## Lab (1)/ Solution

**Solutions:** are chemical compounds made up of two or more elements.

Liquid solutions are the most commonly used solutions and usually occur in liquid media (solutions) and are of different natures and concentrations.

## Solution components

**1. Solute**: such as Salt, Sugar

**2. Solvent**: Which is distilled water in most cases or other.

Most properties of solutions depend on their concentrations, which can be expressed in various ways involving the amount of solute and solvent.

**Concentration**: It is the ratio of the amount of a substance in a specific weight or volume of solvent. Concentration can be expressed in grams per liter (g/L).

**Solutions:** are divided into several types depending on the concentration:

1. **A molar solution(M)**
2. **A molal solution ( *m* )**
3. **Normal solution(N)**
4. **Percent solution (%)**

### 1. A molar solution (M):

Dissolving one gram molecular weight of a water-soluble substance in a given volume of solvent (water) and completing the volume to a liter (1000) ml and symbolized by M.

**M = moles**

**Molarity equation:**

$$M = W(gm) \times 1000 / MW \times V$$

**Example:** To prepare 1 molar of NaOH, we calculate its molecular weight (which is equal to the sum of the atomic weights).

Na= 23, O=16, H=1

sum of the atomic weights= 40

So, dissolve 40 grams of NaOH in a quantity of water, then bring the volume to a liter.

To prepare 0.5 molar, dissolve half the molecular weight, 40/2 g, and bring the volume to a liter.

Molarity is calculated according to the following law:

**M = W(gm) X1000 /MW X V**

**1M NaOH= W x1000/ 40 X1000**

**W= 40 gm** dissolve in a quantity of water and complete the volume to a liter**.**

**2. A molal solution ( m ):** is defined as an aqueous solution that contains 1 mole (gram-molecular weight) of a compound dissolved in 1 liter of a solution. The symbol for molality is (m) written in italics.

**Molality equation**

**m = W (gm) x1000 /MW x 1000**

**m = moles solute / kilograms solvent**

**Example:** To prepare 1m of NaCl

1 = W x1000/ 58.5 X1000

58.5 gm add to 1L.

**3. Normal Solution:** Normality (N) is another way to quantify solution concentration. It is similar to molarity but **uses the gram-equivalent weight** of a solute in its expression of solute amount in a liter (L) of solution, rather than molecular weight (MW) expressed in molarity. **Normality** solution contains 1 gram-equivalent weight of solute per liter of solution.

**N=W×100/EW×V**

**EW =MW/ Valence**

**Equivalent weight(EW) as measured by:**

1. Number of hydrogen atoms in acid :EW=MW/No.(H) .
2. Number of (OH) atoms in alkaline :EW=MW/No.(OH).
3. Number of number of negative and positive charges in Salt
   :EW=MW/No.($H^+$ and $OH^-$)

**Percent solutions**

Percent solutions is a simple unit used in chemistry to indicate content of solute in a 100 % of solution.

Relations could be in:

1. **Volume: Volume** (%V:V, ml of solute/100 ml of solvent) A certain volume of solute in a certain volume of solvent and then completed to 100 ml.
2. **Weight :Weight** (%W:W, g of solute/100 g of solvent) A certain Weight of solute in a certain Weight of solvent and then completed to 100 ml.
3. **Weight :Volume** (%W:V, g of solute/100 ml of solvent) A certain Weight of solute in a certain Volume of solvent and then completed to 100 ml.

**dilute solutions:**

A dilute solution is one in which there is a relatively small amount of solute dissolved in the solution.

**dilution law :** $N_1V_1=N_2V_2$