→ $BaSO_4$? ($K_{sp} = 1.5 \times 10^{-9}$) (p718 Table of K_{sp})

97. Will a precipitate form when 75.0 mL of 0.020 *M* $BaCl_2$ and 125 mL of 0.040 *M* Na_2SO_4 are mixed together?

$BaCl_2 \rightarrow Ba^{2+} + 2Cl^-$

$M_1V_1 = M_2V_2$

$(.020)(75.0) = (M_2)(200.0)$

$M_2 = .0075\,M\ Ba^{2+}$

$Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-}$

$M_1V_1 = M_2V_2$

$(.040)(125) = M_2(200)$

$M_2 = .025\,M\ SO_4^{2-}$

$BaSO_4 \rightleftharpoons Ba^{2+} + SO_4^{2-}$

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

$Q = (.0075)(.025)$

$Q = 1.9 \times 10^{-4}$

$Q > K_{sp}$ so $BaSO_4(s)$ will form

→ $Mg(OH)_2$ ($K_{sp} = 8.9 \times 10^{-12}$)

98. Will a precipitate form when 100.0 mL of 4.0×10^{-4} *M* $Mg(NO_3)_2$ is added to 100.0 mL of 2.0×10^{-4} *M* NaOH?

$Mg(NO_3)_2 \rightarrow Mg^{2+} + 2NO_3^-$

$M_1V_1 = M_2V_2$

$(4.0 \times 10^{-4})(100.0) = (M_2)(200.0)$

$M_2 = 2.0 \times 10^{-4}\ M\ Mg^{2+}$

$NaOH \rightarrow Na^+ + OH^-$

$M_1V_1 = M_2V_2$

$(2.0 \times 10^{-4})(100.0) = (M_2)(200.0)$

$M_2 = 1.0 \times 10^{-4}$

$Mg(OH)_2 \rightleftharpoons Mg^{2+} + 2OH^-$

$K_{sp} = [Mg^{2+}][OH^-]^2$

$Q = (2.0 \times 10^{-4})(1.0 \times 10^{-4})^2$

$Q = 2.0 \times 10^{-12}$

$Q < K_{sp}$ so $Mg(OH)_2$ will not ppt.

99. Calculate the final concentrations of $K^+(aq)$, $C_2O_4^{2-}(aq)$, ... adding 0.100 L

100. $Pb(NO_3)_2 \rightarrow Pb^{2+} + 2NO_3^-$

$M_1V_1 = M_2V_2$

$(.10)(50.0) = M_2(100.0)$

$M_2 = .050M = [Pb(NO_3)_2]$

$[Pb^{2+}] = .050M$

$KCl \longrightarrow K^+ + Cl^-$

$M_1V_1 = M_2V_2$

$(1.0)(50.0) = M_2(100.0)$

$M_2 = .50M = [KCl]$

$[Cl^-] = .50M$

* assume ppt rxn goes to completion

	Pb^{2+}	+ $2Cl^-$	$\rightarrow$ $PbCl_2$
i	.050	.50	0
c	−.050	−.10	+.05
e	0	.40	+.05

$K_{sp} = [Pb^{2+}][Cl^-]^2$

$1.6 \times 10^{-5} = (x)(.40 + 2x)^2$

$X = 1.0 \times 10^{-4} M = [Pb^{2+}]$

$[NO_3^-] = .10\ M$

$[Pb^{2+}] = 1.0 \times 10^{-4}\ M$

$[K^+] = .50M$

$[Cl^-] = .40\ M$

101. A solution contains 1.0×10^{-5} *M* Na_3PO_4. What is the minimum concentration of $AgNO_3$ that would cause precipitation of solid Ag_3PO_4 ($K_{sp} = 1.8 \times 10^{-18}$)?

$Ag_3PO_4 \rightleftharpoons 3Ag^+ + PO_4^{3-}$

$K_{sp} = [Ag^+]^3 [PO_4^{3-}]$

$1.8 \times 10^{-18} = [Ag]^3 [1.0 \times 10^{-5} M]$

$[Ag_3PO_4] = [Ag] = 5.6 \times 10^{-5} M$

$[Ag_3PO_4]$: ↗ any amount over this will result in ppt.