

Name _____

Box _____

A Recipe for Success Limiting Reactant Lab

It's Wednesday after school and you are STARVING but.....there's no food at home! Your out of money so you can't go buy food, your parents are not home so no luck to get them to buy food for you. What to do???? You are stumped! It looks like you'll have to resort to making something. Hmmmm.....what should it be? Ah ha! CHOCOLATE CHIP COOKIES!!! They're a perfect snack food and the perfect food to bring into your favorite class, Chemistry! Plus, they are a great snack for doing homework!! You dig up the granddaddy of all recipes from your family's recipe box:

“Mr. Niemann’s Ultimate Chocolate Chip Cookie Recipe”

Ingredients

12 cup margarine or butter
9 cup sugar
9 cup brown sugar
24 eggs
12 teaspoons vanilla

Dry Ingredients

27 cups flour
12 teaspoon soda
12 teaspoon salt

12 12-ounce package chocolate chips

Directions:

Preheat oven to 375
Cream butter and sugars in a large bowl.
Add eggs and vanilla, mix well.
Add dry ingredients.
Stir in chocolate chips.
Drop teaspoonfuls onto greased cookie sheet.
Bake at 375 degrees for 9 to 11 minutes. Makes 240 cookies.

Sounds like a lot of cookies to make but you go to the fridge and cupboards to see what ingredients you have. **OH NO!!** You don't have enough of each of the ingredients to make 240 cookies, but lucky you! You're in Chemistry and know how find the limiting reactant! And you know that once you've found your limiting reactant, you can figure out how many cookies you can make and adjust the amounts of all of the other ingredients to make your cookies. Mmmm....Mmmm, yummy cookies, now it's time for you to get started making those cookies.

Background

Have you ever made something at home and found that you were low on an ingredient? Could you still make it? How did you determine how much you could make? The same situation exists for chemical reactions. How do you determine how much product will come out of a chemical process? First, you have to have a balanced equation for the reaction. Then you need to know how much of each starting reactant you have. Next, you need to determine which reactant is the limiting quantity, given the molar ratios of all the reactants. Finally, you must use the quantity of the limiting reactant to determine how much product you will get.

When you use recipes in the kitchen, the same process takes place. In this lab, you will be given a recipe, which includes a list of ingredients. By comparing what you find at home to the recipe, you will determine which ingredient is limiting. You will then calculate the quantities of other ingredients you need based on the amount you can make with your limiting reactant. Once you mix your ingredients together, take your mix home, and bake the cookies. It is important that you keep careful records of your procedure and the amounts of your materials. Your results (the cookies) will be compared to those of your classmates the next day.

Pre Lab Questions

1. Will the results always be identical if you mix the same ingredients in exactly the same proportions every time? Why?
2. What is the importance of having a procedure and following it closely?
3. How does the quantity of a chemical in a reaction determine the outcome of an experiment in the kitchen? In the chemistry lab?
4. What safety precautions should you observe in the kitchen?
5. If 16.5 g of aluminum are reacted with 39.2 g of chlorine gas, Cl_2 , aluminum chloride, Al_2Cl_3 is formed. Which reactant is the limiting reactant? Calculate the mass of aluminum chloride formed.
6. How can the concept of limiting reactants be applied to a cooking recipe?

Materials

Index card with your ingredient amounts

Kitchen equipment measuring cups, measuring spoons, bowls

Ingredients for cookies:

Chocolate chips	butter
brown sugar	sugar
eggs	vanilla
flour	baking soda
salt	

Procedure

1. Calculate the amount of each ingredient that you will use based on your ingredients on your index card. Show calculations in the lab write up!!! List calculated amounts in data table 1.
2. Gather amount of ingredients needed.
3. FOLLOW DIRECTIONS CAREFULLY mixing ingredients, making careful notes of measurements and the order of adding ingredients.
4. Follow directions for baking the cookies.
5. Bring in results the next day!
6. Record observations about color, texture, taste, etc. for each groups cookies.

Data Table 1

Ingredients	Amount	# of cookies

Data Table 2

Name of group	Color	Texture	Taste

Questions

1. What were your limiting ingredients?
2. How much product could you make?
3. Write the balanced equation for your recipe.
4. Try to indicate the factors may have contributed to the best tasting cookies. Ask others what they did.
5. Were all the cookies the same size? Were all the cookies the same consistency? (chewy, moist, etc)
6. What effect does not having a procedure have on the results?
7. Why are the ratios of ingredients important in a cookie recipe?