CH302 Worksheet 2—Colligative Properties

All of this is intended to be done without the aid of a calculator. All of the calculations are designed such that approximating should be straight-forward and produce a correct result.

1. Based on the physical constants involved, which colligative property has the greatest magnitude for a solution of a given concentration? Which can't be compared in this way? Why?

2. Which colligative properties have a linear concentration dependence? Write their equations.

3. Rank the following aqueous solutions in terms of increasing boiling point: 3 m sugar, 2 m NaCl, 0.5 m $Mg(OH)_2$, 5 m AlN, 1 m urea.

4. Assuming a cell wall can withstand an osmotic pressure of 1 atmosphere and the concentration of Na^+ in a cell is 50 mM, approximate the $[Na^+]$ outside the cell that would cause lysis.

5. If you dissolved 28 grams of NaCl in 90 grams of pure H_20 hot enough to have a vapor pressure of 30 torr, what will the new vapor pressure be?

6. Assuming standard conditions and a $K_f = 0.2\ K \cdot m^{-1}$ and a $K_b = 0.5\ K \cdot m^{-1}$ for water, what would be the freezing point of a solution that boiled at 375.5 K? Express your answer in both K and °C.

7. Based on the question above and assuming 1 kg of water, how many moles of NaCl would be needed to produce this effect? What about sugar?

8. Based on you understanding of boiling point elevation, why **doesn't** salting water help food to cook faster?

9. Vapor pressure is often described as a "surface phenomenon." Define this term in your own words to the best of your ability.

10. Raoult's can be used to calculate the decrease in vapor pressure when a non-volatile substance (like salt) is dissolved in a volatile substance (like water). Explain this phenomenon.