# Preparation Of Different Types Of Solution

**Concentration of a Solution :-** amount of solute present in a given quantity of solvent or solution.

**Molarity** :- is the concentration of a solution expressed as the number of moles of solute per liter of solution

**Moles** :- weight of sample/ molecular weight of sample

$$\text{Molarity} = M = \frac{\text{number of moles of solute}}{\text{1 liter of solution}}$$

where

$$\text{number of moles of solute} = \frac{\text{weight of solute}}{\text{molecular weight of solute}}$$

then

$$M = \frac{\text{Weight of solute}}{\text{m.wt solute} \times \text{L solution}} = \frac{\text{grams}}{\text{m.wt} \times \text{L}}$$

**Normality** :- is the concentration of solution expressed as the number of equivalent weights (equivalents) of solute per liter of solution.
A 1 normal (1 N) solution contains 1 equivalent weight of solute per liter of solution.

**Equivalent weight** :- is equal to the molecular weight divided by valance number

$$\text{normality} = N = \frac{\text{number of equivalents of solute}}{\text{1 liter of solution}}$$

where

$$\text{number of equivalents of solute} = \frac{\text{Weight of solute}}{\text{equivalent weight of solute}}$$

then

$$N = \frac{\text{Weight of solute}}{\text{eq.wt solute} \times \text{L solution}} = \frac{\text{grams}}{\text{eq.wt} \times \text{L}}$$

$$\text{eq.wt.} = \text{m.wt.} / n$$

The preparation of solution is being either from liquid or solid substance

1. **Solid substances**

a. To prepare volume (V) from solid chemical substance have the molecular weight (m.wt) and Molarity (M) using following equation :-

$$Wt = \frac{M * V_{(ml)} * m.wt}{1000}$$

V : volume (ml)
Wt : weight (gm)

b. To prepare volume (V) from solid chemical substance have the equivalent weight (eq.wt) and Normality (N) using following equation :-

$$Wt = \frac{N * V_{(ml)} * eq.wt}{1000}$$

**Procedure :**

Prepare 0.1 M from NaCl in volume 100 ml , the at.wt of Na =23 , Cl = 35.5 ?

$$Wt = \frac{M * V_{(ml)} * m.wt}{1000}$$

m.wt = 23*1 +35.5*1 =58.5 g/mol

$$Wt = \frac{0.1 * 100 * 58.5}{1000}$$

Wt = 0.585 g

**2. Liquid substances**

To prepare volume (V) from liquid chemical substance or concentration liquid substance have the Normality (N) using following equation :-

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

Sp.gr : Specific gravity

Eq.wt : equivalent weight

After that using dilution low

$$N_1 * V_1 = N_2 * V_2$$

Conc. dil.

**Procedure :**

Prepare 0.1 N from HCl in 100 ml $H_2O$ , if you known the percentage 35.4% and specific gravity 1.18 . at.wt to H =1 , Cl = 35.5 ?

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

m.wt = 1*1 + 1*35.5 = 36.5 g/mol

$$eq.wt = \frac{m.wt}{n} = \frac{36.5}{1} = 36.5$$

$$N = \frac{1.18 * \frac{35.4}{100} * 1000}{36.5}$$

N = 11.44

$$N_1 * V_1 = N_2 * V_2$$

Conc. dil.

$11.44 * V_1 = 0.1 * 100$

$V_1 = 0.87$ ml.

**Percent Concentration**

Percent concentration are generally expressed as part of solute per 100 part of total solution.

**W/W % :** the weight of solute per weight of solution ( solute + solvent ).
Ex : 5% (w/w) of NaCl contain 50 g of NaCl + 950 g of solvent.

$$w/w\% = \frac{\text{wt. of solute}}{\text{wt. of solution}} * 100\ \%$$

**V/V %** : the volume of liquid solute per total volume of solution (solute + solvent) . Ex : 1% (v/v) of HCl contain 1 ml of HCl per 100 ml of solution .

$$V/V\ \% = \frac{V.\ of\ solute}{V.\ of\ solution} * 100\ \%$$

**Wt/V %** : the weight of solute per volume of solution.

$$Wt./V\ \% = \frac{wt.\ of\ solute}{V.\ of\ solution} * 100\ \%$$

$C_{ppm}$ : is the concentration in part per million . One ppm is equivalent to (mg/l) or 1 (mg/kg).

$$Cppm = \frac{wt.\ of\ solute}{wt.\ of\ solution} * 10^6$$

$$ppm = \frac{mg\ of\ solute}{L\ solution}$$

## Dilution

is a useful method which allows you to calculate how to dilute a stock solution of known concentration

$C_1 * V_1 = C_2 * V_2$

Where $C_1$ and $V_1$ for concentration solution , and the $C_2$ and $V_2$ for dilution solution.

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Q : 2.00 L of 0.800 M $NaNO_3$ must be prepared from a solution known to be 1.50 M in concentration. How many mL are required?