

The Greenhouse Effect

SKILLS MENU

- ▶ Questioning
- ▶ Hypothesizing
- ▶ Predicting
- ▶ Planning
- ▶ Controlling Variables
- ▶ Performing
- ▶ Observing
- ▶ Analyzing
- ▶ Evaluating
- ▶ Communicating

You have learned about the greenhouse effect in Earth's atmosphere. Now you will study it by designing and constructing a model.

In this investigation, you will test the ability of different kinds of materials to trap thermal energy. These materials will represent the various greenhouse gases in Earth's atmosphere.

SKILLS HANDBOOK
1.B., 3.B., 6.A.

Testable Question

How do different kinds of materials, and different thicknesses of materials, vary in their ability to trap thermal energy?

Hypothesis/Prediction

Write a prediction for the Testable Question using what you know about the greenhouse effect.

Experimental Design

You will design a test to see how different materials trap thermal energy. The thermal energy will be provided by adding hot water to foam cups. You will choose different materials and thicknesses of materials to cover the cups. Then, you will compare how well each material trapped thermal energy.

Equipment and Materials



eye protection



lab apron



gloves



foam cups



hot water



thermometer



rubber bands



glass plate



cardboard



aluminum foil




wool cloth



plastic wrap

Procedure

Part A: Design Your Investigation

1. Select materials from the following list to model different greenhouse gases: a glass plate, cardboard, aluminum foil, wool cloth, plastic wrap.
2. Write a procedure to test the effects of covering a cup filled with hot water with the materials you chose in Step 1. Remember, the hot water provides thermal energy in this investigation. Your procedure should include four different tests. For example, you could use four different materials, different thicknesses of the same material, or combinations of different materials. 
3. Have your teacher approve your design.
4. Prepare a table similar to **Table 1** in which to record your observations. Make sure you include the control (no cover on the cup).

Part B: Perform Your Investigation

5. Put on your eye protection, lab apron, and gloves.
6. Carry out your procedure and record your observations in your table.

CAUTION

Hot Liquids

Be careful when handling hot water. Wear eye protection, gloves, and an apron to protect yourself from spills and splashes.


Table 1 Observations

Type of cover	Initial temperature	Temperature after X min	Temperature after Y min
Control (no cover)			
Trial 1 glass plate			

Analyze and Evaluate

- (a) Draw a line graph showing how the temperature in each cup changed over time. Plot your temperature data for the control and for each of the four tests on the same graph. **T/I C**
- (b) Which material, or combination of materials, was the best at trapping thermal energy? **T/I**
- (c) If you tested different thicknesses of materials, what effect did thickness have? **T/I**
- (d) Answer the Testable Question. Compare your answer with your prediction. Explain any differences. **T/I C**

Apply and Extend

- (e) Scientists have determined that different gases in the atmosphere have different abilities to absorb infrared radiation. Based on your results in this activity, is this also true of solids? Explain. **T/I C**
- (f) How is the greenhouse effect similar to an actual greenhouse? How is it different? **A** 

DIG DEEPER

Web Link

A greenhouse is a glass structure that traps thermal energy and allows plants to grow in cold conditions. To learn more about how a greenhouse works,

GO TO NELSON SCIENCE