

Monday March 3, 2014

Objective: The student will be able to

- (1) write systems in equilibria for slightly soluble ionic compounds.
- (2) calculate the K_{sp} for these slightly soluble systems
- (3) calculate concentrations of substances given the K_{sp}

Homework: (1) Begin reading chapter in Zumdahl (2) complete K_{sp} PS #1

Warm - Up: (5 minutes)

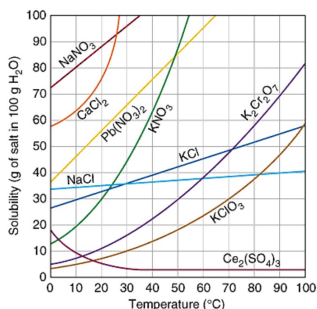
1. Write an electron configuration for iron.
2. Derive the set of quantum numbers for the 35th electron in lead.
3. Consider ions of chromium. Classify them as either acidic, basic, or neutral.

Page 1

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Page 2

Writing Equilibrium Expression for Slightly Soluble Ionic Substances (K_{sp})



K_{eq} vs. K_{sp} (use $CaCl_2$)

using solubility curve to ascertain the M.S.

Page 3

A student places 6.00 grams of gypsum (solid calcium sulfate) into a beaker that contains 500.0 ml of distilled water, but discovers that only 9.17% actually dissolves. What is its molar solubility & its K_{sp} ?

Page 4

K_{sp} Equilibrium Expressions Exceptions

I-A and II-A metallic sulfides (Na_2S vs. Cr_2S_3)

Page 5

"x" and K_{sp}

Relationship only exists when studying a saturated solution of a substance.

In terms of "x", what is the value of K_{sp} of compounds with the following formulas?

AB

AB₂

Page 6

pH / M.S. / K_{sp}

If a slightly soluble ionic compound contains **the anion of a weak acid**, then the addition of H_3O^+ (from a strong acid) **increases its solubility**.

Page 7

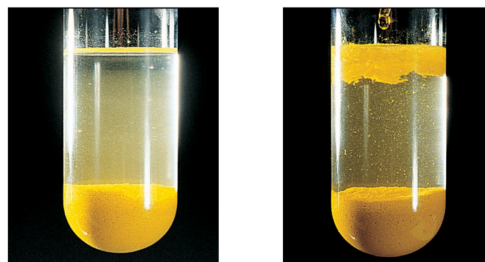
Ex. 1 What is the pH of a saturated solution of ferrous hydroxide if the K_{sp} is 2.6×10^{-12} ?

Page 8

Ex. 2 If a saturated solution of chromium (III) hydroxide has a pH of 8.93, what is the K_{sp} ?

Page 9

Common Ion Effect



Page 10

Ex. 3 What is the M.S. of a saturated solution of silver phosphate if the K_{sp} is 1.8×10^{-18} ?

Page 11

Thursday March 6, 2014

Objective: The student will be able to (1) compare Q_{sp} and K_{sp} to determine formation of a precipitate and (2) analyze simultaneous equilibria systems.

Homework: Complete K_{sp} Problem Sets #1 and #2

Warm - Up: (7 minutes)

1. Write equilibrium expressions for: $\text{AgBr}_{(s)}$ and $\text{MgS}_{(s)}$

2. What is the K_{sp} value for stannic hydroxide if a saturated solution only has a pH of 9.024?

Page 12

Warm - Up Answers

1. (a) $K_{sp} = [Ag^+][Br^-]$ (b) $K_{sp} = [Mg^{2+}][HS^-][OH^-]$

2. K_{sp} for $Sn(OH)_4 = 3.35 \times 10^{-26}$

What is the K_{sp} value for stannic hydroxide if a saturated solution only has a pH of 9.024?

Q_{sp} vs. K_{sp}

Comparing K_{sp} values to 1 = a no go.

We compare K_{sp} values to Q_{sp} (or Q_{ip}) values:

$Q_{sp} = K_{sp}$ solution is saturated (no change)

$Q_{sp} > K_{sp}$ ppt will form until saturation

$Q_{sp} < K_{sp}$ no ppt will form (unsat. soln.)

Ex. 5 Can 4.00 millimoles of solid lead (II) nitrate be added to 500.0 ml of a 0.0020 M solution of potassium iodide without precipitation occurring?
 K_{sp} for $PbI_2 = 1.4 \times 10^{-8}$

Ex. 6 What about mixing equal volumes of a 0.0020 M lead (II) nitrate solution with 0.0040 M sodium iodide solution -- will a precipitate form?

Ex. 7 What about mixing 100.0 ml of a 0.010 M lead (II) nitrate solution with 300.0 ml of a 0.0030 M calcium iodide solution -- will a precipitate form?

Given: a solution that is known to contain both the Sn^{+2} ion and the Cr^{+3} ion in the nitrate form.

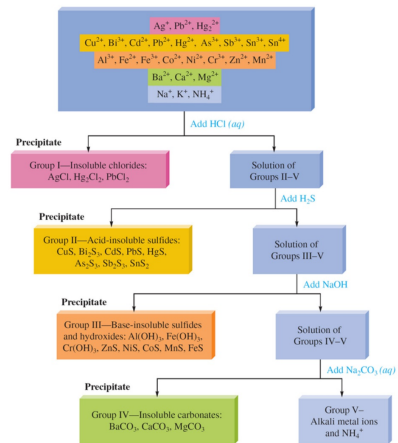
$[\text{Sn}^{+2}] = 0.0012 \text{ M}$ and $[\text{Cr}^{+3}] = 0.060 \text{ M}$

K_{sp} for $\text{Sn}(\text{OH})_2 = 2.0 \times 10^{-27}$ and K_{sp} for $\text{Cr}(\text{OH})_3 = 6.5 \times 10^{-30}$

- A) What is the $[\text{OH}^{-1}]$ needed to ppt each of the cations?
 B) Which cation precipitates first?

Ex. 8c What is the percentage of the **less soluble cation** still in solution when the **more soluble cation** just begins to start precipitating out?

The Five Groups of Qualitative Analysis



H₂S as a Precipitating Agent

simultaneous equilibria

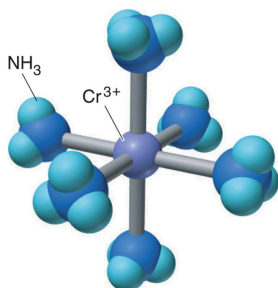
Page 21

Ex. 9 What is the pH needed for a saturated solution of hydrosulfuric acid to just begin precipitation of NiS, from a 2.0×10^{-5} M Ni(NO₃)₂ solution, given that the K_{sp} for NiS is 3.0×10^{-18} ?

Page 22

K_{sp} & $K_{complex}$ (or $K_{instability}$)

Chromium (III) nitrate is added to a solution of 6.0 M aqueous ammonia.



relat. of $K_{complex}$ to K_{inst} & C.N. review

Page 23

Ex. 10 What is the molar solubility of a saturated solution of AgBr, given that the $K_{sp} = 5.0 \times 10^{-13}$?

Page 24

Ex. 11 What is the molar solubility of silver bromide in a 6.0 M aqueous solution of ammonia, given the following information about the formation of the complex.

The silver ion forms a stable complex with the ammonia ligand. $K_{\text{complex}} = 1.5 \times 10^7$ for the reaction:

