Date : 03/04/25

# Ch-1 Chemical reaction and its equations

~Notes:-

Original substances looses its nature and identity and form new substance with new nature and identity is termed as chemical reaction

## ~ Chemical reactions

Example: $C + O \longrightarrow CO_2$
[carbon] [oxygen] [carbon-di-oxide]

1) Lead nitrate reacts with Potassium Iodide and give lead iodide and potassium

Word equation:-

$Pb(NO_3)_2 + KI \longrightarrow PbI_2 + KNO_3$

Lead nitrate + Potassium Iodide ⟶ lead iodide + potassium nitrate

Lead nitrate + Potassium Iodide → Reactant

lead iodide + potassium nitrate → product

L.H.S

R.H.S

Chemical equation: $Pb(NO_3)_2 + KI \longrightarrow PbI_2 + KNO_3$

→ Skeletal equation

Balanced equation:

$Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$

Complete reaction:

$Pb(NO_3)_{2\,(aq)} + 2KI_{(aq)} \longrightarrow Pb\!\downarrow_{(Yellow)} + 2KNO_{3\,(aq)}$

(2) A magnesium ribbon burnt in presence of oxygen in air it will form magnesium oxide

->Magnesium + Oygen -> Magnesium oxide

a) Sketal equation

$Mg + O_2 \longrightarrow MgO$

b) Balancing equation

$2Mg_{(s)} + O_{2\,(gas)} \longrightarrow 2MgO_{(s)}$

$MgO + H_2O \longrightarrow Mg(OH)_2$

[Base]

* in litmus paper the colour was "blue"

3) Sodium carbonate reacts with Sulphuric acid and form sodium sulphate, water and carbon dioxide

Word equation

Sodium carbonate + Sulphuric acid → Sodium sulphate + water + Carbon dioxide

Chemical equation

$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2\uparrow$
(s) (aq) (aq) (l) (g)

4) Zinc reacts with hydrochloric acid to form zinc chloride and hydrogen gas

Word equation:

Zinc + hydrochloric → zinc chloride + hydrogen gas↑

Chemical equation

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$
(s) (aq) (aq) (g)

## * Characterotics of chemical reaction

Easily observable changes that take place in a chemical reaction is said to be characterstic of chemical reaction

1) Change in state
2) Change in colour
3) Evolution of gas
4) Formation of precipate
5) Change in temperature.

## * Change in state.

Ex - Candle burn its forms gaseous $CO_2$ & $H_2O$ (Vapour)

## * Change in colour

$$Pb(NO_3)_2 + 2KI \longrightarrow PI_2 + 2KNO_3$$

## * Formation of precipitate

$$Pb(NO_3)_2 + 2KI \longrightarrow PI_2 + 2KNO_3$$

(Yellow) ppt

## * Evolution of gas

- $Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O + CO_2\uparrow$

- $Zn + 2HCl \longrightarrow ZnCl_2 + H_2 \uparrow$

* Change in temperature

→ Exothermic and Endothermic

Exothermic:- Heat released in a chemical reaction
(calcium oxide) (calcium dioxide)
$CaO + H_2O \longrightarrow Ca(OH)_2$
(quicklime) (slaked lime)

Endothermic:- A process in which heat is absorbed in a chemical reaction

* $Ba(OH)_2 + 2NH_4Cl \rightarrow BaCl_2 + 2NH_4OH$
Barium hydroxide
Heat ↑ Heat ↓

* $KClO_3 \longrightarrow KCl + O_2$
Potassium chlorate — Potassium chloride — oxygen

Types of Chemical reaction

In a chemical reaction arrangement of atom takes place and hence they are classified in various type:.

1) Combination reaction

2) Decomposition reaction
3) Displacement reaction
4) Double displacement reaction

5) Oxidation reaction
6) Neutralization
7) Precipitation reaction.

1) Combination reaction

When two or more substance (Element or compound) combine together and form new substance are termed as combination reaction

Combination reaction are 3 type:

→ Combination of element with element
→ Combination of element with compound
→ Combination of compound with compound

* Combination of element with element

- $C + O_2 \longrightarrow CO_2$
  (carbon) (oxygen) (carbon dioxide)
- $2Mg + O_2 \longrightarrow 2MgO$
  (magnessium) (oxygen) (magnessium oxide)
- $Fe + S \longrightarrow FeS$
  (Iron) (Sulphur) (Iron sulphide)

- $H_2$ + $Cl_2$ $\longrightarrow$ $2HCl$
  (Hydrogen) (Chlorine)
- $N_2 + 3H_2 \longrightarrow 2NH_3$
  (Nitrogen) (Hydrogen) (Ammonia)
- $2H_2 + O_2 \longrightarrow 2H_2O$
  (Hydrogen) (Oxygen) (water)

* Combination of element with compound

- $2NO + O_2 \longrightarrow 2NO_2$
  (Nitrous oxide) (oxygen) (Nitrogen dioxide)
- $2SO_2 + O_2 \longrightarrow 2SO_3$
  (sulphur dioxide) (oxygen) (sulphur trioxide)

* Combination of compound with compound.

- $NH_{3(g)} + HCl_{(g)} \longrightarrow NH_4Cl_{(g)}$
  (Ammonia) (hydrogen chloride) White colour (Ammonium chloride)
- $CaO + H_2O \longrightarrow Ca(OH)_2$
- $CaO + SO_2 \longrightarrow CaSO_4$
  Calcium sulphate.

Note:- Combination reaction mostly show exothermic in nature.

ex:-

$$CH_4 + O_2 \longrightarrow CO_2 + \text{heat/energy}$$

$$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O + \text{Energy}$$

Decomposition reaction:- Reaction are those reaction in which complex compound break down into simple fo

* Decomposition occur in 3 ways:-

1) Thermal decomposition
2) Electrical decomposition
3) Photolytic decomposition

## 1) Thermal decomposition

A reaction which occur in presence of heat is said to be thermal decomposition

ex: $2Pb(NO_3)_2 \xrightarrow[\text{Heat}]{\Delta} 2PbO + 4NO_2 + O_2$

$Pb(NO_3)_2$ (s) — lead nitrate
$PbO$ (s) — lead oxide
$NO_2$ (g) — Nitrogen oxide
$O_2$ (g) — Oxygen

Bluish

$FeSO_4 \cdot 7H_2O \xrightarrow{\Delta} FeSO_4 + H_2O$ (white powder)

$FeSO_4 \cdot 7H_2O$ — Hydrated ferrous sulphate
$FeSO_4$ — Unhydrated

- $FeSO_4 \longrightarrow Fe_2O_3 + SO_2\uparrow + SO_3\uparrow$

(Ferric oxide)

Brown fumes

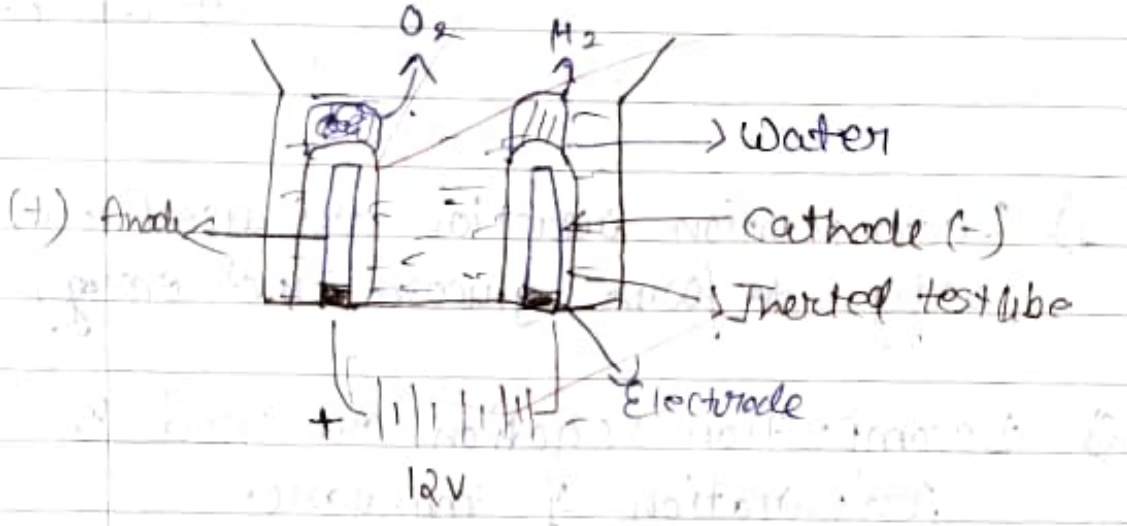
## 2) Electrolytic decomposition :-

Decomposition that is carried in presence of electricity is said to be electrical decomposition

Imp Example:-

$$2H_2O_{(l)} \xrightarrow{\text{electrolysis}} 2H_{2(g)} + O_{2(g)}$$

## Experimental Support



3) Photolytic decomposition

A decomposition reaction which take place in presence of sunlight are termed to be photolytic decomposition reaction

Ex:-

- $2AgCl \xrightarrow[h\nu]{\text{Sunlight}} 2Ag + Cl_2$
- $2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$
  Silver bromide.

Note:-
It was used in ~~phog~~ photographic

Note:-
Mostly decomposition reaction are considered to be endothermic nature.

* Uses of decomposition reaction:

1) Decomposition reaction are used in body to form glucose and energy

2) Decomposition reaction are used in preparation of manyare.

3) Decomposition reaction are used in metallurgical process.

Ex> $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

$HgO \xrightarrow{\Delta} Hg + O_2$

## Displacement reaction:-

### Reactivity series of metal

K
Na
Ba
Ca
Mg
Al
Zn
Fe
Co
Ni
Sn
Pb
H
Cu
Hg
Ag
Au
Pt

$K > Na > Ba > Ca > Mg > Al > Zn > Fe > Co > Ni > Sn > Pb > H > Cu > Hg > Ag > Au > Pt$

# Reaction in which high reaction metal ~~[illegible]~~ that displaces low reactive metal from its metal salt is said to be displacement reaction

Example:

* $Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$
  Zinc (Copper sulphate) (Zinsulphate) (Copper)

* $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$
  (Zinc) (Hydrogen sulphate) (Zinc sulphate) (Hydrogen)

* $Cu + AgNO_3 \longrightarrow CuNO_3 + Ag$

* $Mg + CuNO_3 \longrightarrow MgNO_3 + Cu$

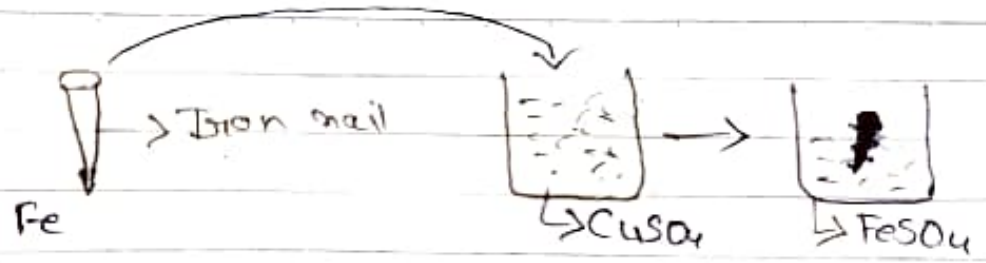
* $Cu + ZnNO_3 \longrightarrow$ No reaction

* $3Ca + Al_2(SO_4)_3 \longrightarrow 3CaSO_4 + 2Al$

Experimental Support:

Suppose we will take

$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$
grey blue Greenish brown




## * Double Displacement or precipitation reaction

Two compound react together and mutal exchange of ion to form new compound are said to be double displacement reaction

Imp Ex:-

$$BaCl_2 + Na_2SO_4 \longrightarrow \underset{(aq)}{BaSO_4}\ (ppt.) + 2NaCl\ (aq)$$

Ex:- $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4\ (ppt) + HCl$

Ex:- $CuSO_4 + H_2S \longrightarrow CuS\ (ppt) + H_2SO_4$

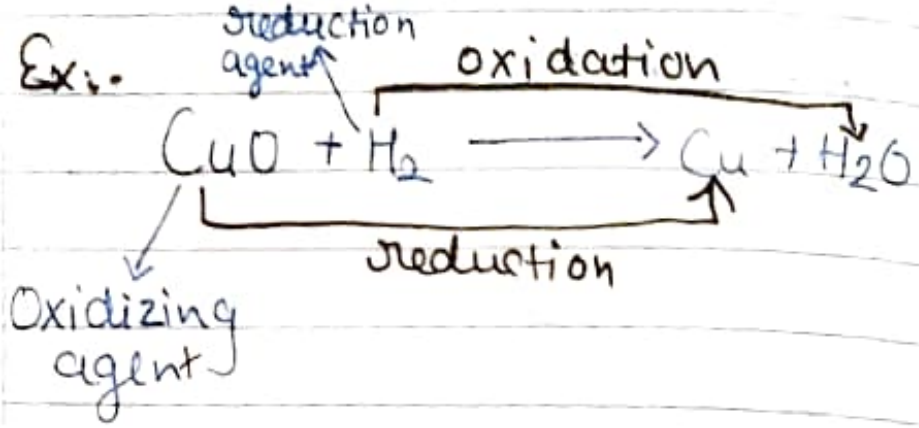
## Redox reaction

A Reaction in which oxidation and reduction takes place simultaneously are termed to be redox reactia

Oxidation:- A reaction in substance involve addition of oxygen and remov of hydrogen are termed to be oxidatic

involved addition of hydrogen or removal of oxygen

Ex:-

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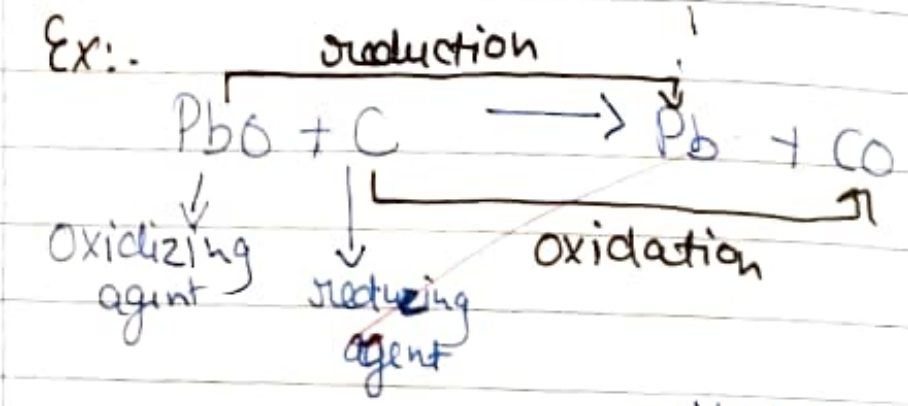


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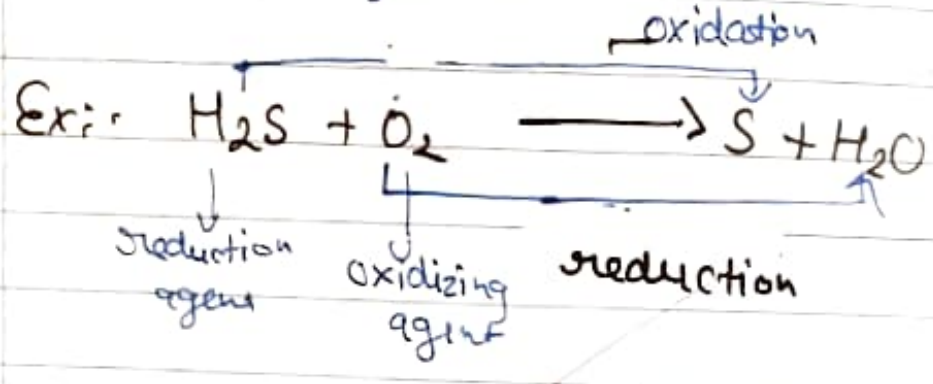


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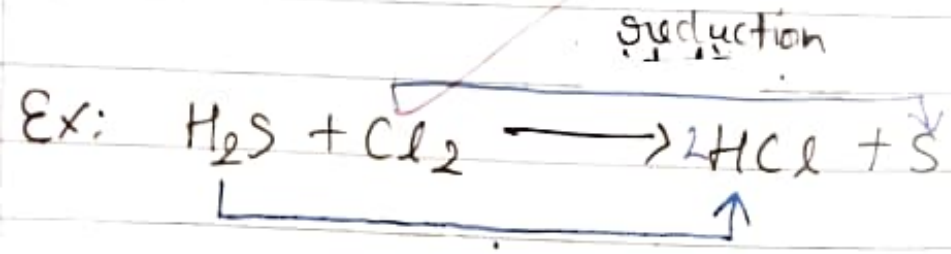
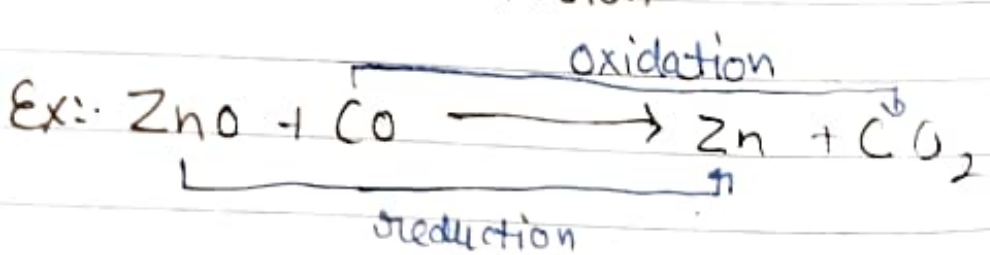



Ex:-



# Corrosion and Rancidity

Corrosion:- Deteoriating of metal in the presence of air and moisture is said to be corrosion

Types of corrosion

1) Rust ($Fe_2O_3 \cdot x H_2O$) $\longrightarrow$ $Fe + O_2 + H_2O$
↳ moisture.

2) Copper carbonate · Copper hydroxide
$CuCO_3 \cdot Cu(OH)_2$

3) Silver sulphide
~~$Ag_2S$~~ $Ag_2S$

$Ag + H_2S \longrightarrow Ag_2S + H_2$

Rancidity

Oily food looses in odour and taste when it comes in contact with air this process is said to be rancidity

Prevention:- 1) Butra-hydrated anisoil (BHA)
2) Refrigeration
3) Vaccum packing
4) Nitrogen packing

## Exercises

Q.4) What is a balanced chemical equation? Why should chemical equations be balanced?

Ans ⇒ A balanced chemical has an equal number of atoms of different elements in the reactants and products.
The chemical equation should be balanced to satisfy the law of conservation of mass.

Q.5) Translate the following statement into chemical equation and then balance them.

Ans ⇒ (a) Hydrogen gas combines with nitrogen to form ammonia

⇒ $3H_{2(g)} + N_{2(g)} \longrightarrow 2NH_{3(g)}$

(b) Zinc + Silver nitrate ⟶ Zinc nitrate + silver

⇒ $Zn + 2AgNO_3 \longrightarrow Zn(NO_3)_2 + 2Ag$

(c) Barium chloride reacts with aluminium sulphate to give aluminium chloride

and a precipitate of barium sulphate

$\Rightarrow 2Al + 3CuCl_2 \longrightarrow 2AlCl_3 + 3Cu$

(d) Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.

$\Rightarrow BaCl_2 + K_2SO_4 \longrightarrow BaSO_4 + 2KCl$

(Q.8) Write the balanced chemical equation for the following and identify the type of reaction in each case.

(a) Potassium bromide + Barium iodide $\longrightarrow$ Potassium iodide + Barium bromide

$\Rightarrow 2KBr + BaI_2 \longrightarrow 2KI + BaBr_2$

Type: Double displacement reaction

(b) Zinc carbonate $\longrightarrow$ Zinc oxide + Carbon dioxide bromide

$\Rightarrow ZnCO_3 \longrightarrow ZnO + CO_2$

Type: Decomposition reaction

(c) Hydrogen + Chloride $\longrightarrow$ Hydrogen chlorid

$\Rightarrow$ Combination reaction

Type: Combination reaction