1. Silver nitrate reacts with barium chloride to form silver chloride and barium nitrate.
   a. Write and balance the chemical equation.

   \[ 2 \text{AgNO}_3 + \text{BaCl}_2 \rightarrow 2 \text{AgCl} + \text{Ba(NO}_3)_2 \]

   b. If 39.02 grams of barium chloride are reacted in an excess of silver nitrate, how many representative particles (and what type) of silver chloride are produced?

   \[ \frac{39.02 \text{g BaCl}_2}{1} \times \frac{1 \text{mole BaCl}_2}{208.233 \text{g BaCl}_2} \times \frac{2 \text{mole AgCl}}{1 \text{mole BaCl}_2} \times \frac{6.02 \times 10^{23} \text{f.u. AgCl}}{1 \text{mole AgCl}} = 2.256 \times 10^{23} \text{f.u. AgCl} \]

   c. If 410.8 grams of barium nitrate are produced how many grams of silver nitrate were reacted?

   \[ \frac{410.8 \text{g Ba(NO}_3)_2}{1} \times \frac{1 \text{mole Ba(NO}_3)_2}{261.335 \text{g Ba(NO}_3)_2} \times \frac{2 \text{mole AgNO}_3}{1 \text{mole Ba(NO}_3)_2} \times \frac{169.872 \text{g AgNO}_3}{1 \text{mole AgNO}_3} = 534.1 \text{g AgNO}_3 \]

2. Nitrogen gas is reacted with hydrogen gas to form nitrogen trihydride.
   a. Write and balance the chemical equation.

   \[ \text{N}_2(g) + 3 \text{H}_2(g) \rightarrow 2 \text{NH}_3(g) \]

   b. How many liters of nitrogen trihydride are produced at STP if 80.28 grams of hydrogen gas are reacted in an excess of nitrogen?

   \[ \frac{80.28 \text{g H}_2}{1} \times \frac{1 \text{mole H}_2}{2.016 \text{g H}_2} \times \frac{2 \text{mole NH}_3}{3 \text{mole H}_2} \times \frac{22.4 \text{L NH}_3}{1 \text{mole NH}_3} = 594.7 \text{L NH}_3 \]

   c. How many grams of hydrogen are needed to fully react 621.9 grams of nitrogen gas?

   \[ \frac{621.9 \text{g N}_2}{1} \times \frac{1 \text{mole N}_2}{28.014 \text{g N}_2} \times \frac{3 \text{mole H}_2}{1 \text{mole N}_2} \times \frac{2.016 \text{g H}_2}{1 \text{mole H}_2} = 134.3 \text{g H}_2 \]

   d. How many liters of nitrogen gas are needed to completely react 90.38 L of hydrogen gas at STP?

   \[ \frac{90.28 \text{L H}_2}{1} \times \frac{1 \text{mole H}_2}{22.4 \text{L H}_2} \times \frac{3 \text{mole H}_2}{1 \text{mole N}_2} \times \frac{22.4 \text{L N}_2}{1 \text{mole N}_2} = 30.09 \text{L N}_2 \]

   OR \[ \frac{90.28 \text{L H}_2}{1} \times \frac{1 \text{L N}_2}{3 \text{L H}_2} = 30.09 \text{L N}_2 \]
3. For the following problem, use the following chemical equation:

\[ C_8H_{18}(l) + O_2(g) \rightarrow CO_2(g) + H_2O(g) \]

a. Balance the chemical equation.

\[ 2 C_8H_{18}(l) + 25 O_2(g) \rightarrow 16 CO_2(g) + 18 H_2O(g) \]

b. How many moles of oxygen are needed to fully react 837.4 grams of C\(_8\)H\(_{18}\)?

\[ \frac{837.4 \text{ g } C_8H_{18}}{1 \text{ mole } C_8H_{18}} \times \frac{1 \text{ mole } C_8H_{18}}{114.232 \text{ g } C_8H_{18}} \times \frac{25 \text{ moles } O_2}{2 \text{ moles } C_8H_{18}} = 91.63 \text{ moles } O_2 \]

c. How many liters of carbon dioxide gas are formed at STP when 3.829 \( \times \) 10\(^{25}\) representative particles of C\(_8\)H\(_{18}\) are reacted in an excess of oxygen gas?

\[ \frac{3.829 \times 10^{25} \text{ molecules } C_8H_{18}}{1} \times \frac{1 \text{ mole } C_8H_{18}}{6.02 \times 10^{23} \text{ molecules } C_8H_{18}} \times \frac{16 \text{ moles } CO_2}{2 \text{ moles } C_8H_{18}} \times \frac{22.4 \text{ L } CO_2}{1 \text{ mole } CO_2} = 1.140 \times 10^4 \text{ L } CO_2 \]

d. How many grams of water are produced when 382.9 liters of oxygen gas at STP are fully reacted?

\[ \frac{382.9 \text{ L } O_2}{1} \times \frac{1 \text{ mole } O_2}{22.4 \text{ L } O_2} \times \frac{18 \text{ moles } H_2O}{25 \text{ moles } O_2} \times \frac{18.015 \text{ g } H_2O}{1 \text{ mole } H_2O} = 221.7 \text{ g } H_2O \]