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 CH3OH l **Types of reactions**

• Combination reaction

• Two or more reactants combine to form one single product.

Examples: CaO s + H2O l \rightarrow Ca(OH)2 aqCalcium oxideWaterCalcium hydroxide (Quick lime)(Slaked lime)C s + O2 g \rightarrow CO2 gCarbonOxygenCarbon dioxide2H2 g + O2 g \rightarrow 2H2O lHydrogenOxygenWaterVater

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

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

 $12N2 \text{ g} + 02 \text{ g} \rightarrow N02 \text{ g}$

• Decomposition reaction

• 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

• 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 ZincZinc SulphateCopper(Blue)(Colourless)(Red)Fe s + CuSO4 aq \rightarrow Cu s + FeSO4 aqIronCopper sulphateCopperIron sulphatee

- 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** \rightarrow 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]
- **Rancidity** When fats and oils are oxidised, their smell and taste change [that's why food is kept in air-tight containers]
- **Reduction** \rightarrow When one substance loses oxygen or gains hydrogen

$$CuO+H_2 \xrightarrow{Heat} Cu+H_2O$$
 [Reduction of CuO]

• **Redox** – Oxidation–reduction reaction

