Chemistry 1410 Spring 2005
Quiz 1, Section 1, 20 pts

Name _____(please print)

Equations: $c = kP$ $P_1 = X_1P_1^\circ$ $\Delta P = X_2P_1^\circ$ T must be °C ⊖ K
$\Delta T_b = K_bm$ $\Delta T_f = K_fm$ $\pi = MRT$ $R = 0.0821$ L atm/mol·K

(2 pts)
1. The concept like dissolves like is based on _____.
   A) surface tension
   B) viscosity
   (C) intermolecular attraction
   D) molecular weight

(2 pts)
2. The solubility of a gas in a liquid depends on _____.
   A) temperature
   B) pressure
   C) nature of the gas
   (D) all of the above

3. (4 pts) Calculate the mass percent sodium bromide if 5.50 g of NaBr is dissolved in 78.2 grams of water.

$$\left(\frac{5.50\text{ g}}{(5.50\text{ g} + 78.2\text{ g})}\right) \times 100 = 6.57 \text{ mass \%}$$

4.(4 pts) If the vapor pressure of pure water at 30°C is 31.82 mm Hg, calculate the vapor pressure of a solution made by dissolving 82.4 g of urea (molar mass = 60.06 g/mol) in 212 g of water at 30°C.

$82.4\text{ g urea} \times \frac{1\text{ mole}}{60.06\text{ g}} = 1.36\text{ moles urea}$

$212\text{ g } H_2O \times \frac{1\text{ mole}}{18.0\text{ g}} = 11.78\text{ moles } H_2O$

$$X_{H_2O} = \frac{11.78\text{ moles}}{(11.78\text{ moles} + 1.36\text{ moles})}$$

$X_{H_2O} = 0.896$

$P_1 = X_1P_1^\circ$, $P_{solution} = (0.896)(31.82\text{ mm Hg})$

$P_{solution} = 28.51\text{ mm Hg}$

5.(4 pts) Find the boiling point of a solution containing 15.0 g of naphthalene (molar mass of 128 g/mole) in 300 g of benzene. (K_f for benzene is 5.12 °C/m, K_b is 2.53°C/m. The boiling point and freezing point of benzene are 80.1°C and 5.5°C, respectively.)

$\Delta T_b = K_b m$ $\quad m = \frac{\text{moles solute}}{\text{Kg solvent}}$

moles solute = 15.0 g naphthalene $\times \frac{1 \text{ mole}}{128 \text{ g}} = 0.117$ moles

300 g benzene = 0.300 Kg ; $m = \frac{0.117 \text{ moles}}{0.300 \text{ Kg}} = 0.391$ molal

$\Delta T_b = (2.53°C/m)(0.391 \text{ molal}) = 0.99°C$

Boiling point = $80.1 + 0.99°C \approx 81.1°C$

6.(4 pts) 7.480 g of an organic compound (MW = 430 g) was dissolved in water to make 300 mL of the solution at 27 °C. Find the osmotic pressure of this solution. $\Pi = MRT$

molarity = moles solute/L solution

moles solute = 7.480 g $\times$ 1 mole/430 g = 1.74×10^{-2} moles

$M = 1.74 \times 10^{-2}$ moles/0.300 L solution = 5.80×10^{-2} M

$\Pi = (5.80 \times 10^{-2} \text{ moles/L})(0.0821 \text{ L atm/mole K})(300 \text{ K})$

$\Pi = 1.43$ atm