CHM 112 Chapter 11 Solutions: Study Guide

Purpose: This is a guide for your as you work through the chapter. The major topics are provided so that you can write notes on each topic and work the corresponding problems.

This should serve a s a study guide as you go on to do the problems in Sapling and take the quizzes and exams.

The Problems are embedded in the Topics and Space for Notes

11.1 Dissolution:

(A) Describe the basic properties of solutions and how they form
(B) Predict whether a given mixture will yield a solution based on molecular properties of its components
(C) Explain why some solutions either produce or absorb heat when they form

(A) Know:

- Solute

- Solvent

- Solution

- Know that like dissolves like

- Saturated

- Unsaturated

(B) Which of the following in each pair will be more soluble in <u>water</u>?

(A) C_6H_6 or $C_6H_{12}O_6$ _____

(B) HCl or CH_3CH_2Cl _____

(C) N_2 or He _____

(C) When KNO_3 is dissolved in water, the resulting solution is significantly colder than the water was originally.

(a) Is the dissolution of KNO_3 an endothermic or an exothermic process?

(b) What conclusions can you draw about the intermolecular attractions involved in the process?

(c) Is the resulting solution an ideal solution?

(D) Predict whether each of the following substances would be more soluble in water or in a hydrocarbon such as heptane:

(a) vegetable oil

(b) isopropyl alcohol

(c) potassium bromide

11.2 Electrolytes:

(A) Define and give examples of electrolytes
(B) Distinguish between the physical and chemical changes that accompany dissolution of ionic and covalent electrolytes
(C) Relate electrolyte strength to solute-solvent attractive forces

(A). Compare the processes that occur when methanol (CH_3OH), hydrogen fluoride (HF), and sodium sulfate (Na_2SO_4) dissolve in water. Write equations and prepare sketches showing the form in which each of these compounds is present in its respective solution. (strong electrolyte, weak electrolyte, nonelectrolyte)

(B) What is the expected electrical conductivity of the following solutions?

(a) NaOH(*aq*)

(b) HCl(*aq*)

(c) $C_6H_{12}O_6$(*aq*) (glucose)

(d) NH_3(*l*)

11.3 Solubility

(A) Describe the effects of temperature and pressure on solubility
(B) State Henry's law and use it in calculations involving the solubility of a gas in a liquid
(C) Explain the degrees of solubility possible for liquid-liquid solutions

(A) Suggest an explanation for the observations that ethanol, C_2H_5OH, is completely miscible with water and that ethanethiol, C_2H_5SH, is soluble only to the extent of 1.5 g per 100 mL of water.

(B) Which of the following gases is expected to be most soluble in water? Explain your reasoning.

(a) CH_4 (b) CCl_4 (c) $CHCl_3$

(C) The Henry's law constant for O_2 is 1.3×10^{-3} *M*/atm at 25 °C. What mass of oxygen would be dissolved in a 40-L aquarium at 25 °C, assuming an atmospheric pressure of 1.00 atm, and that the partial pressure of O_2 is 0.21 atm?

(C) Know the effects of Temperature and Pressure on solubility.

11.4 Colligative Properties

- (PA=XAP∘A)
- Psolution=∑iPi=∑iXiP∘iPsolution=∑iPi=∑iXiPi°
- Psolution=XsolventP∘solventPsolution=XsolventPsolvent°
- $\Delta T_b = iK_b m$
- $\Delta T_f = iK_f m$
- $\Pi = iMRT$

(A) Express concentrations of solution components using mole fraction and molality
(B) Describe the effect of solute concentration on various solution properties (vapor pressure, boiling point, freezing point, and osmotic pressure)
(C) Perform calculations using the mathematical equations that describe these various colligative effects
(D) Explain the process of osmosis and describe how it is applied industrially and in nature

(A) Units of Concentration! Know Units of Concentration and be able to convert between them.

- Molarity

- Normality

- Molality

- Mole fraction

- Mass %

(A) What is the molality and mass percentage of a solution that is 25.0% by mass HCl(aq)?

(B) What is the Normality of a 1.5 M solution of H_2SO_4?

(C) What is the molality of a 1.22 M solution of sugar ($C_{12}H_{22}O_{11}$)? The density of the solution is 1.12 grams/mL.

(D) What is the molality of nitric acid in a concentrated solution of nitric acid (68.0% HNO_3 by mass)?

Know:

- Electrolytes

- Vapor Pressure Lowering

- Boiling Point elevation

- Freezing Point depression

- Osmosis

Describe the effect of solute concentration on various solution properties (vapor pressure, boiling point, freezing point, and osmotic pressure)

Perform calculations using the mathematical equations that describe these various colligative effects

Explain the process of osmosis and describe how it is applied industrially and in nature

(E) What is the freezing point of a solution of 9.04 g of I_2 in 75.5 g of benzene?

(F) What is the osmotic pressure of an aqueous solution of 1.64 g of $Ca(NO_3)_2$ in water at 25 °C? The volume of the solution is 275 mL.

(G) What is the Osmotic pressure of a 0.15 M solution of $MgCl_2(aq)$ at 25 °C?

(H) 0.325 grams of a polystyrene polymer is dissolved in enough benzene to make 50.0 mL of solution. This solution has an osmotic pressure of 79.2 Torr at 25 °C. What is the Molar Mass of the polystyrene?

(I) Define Osmosis and write the equation for Osmotic Pressure. Describe reverse osmosis.

(J) Define hypotonic, hypertonic and isotonic. Describe what happens when red blood cells are put in hypotonic, hypertonic and isotonic solutions.

11.6 Colloids: Describe the composition and properties of colloidal dispersions

(A) Identify the dispersed phase and the dispersion medium in each of the following colloidal systems: starch dispersion, smoke, fog, pearl, whipped cream, floating soap, jelly, milk, and ruby.

And last but not least:

Explain the cleansing action of soap.