Exploration Lab

# Heating and Cooling Rates of Water and Soil

### **Teacher Notes**

**TIME** 45 minutes

TEACHER PREPARATION

## 

Purpose Compare heating and cooling rates of soil and water

**Safety** Students should exercise caution with the hot bulb of the lamp. Caution them to be careful with the water near the electrical lamp cord and outlet. Students should wash their hands before leaving the lab each day.

#### ANSWERS

#### Analyze and Conclude

- 1. The soil had the faster rate of both heating and cooling.
- 2. Aquatic ecosystems do not experience the daily temperature extremes that terrestrial ecosystems do, so aquatic species have not evolved the kind of behavioral or metabolic adaptations that many terrestrial species have. What this means, though, is that if an extreme change occurs, the organisms in an aquatic ecosystem may be less able to cope than those in a terrestrial system. The bleaching events seen in coral reef ecosystems are an example.
- 3. Coastal cities have smaller temperature ranges than inland areas have because the large body of water nearby tends to moderate the climate of the city. In summer, the water can offer evaporative cooling, and in winter, heat remaining from the warmer months can radiate out and warm the city somewhat.

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Exploration Lab

Environmental Engineering

# Heating and Cooling Rates of Water and Soil

Water and soil have many different qualities. One quality is the rate at which each substance heats up and cools down. In this lab, you will compare the heating and cooling rates of water and soil.

#### PROBLEM

What are the heating and cooling rates of water and soil?



#### MATERIALS

- marker
- 2 clear plastic cups
- ruler
- soil
- water at room temperature
- 2 thermometers
- lamp

### PROCESS SKILLS

Comparing

### PROCEDURE

- 1. Mark a line 3 centimeters from the bottom of each cup. Fill one cup to the line with water and the other with soil.
- 2. Design a table in which to record your data.
- 3. Place a thermometer into the contents of each cup. Allow the thermometer to sit in each cup for 3 minutes, then take an initial temperature reading. Record your data.

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Name	

Heating and Cooling Rates of Water and Soil continued

- 4. Put the cups side by side under a lamp. Do not allow the bulb to touch the water. Keep all cords away from the water. After 15 minutes, record the temperature in each cup.
- 5. Turn off the lamp and move the cups away from the lamp to simulate shade. After 15 minutes, record the temperature in each cup.

#### ANALYZE AND CONCLUDE

- 1. Analyze Data Which substance had the faster rate of heating? Which had the faster rate of cooling?
- 2. Infer How do the heating and cooling rates of water and soil affect aquatic and terrestrial ecosystems?
- **3.** Apply How do the differences in heating and cooling rates affect climates of coastal cities?