



Al-Mustaqbal University College
Department of Radiology Techniques - First Stage
General Chemistry

Third Lecture: Analytical Chemistry



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Out line

- ✓ **What is Analytical Chemistry**
- ✓ **Types of Analytical Chemistry**
- ✓ **Qualitative and Quantitative Analysis**
- ✓ **Types of Quantitative Analysis**
- ✓ **Solutions**
- ✓ **Types of Solutions**
- ✓ **Methods of expressing concentration of solutions**



What is Analytical Chemistry?

- ❖ **Analytical Chemistry:** is concerned with the **chemical characterization** of matter.
- ❖ **Analytical chemistry** is **answering** the **questions:**
 - 1. What chemical species** are **present** in a sample?
 - 2. How much** of **each chemical species** are **present?**



Analytical Chemistry

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graph TD; A[Analytical Chemistry] --> B[Qualitative Analysis]; A --> C[Quantitative Analysis]; C --> D[Volumetric Analysis]; C --> E[Gravimetric Analysis]; C --> F[Instrumental Analysis];
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Qualitative Analysis

Quantitative Analysis

Volumetric Analysis

Gravimetric Analysis

Instrumental Analysis

1. Qualitative Analysis

- ❖ **Qualitative Analysis:** It deals with the **identification** of elements, ions or compounds present in the **unknown sample**.

2. Quantitative Analysis

- ❖ **Quantitative Analysis:** It deals with the **determination** of the **quantity** of one or more compounds of **the sample**.



QUANTITATIVE



QUALITATIVE

Types of Quantitative Analysis

1. Volumetric Analysis

- ❖ Base up on the **measurement of the volume of the standard reagent to find the quantity of unknown substance.**

2. Gravimetric Analysis

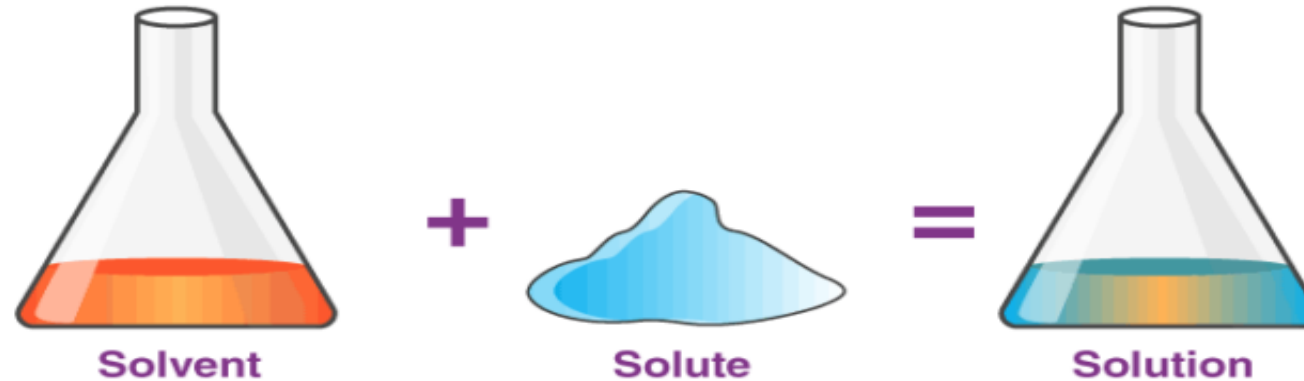
- ❖ Base up on the **measurement of the weight of a precipitate to find the quantity of unknown substance.**

3. Instrumental Analysis

- ❖ Is a field of analytical chemistry that **investigates analytes using scientific instruments.**

Solutions

❖ **Solution:** is **homogenous mixture** formed by **dissolving one or more solute present in solvent.**



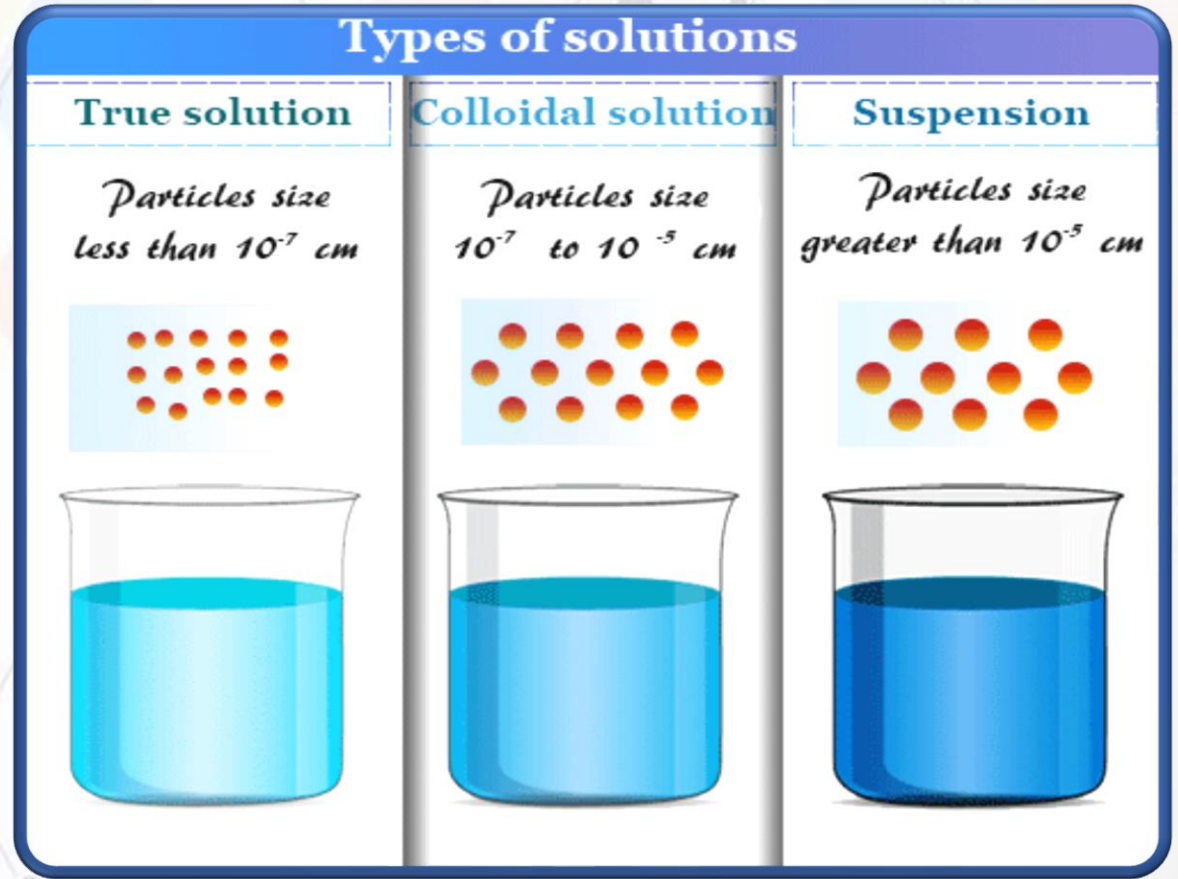
Types of Solutions

- ❖ It can be divided into **two types**:
 1. Depend on the **particle size of solute in solvent.**
 2. Depend on the **concentration of solute in solvent.**



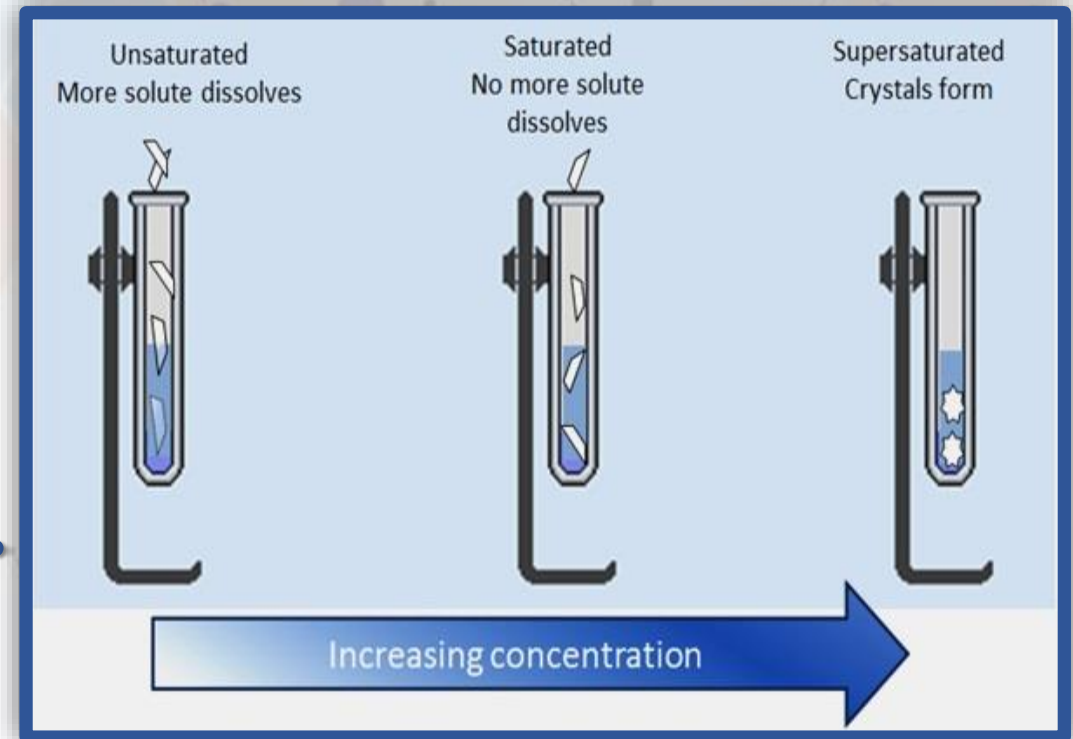
1. Depend on the particle size of solute in solvent

1. True solutions.
2. Suspended solutions.
3. Colloidal solutions.



2. Depend on the concentration of solute in solvent

1. Unsaturated solutions
2. Saturated solutions.
3. Super Saturated solutions.



Methods of expressing concentration of solutions

- 1. Formality (F).**
- 2. Molarity (M).**
- 3. Normality (N).**
- 4. Percent composition (%).**
- 5. Parts per million (ppm) .**
- 6. Molality (m).**



1. Formality (F)

- ❖ Defined as the **number of formula weight of substance dissolved per liter of the solution.**
- ❖ **Unit of formality is (F).**

$$F = \frac{Wt}{F. wt} \times \frac{1000}{Vml}$$

2. Molarity (M)

- ❖ A concentration that is defined as the **number of moles per Liter** of solution (solvent).
- ❖ **Unit of molarity is (M) or (mol / L).**

$$M = \frac{Wt}{M. wt} \times \frac{1000}{Vml}$$

3. Normality (N)

- ❖ A concentration that is defined as **number of equivalent per Liter of solution (solvent)**.
- ❖ **Unit of normality is (N)**.

$$N = \frac{Wt}{Eq. wt} \times \frac{1000}{Vml}$$

4. Percentage Compositions

❖ There are three ways:

A. Weight / Weight W/W%

B. Volume / Volume V/V%

C. Weight / Volume W/V%



A. Weight / Weight W/W%

❖ **Weight / Weight W/W% : grams of substances per 100 g of sample.**

$$\frac{W}{W} \% = \frac{\text{Wt of solute in g}}{\text{Wt of solution in g}} \times 100$$

B. Volume / Volume V/V%

❖ **Volume / Volume V/V% : ml of solute within 100 ml of solvent for dilute solution.**

$$\frac{V}{V} \% = \frac{V \text{ of solute in ml}}{V \text{ of solution in ml}} \times 100$$

C. Weight / Volume W/V%

❖ **Weight / Volume W/V% : gram of solute per 100 ml of solvent.**

$$\frac{W}{V} \% = \frac{\text{Wt of solute in g}}{\text{V of solution in ml}} \times 100$$

5. Part Per Million (ppm)

- ❖ When the **amount of solute** present in the solution in **very less quantities**, the concentration expressed as part per million (ppm).
- ❖ Defined as **one part of solute in million parts of solution**.

$$\text{ppm} = \frac{\text{W of solute in mg}}{\text{V of solution in litter}}$$

6. Molality (m)

- ❖ Number of **moles of solute (n)** per **(Kg)** of solvent this concentration is used for **very specified preparation**.
- ❖ **Unit of molality is $m = \text{mol / Kg}$**

$$\text{Molality} = \frac{\text{no. moles of solute}}{1000 \text{ gm of solvent}}$$

$$\text{No. Moles} = \frac{\text{Wt of matter}}{\text{M. Wt of matter}}$$



Thank You