


Exercise 1G


THE GREENHOUSE


EFFECT

This activity introduces the concepts of climate change and the “greenhouse effect.” While global warming may sound great, thinking through the possible effects upon plants, sea levels, and the world’s food supply may cause the students to better appreciate how complex a role the atmosphere has in our lives.

CRITICAL OBJECTIVES

 Understand that the atmosphere traps heat and makes the surface of the Earth warm enough for life

 Recognize that air pollution can cause a rise in temperature and ecological decline

 Recognize that human activities can cause air pollution

SKILLS

 Observing

 Comparing

 Interpreting test results

Target Grade Level

4th-5th

Duration

20 minutes (suggested optional extensions can further time).

Vocabulary

Albedo

Carbon dioxide

Chlorofluorocarbons

Greenhouse effect

Greenhouse gas

Methane

Nitrogen oxides

Materials

- Two clean, dry, widemouth glass jars with lids (such as mayonnaise jars)
- Heavy aluminum foil
- Piece of dark cloth or construction paper
- Stop watch or watch with a second hand
- Two identical thermometers that fit into the jars (“Instantread” meat thermometers work well)
- Paper
- Pencils

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 Drawing conclusions

GUEST PRESENTER

Guest presenters could include air quality engineers, chemists, ecologists, meteorologists, or physicists.

BACKGROUND

The greenhouse effect is a term scientists use to describe the trapping of heat on the surface of the Earth by the atmosphere, a normal atmospheric occurrence. As a result of this, the Earth's surface is about 53°F (12°C) warmer than it would be without this trapping. This effect is magnified by certain greenhouse gases in the atmosphere, most notably carbon dioxide, methane, nitrogen oxides, and chlorofluorocarbons (CFCs). Methane is a product of natural decay from living (or once-living) things; nitrogen oxides are generally a result of man-made burning and automobile and similar internal-combustion engines; and CFCs are a class of chemicals used often in air conditioners, refrigerators, and as the pressurizing gas in aerosol spray cans. While all of these pollutants contribute to air pollution, and contribute to the greenhouse effect, carbon dioxide is the major greenhouse gas. Scientists believe that concentrations of greenhouse gases in the atmosphere will double over the next hundred years, producing average temperature rises of about 8 to 10°F (4 to 6°C). While most scientists believe that the greenhouse effect will gradually warm up the Earth's climate, there are some who believe that increased cloud cover will eventually reflect more sunlight away from the Earth and lower the average temperature. This increased reflectivity is called the Earth's albedo. (See reading material on "Air Pollution" and "The Greenhouse Effect" from the EPA Project A.I.R.E. website.).

WHAT TO DO

I. Divide the class into two work groups. Give each group one of the jars. Have each group put a piece of dark cloth or paper into their jar. Have

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them put a thermometer in each jar so that the scale can be read through the side. Have one group screw the cover onto their jar. Have the other group leave their jar open.

2. Have the groups place the jars, on their sides, in the sunshine so that their bottoms face the sun.

3. Instruct each group to watch the thermometers and have one person from the group record the temperature shown in their jar every minute. Instruct the group with the closed jar to announce when the thermometer in their jar levels off or reaches 140°F (60°C). Stop the experiment at that point.

4. Have students discuss the following questions:


In which jar does the temperature rise fastest?


How much faster did it rise? Why? How is this like a greenhouse?

How is this like the real world's atmosphere?

What was the role of the dark cloth in the jars?

SUGGESTED EXTENSIONS (OPTIONAL)

 Have students wrap one of the jars with aluminum foil, leaving a clear area away from the sun to read the thermometer. Repeat the experiment, and compare the times to reach 140°F (60°C). Discuss why it took longer.

 Have students try the experiment on a cloudy day. Discuss the difference in results. Have them try the experiment without the dark cloths and discuss the difference in results.

SUGGESTED READING

Berreby, David. "The Parasol Effect." *Discover*, 14 (July 1993) p. 44.

Bright, Michael. *The Greenhouse Effect*. New York: Gloucester Press (1991).

Gay, Kathlyn. *Ozone*. New York, NY: Franklin Watts (1989).

From: EPA Project A.I.R.E. <http://www.epa.gov/region01/students/teacher/aire.html>