Name _____ S'mores and Limiting Reactants 

Background

Two atoms or molecules must come together in just the right way in order for them to react. As a result, it is virtually impossible to obtain a 100% yield in a chemical reaction by combining reactants in exact proportions. In order to increase the odds that at least one reactant will react completely, we often add more than is needed of another reactant; this reactant is said to be in excess. The reactant that is used up in the reaction is called the **limiting reactant or reagent** because it limits the amount of product formed.

In this activity, you will use a recipe for S'mores as an analogy for a chemical equation in which reactants and products are in set proportions to each other. You will be given varying amounts of each reactant. One of these reactants will limit the number of S'mores you can produce. The other reactants will be in excess. After working with this culinary "reaction," you will be able to identify the limiting and excess reactant in chemical reactions.

Goal

- Investigate the concept of limiting reagents by constructing S'mores

Directions: Use the following recipe to determine a balanced "reaction"

Recipe for 1 S'more (Gr_2ChM)

2 graham cracker halves (chemical symbol Gr)	**G.F.M.: 1 "mole" Gr = 7.67 grams**
1 chocolate bar (chemical symbol Ch)	**G.F.M.: 1 "mole" Ch = 13.02 grams**
1 marshmallow (chemical symbol M)	**G.F.M.: 1 "mole" M = 6.28 grams**

1.) Write a balanced equation for your reaction using the chemical symbols given. *Remember that the coefficients represent how many "moles" of each reactant and product you have.*

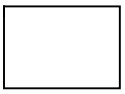
___ Gr + ___Ch + ___ M → _1_ Gr_2ChM

2.) The teacher has the following materials for s'mores.

- 250 grams of graham cracker halves
- 320 grams of chocolate bars
- 270 grams of marshmallows

If each student is to get one s'mores, based on the ingredients provided, how many "moles" of s'mores can be made with each separate ingredient? *(Hint: Convert grams of each given ingredient to moles of s'mores)*

3.) Our class has _____ people in it. Which ingredient is the limiting reactant? _____
Calculate how many grams of the limiting ingredient is needed to ensure each student can get one s'more.

You are now ready to bring this sheet to your teacher for checking! 

After your group's calculations have been checked, go to a Bunsen burner. Each person in the group should obtain a wooden skewer and the S'more ingredients. You can use a paper towel as a clean surface for your ingredients.

Step 1) Light your Bunsen burner and adjust the flame so that it is a non-luminous (blue) flame.
Step 2) Roast your marshmallow over the Bunsen burner
Step 3) Assemble your s'more and enjoy the sweet taste of success in chemistry!

Conclusion Questions

1. Ammonia can be formed from the elements N_2 and H_2, as shown: $N_2 + 3\ H_2 \rightarrow 2\ NH_3$
   a. How many moles of ammonia could we make if we started with 100.0 grams each of N_2 and H_2?

   b. Which reactant is the limiting reactant? _____

2. Zinc and Iodine react to form zinc iodide in the following reaction: $Zn + I_2 \rightarrow ZnI_2$
   a. Suppose that 50.0 grams of zinc and 50.0 grams of iodine are used to form zinc iodide. Assuming the reaction goes to completion how many total grams of zinc iodide can be formed?

   b. Which reactant is the limiting reactant? _____