The Analemma

Summary

To help understand that the sun's position in the sky is not constant, students will learn about analemmas.

Group Size

Large Groups

Materials

- Southern facing window with direct sunlight
- Masking tape
- Permanent marker

Background for Teachers

An *analemma* is a lopsided figure-eight shape that shows the apparent motion of the sun across the sky. In this activity we begin to create an analemma. The goal is to show students that the sun’s position in the sky is not constant. As summer approaches, the sun rises higher in the sky, giving more intense heat to Earth. As winter approaches, the opposite is true. The sun is lower in the sky thus giving less intense heat to Earth. This is because Earth’s axis is tilted at an angle of 23.5°. This explains the sun’s apparent north and south track across the sky. However, the sun also appears to move eastward and westward at a specific time because Earth’s orbit around the sun is an ellipse.

Safety Note

Remind students that it is never wise to look directly at the sun as it may cause permanent damage to the eye.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles

Instructional Procedures

Invitation to Learn

Ask students what they can do to show that the sun’s position in the sky isn’t changing. Discuss their ideas on how to prove this.

Instructional Procedures

Prior to the activity, find a southern facing window that has good exposure to the sun and nothing to block the sun like trees. If you do not have one in your classroom, you might find one in a central location such as the cafeteria or library. Mark where you will place the mirror and be sure to put it in the exact same position each time.

Obtain a small mirror, one or two inches across is adequate. Place the mirror in the windowsill and check that the area it reflects on is free of obstacles such as lights. If the area isn’t clear, you can either move the mirror or do the activity at a different time. If you can tape the mirror permanently in place, do so. Otherwise, mark the spot where you place the mirror. It is very important that the mirror be in exactly the same position each time you take a measurement.

On a piece of masking tape, write the date and time, then place the tape on the ceiling in the middle of the light reflected from the sun.

One to two times a week, at the exact same time each day, write the date and time (on a new

piece of tape) and place it in the middle of the reflected light. Be careful of daylight savings time; it is probably best to just use standard time.

Extensions

This is a great opportunity to discuss reflection. It is easy to show that the angle of reflection is opposite the angle of incidence during this activity. As the sun moves one way across the sky, the reflected sunlight on your ceiling moves in the opposite direction. You create a crude analemma in this activity. Use the links listed under *Additional Resources* to gain additional information on analemmas.

Family Connections

Have students try this activity at home with their family and report on how it worked.

Assessment Plan

The following questions can be discussed orally as a class or in groups. You may also have students write the answers to these questions in a science journal.

In which direction do you expect the light to move as winter approaches?

In which direction do you expect the light to move as summer approaches?

Do you think the light will move in any other direction?

Do you think that the light reflected on the ceiling from the sun will be in the exact same spot one year from today? Why or why not?

Students draw the position of the sun in their journals and label each measurement.

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