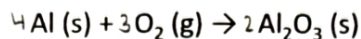


## Example

What mass (g) of  $\text{Al}_2\text{O}_3$  is formed if 75.89 g of Al (s) (26.98 g/mol) is reacted with 112.25 g  $\text{O}_2$  (g)?



a. Balance the chemical equation for the reaction.

b. Find moles of Al (s) available.

$$75.89\text{ g} \cdot \frac{1\text{ mol}}{26.98\text{ g}} = 2.81\text{ mol}$$

c. Find moles  $\text{O}_2$  (g) available.

$$112.25\text{ g} \cdot \frac{1\text{ mol}}{32\text{ g}} = 3.51\text{ mol}$$

d. Determine if  $\text{Al (s)}$  or  $\text{O}_2$  (g) is the *limiting reactant*.

$$2.81\text{ mol Al} \cdot \frac{3\text{ O}_2}{4\text{ Al}} = 2.11\text{ mol O}_2$$

The reactant that is used up first

## Example

e. Determine moles of  $\text{Al}_2\text{O}_3$  that can be produced based on the limiting reactant.

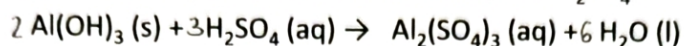
$$2.81\text{ mol Al} \cdot \frac{2\text{ Al}_2\text{O}_3}{4\text{ Al}} = 1.41\text{ mol Al}_2\text{O}_3$$

f. Calculate the mass of  $\text{Al}_2\text{O}_3$  (101.96 g/mol) that will be produced.

$$1.41\text{ mol} \cdot \frac{101.96\text{ g}}{1\text{ mol}} = 143.76\text{ g}$$

## Example

What mass (g) of  $\text{Al}_2(\text{SO}_4)_3$  (342.15 g/mol) is formed if 31.2 g of  $\text{Al}(\text{OH})_3$  (78.0 g/mol) is combined with 0.500 mol  $\text{H}_2\text{SO}_4$ ?



- Balance the chemical equation for the reaction.
- Find moles of  $\text{Al}(\text{OH})_3$  (s) available.

$$31.2 \text{ g} \cdot \frac{1 \text{ mol}}{78 \text{ g}} = 0.4 \text{ mol}$$

- Determine if  $\text{Al}(\text{OH})_3$  (s) or  $\text{H}_2\text{SO}_4$  (aq) is the *limiting reactant*.

$$0.4 \text{ mol Al}(\text{OH})_3 \cdot \frac{3 \text{ H}_2\text{SO}_4}{2 \text{ Al}(\text{OH})_3} = 0.6 \text{ mol H}_2\text{SO}_4$$

## Example

- Determine moles of  $\text{Al}_2(\text{SO}_4)_3$  that can be produced based on the limiting reactant.

$$0.5 \text{ mol H}_2\text{SO}_4 \cdot \frac{1 \text{ Al}_2(\text{SO}_4)_3}{3 \text{ H}_2\text{SO}_4} = 0.17 \text{ mol Al}_2(\text{SO}_4)_3$$

- Calculate the mass of  $\text{Al}_2(\text{SO}_4)_3$  that will be produced.

$$0.17 \text{ mol} \cdot \frac{342.15 \text{ g}}{1 \text{ mol}} = 58.17 \text{ g} \quad \text{Theoretical yield}$$

- When the reaction was performed 41.2 g of  $\text{Al}_2(\text{SO}_4)_3$  was produced. Calculate the *percent yield* for the reaction.

$$\frac{41.2}{58.17} = 70.8\%$$