EXPRESSING CONCENTRATION OF SOLUTIONS

Concentration

Mass And Volume Percentage

Molarity (Molar Concentration)

It is expressed as the quantity of moles of the solute dissolved per liter or per cubic decimeter of the solution. i.e.,

$$\text{Molarity (M)} = \frac{\text{Number of moles of solute}}{\text{Number of litres of solution}}$$

or

$$\text{Molarity} \times \text{Number of liters of solution} = \text{Number of moles of solute}$$

Let w_A g of the solute of molecular mass m_A be dissolved in V litre of solution.

$$\text{Molarity of solution} = \frac{w_A}{m_A \times V}$$

or

$$\text{Molarity} \times m_A = \frac{w_A}{V} = \text{Strength of the solution}$$

If V is taken in mL (cm^3), then Molarity of the solution $= \frac{w_A}{m_A \times V} \times 1000$

The unit of molarity is mol L^{-1} s mol or mol dm^3

Percentage by weight

The weight fraction of the solute is determined by the amount of solute in grams dissolved in one gram of the solution. Therefore,

$$\text{weight fraction} = \frac{w}{w + W}$$

Where 'w' grams of solute are dissolved in W grams of solvent.

$$\text{weight percent} = \frac{\text{weight of solutein grams} \times 100}{\text{weight of solution in grams.}}$$

$$w = \frac{w \times 100}{w + W}$$

Percent by volume (Volume fraction)

This technique is employed for liquid-in-liquid solutions. The volume fraction is defined as the volume of liquid (solute) in milliliters dissolved in one milliliter of the solution.

$$\text{Volume fraction} = \frac{\text{Volume of liquid solute in mL}}{\text{volumeof solution in mL}}$$

$$\text{Volume percent} = \frac{\text{Volumeof solute} \times 100}{\text{Volume of solution}}$$

Ex. If we have 6% w/w urea solution with density 1.060 g/mL, then calculate its strength in g/L?

Sol. 6 g urea is present in 100 gm solution.

$$6 \text{ g in} \frac{100}{1.060} \text{ mL}$$

$$\frac{100}{1.060} \text{ mL} \longrightarrow 6 \text{ gm.}$$

$$\therefore \quad 1000 \text{ mL} = \frac{6}{100} \times 1.060 \times 1000 = 10.6 \times 6 = 63.6$$