WorkSheet 3   Solutions

1. Let's look at the question "Does adding salt to water help the pasta cook faster?"

A. Beware of the internet as the source of all knowledge. Use your favorite search engine to try to answer this question to immerse yourself in the non-sense you'll find.

B. Clear your mind and let's think about it rationally.

How much salt should you add to pasta water. Recipes often say something like "salty like the ocean" For quantities, I've seen add 1-2 tablespoons to 4 quarts of water. Nice units.

Find the molality of this solution. (First you'll need the density of NaCl, then find the mass, then the number of moles…)

What is the boiling point of this solution, given that Kb for water is 0.5 °C /m

C. Do you think this would have any effect on the cooking rate? What else might it affect?

2.   Which has a lower Gibb's Free energy: 1 L of 1M NaCl soluition and 1L of pure water, or 2L of 0.5 M NaCl?

3. You place 100 mL of a 0.1 M sucrose solution into a 1 L chamber along with 400 mL of a 0.2 M mL sucrose solution. You let the system come to equilibrium at a constant temperature of 25°C.

Given that the vapor pressure of pure water at 25°C is 23.76 Torr, what is the partial pressure of water in the vapor above the solutions at equilibrium?

(hint: What is the vapor pressure of the 0.1 M solution? What is the vapor pressure of the 0.2M solution? Can they have different vapor pressure? What will happen to the two solutions?)

4. You dissolve 35 g of NaCl, 50 g of sucrose, and 50 of $CaCl_2$ into 1 L of H_2O .

What is the freezing point of this solution? What is its osmotic pressure?

5. You are in the lab and trying to figure out the molecular weight of a sample of cellulose (a natural polymer). You make a sample in which you dissolve the cellulose in dimethylformamide at a concentration of 22 g/L. The osmotic pressure is found to be .00323 atm at 30°C. What is the molecular weight of the polymer?

6. What does osmotic pressure how to do with the following

Salting food to preserve it.
Keeping fish alive in a fish tank.
Given a person "saline" solution intravenously when they are dehydrated

7. In your car your radiator has a mixture of H_2O and ethylene glycol (anti-freeze). Ethylene Glycol has a boiling point of 197°C and a freezing point of -12.9°C.

Why do you use a mixture of water and ethylene glycol instead of pure ethylene glycol?

To get the largest temperature range should you use a mixture that is more ethylene glycol or more water?