NOTES # 56 Acids/Bases & Ksp

I. Acid-Base Indicators.

1. There are *many* other acid/base indicators besides phenolphthalein as you can see on page 672 in your book.

2. A indicator is often an _____ acid that has distinctly different colors in it's acid vs conjugate base form.

Ex:

- Acidic soln: lots of H^+, pushes _____, more _____
- Basic soln: less H^+, pushes _____, more _____

3. How do you know which one to use and when? Remember, that an indicators purpose is to signal the EQUIVALENCE POINT...to tell you when all of the acid or base in question has been neutralized. The equivalence point falls in the steep portion of the titration curve. You should pick an indicator that will change colors somewhere within this steep region on a titration curve.

EX 1: Consider the titration curve we constructed for the titration of HNO_2. Of the indicator choices in your book, what would be some possible indicators to use to signal the equivalence point.

EX2: Roughly, what would be ideal indicators for a WA/SB titration? WHY?

Roughly, what would be ideal indicators for a WB/SA titration? WHY?

II. SOLUBILITY EQUILIBRIA (K_{sp}).....Last BIG section of Ch 17.

** We talked about solubility rules in general in Ch 4....now, we need to be more specific about just how much certain ionic compounds dissolve and what other factors affect this.

1. Write the K_{sp} expressions for the following reactions. *Writing such expressions is NO different than any other equilibrium expression.*

a. $BaCO_3\ (s) \rightleftharpoons Ba^{2+}(aq) + CO_3^{2-}(aq)$ $K_{sp} =$

b. $Ag_2CO_3\ (s) \rightleftharpoons 2\ Ag^+\ (aq) + CO_3^{2-}(aq)$ $K_{sp} =$

c. $Al(OH)_3\ (s) \rightleftharpoons$ $K_{sp} =$

d. $NaCl\ (s) \rightleftharpoons Na^+\ (aq) + Cl^-\ (aq)$ $K_{sp} =$

2. So., what IS K_{sp}? It's called the _____ and is a measure of HOW MUCH a given ionic compound or salt will dissolve in water. The HIGHER the K_{sp} value, the MORE the reaction pushes towards products, or ions, the _____ soluble.

3. So, what does EQUILIBRIUM look like for a K_{sp} expression? There are three types of solutions that exist...Which one do YOU think represents K_{sp} equilibrium? _____

** You can recognize what type of solution you have, unsaturated, saturated or supersaturated, by looking at the initial ion concentrations, calculating Q and comparing this value to K_{sp}. Consider the K_{sp} expression for AgCl.

$AgCl\ (s) \rightleftharpoons Ag^+\ (aq) + Cl^-\ (aq)$ $K_{sp} = 1.6 \times 10^{-10}$

a. UNSATURATED - room for more ions to dissolve.

b. SATURATED - has just enough ions dissolved.

c. SUPERSATURATED - too many ions dissolved in solution.

EX 2: If you had initial concentrations of 0.0010 M for Ba^{2+} and 0.0060 M for SO_4^{2-}. What type of solution would you have and what would the system do to reach equilibrium? $K_{sp} = 1.1 \times 10^{-10}$

5. Other ways of representing solubility and methods for converting.

   a. MOLAR SOLUBILITY - moles of solute dissolved in one liter of saturated solution. Units = _____

   b. SOLUBILITY - grams of solute dissolved in one liter of saturated solution. Units = _____

   ** (a) and (b) are most convenient for dealing with in lab. You can calculate a K_{sp} value from either (a) or (b) following the PATH....

EX 3: The solubility of lead chromate ($PbCrO_4$) is 4.5×10^{-5} g/L. Calculate K_{sp} for this compound.

EX 4: *Going from K_{sp} to molar solubility....backwards.* Calculate the solubility of $Ca_3(PO_4)_2$. $K_{sp} = 1.2 \times 10^{-26}$.

6. Predicting precipitation reactions....the K_{sp} way. What are we looking for in order to get a PRECIPITATE?

EX 5: (a) If 2.00 mL of 0.200 M NaOH are added to 1.00 L of 0.100 M $CaCl_2$, will precipitation occur? $K_{sp} = 8.0 \times 10^{-6}$

(b) Determine the concentrations above which a precipitate will occur?