Solutions – Colligative Properties/SS **Name:** _____

For complete credit show all the work for the calculations and give the answers in the correct significant figures. Make sure you have the formulas you should be working with.

1. A solution is prepared by dissolving 396 g of sucrose in 624 g of water. What is the vapor pressure of this solution at 30 ^{o}C? (VP of H_2O at 30 ^{o}C = 31.8 mmHg) (ans: 30.8 mmHg)

2. Calculate the freezing point and boiling point of water when 100 g of ethylene glycol (CH_2OHCH_2OH; MW = 62.07 g/mol) is added to 1450 g of water. (K_b = 0.52 ^{o}C/*m* ; K_f = 1.86 ^{o}C/*m*) (ans: 100.58 ^{o}C; -2.069 ^{o}C)

3. Use Raoult's law to predict the vapor pressure of a solution, at 0 ^{o}C, made from two volatile liquids: 35.6 g dibromomethane (CH_2Br_2; MW = 183.8 g/mol; VP = 0.015 atm) and 35.6 g dichloromethane (CH_2Cl_2; MW = 84.93 g/mol; VP = 0.175 atm) (ans: 0.124 atm)

(***Strategy***: a) find mols of both solvents; b) find mol fractions of both; c) find VP using the mol fraction and d) add the two VPs)

4. Calculate the molar mass of naphthalene, the organic compound in "mothballs", when a solution prepared by dissolving 5.00 g of naphthalene in 100 g of benzene has a freezing point 2.0 ^{o}C below that of pure benzene. (K_f benzene = 5.12 ^{o}C/*m*) (ans: 128 g/mol)

(***Strategy***: a) use the ΔT to find molality; c) use that to find mols; d) find mol wt by dividing mols g by mol (g/mol))

5. A solution made by dissolving 25 mg of insulin in 5.0 mL of water has an osmotic pressure of 15.5 mmHg at 25 ^{o}C. Calculate the molar mass of insulin. (Assume that there is no change in volume when the insulin is added to the water) (ans: 5.99×10^3 g/mol)

(***Strategy***: make sure you convert everything to SI units)

6. Arrange the following aqueous solutions in order decreasing freezing point, and state your reason: 0.15 *m* CH_3COOH, 0.15 *m* $CO(NH_2)_2$ (urea), 0.10 *m* H_2SO_4, 0.10 *m* $Mg(NO_3)_2$ and 0.10 *m* NaBr.