

ANALYTICAL CHEMISTRY

Chemical Engineering Department

First Glass / First Term

Al-Mustaqbal collage

By

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assist. Teach

LECTURE One

Solutions : Homogenous mixture for two or more substances , one of them called solute and the other one is the solvent .

The solute is an active substance in reaction and the solvent is active.

There are many solutions formed by dissolving gasses in liquids like CO₂ in water .

Homogenous solution : A partial homogenous mixing for two or more substances that will not react chemically with each other.

Heterogenous solution : Represent with suspended and colloidal solution.

Aqueous solution : is the solution in which water is the solvent .

Nonaqueous solution : when the solvent is any substance except water.

Classification of solutions are depends upon :

a) *nature of molecules* (or the volume of atoms or molecules of solute) ,these solutions are :

- 1) True solution.
- 2) Suspended solution.
- 3) Colloidal solution.

b) ***solute concentration in solution*** , it can be classified into :

- 1) saturated solution.
- 2) unsaturated solution.
- 3) super saturated solution.

Units of weight and concentration:

Concentration of solution : is the weight of solute dissolved in a given amount (volume or weight) of solvent.

Weight of solute can be expressed by :

- 1) physical units , e.g. gram(g) , milligram(mg) , kilogram(kg).
- 2) chemical units : - includes ,
 - a) g- atomic weight.
 - b) g- molecular weight.
 - c) g- formula weight.
 - d) g- ionic weight.
 - e) g- equivalent weight.

Mole : is the summation of the atomic weight in grams for all of the atoms in the chemical formula for the species,.

No. of moles = $M_w(g)/M.wt(g/m)$

Methods for the expression of concentration of solutions :

There are several methods for express the concentration of solutions :

1) Molarity (M) : moles of solute contained in one liter of solution or mol/L or ml.mol/ml

2) Normality (N) : number of g-equivalent weight of solute that are contained in a liter of solution.

General principles to calculate the equivalent weight :

a) for acids :

$$\text{eq.wt of acid} = \frac{\text{M.wt of acid}}{\text{no.of H}^+ \text{ active}}$$

There are many types of acids :

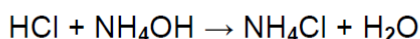
- 1) mono basic acid : HCl , HNO₃ , HF, ect.
- 2) di basic acid : H₂SO₄ , H₂S , H₂SO₃,ect.
- 3) tri basic acid : H₃PO₄,ect.

يعتمد حساب الوزن المكافئ على التفاعل الذي يدخل به المركب الكيميائي ، فقد يحدث ان يفقد الحامض H⁺ واحدة اثناء التفاعل لذلك يقسم الوزن الجزيئي على ١ ، او قد يستهلك 2H⁺ في التفاعل فيقسم الوزن الجزيئي على ٢ او قد يستهلك 3H⁺ فيقسم على ٣ .

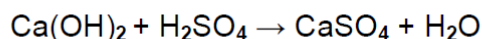
اذن يعتمد الحساب على معادلة التفاعل الكيميائي وكم يستهلك من H⁺ في التفاعل .

b) for base :

$$\text{eq.wt of acid} = \frac{\text{M.wt of base}}{\text{no.of OH}^- \text{ active}}$$



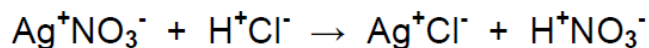
$$\text{eq.wt. of NH}_4\text{OH} = \frac{\text{M.wt of NH}_4\text{OH}}{\text{no.of OH}^- \text{ active}} = \frac{35}{1} = 35$$



$$\text{eq.wt.of Ca(OH)}_2 = \text{-----}$$

d) for salts :

$$\text{eq.wt of salt} = \frac{\text{M.wt of salt}}{\text{no.of positive ion or no.of negative ion}}$$



$$\text{eq.wt. of } \text{Ag}^+\text{NO}_3^- = \frac{\text{M.wt of Ag+NO}_3^-}{1}$$

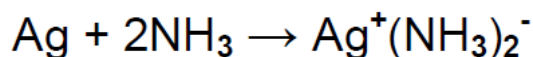
$$\text{eq.wt. of } \text{Ag}_2^+\text{O}^{-2} = \frac{\text{M.wt}}{2}$$

$$\text{eq.wt. of } \text{Al}^{+3}\text{PO}_4^{-3} = \frac{\text{M.wt}}{3}$$

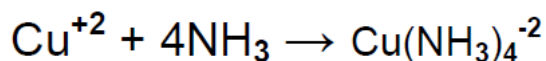
$$\text{eq.wt. of } \text{Ca}_3^{+2}(\text{PO}_4)_2^{-3} = \frac{\text{M.wt}}{6}$$

f) for complex ion :

$$\text{eq.wt. of complex ion} = \frac{\text{M.wt}}{\text{no.of charges}}$$



$$\text{eq.wt. of } \text{Ag}^+(\text{NH}_3)_2^- = \frac{\text{M.wt}}{1}$$



$$\text{eq.wt. of } \text{Cu}(\text{NH}_3)_4^{-2} = \frac{\text{M.wt}}{2}$$