Chem 1063 Exam 3. J-Term 2009

Name_____

I have neither given nor received unauthorized aid on this exam.

You must show all work for credit. **REMEMBER: Colligative properties depend on the concentration of DISSOLVED PARTICLES!!!!!!!!!**

Useful information: R= 8.317J/molK, 0.0821 L•atm/mol•K, $\ln\dfrac{P_1}{P_2} = \dfrac{\Delta H_{vap}}{R}\left(\dfrac{1}{T_2} - \dfrac{1}{T_1}\right)$, solubility = kP, $P_{so\,ln} = X_A P_A^\circ + X_B P_B^\circ$, $\Delta T_b = K_b m$, $\Delta T_f = -K_f m$, $\Pi = MRT$

(1)(4 points) A major component of mothballs is napthalene. You can smell napthalene because it has a significant vapor pressure at room temperature. You can use the Clausius-Claperyon equation to calculate this vapor pressure. Napthalene has a normal boiling point of 218 °C and a ΔH of 62 kJ/mol. What is the vapor pressure of napthalene at 25 °C?

(2)(4 points) At 100 feet, the external pressure on a scuba diver is 3.95 atm. If the mole fraction of N_2 in the breathing gas is 0.8, and the Henry's Law constant is 6.1 x 10^{-4} M/atm for nitrogen, what is the maximum concentration of nitrogen in the blood of a diver at 100 ft?

(3)(4 points) You need to heat a reaction at a constant 105 ºC. To do this, you plan on making a salt-water bath that will boil at 105 ºC. If the K_b for water is 0.51 ºC/m, what mass of NaCl needs to be added to 500 g of water to make such a solution?

(4)(4 points) If you want to depress the freezing point of 1.00 L of water to 0 ºF (-18 ºC), you could use a salt such as $MgCl_2$ or NaCl. Which one of the two would require a larger mass of salt? K_f = 1.86 ºC/m for water

(5)(4 points) Dr. Malmberg gives his students an unknown compound to identify in Organic II. One group of students found that their unknown was water soluble. They had narrowed the possibilities to propylene glycol ($C_3H_8O_2$) or n-propanol (CH_3CH_2OH). To decide between them, the students decide to measure the osmotic pressure. To 99 mL of water, 1.00 g of unknown was added (100.0 mL solution). The osmotic pressure at 298 K was 3.2 atm. What is the identity of the unknown?

(6)(4 points) The osmotic pressure of blood is about 7.5 atm. How much sodium chloride (in g) should be added to 500 mL of water for an intravenous solution of saline (sodium chloride) with the same osmotic pressure as the blood (at 37 °C)?

(7)(4 points) What is the vapor pressure above a solution made from 20.0 g of solid glucose ($C_6H_{12}O_6$) and 100.0 g of methanol (CH_4O) at 27 °C? The vapor pressure of pure methanol is 0.184 atm?

(8)(2 points) When a salt truck spread salt on the road at -2°C, the ice melted. When the same truck spread the same amount of salt on the road at -20 °C, the ice did not melt. Explain the different outcomes.

(9)(2 points) A 2 L pot of water was heated just to boiling. When a large amount of sugar was added, the water stopped boiling and did not boil until the heat was turned up to a higher setting. Why did this happen?

(10)(2 points) If you needed to determine the molecular weight of an unknown molecule by a colligative property, which one would you choose to get the most precise molecular weight? Why?