Solubility Equilibria

- All ionic compounds dissolve in water to some degree.
  - However, many compounds have such low solubility in water that we classify them as insoluble.

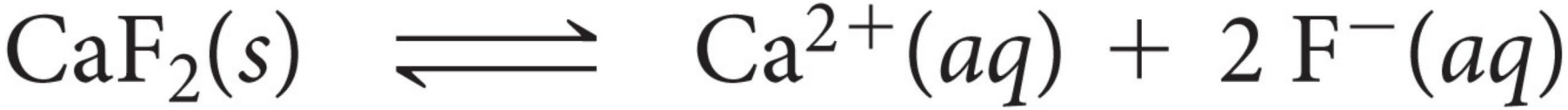
Calculating Ksp from molar solubility

Determine the K_{sp} of silver bromide, given that its molar solubility is 5.71×10^{-7} moles per liter.

Calculating molar solubility from Ksp

Calculate the molar solubility of calcium hydroxide if the Ksp is 6.5×10^{-6}

Common ion
0.100 M *F-(aq)*



Equilibrium shifts left

What is the molar solubility of CaF_2 in a solution containing 0.100 M NaF?

Precipitation

- $Q = K_{sp}$, the solution is saturated, no precipitation
- $Q < K_{sp}$, the solution is unsaturated, no precipitation
- $Q > K_{sp}$, the solution would be above saturation, the salt above saturation will precipitate.

Predicting Precipitation Reactions by Comparing *Q* and K_{sp}

A solution containing lead(II) nitrate is mixed with one containing sodium bromide to form a solution that is 0.0150 M in $Pb(NO_3)_2$ and 0.00350 M in NaBr. Does a precipitate form in the newly mixed solution?

Qualitative Analysis

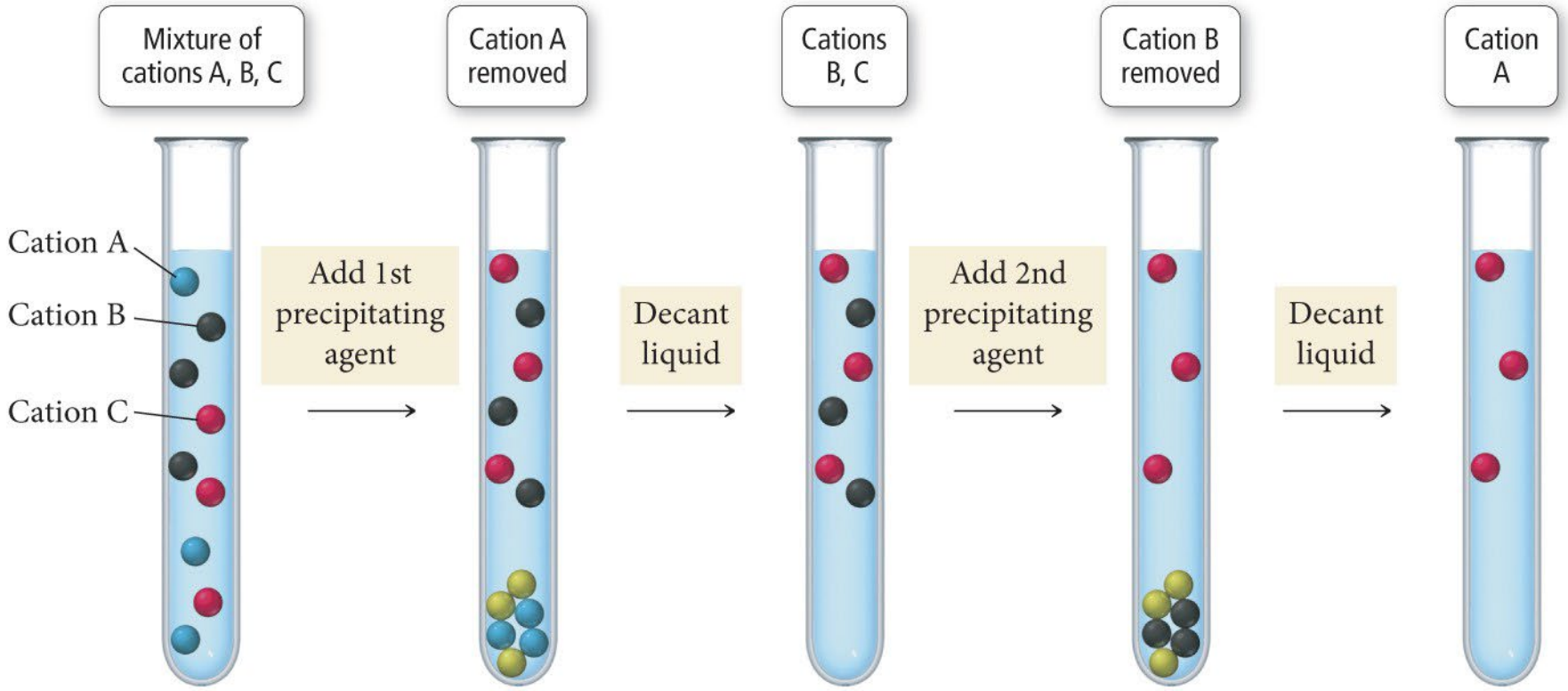
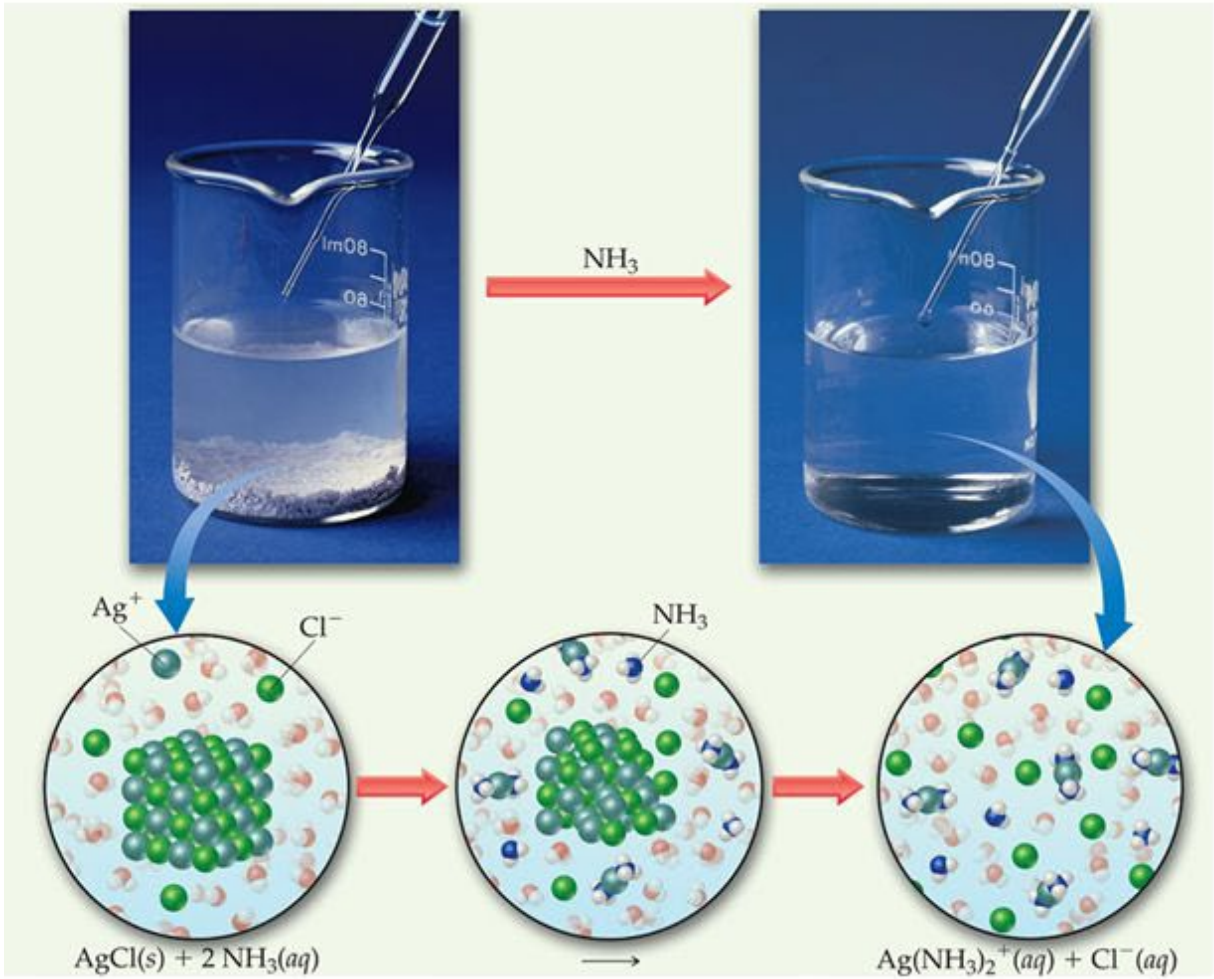


Table 19.4 Formation Constants (K_f) of Some Complex Ions at 25 C

Complex Ion	K_f
$Ag(CN)_2^-$	3.0×10^{20}
$Ag(NH_3)_2^+$	1.7×10^{7}
$Ag(S_2O_3)_2^{3-}$	4.7×10^{13}
AlF_6^{3-}	4×10^{19}
$Al(OH)_4^-$	3×10^{33}
$Be(OH)_4^{2-}$	4×10^{18}
CdI_4^{2-}	1×10^{6}
$Co(OH)_4^{2-}$	5×10^{9}
$Cr(OH)_4^-$	8.0×10^{29}
$Cu(NH_3)_4^{2+}$	5.6×10^{11}
$Fe(CN)_6^{4-}$	3×10^{35}
$Fe(CN)_6^{3-}$	4.0×10^{43}
$Hg(CN)_4^{2-}$	9.3×10^{38}
$Ni(NH_3)_6^{2+}$	2.0×10^{8}
$Pb(OH)_3^-$	8×10^{13}
$Sn(OH)_3^-$	3×10^{25}
$Zn(CN)_4^{2-}$	4.2×10^{19}
$Zn(NH_3)_4^{2+}$	7.8×10^{8}
$Zn(OH)_4^{2-}$	3×10^{15}

Complex Ions



– The formation of these complex ions increases the solubility of these salts.

Other ways to increase solubility of “insoluble” salts