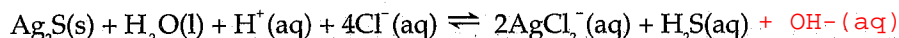
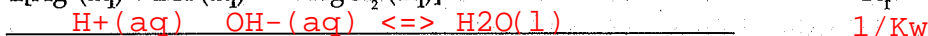
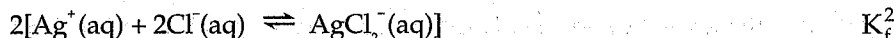
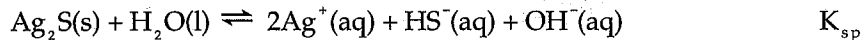
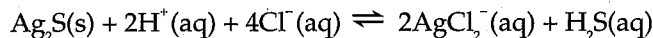


17.68 According Appendix D.3, K_{sp} for $Ag_2S(s)$ is of the type



~~Add $H^+(aq)$ to each side to obtain the overall reaction~~ really need to add in water equil. above

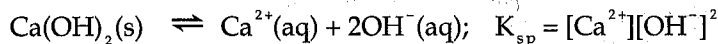


$$K = \frac{K_{sp} \times K_f^2}{K_{a1} K_w} = \frac{(6 \times 10^{-51})(1.1 \times 10^5)^2}{(9.5 \times 10^{-8})(1.0 \times 10^{-14})} = 7.64 \times 10^{-34} = 8 \times 10^{-34} = 7.64 \times 10^{-20}$$

Precipitation and Separation of Ions (Section 17.6)

17.69 *Analyze/Plan.* Follow the logic in Sample Exercise 17.16. Precipitation conditions: will Q (see Chapter 15) exceed K_{sp} for the compound? *Solve.*

(a) In base, Ca^{2+} can form $Ca(OH)_2(s)$.



$$Q = [Ca^{2+}][OH^-]^2; [Ca^{2+}] = 0.050 M; pOH = 14 - 8.0 = 6.0; [OH^-] = 1.0 \times 10^{-6} M$$

$$Q = (0.050)(1.0 \times 10^{-6})^2 = 5.0 \times 10^{-14}; K_{sp} = 6.5 \times 10^{-6} \text{ (Appendix D.3)}$$

$Q < K_{sp}$, no $Ca(OH)_2$ precipitates.

(b) $Ag_2SO_4(s) \rightleftharpoons 2Ag^+(aq) + SO_4^{2-}(aq); \quad K_{sp} = [Ag^+]^2[SO_4^{2-}]$

$$[Ag^+] = \frac{0.050 M \times 100 mL}{110 mL} = 4.545 \times 10^{-2} = 4.5 \times 10^{-2} M$$

$$[SO_4^{2-}] = \frac{0.050 M \times 10 mL}{110 mL} = 4.545 \times 10^{-3} = 4.5 \times 10^{-3} M$$

$$Q = (4.545 \times 10^{-2})^2 (4.545 \times 10^{-3}) = 9.4 \times 10^{-6}; K_{sp} = 1.5 \times 10^{-5}$$

$Q < K_{sp}$, no Ag_2SO_4 precipitates.

17.70 (a) $Co(OH)_2(s) \rightleftharpoons Co^{2+}(aq) + 2OH^-(aq); \quad K_{sp} = [Co^{2+}][OH^-]^2 = 1.3 \times 10^{-15}$

$$pH = 8.5; pOH = 14 - 8.5 = 5.5; [OH^-] = 10^{-5.5} = 3.16 \times 10^{-6} = 3 \times 10^{-6} M$$

$$Q = (0.020)(3.16 \times 10^{-6})^2 = 2 \times 10^{-13}; Q > K_{sp}, Co(OH)_2 \text{ will precipitate.}$$

(b) $AgIO_3(s) \rightleftharpoons Ag^+(aq) + IO_3^-(aq); \quad K_{sp} = [Ag^+][IO_3^-] = 3.1 \times 10^{-8}$

$$[Ag^+] = \frac{0.010 M Ag^+ \times 0.020 L}{0.030 L} = 6.667 \times 10^{-3} = 6.7 \times 10^{-3} M$$