Name _____ Class _____ Date _____

Inquiry Lab

MODELING

Global Warming in a Jar

How can we learn more about global warming? Because we have only one Earth, we can't experiment with it. However, we can experiment with a model. In this investigation, you will construct a simple "greenhouse" in a glass jar to model the warming of Earth. Then, you will choose a question about global warming that interests you and design and carry out your own experiment to answer it.

OBJECTIVES

Design a controlled experiment by forming a hypothesis and isolating variables.

Predict the outcome of an experiment.

Evaluate a model of a real-world problem.

MATERIALS

- cardboard, thin, small pieces
- graph paper
- identical glass jars (2)
- one or more of the following items: black and white latex paint, water, soil, sod or plant pieces, ice cubes
- pen or pencil
- plastic wrap, clear
- rubber bands or string
- tape, masking
- thermometers, outdoor (2)
- watch or clock

Procedure

PART I—OBSERVING THE GREENHOUSE EFFECT

1. Tape thin pieces of cardboard over the bulbs of two weather thermometers so that the sun will not shine directly on them. Tape a thermometer to the inside of each of two jars so that the thermometer does not touch the bottom. Record the temperature inside each jar.
2. Cover the opening of one of the jars with plastic wrap, and secure the plastic wrap with rubber bands or string.
3. Place the jars in a bright sunny spot outdoors.
4. Every two minutes, read both thermometers. Always read the same thermometer first. Record the temperatures in the table on page 69. Continue until the temperature increases noticeably in both jars. This may take 10 minutes or more.

TEMPERATURE OBSERVATIONS

Time	Temperature	
	Uncovered jar	**Covered jar**
Before going outdoors	**Data may vary.**	
When first placed in sun		
+ 2 minutes		
+ 4 minutes		
+ 6 minutes		
+ 8 minutes		
+ 10 minutes		

5. Which jar is the greenhouse model and which is the control? What is the purpose of the control?

6. Make a line graph to show your results on a separate piece of graph paper.

PART II—WHAT'S YOUR VARIABLE?

As you read in Chapter 13, some scientists suggest that Earth will warm up as greenhouse gases are added to the atmosphere. However, not all parts of Earth are expected to warm up by the same amount. Consider the following questions about how a warming effect could vary over different parts of Earth:

- Will the air heat up faster over snow-covered plains or newly plowed fields?
- Will air over the ocean or air over land heat up faster?
- Does the presence of plants affect the rate of warming?
- How does the amount of moisture in the soil affect the rate of warming?
- Does the temperature of the land affect the temperature of the air above it?

7. Choose one of the variables above to investigate. Write a hypothesis about the variable you chose.

8. Think of an experiment you could do to test your hypothesis, using the same kind of jars you used to demonstrate the greenhouse effect in Part I. Choose materials from the following list for your experiment:

- ice cubes
- latex paint, black and white
- sod or plant pieces
- soil
- water

Which of these materials could you use to test your hypothesis?

9. On a separate sheet of paper, describe your proposed experimental design. Remember to include a control jar as well as an experimental jar.

10. Consider your hypothesis, and predict the results that you expect. Write your prediction.

PART III—TEST YOUR HYPOTHESIS

11. Set up and carry out your experiment. Create a table similar to Table 1 to record your data. Label it Table 2. If you do anything differently from the way you planned your experiment, note the changes that you made.

12. Graph your results on a separate sheet of graph paper.

Analysis

1. Analyzing Data How did your results relate to your predictions? What does this tell you about your hypothesis?

2. Analyzing Results Compare your results with those of your classmates. Which variables had the greatest influence on the rate of warming in a greenhouse? Which had the least influence?

Conclusions

3. **Evaluating Results** What can you conclude from the data you collected?

4. **Applying Conclusions** How did your experiment model differences in global warming rates?

5. **Evaluating Methods** How did your model differ from the real world?

Extension

1. **Research and Communications** In what way did your experiment model the way in which global warming may occur at different rates in different parts of the world? What are some differences between your model and the real "greenhouse Earth"? Use library resources to determine how other researchers predict your variable will influence global warming trends in particular regions of the world. Write a paragraph about your discoveries, and present them orally to your class.