Name Period Date

INVESTIGATING

Air Quality

Your task is to determine what can affect air quality by designing your own experiment. The air around you contains many types of particulates, such as pollen, dust, and fur from pets. In this investigation you will study factors that can determine the amount of particulates in the air. These pages will guide you through the scientific processes you have been learning, and will help you to complete each step of your experiment. First, you will need to do some background research to obtain information about air quality and particulates that may be in the air in your region. Identify factors that you can test with the materials and time available.

Sampling Tip: With a ruler, draw a square that is 2.5 centimeters per side on the center of a blank index card. Cut out the square and completely cover the hole with a piece of clear packing tape so that you have a sticky window in the card. Collect particulates by leaving cards like this, sticky side up, outside for a period of time wherever you choose to sample air quality. Then, you can lay the card down on a graph paper grid and count the particulates within each square.

1. PROBLEM STATEMENT

a. Consider what might affect the amount of particulates in the air, such as wind speed, humidity, air temperature, and location, among other factors. Identify and clearly define the one property you will test as a factor in air quality.

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.

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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?

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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.

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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, how does the factor you tested affect the amount of particulates in the air? Provide examples from the data you collected to explain the importance of the property you tested.

b. Did your investigation reveal any trends in the data that should be described? If so, what do these trends indicate? Is particulate level the only measure of air quality? Did your sampling reveal any data about the type of particulates in the air? Explain.

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 you have that could lead to additional experiments. For example, consider how you might test a combination of factors that can change air quality.