

LAB
2 Laboratory
 Activity

Using the Sun's Energy

You may recall how water in a garden hose lying in the grass can become hot on a sunny afternoon. Allowing the Sun's radiant energy to warm water in a solar collector is one way people are using solar energy to heat homes. To be useful and efficient, the solar collector must absorb and store a large amount of solar energy. In this experiment you will see how a solar collector can be used to heat water.

Strategy

You will build a solar hot water heater.

You will measure the temperature change of the heated water.

You will explain some benefits and problems in using solar heat.

Materials

100-mL graduated cylinder
 water
 plastic foam cup
 pen or pencil
 scissors
 shallow box
 metric ruler

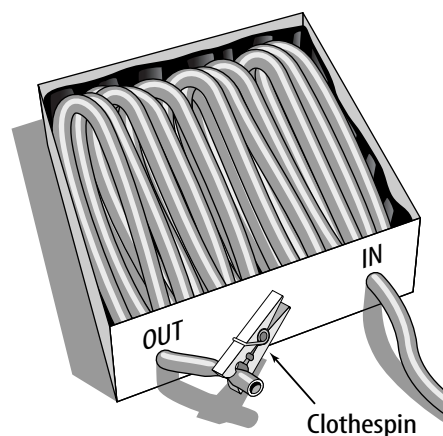
black cloth or paper
 tape
 black rubber or plastic tubing, 5–6 m
 buckets (2)
 clothespin, spring-loaded
 thermometer
 graph paper

Procedure

Part A—Building a Solar Water Heater

1. Use the graduated cylinder to add 100 mL of water to the plastic foam cup. Use the pencil or pen to mark the surface of the water on the inside of the cup. (Do not use a felt tip marker.) Discard the water and save the cup for later use.
2. Make 2 holes near the bottom of a large shallow box as shown in Figure 1. The diameter of each hole should be the same as the diameter of the outside of the rubber tubing. Label one hole *IN* and the other *OUT*.
3. Line the box with a black cloth or paper. If paper is used, tape it securely in place. The top of the box must be open to the sun.
4. Fold the rubber tubing in place inside the box as shown. Arrange the tubing so most of it will be exposed to the sun. The ends of the tubing should extend from the holes in the box.

Figure 1



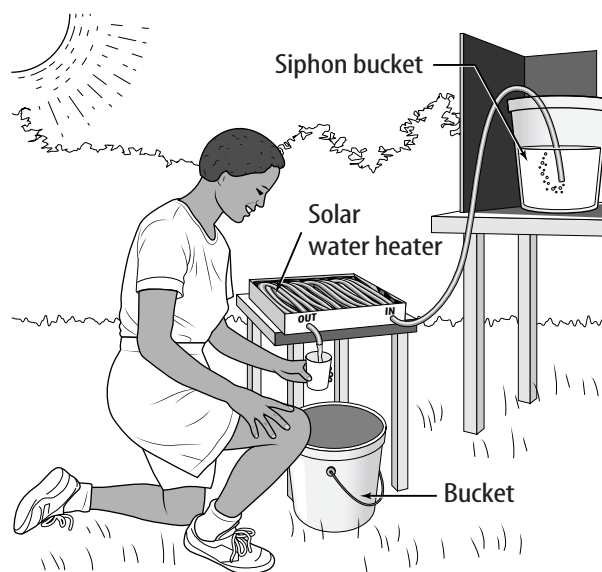
Laboratory Activity 2 (continued)

Part B—Using Solar Energy

1. Move the box to a sunny location. Turn the box so that it is in direct sunlight.
2. Place an empty bucket beneath the tubing leading from the *OUT* hole. Place a second bucket filled to the top with water so it is above the level of the box. See Figure 2. Shade the bucket of water from the sun. Your teacher will show you how to start a siphon to fill the tube.
3. When the entire tube is filled with water, pinch the *OUT* tube with a spring-loaded clothespin. The flow of water should stop. Maintain the siphon. Do not remove the *IN* tube from the bucket of water.
4. Slowly release the clothespin and fill the plastic foam cup to the 100 mL line. New water should siphon into the system through the *IN* tube. Measure the temperature of the water in the cup with the thermometer. Record the temperature in Table 1 as the temperature at 0 minutes.

5. Collect samples of water from the water heater every 5 minutes. Check to make sure new water is siphoning into the system from the bucket. Measure and record the temperature of each water sample in Table 1.

Figure 2



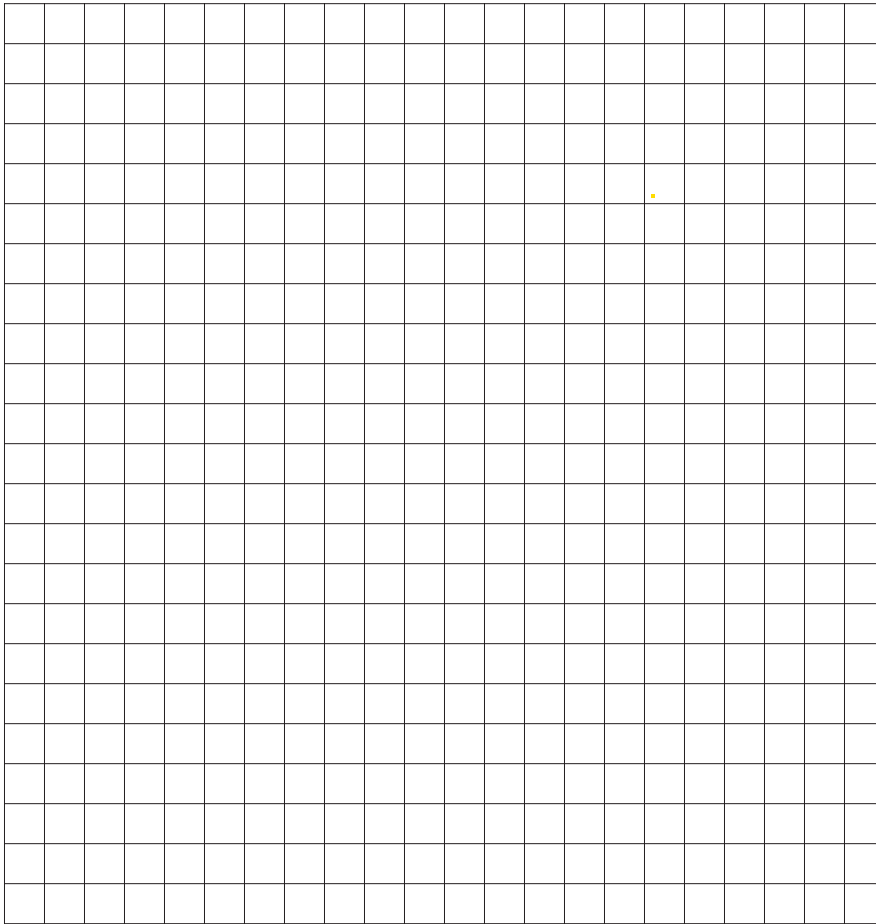
Data and Observations

Table 1

Time (min)	Temperature (°C)
0	
5	
10	
15	
20	
25	
30	

Laboratory Activity 2 (continued)

Use Graph 1 to graph the time and temperature of the water that you heated in the solar water heater. Determine which variable should be represented by each axis.

Graph 1**Questions and Conclusions**

1. What happens to the temperature of the water in the tubing as it is exposed to the Sun?

2. Explain how your graph indicates that solar energy can be used to heat water.

Laboratory Activity 2 (continued)

3. Why is the inside of the box of the solar water heater black?

4. Designers are using solar-heated water to heat entire houses. Tubes of heated water run through the walls of these solar houses. Usually the water heater is placed on the top of the house in a sunny location. Discuss some of the benefits and problems of using solar energy in this way to heat a house.

Strategy Check

_____ Can you build a solar hot water heater?

_____ Can you evaluate the usefulness of solar heat?