CHE 371 Fall 2007

Practice Problems for Exam 3

These problems are given to you as <u>extra</u> practice. The key to studying for this exam is, however, to review the notes and homework! You should understand the notes, including being able to describe/use any graphs, and understand the *concepts* behind the homework. There will be several "mathematical" problems; they are mostly similar to the homework.

1. Sketch the phase diagram of I_2 given the following data: triple point, 113 °C and 0.12 atm; critical point, 512 °C and 116 atm; normal melting point, 114 °C; normal boiling point, 184 °C; and density of liquid > density of solid.

2. Figure 24-15 in your text shows the vapor pressures for dimethoxymethane and carbon disulfide in solution. Describe Henry's Law, Raoult's Law, and the deviations (in terms of intermolecular forces) observed for this solution.

3. The vapor pressure of tetrachloromethane (1) and trichloroethylene (2) between 76.8 °C and 87.2 °C can be expressed empirically as:

$$\ln\left(P_1^* / \text{torr}\right) = 15.8401 - \frac{2790.78}{t + 226.4}$$

and $$\ln\left(P_2^* / \text{torr}\right) = 15.0124 - \frac{2345.4}{t + 192.7}$$

where t is the temperature in Celsius. Assuming that these components form an ideal solution at all compositions, calculate the values of x_1 and x_2 at 82.0 °C and 77.1 °C (at an ambient pressure of 760 torr).

4. Show that $a_2 = a_{\pm}^2 = m^2 \gamma_{\pm}^2$ for $CuSO_4$.

5. Find $\Delta_r G^\circ(T)$ and $K_P(T)$ at 25 °C for $CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$. What does the size of $K_P(T)$ tell you about the reaction?

6. The value of K_p for a gas-phase reaction doubles when the temperature is increased from 300 K to 400 K at a fixed pressure. What is the sign of $\Delta_r H^\circ(T)$ for this reaction? What is the value?

7. What is the pH for a solution 0.100 M $HClO_2$ ($K_a = 1.12 \times 10^{-2}$) at equilibrium? Compare this problem to the one completed in class. What does the size of K_a tell you about acid strength?