ANALYTICAL CHEMISTRY

Chemical Engineering Department

First Glass / First Term

Al-Mustaqbal collage

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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 CO_2 in water .

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

 # Hetrogenous 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 =Mw(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 :

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

There are many types of acids :

1) mono basic acid : HCl , HNO_3 , HF, ... ect.

2) di basic acid : H_2SO_4 , H_2S , H_2SO_3, ...ect.

3) tri bacic acid : H_3PO_4, ...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 :

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

$$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$$

$$\text{eq.wt. of } NH_4OH = \frac{\text{M.wt of NH4OH}}{\text{no.of OH}- \text{ active}} = \frac{35}{1} = 35$$

$$Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + H_2O$$

eq.wt.of $Ca(OH)_2$ = ----------

d) for salts :

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

$$Ag^{+}NO_3^{-} + H^{+}Cl^{-} \rightarrow Ag^{+}Cl^{-} + H^{+}NO_3^{-}$$

$$\text{eq.wt. of } Ag^{+}NO_3^{-} = \frac{\text{M.wt of Ag+NO3}-}{1}$$

$$\text{eq.wt. of } Ag_2^{+}O^{-2} = \frac{\text{M.wt}}{2}$$

$$\text{eq.wt. of } Al^{+3}PO_4^{-3} = \frac{\text{M.wt}}{3}$$

$$\text{eq.wt. of } Ca_3^{+2}(PO_4)_2^{-3} = \frac{\text{M.wt}}{6}$$

f) for complex ion :

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

$$Ag + 2NH_3 \rightarrow Ag^{+}(NH_3)_2^{-}$$

$$\text{eq.wt. of } Ag^{+}(NH_3)_2^{-} = \frac{\text{M.wt}}{1}$$

$$Cu^{+2} + 4NH_3 \rightarrow Cu(NH_3)_4^{-2}$$

$$\text{eq.wt. of } Cu(NH_3)_4^{-2} = \frac{\text{M.wt}}{2}$$