Stoichiometry: Mass to Mass Problems

1. $2 \text{KClO}_3 \rightarrow 2 \text{KCl} + 3 \text{O}_2$

   How many grams of potassium chloride are produced if 25g of potassium chlorate decompose?

   Known: 25g KClO$_3$
   Want: grams KCl

   Molar Mass: KClO$_3$ = 39.10 + 35.45 + 3(16.00) = 122.55
   KCl = 39.10 + 35.45 = 74.55

   $25 \text{g KCl} \times \frac{1 \text{mol}}{122.55 \text{g}} \times \frac{2 \text{mol KCl}}{1 \text{mol KClO}_3} \times \frac{74.55 \text{g}}{1 \text{mol KCl}} = 15g$

2. $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$

   How many grams of hydrogen are necessary to react completely with 50.0g of nitrogen in the above reaction?

   Known: 50.0g N$_2$
   Want: grams H$_2$

   Molar Mass: N$_2$ = 2(14.01) = 28.02g
   H$_2$ = 2(1.008) = 2.016g

   $50.0g \text{N}_2 \times \frac{1 \text{mol N}_2}{28.02g} \times \frac{3 \text{mol H}_2}{1 \text{mol N}_2} \times \frac{2.016g \text{H}_2}{1 \text{mol H}_2} = 10.8g$

   How many grams of ammonia are produced in the above reaction?

   Known: 50.0g N$_2$
   Want: grams NH$_3$

   Molar Mass: N$_2$ = 28.02g
   NH$_3$ = 2(14.01) + 3(1.008) = 17.034g

   $50.0g \text{N}_2 \times \frac{1 \text{mol N}_2}{28.02g} \times \frac{2 \text{mol NH}_3}{1 \text{mol N}_2} \times \frac{17.034g \text{NH}_3}{1 \text{mol NH}_3} = 60.8g$

3. $2 \text{AgNO}_3 + \text{BaCl}_2 \rightarrow \text{AgCl} + \text{Ba(NO}_3)_2$

   How many grams of silver chloride are produced from 5.0g of silver nitrate reacting with an excess of barium chloride?

   Known: 5.0g AgNO$_3$
   Want: grams AgCl

   Molar Mass: AgNO$_3$ = 107.86 + 14.01 + 3(18.00) = 169.87g
   AgCl = 107.86 + 35.45 = 143.31g

   $5.0g \text{AgNO}_3 \times \frac{1 \text{mol AgNO}_3}{169.87g} \times \frac{2 \text{mol AgCl}}{1 \text{mol AgNO}_3} \times \frac{143.31g}{1 \text{mol AgCl}} = 4.2g$

   How much barium chloride is necessary to react with the silver nitrate?

   Known: 5.0g AgNO$_3$
   Want: grams BaCl$_2$

   Molar Mass: AgNO$_3$ = 169.87g
   BaCl$_2$ = 137.33 + 2(35.45) = 208.23g

   $5.0g \text{AgNO}_3 \times \frac{1 \text{mol AgNO}_3}{169.87g} \times \frac{2 \text{mol BaCl}_2}{1 \text{mol AgNO}_3} \times \frac{208.23g}{1 \text{mol BaCl}_2} = 3.1g$