Al-Mustaqbal University College

Department of Radiology Techniques - First Stage

General Chemistry

Third Lecture: Analytical Chemistry

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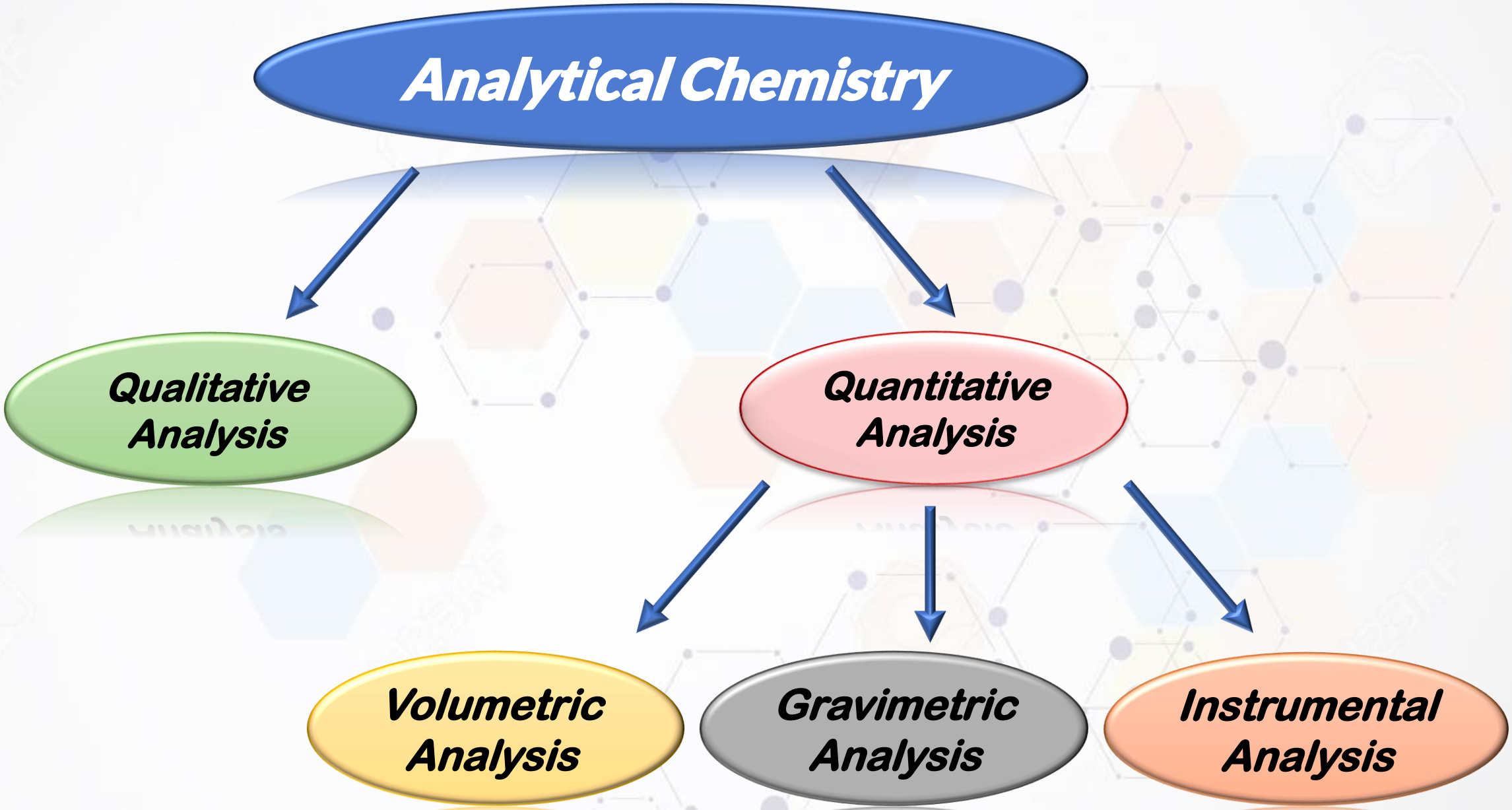
Out line

- ✓ 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?

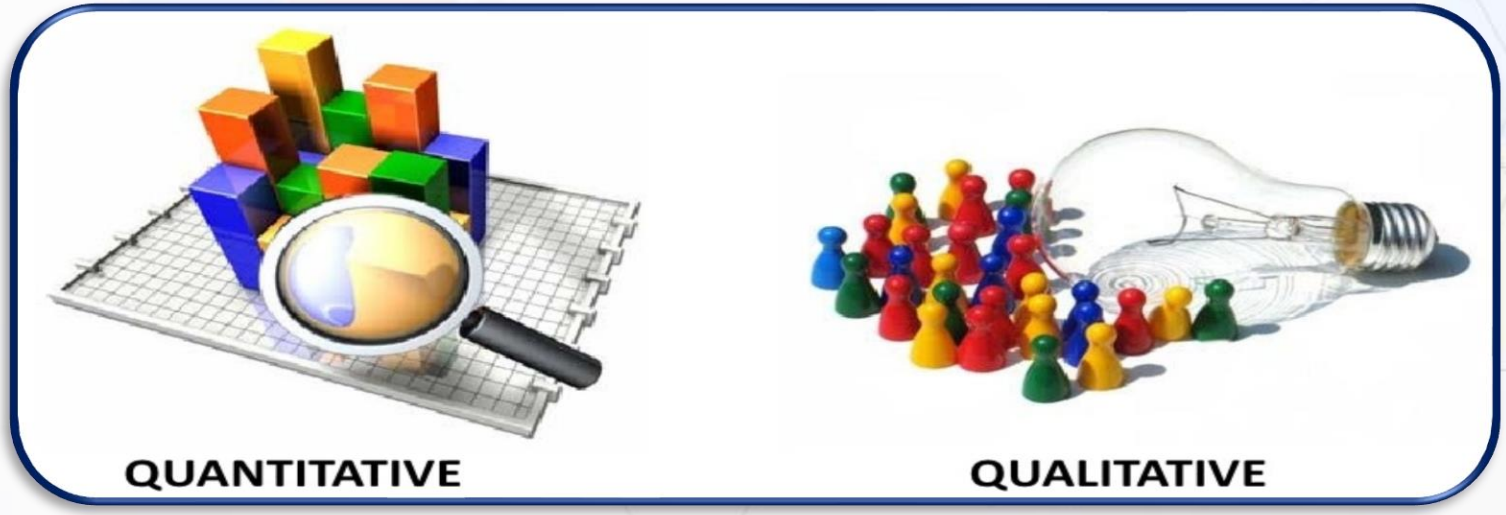

Analytical Chemistry
Qualitative Analysis
Quantitative Analysis
Volumetric Analysis
Gravimetric Analysis
Instrumental Analysis

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.**



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.**

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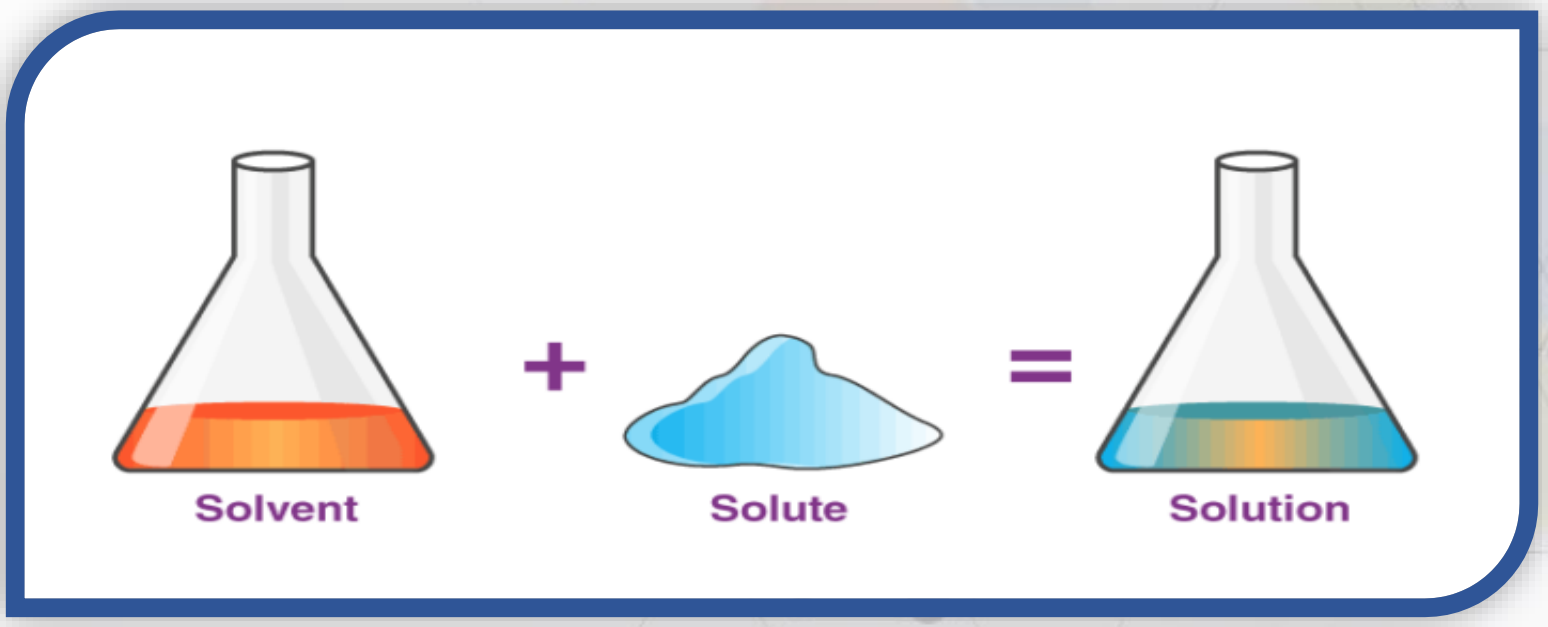
Solutions

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



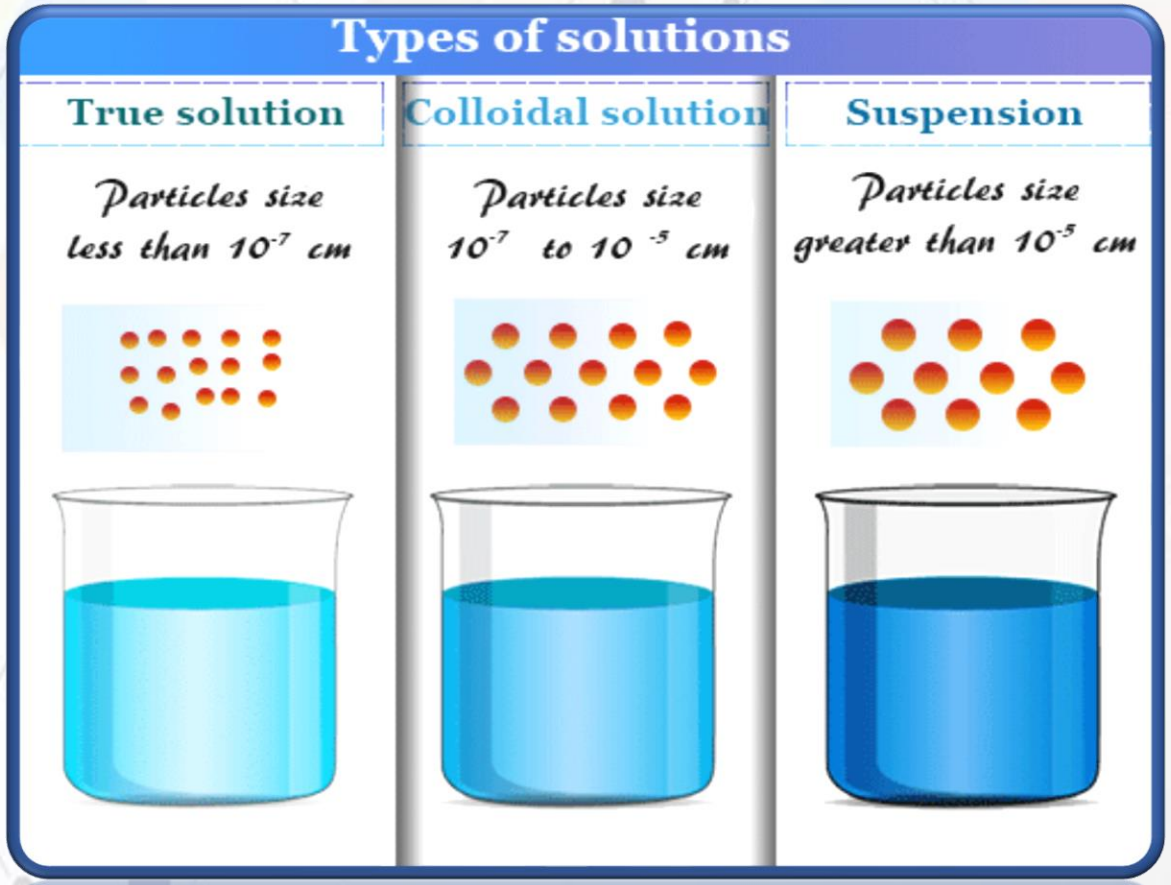
Types of Solutions

- 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.

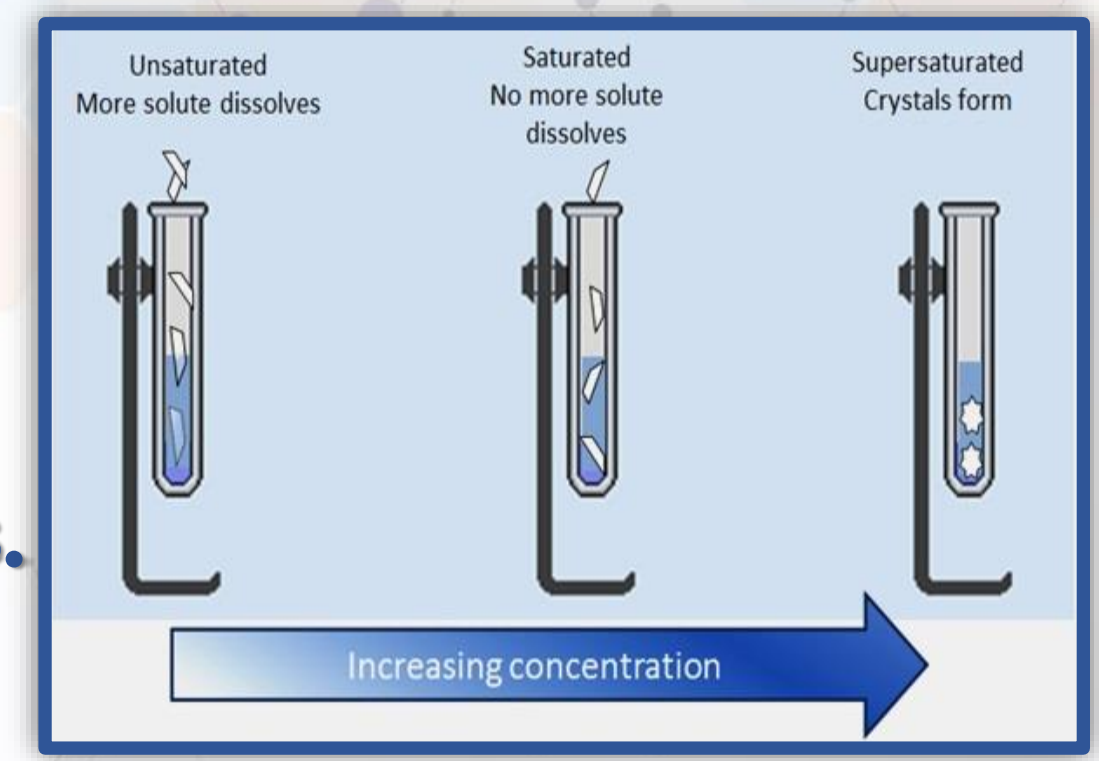
1. Depend on the particle size of solute in solvent

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).

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1. Formality (F)

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

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

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).**

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

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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.

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

B. Volume / Volume V/V%

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

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

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**.

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

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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 = mol / Kg

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

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

Thank You