# CHAPTER 1.

# CHEMICAL REACTIONS AND EQUATIONS

**Chemical Reaction: –**Whenever a chemical change occurs we can say that a chemical reaction has taken place

e.g. – Food gets digested in our body.

– Rusting of iron.

**Chemical Equation:–** A chemical reaction can be expressed symbolically by using chemical equations.

e.g. Magnesium is burnt into air to form Magnesium Oxide .This can be represented as:

$Mg + O_2 \rightarrow MgO$

- We can observe or recognize a chemical reaction by observing change in state, color, by evolution of gas or by change in temperature.
- Physical state of the reactant and products are mentioned to make chemical reactions more informative. e.g. We use (g) for gas, (l) for liquid, (s) for solid and (aq.) for aqueous.

**Balancing a Chemical Equation: –** We balance a chemical equation so that no. of atoms of each element involved in the reaction remain same at the reactant and product side. It satisfies Law of Conservation of mass which states that the mass can neither be created nor destroyed but is transformed from one form to another.

e.g.- $Fe + H_2O \rightarrow Fe_3O_4 + H_2$ can be written as a balanced equation as:

$3\ Fe\ (s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4H_2\ (g)$

**Different types of Chemical Reactions**

**Combination Reaction:–**The reaction in which two or more substances combine to form a new single substance.

e.g. –$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (aq.)$

Calcium Oxide Water Calcium Hydroxide

$Ca(OH)_2$ (slaked lime) is used for white washing. It reacts with $CO_2$ to form $CaCO_3$ and gives a shiny finish to the walls.

**Exothermic Reactions:–**Reaction in which heat is released along with the formation of products.

e.g.- $CH_4(g) + 2O_2(g) \rightarrow CO_2\ (g) + 2H_2O\ (g)$

– Respiration is also exothermic reaction.

– Decomposition of vegetable matter into compost.

**Decomposition Reactions:–** The reaction in which a single substance decomposes to give two or more substances. Decomposition reactions can be of three types:

**Decomposition Reactions**

→ **Thermal Decomposition :-** When a decomposition reaction is carried out by heating

eg $2\ FeSO_{4(s)} \xrightarrow{Heat} Fe_2O_{3(s)} + SO_{2(g)} + SO_{3(g)}$

Ferrous Sulphate (Green Colur) → Ferric Oxide (Reddish brown colour)

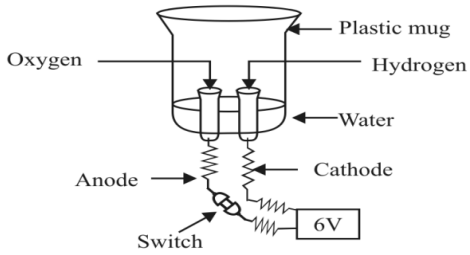
$Ca\ CO_{3(s)} \xrightarrow{Heat} CaO_{(s)} + CO_{2(g)}$

$Pb\ (NO_3)_{2(s)} \xrightarrow{Heat} PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

Lead Nitrate (White colour) → Leadoxide (Brown colour) + Nitrogen dioxide + Oxygen

→ **Electrolytic Decomposition :-** When a decomposition reaction is carried out by electric current,

eg. $H_2O_{(l)} \xrightarrow[current]{electric} 2\ H_{2(g)} + O_{2(g)}$




→ **Photolytic decomposition :-** When a decomposition reaction is carried out by light

eg. $2Ag\ Cl_{(s)} \xrightarrow{Sunlight} 2Ag_{(s)} + Cl_{2(g)}$

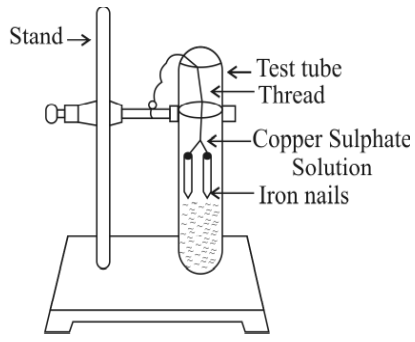
White colour → grey clour

**Endothermic Reactions –** The reactions which require energy and proceed with the absorption of heat energy are called endothermic reactions.

$2NH_3$ + Heat → $N_2$ + $3H_2$

**Displacement Reaction:** The chemical Reaction in which a more reactive element displaces another element from its solution.

e.g. -Fe (s) + $CuSO_4$ (aq.) → $FeSO_4$ + Cu (s)



The nail becomes brownish in colour and the blue colour of Copper Sulphate solution fades.

**Double Displacement Reaction:** The reaction in which two different atoms or group of atoms are mutually exchanged.

e.g.- $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4(s) + 2NaCl$

A white insoluble substance or precipitate of $BaSO_4$ is formed in the above reaction.

**Precipitation Reaction** – Any reaction that produces a precipitate is called a precipitation reaction.

e.g.- $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 \downarrow + 2KNO_3$

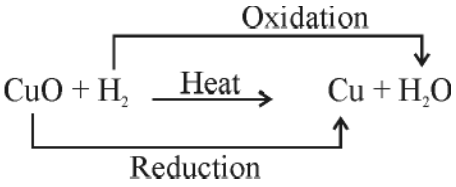
**Oxidation :** Oxidation is the gain of oxygen or loss of hydrogen

e.g- $2Cu + O_2 \rightarrow 2CuO$

When Copper is heated a black colour appears. If this CuO is reacted with hydrogen gas then again Cu becomes brown as reverse reaction takes place.

**Reduction:** Reduction is the loss of oxygen or gain of hydrogen.

**Redox Reaction:** The reaction in which one reactant gets oxidized while other gets reduced.




**Oxidizing agent-**Compounds which can give oxygen or remove hydrogen are called oxidizing agent. An oxidizing agent itself gets reduced in the reaction. In the above reaction CuO is the oxidizing agent which gets reduced to Cu.

**Reducing agent-**Compounds or elements which can cause reduction (give hydrogen) are called Reducing agents. They themselves get oxidized. In the above reaction, $H_2$ is the reducing agent which gets oxidized to $H_2O$