Ministry of higher education and scientific research
AL-Mustaqbal University college
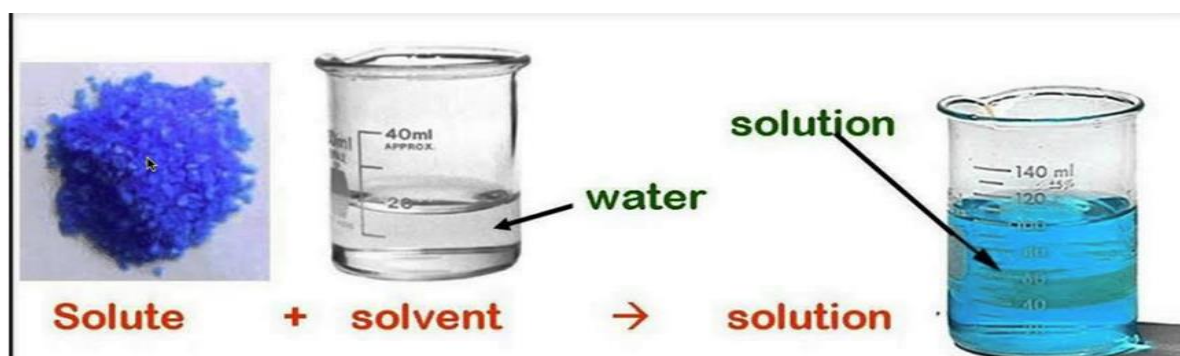Department of medical physics

Stage one

General chemistry (practical)

Lecture 1

Preparation and dilution of solution

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REMINDER

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

A **concentrated solution** contains a relatively large amount of solute.

What is SOLUTIONS ?

A simple solution is basically two substances that are evenly mixed together.

🔸 One of them is called the **solute** and the other is the **solvent**.

🔸 Solution can be composed from one or more solute dissolved in a solvent forming a homogenous mixture.
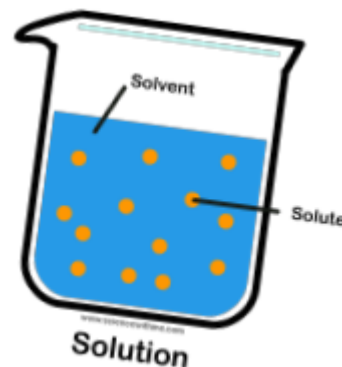
Stoichiometric Calculations:-

🔸 **Gram atomic weight (Awt):** Is the weight of a specified number of atoms of that element (contains exactly the same number of atoms of that element as there are carbon atoms in exactly 12gm of carbon 12 (this number is Avogadro's number = 6.022×10^{23} atoms).

🔸 **Gram molecular weight (M.wt):** Defined as the sum of the atomic weight of the atoms that make up a molecular compound.

🔸 **Gram formula weight (F.wt):** The sum of the atomic weight of the atoms that make up an ionic formula).

🔸 Sometimes use the term molar mass **(Molecular weight, M.wt)** in place of gram formula weight, gFw).

Example (1) :-Calculate the number of grams in one mole of CaSO4.7H2O(calculate gram molecular or formula weight).

    Solution: One mole is the formula weight expressed in grams. The formula weightis (Ca=40.08; S=32.06; O=16.00; H=1.01)

$$\text{CaSO4.7H2O} = 40.08 + 32.06 + (16.0 \times 4) + 7[(2 \times 1.01) + 16.00] = 262.25 \text{ g/mol}$$

🔸 **Mole:** which is Avogadro's number (6.022×10^{23}) of atoms, molecules, ions or other species.

🔸 **Numerically:** it is the atomic, molecular, or formula weight of a substance expressed in grams.
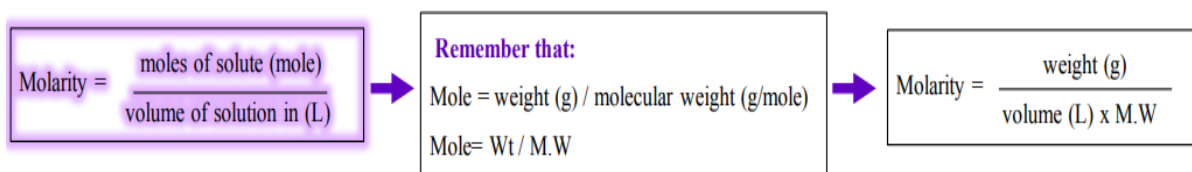

Solution concentration

Solution concentration define as: quantity of a substance dissolved in per unit quantity of another substance (the relative amounts of solute and solvent in a solution).There are different ways to express concentration:
1. Molarity.
2. W/V %.
3. W/W %.

1- Molarity

➕ Molarity define as : the number of moles of solute in one liter of a solution.

Molar = number of mole/volume in L

Molarity = $\dfrac{\text{moles of solute (mole)}}{\text{volume of solution in (L)}}$	**Remember that:** Mole = weight (g) / molecular weight (g/mole) Mole= Wt / M.W	Molarity = $\dfrac{\text{weight (g)}}{\text{volume (L) x M.W}}$

➕ Molar solution is a solution in which 1 mole of solute is dissolved in a total volume of 1 liter (1000ml). (0.5 Molar (M) solution: that mean there are 0.5 mole dissolved in 1L etc)Units of molarity are : M, molar or mole/L.

How to prepare 2 Molar NaCl in 100ml ?

→**Concentration = 2M , Solution volume= 100 ml → So**

How many grams of NaCl I need to prepare 2 Molar NaCl solution?

$$\text{Molarity} = \frac{\text{weight (g)}}{\text{volume (L) x M.W}}$$

Molarity= 2M Solution
volume= 100 ml → convert to L = 100/1000 = 0.1L.
Molecular weight (M.W) = 58.5 g/mole Weight = ?
So:
Weight = Molarity x volume in L x M.W

Weight = 2 x 0.1 x 58.5 = 11.7g

11.7 g of NaCl dissolved in small volume of dis.H2O, then complete the volume up to 100 ml.

2- W/V%

✠   **W/V% :** Weight/Volume Percentage Concentration.

✠   **W/V% define as** : The number of grams of solute dissolved in 100 mL of solution (% = 100).
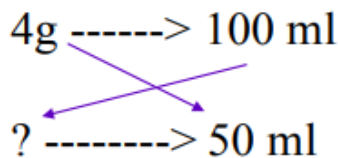
$$W/V\% = \frac{\text{weight of solute in (g)}}{\text{volume of solution in (ml)}} \times 100$$

For example:

4 w/v% NaOH →Mean 4 grams of NaOH is dissolved in 100 ml of the solution.

SO →   how many grams of NaOH I need to prepare 50ml of 4%NaOH solution?

4g ------> 100 ml

? --------> 50 ml

3- W/W%

✠ W/W% → Weight/Weight Percentage Concentration.

✠ W/W% define as: the number of grams of solute dissolved in 100 gram of solution. (% = 100).

✠ The concentrations of many commercial acids are giving in terms of w/w%.

→In order to calculate the volume of the stock solution required for a given preparation the density (specific gravity) of stock solution should be provided.

Weight (wt) = volume (ml) x SG x w/w% (as decimal)

To calculate w/w% as decimal = (w/w)/100 , For example: w/w%= 13% è 13 / 100 = 0.13