METHODS FOR EXPRESSION OF CONCENTRATION

A solution is a soluble solid substance dissolved in a liquid. The former is called the solute and the latter the solvent. There are different methods of expressing concentration of solution -

1. In percent (%):

   a) % w/v or w/v ratio - The concentration of a solution is expressed by the weight of a solute in the total volume of the solvent. It is the most commonly used method of expressing the concentration of solutions. It can be defined gram of solute in 100ml of solution. It can be expressed in different way also e.g. %, g/dl, g/100ml

   b) % v/v or v/v ratio

2. Molar or molal: The concentration of a solution is expressed by volume of solute in the total volume of the solvent. It is commonly used for expressing the concentration of liquid solute such as ethanol. It can be defined as ml of solute in total 100 ml of solution. Eg. 100 ml of 70% ethanol indicates 70 ml of ethanol added to 30 ml of water. To prepare 'V' ml of X % of a solute→

$$\text{ml of liquid solute to be taken} = \frac{X}{100} \times V$$

According to system international units (SI units) solute concentrations are expressed in mole or millimole per litre.

One mole of a substance is defined as the atomic or molecular weight of that substance. A gram symbol or a formula weight of any substance contains 6.02×10^{23} (Avogrado number of particles). When one mol of substance dissolved in 1 kg of water the concentration is defined as 1 molal (1m) solution. When 1 mol of substance dissolved in 1 litre of a final solution the concentration is defined as 1 molar (1M or 1 mol/ L) solution.

Molar solution is a part of metric system, hence M = g MW/l, mM = mg MW/L, µM = µg MW/L etc.

Problem:

3) Normality: used to express the concentration of acid, base, oxidizing and reducing solution. Equivalent weight in grams in 1000 ml gives one normal. A normal solution of an acid contains the weight of acid per litre of solution, which donates formula weight of H^+ (6.02×10^{23} H^+).

A normal oxidizing solution contains sufficient oxidizing agent liter to increase the positive valence or decrease the negative valence of a gram-formulae weight of reducing agent by one unit and vice-versa.

Problem:
Relationship between molarity and normality: -

Molarity and normality is equal when valence is one. But one molar substance is two normal when the valency of the substance is 2 and so on.

Problem:

Relationship between millimole, milliosmol and milliequivalent: -

The term millimole is used to express the concentration of solute in solution. One millimole means atomic weight or molecular weight of that substance in 1000 ml solution.

The osmole proportion of a solute in solutions is related to the number of particles in solution and not to its weight or its charge. One osmole is equal to molecular weight in grams, which gives 6.02 x 10^{23} particles in 1000 ml of solution. In case of non-electrolyte millimole and milliosmol is same but in case of electrolyte, it depends on number of dissociable ions.

The term milliequivalent is used to express the concentration of ions (electrolytes) in biological fluids. Equivalent weight in grams in 1000 ml gives 1Equivalent weight. For univalent ions, 1 mole equals to 1 equivalent (Eq). For multivalent ions, 1 Equivalent weight is equal to the molecular weight in grams (i.e. 1 mole) divided by charge of particle

Formulae for Preparation of Molar and Normal solution:

1. Preparation of a solution of concentration of '**M**' Molar of 'V' volume:

$$\text{Grams of solute to be dissolved in V ml of water} = \frac{\text{Molecular Weight} \times (\text{M}) \times \text{V}}{1000}$$

2. Preparation of a solution of concentration of '**N**' Normal of 'V' volume:

$$\text{Grams of solute to be dissolved in V ml of water} = \frac{\text{Molecular Weight} \times (\text{N}) \times \text{V}}{\text{Valence} \times 1000}$$

3. Preparation of solution of given Osmolarity (Os):

$$\text{Grams of Solute to be taken} = \frac{\text{Os} \times \text{Molecular Weight} \times \text{Desired Volume}}{\text{Number of particle dissociated} \times 1000}$$

POWER PREFIXES

Prefix	Symbol	Factor
yotta	Y	10^{24}
zetta	Z	10^{21}
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deka	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	µ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}
zepto	z	10^{-21}
yocto	y	10^{-24}

IMPORTANT CONVERSIONS:

1 cm^3 = 1 ml	1 deci liter (dl)= 100 ml	$C^o = \frac{(F^o - 32)\times 5}{9}$ { C°=degree celcius F°= degree Fahrenheit}
1 mole= 6.02× 10^{23} (Avagadro's Number)		