14 • Solutions and Their Properties

STUDY LIST

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

- ☐ 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)

- ☐ 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 the two big driving forces of the universe: (important preview idea)
  tend toward minimum Enthalpy (ΔH) … potential energy
  tend toward maximum Entropy (ΔS) … randomness… disorder… spreadioutiness

- ☐ Apply the driving forces to the solubility of ***gases***:
  gas + liquid solvent ⇌ saturated solution of the gas + HEAT
  (NOTE: equilibrium results when the driving forces work in opposite directions)

- ☐ Le Chatelier's Principle:
  increased pressure of the gas = more gas (equilibrium shifts to the right)
  increased temperature = more heat (equilibrium shifts to the left)

- ☐ Know and be able to do simple problems with Raoult's Law: $P_{solvent} = X_{solvent} P°_{solvent}$
- ☐ Know what an ideal solution is (IMF of each component = IMF of mixture)
- ☐ Know that this has applications in distilling volatile liquids esp. petroleum products. (Online Tutorial about Petroleum Dist.)
- ☐ 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.

- ☐ 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)

- ☐ Heats of solution = (DEMO)
  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 $CaCl_2$)