1. Classify each of the following as an element, a compound, or a
    mixture. Justify each answer.   (8%)
    (a) Calcium oxide
    (b) Antimony
    (c) Milk
    (d) Ice cream
    (e) Ink
    (f) Acetic acid
    (g) Steel
    (h) Pure water

2. Write formula for each of the following compound.   (9%)
    (a) Sodium hydrogen carbonate
    (b) Carbon dioxide
    (c) Acetone
    (d) Aluminum phosphate
    (e) Ammonia
    (f) Mercury

3. From the curves shown below, indicate the normal boiling point for
    diethyl ether, ethanol and H_2O, respectively.   (9%)
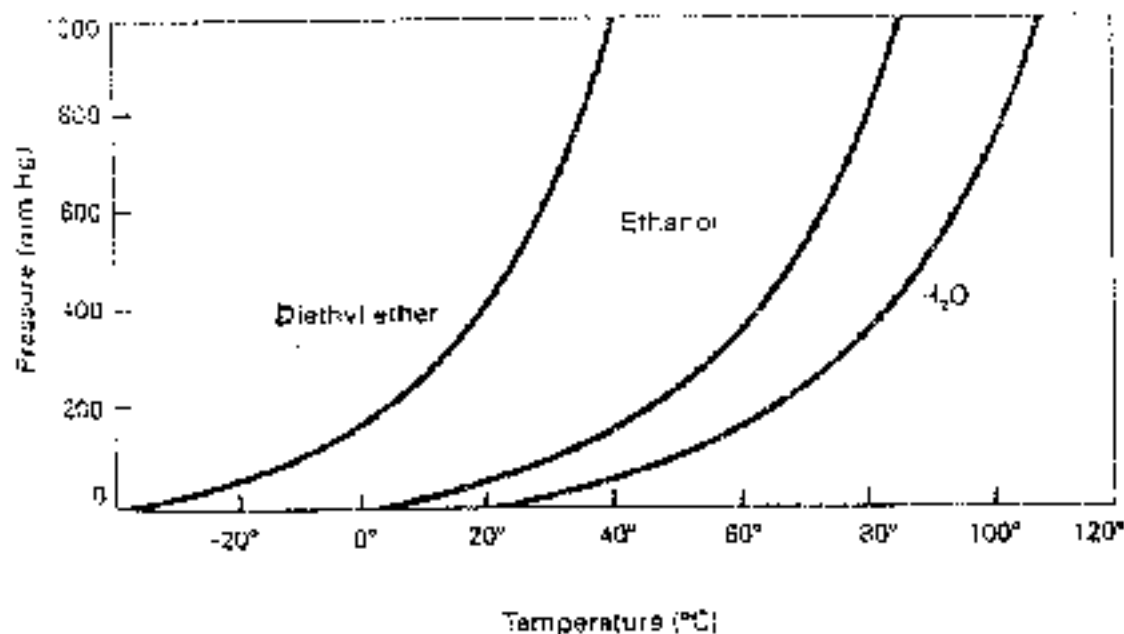
4. To follow diagram shows vapor pressures above a mixture of two volatile liquids. Indicate where does Raoult's or Henry's Law exist? (8%)
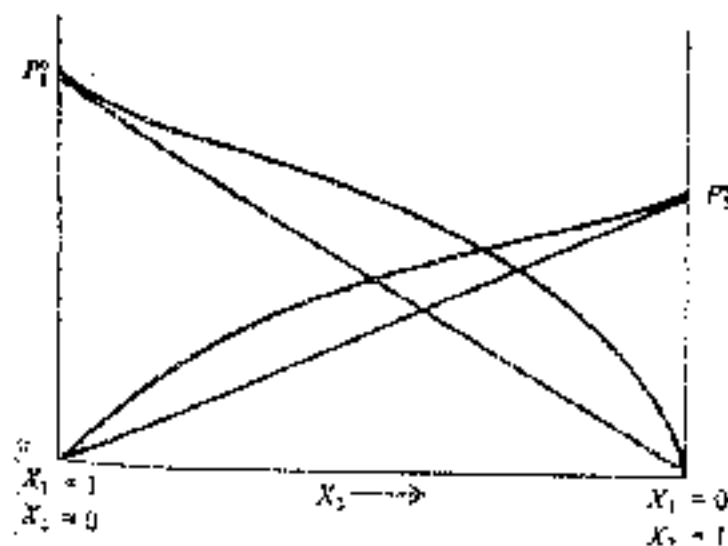
5. Write down the names (or formula) for at least three forms of carbon. (9%)

6. In the $YBaCu_3O_7$ compound,

   (a) What are the oxidation states for the copper atoms?

   (b) How do you verify these oxidation states by chemical methods? (10%)

7. Ascorbic acid (vitamin C) is a diprotic acid, $H_2C_6H_6O_6$. (a) What is the pH of a 0.1 M solution? (b) What is the concentration of ascorbate ion, $C_6H_6O_6^{2-}$? The acid ionization constants are $K_{a_1} = 7.9 \times 10^{-5}$ and $K_{a_2} = 1.6 \times 10^{-12}$. (10%)

8. Sodium has the body-centered cubic structure, and its lattice parameter is 4.28Å. (10%)

   (a) How many Na atoms does a unit cell contain?

   (b) What fraction of the volume of the unit cell is occupried by Na atoms, if they are repressented by spheres in contact with one another?

9. A chemist vaporized a liquid compound and determined its density. If the density of the vapor at 90°C and 753 mmHg is 1.585 g/l, what is the molecular weight of the compound? (7%)

10. State whether each of the following sets of quantum numbers is permissible for an electron in an atom. If a set is not permissible, explain why. (10%)

(a) $n=1, l=1, m_l = 0, m_s = +\frac{1}{2}$

(b) $n=3, l=1, m_l = -2, m_s = -\frac{1}{2}$

(c) $n=2, l=1, m_l = 0, m_s = +\frac{1}{2}$

(d) $n=2, l=0, m_l = 0, m_s = 1$

11. An experimenter makes up a solution of 0.375 mol Na_2CO_3, 0.125 mol $Ca(NO_3)_2$, and 0.200 mol $AgNO_3$ in 2.000 L of water solution. Note any precipitations that occur, writing a balanced equation for each. Then, calculate the molarities of each ion in the solution. (10%)