CHAPTER 14

Teaching Suggestions

Science and Mathematics Lab

(Course 3, Lesson 5-5)

Sun and Temperature

OVERVIEW

This activity is designed to show students how the angle of the Sun's rays affects the temperature at different times of the day. They will estimate the Sun's intensity rates by experimenting and measuring.

RECOMMENDED TIME

1 class period

MATERIALS

- flashlight
- grid paper (cm)
- paper
- protractor
- ruler
- pencil
- tape

PREPARATION

Medium-sized hand-held flashlights work best. You may wish to purchase inexpensive plastic ones from a hardware store, or have students bring their own.

TEACHING THE LAB

1. Explain how this lab shows how the intensity of sunlight changes with the time of day. Remind students that their measurements are only an estimation, not a true calculation, because of many factors: Earth is round, not flat; the Sun is not always exactly overhead at noon; and so on.
2. Demonstrate how to prepare the flashlight. Show the class how to make the focusing hood and attach it to the flashlight.
3. Show the class how the focusing hood makes the beam's edge clearly visible on a flat surface. Also show students how to use a protractor to measure the angle of the flashlight to the flat surface. Tell the students that this is the angle at which the light rays hit the surface.

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4. Have students work in groups of at least two.

5. You may need to dim the lights or turn them off while students are working with the flashlights.

Answers and Conclusions

1. The percent of lit area increases as the angles decrease.

2. The intensity decreases as the area covered increases.

3. The temperature is higher when the energy is spread over a smaller area.

4. The Sun's angle at 9 A.M. and 3 P.M. is 45°.

5. Sample answer: The temperature rises until midday and then it begins to fall.

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INTRODUCTION

Energy from the Sun is important for life on Earth. During the day, the total amount of energy from the Sun remains about the same, but the *intensity* changes. Sunlight intensity is a measure of energy per unit area. The intensity of the Sun is one of the reasons why the temperature changes during the day.

OBJECTIVES

In this lab, you will:

- simulate the amount of sunlight striking Earth's surface at different angles.
- estimate the percent of the surface covered by sunlight.
- investigate the relationship between sunlight intensity and temperature.

MATERIALS

- flashlight
- grid paper (cm)
- paper
- protractor
- ruler
- pencil
- tape

PROCEDURE

Part 1 Making a focusing hood for your artificial Sun

1. Wrap the piece of paper around the bulb end of your flashlight to make a tube with the same diameter at both ends. The paper should extend at least 3 inches beyond the flashlight.
2. Tape the tube securely to the flashlight. When you turn on the flashlight and shine it on your desk, you should see the edge of the beam clearly.

Part 2 Simulating solar intensity

1. Place your grid paper on a flat surface. Have a classmate hold the flashlight directly above the grid paper. The end of the paper hood should be 2 inches above the paper. The flashlight and hood should make a 90° angle with the paper. Check the angle measure with your protractor.

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Sun and Temperature (continued)

2. Have the other lab partner carefully trace the outline of light on the paper. Label this circle 90°.
3. Estimate the percent of the grid paper covered by the sunlight. Record this percent next to the circle.
4. Tilt the flashlight until it makes a 75° angle with the paper. Use a protractor to measure the angle. Trace the outline of the light and label the outline 75°. Estimate the percent of the paper covered by sunlight and record this number.
5. Repeat the procedure for 60°, 45°, 30°, and 15°. If the light shines off the edge of the grid paper, move the flashlight so that as much of the light as possible is on the paper.

Questions and Conclusions

1. What happens to the percent of lit area as the angles decrease?
2. The intensity of sunlight is a measure of energy per unit area. Since the energy from the Sun remains consistent, what do you think happens to the intensity as the area covered by sunlight increases?
3. Is the temperature higher when the energy is spread over a large area or small area?
4. Assume that the Sun rises about 15° each hour and reaches 90° at noon, when it begins decreasing about 15° each hour. What is the Sun's angle at 9 A.M.? 3 P.M.?
5. Explain what happens to the temperature during the day based on your data.