Activities

Student Activities *continued*

11 Now allow students to use their hands or the measurement tools to discover which surface gives off the most, second most, third most, and least heat. These discoveries should also be written down on individuals' papers as answers to number three.
(The darkest face should radiate the most heat, and the white face the least. The other two will be somewhere in the middle, with differences somewhat similar.)

12 Why were the results as they were? Discuss that dark objects absorb heat more, and white least of all, so they would only be able to give off what they had collected.

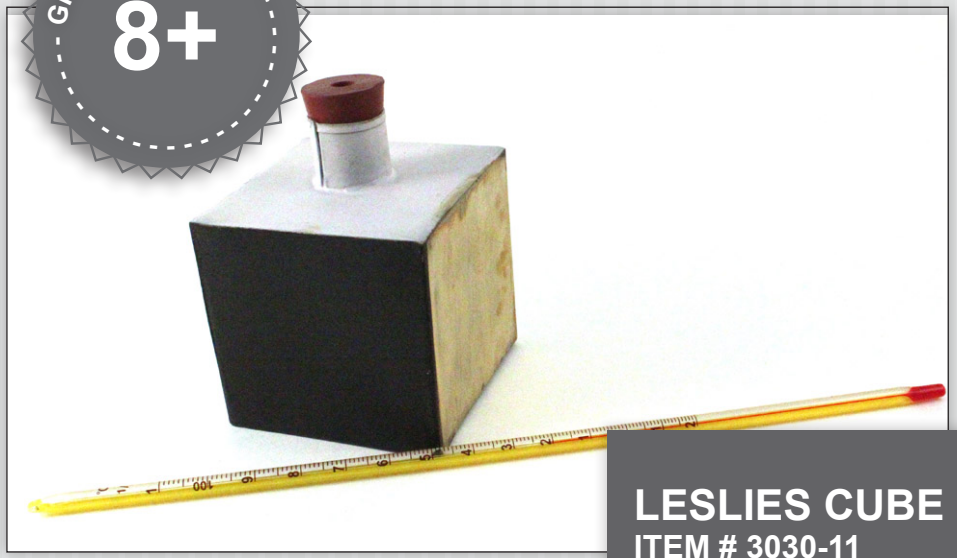
13 Discuss where the heat that planets have comes from. Take volunteer explanations, but then have them write on their papers that the heat for each body comes from the sun, and then that body gives off that heat in a radiant way, much as they saw from the ear thermometer or the cube. This would go next to a number four.

14 Ask students to research how scientists come to a decision about the temperature of the planets. A summary paragraph, with citation of source, should be the answer to number five on their paper.

***Note:* Instructions for the Thermopile:**
Attach the thermopile to a galvanometer. Place the thermopile a specific distance from the cube. Next, fill the cube with hot water and note the galvanometer reading as the thermopile faces each surface. Be sure that the cube-to-thermopile distance remains the same throughout the measuring.

TEACHERS GUIDE

GRADE LEVEL 8+



LESLIES CUBE
ITEM # 3030-11

ENERGY - HEAT

Students learn the concepts of radiant heat and its variations depending on surface types involved. This tinplate box has four different 130 mm vertical faces; blackened, roughened, varnished, and polished. The top opening to the box is 25 mm in diameter, allowing the box to be filled with boiling water. A Bunsen burner flame can maintain the water temperature. Thermopiles and galvanometers can be used to compare the relative output of heat for each surface. Care is needed to not read the thermopile directly from the flame.

- What does a simple ear thermometer and Nasa have in common?
- How do scientists know the temperature of Mars or Jupiter?

Materials

- 4 Bunsen burners
- an ear thermometer
- pictures of planets and stars
- 4 Leslie's cubes
- 4 galvanometers and thermopiles
- access to the Internet

Goals & Objectives

Students will:

- relate a common household item to important science.
- practice measuring radiant heat.
- discern which surfaces radiate more heat and which surfaces radiate less.
- apply these concepts to calculating the temperatures of celestial bodies.

Assessment

For Student Assessment, use:

- Group participation
- Notebook pages
- Discussion

Activities

1. Ask students how many of them have had their temperature taken via their ear. How does that work?

2. Show the pictures of the planets and stars and ask how scientists know what their temperatures are. (We can't get close enough to check directly.)

3. The answer to both is the measurement of radiant heat. Write this term on the board. Students should write number one on their own notebook paper, and next to it this term. Ask students to "Google" the term and define in their own words, writing it down on their paper. An acceptable definition would be something like "heat sent across waves instead of created directly by convection or conduction."

4. Ask for volunteers to have their temperature taken.

5. As you do this, ask them if the instrument is touching anything inside the ear. Are you touching their eardrum?
(No, it's too fragile. However, being inside the body, it gives an excellent reading of body temperature, so we use a way to measure the heat it gives off.)

6. Ask students to volunteer an explanation of how this idea is connected to ascertaining the temperature of various planets or stars.
(They can't be on the surface because it's too far, but they can measure the heat coming from each one, or its radiant heat.)

Note

It is always best to DO an experiment ahead of time to be able to best present it to the class.

7. One variable that will help in this measurement is the surface type.

8. Group students into 4 groups. Give each group a Leslie's cube, and a method of measuring temperature.

9. Allow each group to fill the cube with boiling water and light the Bunsen burner.

10. While waiting for the cube to heat, let groups make hypotheses about which surface will give off the most heat. Each student should write these hypotheses down on the same notebook paper as the definition, next to a number two.