**Stoichiometry of S’mores**

Purpose of this activity: stoichiometry is fun and s’mores taste good. We are practicing stoichiometry with a hands on example. We are also determining the meaning of “limiting reactant”.

**Materials:**

1 “sample bag” of chocolate bars per group  
1 “sample bag” of marshmallows per group  
1 “sample bag” of graham crackers per group Paper Towels  
An electronic balance  
A Bunsen burner  
Wooden sticks

**Procedure:** do not open the bags until directions say to make the s’mores.

1. Write a balanced equation for a s’mores using the following information: you need 2 moles of G2 (graham crackers) added to 1 mole of C2 (chocolate) and 1 mole of M (marshmallow) to yield 1 mole of G4C3M (a s’more).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How many moles of each reactant do you have in your sample bag?
2. Marshmallow (M) \_\_\_\_\_\_\_\_
3. Graham crackers (G2) \_\_\_\_\_\_\_\_
4. Chocolate (C2) \_\_\_\_\_\_\_\_

3. Based on the number of each reactant in your sample bag, and the equation to synthesize a S’more – how many S’mores could you synthesize? \_\_\_\_\_\_\_

Which reactant was used up first (ran out first)? \_\_\_\_\_\_\_\_\_\_\_\_

This is known as your limiting reactant: The reactant in a chemical reaction that limits the amount of product that can be formed. The reaction will stop when all of the limiting reactant is consumed

Which reactants were left over? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This is known as your excess reactant: The reactant in a chemical reaction that

remains when a reaction stops when the limiting reactant is completely consumed. The excess reactant remains because there is nothing with which it can react.

Now use the following data from our s’more periodic table for your calculations:

Chocolate (C2) has a molar mass of 7.3 grams

Graham cracker (G2) has a molar mass of 7.4 grams

Marshmallow (M) has a molar mass of 6.9 grams

4. Weigh your samples on the balance> DO NOT remove form the bag yet. Just subtract the mass of a bag from you weights (mass of a bag is 4.7 grams.

|  |  |
| --- | --- |
| Sample | Mass(g) |
| chocolate |  |
| Graham crackers |  |
| marshmallows |  |

5. Calculate the molar mass of 1 s’more (look at the equation and the information given above for molar masses.)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Using stoichiometry, the information you got in question 4, and the balanced equation from question 1 calculate how many grams of s’mores can be made from the amounts of each one of your ingredients. Hint: each one of these problems involves a gram to gram conversion with 4 sets of parenthesis.

**Chocolate**

**Graham cracker**

**Marshmallow**

7. Looking at your answers from step 6, which ingredient is your limiting reactant? (meaning which ingredient yielded the smallest mass of s’more in your question 6 calculations?)

8. Using the information on your limiting reactant, how many ***moles*** of s’mores should you be able to make?

9. Now you may put your s’mores together on a napkin. How many were you actually able to make using the formula?

10. Weigh your actual product and compare it to the molar mass of G4C2M.

11. Once you are completely finished and have correct answers for numbers 1-10 you make use a Bunsen burner to cook your marshmallow, remake your s’more and eat it. DO NOT MAKE A MESS OR **MANDATORY** MEGALUNCH CLEANUP WILL BE ISSUED :0) enjoy!

Conclusion

1. Define limiting reactant in your own words
2. Define excess reactant in your own words

3. P4 + Cl2 🡪 4PCl3

Suppose we start with 5 grams of each reactant. Which will be the limiting reactant and which will be the excess reactant?