REVIEW- Honors Solutions

Name _____
Period _____ ***Date*** _____

Topics:

- Saturated, unsaturated, supersaturated solutions; using solubility curves chart
- Temperature and pressure effects on solubility (for solids and gases)
- Molarity of solutions (preparing solutions from solids and by diluting solutions)
- Beer's Law & direct relationship between concentration & absorbance.
- Stoichiometry calculations involving solution concentrations
- Colligative properties of mixtures: freezing point depression and boiling point elevation
- Colligative property calculations: van't Hoff Factor, FPD, BPE, Molar Mass of solute.
  - Important equations: molality $m = \dfrac{\text{mol solute}}{\text{kg solvent}}$

$\Delta T_f = i K_f m$	$\Delta T_b = i K_b m$
$T_f = T_f^\circ - \Delta T_f$	$T_b = T_b^\circ + \Delta T_b$

Practice Problems:

1) Refer to the solubility curve in your reference charts (Chart G) for these questions.
   a) At what temperature can one dissolve exactly 40g of NH_4Cl in 100 g of water? _____
   b) At what temperature do NaCl and KCl share the SAME solubility limit? _____
   c) If 80 g of KNO_3 are added to 100 g of water at 60°C, is the solution **sat**, **unsat** or **supersat**?
   d) If 110 g of $NaNO_3$ are added to 100 g of water at 30°C, is the solution **sat**, **unsat** or **supersat**?
   e) A chemist wants to make a solution with 70g of KNO_3 dissolved in 100 g of water at 30°C. What type of solution would this be? _____ Describe how this solution could be made.

   f) The solubility of NH_3, HCl and SO_2 decreases with increased temperature, but solubility increases with increased temperature for all the other compounds. What accounts for this difference?

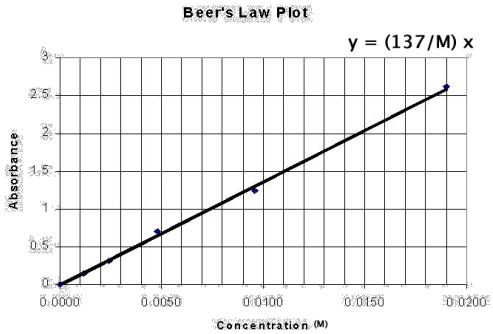
2) The solubility of a gas **(increases, decreases)** with increased pressure.

3) Why is it important that a scuba diver come to the surface slowly after spending some time deep underwater?

4) Calculate and describe how one would make 500. mL of a 3.00 M solution of $FeCl_3$ from solid $FeCl_3$.

5) Calculate and describe how one would make 250. mL of 5.00 M HCl from a 12.0 M HCl solution (remember to specify how to mix acid with water).

6) The Beer's Law calibration plot for $CoCl_2$ at 545 nm is shown at right. Use the plot or the equation for the line (the unit for slope is 1/M or M^{-1}) to determine the following:



a) What is the concentration of a solution with absorbance = 1.5?

b) What is the absorbance of a 0.0170 M solution?

7) What is the theoretical yield of $PbCl_2$ when 100. mL of 0.050 M $AlCl_3$ is mixed with excess $Pb(NO_3)_2$ according to the following equation (balance!)?

____ $Pb(NO_3)_2$ (aq) + ____ $AlCl_3$ (aq) ⟶ ____ $PbCl_2$ (s) + ____ $Al(NO_3)_3$ (aq)

8) What is the concentration of a hydrobromic acid solution if 15.8 mL of the solution reacts with excess Zn according to the following reaction (balance!) and produces 62.3 mL of dry H_2 at 0.955 atm and 21.5°C.

____ HBr (aq) + ____ Zn (s) ⟶ ____ $ZnBr_2$ (aq) + ____ H_2 (g)

9) A solution of antifreeze (ethylene glycol) and water....

a) has a freezing point which must be **(at, above or below)** 0°C.

b) has a boiling point which must be **(at, above or below)** 100°C.

10) Explain **why** the freezing point gets lower the more salt one dissolves into water.

11) Suppose the temperature outside is –5°C and there is ice on the roads. Salt is put on the roads to melt the ice. Why does the ice melt when salt is added?

12) Arrange the following from lowest to highest freezing point: *1.5 M Na_2S, 0.5 M Na_2S, 1.0 M Na_2S*

Lowest FP _____ _____ _____ **highest FP**

13) a) What does the van't Hoff factor, *i*, indicate?

b) What are the values of *i* for the following compounds? C_3H_7OH _____; LiOH _____; $FeCl_3$ _____

14) Determine the boiling point of an aqueous solution of 94.6 g of Na_3PO_4 (what is *i*?) dissolved in 250.0 g H_2O (K_b = 0.512°C/*m*).

a) What is the molality of the solution?

b) What is the boiling point elevation?

c) What is the boiling point of the solution?

15) A 0.300 g sample of caffeine (a molecular compound) was dissolved in 20.0 g of camphor (K_f = 39.7 °C/*m*, T°_f = 179.00°C), decreasing the freezing point of camphor to 175.93°C.

a) What is the molality of the solution?

b) How many moles of caffeine are present?

c) What is the molar mass of caffeine?

Answers: 4) 243 g $FeCl_3$; 5) 104 mL 12.0 M HCl; 6a) 0.011 M; 6b) A = 2.3; 7) 2.09 g $PbCl_2$; 8) 0.312 M HBr; 14a) 2.31 *m*; 14b) 4.73°C; 14c) 104.73°C; 15a) 0.0773 *m*; 15b) 0.00155 mol; 15c) 194 g/mol