Heating Land and Water

The heating of Earth's surface controls the temperature of the air above it. To understand variations in air temperature, we consider the characteristics on the surface. Different land surfaces absorb varying amounts of incoming solar radiation. The largest contrast, however, is between land and water. The air temperature above water can influence the air temperature over land.

In this lab you will model the difference in the heating of land and water when they are subjected to a source of radiation. You first will assemble simple tools. Then you will observe and record temperature data. Finally, you will explain the results of the experiment and how they relate to the moderating influence of water on air temperatures near Earth's surface.

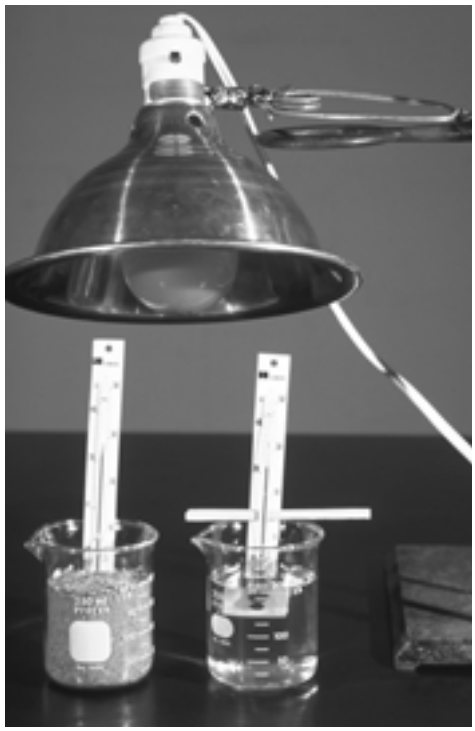

Figure 1

Problem How do the heating of land and water compare?

Materials

- 2 250-mL beakers
- dry sand
- tap water
- ring stand
- light source
- ruler
- 2 flat wooden sticks
- 2 thermometers
- United States map
- 3 different-colored pencils

Skills Modeling, Observing, Measuring, Analyzing Data

Procedure

Part A: Preparing for the Experiment

1. Use the Data Table to record your measurements.
2. Pour 200 mL of dry sand into one of the beakers. Pour 200 mL of water into the other beaker.
3. Hang a light source from a ring stand so that it is about 5 inches above the beaker of sand and the beaker of water. The light should be situated so that it is at the same height above both beakers.
4. Using the wooden sticks, suspend a thermometer in each beaker, as shown in Figure 1. The thermometer bulbs should be just barely below the surfaces of the sand and the water.
5. Record the starting temperatures for both the dry sand and the water in the data table.

Part B: Heating the Beakers

CAUTION: *Do not touch the light source or the beakers without using thermal mitts.*

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6. Turn on the light. Observe and record the temperatures in the Data Table at one-minute intervals for 10 minutes.
7. Turn off the light for several minutes. Dampen the sand with water and record the starting temperature for damp sand. Repeat Step 6 for the damp sand.

DATA TABLE Land and Water Heating

	Starting Temperature	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min	9 min	10 min
Water											
Dry sand											
Damp sand											

Analyze and Conclude

1. **Using Tables and Graphs** Use the data you collected to plot the temperatures for the water, dry sand, and damp sand. Use a different-colored line to connect the points for each material.

2. **Comparing and Contrasting** How does the changing temperature differ for dry sand and water when they are exposed to equal amounts of radiation?

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3. **Comparing and Contrasting** How does the changing temperature differ for dry sand and damp sand when they are exposed to equal amounts of radiation?

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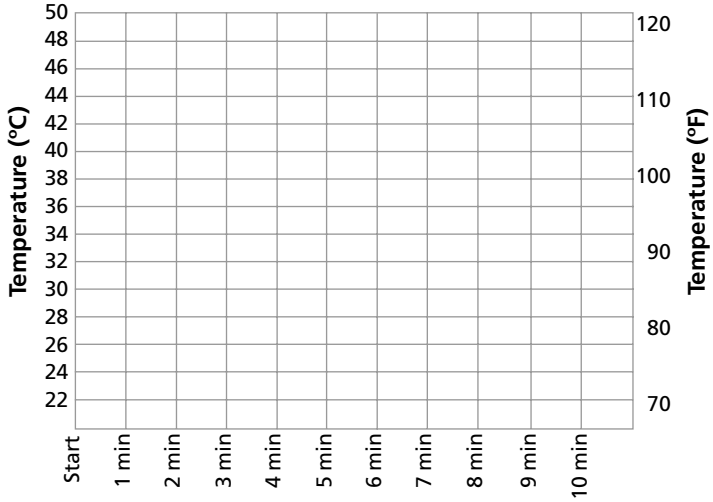
Land and Water Heating Graph



4. **Applying** Locate Eureka, California, and Lafayette, Indiana, on a United States map. Infer which city would show the greater annual temperature range. Explain your answer.

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