

# Mole-Mole practice Problems

**How many steps are needed for each of these problems and why?**

Solve each problem and report your answer to the correct number of significant figures. Show all work. Be sure the equation is balanced before you begin.

1. In the following reaction, how many moles of iron are produced if 8 moles of Iron (III) oxide are decomposed by electrolysis?  
$$2 \text{Fe}_2\text{O}_3 \rightarrow 4 \text{Fe} + 3 \text{O}_2$$
2. How many moles of aluminum are required to react with 2.0 moles of iron(III) oxide?  
$$\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$$
3. How many moles of carbon dioxide are produced if 7 moles of methane are combusted?  
$$\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$$
4. When 1.50 moles of aluminum oxide decomposes into aluminum and oxygen gas, how many moles of oxygen are produced? Write the balanced equation before you begin.
5. Determine the moles of nickel (II) hydroxide are produced when 0.730 moles of nickel(II) nitrate reacts with sodium hydroxide in a double-replacement reaction.  
$$\text{Ni}(\text{NO}_3)_2 + 2\text{NaOH} \rightarrow \text{Ni}(\text{OH})_2 + 2\text{NaNO}_3$$
6. Lithium nitride reacts with water to produce ammonia ( $\text{NH}_3$ ) and lithium hydroxide. Determine the moles of ammonia produced when 30. moles of lithium nitride completely reacts with excess water.  
$$\text{Li}_3\text{N} + 3 \text{H}_2\text{O} \rightarrow \text{NH}_3 + 3 \text{LiOH}$$
7. In a soda-acid fire extinguisher, concentrated sulfuric acid reacts with sodium hydrogen carbonate to produce carbon dioxide, sodium sulfate and water. How many moles of sodium hydrogen carbonate are produced from a reaction of 0.40 moles of sulfuric acid? Write the balanced equation first.

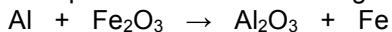
## Mass problems

(How many steps are needed in these problems and why?) Solve each and show your work. Be sure the equations are balanced before you begin.

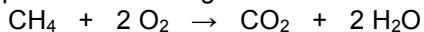
1. In the following reaction, how many grams of oxygen are produced if 155 grams of Iron (III) oxide are decomposed by electrolysis?



2. How many grams of aluminum are required to react with 27.8 grams of iron(III) oxide?



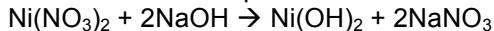
3. How many grams of water are produced if 50.0 grams of methane are combusted?



4. When 9.8 grams of aluminum oxide decomposes into aluminum and oxygen gas at STP, how many grams of aluminum are produced?



5. Determine the mass of sodium nitrate produced when 0.73 grams of nickel(II) nitrate reacts with sodium hydroxide in a double-replacement reaction.



6. Lithium nitride reacts with water to produce ammonia ( $\text{NH}_3$ ) and lithium hydroxide. Determine the mass of lithium hydroxide produced when 3.80 grams of lithium nitride completely reacts with water.



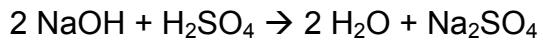
7. In a soda-acid fire extinguisher, concentrated sulfuric acid reacts with sodium bicarbonate to produce carbon dioxide, sodium sulfate and water. How many grams of sodium bicarbonate are produced from a reaction of 150.0 grams of sulfuric acid?

8. Given the single-replacement reaction between aluminum metal and copper(II) sulfate, how many grams of copper could theoretically be produced from 37.5 grams of aluminum?

## **Stoichiometry Practice Worksheet**

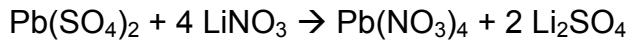
*Solve the following stoichiometry grams-grams problems:*

- 1) Using the following equation:



How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

- 2) Using the following equation:



How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

## Mixed Stoichiometry Practice

Write and/or balance the following equations (remember the diatomic elements and to criss-cross charges for ionic compounds!!!) Use the mole ratios from the balanced equations to solve the following stoichiometry problems. Use units and labels in all conversions, and round your answer to sig figs.

1. Potassium chlorate decomposes into potassium chloride and oxygen gas.

**Balanced Equation:**

2. How many moles of oxygen are produced when 3.0 moles of potassium chlorate decompose completely?

3. Butane ( $C_4H_{10}$ ) undergoes combustion.

**Balanced Equation:** \_\_\_\_\_  $C_4H_{10}(l)$  + \_\_\_\_\_  $O_2(g)$   $\rightarrow$  \_\_\_\_\_  $CO_2(g)$  + \_\_\_\_\_  $H_2O(l)$

4. How many moles of  $CO_2$  are produced when 88 g of  $O_2$  are reacted with an excess of butane?

5. Water decomposes into hydrogen gas and oxygen gas.

**Balanced Equation:**

6. How many grams of hydrogen will be produced when 6.0 moles of oxygen are produced?

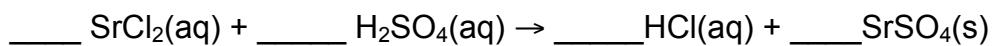
7. How many grams of water are required to produce 9.00 grams of hydrogen?

8. Cobalt(II) chloride reacts with fluorine in a single replacement reaction to produce cobalt(II) fluoride and chlorine gas.

**Balanced Equation:** \_\_\_\_\_ CoCl<sub>2</sub> + \_\_\_\_\_ F<sub>2</sub> → \_\_\_\_\_ CoF<sub>2</sub> + \_\_\_\_\_ Cl<sub>2</sub>

9. How many moles of fluorine are required to produce 290.8 g of cobalt(II) fluoride?

10. Balance the following equation.



11. What is the mass of strontium chloride that reacts with 300.0 g of sulfuric acid?

12. Solid iron(III) oxide reacts with hydrogen gas to form iron and water.

**Balanced Equation:**

13. How many grams of iron are produced when 4.50 moles of iron(III) oxide are reacted?

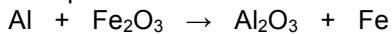
14. How many moles of water will be produced when 0.0155 moles of hydrogen gas react completely with iron(III) oxide?

## Particle Problems

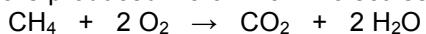
(How many steps are needed in these problems and why?) Solve each and show your work. Be sure the equations are balanced before you begin.

1. In the following reaction, how many molecules of oxygen are produced if 2 moles of Iron (III) oxide are decomposed by electrolysis?  $2 \text{Fe}_2\text{O}_3 \rightarrow 4 \text{Fe} + 3 \text{O}_2$

2. How many atoms of aluminum are required to react with 1.00 moles of iron(III) oxide?



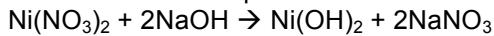
3. How many molecules of water are produced if  $5.0 \times 10^{23}$  molecules of methane are combusted?



4. When  $9.8 \times 10^{23}$  formula units of aluminum oxide decomposes into aluminum and oxygen gas at STP, how many grams of aluminum are produced? (FYI: a formula unit is the ionic equivalent of "molecules".)



5. Determine the mass of sodium nitrate produced when 0.73 moles of nickel(II) nitrate reacts with sodium hydroxide in a double-replacement reaction.



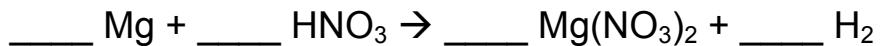
6. Lithium nitride reacts with water to produce ammonia ( $\text{NH}_3$ ) and lithium hydroxide. Determine the moles of lithium hydroxide produced when  $3.80 \times 10^{24}$  molecules of water reacts.



7. Given the single-replacement reaction between aluminum metal and copper(II) sulfate, how many atoms of copper could theoretically be produced from 37.5 grams of aluminum?

## **Percent Yield Calculations**

- 1) Balance this equation and state which of the six types of reaction is taking place:



Type of reaction: \_\_\_\_\_

- 2) If I start this reaction with 40 grams of magnesium and an excess of nitric acid, how many grams of hydrogen gas will I produce?

- 3) If 1.7 grams of hydrogen is actually produced, what was my percent yield of hydrogen?

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- 4) Balance this equation and state what type of reaction is taking place:



Type of reaction: \_\_\_\_\_

- 5) If 25 grams of carbon dioxide gas is produced in this reaction, how many grams of sodium hydroxide should be produced?

- 6) If 50 grams of sodium hydroxide are actually produced, what was my percent yield?

## More Exciting Stoichiometry Problems including limiting reagent!

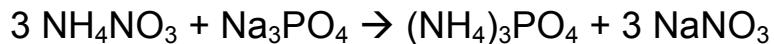
*Answer the following stoichiometry-related questions:*

## Limiting Reagent Worksheet

For the following reactions, find the following:

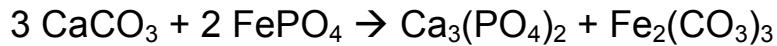
- a) Which of the reagents is the limiting reagent?
- b) What is the maximum amount of each product that can be formed?
- c) How much of the other reagent is left over after the reaction is complete?

1) Consider the following reaction:



Answer the questions above, assuming we started with 30 grams of ammonium nitrate and 50 grams of sodium phosphate.

2) Consider the following reaction:



Answer the questions at the top of this sheet, assuming we start with 100 grams of calcium carbonate and 45 grams of iron (III) phosphate.