CHEM 1
Problem Set Ch.12

1. a) Based on the nature of intermolecular forces, explain what the phrase "like dissolves like" means.
   b) Would naphthalene, $C_{10}H_8$, be more soluble in methanol, CH_3OH, or in benzene, C_6H_6.

2. Define the following terms: saturated solution, unsaturated solution, supersaturated solution.

3. Why does the solubility of any gas in water decrease with rising temperature?

4. The partial pressure of CO_2 gas above the liquid in a bottle of champagne at 20 ^oC is 5.5 atm. What is the solubility of CO_2 in champagne? Assume that the Henry's law constant is the same for champagne as for water; at 20 ^oC, $k_H = 2.3 \times 10^{-2}$ mole/L-atm.

5. How many grams $Ba(NO_3)_2$ would be required to make 180 mL of 0.1 *M* barium nitrate solution?

6. If you wanted to make 3 liters of 0.1 *M* HCl, how many mL of the concentrated (12 *M*) HCl would you need?

7. What is the molality of a solution that contains 0.1 g urea, CN_2H_4O, in 5.0 g H_2O?

8. If you had 50.0 mL of 3.5 *M* HCl and wanted to dilute it with water in order to make 2.0 *M* HCl, how much water should you add?

9. What mass of acetic acid, $HC_2H_3O_2$ is in 1.34 liters of 19% by weight solution? (density = 1.0267g/mL)

10. Calculate the mole fraction of solvent and solute in a solution containing 1.65 g silicon tetriodide, SiI_4, in 76.5 g carbon disulfide, CS_2.

11. Calculate the percent composition and the molality of an aqueous solution of $NaNO_3$, if the mole fraction of the $NaNO_3$ is 0.20.

12. A solution of sodium carbonate having a volume of 0.400 L was prepared from 4.032 g $Na_2CO_3 \cdot 10H_2O$. Calculate the molarity of this solution.

13. What is the mole fraction of solute in a 1.00 molal aqueous solution?

14. A man bought a goldfish in a pet shop. Upon returning home, he put he goldfish in a bowl of recently boiled water that had been cooled quickly. A few minutes later the fish was found dead. Explain what happened to the fish.

15. Explain why it is essential that fluids used in intravenous injections have approximately the same osmotic pressure as blood.

16. Define the van't Hoff factor. what information does this quantity provide?

17. What would be the boiling point of 20% (by weight) solution of glycerin, $C_3H_8O_3$, in water?

18. A solution that contains 20 grams of a nonelectrolyte solute in 200 g H_2O freezes at –0.93 ^oC. What is the molar mass of the solute?

19. Calculate the freezing point of a liter of water that contains 1.00 g NaCl (assume complete ionization).

20. The solubility of carbon dioxide at 9 ^oC and 1.00 atm is 0.3346 g/100 g H2O. How many grams of CO_2 would you expect to dissolve in 100 g H_2O at 0 ^oC if the pressure of the CO_2 is increased from 1 atm to 5 atm?