

Unit 6 – Chapter 11: Solutions & IMFs

Assignment #2: Van't Hoff Factor on BP, FP & Osmotic Pressure

Name _____

Period _____

- 1) A solution is prepared by dissolving 27.0 g of urea, $(\text{NH}_2)_2\text{CO}$, in 150.0 g of water. Calculate the boiling point of the solution. Urea is a nonelectrolyte.

- 2) A 2.00-g sample of a large biomolecule was dissolved in 15.0 g of carbon tetrachloride. 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 is $5.03^\circ\text{C} \cdot \text{kg/mol}$, and the boiling point of pure carbon tetrachloride is 76.50°C .

- 3) The freezing point of *t*-butanol is 25.50°C and K_f is $9.1^\circ\text{C} \cdot \text{kg/mol}$. Usually *t*-butanol absorbs water on exposure to air. If the freezing point of a 10.0-g sample of *t*-butanol is 24.59°C , how many grams of water are present in the sample?

- 4) An aqueous solution of 10.00 g of catalase, an enzyme found in the liver, has a volume of 1.00 L at 27°C . The solution's osmotic pressure at 27°C is found to be 0.74 torr. Calculate the molar mass of catalase.

- 5) A water desalination plant is set up near a salt marsh containing water that is 0.10 M NaCl. Calculate the minimum pressure that must be applied at 20.0°C to purify the water by reverse osmosis. Assume NaCl is completely dissociated.

- 6) Calculate the freezing point and the boiling point of each of the following solutions using the observed van't Hoff factors in Table 11.6
 - a. 0.050 *m* MgCl_2
 - b. 0.050 *m* FeCl_3

- 7) A 0.500-g sample of a compound is dissolved in enough water to form 100.0 mL of solution. This solution has an osmotic pressure of 2.50 atm at 25°C . If each molecule of the solute dissociates into two particles (in this solvent), what is the molar mass of this solute?