CHE-371 Fall 2007

Homework #5

Chapter 23

1. McQuarrie and Simon Problems: 1,16, 22, 27, 30
2. Use the phase diagram(s) in Figure 23.5 to describe what would be observed when a sample of water, initially at 1.0 atm at 500 K, is subjected to the following cycle:
    a. Isobaric (same pressure) heating to 710 K
    b. Isothermal compression to 500 atm
    c. Isobaric cooling to 300 K
    d. Isothermal decompression to 1.0 atm
    e. Isobaric heating to 500 K

Chapter 24

1. McQuarrie and Simon Problems: 29, 50 (also show where the plots follow Raoult's law and Henry's law), 51 (also comment on meaning of the γ_i values)
2. The solubility of N_2 in blood at 37 °C and a partial pressure of 0.80 atm is 5.6×10^{-4} mol/L. A deep-sea diver breathes compressed air with a partial pressure of N_2 equal to 4.0 atm. Assume the total volume of blood in the body is 5.0 L. Calculate the amount of N_2 gas released (in L) when the diver returns to the surface of water, where the partial pressure of N_2 is 0.80 atm. [$k_H = 6.80 \times 10^7$ torr]

Chapter 25

1. McQuarrie and Simon Problems: 1 (w/out molality at 0C), 2, 29, 41, 44, 48, 62

2. At 298 K, the vapor pressure of pure water is 23.76 mmHg and that of seawater is 22.98 mmHg. Assuming seawater contains only NaCl, estimate its concentration. (Hint: Sodium chloride is a strong electrolyte.)

3. A forensic chemist is given a white powder for analysis. She dissolves 0.50 g of the substance in 8.0 g of benzene. The solution freezes at 3.9 °C. Can the chemist conclude that the compound is cocaine ($C_{17}H_{21}NO_4$)? What assumptions are made in the analysis? The freezing point of benzene is 5.5 °C.

4. Acetic acid is a polar molecule that can form hydrogen bonds with water molecules. Therefore, it has a high solubility in water. Yet acetic acid is also soluble in benzene (C_6H_6), a nonpolar solvent that lacks the ability to form hydrogen bonds. A solution of 3.8 g of CH_3COOH in 80 g C_6H_6 has a freezing point of 3.5 °C. Calculate the molar mass of the solute, and suggest what its structure might be. (Hint: Acetic acid molecules can form hydrogen bonds among themselves.)

For Presentation (Nov 16):

Group B: Chapter 23, McQuarrie and Simon #22
Group C: Chapter 24, #2
Group D: Chapter 25, #3