

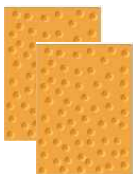
Chemistry S'mores Limiting Reagent

Name: _____ Date: _____ Period: _____

Model 1: The S'more – Baggie Ingredients

A delicious treat known as a S'more is constructed with the following ingredients and amounts:

2 graham crackers



1 chocolate bar



2 marshmallows



Using the baggie of ingredients determine the maximum number of S'mores that can be made following the given recipe. Be sure to answer the questions regarding your baggie of ingredients.

Baggie # _____

Maximum Number of S'mores that can be made: _____

What item in your baggie limited the amount of S'mores that could be made: _____

List the item(s) in excess and how much in excess:

_____ (item) _____ (quantity remaining)

_____ (item) _____ (quantity remaining)

Model 2: The S'more – large scale

At a particular store, these items can be obtained only in full boxes, each of which contains one gross (144) of items. A gross is a specific number of items, analogous (but not equal) to one dozen. The boxes of items have the following net weights (the weight of the material inside the box):

Box of graham crackers	9.0 pounds
Box of chocolate bars	36.0 pounds
Box of marshmallows	3.0 pounds

1. Based on the information given, which of the three ingredients (a graham cracker, a chocolate bar, or a marshmallow) weighs the most? Which weighs the least?

_____ weighs most _____ weighs least

2. If you have a collection of 100 graham crackers, how many chocolate bars and how many marshmallows do you need to make S'mores with all of the graham crackers?

_____ chocolate bars _____ marshmallows

3. If you have a collection of 1000 graham crackers, 1000 chocolate bars, and 1000 marshmallows, how many S'mores can you make? What will be left over (be sure to include how many)?

_____ # of S'mores _____ left over item(s)

4. If you have 36.0 pounds of graham crackers, 36.0 pounds of chocolate bars, and 36.0 pounds of marshmallows, which item do you have the most of? The least? Explain your reasoning

_____ most _____ least

5.

_____ a) If you attempt to make S'mores from the material described in question #4, what item will you run out of first? (This item is known to chemists as the **limiting reagent** because it is the reactant which limits the amount of product which can be made.)

_____ b) How many gross of S'mores will you have made?

_____ c) How many gross of each of the two left over items will you have?

_____ d) How many pounds of each of the left over items will you have?

_____ e) How many pounds of S'mores will you have?

6. Using G as the symbol for graham crackers and Ch as the symbol for the chocolate bars and M for marshmallows, write a "balanced chemical equation" for the production of S'mores.

7. Why is it not correct to state that if we start with 36 pounds each of G, Ch, and M, then we should end up with $3 \times 36 = 108$ pounds of S'mores?

Model 2: Water

8. Write the balanced chemical equation for the production of water from hydrogen gas and oxygen gas.

9. If 0.500 moles of hydrogen reacts with 0.500 moles of oxygen

_____ a. Which reactant is limiting?

_____ b. How many moles of water are formed?

10. If 25.0 g of hydrogen reacts with 25.0 g of oxygen

_____ a. Which reactant is limiting?

_____ b. How many moles of water are formed?

Model 2: Water

8. 25.0 grams of hydrogen and 25.0 grams of oxygen react to form water.

- Write the balanced chemical equation and show all steps.
- Assuming that the reaction goes to completion, which element will be totally consumed in the formation of water?
- What is the limiting reagent?
- How many grams water can be produced?
- How many grams of the excess element remain unreacted?

Independent Activity #1

1. Given the balanced chemical equation: $2 \text{NO(g)} + \text{O}_2\text{(g)} \rightarrow 2 \text{NO}_2\text{(g)}$
calculate the mass of nitrogen dioxide that can be made from 30 grams of NO and 30 grams of O_2 .
2. Zinc and iodine, I_2 , react to form zinc iodide, ZnI_2 (the reactants and the product are all solids at room temperature).
 - a) Write a balanced chemical equation for this reaction.
 - b) Suppose that 50.0 g of zinc and 50.0 g of iodine are used to form zinc iodide.
 - 1) Assuming that the reaction goes to completion, which element will be totally consumed in the formation of the zinc iodide?
 - 2) What is the limiting reagent?
 - 3) How many grams of zinc iodide can be produced?
 - 4) How many grams of the excess element remain unreacted?
3. Acetylene gas, HCCH , is commonly used in high temperature torches.
 - a) Write a balanced chemical equation for the reaction of acetylene with hydrogen gas (H_2) to form ethane (C_2H_6).
 - b) How many grams of ethane can be produced from a mixture of 30.3 grams of HCCH and 4.14 grams of H_2 ?
4. Titanium (Ti) is a strong, lightweight metal that is used in the construction of rockets, jet engines, and bicycles. It can be prepared by reacting TiCl_4 with Mg metal at very high temperatures. The products are Ti(s) and $\text{MgCl}_2\text{(s)}$.
 - a) Provide a balanced chemical reaction for the reaction described above.
 - b) How many grams of Ti metal can be produced from a reaction involving 3.54×10^4 g of TiCl_4 and 6.53×10^3 g of Mg?