

thLAB: Limiting Reactants in a Recipe

MATERIALS

Bag of sugar of unknown mass
Recipe for cookies – you may use the one below or you may use your own

PROCEDURE

Using a bag of sugar you will be given and the recipe for cookies below (or a recipe of your own choosing, make a batch of cookies to share with the class.

First, determine how much sugar you have, and then use it to determine how much of each of the other ingredients you will need to make "the perfect" cookie." You must show all your calculations for this using the Q formula in the *Observations* section of your lab report (written in your lab book.) Also include in your observations qualitative observations such as what the mixture looked like, etc., what happened when it was cooked, the smell, taste, etc. **You must bring the results of your experiment – at least 12 cookies, to class.**

You are only allowed to use the amount of white sugar that is in your bag – no more, no less. You cannot remove any sugar from the bag if you have more than the recipe calls for, and you cannot use any other type of sweetener to supplement the amount you may be missing from your bag. You can only use the sugar in your bag and the other ingredients listed in the recipe.

One last note - it will probably be useful to use a handy gram-to-cup conversion chart like the one you can find at <http://allrecipes.com/howto/cup-to-gram-conversions/>

CHOCOLATE CHIP COOKIE RECIPE

INGREDIENTS, Etc.

1 cup white sugar	2 cups chocolate chips or chunks
1 cup packed brown sugar	1 cup chopped pecans, <i>optional</i>
1 cup butter or margarine, softened, at room temp	Mixing bowls
2 eggs	Mixing spoon
1/2 tsp. salt	Measuring spoons and cups
2 tsp. vanilla extract	Cookie sheet
1 tsp. baking soda	Electric mixer, <i>optional</i>
3 cups all purpose flour	

PROCEDURE

1. Preheat oven to 350°F.
2. In the mixing bowl, combine the sugars and margarine together and blend until smooth. (An electric mixer will make this process go much faster.)
3. Beat in the eggs into the butter mixture one at a time, then salt, and then the vanilla. Mix well.
4. In a separate bowl, stir together the baking soda, flour. Gradually stir the flour mixture into the butter mixture. Stir in the chocolate chips. Chill the dough for an hour in the refrigerator for best results.
5. Divide the dough into 48 small balls about 3 cm in diameter. Place the balls on an ungreased cookie sheet about 4 cm apart.
6. Bake at 350°F for about 10 minutes in the preheated, or until the cookies are light brown. Yield: 48 cookies

QUESTIONS

Suppose you are given the following amounts of ingredients:

1 dozen eggs

24 tsp. of vanilla

1 lb. (82 tsp.) of salt

1 lb. (84 tsp.) of baking soda

3 cups of chocolate chips

5 lb. (11 cups) of sugar

2 lb. (4 cups) of brown sugar

1 lb. (4 sticks) of margarine

1. For each ingredient listed above, calculate how many cookies could be prepared if all of that ingredient were used. Show all calculations using the Q formula. (*For example, the recipe shows that using 2 eggs—with the right amounts of the other ingredients—yields 48 cookies. You would use that as your conversion factor to determine how many cookies you could make if the recipe was increased proportionately for 12 eggs.*)
2. Determine the limiting reactant for the new ingredients list. Explain your answer.
3. What is the maximum number of cookies that can be produced from the new amounts of ingredients? Explain your answer.