

Summary:

Students construct “Mystery Boxes” to explore qualities of light provided by the sun.

Grade Level:

K-4

Subject Areas:

Language Arts, Mathematics, Physical Science, Environmental Literacy & Sustainability, Art (if students assemble their own Mystery Boxes)

Setting: Classroom for Mystery Box assemblage; Schoolyard for activity

Time:

Preparation: 30 minutes (plus time to prepare Mystery Boxes)
Activity: 50-minute period

Vocabulary: Energy, Light, Opaque, Solar energy, Sun, Translucent, Transparent

Materials:

- Materials to assemble several Mystery Boxes (see **Mystery Box Assembly Directions**)
- Flashlight (optional)
- **Energy Learning Log** and writing implements

Standards Addressed:

CC ELA: L.K.5.D, L.K-2.6, L.1.5.B, L.2.5.A-B, L.3.5.B, RI.3.4, RI.4.7, SL.K.1.A, SL.K.2-4, SL.K.6, SL.1.1.B-C, SL.1.4, SL.2.1.B-C, SL.2.2, SL.3.1.A-B&D, SL.3.6, SL.4.1.A-D, W.K.2&8, W.K-4.7

CC Math: MP5

NGSS: 1-PS4-2

SEP: Constructing Explanations and Designing Solutions

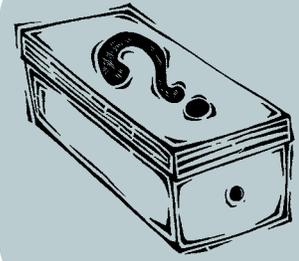
DCI: PS4.B: Electromagnetic Radiation
CCC: Cause and Effect

EL&S: Connect: C1.C.e
Explore: EX2.C.e

Related KEEP Activities:

In “Evidence of Energy,” students learn by investigating motion, sound, heat and light that they and other objects in the classroom use energy at keepprogram.org.

Let the Sun Shine Through



Objectives

Students will be able to:

- recognize that the sun’s energy can be seen as light; and
- demonstrate that the amount of light affects what they can see.

CAUTION:

Because too much exposure to the sun can be harmful, remind students to dress properly and use sunscreen when doing outdoor activities for long periods. Also, remind the children they should never look directly into the sun. Sunglasses are always a good idea.



Procedure

1. Take students outside on a sunny day and discuss where sunlight comes from and what it represents (sun’s energy). Have students close and cover their eyes with their hands and ask them if they can see. Continue the discussion until students understand that we need light to see. Discuss the difference between night and day. How do colors compare in the night versus in the day? Why do students think this is?

2. Proceed with the Mystery Box demonstration to reinforce the idea that light from the sun enables us to see. Depending on the number of Mystery Boxes constructed, divide the students into groups and give a box to each. Tell the students they are going to investigate how levels of light—no light, a little light, or a lot of light—affect what they can see.

3. Have them hold the box up toward the sky and look through the pencil hole (but not directly at the sun). Ask them how much light is coming through the hole. Ask them to try to identify the object inside. If they cannot, ask them why.

4. Ask students to flip down the cardboard flaps to expose the waxed paper and look through the pencil hole. How much light is coming through now? Can they identify the object? If so, what

color is it? If not, why can’t they identify the color of the object? Light can pass through the waxed paper, but it is diffused so objects cannot yet be seen clearly.

5. Ask students to take off the second layer, leaving only the clear wrap. Ask them how much light is entering the Mystery Box now. Can they identify the color? Why can they identify the color with the see-through plastic, when they could not with the waxed paper?

6. Have students collect items from the schoolyard or classroom and test their properties by shining a flashlight behind the object and noting whether there is no light, a little light, or a lot of light shining through. Have them describe or illustrate in their **Energy Learning Logs** what the presence of sunlight means and describe or illustrate examples of the items they collected.

Assessment

- Have students describe the importance of light.
- Have students describe how objects appear in varying amounts of light.

Extensions

To reinforce the idea that light from the sun enables us to see, have students use a dark crayon to draw or trace simple pictures on sheets of light-colored construction paper. Make sure the objects they draw cannot be seen from the reverse side of the construction paper until you place the paper against a window. Display the sheets against the wall or the blackboard, blank side out. Ask the children if they can see the pictures they have drawn. Finally, place the sheets against the window glass with the blank sides out. The children should be able to see the pictures easily. Have them identify the various objects.

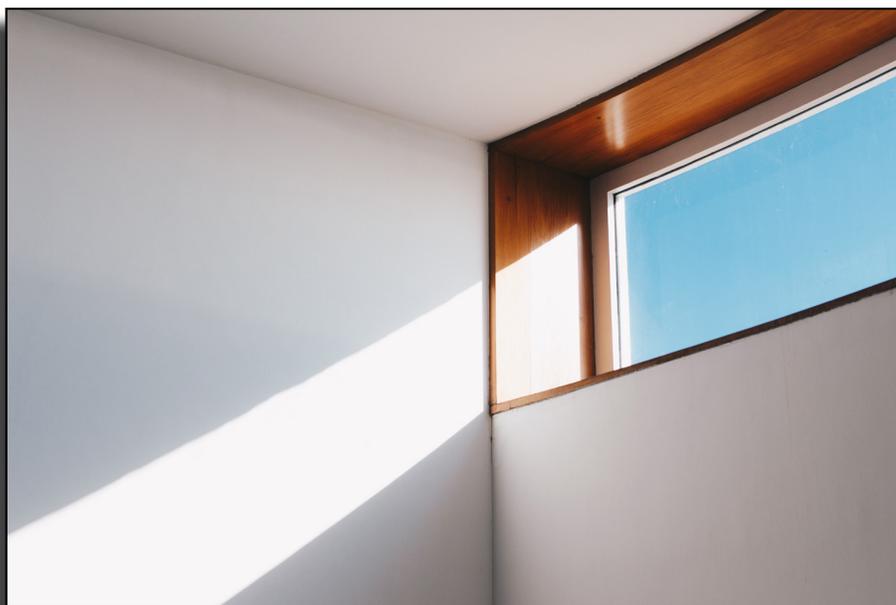
New buildings are often designed to take advantage of natural light so that artificial lights don’t have to be used during the day. Take a field trip and explore the difference between a building that uses daylighting and one that does not.

Create a shade line to continue exploring colors (e.g., have the students gather leaves in various shades of green and arrange them in order from dark to light). Talk about how the sun affects color. Hand out prisms and have the students look at the light spectrum. This can be an opportunity to learn more about rainbows.

The Mystery Box can be used to demonstrate that various objects or materials have transparent, translucent, and opaque properties. Opaqueness (the quality of blocking the passage of radiant energy, especially light) can be introduced by explaining that light is not able to pass through the cardboard. Translucency (the quality of transmitting and diffusing light so that objects beyond cannot be seen clearly) can be introduced by explaining that the waxed paper diffuses the light. Introduce transparency (the quality of being able to transmit light so that objects lying beyond can be seen clearly) when the clear plastic layer is exposed.

Mystery Box Assembly Notes: To ensure desired results, when the Mystery Box is assembled correctly, make sure it is dark enough inside that the colored object can't be identified. With the cardboard flap open and the waxed paper exposed, the students should be able to identify the object but not its color. With the waxed paper removed and the clear plastic exposed, the student should be able to identify both the object and its color.

Depending on their dexterity, students can make the Mystery Boxes and put an item inside. Students can trade boxes to try to guess the item.

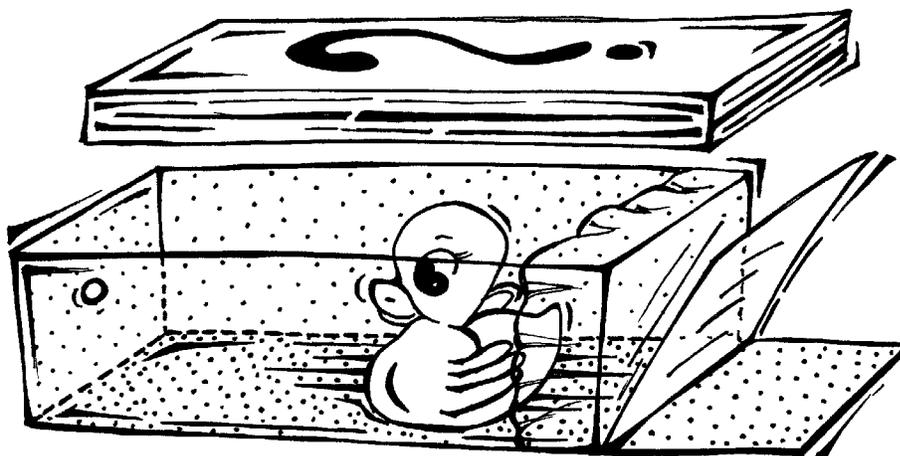




Mystery Box Assembly Instructions

Materials

- Shoebox
- Pencil
- Scissors
- Tape
- Clear plastic wrap
- Two or three sheets of waxed paper
- Small objects in a variety of colors (e.g., small toy, box of raisins, crayons, etc.)



Directions

- Poke a peephole in the center of one end of the shoebox with a pencil.
- Remove the lid. With the scissors, cut the other end of the shoebox so it hangs open, remaining connected at the bottom like a flap.
- Tape a sheet of clear plastic securely over the open end.
- Take the waxed paper and tape it onto the open end of the shoebox. You may need to use more than one piece to effectively diffuse the light. Be sure the flap is still able to be closed with tape and that the waxed paper can eventually be removed.
- Secure one of the colored objects to the bottom of the shoebox near the opposite end of the peephole.
- Replace the lid and close the cardboard flap of the box.