Friday "Single Page Note" Date 21st July-23

# Unit 1 Stoichiometry

**Stoichiometry** (Greek word) element measurements
The study of relative amount of Product and reactant in a chemical Reaction.

**Stoichiometric Amount**
The amount of reactant and product in balance chemical eq.

**Mole Ratio** -/-
Ratio of no. moles of reactant to no. of moles of product.
e.g $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
1 mole of $C_3H_8$ + 5 mole of $O_2$ eq 3 mole of $CO_2$ + 4 mole of $H_2O$

**Mole** basic unit of chemistry
The atomic mass, formula mass, molecular mass of substance expressed in grams e.g: 1g H = 1 mole.

**Avagadro No** - $N_A$
The no. of atoms, molecules, ions & formula of 1 mole of substance.
Numerically, $6.023 \times 10^{23}$ (particles)

**Molar Volume**
1 mole of any gas at S.T.P is 22.414 $dm^3$. (T = 0°C & P = 180,760 torr, 1 atm)
1 mole of $O_2$ = 22.414 $dm^3$
occupies $6.023 \times 10^{23}$ molecule

Types of problems.
- Mole to Mole.
- Mole to Mass
- Mass to particles
- Mole ⇄ volume

**Percentage Composition** When relative amount of any element in a compound expressed in %.
(% of element = $\frac{\text{mass of element}}{\text{molar mass of compound}} \times 100\%$)
In $CO_2$ = C = 27.2% $O_2$ = 72.7%

| | Limiting Reactant | Non-Limiting R. | Theoretical yield | Actual yield |
|---|---|---|---|---|
| 1- | The reactant present in less quantity. | The reactant present in excess quantity. | The quantity calculated by a chemical eq. | The quantity took by analytical proced. |
| 2- | Produce less product. | Can produce more Product | • It is ideal. Move quantity | It is real. less quantity. |
| 3- | Stops the reactant. | Do not do so. | Reason of Actual yield less theoretical. | |
| e.g | $2H_2 + O_2 \rightarrow 2H_2O$ | | • Side product formed. | |
| | $H_2$ = produce 10 moles of $H_2O$. | | • Reversible reaction. | |
| | $O_2$ = produce 14 moles of $H_2O$. | | • Mechanical loss due to natural conditions | |
| | $H_2$ = limiting $O_2$ = non-limiting. | | | |

**Solution for Every Prob.**
COM
C = compare
O = make one
P = multiple.

**Formulas**
6- % = $\frac{\text{mass of element}}{\text{M.M of compound}}$
6- % yield = $\frac{\text{Actual yield}}{\text{Theoretical yield}}$
3- no. of moles = $\frac{\text{Volume of gas}}{\text{volume at S.T.P}}$
4- Combine eq (i) & (ii). mass in g = $\frac{\text{no. of particles} \times \text{molar mass}}{N_A}$
1- No. of moles eq(i) = $\frac{\text{Mass}}{\text{molar mass}}$
2- No. of moles eq(ii) = $\frac{\text{Particles}}{N_A}$