



Shadows in the Schoolyard

Objective

- Students will demonstrate that the sun's position in the sky determines shadow length and direction.

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. Tell students they are going to investigate "The Mystery of the Schoolyard Shadows" (embellish the story as desired; you can play the part of a person who keeps losing his or her shadow). Explain that the shadows in the schoolyard keep changing throughout the day and they must help to solve this mystery. Ask them what they think happens to shadows, and have them write the answer in their **Energy Learning Logs**. Ask them to predict when the shadows will be longest and when they will be shortest.

2. Find a sunny, flat area near your school. Orient students to north and review how to use a ruler as needed. **NOTE:** To help younger students understand directions, you might want to orient them to a landmark in the schoolyard, such as a tree or a building that is north of them. They can use this landmark as a reference point. For measuring they can use a string, a piece of yarn, or another adapted measuring tool. Students can then draw the length of string on a wall chart to measure shadow length and identify the schoolyard landmark to record shadow direction.

3. Choose an object that will cast a shadow that is easy to measure. The object can be a mailbox, pole, or piece

of playground equipment, or you (the teacher). At various times of day, have the students go outside and measure the length of the assigned object's shadow with a yardstick or string, recording the length and direction of the shadow and the time of day in the **Schoolyard Shadow Table**. After each measurement, have students compare it to the previous measurement and predict how the shadow will be cast next time. See if they notice a pattern.

4. Have students look at the table to determine if they predicted correctly. Why does the shadow change throughout the day? Continue to investigate this case for at least a week. Are the shadows the same day after day?

5. Were students able to solve the mystery of why the shadows change throughout the day? The students that worked together can present their findings as a group, or the entire class can work together to solve the mystery. Continue the discussion until students understand that the sun appears to be positioned differently in the sky during the day due to Earth's rotation (i.e., be sure students understand that the sun is stationary while it is our planet that is moving). Earth's orbit changes during the different seasons, which also seems to change the position of the sun.

Assessment

- Have students collect data throughout the week, record their findings in their **Energy Learning Log**, and use the information to compile the **Energy Flow Mural**.
- With a drawing or a play, have students demonstrate the sun's position in the sky and the change in shadows throughout the day.

Extensions

Repeat these activities over the course of the school year. Have the students keep a seasonal log to track the data obtained and to look for patterns.

Summary:

Students measure shadow lengths to appreciate how the sun's height and location in the sky varies throughout the day.

Grade Levels: K-4

Subject Areas: Language Arts, Mathematics, Earth and Physical Science, Environmental Literacy & Sustainability

Setting: Outdoor site where there are shadows that can be measured

Time:

Preparation: 20 minutes

Activity: 50-minute period plus time needed for shadow measurements throughout the day

Vocabulary: Light, Shadow, Solar energy, Sun

Standards Addressed:

CC ELA: L.4.2.D, L.4.3.A-B, RI.K.1&3&10, RI.1.3&5, RI.2.5, RI.3.3-5, RL.K.1&10, SL.K.1-6, SL.K.1.A, SL.1.1-6, SL.1.1.B-C, SL.2.1-2, SL.2.1.A-C, SL.2.4, SL.2.6, SL.3.1.A-B&D, SL.3.6, SL.4.1.A-D, SL.4.5, W.K.1-3&8, W.1.1-3&8, W.2.1&3&8, W.3.1.B&D, W.3.7, W.4.1.B-C, W.4.2.D-E, W.4.3.D-E, W.4.7

CC Math: MP5, 2.MD.1-5

NGSS: 1-ESS1-1

SEP: Planning and Carrying Out Investigations

DCI: ESS1.A: The Universe and its Stars
CCC: Patterns

EL&S: Connect: C1.A.i, C1.C.e, C1.C.i
Explore: EX2.A.e, EX2.A.i, EX5.B.e

Materials:

- Energy Learning Log** and writing implements
- Piece of schoolyard equipment, a tree located in an open area
- Compass (optional)
- Rulers
- Copies of **Schoolyard Shadow Table**

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Related KEEP Activities:

To investigate how shading, coloring, and other factors affect temperature, refer to “Taking Temperatures.” Refer to “Exploring Heat” and “Shoebox Solar Cooker” to help students understand heat and thermal properties of sunlight. Energize students by exploring light energy through the use of mini solar panels. To generate ideas on how to power up radios, toys, and more in your classroom, refer to “The Miracle of Solar Cells.” To further explore the heat and light properties of the sun, refer to KEEP Energy Sparks “Exploring Light Energy” and “Exploring Heat.” Available at keepprogram.org.

Investigate what happens to the length of shadows in your schoolyard in the morning, afternoon and evening by having students trace other classmates’ shadows on large pieces of butcher paper. Compare the proportions.

Compare the time of day and where on the horizon the sun sets in summer, fall, winter, and spring. Is there a relationship between outside temperatures and sun height in the sky? What do people wear each season

in response to temperature changes? Have the students create a collage or perform a fashion show that illustrates the various kinds of clothing people wear during different seasons.

Use the sun to determine which direction (north, south, west, or east) the front of your school faces. Which part of the school faces the sun when it rises? Label the east and west sides. Which side or part of your school is always in the shade? This is the northern side.





What the Sun Does for Me

Schoolyard Shadow Table

Date	Time	Shadow Length (inches)	Shadow Direction (N, W, E, S)	Change since last measurement (inches)