

Introduction to Chapter 11

Directions: Read through sections 11.1 and 11.3, answering the following as you go.
[Note: for all problems assume that the density of pure water is 1.00 g/mL.]

A. Section 11.1 Solution Composition

1. What is a solution? _____

2. What's the difference between a solvent and a solute? _____

3. Define the following with a formula:

a. molarity:

b. mass percent:

c. mole fraction:

d. molality:

4. If you mix 8.50 g of sucrose ($C_{12}H_{22}O_{11}$) in 90.0 mL of water (same as 90.0 g), the volume of the solution will be 95.0 mL. What will the following be for this solution? (show all set-ups)

a. molarity:

b. mass percent:

c. mole fraction:

d. molality:

5. Normality doesn't show up on the AP Exam, so we'll skip it.

6. According to research results found at MIT, does the brain seem to respond better to stationary images (like on a printed page) or to images on a screen (like the Growler) ?

7. The density of a solution of HCl in water is 1.19 g/cm^3 . The mass percent of HCl is 38%. What is each of the following of the HCl in this solution? [Hint: the 38% means 38 g of HCl per 100. g of solution, and the 1.19 g/cm^3 means exactly one cm^3 , or one mL of solution, has a mass of 1.19 g.]

a. molarity

b. molality

c. mole fraction

8. The density of a solution of ammonia in water is $.900 \text{ g/cm}^3$. The mass percent of the ammonia is 28%. What is each of the following of the ammonia in this solution?

a. molarity

b. molality

c. mole fraction

9. A bottle of wine contains 12.5% ethanol by volume. The density of pure ethanol (C_2H_5OH) is 0.789 g/cm^3 . Calculate the concentration of ethanol of wine in terms of:

- mass percent

- molality

10. A 1.37 M solution of citric acid ($H_3C_6H_5O_7$) in water has a density of 1.10 g/cm^3 . Calculate:

- mass percent

- molality

- mole fraction

11. If you have a 1.00 molal solution of acetone in ethanol, what would be the molarity and mole fraction? You can assume the volumes add (Ex: 1.0 mL acetone + 2.0 mL ethanol --> 3.0 mL of solution). The density of acetone (CH_3COCH_3) is 0.788 g/cm^3 . The density of ethanol ($\text{C}_2\text{H}_5\text{OH}$) is 0.789 g/cm^3 .

a. molarity

b. mole fraction

B. Section 11.3 Factors Affecting Solubility

1. What about the structure of Vitamin C makes it so much more water soluble than Vitamin A?

2. What are two other terms for

a. hydrophobic: _____, _____

b. hydrophilic: _____, _____

3. What negative affect can come from fat soluble vitamins? _____

4. Like dissolves like. Which solvent, water or carbon tetrachloride, would you choose to dissolve each of the following? (Carbon tetrachloride is non-polar.)

a. CO_2 _____

b. NH_4NO_3 _____

c. $\text{CH}_3\overset{\text{O}}{\parallel}\text{CCH}_3$ _____

d. $\text{HC}_2\text{H}_3\text{O}_2$ _____

e. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$ _____

5. What factors cause one solute to be more strongly attracted to water than another? For each of the following pairs, circle the substance which would be more soluble in water.

a. $\text{CH}_3\text{CH}_2\text{OH}$ or $\text{CH}_3\text{CH}_2\text{CH}_3$

b. CHCl_3 or CCl_4

c. $\text{CH}_3\text{CH}_2\text{OH}$ or $\text{CH}_3(\text{CH}_2)_{14}\text{CH}_2\text{OH}$

6. Rationalize (explain) the trend in water solubility for the following simple alcohols:

Alcohol	Solubility (g/100 g H ₂ O at 20°C)
Methanol, CH ₃ OH	Soluble in all proportions.
Ethanol, CH ₃ CH ₂ OH	Soluble in all proportions.
Propanol, CH ₃ CH ₂ CH ₂ OH	Soluble in all proportions.
Butanol, CH ₃ CH ₂ CH ₂ CH ₂ OH	8.14
Pentanol, CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ OH	2.64
Hexanol, CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ OH	0.59
Heptanol, CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ OH	0.09

7. What is Henry's Law (in words)? _____

a. The higher the pressure over a liquid the **more / less** gas will be able to be dissolved in the liquid. (circle one)

8. What killed all those people (and animals) around Lake Nyos in Cameroon? _____

a. Where did it come from? _____

b. Could this happen again in the same place? _____

9. According to figure 11.6, what happens to the solubilities in water of most ionic substances as temperature increases?

a. What are two exceptions to this? _____ and _____

10. According to figure 11.7, what happens to the solubilities in water of the gases shown as temperature increases?

Done for now!