Preparation of solutions

- **Type of Concentrations**
  1- **Molarity [M]**
  2- **Normality [N]**
  3- **Molality [m]**
  4- **Part per Million [ppm]**
  5- **Percentage [%]**

Molarity: Number of moles in one liter of solution.

$$\text{Mole} = \frac{\text{Weight (gm)}}{\text{Molecular weight (g/mol)}}$$

Mole $\Longrightarrow$ **6.022×10^{23}**

X **12.044×10^{23}**

X = 2 mole

$$M = \frac{\text{Weight}}{\text{Molecular weight}} \times \frac{1000}{V_{\text{in (ml)}}}$$

$$M = \frac{Wt.}{M.Wt} \times \frac{1000}{Vin\ (ml)}$$

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<u>Normality :</u> Number of gramic equivalent in one liter of solution.

$$N = \frac{Weight}{equivalent\ we} \times \frac{1000}{V_{in\ (ml)}}$$

$$N = \frac{Wt.}{eq.Wt} \times \frac{1000}{Vin\ (ml)}$$

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$$eq.wt\ of\ acid = \frac{M.Wt}{No.\ of\ H^{+}}$$

$HCl \longrightarrow H^+ + Cl^-$

$$\text{eq.wt of HCl} = \frac{36.5}{1} = 36.5$$

1 35.5

M = N

$H_2SO_4 \longrightarrow 2H^+ + SO_4^{-2}$

$$\text{eq.wt of } H_2SO_4 = \frac{98}{2} = 49$$

M = 2N

$CH_3COOH \rightleftharpoons CH3COO^- + H^+$

$$\text{eq.wt of } CH_3COOH = \frac{60}{1} = 60$$

M = N

Q/ How many Normality for 0.3 M H_2SO_4 ?

M=2N

0.3 = 2N

N =

$$\text{eq.wt of basic} = \frac{\text{M.Wt}}{\text{No. of } OH^-}$$

$$NaOH \longrightarrow Na^+ + OH^-$$

$$\text{eq.wt of NaOH} = \frac{40}{1} = 40$$

23 16 1

M = N

$$\text{eq,wt of } Ca(OH)_2 = \frac{\text{M. Wt}}{\text{No. of } OH^-} = \frac{74}{2} = 37$$

M = 2N

$$Ca(OH)_2 \longrightarrow Ca^{+2} + 2OH^-$$

$$\text{eq.wt of Salt} = \frac{\text{M.Wt}}{\text{No. of Metal x equivalent of Metal}}$$

$$\text{eq.wt of NaCl} = \frac{58.5}{1 \times 1} = 58.5$$

23 35.5

M = N

$NaCl \longrightarrow Na^+ + Cl^-$

$$\text{eq.wt of } Na_2CO_3 = \frac{106}{2 \times 1} = 53$$

23 12 16

M = 2N

Q/ Prepare of 0.1 N Sodium Carbonate Na_2CO_3 in 250 ml ?

At. wt for Na = 23, C = 12, O = 16

Solution:

$$N = \frac{Wt}{eq.Wt} \times \frac{1000}{V_{in\ ml}}$$

$$0.1 = \frac{Wt}{53} \times \frac{1000}{250}$$

$$Wt = \frac{0.1 \times 53 \times 250}{1000}$$

$$= 1.325 \text{ gm}$$

Standard Solution Properties

1- Non hydroscopic

2- Non Evaporated and Poising

3- High Molecular weight

4- Not effect on air, heat, light

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$$M = \frac{SP. \times \% \times 1000}{M.Wt}$$

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Sp = Specific gravity

% = Percentage

$$N = \frac{Sp. \times \% \times 1000}{eq. Wt}$$

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Dilution rule

$N_1 V_1 = N_2 V_2$

, $M_1 V_1 = M_2 V_2$

Q/ Prepare 0.1 N Sulfuric acid H_2SO4 in 250 ml?
At wt. for H=1, S=32, O=16, Sp.=1.09, %=98

Solution:

$$N = \frac{Sp. \times \% \times 1000}{eq.wt}$$

$$= \frac{1.09 \times 0.98 \times 1000}{49}$$

$$= 21.8$$

$$eq.wt = \frac{M.wt}{2}$$

$$= \frac{98}{2}$$

$$= 49$$

$N_1 V_1 = N_2 V_2$

$21.8 \times V_1 = 0.1 \times 250$

$$V1 = \frac{0.1 \times 250}{21.8} = 1.147 \text{ ml}$$

Q/ How many Milliliter of 2N of HCl you take to prepare 0.1N in volumetric flask of 500 ml?

Solution :

$N_1 V_1 = N_2 V_2$

$2 \times V_1 = 0.1 \times 500$

$$V_1 = \frac{0.1 \times 500}{2} = 25 \text{ ml}$$

Q/ Prepare 0.5 M of Sodium hydroxide NaOH in volumetric flask of half liter?

Titration

Titration is the slow addition of one solution of a known concentration to a known volume of another solution of unknown concentration until the reaction reaches neutralization, which is often indicated by a color change. Titration is a technique to determine the concentration of an unknown solution.

***Acid-Base Titration**

Acid-Base Titration are usually used to find the amount of known acidic or basic substance through acid base reactions. The analyte (titrand) is the solution with an unknown molarity. The reagent (titrant) is the solution with a known molarity that will react with the analyte.

Indicators

Indicators are substances whose solutions change color due to changes in pH. These are called acid – base indicators but their conjugate base or acid forms have different colors due to differences in the absorption spectra.

Common Indicators :