Assessment

Student Assessment Questions/Answers

Review

1. Why do people in hot climates wear light-colored clothing?
   It reflects light, so they remain cooler

2. Why shouldn't they wear darker clothes?
   They absorb light and heat, making people hotter.

3. Why doesn't foil get hot?
   It reflects

Lab

4. Get a flashlight and shine it directly at the radiometer. What is its response?
   Vanes spin

5. Which direction does this response happen?

6. Turn the flashlight off and just allow the radiometer to react to the classroom lighting. What is the response?
   Spins slower (depends on how bright these are)

7. Take the radiometer outside (if it's a bright sunny day) and record the response and how it differs from the other attempts.
   Spins faster (depends on how bright the sun is)

8. Place your hands very close to the radiometer and let the heat from your hands warm the bulb. What is the response?
   It spins from the heat

9. Remove your hands and note what happens as the radiometer cools.
   It cools and slows down; it may reverse direction

10. Hypothesize about what causes the radiometer to respond as it does.
    Answers will vary

TEACHERS GUIDE

RADIOMETER
ITEM # 8224-00

ENERGY - HEAT

- What simple evidence might scientists have used to realize that the sun's energy could produce energy for today's technology?

Practice scientific inquiry and solar power as students learn about the development of the radiometer. Inside an evacuated glass bulb are four metal vanes, each with one shiny side and one dark side, on a frictionless spindle. When exposed to strong light, the vanes spin.

Materials

- 6-7 radiometers
- aluminum foil
- pictures of Arabian or other light colored garb to be worn in hot climates
- a tea-light candle or other source of flame
- student handout
- 6-7 flashlights
- Internet access

Goals & Objectives

Students will:

- explain how light energy can be transferred to mechanical energy.
- Summarize the historical development of scientific theories related to solar energy use.
- participate in and apply the processes of scientific investigation to build models.

Activities

1. Show pictures of the light colored clothing. Ask students why people wear those colors.
   (White reflects light.)
2. Ask students why they wouldn't wear black.
   (Absorbs heat and makes you hotter.)
3. Burn a tea-light candle, and hold a piece of foil over it. Have students feel it. Is it hot?
   (No, because it reflects heat.)
4. Distribute the handout, and ask them to answer the first section.
5. Group students into groups of four. Place a radiometer in front of each group. Ask them to use the information on the handout to work through the rest of the lab.
6. Once use of the radiometer and completion of the handout has occurred, each group should research a previous scientific theory regarding why the radiometer works. (Pressure of Light- James Clerk Maxwell, Radiometer according to Einstein, Thermal Transpiration- Osborne Reynolds)
   Research should answer: what was thought to be the cause of the spinning, what were the flaws in the theory.
7. Using paper and foil for vanes, paper clips for spindles, and other ingenuity, groups should build their own model, and write a statement about the variables that may thwart or benefit its performance.
8. Groups present their efforts in steps 6 and 7. 8.

Note

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

Assessment:
Handout,
Research,
Presentation with model.

STUDENT HANDOUT

Review

1. Why do people in hot climates wear light-colored clothing?

2. Why shouldn't they wear darker clothes?

3. Why doesn't foil get hot?

Lab

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5. Which direction does this response happen?

6. Turn the flashlight off and just allow the radiometer to react to the classroom lighting. What is the response?

7. Take the radiometer outside (if it's a bright sunny day) and record the response and how it differs from the other attempts.

8. Place your hands very close to the radiometer and let the heat from your hands warm the bulb. What is the response?

9. Remove your hands and note what happens as the radiometer cools.

10. Hypothesize about what causes the radiometer to respond as it does.