CH1020 Exercises (Worksheet 7)

1. Determine whether each compound is soluble or insoluble. For the soluble compounds, list the ions present in solution

   a. $AgNO_3$ — soluble; $Ag^+(aq)$, $NO_3^-(aq)$

   b. KNO_3 — soluble; $K^+(aq)$, $NO_3^-(aq)$

   c. $(NH_4)_2S$ — soluble; $NH_4^+(aq)$, $S^{2-}(aq)$

   d. AgI — insoluble

   e. K_3PO_4 — soluble; $K^+(aq)$, $PO_4^{3-}(aq)$

   f. $Cu_3(PO_4)_2$ — insoluble

   g. $CoCO_3$ — insoluble

   h. $LiOH$ — soluble; $Li^+(aq)$, $OH^-(aq)$

   i. $CaCO_3$ — insoluble

   j. $PbSO_4$ — insoluble

   k. $(NH_4)_3PO_4$ — soluble; $NH_4^+(aq)$, $PO_4^{3-}(aq)$

   l. Fe_2S_3 — insoluble

2. Complete and balance each equation. If no reaction occurs, write "No Reaction".

   a. $NaNO_3(aq) + KCl(aq) \rightarrow$ No Reaction

   b. $2NaCl(aq) + Hg_2(CH_3CO_2)_2(aq) \rightarrow 2NaCH_3CO_2(aq) + Hg_2Cl_2(s)$

   c. $(NH_4)_2SO_4(aq) + SrCl_2(aq) \rightarrow 2NH_4Cl(aq) + SrSO_4(s)$

   d. $3NaOH(aq) + FeCl_3(aq) \rightarrow 3NaCl(aq) + Fe(OH)_3(s)$

3. Show with appropriate net ionic reactions how Cr^{3+} and Cd^{2+} can be removed from wastewater by treatment with solutions of sodium hydroxide.

$$Cd^{2+}(aq) + 2OH^{-}(aq) \rightarrow Cd(OH)_2(s)$$

$$Cr^{3+}(aq) + 3OH^{-}(aq) \rightarrow Cr(OH)_3(s)$$

4. Write balanced complete ionic and net ionic equations for each reaction

a.
$$2K^{+}(aq) + SO_4^{2-}(aq) + Ca^{2+}(aq) + 2I^{-}(aq) \rightarrow CaSO_4(s) + 2K^{+}(aq) + 2I^{-}(aq)$$
$$Ca^{2+}(aq) + SO_4^{2-}(aq) \rightarrow CaSO_4(s)$$

b.
$$6Na^{+}(aq) + 2PO_4^{3-}(aq) + 3Ni^{2+}(aq) + 6Cl^{-}(aq) \rightarrow Ni_3(PO_4)_2(s) + 6Na^{+}(aq) + Cl^{-}(aq)$$
$$2PO_4^{3-}(aq) + 3Ni^{2+}(aq) \rightarrow Ni_3(PO_4)_2(s)$$

c.
$$Ag^{+}(aq) + NO_3^{-}(aq) + Na^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s) + Na^{+}(aq) + NO_3^{-}(aq)$$
$$Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$$

d.
$$2CH_3COO^{-}(aq) + 2H^{+}(aq) + 2K^{+}(aq) + CO_3^{2-}(aq) \rightarrow H_2O(l) + CO_2(g) + 2K^{+}(aq) + 2CH_3COO^{-}(aq)$$
$$2H^{+}(aq) + CO_3^{2-}(aq) \rightarrow H_2O(l) + CO_2(g)$$

e.
$$Mg^{2+}(aq) + S^{2-}(aq) + Cu^{2+}(aq) + 2Cl^{-}(aq) \rightarrow CuS(s) + Mg^{2+}(aq) + 2Cl^{-}(aq)$$
$$S^{2-}(aq) + Cu^{2+}(aq) \rightarrow CuS(s)$$

5.
$$Pb^{2+}(aq) + 2NO_3^{-}(aq) + 2K^{+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2K^{+}(aq) + 2NO_3^{-}(aq)$$
$$Pb^{2+}(aq) + SO_4^{2-}(aq) \rightarrow PbSO_4(s)$$