PARMAR SSC

SSC GK

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Chemistry

Chemical Reactions

Lecture :- 7

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CHEMICAL REACTIONS

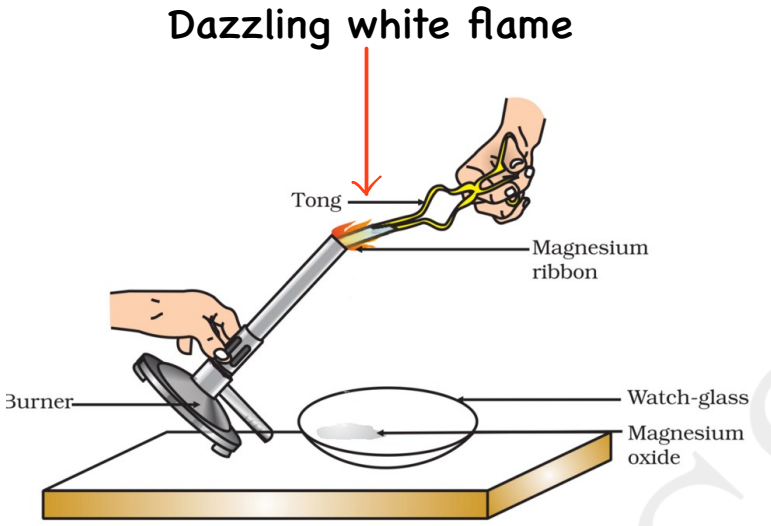


Figure 1.1
Burning of a magnesium ribbon in air and collection of magnesium oxide in a watch-glass

→ white ppt.

Magnesium + Oxygen → Magnesium oxide

$Mg + O_2 \rightarrow 2\,MgO$

Reactants

Product

to balance oxygen

- According to the LAW OF CONSERVATION OF MASS, in a chemical equation, mass remains constant.

- In a chemical reaction, bonds break and re-generate but the number of atoms remains the same.

- Example :

$3\,Fe + 4\,H_2O \rightarrow Fe_3O_4 + 8\,H_2$

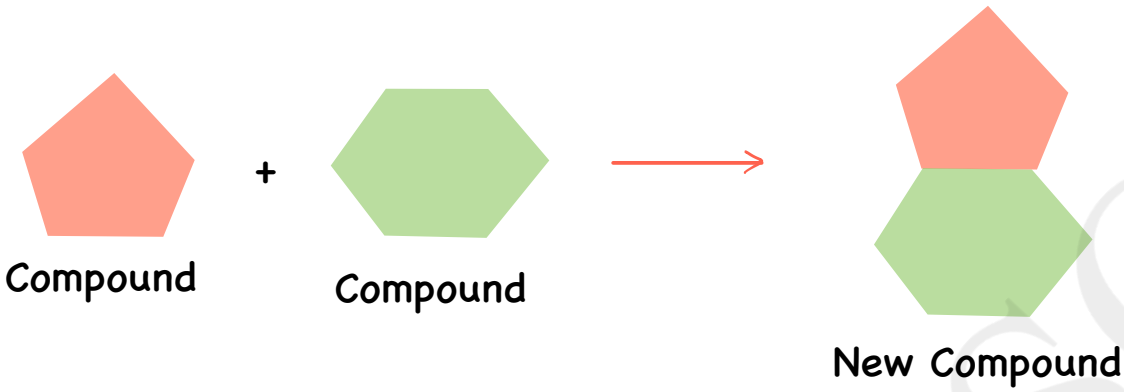
to balance hydrogen

to balance oxygen

to balance iron

Types of chemical reactions

1. Combination Reactions



- Two reactants combine to form a single product.

CaO + H_2O → $Ca(OH)_2$

(quick lime) (slaked lime)

Vigorous reaction and heat evolves

↓

Exothermic Reaction

applied on walls

$Ca(OH)_2$ + CO_2 → $CaCO_3$

↓ ↓

(lime water) shiny finish (Milky)

whitewashing walls

$CaCO_3$ → Marble, Limestone, Chalk

$CaCO_3$ ← Outer part of egg

CH_4 + $2O_2$ → (exothermic) CO_2 + $2H_2O$

methane

↓

evaporates

C + O_2 → (exothermic) CO_2 (Burning of coal)

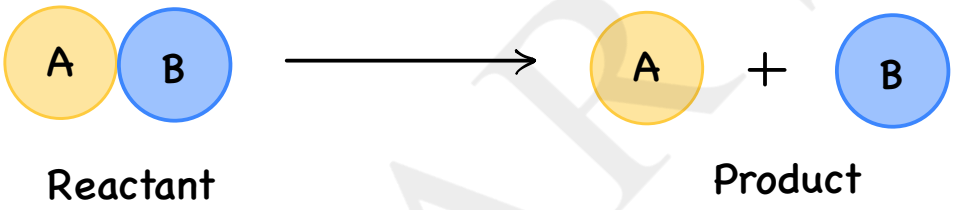
- All combination reactions are not exothermic in nature.

- Respiration is an exothermic reaction :-

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$$

- Decomposition of waste is exothermic reaction.

2. Decomposition Reactions



Reactant Product

Energy usually consumed in this reaction- ENDOTHERMIC

Eg. $Pb(NO_3)_2 \xrightarrow{\Delta} PbO + NO_2 + O_2$

heat

NO_2 ↓ brown fumes evolve

↓ thermal decomposition

Eg. $Cu(NO_3)_2 \xrightarrow{\Delta} CuO + NO_2$

(blue) (black) (brown)

Eg. $2AgCl \xrightarrow{light} 2Ag + Cl_2$

$2AgBr \xrightarrow{light} 2Ag + Br_2$

photochemical decomposition

↓ used in black and white photography

Eg. $FeSO_4 . 7H_2O \xrightarrow{\Delta} FeSO_4 \xrightarrow{\Delta} Fe_2O_3 + SO_2 + \ldots$

(green)

Eg. $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

quick lime

↓

used in cement industry

3. Displacement Reactions

Vicky + Selmon-Katrina → Vicky-Katrina + Selmon

Selmon displaced by Vicky

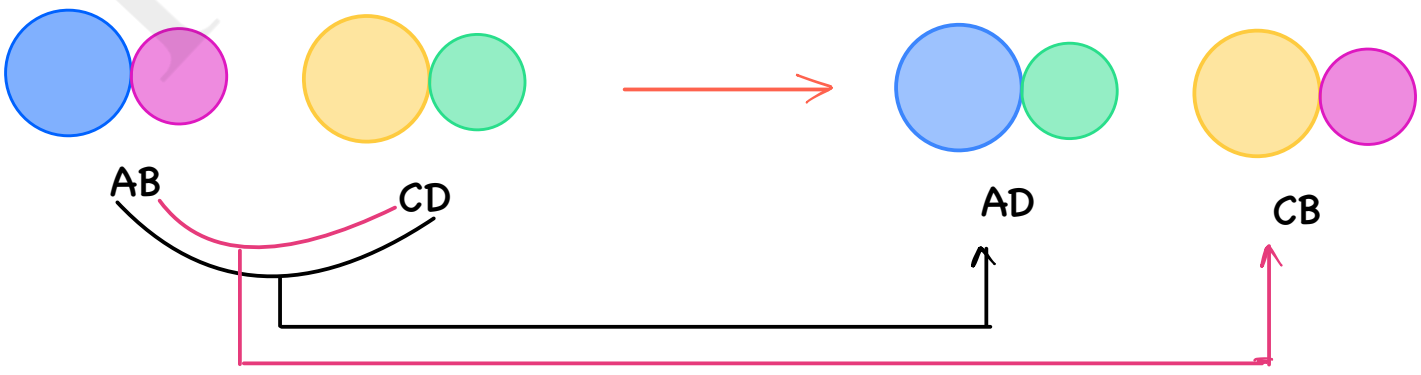
Eg. $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

- Iron is more reactive than Copper

$Cu + FeSO_4 \rightarrow$ NO REACTION (Not feasible)

copper cannot displace iron as it is less reactive than iron.

4. Double Displacement Reaction



Na_2SO_4 + $BaCl_2$ → $BaSO_4$ + 2NaCl

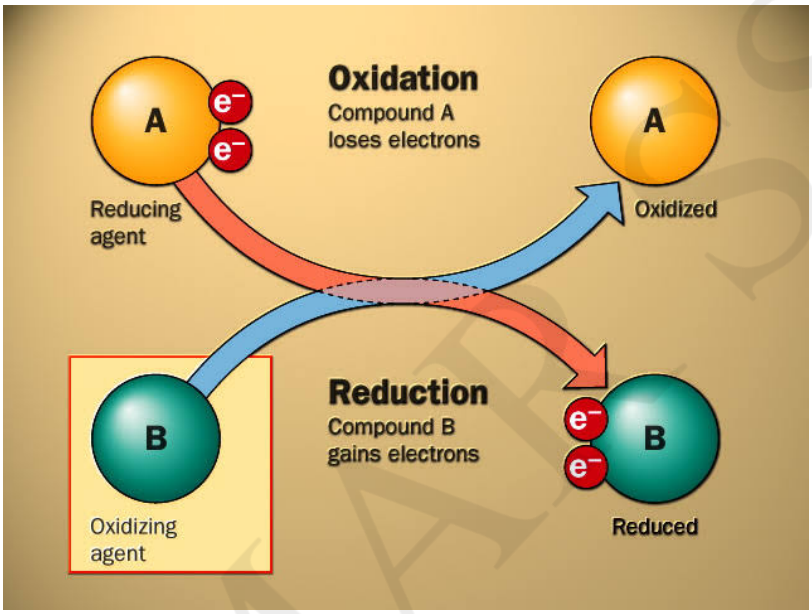
(SO_4^{2-}) (Ba^{2+})

↓ exchange of ions

5. Oxidation and Reduction → Removal of oxygen

↓

addition of oxygen



- $2Cu + O_2 \rightarrow 2CuO$ (Oxidation)

copper oxidises

hydrogen oxidises
(Addition of oxygen)

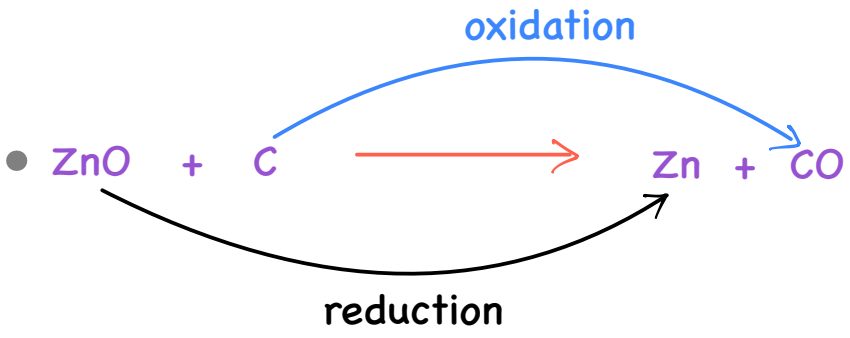
- $CuO + H_2 \rightarrow Cu + H_2O$

copper reduces
(Removal of oxygen)

REDOX REACTION

↓

both oxidation and reduction takes place simultaneously



Day-to-Day Life Examples

1. Corrosion (Oxidation) :

- Fe $\xrightarrow{\text{in air}}$ Fe_2O_3 iron oxide (Reddish brown) → Rusting
- Cu → $CuCO_3$ copper carbonate (Green)
- Ag → Ag_2S silver sulphide (Black)

2. Rancidity :

When fats gain oxygen, it oxidises and thus causes rancid smell.

O_2 → 

Chips → NO_2 gas → To prevent oxidisation of fats

Laws of Gases

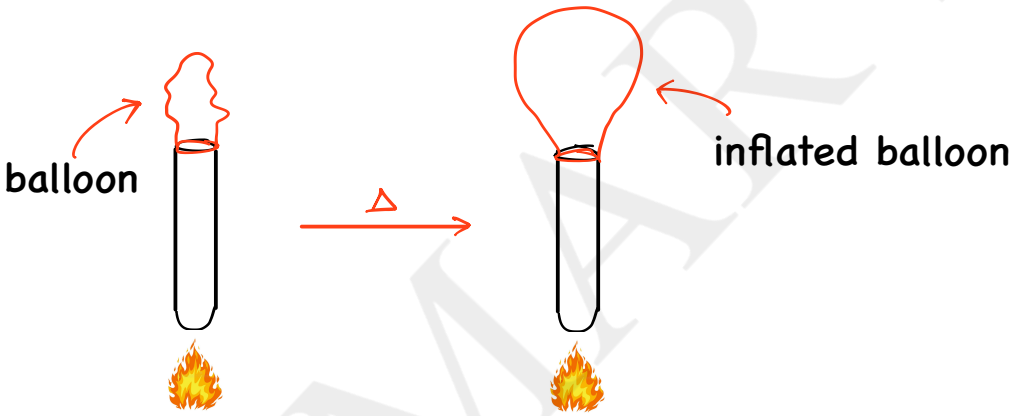
1. Boyle's Law (1662)

$$P \propto \frac{1}{V}$$ (At constant temp.)

$$P_1 V_1 = P_2 V_2$$

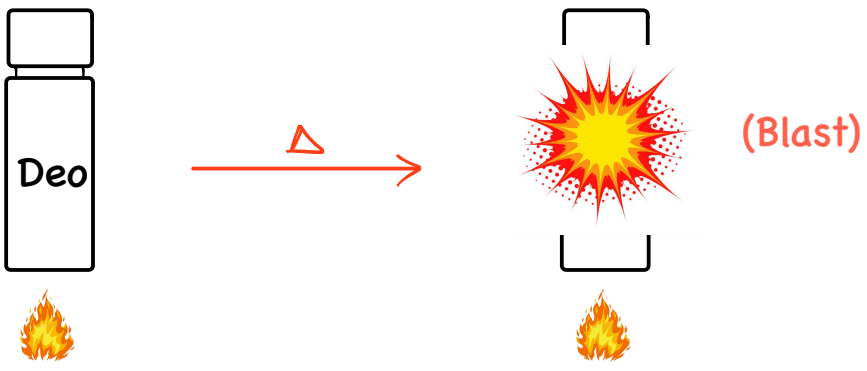
2. Charle's Law (1780)

$$V \propto T$$ (At constant pressure)



3. Gay Lussac's Law (Law of combining volume of gases)

$$P \propto T$$ (At constant volume)



4. Dalton's Law (Law of partial pressure)

Total pressure of a mixture of gases is equal to the sum of partial pressure of each gas.