METHODS OF EXPRESSING CONCENTRATION

Mass/Weight Percentage or Per cent by Mass/Weight:

It is defined as the amount of solute in grams present in 100 grams of the solution.

$$Mass\ Percentage = \frac{Mass\ of\ Solute}{Mass\ of\ Solution} \times 100$$
$$= \frac{Mass\ of\ Solute}{Mass\ of\ Solute + Mass\ of\ Solvent} \times 100$$
$$= \frac{Mass\ of\ Solute}{Volume\ of\ Solution + Density\ of\ Solution} \times 100$$

The ratio mass of solute to the mass of solvent is termed as **mass fraction**.
Thus, Mass percentage of solute = Mass fraction × 100

Volume Percentage

It is defined as the volume of solute in mL present in 100 mL solution.
$$Volume\ Percentage = \frac{Volume\ of\ Solute}{Volume\ of\ Solution} \times 100$$

10% solution of HCl by volume means that 10 mL of liquid HCl is present in 100 mLof the solution.

Mass by Volume Percentage

It is defined as the mass of solute present in 100 mL of solution.
$$Mass\ by\ Volume\ Percentage = \frac{Mass\ of\ Solute}{Volume\ of\ Solution} \times 100$$

A 10% mass by volume solution means that 10 gm solute is present in 100 mL of solution.

Molarity

The molarity of a solution gives the number of gram molecules of the solute present in one litre of the solution.

$$Molarity(M) = \frac{Number\ of\ moles\ of\ solute}{Volume\ of\ Solution\ in\ L}$$

Molality

Molality of a solution is defined as the number of moles of solute dissolved in 1 Kg of the solvent.

$$Molality\ (m) = \frac{Number\ of\ moles\ of\ solute}{Mass\ of\ Solvent\ in\ kg}$$

Normality:

The normality of a solution gives the number of gram equivalents of the solute present in one litre of the solution.

$$Normality\ (N) = \frac{Number\ of\ gram\ equivalents\ of\ solute}{Volume\ of\ Solution\ in\ L}$$

Parts per million (ppm):

When a solute is present in trace quantities, it is convenient to express concentration in parts per million (ppm)

$$ppm = \frac{Number\ of\ parts\ of\ the\ component}{Total\ number\ of\ parts\ of\ the\ components\ in\ the\ solution} \times 10^6$$

Formality

It is the number of formula mass in grams present per litre of solution. In case formula mass is equal to molecular mass, formality is equal to molarity. Like molarity and normality, the formality is also dependent on temperature. It is used for ionic compounds in which there is no existence of molecule. Mole of ionic compounds is called formole and molarity as formality.

$$Formality = \frac{Weight\ of\ solute(gm)}{Formula\ weight\ of\ solute} \times \frac{1}{Volume\ of\ solutions(L)}$$