Al-Mustaqbal University College
Department of Pharmacy
Second Stage – First Semester

Physical Pharmacy Laboratory

Second Experiment

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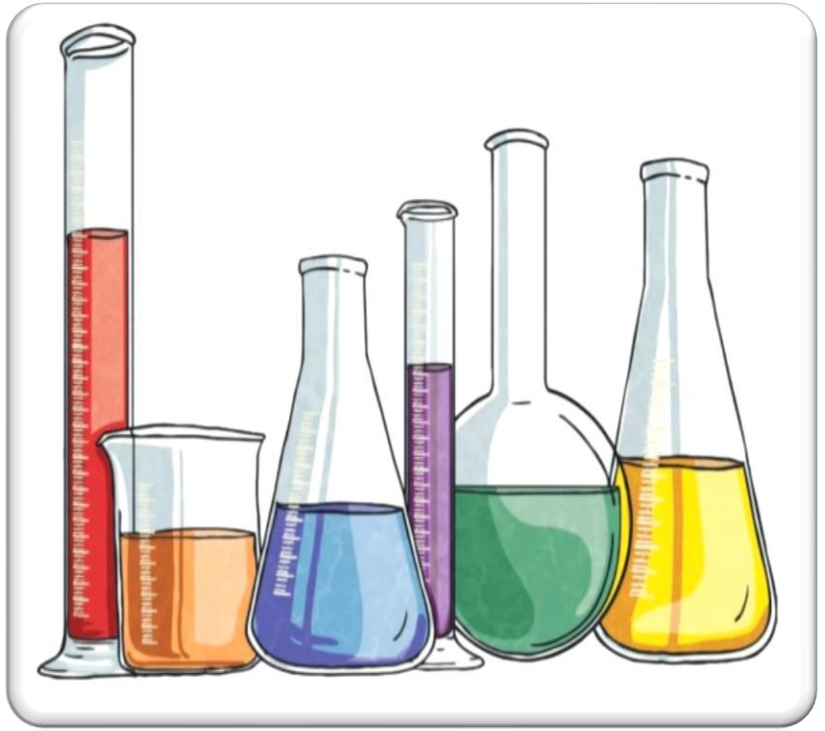
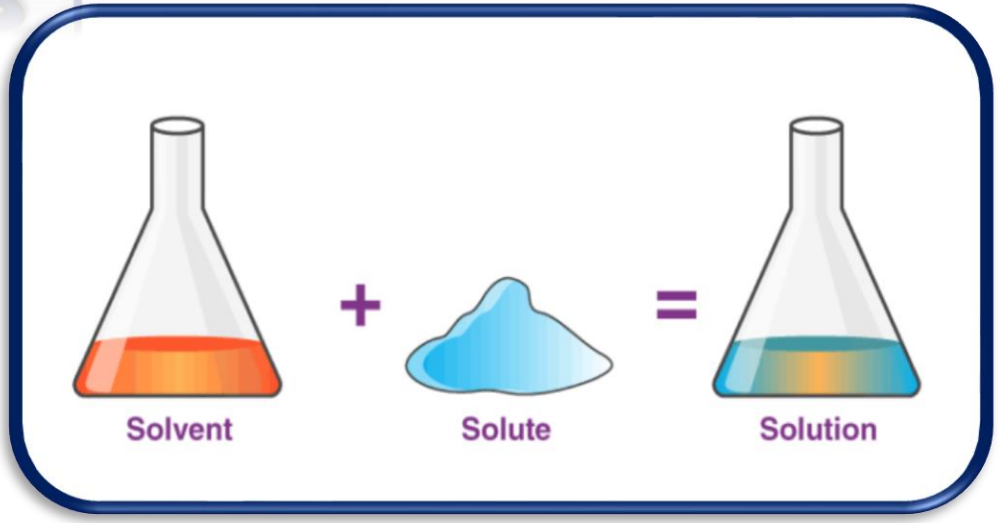
Out line

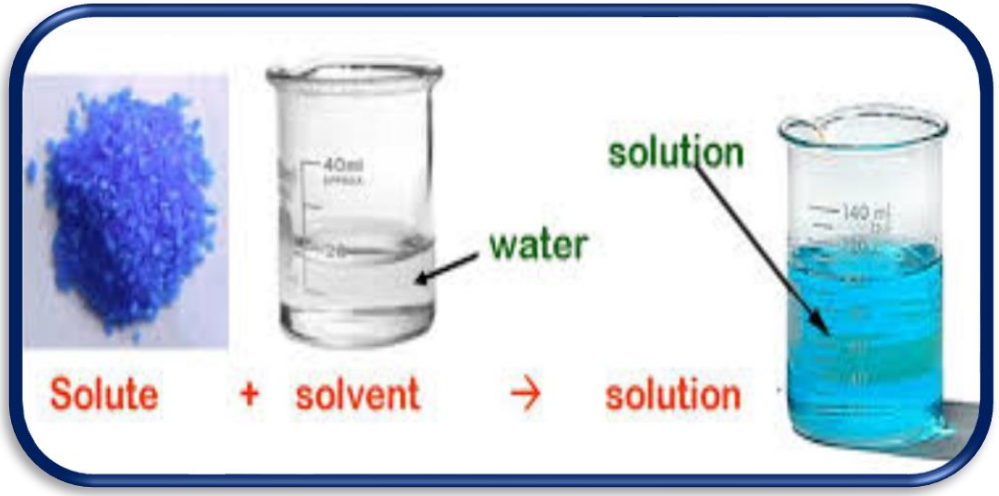
- ✓ Solution
- ✓ Methods of expressing concentration of solutions
- ✓ Standard (Stock) Solution
- ✓ Preparation Stock Solution
- ✓ Molarity
- ✓ Normality
- ✓ Parts per million (ppm)
- ✓ Percent concentration %

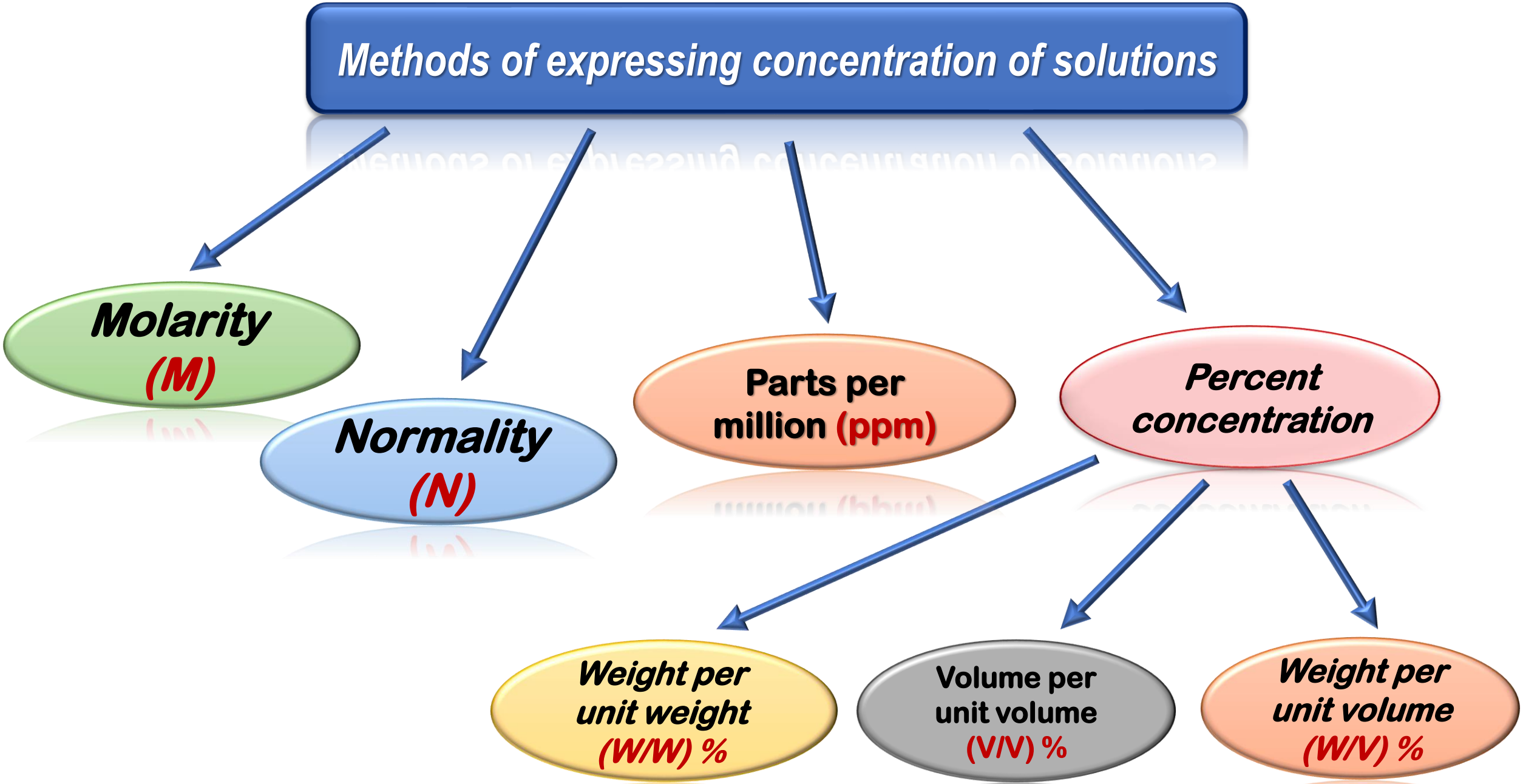


Solutions

- **Solution:** is homogenous mixture formed by dissolving one or more solute present in solvent.
- The chemical present in a smaller amount, the solute, is soluble in the solvent (the chemical present in a larger amount).






Methods of expressing concentration of solutions
Molarity (M)
Normality (N)
Parts per million (ppm)
Percent concentration
Weight per unit weight (W/W) %
Volume per unit volume (V/V) %
Weight per unit volume (W/V) %

Standard (Stock) Solutions

- **Standard (Stock) Solutions: Solutions with accurately known concentrations.**
- **Standard Solution can be prepared by two ways:**

1. ***Solids added to liquids***
2. ***Liquids added to liquids***

Preparing a Standard Solution from a Solid

From Molarity

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

$$Wt = \frac{M * M.Wt * V_{ml}}{1000}$$

Preparing a Standard Solution from a Solid

From Normality

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

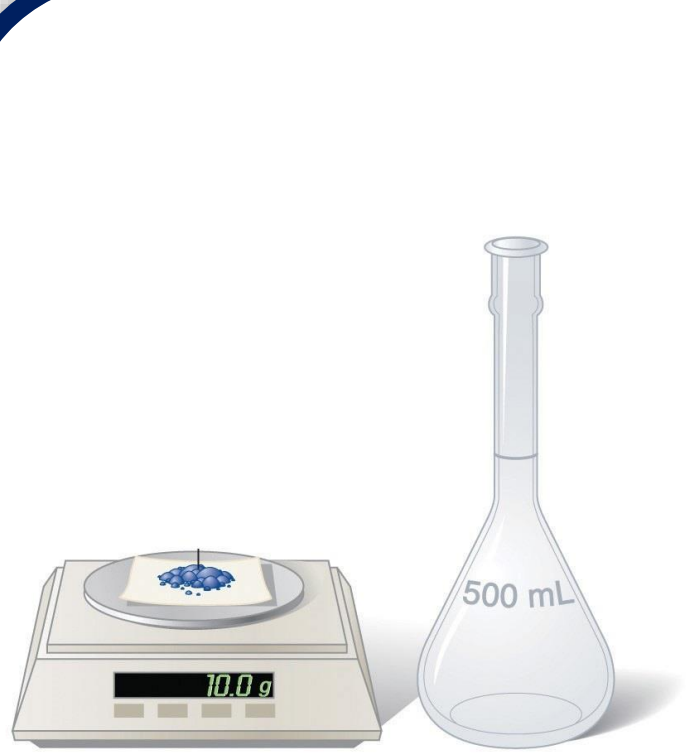
$$Wt = \frac{N * Eq.Wt * V_{ml}}{1000}$$

$$Eq.Wt = \frac{M.Wt}{\eta}$$

Procedure

1. Weight the solid substance in a watch glass.
2. Transfer to a beaker and add a small amount of solvent to the beaker and stirred the solution until the solid substance is dissolved.
3. Transfer the solution to the volumetric flask.
4. Put a funnel into the slim neck of the volumetric flask.
5. Complete the additional of solvent to required volume
6. *Capped the volumetric flask and inverted until the contents are thoroughly mixed.*

Procedure



(a) An amount of solute is weighed out on an analytical balance and then

(b) A portion of the solvent is added to the volumetric flask.

(c) The mixture is swirled until *all* of the solute is dissolved.

(d) Additional solvent is added up to the mark on the volumetric flask.

Preparing a Standard Solution from a Liquid

$$M = \frac{\% * Sp.gr * 1000}{M.wt}$$

$$N = \frac{\% * Sp.gr * 1000}{Eq.wt}$$

%: is the percentage of substance on the container.

Sp.gr: is the specific gravity of substance.

M.wt: is the Molecular weight of substance.

Eq.wt: is the equivalent weight of substance.

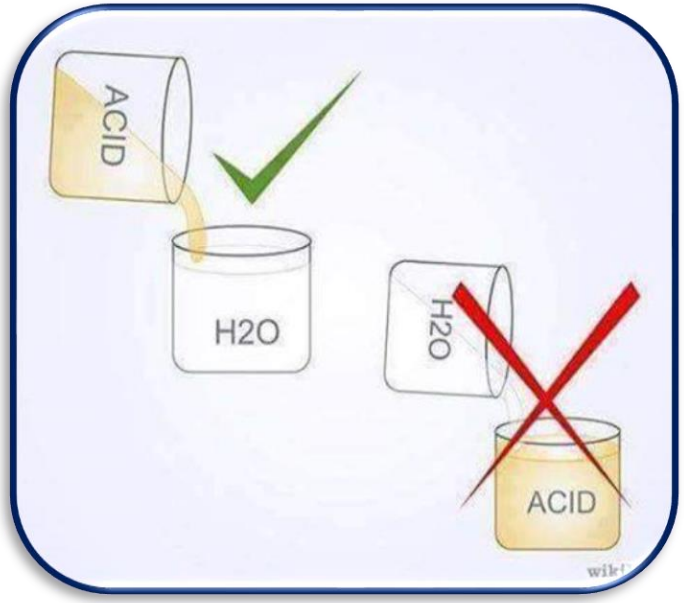
$$M_1\ V_{1\ (conc.)} = M_2\ V_{2\ (diluted)}$$

$$N_1\ V_{1\ (conc.)} = N_2\ V_{2\ (diluted)}$$

Procedure

1. Use a pipet to take an exact amount from the stock solution (concentrated) into a clean volumetric flask.
2. *Put a funnel into the slim neck of the volumetric flask.*
3. *Add the solvent until the liquid level reaches to the mark on the neck.*

- ***NEVER** add water to concentrated acid. The reaction is very exothermic, heating the solution and potentially causing splattering.*



Molarity (M)

- Defined as the number of moles of solute per liter of solution.

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

Normality (N)

- Defined as the number of equivalents of solute per liter of solution.
- Equivalent weights are determined by the valence, which reflects the number of combining or replaceable units.
- The equivalent weight of an element or compound is equal to the molecular weight divided by the valance.

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

$$Eq.Wt = \frac{M.Wt}{\eta}$$

Parts 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.

$$\text{ppm} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^6$$

Percent concentration

- **Percent concentrations are generally expressed as parts of solute per 100 parts of total solution,**
- **Percent concentrations include:**

1. **Weight per unit weight (W/W) %**
2. **Volume per unit volume (V/V) %**
3. **Weight per unit Volume (W/V) %**

1. Weight per unit weight (W/W) %

- **Both solute and solvent are weight. Example, 5% w/w of NaCl contains 50g of NaCl + 950g of solvent.**

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

2. Volume per unit Volume (V/V) %

- The volume of liquid solute per total volume of solute and solvent is expressed.

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

3. Weight per unit Volume (W/V) %

- The most frequently used expression, concentration of w/v are reported as **grams percent (g%)** or **g/dL**, as well as **mg/dL** and **µg/dL**.

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


THANK YOU