If you are a student that **HAS** access to technology, this is not the packet for you. This packet is for students who pick up and drop off their work at the front office every week. If you have access to technology, please go back to your teacher's website and complete the correct assignment.

Name: _____ Period: _____ Teacher: _____

Distance Learning Week 7 Paper Packet
5/18/2020 – 5/24/2020

Assignment 7.1 - INTRODUCTION TO THE MOLE RATIO & STOICHIOMETRY

Patriot Pack Cookie Recipe:

- 3 cups dough + 1 cup chocolate chips → 15 cookies

Additional Information for the recipe:

- 1 cup of dough weighs 200.00 grams
- 1 cup chocolate chips has 100. chips in it.

Use the recipe and the additional information to answer the questions below.

1. How many cookies can you make from 6.00 cups dough, assuming an excess of chips (*that means you have as many chips as you need to make the cookies*)?

2. How many cookies can you make from 4.00 cups of chips, assuming excess of dough?

3. How many cookies can you make from 17.5 cups of dough, assuming an excess of chips?

4. How many cookies can you make from 18.0 cups of dough and 6.00 cups of chips?

5. How many cookies can you make from 18.0 cups of dough and 2.00 cups of chips?

6. How many cookies can you make from 400 chocolate chips, assuming enough dough?

7. How many cookies can you make from 400. g of dough, assuming enough chips?

8. How many cups of cookie dough are needed to make 60. Cookies?

An educated guess… What do you think stoichiometry is?

I think stoichiometry is _____

because _____.

Assignment 7.2: Mole Ratio Notes

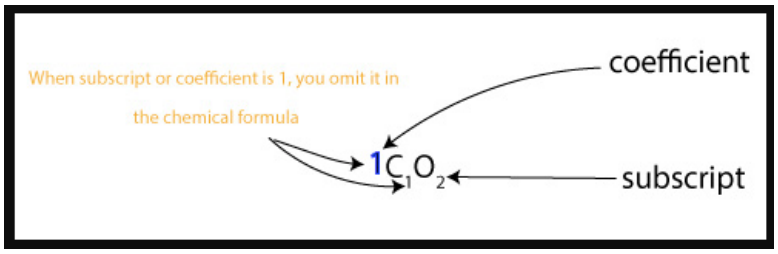
How to interpret a balanced chemical equation

You can interpret a balanced chemical equation in 2 ways:

1. In terms of atoms or molecules
2. In terms of moles

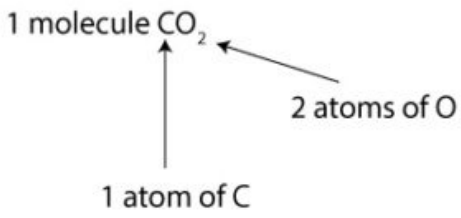
A bit of review:

- A molecule consists of at least 2 or more atoms bonded together:
- Example:

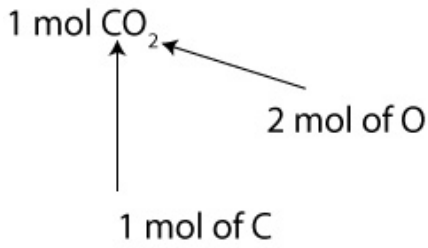


As you can see, a molecule usually consists of coefficients and subscripts. The coefficients can be interpreted as molecules or moles. While the subscripts can be interpreted as atoms or moles.

To interpret the chemical formula in terms of molecules, we will say 1 molecule of CO_2 consists of 1 atom of carbon (C) and 2 atoms of oxygen (O). Here is a picture of the interpretation:



To interpret the chemical formula in terms of moles, we will say 1 mol of CO_2 consists of 1 mol of carbon (C) and 2 mol of oxygen (O). Here is a picture of the interpretation:



Now, let's apply our understanding to interpret the following equation in terms of molecules and moles.

When hydrogen (H_2) reacts with iodine (I_2) to produce hydrogen iodide (HI), we can write a balanced chemical equation for the reaction as: **$H_2 + I_2$–> 2HI.**

To interpret this equation in terms of molecules: we can say that **1 molecule of H_2** reacts with **1 molecule of I_2** to give **2 molecules of HI.** Recall that the number 1 is implied when you don't see a number written in front of a chemical symbol or formula in a chemical equation.

To interpret equation A in terms of moles: we can say that **1 mole of H_2 molecules** reacts with **1 mole of**

It's sometimes confusing to interpret the mole this way. To ease this confusion a little, we can relate a mole to a dozen. For example, we can say that: 1 dozen H_2 molecules reacts with 1 dozen I_2 molecules to give 2 dozen HI molecules.

Chemists usually count individual atoms or molecules by weighing a bunch of them. This means that it's more useful to interpret the chemical equation in terms of moles. Once we do that, we can use the mole concept to work back to figure out the number of molecules in a substance.

Fill in the following the chart below using the information above:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

	N_2 Consumed	H_2 Consumed	NH_3 Produced	Ratio N_2:H_2:NH_3 (reduced)
For a single reaction, how many molecules of each substance would be consumed or produced?				
If the reaction occurred one hundred times, how many molecules would be consumed or produced?				
If the reaction occurred 538 times, how many molecules would be consumed or produced?				

	N_2 Consumed	H_2 Consumed	NH_3 Produced	Ratio N_2:H_2:NH_3
If the reaction occurred 6.02×10^{23} times, how many molecules would be consumed or produced?				
How many ***moles*** of each substance would be consumed or produced in the previous situation?				

What is a mole ratio?

A **mole ratio** is the **ratio** between the amounts in **moles** of any two compounds involved in a chemical reaction. **Mole ratios** are used as conversion factors between products and reactants in many chemistry problems

Example: $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$

Ratio of Al : O_2 is 4 mole Al : 3 mole O_2

Ratio of Al : Al_2O_3 is 4 mole Al : 2 mole Al_2O_3

Ratio of O_2 to Al_2O_3 is 3 mole O_2 : 2 mole Al_2O_3

Problem: $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$
If I have 6 moles of Al, how many moles of O_2 will react with it?

Solved: To solve the problem:

1. Find the given and the want. Given = 6 mol Al Want = ? mol O_2
2. Find the mole ratio between given and want. 4 moles Al: 3 moles O_2
3. Use dimensional analysis to cover the given to the want. Use the mole ratio as the conversion factor, and remember to put the units you START with on the BOTTOM so they cancel out!
4. To calculate, multiply the top numbers and divide by the bottom numbers. (6 x 3 ÷ 4 = 4.5)

$$\frac{6\ mol\ Al}{} \times \frac{3\ mol\ O_2}{4\ mol\ Al} = 4.5\ mol\ O_2$$

Now try these Problems: (answers at end of packet)

1) $2\ Mg + O_2 \rightarrow 2\ MgO$
   - If I have 3.6 moles of O_2, how many moles of MgO can I make?

2) $2\ Mg + O_2 \rightarrow 2\ MgO$
   - If I want to make 4.6 moles of MgO, how many moles of Mg do I need?

3) $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
   - If 4.5 moles of C_3H_8 combusts, how many moles of CO_2 will be produced?

4) $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
   - If I want to produce 7.65 moles of H_2O, how much O_2 should I use?

Assignment 7.3: Mole Ratio Practice

Before you begin, make sure you have completed assignment 7.1 and 7.2.

Please show your work for questions 1-14 on a separate sheet of paper. Take a picture of your work and submit it to turnitin.com. **You must show your work in order to receive full credit.**

1. Consider the following equation: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
   a. The mole ratio for $N_2 : H_2$ is **1 mol of N_2 : 3 moles of H_2**
   b. The mole ratio for $N_2 : NH_3$ is _____
   c. The mole ratio for $H_2 : NH_3$ is **3 mol of H_2 : 2 mol of NH_3**

Questions 3-12: Use the following chemical equation, it's already balanced.

$$2Na + Cl_2 \rightarrow 2NaCl$$

2. What is the mole ratio of Na : Cl_2 : NaCl?
3. What is the mole ratio of Na : Cl_2?
4. What is the mole ratio of Na : NaCl?
5. What is the mole ratio of Cl_2 : NaCl?

Example: If the reaction consumes 3 moles of Na (start), how many moles of Cl_2 (end) will be consumed?

Na : Cl_2 mole ratio = 2 mol of Na : 1 mole of Cl_2 (from question

3 ~~mol of Na~~ (what you **start** with)	**1 mol of Cl_2**	**= 1.5 mol of Cl_2** (what you **end** with)
	~~2 mol of Na~~	

Your mole ratio will go in the middle.

Notice that the mol of Na goes on the bottom because it needs to cancel out the mol of Na in the top left.

Now multiply everything on the top together, divided by everything on the bottom
→ (3 x 1 mol of Cl_2) / (2) = 1.5 mol of Cl_2

$$2Na + Cl_2 \rightarrow 2NaCl$$

6. If the reaction consumes 7.5 moles of Na, how many moles of Cl_2 will be consumed?

Na : Cl_2 mole ratio = _____ (answer to question 4)

(what you **start** with)		(what you **end** with)

remember that your mole ratio goes in the middle

7. If the reaction consumes 4 moles of Cl_2, how many moles of Na will be consumed?

8. If the reaction produces 13.5 moles of NaCl, how many moles of Cl_2 will be consumed?

NaCl : Cl_2 mole ratio = _____ (answer to question 5)

9. If the reaction produces 23 moles of NaCl, how many moles of Na will be consumed?

Question 10-11: Use the following chemical equation, it's already balanced.

$$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$$

10. If the reaction consumes 5.9 moles of Fe_2O_3, how many moles of CO_2 are produced?
11. If the reaction consumes 2.21 moles of C, how many moles of Fe_2O_3 are consumed?

Question 12-14: Use the following chemical equation, it's already balanced.

$$C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2$$

12. How many moles of O_2 will I need to produce 8.2 moles of H_2O?
13. How many moles of C_3H_8 will react with 13.2 moles of O_2?
14. How many moles of CO_2 will 0.52 moles of O_2 produce?

Optional challenge question: This equation is not balanced (you have to balance it first).

$$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$$

How many moles of H_2O will 7.7 moles of $C_6H_{12}O_6$ produce? How many grams of H_2O (use mole island)?

Answer Keys:

7.1

1. 30 cookies
2. 60 cookies
3. 87 cookies
4. 90 cookies
5. 30 cookies (you're limited by how many chips you have, you have enough dough for 90 cookies, but not enough chips and cookies without chocolate chips are basically crackers).
6. 60 cookies
7. 10 cookies
8. 12 cups dough

7.2

1) 7.6 mol MgO
2) 4.6 mol Mg
3) 13.5 mol CO_2
4) 9.56 mol O_2

7.3

6) 3.75 mol Cl_2
7) 8 mol Na
8) 6.75 mol Cl_2
9) 23 mol NaCl
10) 8.85 mol O_2
11) 1.47 mol Fe_2O_3
12) 10.25 mol H_2O
13) 0.04 mol C_3H_8
14) 0.312 mol CO_2

challenge problem: 46.2 mol H_2O; 831.6 g H_2O