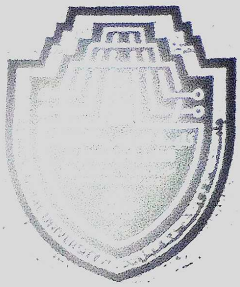
اول علوم حياة

جامعة المستقبل



كلية العلوم والتقنيات

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رقم المحاضرة: 2

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مكتبة ALEF للاستنساخ والقرطاسية

Introduction:

Analytical chemistry is the branch of chemistry that deals with the analysis of different substances and it involves the separation, identification, and the quantification of matter. by using of classical methods along with modern scientific instruments to achieve all these purposes. Analytical chemistry divided to :

(A) **Qualitative analysis** which deals with the identification of elements, ions, or compounds present in a sample (tells us what chemicals are present in a sample).

(B) **Quantitative analysis** which is dealing with the determination of how much of one or more component is present (tells how much amounts of chemicals are present in a sample). This analysis can be divided into three branches.

Chemical analysis methods:

(1) **Volumetric analysis (Titrimetric analysis):** The analyte reacts with a measured volume of reagent of known concentration, in a process called titration.

(2) **Gravimetric analysis:** usually involves the selective separation of the analyte by precipitation, followed mass (of the precipitate).

(3) **Instrumental analysis:** They are based on the measurement of a physical property of the sample, for example, an electrical property or the absorption of electromagnetic radiation. Examples are spectrophotometry (ultraviolet, visible, or infrared), mass spectrometry, nuclear magnetic resonance spectrometry (NMR), X-ray spectroscopy.

- **Solution:** Homogeneous mixture of two or more substance produce from dissolved (disappeared) solute particle (ions, atoms, molecules) (lesser amount) between solvent particle (larger amount).

Solvent (larger amount) + Solute (lesser amount) = Solution

- **Concentrated Solution**: has a large amount of solute. Dilute Solution: has a small amount of solute.
- **Unsaturated solutions:** if the amount of solute dissolved is less than the solubility limit, or if the amount of solute is less than capacity of solvent.
- **Saturated Solution:** is one in which no more solute can dissolve in a given amount of solvent at a given temperature, or if the amount of solute equal to capacity of solvent.
- **Super saturated solutions**: solution that contains a dissolved amount of solute that exceeds the normal solubility limit (saturated solution). Or a solution contains a larger amount of solute than capacity of solvent. This it's occurs when the solution is heated to a high temperature.

Classification of solution based on solute particle size:

(1) True solution: A homogeneous mixture of two or more substance in which substance (solute) has a particle size less than 1 nm dissolved in solvent. Particles of true solution cannot be filtered through filter paper and are not visible to naked eye (NaCl in water).

(2) Suspension solution: heterogeneous mixtures which settles on standing and its components can be separated by filtrating (Amoxcycilline Antibiotics), particle of solute visible to naked eye.

(3) Colloidal solution: homogeneous mixture which does not settle on standing, non filterable, solute particle visible with electron microscope (milk).

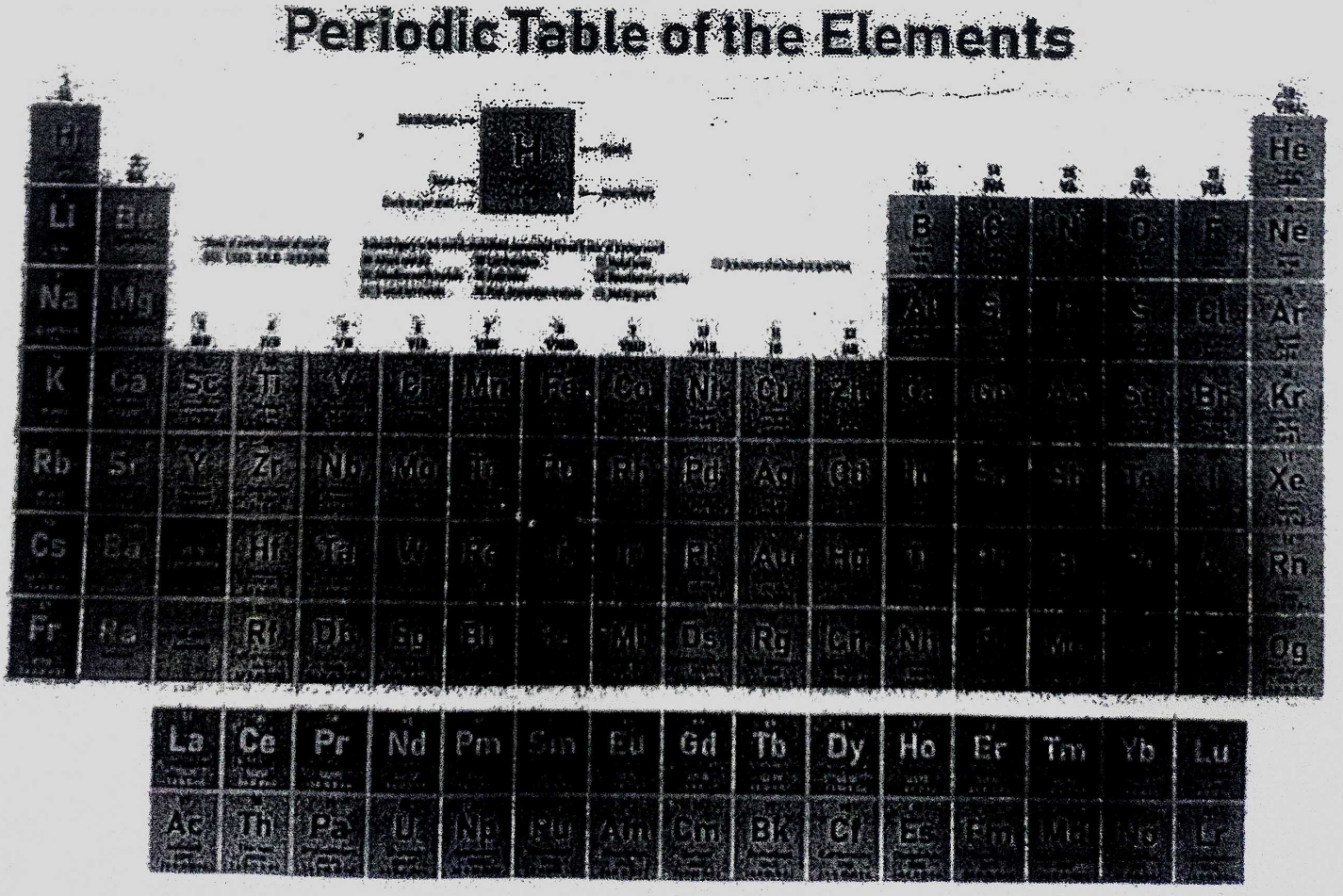
Atomic and molecular weight:

Mass of an atom, based on 12 as the atomic weight of carbon-12. while molecular weight is calculated in practice by summing the atomic weights of the atoms making up the substance's molecular formula.

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 weight is (Ca=40.08, S=32.06, O=16.00, H=1.01)



M.wt of $CaSO_4.7H_2O$

$CaSO_4$:
- Ca ×1 = 40.08×1 = 40.08
- S × 1 = 32.06 ×1 = 32.06
- O × 4 = 16 × 4 = 64.00

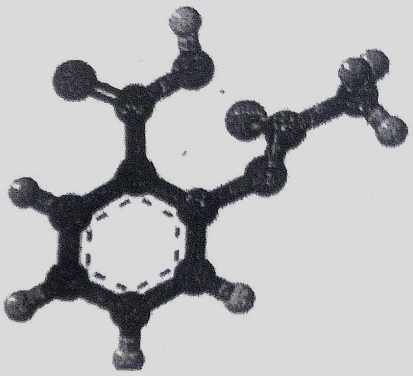
$7H_2O$:
- H ×14 = 1.01 × 14 = 14.14
- O × 7 = 16 × 7 = 112

or H_2O 18.02 × 7 = 126.14

262.28 (gm/mol)

H.W. Calculate the molecular weight of :

1- $Ca(OH)_2$
2- H_2SO_4
3- Benzene
4- C_2H_5OH
5- Aspirin $C_9H_8O_4$



Mole concept:

Avogadro's number: is 'the number of units in one mole of any substance The units may be electrons, atoms, ions, or molecules, depending on the nature of the substance(defined as its weight in grams), equal to 6.022×1023

$$\text{mole} = \frac{\text{weight (g)}}{\text{formula weight } \left(\frac{g}{\text{mole}}\right)}$$

Example (2): Calculate the number of moles in 500 mg Na2WO4.

Solution:

(A.wt W= 183,84 g/mole , Na = 23 g/mole, O = 16 g/mol)

M.wt = (23×2) + (1×183.84) + (16×4) = 293.8

$$\text{mmole} = \frac{\text{wt (mg)}}{\text{M.wt } \left(\frac{\text{mg}}{\text{mmole}}\right)} = \frac{500 \text{ (mg)}}{293.8 \left(\frac{\text{mg}}{\text{mmole}}\right)} = 1.706 \text{ mmole}$$

$$\text{mole} = \frac{\text{mmole}}{1000} = \frac{1.706}{1000} = 0.00170 \text{ mol}$$

H.W. How many molecules are contained in 25.0 g H2.

Example (3): how many milligrams are in 0.250 mmole Fe2O3 (ferric oxide). (A.wt O= 16 g/mole , Fe = 55.85 g/mole)

Mwt of Fe_2O_3 = Fe ×2 = 55.85×2 = 111.7
O × 3 = 16 × 3 = 48.0
159.7

$$\text{wt (mg)} = \text{mmole} \times \text{M.wt}\left(\frac{\text{mg}}{\text{mmol}}\right)$$

$$= 0.250 \text{ mmole} \times 159.7 \frac{\text{mg}}{\text{mmol}} = 39.9 \text{ mg}$$

Example (4): Calculate the number of mole of NaCl required to prepare 1Kg of AgCl according to the equation: (Na=23 ,Cl=35.5, N=14 , Ag =107.86, O = 16 g/mole).

$$AgNO_3 + NaCl \longrightarrow NaNO_3 + AgCl$$

$$\text{No of mols(AgCl)} = \left(\frac{wt}{Mwt}\right) = \left(\frac{1\text{Kg}}{143.36(\frac{g}{mol})}\right) = \left(\frac{1000\text{g}}{143.36(\frac{g}{mol})}\right) = 6.98 mol$$

according to the balance equation the mole ratio between NaCl & AgCl equal 1:1 therefore we need 6.98 mol of NaCl .

Example (5): Calculate the number of mole of Ca(HCO3)2 required to prepare 1.5 mol of CO2 according to the equation.

$$Ca(HCO_3)_2 + 2HCl \longrightarrow CaCl_2 + 2CO_2 + 2H_2O$$

1 mole — 2 mole
X mole — 1.5 mole

$2X = 1.5 \times 1$

$X = 0.75$

Or:

No. of mol of $Ca(HCO_3)_2$ = No. of mol of $CO_2 \times 0.5$
$= 1.5 \times 0.5 = 0.75$ mol of $Ca(HCO_3)_2$

N.

قوانين مهمة

$$e = \frac{wt\ (gm)}{M.wt\ \frac{(gm)}{mole}}$$

$$mMole = \frac{wt\ (mg)}{M.wt\ \frac{(mg)}{M\ mol}}$$

$$wt\ (mg) = mMole * M.wt\left(\frac{mg}{Mmole}\right)$$

$$mole = \frac{mMole}{1000}$$

الحسابات HNO_3 $NaOH$

صيغة المثال تكتب بالتفصيل

$$m_1 x V_1 = M_2 x V_2$$

$$V_1 x C_1 = N_2 C_2$$

$$93.5 \times 0.1 = 10 \times C_2$$

$$C_2 = \frac{93.5 \times 0.1}{10} =$$