CHEMISTRY DAILY PLAN

Class: **Date:**

Subject: ***Selective Precipitation*** **Time:**

In some cases it is desirable to remove some ions from a solution while leaving other ions in the solution. Consider a solution containing Cl^- and I^- ions. When we examine the solubility product table we will see that both AgCl and AgI are slightly soluble substances. Ksp(AgCl) = 1.7×10^{-10} and Ksp(AgI) = 8.5×10^{-17}. The solubility products show that AgI is less soluble than AgCl. If $AgNO_3$ solution is slowly added to the solution containing I^- and Cl^- ions, first AgI will begin to precipitate first. By keeping [Ag+] within a certain range, it is possible to let just AgI precipitate, later the precipitate formed is filtered out, the clear solution now contains Cl^- ions only. The following example illustrates the subject best.

EXAMPLE 8 Selective Precipitation

Problem : Solid $AgNO_3$ is added to a solution containing 1.0×10^{-3} M each of Cl^- and I^- ions. What must be the minimum and maximum concentration of Ag^+ ions just to precipitate I^- as AgI?

Solution : Let us calculate the minimum concentration of Ag^+ to start the precipitation of AgI.

$AgI_{(s)} \Leftrightarrow Ag^+_{(aq)} + I^-_{(aq)}$ $\quad Ksp = [Ag^+]\,[I^-] = 8.5 \times 10^{-17}$

To start precipitation Qsp = Ksp $[I^-] = 1 \times 10^{-3}$ M $\Rightarrow$

$[Ag^+] = 8.5 \times 10^{-17} / 1 \times 10^{-3} = 8.5 \times 10^{-14}$ M

Then if $[Ag^+] > 8.5 \times 10^{-14}$ M, AgI will begin to precipitate. Let us calculate the minimum concentration of Ag^+ ions to start the precipitation of AgCl.

$AgCl_{(s)} \Leftrightarrow Ag^+_{(aq)} + Cl^-_{(aq)}$ $\quad Ksp = [Ag^+]\,[Cl^-] = 1.7 \times 10^{-10}$

$[Ag^+] = 1.7 \times 10^{-10} / 1 \times 10^{-3} = 1.7 \times 10^{-7}$ M

If $[Ag^+] > 1.7 \times 10^{-7}$ M, AgCl will precipitate too.

Thus, $8.5 \times 10^{-14} < [Ag^+] < 1.7 \times 10^{-7}$ is needed to precipitate I^- only as AgI.

PROBLEMS IN CLASS: Selective Precipitation.

Problem 12: A solution contains 1×10^{-2} mol/L Cl^- and 1×10^{-3} mol/L CrO_4^{-2} ions. Solid $AgNO_3$ is added to this solution. What will be the concentration of Cl^- ions in one liter solution when the precipitation of Ag_2CrO_4 starts? Ksp for AgCl = 1.7×10^{-10} and Ksp for Ag_2CrO_4 = 1.6×10^{-12} (Assume that addition of $AgNO_3$ does not change the volume)