Solubility Review

#1. $AgCH_3COO(s) \rightleftharpoons Ag^+(aq) + CH_3COO^-(aq)$

$$\frac{1.84\text{ g }AgCH_3COO}{0.2500\text{ L}} \times \frac{1\text{ mol }AgCH_3COO}{166.9\text{ g }AgCH_3COO} \doteq \frac{0.0441\text{ mol }AgCH_3COO}{\text{L}}$$

107.9
24.0
32.0
3 0

$$K_{sp} = [Ag^+][CH_3COO^-]$$

$$\therefore [4.41\times10^{-2}][4.41\times10^{-2}]$$

$$\boxed{K_{sp} = 1.94\times10^{-3}}$$

#2. $MgCO_3(s) \rightleftharpoons Mg^{2+}(aq) + CO_3^{2-}(aq)$

X X X

$$K_{sp} = [Mg^{2+}][CO_3^{2-}] = 6.8\times10^{-6}$$

$$\therefore \sqrt{x^2} = \sqrt{6.8\times10^{-6}}$$

$$x = \frac{2.6\times10^{-3}\text{ mol}}{1\text{ L}} \times 2.0\text{ L} \doteq 0.0521\text{ mol}$$

Mg = 24.3
C = 12.0
3 O = 48.0
84.3

$$0.0521\text{ mol }MgCO_3 \times \frac{84.3\text{ g }MgCO_3}{1\text{ mol }MgCO_3} \doteq 0.440\text{ g }MgCO_3$$

$$\therefore 1.00\text{ g} - 0.4396 = \boxed{0.56\text{ g }MgCO_3 \text{ is undissolved}}$$

#3. $CaSO_4(s) \rightleftharpoons Ca^{2+}(aq) + SO_4^{2-}(aq)$

$x \qquad x \qquad x$

$K_{sp} = [Ca^{2+}][SO_4^{2-}] = 7.1 \times 10^{-5}$

$\therefore \sqrt{x^2} = \sqrt{7.1 \times 10^{-5}}$

Ca = 40.1
S = 32.1
40 = 64.0 / 136.2

$x = \frac{8.43 \times 10^{-3} \text{ mol } CaSO_4}{1 \text{ L}} \times 0.1000 \text{ L} =$

$8.43 \times 10^{-4} \text{ mol} \times \frac{136.2 \text{ g } CaSO_4}{1 \text{ mol } CaSO_4} =$ **0.11 g $CaSO_4$**

#4. $AgIO_3(s) + \text{heat} \rightleftharpoons Ag^+(aq) + IO_3^-(aq)$

(1) Decrease the temperature to shift the equilibrium to the reactant side

(2) Add a soluble compound containing either Ag^+ (ie $AgNO_3$) or IO_3^- (ie $NaIO_3$) to increase the ion [ ]'s + shift the rxn to the reactant side.

#5. $2AgNO_3(aq) + MgSO_4(aq) \rightarrow Ag_2SO_4(s) + MgNO_3(aq)$

$\therefore Ag_2SO_4(s) \rightleftharpoons 2Ag^+_{(aq)} + SO_4^{2-}(aq)$

$K_{sp} = [Ag^+]^2[SO_4^{2-}]$

Beaker #1 $K_{sp} = [0.025]^2[0.024] = 1.5 \times 10^{-5}$

Beaker #2. $\frac{1.5 \times 10^{-5}}{[0.050]^2} = \frac{[0.050]^2[x]}{[0.050]^2}$

$\boxed{6.0 \times 10^{-3}\ M = [SO_4^{2-}]}$

#6. $Na_2SO_3(aq) + CuCl_2(aq) \rightarrow CuSO_3(s) + 2NaCl(aq)$

a) $CuSO_3(s)$ is the ppt that forms

b) $2Na^+(aq) + SO_3^{2-}(aq) + Cu^{2+}(aq) + 2Cl^-(aq) \rightarrow CuSO_3(s) + 2Na^+(aq) + 2Cl^-(aq)$

c) $Na^+(aq) + Cl^-(aq)$ are the spectator ions.

#7. $[Ca(NO_3)_2]_F = \frac{0.600M \times 0.1000L}{0.5000L} = 0.120\ M\ Ca(NO_3)_2$

$\boxed{[Ca^{2+}] = 0.120\ M}$

$\boxed{[NO_3^{-}] = 0.240\ M}$

#8.

	Ag^+	Pb^{2+}	Cu^+
Cl^-	ppt	ppt	ppt
SO_4^{2-}	ppt	ppt	—

a) ∴ you could add Cu^+ to ppt off the Cl^-!

b) $Cu^+_{(aq)} + Cl^-_{(aq)} \longrightarrow CuCl_{(s)}$.

#9. $Cu(NO_3)_2(aq) + NaIO_3(aq) \rightarrow Cu(IO_3)_2(s) + NaNO_3$

∴ $Cu(IO_3)_2(s) \rightleftharpoons Cu^{2+}(aq) + 2IO_3^-(aq)$ $\quad K_{sp} = [Cu^{2+}][IO_3^-]^2 = 6.9\times10^{-8}$

$$[Cu(NO_3)_2]_F = \frac{1.00\times10^{-2}\,M \cdot 0.0900\,L}{0.1000\,L} = 9.00\times10^{-3}\,M \therefore [Cu^{2+}] = 9.00\times10^{-3}$$

$$[NaIO_3]_F = \frac{1.00\times10^{-2}\,M \cdot 0.0100\,L}{0.1000\,L} = 1.00\times10^{-3}\,M \therefore [IO_3^-] = 1.00\times10^{-3}$$

$$T_{IP} = [9.00\times10^{-3}][1.00\times10^{-3}]^2$$

$$= 9.00\times10^{-9} < 6.9\times10^{-8} \therefore \text{No PPT forms!}$$

#10.

a) $AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$

b) Volume $AgNO_3$ = 27.22 mL − 18.20 mL = 9.02 mL → 0.00902 L

$$\overset{0.100}{AgNO_3} \rightarrow \overset{0.100}{Ag^+} + \overset{0.100}{NO_3^-}$$

$$\therefore \frac{0.100 \text{ mol } Ag^+}{1 \text{ L}} \times 0.00902 \text{ L} = 9.02 \times 10^{-4} \text{ mol } Ag^+$$

$$\rightarrow 9.02 \times 10^{-4} \text{ mol } Ag^+ \times \frac{1 \text{ mol } Cl^-}{1 \text{ mol } Ag^+} = 9.02 \times 10^{-4} \text{ mol } Cl^-$$

$$[Cl^-] = \frac{9.02 \times 10^{-4} \text{ mol } Cl^-}{0.02500 \text{ L}} = \boxed{0.0361 \text{ M } Cl^-}$$