

Chapter 11

Warm Up!

- Write the balanced chemical equation for the combustion of ethane (C_2H_6) (don't worry about net ionics!).
- Write the balanced chemical equation for aluminum reacting with copper (II) chloride.

Today's Agenda

- QOTD : What is stoichiometry and how do we use balanced equations to calculate quantities used in chemical processes?
- Intro to stoichiometry
- Stoichiometric calculations
- **Quiz Friday!** Empirical and molecular formulas, hydrate lab, basic stoichiometry.
- **Homework:** Ch 10- 181, 186, 187 and Ch 11- 42, 44, 46, 50, 54, 60, 61, 62, 65, 66 and review sheet **due Friday.**

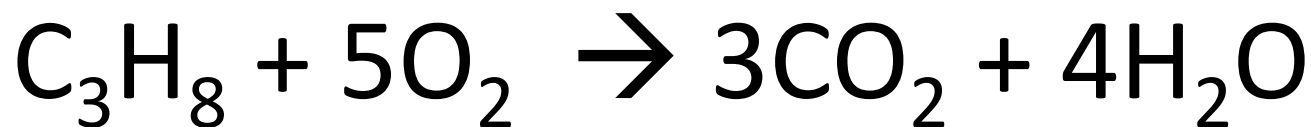
Stoichiometry

- Stoichiometry (s-toy-key-ometry) – study of the quantitative relationships.
- We take balanced chemical equations and mole conversions to calculate how much reactants you will need to make a sufficient amount of products!

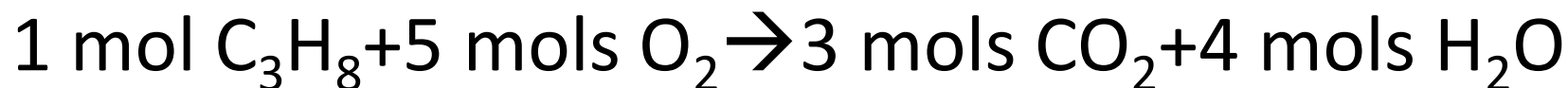
Conservation of Mass

- Mass is neither created nor destroyed.
- The combustion of C₃H₈ (propane) provides energy to heat homes and cook food! Show that the law of conservation of mass is conserved.





- The equation tells us how many moles of each compound! We need to use this information to find mass and see if the mass is the same on both sides:
 1. Find moles
 2. Find mass



Use moles to find mass

$$1 \text{ mol C}_3\text{H}_8 \times \frac{44.09 \text{ g C}_3\text{H}_8}{1 \text{ mol C}_3\text{H}_8} = 44.1 \text{ g C}_3\text{H}_8$$

$$5 \text{ mol O}_2 \times \frac{32.0 \text{ g O}_2}{1 \text{ mol O}_2} = 160.0 \text{ g O}_2$$

204.1 g reactants

$$3 \text{ mol CO}_2 \times \frac{44.01 \text{ g CO}_2}{1 \text{ mol CO}_2} = 132.0 \text{ g CO}_2$$

$$4 \text{ mol H}_2\text{O} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 72.08 \text{ g H}_2\text{O}$$

204.1 g reactants

Check the law of conservation of mass

- Write the complete chemical reaction, balance it, find the moles and convert to mass!
- Hydrochloric acid reacts with potassium hydroxide.
- Magnesium ribbon is burned in oxygen (just like you did in lab!!)

Basic Stoich Problems

1. You must know how to write and balance a chemical equation. (You **MUST** be successful with these tasks before you can tackle stoich!)
2. Identify your given and convert to moles. If you are given moles, move on!
3. Make a mole to mole ratio using **COEFFICIENTS** from your balanced chemical reaction.
4. Convert from moles to desired units, unless you want moles.

Example!

How many liters of CO_2 are produced when you combust 5 g of ethane (C_2H_6) gas?

1.) Write balanced chemical equation:



$$2.) \quad \cancel{5\text{g C}_2\text{H}_6} \times \frac{1 \text{ mol C}_2\text{H}_6}{\cancel{30 \text{ g C}_2\text{H}_6}} = 0.167 \text{ mol C}_2\text{H}_6$$

$$3.) \quad 0.167 \text{ mol } \cancel{\text{C}_2\text{H}_6} \times \frac{4 \text{ mol CO}_2}{\cancel{2 \text{ mol C}_2\text{H}_6}} = 0.333 \text{ mol CO}_2$$

Example

- Now we have moles of CO₂ and we need liters!
Convert to liters!

- $0.333 \cancel{\text{ mol CO}_2} \times \frac{22.4 \text{ L CO}_2}{1 \cancel{\text{ mol CO}_2}} = 7.47 \text{ L CO}_2$

- You can do it all in one step if you want!

$$5\text{g C}_2\text{H}_6 \times \frac{1 \text{ mol C}_2\text{H}_6}{30 \text{ g C}_2\text{H}_6} \times \frac{4 \text{ mol CO}_2}{2 \text{ mol C}_2\text{H}_6} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mol CO}_2} = 7.47 \text{ L CO}_2$$

Example

- How many grams of aluminum are needed to react with a copper (II) chloride so that 2.4 grams of copper is produced?



$$2.4 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.5 \text{ gCu}} \times \frac{1 \text{ mol Al}}{3 \text{ mol Cu}} \times 27 \text{ g Al} = 0.34 \text{ g Al}$$

Your Turn

- How many L of carbon dioxide are produced from the combustion of 1.8 g of C_2H_6 ?
- If 31 grams of water are produced when hydrochloric acid reacts with calcium hydroxide, how many grams of calcium hydroxide were used?