CHEM 104 (WOOHOO!)
PLI 25
Wednesday, July 6, 2016

Chapter 13

1. A solution is prepared by mixing 1.00 g ethanol (C_2H_5OH) with 100.0 g of water to give a final volume of 101 mL. Calculate the molarity, mass percent, mole fraction, and molality of ethanol in this solution.

2. Calculate the expected vapor pressure at 25°C for a solution prepared by dissolving 158.0 g common table sugar (molar mass = 342.3 g/mol) in 643.5 cm^3 of water. At 25°C, the density of water is 0.9971 g/cm^3 and the vapor pressure is 23.76 mmHg.

3. Consider the following solutions:

0.10 *m* Na_3PO_4 in water	0.20 *m* $CaBr_2$ in water
0.20 *m* KCl in water	0.20 *m* HF in water

a. Assuming complete dissociation of the soluble salts, please circle the solution(s) that would have the same boiling point as 0.40 *m* glucose ($C_6H_{12}O_6$, non-electrolyte) in water.

b. Which solution would have the largest freezing-point depression and why?

c. How many grams of glucose per liter should be used for an intravenous solution that is isotonic with the 7.65 atm osmotic pressure of blood at body temperature, 37.0°C?

4. A 2.00 g sample of a large biomolecule was dissolved in 15.0 g carbon tetrachloride (CCl_4). The boiling point of this solution was determined to be 77.85°C. Calculate the molar mass of the biomolecule. For carbon tetrachloride, the boiling point constant, K_{bp}, is 5.03°C•Kg/mol, and the boiling point of pure carbon tetrachloride is 76.50°C.

5. What mass of ethylene glycol ($C_2H_6O_2$), in grams, must be added to 1.0 kg of water to produce a solution that boils at 105.0°C? The boiling point elevation constant for water, K_{bp}, is 0.512°C/*m*.

NOTE: Q6 on ion hydration enthalpies is not something that was stressed in lecture, and so is outside the scope of the course.

6. Ion hydration enthalpies:

Ion	$\Delta H_{hydration}$ (kJ/mol)
Li^+	-545
Na^+	-418
K^+	-351
Mg^{2+}	-1923
Cl^-	-338

a. Explain why the hydration enthalpy falls as you go down group 1.

b. Explain why the value for Mg^{2+} is so much greater than that of Na^+.

c. Would the value for Ca^{2+} be more negative or less negative than that of Mg^{2+}?

d. If the $-\Delta H_{lattice}$ for $MgCl_2$ is +2526 kJ/mol, estimate the enthalpy change for a solution of $MgCl_2$.