

INVESTIGATING

Consumer Products

Your task is to determine the best brand of ketchup by designing your own experiment. These pages will guide you through the scientific processes you have been learning, and will help you to complete each step of your investigation. You will need to write a problem statement and hypothesis, collect and analyze data, and decide what all of your work means. Choosing the best brand of ketchup may not appear to be a difficult scientific challenge, but it is the sort of product testing that occurs every day. It is also important because this kind of practice will allow you to continue the art of scientific inquiry all on your own.

1. PROBLEM STATEMENT

- a.** Consider what you think “best” means in terms of ketchup. Is the best ketchup the thickest? the most flavorful? the sweetest? the reddest? Clearly define below what your experiment will test to find the best ketchup.

- b.** Write your problem statement in the form of a question. Remember that your problem should not have a “yes” or “no” answer. Begin the problem with a word such as *how*, *which*, or *what*. Be sure the question is one that interests or puzzles you.

2. HYPOTHESIS

Remember that a hypothesis includes a tentative explanation for an observation or scientific problem. The way you write your hypothesis ultimately determines the type of experiment you will carry out, so give it some thought. Write your hypothesis below in the form of an “If . . . , then . . . , because . . .” statement.

3. VARIABLES

The independent variable comes after the *if* in your hypothesis and is the variable that is being manipulated. The dependent variable comes after *then*, and is the variable that is being measured. Identify each in the spaces below.

a. Independent variable: _____

b. Dependent variable: _____

4. OPERATIONAL DEFINITION

Recall that your operational definition describes the one particular way in which you will measure the dependent variable. Keep in mind that you must have the resources available in the classroom to carry out your measurements. Write your operational definition below.

5. CONSTANTS

After completing your hypothesis and your dependent and independent variables, you have a framework for an investigation. Think carefully about how you will carry out the investigation. Which factors will be constants in order to properly test your independent variable?

6. MATERIALS

Decide what materials you will need to conduct your investigation. Make a list of everything you must have in order to complete your experiment. Be sure to include quantities and sizes. After you write your procedure, it may be helpful to look back to your list to add any additional materials or delete anything you do not need.

7. PROCEDURE

Break into steps what you will need to do in order to test your hypothesis. Remember to write your procedure as precisely as possible so that someone else can copy your work exactly. To generate reliable data, design your procedure with a sufficient number of trials. Keep in mind that more data are nearly always better. Use a separate sheet of paper to write the steps of your experimental procedure. If you think it would be helpful to include illustrations that describe different parts of the procedure, be sure to include them.

8. RECORD OBSERVATIONS

Set up a data table before you begin collecting your data. Organize your table into columns and rows, and include units in the column headings. Include space for every trial, as well as a place for the means of your data. You should also leave room for any qualitative observations that you make during the experiment. Draw your data table below.

9. SUMMARIZE RESULTS

After collecting all of your data, decide how to summarize and present your results. You should include one or more graphs to make your data easy to interpret. Remember, comparative data are best shown by bar graphs, and continuous relationships between variables are best presented by line graphs. Use graph paper or computer graphing software for the actual graph(s), but show how you will set up the axes below.

10. DISCUSS

- a.** Describe what you found out in the investigation. According to your data, which ketchup appears to be “best?” Provide examples from the data you collected to make your case.

- b.** Did your investigation reveal any trends in the data that should be described? If so, what do these trends indicate?

- c.** Do you think that anything other than the independent variable may have affected your experimental results? Consider any limitations in your constants, procedure, or results.

11. CONCLUDE

- a.** Discuss whether or not your data support your hypothesis. Write your conclusion in complete sentences. Remember that a single investigation does not prove anything.

- b.** Write out any questions that could lead to additional experiments that you could conduct. For example, consider how you might conduct the investigation if the cost of the ketchup was a factor in the study.
