Answers to More Chapter 4 Study Questions

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

   b) $30.0\ mL\ x\ \frac{0.500\ moles\ NaOH}{1000\ mL\ solution} x \frac{1\ mol\ FeCl_3}{3\ mol\ NaOH} x \frac{1000\ mL\ solution}{0.200\ mol\ FeCl_3} = 25.0\ mL$

   c) $30.0\ mL\ x\ \frac{0.500\ moles\ NaOH}{1000\ mL\ solution} x \frac{1\ mol\ Fe(OH)_3}{3\ mol\ NaOH} x \frac{106.8\ g\ Fe(OH)_3}{1\ mol\ Fe(OH)_3} = 0.534\ g$

2. $3\ AgNO_3(aq) + AlCl_3(aq) \rightarrow Al(NO_3)_3(aq) + 3\ AgCl(s)$

   This is a limiting reactant problem, so first determine which reactant is limiting.

   $25.0\ mL\ x\ \frac{0.200\ mol\ AgNO_3}{1000\ mL\ solution} x \frac{3\ mole\ AgCl}{3\ mol\ AgNO_3} x \frac{143.3\ g\ AgCl}{1\ mole\ AgCl} = 0.716\ g\ AgCl$

   $10.0\ mL\ x\ \frac{0.150\ mol\ AlCl_3}{1000\ mL\ solution} x \frac{3\ mole\ AgCl}{1\ mol\ AlCl_3} x \frac{143.3\ g\ AgCl}{1\ mole\ AgCl} = 0.645\ g\ AgCl$

   Therefore, 0.645 g AgCl is formed.

3. $Ba(OH)_2(aq) + 2\ HNO_3(aq) \rightarrow 2\ H_2O(l) + Ba(NO_3)_2(aq)$

   $25.0\ mL\ x\ \frac{0.300\ mol\ HNO_3}{1000\ mL\ solution} x \frac{1\ mole\ Ba(OH)_2}{2\ mol\ HNO_3} x \frac{1000\ mL\ solution}{0.0500\ mole\ Ba(OH)_2} = 75.0\ mL$

4. $50.0\ mL\ x\ \frac{2.00\ mol\ KCl}{1000\ mL\ solution} x \frac{74.5\ g\ KCl}{1\ mol\ KCl} = 7.45\ g\ KCl$

5. $V_1\ x\ M_1 = V_2\ x\ M_2 \qquad V_1\ x\ 6.00\ M\ HCl = 30.0\ mL\ x\ 0.500\ M\ HCl$

   $V_1 = (30.0\ mL\ x\ 0.500\ M)/6.00\ M = 2.50\ mL$

6. $Ba(NO_3)_2(aq) + K_2SO_3(aq) \rightarrow BaSO_3(aq) + 2\ KNO_3(aq)$

   $40.0\ mL\ x\ \frac{0.250\ mol\ Ba(NO_3)_2}{1000\ mL\ solution} x \frac{1\ mol\ BaSO_3}{1\ mol\ Ba(NO_3)_2} x \frac{217.4\ g\ BaSO_3}{1\ mol\ BaSO_3} = 2.17\ g$