Chapter 6
Chemical Equilibrium

I. Equilibrium Constant

II. Review of Equilibrium Calculations

III. Separation by Precipitation

IV. Complex Formation

V. Acids and Bases

I. Equilibrium Constant

- *Expressing terms in K_{eq}*

  Each term is actually a ratio

- *Equilibrium and Thermodynamics*
- *Equilibrium Constant Algebra*

II. Review of Equilibrium Calculations

Handout

III. Separation by Precipitation

Ex: Calculate the solubility of:

a) PbI_2 ($K_{sp} = 7.9 \times 10^{-9}$)

b) Hg_2I_2 ($K_{sp} = 1.1 \times 10^{-28}$)

III. Separation by Precipitation (cont.)

Ex: Consider a solution of 0.010 M Pb^{2+} and 0.010 M Hg_2^{2+}. Is it possible to "completely" separate one from the other with solid KI?
(completely = 99.99% of one ion is removed)

Ex: At what concentration of Hg_2^{2+} would a 99.99% separation no longer be allowed if $[Pb^{2+}]$ remains at 0.010 M?

IV. Complex Formation

$$PbI_2(s) \rightleftharpoons Pb^{2+}(aq) + 2\ I^-(aq)$$

$$K_{sp} = 7.9 \times 10^{-9}$$

Key to complex equilibrium calculations:

All equilibrium expressions must be satisfied simultaneously!!

Question:

If $[I^-]$ is known, what is the concentration of all the other species in solution?

V. Acids and Bases

- *Bronsted-Lowry Definitions:*

  Acid – proton donor

  Base – proton acceptor
- Water can act as either an acid or a base (*amphiprotic*)

  Autoprotolysis of water
- Acid Dissociation Reaction
- Base Hydrolysis Reaction

V. Acids and Bases (cont.)

Relationship of K_a and K_b:

A. Monoprotic Acids

B. Diprotic Acids

C. Triprotic Acids

Appendix G: ONLY K_a VALUES!!

- compound name is neutral species
- completely protonated species is shown