1. How many grams of potassium hydroxide (KOH) are needed to neutralize 2 mole of hydrochloric acid?

2. How many grams of sodium hydroxide (NaOH) are needed to neutralize 1 mole of sulfuric acid (H₂SO₄)?

3. How many grams of potassium hydroxide (KOH) are needed to neutralize 196 g of sulfuric acid (H₂SO₄)?

4. How many grams of sodium chloride (NaCl) are needed to precipitate all silver from the solution containing 200 g of silver nitrate (AgNO₃)?

5. How many moles of calcium bromide (CaBr₂) are needed to precipitate all silver from the solution containing 100 g of silver nitrate (AgNO₃)?
6. How many grams of precipitate (CaSO₄) will be formed in reaction between 100 g of calcium chloride (CaCl₂) and 100 g of sodium sulfate (Na₂SO₄)?

7. How many grams of carbon dioxide will be produced upon dissolving of 100 g of calcium carbonate (CaCO₃) in the excess of hydrochloric acid?

8. How many grams of barium sulfate will be formed in the reaction between 100 g of barium chloride (BaCl₂) and 100 g of sodium sulfate (Na₂SO₄)?

9. How many liters of water will be produced upon combustion of 2 liters of benzene (C₆H₆)? The density of benzene is D = 0.782 g/ml.

10. How many grams of carbon dioxide will be produced upon combustion of 1 liter of propane (C₃H₈)? The density of propane is D = 0.832 g/ml.
ANSWERS TO THE HOMEWORK ON GRAMS AND MOLES

1. How many grams of potassium hydroxide (KOH) are needed to neutralize 2.00 mole of hydrochloric acid?

\[
\begin{align*}
\text{HCl} + \text{KOH} & \rightarrow \text{KCl} + \text{H}_2\text{O} \\
1 \text{ mole} & \rightarrow 1 \text{ mole} \\
2 \text{ mole} & \rightarrow 2 \text{ mole}
\end{align*}
\]

2.00 mole KOH weigh (2.00 mole * 56.0 g/mole) = 112 g

2. How many grams of sodium hydroxide (NaOH) are needed to neutralize 1.00 mole of sulfuric acid (H\text{2SO}_4)?

\[
\begin{align*}
2 \text{ NaOH} + \text{H}_2\text{SO}_4 & \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{ H}_2\text{O} \\
2 \text{ mole} & \rightarrow 1 \text{ mole}
\end{align*}
\]

2 mole of NaOH weigh (2.00 mole * 40.0 g/mole) = 80.0 g

3. How many grams of potassium hydroxide (KOH) are needed to neutralize 196 g of sulfuric acid (H\text{2SO}_4)?

\[
\begin{align*}
\{\text{H}_2\text{SO}_4\} &= 196g / 98 \text{ g/mole} = 2.00 \text{ mole} \\
2 \text{ KOH} + \text{H}_2\text{SO}_4 & \rightarrow \text{K}_2\text{SO}_4 + 2 \text{ H}_2\text{O} \\
2 \text{ mole} & \rightarrow 1 \text{ mole} \\
4 \text{ mole} & \rightarrow 2 \text{ mole}
\end{align*}
\]

4.00 mole KOH weigh (4.00 mole * 56.0 g/mole) = 224 g

4. How many grams of sodium chloride (NaCl) are needed to precipitate all silver from the solution containing 200 g of silver nitrate (AgNO\text{3})?

\[
\begin{align*}
\text{M}_{w(\text{AgNO}_3)} &= 170.0 \text{ g/mole} \\
\{\text{AgNO}_3\} &= 200 \text{ g} / 170.0 \text{ g/mole} = 1.18 \text{ mole} \\
\text{NaCl} + \text{AgNO}_3 & \rightarrow \text{AgCl}↓ + \text{NaNO}_3 \\
1 \text{ mole} & \rightarrow 1 \text{ mole} \\
1.18 \text{ mole} & \rightarrow 1.18 \text{ mole}
\end{align*}
\]

1.18 mole KOH weigh (1.18 mole * 58.5 g/mole) = 69.0 g

5. How many moles of calcium bromide (CaBr\text{2}) are needed to precipitate all silver from the solution containing 100 g of silver nitrate (AgNO\text{3})?

\[
\begin{align*}
\{\text{AgNO}_3\} &= 100 \text{ g} / 170.0 \text{ g/mole} = 0.588 \text{ mole} \\
\text{CaBr}_2 + 2 \text{ AgNO}_3 & \rightarrow 2 \text{ AgCl}↓ + \text{Ca(NO}_3\text{)}_2 \\
1 \text{ mole} & \rightarrow 2 \text{ mole} \\
\frac{1}{2} \text{ mole} & \rightarrow 1 \text{ mole}
\end{align*}
\]

0.294 mole \leftarrow 0.588 \text{ mole}
ANSWERS TO THE HOMEWORK ON GRAMS AND MOLES

6. How many grams of precipitate (CaSO₄) will be formed in reaction between 100 g of calcium chloride (CaCl₂) and 100 g of sodium sulfate (Na₂SO₄)?

\[ \text{M}_{\text{W(CaSO₄)}} = 136.0 \text{ g/mole} \quad \text{M}_{\text{W(Na₂SO₄)}} = 142.0 \text{ g/mole} \quad \text{M}_{\text{W(CaCl₂)}} = 111 \text{ g/mole} \]

\[ \text{CaCl}_2 + \text{Na₂SO₄} \rightarrow \text{CaSO₄} \downarrow + 2 \text{NaCl} \]

1 mole \(\rightarrow\) 1 mole \(\rightarrow\) 1 mole

\{CaCl₂\} = 0.901 mole > \{Na₂SO₄\} = 0.704 mole \text{ Na₂SO₄ - limiting} \]

0.704 mole Na₂SO₄ \(\rightarrow\) 0.704 mole CaSO₄

0.704 mole CaSO₄ weigh (0.704 mole \(\times\) 136.0 g/mole) = 95.7 g

7. How many grams of carbon dioxide will be produced upon dissolving of 100 g of calcium carbonate (CaCO₃) in the excess of hydrochloric acid?

\[ \text{M}_{\text{W(CaCO₃)}} = 100 \text{ g/mole} \quad \{\text{CaCO₃}\} = 1.00 \text{ mole} \]

\[ \text{CaCO₃} + 2 \text{ HCl} \rightarrow \text{CaCl₂} + \text{CO₂} + \text{H₂O} \]

1 mole \(\rightarrow\) 1 mole (CO₂)

1.00 mole CO₂ weigh 44.0 g

8. How many grams of barium sulfate will be formed in the reaction between 100 g of barium chloride (BaCl₂) and 100 g of sodium sulfate (Na₂SO₄)?

\[ \text{M}_{\text{W(Na₂SO₄)}} = 142.0 \text{ g/mole} \quad \text{M}_{\text{W(BaCl₂)}} = 208.4 \text{ g/mole} \]

\[ \text{BaCl₂} + \text{Na₂SO₄} \rightarrow \text{BaSO₄} \downarrow + 2 \text{ NaCl} \]

1 mole \(\rightarrow\) 1 mole \(\rightarrow\) 1 mole

\{BaCl₂\} = 0.480 mole < \{Na₂SO₄\} = 0.704 mole \text{ BaCl₂ - limiting} \]

\{BaSO₄\} = 0.480 mole

0.480 mole of BaSO₄ weigh (0.480 mole \(\times\) 233.4 g/mole) = 112 g

9. How many liters of water will be produced upon combustion of 2 liters of benzene (C₆H₆)? The density of benzene is D = 0.782 g/ml.

\[ \text{C₆H₆} + \frac{15}{2} \text{ O₂} \rightarrow 6 \text{ CO₂} + 3 \text{ H₂O} \]

\[ \begin{array}{c|c|c|c|c|c|c}
\text{V}_{\text{C₆H₆}} & \text{M}_{\text{C₆H₆}} & \{\text{C₆H₆}\} & \{\text{H₂O}\} & \text{M}_{\text{H₂O}} & \text{V}_{\text{H₂O}} \\
\hline
2000 \text{ ml} & 1564 \text{ g} & 20.1 \text{ mole} & 60.3 \text{ mole} & 1082 \text{ g} & \text{1.08 liter} \\
\end{array} \]

10. How many grams of carbon dioxide will be produced upon combustion of 1 liter of propane (C₃H₈)? The density of propane is D = 0.782 g/ml.

\[ \text{C₃H₈} + 5 \text{ O₂} \rightarrow 3 \text{ CO₂} + 4 \text{ H₂O} \]

\[ \begin{array}{c|c|c|c|c|c|c}
\text{V}_{\text{C₃H₈}} & \text{M}_{\text{C₃H₈}} & \{\text{C₃H₈}\} & \{\text{CO₂}\} & \text{M}_{\text{CO₂}} \\
\hline
1000 \text{ ml} & 782 \text{ g} & 17.8 \text{ mole} & 53.3 \text{ mole} & \text{2350 g} \\
\end{array} \]