Recitation Exercise 03 – Henry's Law and Dissolved Oxygen (DO)

Consequences of Unusual DO Levels: If dissolved oxygen concentrations drop below a certain level, fish mortality rates will rise. Sensitive freshwater fish like salmon can't even reproduce at levels below 6 mg/L. In the ocean, coastal fish begin to avoid areas where DO is below 3.7 mg/L, with specific species abandoning an area completely when levels fall below 3.5 mg/L. Below 2.0 mg/L, invertebrates also leave and below 1 mg/L even benthic organisms show reduced growth and survival rates .

http://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/

Henry's law states that the concentration of a dissolved gas in a liquid is proportional to the pressure of that gas above the liquid, as expressed by the equation $c = kP$, where c is concentration, P is the partial pressure of the gas, and k is the proportionality constant.

A. Do you expect k to increase with temperature or decrease with temperature? Explain.

B. Your recitation instructor will write the Henry's law constants for oxygen in water on the board. Calculate the concentration of DO in water assuming 40°C and an air pressure of 1 atm over the water. (The effluent water from an electric power plant is roughly 40°C.)

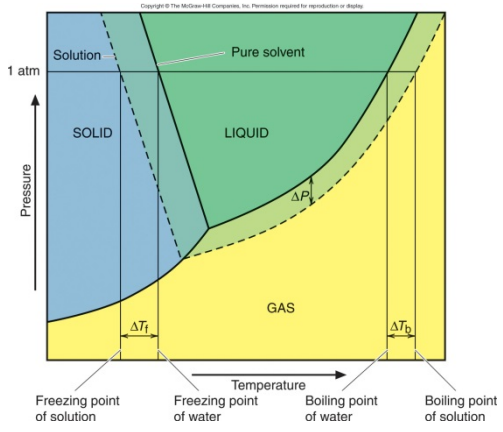
C. Convert your answer to mg/L. How are the fish doing?

Recitation Exercise 04 – Freezing Point Depression and Boiling Point Elevation

The equations for Freezing Point (FP) Depression (ΔT_f) and Boiling Point (BP) Elevation (ΔT_b) are given below.

$$\Delta T_f = K_f m \qquad \Delta T_b = K_b m$$

The concentration unit here is molality, moles of solute per kg of solvent. The K constants are positive, so the ΔT values you calculate will also be positive. You have to remember that FP goes down and BP goes up. The phase diagram on the right helps us understand why FP and BP move in different directions. We will discuss colligative properties in class, but for now it is sufficient to know that they depend only on the concentration of the solute, not on its chemical nature.



A. A solution is prepared by adding 5.2 g of fructose ($C_6H_{12}O_6$) to 1500 mL of water and stirring until dissolved. What is the molality of that solution?

B. Determine the FP and BP of the solution. For water, $K_f = 1.86$ °C/ m and $K_b = 0.52$ °C/ m.