Q: Find the number of Na^+ ions in 2.92 gram of Na_3PO_4? (Skoog, Q4.7)

$Na^+ = ?$ $\quad Na_3PO_4 = 2.92$ gram

$Na_3PO_4 \longrightarrow 3Na^+ + PO_4^{3-}$

$$\frac{2.92 \text{ gram}}{\text{Molar mass } \frac{\text{gram}}{\text{mole}}}$$

$$= \frac{2.92 \text{ gr}}{164 \frac{\text{gr}}{\text{mole}}} = 0.0178 \text{ mole}$$

$1 Na_3PO_4 \rightarrow 3Na^+ + PO_4^{3-}$

0.0178 mole $\quad * 3 \quad 1$

$$\frac{0.0178 * 3}{1} = 0.0534 \text{ mole}$$

$Na^+ = 0.0534 * 6.022 * 10^{23}$

$= 3.22 * 10^{22}$ Na^+

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Q: Find the number of Na^+ ions in 2.92 gram of Na_3PO_4? (Skoog, Q4.7)

Answer: we need to calculate the moles of Na_3PO_4 first, then calculate the moles of Na^+ ions produced from Na_3PO_4:

Molar mass of Na_3PO_4= (23*3)+(31*1)+(4*16)

= 164 g/mole

No. of moles of Na_3PO_4=2.92(g)/164(g.mole^{-1})

= 0.0178 mole

$Na_3PO_4 \rightarrow 3Na^+ + PO_4^{-3}$

0.0178 → 3/1*0.0178

Na^+ moles = 0.0534

From eq 1 above,

no. of Na^+ ions= $0.0534*6.022*10^{23}$

$=3.22*10^{22}$ ions

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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 filtrating (Amoxcycilline 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: HNO_3, H_2SO_4, HCl, $HClO_4$

Strong bases: 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	$\frac{\text{grams solute}}{\text{100 grams solution}}$	% w/w

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Table 2.4 Common Units for Reporting Concentration

Name	Units	Symbol
volume percent	$\frac{\text{mL solute}}{\text{100 mL solution}}$	% v/v
weight-to-volume percent	$\frac{\text{grams solute}}{\text{100 mL solution}}$	% 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

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

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

If we combined the above equations we will get:

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