

Chapter 1: Chemical Reactions and Equations

◆ What is a Chemical Reaction?

A chemical reaction is a process in which one or more substances (reactants) are changed into new substances (products) with different properties.

💡 Examples from daily life:

- Milk turning sour
- Iron getting rusty
- Grapes fermenting
- Cooking of food
- Digestion
- Respiration

These involve change in identity or chemical nature — that's why they are chemical changes.

◆ How Do You Know a Chemical Reaction Has Happened?

You can say a chemical reaction has occurred if you observe:

1. **Change in colour**
 2. **Change in state**
 3. **Evolution of gas**
 4. **Change in temperature**
-

◆ Word Equation

A word equation represents a chemical reaction using names of reactants and products.

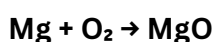
Example:

Magnesium + Oxygen → Magnesium oxide

Reactants are written on the left-hand side (LHS), products on the right-hand side (RHS), and an arrow → shows the direction of the reaction.

◆ Chemical Equation

Instead of words, we can use chemical formulas:

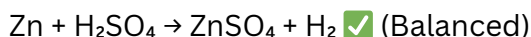


This is called a skeletal chemical equation (unbalanced).

◆ Balanced Chemical Equation

To follow the Law of Conservation of Mass, number of atoms of each element must be same on both sides.

Example:



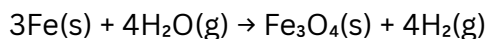
If atoms are unequal, you adjust the equation by adding small whole number coefficients.

◆ Physical States in a Chemical Equation

To make equations more informative, physical states are written as:

- (s) – solid
- (l) – liquid
- (g) – gas
- (aq) – aqueous (dissolved in water)

Example:

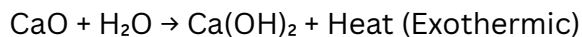


Types of Chemical Reactions

1 Combination Reaction


When two or more substances combine to form a single product.

Example:



Other examples:

- $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
- $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

 **Exothermic Reaction** = Heat is released during the reaction

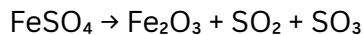
2 Decomposition Reaction

A single compound breaks down into two or more simpler substances.

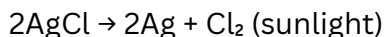
⚠ Usually needs heat, light, or electricity.

Types:

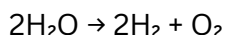
(a) **Thermal decomposition** (by heat)



(b) **Photodecomposition** (by light)



(c) **Electrolytic decomposition** (by electricity)



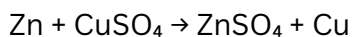
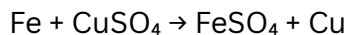
🧠 **Endothermic Reaction** = Energy is absorbed

—

3 Displacement Reaction

A more reactive element displaces a less reactive element from its compound.

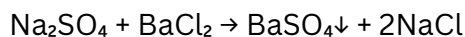
Example:



4 Double Displacement Reaction

Exchange of ions between two compounds to form new compounds.

Example:



Here BaSO_4 is a white insoluble solid → called a precipitate

🧠 **Precipitation Reaction** = An insoluble substance (solid) is formed

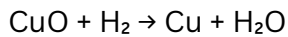
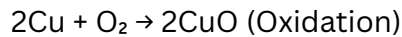
—

5 Oxidation and Reduction (Redox)

Definitions:

- **Oxidation** = Gain of oxygen or loss of hydrogen
- **Reduction** = Loss of oxygen or gain of hydrogen

💡 Example:



CuO is reduced (loses oxygen), H₂ is oxidised (gains oxygen)

These reactions are called redox reactions.

—

Important Daily Life Effects

—

◆ Corrosion

When a metal reacts slowly with air, water, or acids, it gets damaged.

Example: Iron becomes reddish-brown (rust), copper becomes green, silver becomes black.

This process is called corrosion.

💡 It leads to damage of iron bridges, railings, etc.

—

◆ Rancidity

Spoiling of food containing oil/fat due to oxidation.

It smells bad and tastes sour.

🧠 **Prevent rancidity by:**

- Using antioxidants
- Packing food in nitrogen
- Keeping food in airtight containers

—

Summary Points

Type of Reaction	Definition	Example
Combination	2 or more reactants → 1 product	$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$
Decomposition	1 compound → 2 or more products	$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
Displacement	1 element replaces another in a compound	$\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$
Double Displacement	Exchange of ions between 2 compounds	$\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{NaCl}$
Oxidation	Gain of oxygen / Loss of hydrogen	$\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
Reduction	Loss of oxygen / Gain of hydrogen	$\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$
Exothermic	Heat is released	$\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Heat}$
Endothermic	Heat/energy is absorbed	$2\text{AgCl} \rightarrow 2\text{Ag} + \text{Cl}_2$