## Lecture 2

## Dr. Rusul H. Hamza



## Definition

A solution is a homogeneous mixture of two or more substance

OR
A solution is a homogenous mixture of solute and solvent.

A solute is dissolved in a solvent

- solute is the substance being dissolved
- solvent is the liquid in which the solute is dissolved
- an aqueous solution has water as solvent

Dilute Solutions: A solution containing relatively small quantity of solute as compared with the amount of solvent.
Concentrated Solution: A solution containing large amount of solute in the solution than that in dilute solution.
saturated solution is one where the concentration is at a maximum - no more solute is able to dissolve at a given temperature.

## Super Saturated Solution:

A solution that contains relatively larger amount of solute than that required for saturation it is prepared by heating and adding more and more solute.

## CONCENTRATION EXPRESSION 5 ways of expressing concentration

-Mass percent: (mass solute / mass of solution) * 100
-Molarity(M): moles solute / Liter solution
-Molality (m) - moles solute / Kg solvent
-Normality ( N )- gram equivalent of solute/ liter solution
-Mole Fraction $\left(x_{A}\right)$ - moles solute / total moles solution

## Percentage Expression

Mass \% of $A=\frac{\text { mass of } \mathrm{A} \text { in solution }}{\text { total mass of solution }} \times 100$

## \%Concentration

## $\%(w / w)=\frac{\text { mass solute }}{\text { mass solution }} \times 100$

$$
\%(\mathrm{w} / \mathrm{v})=\frac{\text { mass solute }}{\text { volume solution }}
$$

$\%(v / v)=$

volume solute $\quad x 100$

It expresses the no. of grams of the solute per 100 gram of the solution.
e.g. a $10 \% \mathrm{w} / \mathrm{w}$ aqueous glycerine solution means 10 g of glycerine dissolved in sufficient water to make overall 100 gram of the solution.

It expresses the no. of milliliters of the solute per 100 milliliters of the solution.
e.g. a $10 \% \mathrm{v} / \mathrm{v}$ aqueous ethanolic solution means 10 ml of ethanol dissolved in sufficient water to make overall 100 mls of the solution.

It expresses the no. of grams of the solute per 100 mls of the solution.
e.g. a $10 \% \mathrm{w} / \mathrm{v}$ aqueous Nacl solution means 10 g of Nacl dissolved in sufficient water to make overall 100 mls of the solution.

## Parts per Million and Parts per Billion

ppm denotes the amount of given substance in a total amount of 1,000,000 of solution
ppb denotes the amount of given substance in a total amount of 1,000,000,000 of solution

## Parts per Million and Parts per Billion

Parts per Million (ppm)

$$
\mathrm{ppm}=\frac{\text { mass of } \mathrm{A}}{\text { total mass of solution }} \times 10^{6}
$$

Parts per Billion (ppb)

$$
\mathrm{ppb}=\frac{\text { mass of } \mathrm{A}}{\text { total mass of solution }} \times 10^{9}
$$

