced Chemical Equation

A **balanced equation** has an equal number of atoms of each element on both sides, following the **Law of Conservation of Mass**: *Mass cannot be created nor destroyed in a chemical reaction.*

Example:



Practice Questions

1. Why must a chemical equation be balanced?
2. Balance the equation: $\text{Fe} + \text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$

IV Exothermic and Endothermic Reactions

Type	Description	Example	Observation
Exothermic	Releases heat energy .	$\text{C} + \text{O}_2 \longrightarrow \text{CO}_2 + \text{heat}$	Increase in temperature
Endothermic	Absorbs heat energy .	$\text{N}_2 + \text{O}_2 + \text{heat} \longrightarrow 2\text{NO}$	Decrease in temperature

Additional Examples:

- **Exothermic:** $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2 + \text{heat}$
- **Endothermic:** $2\text{AgCl} \longrightarrow 2\text{Ag} + \text{Cl}_2$ (on heating)

Practice Questions

1. Define exothermic and endothermic reactions with one example each.
2. Is the burning of magnesium an exothermic or endothermic reaction? Explain why.

V Types of Chemical Reactions

Practice Questions

1. Provide one example each of decomposition and displacement reactions.
2. Identify the type of reaction: $\text{AgNO}_3 + \text{NaCl} \longrightarrow \text{AgCl} + \text{NaNO}_3$.
3. Write a redox reaction and label the oxidation and reduction parts.

Type	Description	Example
Combination	Two or more substances form a single product.	$2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$
Decomposition	A compound breaks into simpler substances.	$2\text{H}_2\text{O} \longrightarrow 2\text{H}_2 + \text{O}_2$
Displacement	One element replaces another in a compound.	$\text{Zn} + \text{CuSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Cu}$
Double Displacement	Exchange of ions between two compounds.	$\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$
Redox	Involves oxidation and reduction.	$\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$

VI Oxidation and Reduction

- **Oxidation:** Addition of oxygen or removal of hydrogen.
- **Reduction:** Addition of hydrogen or removal of oxygen.

Example:



- CuO is **reduced** to Cu.
- H₂ is **oxidized** to H₂O.

Practice Questions

1. Define oxidation and reduction with one example each.
2. In the above reaction, identify the oxidizing and reducing agents.

VII Effects of Oxidation in Daily Life

Corrosion

- Slow deterioration of metals due to air, moisture, or chemicals.
- Example: Rusting of iron $\text{Fe} + \text{O}_2 + \text{H}_2\text{O} \longrightarrow \text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$
- **Prevention:** Painting, oiling, galvanizing, electroplating.

Rancidity

- Oxidation of fats and oils in food, causing bad smell/taste.
- **Prevention:** Use airtight containers, refrigeration, antioxidants.

Practice Questions

1. What is corrosion? Suggest one prevention method.
2. What is rancidity? How can it be prevented?

VIII Characteristics of Chemical Reactions

1. Change in **state**
2. Change in **color**
3. **Gas evolution**
4. Change in **temperature** (heat produced/absorbed)
5. Formation of a **precipitate**

Example:



Practice Questions

1. List three characteristics of a chemical reaction.
2. Provide one example each for a reaction showing a change in color and gas evolution.

IX Important Examples

Reaction	Equation
Burning of magnesium	$2 \text{Mg} + \text{O}_2 \longrightarrow 2 \text{MgO}$
Electrolysis of water	$2 \text{H}_2\text{O} \longrightarrow 2 \text{H}_2 + \text{O}_2$
Heating ferrous sulphate	$2 \text{FeSO}_4 \longrightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
Iron in copper sulphate	$\text{Fe} + \text{CuSO}_4 \longrightarrow \text{FeSO}_4 + \text{Cu}$

Practice Questions

1. Write the equation for heating ferrous sulphate.
2. What type of reaction occurs when iron is dipped in copper sulphate solution?

X Key Formulae

Substance	Formula	Chemical Name
Quick lime	CaO	Calcium oxide
Slaked lime	Ca(OH)_2	Calcium hydroxide
Washing soda	$\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$	Sodium carbonate decahydrate
Baking soda	NaHCO_3	Sodium hydrogen carbonate

Practice Questions

1. Write the chemical formulas for slaked lime and washing soda.
2. What is the chemical name of baking soda?

XI Quick Revision Tips

- Always ensure the number of atoms is balanced on both sides of the equation.
- Memorize one example for each type of reaction.
- Review oxidation effects (corrosion, rancidity).
- Practice balancing equations daily.
- Understand exothermic vs. endothermic: **burning = exothermic, decomposition (often) = endothermic.**