1. A solution of acetone in ethanol has a concentration of 1.25 m. If the density of acetone is 0.788 g/mL and the density of ethanol is 0.789 g/mL, what is the molarity of this solution? Consider acetone to be the solute. The molar mass of acetone is 58.1 g/mol and the molar mass of ethanol is 46.1 g/mol.

2. A solution of antifreeze (ethylene glycol) in water is 38.2 % ethylene glycol by mass, with a density of 1.049 g/mL. What is the mole fraction of ethylene glycol in this solution? The molar mass of ethylene glycol is 62.08 g/mol. Assume you have 100.0 g of solution.

3. A solution is prepared by dissolving 32.0 g of glucose (a nonelectrolyte) in 760.0 g of water at 38.0 degrees Celsius (deg C). If the vapor pressure of pure water is 49.7 torr at this temperature, what is the vapor pressure of this solution? The formula for glucose is $C_6H_{12}O_6$. First determine the mole fraction, χ, for the solvent and use Raoult's law.

4. Eugenol, responsible for the odor and taste of cloves, has the formula $C_{10}H_{12}O_2$. What is the boiling point of a solution containing 0.177 g eugenol dissolved in 12.5 g benzene? The molal boiling point elevation constant for benzene (K_b) is 2.53 deg C kg/mol and pure benzene boils at 80.1 deg C.

5. Anthraquinone has the empirical formula C_7H_4O. The freezing point of camphor is lowered by 22.3 deg C when 1.32 g anthraquinone is dissolved in 11.4 g camphor. Determine the molar mass and the molecular formula of anthraquinone. $\Delta T_f = K_f m$ where m = molality.

6. Sometimes calcium chloride is scattered on an icy sidewalk in the winter instead of rock salt (NaCl). Would you expect calcium chloride to be more or less effective in melting the ice than sodium chloride? Explain using the freezing point depression equation ($\Delta Tf = Kfm$). For soluble salts molality equals moles of ions per kg solvent.

7.
A 2.10-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 78.05 °C. Calculate the molar mass of the biomolecule. For carbon tetrachloride, the boiling-point constant is 5.03 °C•kg/mol, and the boiling point of pure carbon tetrachloride is 76.50 °C.

molar mass = _____ g/mol

8.
The freezing point of t-butanol is 25.50 °C and Kf is 9.1 °C•kg/mol. Usually t-butanol absorbs water on exposure to air. If the freezing point of a 11.7-g sample of t-butanol is 24.84 °C, how many grams of water are present in the sample?

mass of water = _____ g

View freezing-point depression equation

9.
What volume of ethylene glycol (C2H6O2), a nonelectrolyte, must be added to 15.2 L of water to produce an antifreeze solution with a freezing point of -21.3 °C? What is the boiling point of this solution? (The density of ethylene glycol is 1.11 g/cm3, and the density of water is 1.00 g/cm3.)

volume of ethylene glycol = _____ L   boiling point = _____ ºC

10
An aqueous antifreeze solution is 40.1 % ethylene glycol ($C_2H_6O_2$) by mass. The density of the solution is 1.05 g/cm3. Calculate the molality, molarity, and mole fraction of the ethylene glycol.

molality = _____ m   molarity = _____ M