Sunlight Speed Test

Investigate how quickly soil, water, and air warm in sunlight.

6.8.a "Plan and carry out an investigation to determine the differences in rates of energy transfer from the sun to air, to land, and to water via conduction, convection, and radiation."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the steps that keep the test fair, circle the temperature readings, and number the three ways heat moves. Use your marks to compare warming rates and plan your own test.

Three Cups in the Sun

1. At noon, Maya's group set three identical cups side by side in direct sunlight. One held soil, one held the same amount of water, and one was empty except for air. A thermometer sat just below the surface of the soil and another just below the water's surface. A third hung inside the air cup without touching its sides. The group checked that all three thermometers read 20°C before starting. They agreed to take the next readings after exactly ten minutes.

2. At 12:10, the soil thermometer read 26°C, the water thermometer read 23°C, and the air thermometer read 22°C. The group used each change in temperature and the ten-minute test time to compare warming rates. Sunlight reaches the cups by radiation. The soil and water absorb some of that energy, while the air can also warm when it touches a sun-warmed cup. If the air thermometer touched the cup's side, it could pick up heat from the cup instead of measuring the air.

3. Heat can move from a warmer surface to something touching it. This is conduction. In water, warmer water can rise as cooler water sinks. Air can move in a similar way. This movement is convection. These processes can affect a thermometer's reading, along with radiation from the sun. To make a useful comparison, Maya's group kept the cups together in the same sunlight and measured each one for the same length of time. A new test could check whether the pattern repeats.

2 ANSWER WITH EVIDENCE

Use the passage

1. Find the soil's warming rate in °C per minute. Show the temperature change and your division.

2. Find the warming rates of the water and air. Which warmed faster?

3. Why did the group keep the air thermometer from touching the cup's side? Name the heat transfer process that could affect a touching thermometer.

4. Suppose the water cup stayed in sunlight for 20 minutes but the soil cup stayed for only 10 minutes. Why would that make their warming rates harder to compare?

3 YOUR TURN

Your own words

Plan one way to keep a 10-minute sunlight test fair using three identical cups, equal amounts of soil and water in two cups, an empty cup for air, and three thermometers; then carry it out with your teacher. Record your actual start and end temperatures for all three, calculate each warming rate in °C per minute, and explain one heat transfer process that may affect a reading.

ANSWER KEY

Sunlight Speed Test

GRADE 6 · 6.8.a

PART 1 · READ AND MARK

Underline the steps that keep the test fair, circle the temperature readings, and number the three ways heat moves. Use your marks to compare warming rates and plan your own test. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Find the soil's warming rate in °C per minute. Show the temperature change and your division.	**26°C minus 20°C = 6°C; 6°C ÷ 10 minutes = 0.6°C per minute.**
2	Find the warming rates of the water and air. Which warmed faster?	**Water: (23 minus 20) ÷ 10 = 0.3°C per minute. Air: (22 minus 20) ÷ 10 = 0.2°C per minute. Water warmed faster.**
3	Why did the group keep the air thermometer from touching the cup's side? Name the heat transfer process that could affect a touching thermometer.	**Heat could move from the warm cup into a touching thermometer by conduction, making it less useful for measuring the air.**
4	Suppose the water cup stayed in sunlight for 20 minutes but the soil cup stayed for only 10 minutes. Why would that make their warming rates harder to compare?	**The cups would have different amounts of time to warm, so the test would not compare them under the same conditions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Sample measurements from one possible test: I placed the cups together so they received the same sunlight. Each started at 21°C. After 10 minutes, the soil was 26°C, the water was 23°C, and the air was 22°C. Soil: 5 ÷ 10 = 0.5°C per minute. Water: 2 ÷ 10 = 0.2°C per minute. Air: 1 ÷ 10 = 0.1°C per minute. Convection may have moved warmer water past the thermometer.

Part 3 requires measurements students collect, not the sample values. Accept correctly calculated rates and a reasonable explanation involving radiation, conduction, or convection.