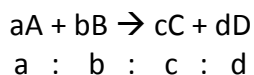


## CHEM110 – Stoichiometric Calculations

These types of questions are essentially all the same. You are given a chemical equation and a mass, a volume or a pressure and are required to determine the mass, volume or pressure of another substance in the reaction. The pattern followed is always the same. For now we will worry only about starting with a mass and move onto volumes and pressures later on. The key linking the substances is the MOLE RATIO  $\rightarrow a : b : c : d$

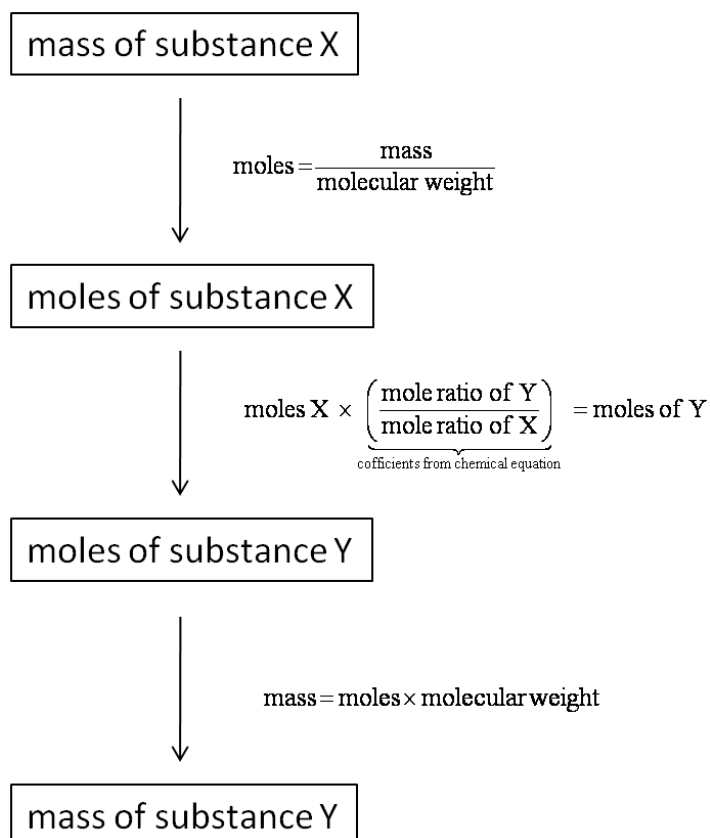


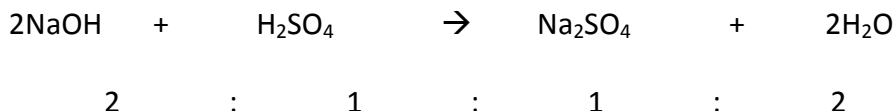
Step 1: Calculate moles of whatever substance you have been given the mass for, using molecular weight (MW) of that substance

Step 2: Use mole ratio from chemical equation to convert moles of what you have been given information about (answer from step 1) to moles of whichever substance you need to know about.

Step 3: Use molecular weight of the substance of interest to convert moles of that substance (answer from step 2) into mass.

These steps are shown in a flow diagram below. There is a similar one in your text book in Figure 2.13 on page 75. An important point to remember is that substance X can be any reactant or product and substance Y can be any reactant or product.





1. Question: How many grams of H<sub>2</sub>O can be produced from 125.3g NaOH?

Translation: Convert mass of NaOH to mass of H<sub>2</sub>O

**mass NaOH → moles NaOH → moles H<sub>2</sub>O → mass H<sub>2</sub>O**

$$125.3 \text{ g NaOH} \times \underbrace{\left( \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} \right)}_{\text{molecular weight of NaOH}} \times \underbrace{\left( \frac{2 \text{ mol H}_2\text{O}}{2 \text{ mol NaOH}} \right)}_{\text{mole ratio}} \times \underbrace{\left( \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right)}_{\text{molecular weight of H}_2\text{O}} = 56.45 \text{ g H}_2\text{O}$$

2. Question: How many grams of Na<sub>2</sub>SO<sub>4</sub> can be produced from 125.3g NaOH?

Translation: Convert mass of NaOH to mass of Na<sub>2</sub>SO<sub>4</sub>

**mass NaOH → moles NaOH → moles Na<sub>2</sub>SO<sub>4</sub> → mass Na<sub>2</sub>SO<sub>4</sub>**

$$125.3 \text{ g NaOH} \times \underbrace{\left( \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} \right)}_{\text{molecular weight of NaOH}} \times \underbrace{\left( \frac{1 \text{ mol Na}_2\text{SO}_4}{2 \text{ mol NaOH}} \right)}_{\text{mole ratio}} \times \underbrace{\left( \frac{142.0 \text{ g Na}_2\text{SO}_4}{1 \text{ mol Na}_2\text{SO}_4} \right)}_{\text{molecular weight of Na}_2\text{SO}_4} = 222.4 \text{ g Na}_2\text{SO}_4$$

3. Question: How many grams of H<sub>2</sub>SO<sub>4</sub> are needed to react with 125.3g NaOH?

Translation: Convert mass of NaOH to mass of H<sub>2</sub>SO<sub>4</sub>

**mass NaOH → moles NaOH → moles H<sub>2</sub>SO<sub>4</sub> → mass H<sub>2</sub>SO<sub>4</sub>**

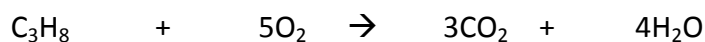
$$125.3 \text{ g NaOH} \times \underbrace{\left( \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} \right)}_{\text{molecular weight of NaOH}} \times \underbrace{\left( \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} \right)}_{\text{mole ratio}} \times \underbrace{\left( \frac{98.08 \text{ g H}_2\text{SO}_4}{1 \text{ mol H}_2\text{SO}_4} \right)}_{\text{molecular weight of H}_2\text{SO}_4} = 153.6 \text{ g H}_2\text{SO}_4$$

4. Question: How many grams of H<sub>2</sub>O are produced if 210.3g of Na<sub>2</sub>SO<sub>4</sub> are produced?

Translation: Convert mass of H<sub>2</sub>O to mass of Na<sub>2</sub>SO<sub>4</sub>

**mass Na<sub>2</sub>SO<sub>4</sub> → moles Na<sub>2</sub>SO<sub>4</sub> → moles H<sub>2</sub>O → mass H<sub>2</sub>O**

$$210.3 \text{ g Na}_2\text{SO}_4 \times \underbrace{\left( \frac{1 \text{ mol Na}_2\text{SO}_4}{142.00 \text{ g Na}_2\text{SO}_4} \right)}_{\text{molecular weight of Na}_2\text{SO}_4} \times \underbrace{\left( \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol Na}_2\text{SO}_4} \right)}_{\text{mole ratio}} \times \underbrace{\left( \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right)}_{\text{molecular weight of H}_2\text{O}} = 53.37 \text{ g H}_2\text{O}$$



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5. Question: How many grams of  $\text{H}_2\text{O}$  can be produced from 62.7g  $\text{C}_3\text{H}_8$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

6. Question: How many grams of  $\text{CO}_2$  can be produced from 62.7g  $\text{C}_3\text{H}_8$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

7. Question: How many grams of  $\text{O}_2$  are needed to react with 62.7g  $\text{C}_3\text{H}_8$ ?

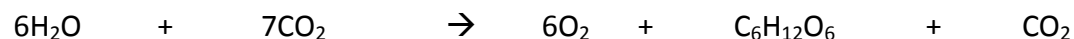
Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

8. Question: How many grams of  $\text{O}_2$  will be produced if 47.09g of  $\text{CO}_2$  are produced?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_



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9. Question: How many grams of  $\text{C}_6\text{H}_{12}\text{O}_6$  can be produced from 45.0g  $\text{CO}_2$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

10. Question: How many grams of  $\text{H}_2\text{O}$  are required to react with 120.4g  $\text{CO}_2$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

11. Question: How many grams of  $\text{CO}_2$  are required to produce 15.0g of  $\text{C}_6\text{H}_{12}\text{O}_6$ ?

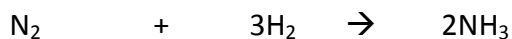
Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

12. Question: How many grams of  $\text{O}_2$  will be produced if 56.0g of  $\text{CO}_2$  are produced?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_



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13. Question: How many grams of  $\text{NH}_3$  can be produced from 55.0g  $\text{N}_2$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

14. Question: How many grams of  $\text{N}_2$  are required to produce 37g of  $\text{NH}_3$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

15. Question: How many grams of  $\text{H}_2$  are required to react with 15.0g of  $\text{N}_2$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_

16. Question: How many grams of  $\text{N}_2$  are required to react with 15.0g of  $\text{H}_2$ ?

Translation: Convert mass of \_\_\_\_\_ to mass of \_\_\_\_\_

mass \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  moles \_\_\_\_\_  $\rightarrow$  mass \_\_\_\_\_