



Name: \_\_\_\_\_

**SOLUTIONS**  
**HONORS CHEMISTRY 2005.1.0**  
**TEXTBOOK PG 485-516**

1. In terms of the attractive interaction explain how the formation of a solution can be exothermic or endothermic.

2. Describe the underlying thermodynamic property which favors the formation of a solution. Explain why some combinations of chemicals do not form homogeneous mixtures.

3. Define the following terms;

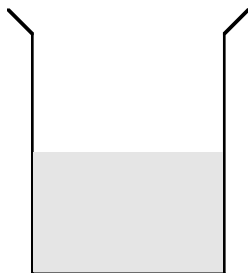
solubility

unsaturated solution

saturated solution

supersaturated solution

4. Given that the beaker below contains an aqueous solution of NaCl, describe a simple test to determine whether the solution is unsaturated, saturated or supersaturated. What would you expect to happen during the test if the solution were unsaturated? saturated? supersaturated?



5. Sketch the orientations of a chloride ion and a several water molecules and a sodium ion and several water molecules to illustrate the ion-dipole interaction.

6. Briefly describe the ion-dipole intermolecular forces which occur when an ionic solid dissolves in water. Indicate what causes the attractive force and describe how the strength depends on the charge and the size of the ion.

7. Define the term lattice energy and explain its importance in the enthalpy of solution.

8. Explain how pressure, temperature and molar mass effect the solubility of a gas in a liquid.

9. Calculate the molality and mol fraction of HCl for a solution which is 37.1 % HCl by weight (mass).

10. A solution of ethylene glycol,  $C_2H_4(OH)_2$ , which is 6.77 molar has a density of 1.05 g/mL. Calculate the mole fraction of ethylene glycol in the solution.

11. Predict whether in the following pairs (solute:solvent) a solution is formed. In each case explain why or why not.

- $HCl(g):H_2O(l)$
- $CH_3COOH(l):H_2O(l)$
- $CH_3OH(l):C_7H_8$  (toluene)(l)
- $C_6H_{14}(l):H_2O(l)$

12. Predict whether the following compounds are soluble or insoluble in water.

- $Na_2SO_4(s)$
- $C_{12}H_{22}O_{11}(s)$
- $CoCl_2(s)$
- $CH_3OH(l)$

13. Given that an aqueous solution, which weighs 367 g, is 40.0 % (ethylene glycol)  $C_2H_6O_2$  by mass and has a density of 1.05 g/mL, determine;

- the mole fraction of ethylene glycol.
- the molality of the solution.
- the molarity of the solution.

14. Describe how you would prepare:

- 520 mL of a 0.760 M NaCl solution.
- 37 g of a 15.2 % (by weight) solution of NaCl.
210. g (grams of solution) of a 0.185 molal NaCl solution.

15. Calculate the expected vapor pressure at 25°C for a solution prepared by dissolving 97.4 g of common table sugar (sucrose, MM = 342 ) in 453 mL of water.

16. A solution was prepared by adding 20.0 g of urea to 125 g of water at 25°C, a temperature at which pure water has a vapor pressure of 23.76 mm of Hg. The observed vapor pressure of the solution was found to be 22.67 mm of Hg. Calculate the molecular weight of urea.

17. Calculate the freezing point and boiling point of a solution prepared by mixing 6.00 g of  $C_6H_{12}O_6$  with 35.0 g of  $H_2O$ .

18. A solution containing a nonelectrolyte dissolved in water has a boiling point of 100.305 °C. Calculate the freezing point of the same solution.

19. 2.57 g of an ionic compound with the formula  $KX$  are dissolved in 120 g of water. The freezing point of the solution was lowered by 1.37 °C. Determine the formula weight of X.

20. Calculate the vapor pressure for each of the following solutions at 25 °C;

- 16.8 g of urea  $(NH_2)_2CO$  dissolved in 108 g of water.
- 8.54 g of  $MgCl_2$  dissolved in 108 g of water.

21. Determine the freezing point of a solution which is 0.50 molal urea (a nonelectrolyte). Determine the boiling point of this solution.

22. A solution containing a nonelectrolyte dissolved in water has a freezing point of  $-1.62\text{ }^{\circ}\text{C}$ . Calculate the boiling point of the same solution.