

# LEGO STOICHIOMETRY

## LAB RXN 1

### INTRODUCTION

From your studies of chemistry, you may or may not be familiar with the word *stoichiometry*, but you know about its underlying principles. The term *stoichiometry*, which literally means “element measuring”, applies to many facets of everyday living—from baking brownies to the knocking in a car engine. In the case of brownies, it is important to mix the proper amounts of sugar and flour and other ingredients so the brownies taste good. Likewise, a combustion engine requires the correct ratio of gasoline and oxygen to run smoothly. In this activity, you will use building-block car kits to explore the importance of being able to figure out how much of each ingredient is “enough”.

### PURPOSE

The purpose of this lab is to illustrate the concept of stoichiometry by using a building-block car kit and determining the relationship between number and mass of each component and the mass of the final product, which is the assembled car.

### EQUIPMENT/MATERIALS

building-block car kit

balance

### PROCEDURE

1. Record the number of the car kit used on the Data Sheet.
2. Set out all the components included in the kit. Do not use any “driver” figure or decorative stickers in this activity; put them aside.
3. Record the name and description of each component on the Data Sheet. Your instructor may provide you with the names of the components.
4. Record the quantity of each type of component in the data table.
5. Verify that all identical components have the same mass. Record the mass ( $\pm 0.1$  g) of one of each component in your table.
6. Build the car according to the instructions included in the kit.

### REFERENCE

Witzel, J. Eric. Lego Stoichiometry. *J. Chem. Ed.* **2002**, 79, 352A-352B.

7. Make sure that you have recorded the number of each component actually used to build the car. If you have extra pieces or require additional pieces, note this information in your table and tell your instructor.
8. Calculate the total mass of the components used to build the car.
9. Measure and record the mass of the complete car.
10. Disassemble the car and return all parts the bag from which you removed them. Any extra parts should also be returned to the bag, unless instructed otherwise.



<b>Component Name</b>	<b>Description</b>	<b>Quantity in Kit</b>	<b>Mass (g)</b>	<b>Total Mass (g)</b>

**Calculated mass of car** \_\_\_\_\_

**Measured mass of car** \_\_\_\_\_

**QUESTIONS**

1. Which component(s) is (are) utilized most frequently? How many times is it (are they) used? Which component(s) is (are) used only once? If there is more than one component in each category, identify the one with the greatest mass in each case.

**In the following questions, A refers to the heaviest component that is used only once and B refers to the heaviest, most frequently used component.**

2. Suppose you have enough components to build 100 cars, except that you have only 4 of A and 12 of B. If you start building cars, which component (A or B) would you run out of first? How many of each of these components would be left over? How many complete cars could you build?
3. You are planning activities for a younger sibling's birthday party. You decide that each of the 10 partygoers will build a car to take home. In your box of building blocks you find the following: 8 of A and 45 of B. You have more than enough of all the other components. Do you relax? Or do you run to the toy store? Explain.
4. *Limiting* reactants are those that directly limit the amount of product produced. Reactants in *excess* are abundant and so do not limit the amount of product produced. In questions 2 and 3, which component (A or B) is limiting and which is in excess? Explain.

5. The law of conservation of matter states that matter can be neither created nor destroyed. How does building this car demonstrate this law?
  
6. Suppose that you have 100 g of A and 100 g of B. How many of each of these components do you have? (Do not include fractions or broken pieces) How many cars could you build, assuming that you have more than enough of all the other required components?