Chemical Reactions and Equations

- In a chemical reaction, at least one of the following will occur:
- Change in state
- · Change in colour
- Evolution of a gas
- Change in temperature
- Formation of a precipitate

A **chemical equation** is the symbolic representation of a chemical reaction in the form of chemical formulae, signs, symbols, and directions. In which the reactant entities are given on the left-hand side and the product entities on the right-hand side.

Balanced chemical equation

Reactants → **Products**

LHS RHS

Total number of atoms on the LHS = Total number of atoms on the RHS

- How to balance an equation
- Write reactants and products
- Balance the maximum number of a particular atom on both sides
- Balance other atoms
- A complete balanced equation should look like

 $CO g + 2H2 g \rightarrow 340 atm CH30H l$

Types of reactions

- Combination reaction
- Two or more reactants combine to form one single product.

• **Exothermic reaction** – Heat gets released in the reaction. Most combination reactions are exothermic. For example,

$$CaO(s)$$
 + $H_2O(1)$ \rightarrow $Ca(OH)_2(aq)$
Calcium oxide Water Calcium hydroxide
(Quick lime) (Slaked lime)

• **Endothermic reaction** – Heat is absorbed in the reaction. Very few combination reactions are endothermic. For example,

$$12N2 g + 02 g \rightarrow N02 g$$

Decomposition reaction

o A single reactant breaks into several simple products.

Examples:2FeSO₄ Ferrous sulphate $\rightarrow \Delta$ Fe₂O₃Ferric oxide+SO₂+SO₃CaCO₃Limestone $\rightarrow \Delta$ CaOCalcium oxide+ CO₂2AgClSilver chloride $\rightarrow \Delta$ 2AgSilver+Cl₂

o All decomposition reactions are **endothermic [they absorb heat**].

• Displacement reactions:

 In displacement reactions, a more reactive metal can displace a less reactive metal from their compounds in aqueous solutions. (However, a less reactive metal cannot displace a more reactive metal.)

Example: CuSO4 + Zn
$$\rightarrow$$
 ZnSO4 + Cu Copper Sulphate Zinc Zinc Sulph ate Copper (Blue) (Colourless) (Red) Fe s + CuSO4 aq \rightarrow Cu s + FeSO4 aqIron Copper sulphate Copper Iron sulphat e

• Double displacement reaction

Exchange of ions occurs between two compounds.

Example; Na2SO4 aq + BaCl2 s \rightarrow BaSO4 aq + 2NaCl sSodium sulphate Barium chlori de Barium sulphate Sodium chloride

- When the aqueous solution of two compounds react by exchanging their respective ions, such that one of the products formed is insoluble salt and appears in the form of a precipitate, then the reaction is said to be **precipitation reaction**.
- When an acid solution reacts with a base and the two exchange their respective ions, such that only salt and water are products, then the reaction is called **neutralisation reaction**.
- When two compounds react with each other and displace their ions, in such a manner that one of the product formed either decomposes into gaseous compounds or is formed in gaseous state, then the reaction is called **gas-forming reaction**.
- **Oxidation** →When a substance gains oxygen or loses hydrogen

Oxidation in everyday life

- Corrosion When a metal is oxidised by the action of air and moisture [that's why metals are coated]
- o **Rancidity** When fats and oils are oxidised, their smell and taste change [that's why food is kept in air-tight containers]
- **Reduction** → When one substance loses oxygen or gains hydrogen

$$\texttt{CuO+H}_2 \xrightarrow{\texttt{Heat}} \texttt{Cu+H}_2 \texttt{O} \qquad \qquad [\texttt{Reduction of CuO}]$$

• **Redox** – Oxidation–reduction reaction

