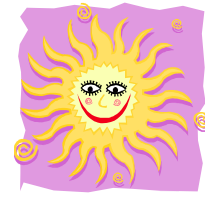


FUN IN THE SUN



BENCHMARKS and TASK

SC.B.1.2.2 The student recognizes various forms of energy (e.g., heat, light, and electricity).

SC.B.1.2.3 The student knows that most things that emit light also emit heat.

SC.E.1.2.3 The student knows that the Sun is a star and that its energy can be captured or concentrated to generate heat and light for work on Earth.

- The student recognizes that energy comes in many different forms: (e.g., **mechanical**, energy of position and motion; **electrical**, energy of moving electrons; **chemical**, energy stored in chemical bonds; **thermal**, heat energy - the energy of moving and vibrating molecules; **nuclear**, energy contained in the nuclei of atoms; and **radiant**, energy that travels in waves like sunlight).

KEY QUESTION

How does light interact with objects?

BACKGROUND INFORMATION

Light is a form of **energy** that travels at very high speeds. Light can pass through air, water, glass, and many other materials. Light can easily pass through materials that are transparent, like clear window panes. Some materials, such as opaque objects, do not permit light to pass through them. Opaque objects are usually **solid** materials, such as books or wooden blocks. Light that hits an opaque object is blocked. A shadow is then formed in the shape of the object blocking the light. Transparent, translucent, and opaque objects can all create shadows. An opaque object casts a shadow that looks totally dark because it blocks all of the light rays falling on it; no light passes directly behind the object. A transparent or translucent object casts a lighter shadow because it blocks only some of the light rays falling onto it.

Photosensitive paper is used in this activity. Photosensitive paper works because the paper is coated with a thin film of a chemical that is changed by the ultraviolet rays that are absorbed from the **sun**. You can see this change when the color of the paper changes from blue to off-white.

MATERIALS

Teacher

scissors
overhead projector

Per student

1 black, construction paper folder containing 2 pieces of sun-sensitive paper

Per class

several shallow pans of water
variety of magnifiers
assortment of paper (colored tissue, construction paper, acetate, foil, and notebook paper)

TEACHING TIPS

1. Photosensitive paper can be purchased at local school supply stores and through science catalogs.
2. Cut photosensitive paper into 10 cm-squares prior to the lesson. Florescent light damages paper. **Cut sun sensitive paper in a dark place and store it in a dark folder made from**

folded black construction paper or the activity may not work. (Each student will need a black, construction paper folder containing two pieces of sun-sensitive paper.)

3. Go outside ahead of time and choose a suitable area for the activity. Place several shallow pans of water in the activity area.

ENGAGE

Darken the room and use a light source, such as an overhead projector, beamed at the screen. Allow the students to explore shadows by using different objects to create shadows on the screen and by standing at various distances between the projector and the screen.

Ask:

What is the largest shadow you can make?

What is the smallest shadow you can make?

How does the distance between the light source and the object affect the shadow?

Can all objects cast a shadow?

EXPLORE

1. Explain to students that they are going to explore how special light-sensitive paper interacts with light. Demonstrate how to use the materials they will be using outside.
2. Give sun-sensitive paper in a protective folder and a magnifier to each student.
3. Take students outside. Tell them to remove the sun paper from the folder and place it on a hard, flat surface.
4. Have students immediately place the magnifier on top of the paper. (Note: Students should be using different kinds of magnifiers, so different effects can be seen.)
5. Have students leave the paper and the magnifier in the light until the paper turns almost white (approximately 3-5 min. or longer).
6. Students should place the paper in a pan of tap water for about one minute.
7. Have students lay their papers on a flat surface to dry and watch the images appear!

EXPLAIN

What colors do you see on the sun-sensitive paper? (White and different shades of blue are usually noted.)

Why do you think there were different shades of blue?

Do all parts of your magnifier look the same? (Tell students to observe the magnifiers they used.

This is a good time to introduce the terms transparent, translucent and opaque. Transparent, translucent and opaque parts of the magnifiers will produce different shades of blue on the sun-sensitive paper because some parts will allow light to pass through and some will not.)

Do all objects cast a shadow?

What causes shadows to be cast?

EXTEND/APPLY

Encourage students to design another experiment. Students will need another sheet of sun-sensitive paper in the dark construction paper folder and assorted squares of opaque, transparent and translucent paper from which to choose. (See materials list.) Students can explore to see how much light can pass through the different materials.

EXTENSIONS

1. Use a variety of objects (leaves, rocks, etc.) to create additional sun prints.

2. Try sun printing at different times of the day. *How does the time of day affect exposure time and shadow lines?*
3. Make a school and home search for other examples of transparent, translucent, and opaque objects and think about why that type of material was used in the object.

ASSESSMENT

Tell students to pretend they are architects and ask them to draw a simple building. Tell them to use transparent, translucent, and opaque glass in the design. They should show where they would use the different types of glass and justify why they would use it in those places.