3.6 Ksp and Solubility

In the last sections, we were able to <u>qualitatively</u> identify which salts were soluble or not soluble.

What about salts that are slightly soluble?

Now, we want to <u>quantify</u> (attach a numerical value) the degree of solubility of the slightly soluble salts.

a) The Solubility Product

i) Salts that are only slightly soluble will form an equilibrium when they dissolve:

ii) We can write an equilibrium expression for the solubility of salt (_____)

iii) Example: Write the Ksp expression for $Na_2SO_{4(s)}$

b) Meaning of Ksp

i)

ii)

iii)

iv)

c) Experimentally Finding Ksp

Method 1: ① Simply take $MgF_{2(s)}$ and add to water until solution is saturated.

② If we know mass of MgF_2 added and water volume we can find $[MgF_2]$ and then we know that:

$[Mg^{+2}] = [MgF_2]$ and $[F^-] = 2 \times [MgF_2]$

③ Ksp =

Method 2: ① Mix together a source of Mg^{+2} such as $MgSO_{4(aq)}$ and a source of F^- such as $NaF_{(aq)}$.

② Let ppt. of $MgF_{2(s)}$ form and "analyze" solution to find $[Mg^{+2}]$ and $[F^-]$.

d) Ksp Calculations

Type 1 (Find Ksp from ion concentrations)

What is the Ksp for $PbCl_2$ if $[Pb^{+2}]$ is 1.1×10^{-4} M and $[Cl^-]$ is 0.33 M?

What is the Ksp for AgBr if the solubility of AgBr is 8.8×10^{-7} M?

If 1.64×10^{-6} g of $Zn(OH)_2$ can dissolve in 1.0 mL of water, what is the Ksp?

Type 2 (Find ion concentrations from Ksp value)

What is the concentration of Ca^{+2} and CO_3^{-2} ions if the Ksp for $CaCO_3$ is 4.8×10^{-9}?

The Ksp for MgF_2 is 6.4×10^{-9}.

a) What is the $[Mg^{+2}]$ and $[F^-]$?

b) What is the molar solubility of MgF_2?

c) What is the solubility of MgF_2 in g/L?

Do Questions: #40 page 91; #41 page 92; #42-55 page 95