Stoichiometry Problems

Directions: In solving each of the following problems, use the unit cancellation (factor-label) method. Remember to always write your units and the formula after every number !!!

1. If 1.20 x 10^2 grams of sodium carbonate reacts with calcium hydroxide, how many grams of sodium hydroxide are formed?

   \[
   \text{Na}_2\text{CO}_3 + \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} + \text{CaCO}_3
   \]

2. If 80.0 grams of calcium chloride reacts with silver nitrate, how many grams of silver chloride are formed?

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

3. If 90.0 grams of barium chloride reacts with sulfuric acid, how many grams of barium sulfate are produced?

   \[
   \text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2 \text{HCl}
   \]

4. If 5.00 x 10^2 grams of potassium iodide reacts with lead acetate, what mass of lead iodide is formed?

   \[
   \text{Pb(C}_2\text{H}_3\text{O}_2)_2 + 2 \text{KI} \rightarrow \text{PbI}_2 + 2 \text{KC}_2\text{H}_3\text{O}_2
   \]
5. How many grams of oxygen are produced by heating 4.00 x 10^2 grams of potassium chlorate?
\[ 2 \text{ KClO}_3 \rightarrow 2 \text{ KCl} + 3 \text{ O}_2 \]

6. How many grams of sodium hydroxide will react with 1.50 x 10^2 grams of phosphoric acid?
\[ \text{H}_3\text{PO}_4 + 3 \text{ NaOH} \rightarrow 3 \text{ HOH} + \text{Na}_3\text{PO}_4 \]

7. If 6.00 x 10^2 grams of calcium hydroxide are neutralized with nitric acid, how many grams of nitric acid are needed?
\[ \text{Ca(OH)}_2 + 2 \text{ HNO}_3 \rightarrow \text{Ca(NO}_3)_2 + 2 \text{ HOH} \]

8. How many grams of calcium carbonate are required in the preparation of 50.0 grams of calcium oxide?
\[ \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \]

9. How many grams of potassium chlorate are needed in the preparation of 70.0 grams of oxygen?
\[ 2 \text{ KClO}_3 \rightarrow 2 \text{ KCl} + 3 \text{ O}_2 \]

10. When 50.0 grams of magnesium react with silver nitrate in solution, how many grams of silver are prepared?
\[ \text{Mg} + 2 \text{ AgNO}_3 \rightarrow \text{Mg(NO}_3)_2 + 2 \text{ Ag} \]
**Stoichiometry Problems**

Directions: In solving each of the following problems, use the unit cancellation (factor-label) method. Remember to always write your units and the formula after every number !!!

1. If $1.20 \times 10^2$ grams of sodium carbonate reacts with calcium hydroxide, how many grams of sodium hydroxide are formed?

   \[
   \text{Na}_2\text{CO}_3 \ + \ \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} \ + \ \text{CaCO}_3
   \]

   
   \[
   \begin{array}{c|c|c|c|c}
   \text{grams} \ #1 & \text{molar mass} \ #1 & \text{moles} \ #1 & \text{molar ratio coefficients} & \text{moles} \ #2 & \text{molar mass} \ #2 & \text{grams} \ #2 \\
   \hline
   120 \text{ g Na}_2\text{CO}_3 & 1 \text{ mol Na}_2\text{CO}_3 & 2 \text{ mol NaOH} & 40.00 \text{ g NaOH} & = 90.6 \text{ g NaOH} \\
   105.99 \text{ g Na}_2\text{CO}_3 & 1 \text{ mol Na}_2\text{CO}_3 & 1 \text{ mol NaOH} & & \\
   \end{array}
   \]

2. If 80.0 grams of calcium chloride reacts with silver nitrate, how many grams of silver chloride are formed?

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

   \[
   \begin{array}{c|c|c|c|c|c}
   \text{grams} \ #1 & \text{molar mass} \ #1 & \text{moles} \ #1 & \text{molar ratio coefficients} & \text{moles} \ #2 & \text{molar mass} \ #2 & \text{grams} \ #2 \\
   \hline
   80.0 \text{ g CaCl}_2 & 1 \text{ mol CaCl}_2 & 2 \text{ mol AgCl} & 143.32 \text{ g AgCl} & = 207 \text{ g AgCl} \\
   110.91 \text{ g CaCl}_2 & 1 \text{ mol CaCl}_2 & 1 \text{ mol AgCl} & & \\
   \end{array}
   \]

3. If 90.0 grams of barium chloride reacts with sulfuric acid, how many grams of barium sulfate are produced?

   \[
   \text{BaCl}_2 \ + \ \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 \ + \ 2 \text{ HCl}
   \]

   \[
   \begin{array}{c|c|c|c|c|c|c}
   \text{grams} \ #1 & \text{molar mass} \ #1 & \text{moles} \ #1 & \text{molar ratio coefficients} & \text{moles} \ #2 & \text{molar mass} \ #2 & \text{grams} \ #2 \\
   \hline
   90.0 \text{ g BaCl}_2 & 1 \text{ mol BaCl}_2 & 1 \text{ mol BaSO}_4 & 233.40 \text{ g BaSO}_4 & = 101 \text{ g BaSO}_4 \\
   208.23 \text{ g BaCl}_2 & 1 \text{ mol BaCl}_2 & 1 \text{ mol BaSO}_4 & & \\
   \end{array}
   \]

4. If $5.00 \times 10^2$ grams of potassium iodide reacts with lead acetate, what mass of lead iodide is formed?

   \[
   \text{Pb(C}_2\text{H}_3\text{O}_2)_2 \ + \ 2 \text{ KI} \rightarrow \text{PbI}_2 \ + \ 2 \text{ KC}_2\text{H}_3\text{O}_2
   \]

   \[
   \begin{array}{c|c|c|c|c|c|c}
   \text{grams} \ #1 & \text{molar mass} \ #1 & \text{moles} \ #1 & \text{molar ratio coefficients} & \text{moles} \ #2 & \text{molar mass} \ #2 & \text{grams} \ #2 \\
   \hline
   500 \text{ g KI} & 1 \text{ mol KI} & 1 \text{ mol PbI}_2 & 461.00 \text{ g PbI}_2 & = 694 \text{ g PbI}_2 \\
   166.00 \text{ g KI} & 2 \text{ mol KI} & 1 \text{ mol PbI}_2 & & \\
   \end{array}
   \]
5. How many grams of oxygen are produced by heating \(4.00 \times 10^2\) grams of potassium chlorate?

\[
2 \text{ KClO}_3 \rightarrow 2 \text{ KCl} + 3 \text{ O}_2
\]

\[
\begin{array}{c|c|c|c}
400 \text{ g KClO}_3 & 1 \text{ mol KClO}_3 & 3 \text{ mol O}_2 & 32.00 \text{ g O}_2 \\
122.55 \text{ g KClO}_3 & 2 \text{ mol KClO}_3 & 1 \text{ mol O}_2 & \\
\end{array}
= 157 \text{ g O}_2
\]

6. How many grams of sodium hydroxide will react with \(1.50 \times 10^2\) grams of phosphoric acid?

\[
\text{H}_3\text{PO}_4 + 3 \text{ NaOH} \rightarrow 3 \text{ HOH} + \text{ Na}_3\text{PO}_4
\]

\[
\begin{array}{c|c|c|c}
150 \text{ g H}_3\text{PO}_4 & 1 \text{ mol H}_3\text{PO}_4 & 3 \text{ mol NaOH} & 40.00 \text{ g NaOH} \\
98.00 \text{ g H}_3\text{PO}_4 & 1 \text{ mol H}_3\text{PO}_4 & 1 \text{ mol NaOH} & \\
\end{array}
= 184 \text{ g NaOH}
\]

7. If \(6.00 \times 10^2\) grams of calcium hydroxide are neutralized with nitric acid, how many grams of nitric acid are needed?

\[
\text{Ca(OH)}_2 + 2 \text{ HNO}_3 \rightarrow \text{Ca(NO}_3)_2 + 2 \text{ HOH}
\]

\[
\begin{array}{c|c|c|c}
600 \text{ g Ca(OH)}_2 & 1 \text{ mol Ca(OH)}_2 & 2 \text{ mol HNO}_3 & 63.02 \text{ g HNO}_3 \\
74.10 \text{ g Ca(OH)}_2 & 1 \text{ mol Ca(OH)}_2 & 1 \text{ mol HNO}_3 & \\
\end{array}
= 1,020 \text{ g HNO}_3
\]

8. How many grams of calcium carbonate are required in the preparation of \(50.0\) grams of calcium oxide?

\[
\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2
\]

\[
\begin{array}{c|c|c|c}
50.0 \text{ g CaO} & 1 \text{ mol CaO} & 1 \text{ mol CaCO}_3 & 100.09 \text{ g CaCO}_3 \\
56.08 \text{ g CaO} & 1 \text{ mol CaO} & 1 \text{ mol CaCO}_3 & \\
\end{array}
= 89.2 \text{ g CaCO}_3
\]

9. How many grams of potassium chlorate are needed in the preparation of \(70.0\) grams of oxygen?

\[
2 \text{ KClO}_3 \rightarrow 2 \text{ KCl} + 3 \text{ O}_2
\]

\[
\begin{array}{c|c|c|c}
70.0 \text{ g O}_2 & 1 \text{ mol O}_2 & 2 \text{ mol KClO}_3 & 122.55 \text{ g KClO}_3 \\
32.00 \text{ g O}_2 & 3 \text{ mol O}_2 & 1 \text{ mol KClO}_3 & \\
\end{array}
= 179 \text{ g KClO}_3
\]

10. When \(50.0\) grams of magnesium react with silver nitrate in solution, how many grams of silver are prepared?

\[
\text{Mg} + 2 \text{ AgNO}_3 \rightarrow \text{Mg(NO}_3)_2 + 2 \text{ Ag}
\]

\[
\begin{array}{c|c|c|c}
50.0 \text{ g Mg} & 1 \text{ mol Mg} & 2 \text{ mol Ag} & 107.87 \text{ g Ag} \\
24.31 \text{ g Mg} & 1 \text{ mol Mg} & 1 \text{ mol Ag} & \\
\end{array}
= 444 \text{ g Ag}
\]