

## Stoichiometry Practice Problems

1. A piece of magnesium burns in the presence of oxygen, forming magnesium oxide (MgO). How many moles of oxygen are needed to produce 12 moles of magnesium oxide?  $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$

$$\left( \frac{1 \text{ mol O}_2}{2 \text{ mol MgO}} \right) 12 \text{ mol MgO} \times \frac{1 \text{ mol O}_2}{2 \text{ mol MgO}} = 6 \text{ mol O}_2$$

2. The carbon dioxide exhaled by astronauts can be removed from a spacecraft by reacting it with lithium hydroxide (LiOH). The reaction is as follows:  $\text{CO}_2(g) + 2\text{LiOH}(s) \rightarrow \text{Li}_2\text{CO}_3(s) + \text{H}_2\text{O}(l)$ . An average person exhales about 20 moles of  $\text{CO}_2$  per day. How many moles of LiOH would be required to maintain two astronauts in a spacecraft for three days?

$$\left( \frac{1 \text{ mol CO}_2}{2 \text{ mol LiOH}} \right) 20 \text{ mol CO}_2 \times \frac{2 \text{ mol LiOH}}{1 \text{ mol CO}_2} = 40 \text{ mol LiOH}$$

$\times 2 \text{ astronauts}$   

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 $80 \text{ mol LiOH}$   
 $\times 3 \text{ days}$   

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 $240 \text{ mol LiOH}$

3. Balance the following equation and answer the questions below.  $2\text{KClO}_3(s) \rightarrow 2\text{KCl}(s) + 3\text{O}_2(g)$

- a. How many moles of  $\text{O}_2$  are produced from 10 moles of  $\text{KClO}_3$ ?

$$\left( \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} \right) 10 \text{ mol KClO}_3 \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} = 15.0 \text{ mol O}_2$$

- b. How many moles of KCl are produced using 3 moles of  $\text{KClO}_3$ ?

$$\left( \frac{2 \text{ mol KCl}}{2 \text{ mol KClO}_3} \right) 3 \text{ mol KClO}_3 \times \frac{2 \text{ mol KCl}}{2 \text{ mol KClO}_3} = 3 \text{ mol KCl}$$

- c. How many moles of  $\text{KClO}_3$  are needed to produce 50 moles of  $\text{O}_2$ ?

$$\left( \frac{2 \text{ mol KClO}_3}{3 \text{ mol O}_2} \right) 50 \text{ mol O}_2 \times \frac{2 \text{ mol KClO}_3}{3 \text{ mol O}_2} = 33 \text{ mol KClO}_3$$

4. The following reaction occurs in plants undergoing photosynthesis.  $6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g})$   
 How many grams of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) are produced when 24.0 moles of carbon dioxide reacts in excess water?

$$24.0 \text{ mol } \cancel{\text{CO}_2} \times \frac{1 \text{ mol } \text{C}_6\text{H}_{12}\text{O}_6}{6 \text{ mol } \cancel{\text{CO}_2}} = 4.00 \text{ mol } \text{C}_6\text{H}_{12}\text{O}_6$$

$$4.00 \text{ mol } \cancel{\text{C}_6\text{H}_{12}\text{O}_6} \times \frac{180.18 \text{ g } \text{C}_6\text{H}_{12}\text{O}_6}{1 \text{ mol } \cancel{\text{C}_6\text{H}_{12}\text{O}_6}} = 721 \text{ g } \text{C}_6\text{H}_{12}\text{O}_6$$

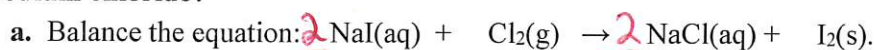
5. Calculate the mass of sodium chloride ( $\text{NaCl}$ ) produced when 5.50 moles of sodium reacts in excess chlorine gas.



$$5.50 \text{ mol } \cancel{\text{Na}} \times \frac{2 \text{ mol } \text{NaCl}}{2 \text{ mol } \cancel{\text{Na}}} = 5.50 \text{ mol } \text{NaCl}$$

$$5.50 \text{ mol } \cancel{\text{NaCl}} \times \frac{58.44 \text{ g } \text{NaCl}}{1 \text{ mol } \cancel{\text{NaCl}}} = 321 \text{ g } \text{NaCl}$$

6. How many grams of chlorine gas must be reacted with excess sodium iodide ( $\text{NaI}$ ) to produce 6.00 moles of sodium chloride?



- b. Perform the calculation.

$$6.00 \text{ mol } \cancel{\text{NaCl}} \times \frac{1 \text{ mol } \text{Cl}_2}{2 \text{ mol } \cancel{\text{NaCl}}} = 3 \text{ mol } \text{Cl}_2$$

$$3 \text{ mol } \cancel{\text{Cl}_2} \times \frac{70.90 \text{ g } \text{Cl}_2}{1 \text{ mol } \cancel{\text{Cl}_2}} = 213 \text{ g } \text{Cl}_2$$

7. Calculate the mass of hydrochloric acid ( $\text{HCl}$ ) needed to react with 5.00 moles of zinc.



- b. Perform the calculation.

$$5.00 \text{ mol } \cancel{\text{Zn}} \times \frac{2 \text{ mol } \text{HCl}}{1 \text{ mol } \cancel{\text{Zn}}} = 10 \text{ mol } \text{HCl}$$

$$10 \text{ mol } \cancel{\text{HCl}} \times \frac{36.46 \text{ g } \text{HCl}}{1 \text{ mol } \cancel{\text{HCl}}} = 365 \text{ g } \text{HCl}$$



8. How many grams of sodium hydroxide (NaOH) are needed to completely react with 50.0 grams of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) to form sodium sulfate (Na<sub>2</sub>SO<sub>4</sub>) and water?  $2\text{NaOH}(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}(\text{g})$

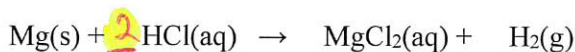
#1  $50.0 \text{ g H}_2\text{SO}_4 \times \frac{1 \text{ mol H}_2\text{SO}_4}{98.09 \text{ g H}_2\text{SO}_4} = 0.510 \text{ mol H}_2\text{SO}_4$

#2  $0.510 \text{ mol H}_2\text{SO}_4 \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} = 1.02 \text{ mol NaOH}$

#3  $1.02 \text{ mol NaOH} \times \frac{40.00 \text{ g NaOH}}{1 \text{ mol NaOH}} = 40.8 \text{ g NaOH}$

9. Balance each equation and solve the problem.

a. If 40.0 g of magnesium reacts with excess hydrochloric acid (HCl), how many grams of magnesium chloride (MgCl<sub>2</sub>) are produced?

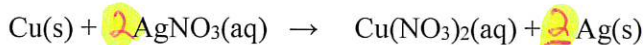


#1  $40.0 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.31 \text{ g Mg}} = 1.645 \text{ mol Mg}$

#2  $1.645 \text{ mol Mg} \times \frac{1 \text{ mol MgCl}_2}{1 \text{ mol Mg}} = 1.645 \text{ mol MgCl}_2$

#3  $1.645 \text{ mol MgCl}_2 \times \frac{95.21 \text{ g MgCl}_2}{1 \text{ mol MgCl}_2} = 157 \text{ g MgCl}_2$

b. Determine the mass of copper needed to react completely with a solution containing 12.0 g of silver nitrate (AgNO<sub>3</sub>).

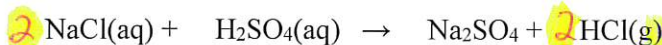


#1  $12 \text{ g AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{169.88 \text{ g AgNO}_3} = 0.0706 \text{ mol AgNO}_3$

#2  $0.0706 \text{ mol AgNO}_3 \times \frac{1 \text{ Cu}}{1 \text{ mol AgNO}_3} = 0.0353 \text{ mol Cu}$

#3  $0.0353 \text{ mol Cu} \times \frac{63.55 \text{ g Cu}}{1 \text{ mol Cu}} = 2.24 \text{ g Cu}$

c. How many grams of hydrogen chloride (HCl) are produced when 15.0 g of sodium chloride (NaCl) reacts with excess sulfuric acid (H<sub>2</sub>SO<sub>4</sub>)?

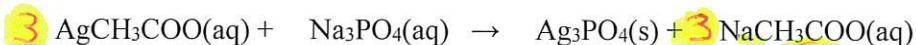


#1  $15.0 \text{ g NaCl} \times \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} = 0.2567 \text{ mol NaCl}$

#2  $0.2567 \text{ mol NaCl} \times \frac{2 \text{ mol HCl}}{2 \text{ mol NaCl}} = 0.2567 \text{ mol HCl}$

#3  $0.2567 \text{ mol HCl} \times \frac{36.46 \text{ g HCl}}{1 \text{ mol HCl}} = 9.36 \text{ g HCl}$

d. Calculate the mass of silver phosphate (Ag<sub>3</sub>PO<sub>4</sub>) produced if 30.0 g of silver acetate (AgCH<sub>3</sub>COO) reacts with excess sodium phosphate (Na<sub>3</sub>PO<sub>4</sub>).



#1  $30.0 \text{ g AgCH}_3\text{COO} \times \frac{1 \text{ mol AgCH}_3\text{COO}}{166.92 \text{ g AgCH}_3\text{COO}} = 0.1797 \text{ mol AgCH}_3\text{COO}$

#2  $0.1797 \text{ mol AgCH}_3\text{COO} \times \frac{1 \text{ mol Ag}_3\text{PO}_4}{3 \text{ mol AgCH}_3\text{COO}} = 0.0599 \text{ mol Ag}_3\text{PO}_4$

#3  $0.0599 \text{ mol Ag}_3\text{PO}_4 \times \frac{418.58 \text{ g Ag}_3\text{PO}_4}{1 \text{ mol Ag}_3\text{PO}_4} = 25.1 \text{ g Ag}_3\text{PO}_4$

