

Investigation 2.1

Investigating Rates of Warming and Cooling

Materials

For you

- Science notebook
- Student Sheet 2.1: *Testing the Warming and Cooling Rates of Soil and Water*

For your group

- 2 Beakers
- 2 Bookends
- 2 Cardboard strips
- 2 Digital thermometers
- 1 Clamp lamp
- 1 Metric ruler
- 1 Stopwatch
- Access to electricity
- Soil
- Water

Procedure

1. You will work with a small group to set up an investigation and collect data about the warming and cooling rates of soil and water.
2. With your teacher, review how to use a stopwatch and digital thermometer.
3. As a class, go over Steps 6–18. Observe as your teacher demonstrates the steps needed to complete the investigation. Review the safety warnings as a class.



Safety Warnings

- Keep water away from all electrical outlets.
- Avoid touching the hot lamp during the investigation and while the lamp is cooling.
- Tuck electrical cords beneath work areas.
- Do not drape cords across foot-traffic areas.
- Be careful with the sharp end of the thermometers.

4. Review Student Sheet 2.1: *Testing the Warming and Cooling Rates of Soil and Water* as your teacher discusses it.
5. Think about how to set up a controlled experiment to test the warming and cooling rates of soil and water. Complete questions 1 and 2 on your student sheet.
6. Set up the lamp by clamping it to two bookends, as shown in Figure 2.3.

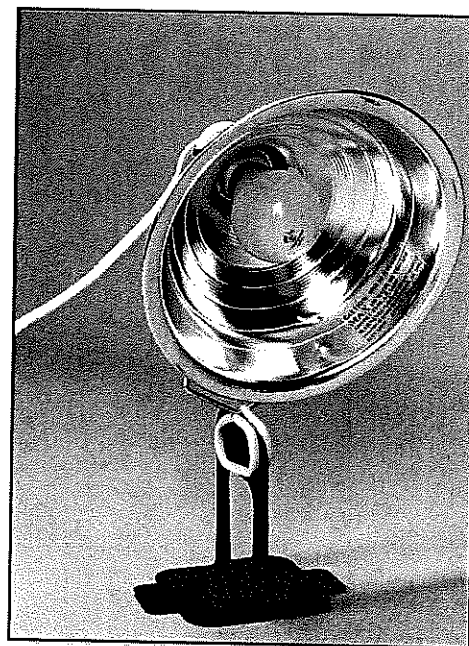


Figure 2.3

Setting up the lamp

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7. Set up the thermometers by inserting them into the hole in the center of each cardboard strip. This will prevent the thermometers from falling into the beakers.
8. Prepare your samples of soil and water. Consider the amount of each sample used so you can conduct a fair test. Record your procedure in your science notebook.

9. Place a thermometer in each sample, as shown in Figure 2.4. Allow the thermometers to sit in each beaker until the temperature readings stop changing. Consider the depth at which you will set each thermometer. Record your procedure in your science notebook.

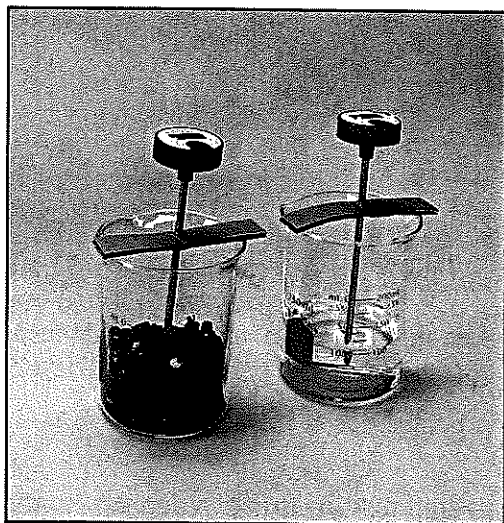


Figure 2.4

Thermometers and cardboard strips

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10. While you are waiting for the temperature readings to stop changing, answer questions 3 and 4 on Student Sheet 2.1.
11. Consider the position at which to place the lamp. Describe the position and/or create a labeled sketch of your setup in your science notebook. Do not turn on the lamp at this time.
12. After the readings on the thermometers have stabilized, record the temperatures for both the soil and the water in Table 1 on Student Sheet 2.1. Record your values in the 0:00 minute row under the columns labeled "Warming."
13. Turn on the lamp.
14. Start your timer. Read the temperature of both materials to the nearest 0.1°C every minute for 10 minutes. Record your data in the table.
15. At the end of 10 minutes, turn off your lamp but keep the timer running. At this time, record the temperature for the soil and water in the "Warming" columns. Record this temperature in the 10:00 minutes row at the top of the "Cooling" columns. Continue reading and recording the cooling temperature for soil and water every minute for 10 minutes.
16. When you finish, clean up by doing the following:
- Turn off the digital thermometers.
 - Dispose of the water from your beaker in a sink or bucket.
 - Do not throw away the soil. Pour it into the empty container set out by your teacher, where it can cool completely.
 - Return your materials to the distribution center.
 - Place your lamp in the spot selected by your teacher.
17. Complete Student Sheet 2.1. Calculate the overall change in temperature of each beaker during warming and cooling. For the "Warming" columns, subtract the first temperature (at 0:00 minutes) from the last temperature (at 10:00 minutes). For the "Cooling" columns, subtract the last temperature (at 20:00 minutes) from the first temperature (at 10:00 minutes). Give your answers to the nearest 0.1°C .
18. Read Building Your Knowledge: *A Hot Topic*.

EXIT SLIP

Imagine a lake and its surrounding land begin at the same temperature in the morning. In the middle of the night, after a hot summer day, which will be cooler, the land or the water?