

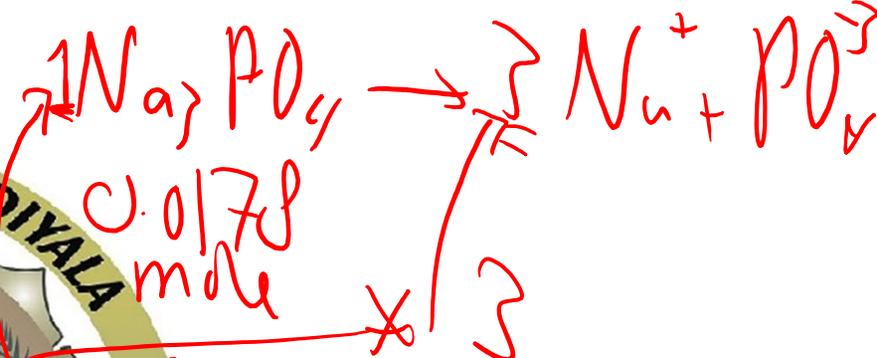
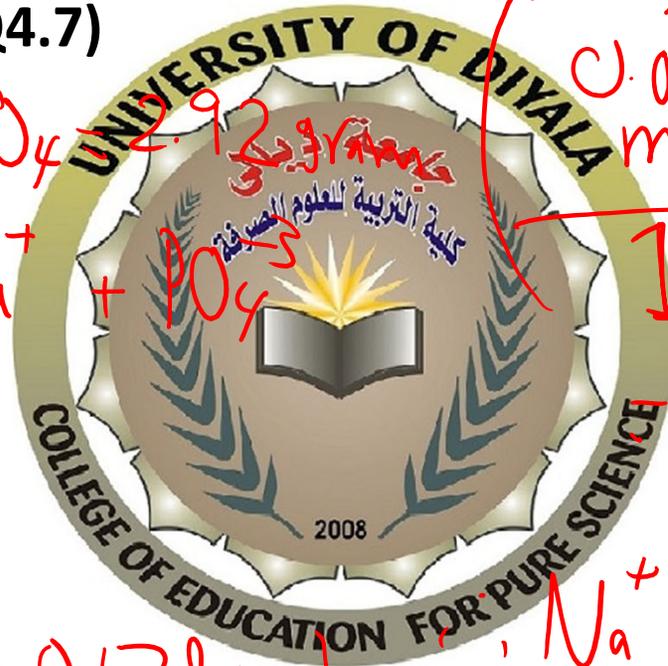
Q: Find the number of  $\text{Na}^+$  ions in 2.92 gram of  $\text{Na}_3\text{PO}_4$ ? (Skoog, Q4.7)

$$\text{Na}^+ = ?$$

$$\text{Na}_3\text{PO}_4 \rightarrow 3 \text{Na}^+ + \text{PO}_4^{3-}$$

$$\frac{2.92 \text{ gram}}{\text{Molar mass gram/mole}} = \frac{2.92 \text{ gr.}}{164 \frac{\text{gr}}{\text{mole}}} = 0.0178 \text{ mole}$$

$$\text{Na}_3\text{PO}_4 = 2.92 \text{ gram}$$



$$0.0178 \text{ mole} \times 3 = 0.0534 \text{ mole}$$

$$\text{Na}^+ = 0.0534 \times 6.022 \times 10^{23} = 3.22 \times 10^{27} \text{ Na}^+$$

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**Q: Find the number of Na<sup>+</sup> ions in 2.92 gram of Na<sub>3</sub>PO<sub>4</sub>? (Skoog, Q4.7)**

**Answer: we need to calculate the moles of Na<sub>3</sub>PO<sub>4</sub> first, then calculate the moles of Na<sup>+</sup> ions produced from Na<sub>3</sub>PO<sub>4</sub>:**

$$\begin{aligned}\text{Molar mass of Na}_3\text{PO}_4 &= (23 \cdot 3) + (31 \cdot 1) + (4 \cdot 16) \\ &= 164 \text{ g/mole}\end{aligned}$$

$$\begin{aligned}\text{No. of moles of Na}_3\text{PO}_4 &= 2.92(\text{g}) / 164(\text{g} \cdot \text{mole}^{-1}) \\ &= 0.0178 \text{ mole}\end{aligned}$$

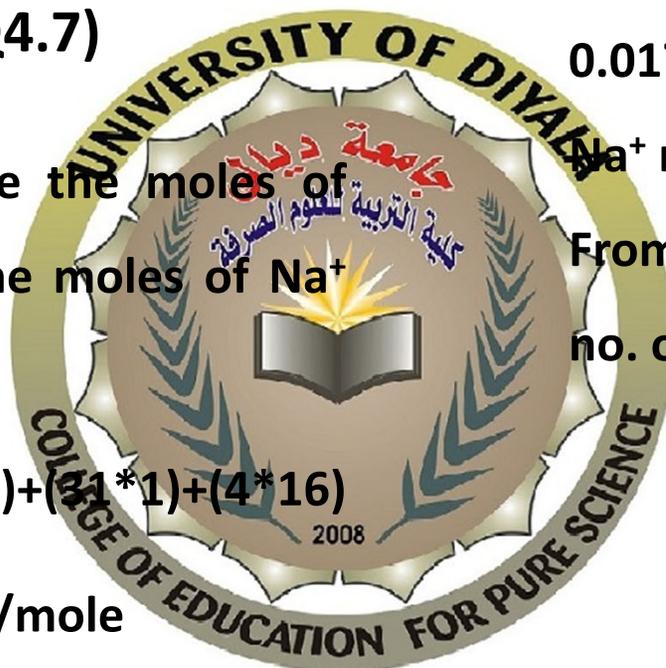


$$0.0178 \rightarrow 3/1 \cdot 0.0178$$

$$\text{Na}^+ \text{ moles} = 0.0534$$

From eq 1 above,

$$\begin{aligned}\text{no. of Na}^+ \text{ ions} &= 0.0534 \cdot 6.022 \cdot 10^{23} \\ &= 3.22 \cdot 10^{22} \text{ ions}\end{aligned}$$



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## Classification of solutions based on solute particle size:

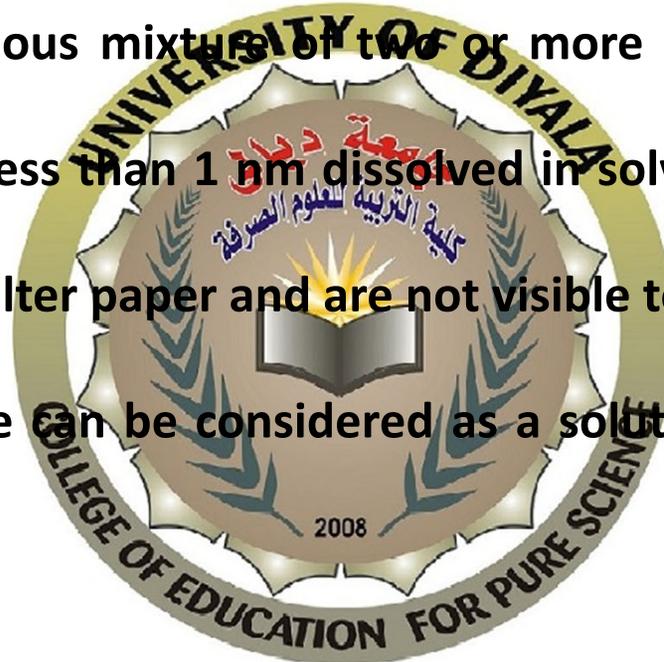
(1) True solution: A homogeneous mixture of two or more substance in which substance (solute) has a particle size less than 1 nm dissolved in solvent. Particles of true solution cannot be filtered through filter paper and are not visible to naked eye (NaCl in water).

Note: any homogenous mixture can be considered as a solution; examples include (but not limited to) the following:

A- mixture of gasses.

B- mixture of miscible liquids.

C- mixture of metals in an alloy.

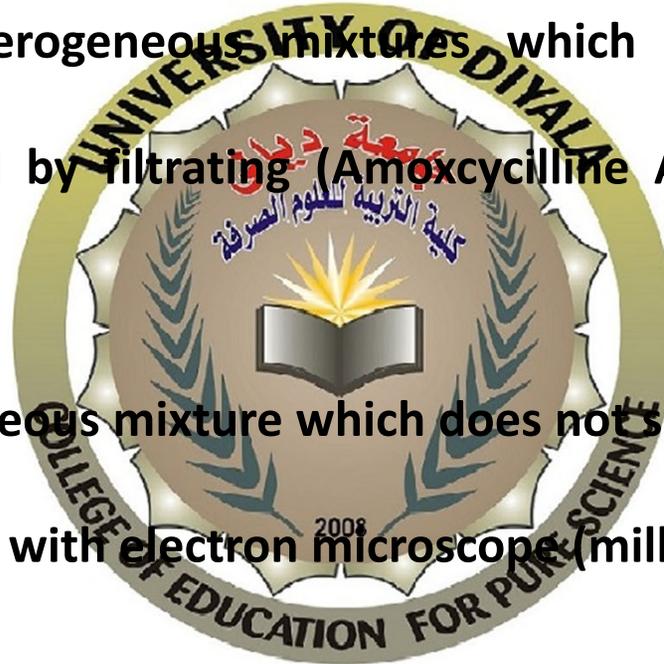


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## Classification of solution based on solute particle size:

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

(3) Colloidal solution: homogeneous mixture which does not settle nor are their components filterable, solute particle visible with electron microscope (milk).



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## Nature of Aqueous Solutions

Strong Electrolytes

Strong acids:  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$ ,  $\text{HClO}_4$

Strong bases:  $\text{MOH}$  (M = Na, K, Cs, Rb

etc.)

Salts: All salts dissolving in water are

completely ionized

## Types of Chemical Reactions

1- Neutralization Reactions (Acid-Base

Reactions)

2- Oxidation-Reduction (RedOx) Reactions

3- Precipitations

4- Complex formation reactions



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## Concentrations expressions:

Table 2.4 Common Units for Reporting Concentration

Name	Units	Symbol
molarity	$\frac{\text{moles solute}}{\text{liters solution}}$	M
formality	$\frac{\text{moles solute}}{\text{liters solution}}$	F
normality	$\frac{\text{equivalents solute}}{\text{liters solution}}$	N
molality	$\frac{\text{moles solute}}{\text{kilograms solvent}}$	m
weight percent	$\frac{\text{grams solute}}{100 \text{ grams solution}}$	% w/w

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**Table 2.4 Common Units for Reporting Concentration**

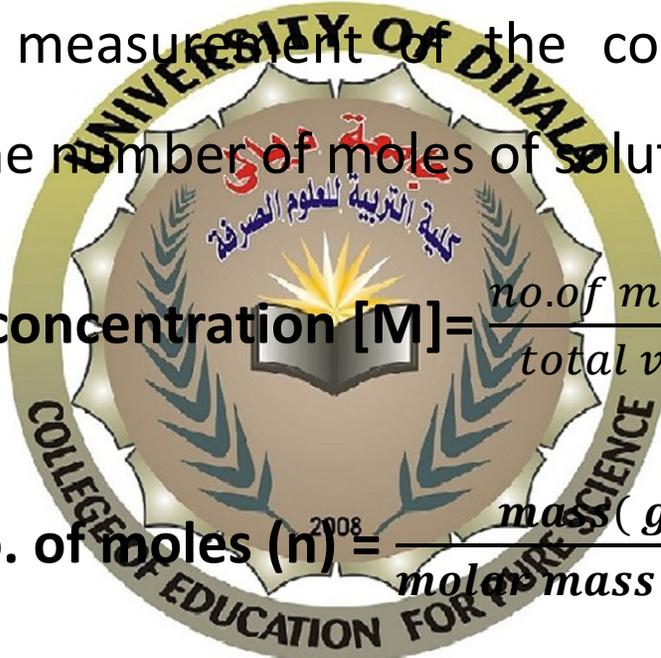
Name	Units	Symbol
volume percent	$\frac{\text{mL solute}}{100 \text{ mL solution}}$	% v/v
weight-to-volume percent	$\frac{\text{grams solute}}{100 \text{ mL solution}}$	% w/v
parts per million	$\frac{\text{grams solute}}{10^6 \text{ grams solution}}$	ppm
parts per billion	$\frac{\text{grams solute}}{10^9 \text{ grams solution}}$	ppb

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# Concentrations expressions:

**1. Molar concentration:** A measurement of the concentration of a solution.

Molarity (M) is equal to the number of moles of solute (n) per liter of solution



Molar concentration [M] =  $\frac{\text{no. of moles (mole)}}{\text{total volume (L)}}$

No. of moles (n) =  $\frac{\text{mass (g)}}{\text{molar mass } (\frac{g}{\text{mole}})}$

If we combined the above equations we will get:

Molar concentration [M] =  $\frac{\text{mass (g)}}{\text{molar mass} * \text{total volume (L)}}$

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