Method of Expressing Concentrations

Disclaimer

All the content material provided here is only for teaching purpose.

- In all the techniques of quantitative analysis the use of solutions requires some basis for the expression of solution concentration.

1. **Normality**
2. **Molarity**
3. **Molality**
4. **Percent Solution**
5. **Formal Concentration**
6. **Parts per Million (PPM)**

➢**Normality**- Number of gram equivalent of solute (Substance) dissolved in one litre (1000 ml) of solution is called as Normality.

➢ Normality is indicated by **N**

$$\text{Equivalent Weight} = \frac{\textbf{Gram equivalent Weight of Solute}}{\textbf{No. of replaceable } H^{+} \textbf{ \& } OH^{-}}$$

➢ **Normality Examples- Molecular weight of NaOH (Sodium Hydroxide)=**

Atomic Weight of Na = 22.99

Atomic Weight of O = 16

Atomic Weight of H = 1

40

- 1N = 40 gm of NaOH is Dissolved in 1000 ml of water (H_2O)
- 0.1 N = 4 gm of NaOH is Dissolved in 1000 ml of water (H_2O)
- 0.01N = 0.4 gm of NaOH is Dissolved in 1000 ml of water (H_2O)

- **Molarity** - Number of moles of solute (Substance) dissolved in one litre (1000 mL) of Solution is called as Molarity.

- **Molarity** is indicated by **M**

$$M = \frac{\text{Number of moles of Solute}}{\text{1000 mL of Solution}}$$

- **Molarity Examples- Molecular weight of NaOH (Sodium Hydroxide)=**

Atomic Weight of Na= 22.99

Atomic Weight of O= 16

Atomic Weight of H= 1

40

- 1M= 40 gm of NaOH is Dissolved in 1000 mL of water (H_2O)

- 0.1 M= 4 gm of NaOH is Dissolved in 1000 mL of water (H_2O)

- 0.01M= 0.4 gm of NaOH is Dissolved in 1000 mL of water (H_2O)

- **Molarity Examples- Molecular weight of HCl (Hydrochloric acid)=**

Atomic Weight of Cl = 35.5

Atomic Weight of H = 1

36.5

- 1M = 36.5 gm of HCl is Dissolved in 1000 mL of water (H_2O)

- 0.1 M = 3.65 gm of HCl is Dissolved in 1000 mL of water (H_2O)

- 0.01M = 0.365 gm of HCl is Dissolved in 1000 mL of water (H_2O)

- **Molality**- A molal solution contains 1 mole of solute per one kilogram of solution (1 lit. of solvent) is called as **Molality.**

- Molality is indicated by **M**

$$N = \frac{\text{Number of mol. Wt. of substance}}{\text{1000 gm of Solution (1Kg)}}$$

- **Molality Examples- Molecular weight of NaOH (Sodium Hydroxide)=**

Atomic Weight of Na = 22.99

Atomic Weight of O = 16

Atomic Weight of H = 1

40

- 1 M = 40 gm of NaOH is Dissolved in 1000 gm of water (H_2O)
- 0.1 M = 4 gm of NaOH is Dissolved in 1000 gm of water (H_2O)
- 0.01 M= 0.4 gm of NaOH is Dissolved in 1000 gm of water (H_2O)
- 1.5 M= 60 gm of NaOH is Dissolved in 1000 gm of water (H_2O)

- **Percent (%) Solution**
- Sometimes the concentration is expressed in terms of per cent (parts per hundred) also. Per cent Composition of a solution can be expressed as:

1. Per cent W/W = Weight of solute/ Weight of solution X 100
2. Per cent V/V = Volume of solute/ Volume of solution X 100
3. Per cent W/V= Weight of solute/ Volume of solution X 100

- 1 %= 1gm of KCl ---------- in 100 ml of water
- 10 % = 10 gm of KCl ---------- in 100 ml of water
- 100 % = 100 gm of KCl ---------- in 100 ml of water

Formal Concentration

- The concentration unit, *formal*, is similar to the more familiar *molar* concentration in that it is calculated as the number of moles of a substance in a liter of solution. Formal concentrations are notated with the symbol *F*.
- *The formal Concentration (Formality) is applicable to the ionic substances*
- Ex. We'll use calcium carbonate because it has a simple formula weight (100 g/mole).
- If one has 1 g $CaCO_3$ in 1 L aqueous solution, the concentration of $CaCO_3$, in formal, is...
- 1 g $CaCO_3$/(100 g $CaCO_3$/mole)/(1 L) = 0.01 *F* $CaCO_3$

- **Parts Per Million**
- Parts per million is frequently employed to express the concentration of very dilute solutions and is express as PPM
- **Conc. In PPM = Mass of solute / mass of solution X 10^6 PPM**
- **1 PPPM = 1 mg/it.**

$$ppm = \frac{(mass\ of\ solute)}{(mass\ of\ solution)} x10^6$$

Reference

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