CLASS 10-SCIENCE
CHAPTER 1
CHEMICAL REACTIONS AND EQUATIONS
PART 2- TYPES OF CHEMICAL REACTIONS

TYPES OF CHEMICAL REACTIONS

- *Combination Reaction- The reaction in which two or more substances (reactants) combine to form a single product is called combination reaction.*

Examples-

i) Two elements combine to form a single compound.

$2Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s)$

$2H_2\ (g) + O_2\ (g) \rightarrow 2H_2O\ (l)$

ii) A compound reacts with an element to form a new compound.

$2CO\ (g) + O_2\ (g) \rightarrow 2CO_2\ (g)$

$2SO_2\ (g) + O_2\ (g) \rightarrow 2SO_3\ (g)$

iii) Two or more compounds combine together to form a new compound.

$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (aq)$

$NH_3\ (g) + HCl\ (g) \rightarrow NH_4Cl\ (s)$

TYPES OF CHEMICAL REACTIONS (cont)

- *Exothermic Reaction-* *The reaction in which heat is released along with the formation of products is called exothermic reaction.*

Examples-

i) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + Heat$

ii) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Energy$

- *Endothermic Reaction-* *The reaction in which energy is absorbed either in the form of heat, light or electricity is called endothermic reaction.*

Examples-

i) $CaCO_3\,(s) + Heat \rightarrow CaO\,(s) + CO_2\,(g)$

ii) $2AgCl\,(s) + Sunlight \rightarrow 2Ag\,(s) + Cl_2\,(g)$

TYPES OF CHEMICAL REACTIONS (cont)

- *Decomposition Reaction-* *When a single reactant decomposes to form two or more simpler products by absorbing energy either in the form of heat, light or electricity, the reaction is called decomposition reaction.*

➢ *Types of Decomposition Reaction-*

1) Thermal Decomposition- When a single reactant decomposes to form two or more simpler products by absorbing energy in the form of heat, the reaction is called thermal decomposition reaction.

Examples-

i) $CaCO_3\ (s) \xrightarrow{Heat} CaO\ (s) + CO_2\ (g)$

(Calcium Carbonate) (Calcium Oxide) (Carbon dioxide)

ii) $2\ FeSO_4\ (s) \xrightarrow{Heat} Fe_2O_3\ (s) + SO_2\ (g) + SO_3\ (g)$

(Ferrous Sulphate) (Ferric Oxide) (Sulphur dioxide) (Sulphur trioxide)

TYPES OF CHEMICAL REACTIONS (cont)

2) Electrolytic Decomposition- When a single reactant decomposes to form two or more simpler products by absorbing energy in the form of electricity, the reaction is called electrolytic decomposition reaction.

Examples-

i) $2H_2O\ (l) \longrightarrow 2H_2\ (g) + O_2\ (g)$

(Water) (Hydrogen) (Oxygen)

ii) $2Al_2O_3\ (l) \longrightarrow 4Al\ (l) + 3O_2\ (g)$

(Aluminium Oxide) (Aluminium) (Oxygen)

TYPES OF CHEMICAL REACTIONS (cont)

3) Photolysis or Photolytic Decomposition- When a single reactant decomposes to form two or more simpler products by absorbing energy in the form of light (sunlight), the reaction is called photolytic decomposition reaction.

Examples-

i) $2AgCl\ (s) \xrightarrow{Sunlight} 2Ag\ (s) + Cl_2\ (g)$

(Silver chloride) (Silver) (Chlorine)

ii) $2AgBr\ (s) \xrightarrow{Sunlight} 2Ag\ (s) + Br_2\ (g)$

(Silver bromide) (Silver) (Bromine)

TYPES OF CHEMICAL REACTIONS (cont)

- *Displacement Reaction- When a more reactive metal displaces a less reactive metal from its aqueous salt solution, the reaction is called displacement reaction.*

Examples-

i) $CuSO_4\ (aq) + Fe\ (s) \rightarrow FeSO_4\ (aq) + Cu\ (s)$

(Copper sulphate) (Iron) (Iron sulphate) (Copper)

ii) $Pb\ (s) + CuCl_2\ (aq) \rightarrow PbCl_2\ (aq) + Cu\ (s)$

(Lead) (Copper chloride) (Lead chloride) (Copper)

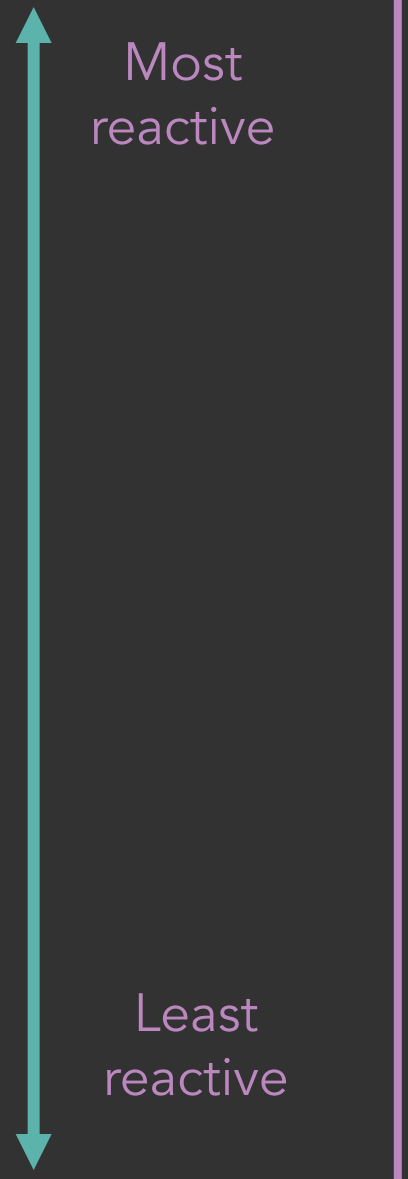
iii) $2KI\ (aq) + Cl_2\ (g) \rightarrow 2KCl\ (aq) + I_2\ (s)$

(Potassium iodide) (Chlorine) (Potassium chloride) (Iodine)

REACTIVITY SERIES

- *The series in which the metals are arranged in the decreasing order of their reactivity is known as the reactivity series of metals. According to this, the least reactive metal is placed at the bottom while the most reactive metal is placed at the top of the series.*

Potassium	K
Sodium	Na
Calcium	Ca
Magnesium	Mg
Aluminium	Al
Carbon	C
Zinc	Zn
Iron	Fe
Tin	Sn
Lead	Pb
Hydrogen	H
Copper	Cu
Mercury	Hg
Silver	Ag
Gold	Au
Platinum	Pt



TYPES OF CHEMICAL REACTIONS (cont)

- *Double Displacement Reaction- The reactions in which two compounds in their aqueous solution react by an exchange of ions between them to form two new compounds are called double displacement reactions.*

Examples-

i) $BaCl_2\ (aq) + Na_2SO_4\ (aq) \rightarrow BaSO_4\ (s) + 2NaCl\ (aq)$

(Barium chloride) (Sodium sulphate) (Barium sulphate) (White ppt.) (Sodium chloride)

ii) $Pb(NO_3)_2\ (aq) + 2KI\ (aq) \rightarrow PbI_2\ (s) + 2KNO_3\ (aq)$

(Lead nitrate) (Potassium iodide) (Lead iodide) (Yellow ppt.) (Potassium nitrate)

TYPES OF CHEMICAL REACTIONS (cont)

- *Precipitation Reaction- Precipitation reaction is a chemical reaction in which the cations and the anions in aqueous solution combine to form an insoluble ionic solid called precipitate.*

Examples-

i) $NaCl\ (aq) + AgNO_3\ (aq) \rightarrow NaNO_3\ (aq) + AgCl\ (s) \downarrow$

(Sodium chloride) (Silver nitrate) (Sodium nitrate) (Silver chloride) (White ppt.)

ii) $BaCl_2\ (aq) + CuSO_4\ (aq) \rightarrow BaSO_4\ (s) \downarrow + CuCl_2\ (aq)$

(Barium chloride) (Copper sulphate) (Barium sulphate) (White ppt.) (Copper chloride)

TYPES OF CHEMICAL REACTIONS (cont)

- *Neutralization Reaction-* *Neutralization reaction is a chemical reaction in which an acid and a base react together to form salt and water as products. In this reaction, H^+ ions and OH^- ions combine to form water (H_2O).*

Examples-

i) $NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l)$

(Sodium hydroxide) (Hydrochloric acid) (Sodium chloride) (Salt) (Water)

i) $NH_4OH\ (aq) + HCl\ (aq) \rightarrow NH_4Cl\ (aq) + H_2O\ (l)$

(Ammonium hydroxide) (Hydrochloric acid) (Ammonium chloride) (Salt) (Water)

TYPES OF CHEMICAL REACTIONS (cont)

- *Oxidation and Reduction Reaction-*

➢ *Oxidation- The addition of oxygen to a substance or removal of hydrogen from a substance is called oxidation.*

Examples-

i) $2Cu + O_2 \rightarrow 2CuO$

ii) $2H_2S + SO_2 \rightarrow 3S + 2H_2O$

➢ *Reduction- The addition of hydrogen to a substance or removal of oxygen from a substance is called reduction.*

Examples-

i) $CuO + H_2 \rightarrow Cu + H_2O$

ii) $H_2S + I_2 \rightarrow 2HI + S$

TYPES OF CHEMICAL REACTIONS (cont)

- *Redox Reaction-* *The reaction in which both oxidation and reduction occur simultaneously is called redox reaction.*

Examples-

Reduction

i) $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$

Oxidation

Reduction

ii) $Fe_3O_4 + 4H_2 \rightarrow 3Fe + 4H_2O$

Oxidation

TYPES OF CHEMICAL REACTIONS (cont)

- *Oxidising Agent- A substance that oxidises another substance and itself gets reduced is called an oxidising agent.*

Examples-

i) $2Cu + O_2 \rightarrow 2CuO$ (O_2 is oxidising agent)

ii) $2H_2S + SO_2 \rightarrow 3S + 2H_2O$ (SO_2 is oxidising agent)

- *Reducing Agent- A substance that reduces another substance and itself gets oxidised is called a reducing agent.*

Examples-

i) $CuO + H_2 \rightarrow Cu + H_2O$ (H_2 is reducing agent)

ii) $H_2S + I_2 \rightarrow 2HI + S$ (H_2S is reducing agent)

EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE

- *Corrosion- Metals when kept exposed, they react with air, moisture, acids and other gases present in the atmosphere and get corroded. This process is called corrosion. It is the formation of layers of undesired compounds such as metallic oxides, metallic hydroxides, metallic carbonates on the surface of the metal. It is slow oxidation caused by moist air containing oxygen, carbon-dioxide and hydrogen sulphide.*

Examples-

i) Rusting of iron- Iron metal when left exposed, it reacts with moisture and air and gets coated with a reddish-brown powdery substance called rust. This process is called rusting.

$4Fe + 3O_2 + 2xH_2O \rightarrow 2Fe_2O_3.xH_2O$

EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE

ii) Copper tarnish- The copper metal items react with oxygen, carbon-dioxide and atmospheric moisture to form a green coloured coating of hydrated copper carbonate.

$2Cu + CO_2 + H_2O + O_2 \rightarrow CuCO_3.Cu(OH)_2$

iii) Silver Tarnish- In silver articles, the metallic silver reacts with hydrogen sulphide or sulphur present in air and gets tarnished thus forming black coloured silver sulphide.

$4Ag + 2H_2S + O_2 \rightarrow 2Ag_2S + 2H_2O$

- Rancidity- When food containing fats and oil is exposed to air for a long time, it gets oxidised and gives bad taste and smell to food. This process is called rancidity.

PREVENTION OF CORROSION

To prevent corrosion, we need to put a barrier between water and oxygen, and the metal's surface.

Steps to prevent corrosion-

(i) Rusting of iron can be prevented by coating the surface with paint

(ii) Iron objects can be prevented by applying oil or grease on their surface

(iii) By electroplating- The process of coating the metal with a layer of another metal with the help of electricity is called electroplating. Tin, chromium and nickel are resistant to corrosion and hence used to prevent rusting of iron.

(iv) By galvanization- The process of depositing a thin layer of zinc metal on an iron object is called galvanization. It is done by dipping the object in molten zinc and then allowing it to harden to protect the iron object from rusting.

v) By alloying- It is the method of improving the properties of a metal by mixing it with another metal or non-metal. Stainless steel is an alloy made from iron and chromium or nickel which is more resistant to corrosion or rusting.

PREVENTION OF RANCIDITY

Steps to prevent rancidity:

(i) Storing food materials in air-tight containers

(ii) Packaging food items by flushing nitrogen in the food packets

(iii) Refrigeration of food items

(iv) Addition of antioxidants or preservatives to the foods containing fats and oils. Some common antioxidants are, BHA (Butylated Hydroxy Anisole), BHT (Butylated Hydroxy Toluene)

THANK YOU