Solutions and Their Properties

STUDY LIST From Paul Groves

Concentration Units

- ☐ Define solute, solvent, and solution
- ☐ Define molarity, molality, mole fraction, weight percent, ppm
- ☐ Convert one concentration into another
- ☐ Realize that density is sometimes needed for calculations involving molarity

Terminology

- ☐ Define unsaturated, saturated, and supersaturated. (DEMO—Hand warmer)
- ☐ Compare these terms with dilute and concentrated. ($AgNO_3$ 970 g/100g & AgCl .00127 g/100g)
- ☐ Solids and gases are called soluble and insoluble.
- ☐ Liquids are called miscible and immiscible. (TOY—Ocean Waves)

Math of the Properties of Solutions

- ☐ Henry's Law—solubility of a gas in a liquid is proportional to the pressure of the gas. $S_g = k_H P_g$
- ☐ Qualitatively know how pressure and temperature affect the solubility of gases. (Opening Soda & SCUBA divers)

- ☐ Know and be able to do simple problems with Raoult's Law: $P_{solvent} = X_{solvent} P°_{solvent}$ to figure out the vapor pressure **above** a solution
- ☐ Recognize that a volatile solute (esp. alcohol) will add to the vapor pressure and LOWER the BP whereas solutions of solids in water RAISE the BP.

~~Colligative Properties – More Math~~

- ☐ Elevation of the BP, ΔT_b
  $\Delta T_b = k_b \cdot m$ (k_b = the molal boiling point elevation constant = ΔT_b @ 1 m)

- ☐ Depression of the FP/MP, ΔT_f
  $\Delta T_f = k_f \cdot m$ (k_f = the molal freezing point depression constant = ΔT_f @ 1 m)
- ☐ This can be used to determine molar mass:
  $$M = \frac{K_f \times w \times 1000}{\Delta T \times W}$$
  (COMPUTER SIMULATION—RAST)

- ☐ Substances that split into ions have a multiplying effect on colligative properties. (elevation of BP in sol'n: sugar vs salt)
- ☐ This is called the van't Hoff factor, i.
  Ex. NaCl, i=2; $CaCl_2$, i=3
  (simple for dilute solutions)

Flashback to Chapter 6

- ☐ Heats of solution =
  NRG to break solvent-solvent & solute-solute bonds – NRG by making solute-solvent bonds (esp. hydration)
  (can be exothermic or endothermic)
  (endothermic implies Entropy is impt)
  (DEMO—baggies of NH_4Cl and $CaCl_2$)