Properties of Solutions (Ch 13) Worksheet
AP Chemistry

1.Molarity and molality are two ways of expressing concentration.

(a) Clearly distinguish between them

(b) Indicate an experimental situation where expressing concentrations as molarity is particularly appropriate.

(c) Indicate an experimental situation where expressing concentration as molality is particularly appropriate.

2. (a) Calculate the molality of a 20.0 percent by weight aqueous solution of NH_4Cl. (Molecular weight: $NH_4Cl = 53.5$)

(b) If this NH_4Cl solution is assumed to be ideal and is completely dissociated into ions, calculate the pressure of this solution at 29.0°C.

(c) Actually a solution of NH_4Cl of this concentration is not ideal. Calculate the apparent degree of dissociation of the NH_4Cl if the freezing point of this solution is -15.3°C? (Molal freezing point constant = 1.86°C)

3. The freezing point and electrical conductivities of three aqueous solutions are given below.

Solution (0.010 molal)	Freezing Point	Electrical Conductivity
sucrose	-0.0186°C	almost zero
formic acid	-0.0213°C	low
sodium formate	-0.0361°C	high

Explain the relationship between the freezing point and electrical conductivity for each of the solutions above. Account for the differences in the freezing points among the three solutions.

4. Elemental analysis of an unknown pure substance indicated that the percent composition by mass is as follows:

Element	Percent by Mass
Carbon	49.02%
Hydrogen	2.743%
Chlorine	48.23%

A solution that is prepared by dissolving 3.150 grams of the substance in 25.00 grams of benzene, C_6H_6, has a freezing point of 1.12°C. (The normal freezing point of benzene is 5.50°C and the molal freezing-point depression constant, k_f, for benzene is 5.12°C/molal.)

(a) Determine the empirical formula of the unknown substance.

(b) Using the data gathered from the freezing-point depression method, calculate the molar mass of the unknown substance.

(c) Calculate the mole fraction of benzene in the solution described above.

(d) The vapor pressure of pure benzene at 35°C is 150. millimeters of Hg. Calculate the vapor pressure of benzene over the solution described above at 35°C.