Ch. 18 Chemical Equilibrium

18.3 Using Equilibrium Constants
Dr. Michael J Passow
Calculating Equilibrium Concentrations

- Chemists can calculate the concentration of any reactant or product if the concentration of the others are known.
- Such calculations are very helpful in deciding whether to manufacture a product from raw materials whose costs are established.
Solubility Equilibria

• Some solutions have (require) high solubility high $K_{eq} \rightarrow$ mostly products
  ex, NaCl (brine)

• Other solutions at equilibrium have very little product (low solubility)

• **Solubility product constants** have been experimentally measured for ‘sparingly soluble compounds’ – useful in various ways
Solubility product constants (not very important for you)

• **Solubility product constants** have been experimentally measured for ‘sparingly soluble compounds’

• Useful in various ways
  -- determining the solubility of an ionic compound
  -- calculating concentration of ions in a saturated solution
  -- predicting whether a precipitate will form when two ionic solutions are mixed
Common Ion Effect
(this is more important for you)

• A **common ion** is an ion that is “common” (occurs) in two or more ionic compounds

• When two solutions with a common ion mix, it affects the concentrations according to Le Chatelier’s Principle

• One example of how this applies involves $F^-$ ions in toothpaste that help re-mineralize tooth enamel (hydroxyapatite)
Importance in Chemical Analyses

• Differences in solubility can be used by chemists to work through a series of steps and identify “unknowns”

• “Hard water” (water with high concentrations of Ca$^{2+}$ and Mg$^{2+}$ ions, especially in areas with limestone bedrock) can be softened using technology based on common ion effect concepts.