

## Activity 2.1 Patterns of the Sun Teacher Notes

### Introduction

You hear “Good morning,” and it is time to wake up for a great day at school. Is it light out yet? Where exactly is the sun when it appears? Will it still be light out when it is time to go home? And where exactly is the sun at that time?

In this activity you will act as a sun tracker and create an instrument to help you make observations about the sun’s position. Once you have made your observations, you will answer questions about the sun’s apparent movement.



### Equipment

- Launch Log for each student
- iPad® tablet
- iPad Apps:
  - Compass for iPad® app
  - Popplet Lite app
- Cardstock, 8.5"x11", 30 sheets, white preferred
- Computer paper, 8.5"x11", cut in half, 15 sheets
- Scissors
- Cellophane tape
- (Optional) Drinking straws, 1 per student
- (Optional) Clay

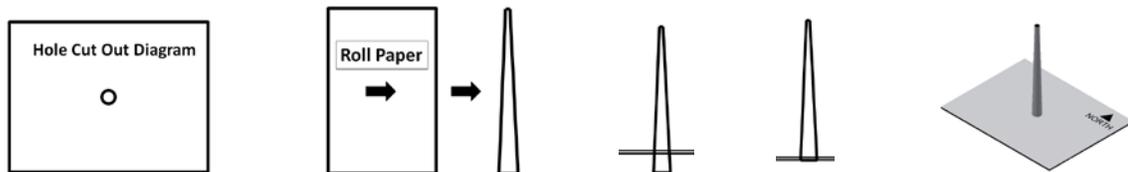
### Procedure

#### Part 1 – Setting the Stage

1. The teacher reads aloud the Light: Observing the Sun, Moon, and Stars Introduction. This is a fictional story that describes the problem three friends experience as they play outside in the sun during recess.
2. The teacher leads a class discussion about the problems faced by the students.
3. The teacher reviews why shadows form as discussed during the previous module, Light and Sound. The teacher discusses the following:
  - a. Why do we see the sun?  
*Sun generates light, and that light travels through space.*
  - b. What does sun provide?  
*Sun provides light energy and heat energy.*

## Part 2 – Building Your Sun Tracker

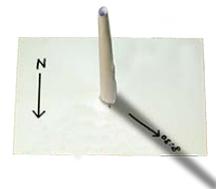
1. The teacher guides students as they build their sun tracker devices using the directions below (assembly guide below).
2. Begin by tracing a circle the size of a dime in the middle of the card stock. Cut out the circle.
3. Cut an 8.5" x 11" sheet of computer paper in half lengthwise. Roll one of the halves into a tight cone with the bottom of the cone just larger than the hole you cut out. When the cone is inserted through the card stock, it should fit snugly. Leave about 1 inch of the cone protruding below the card stock. Tape the cone in several places to keep it tightly rolled.
4. Insert the cone into the cardstock. To create flaps, use scissors to cut approximately 8 slits in the protruding portion of the cone below the card stock. Fold the flaps until they are flat with the bottom of the base of the cardstock.
5. Tape the bottom cut flaps to the base using cellophane tape.



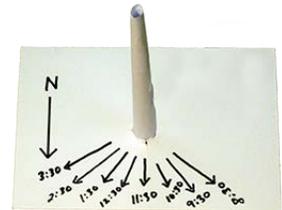
6. Note: If the above directions are too difficult for the students, the teacher may choose to assemble the sun trackers or use an alternate building strategy using drinking straws and clay. In this setup the straw is inserted through the cardstock and held in place with a small amount of modeling clay.

## Part 2 – Sun Tracking

1. The teacher uses the instructions below to show students how to collect sun data with the sun trackers.
  - a. On a sunny day, take students outside with their sun trackers, tablets, and pencils.
  - b. If it is windy outside, have students tape down the sun trackers.
  - c. Using the Compass app on a tablet, direct students to lay their sun tracker down and align the north arrow with north on the compass app as shown below. Direct the students to draw an arrow on their sun trackers in the middle of the shadow and label the time.



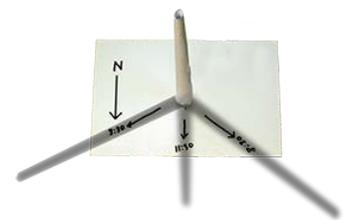
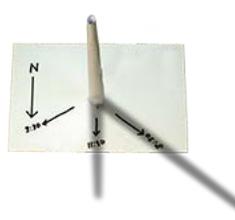
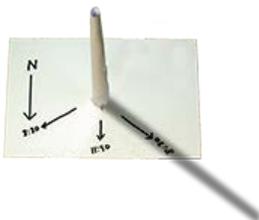
2. Direct students to take a picture with the tablet. Students must make sure they include the sun tracker and the complete shadow in the picture.
3. Wait an hour (or to the end of the class period) and repeat.



- a. Depending on the length of class, consider the following:
    - Have the next class make their own sun tracker and record data for the previous class as well as their own data.
    - Have students collect two or three sets of data throughout the day.
    - Have students take sun trackers home and collect data on the weekend.
    - Have students copy a completed teacher example with all arrows and times labeled for when they were not able to collect data.
  - b. The teacher creates a model for students to follow that shows the hours of the school day completed.
  - c. The teacher takes pictures in the early morning, mid-day, and afternoon for use later when examining shadows.
4. Draw a “sun symbol” on your base to show which side of the cone the sun must have been on.

### Part 3 – Examining Shadows

1. To examine the shadows, you may choose to have students take photos another day or use images you captured on the day when you tracked the sun.
2. Students will take pictures throughout the day to include images from early, mid-day, and later in the afternoon. Alternately, students can use images taken by other classes or teacher images if the schedule does not allow for the students to take photos throughout the day.
3. Direct the students to open the Popplet Lite app on the tablets and guide them through the following steps.
  - a. Add a picture from early, midday, and afternoon to three different popplets (samples below).
  - b. Label each popplet with the time of day when you took the picture.



- c. Compare the lengths of each shadow. Which is the shortest? Longest?
- d. Add a popplet to the pictures to EXPLAIN your thoughts on why some shadows are longer than others.

#### Part 4 – Examining the Amount of Daylight throughout the Year

1. Direct your students to their Launch Log and have them color in the bar graph showing amount of daylight.

a.

Month	Hours of Light	Month	Hours of Light
January	9.50	July	14.90
February	10.20	August	14.25
March	11.30	September	13.00
April	12.70	October	11.75
May	13.85	November	10.50
June	14.75	December	9.50

- b. This data was retrieved for Indianapolis, IN. You can find data specific to your area at various websites, such as:  
<http://dateandtime.info/citysunrisesunset.php?id=4259418>
2. Discuss the pattern that they observe. Students may observe that the data shows less sunlight in the winter months and more in the summer.
3. This graph may also be used to introduce students to the various parts of a bar graph, including the title, the two axes with labels, a scale, and bars.
4. Discuss other patterns of the sun that have been observed. Lead students to fill in the missing words in their Launch Log to the following statement:  

The Sun rises in the morning and sets at night.
4. After the students have collected data on the sun trackers, you may direct them to remove the center tube and then tape or glue the cardstock into their Launch Logs at the top of Page 2. If students made the sun trackers in pairs, the teacher may wish to photocopy the trackers so both students have a sample to include.
5. The teacher may choose to have the students write an answer to one of the conclusion questions in their Launch Log on Page 2 or discuss the questions as a class or in small groups.

#### Conclusion Questions for Discussion

1. What is the problem faced by Suzie, Mylo, and Angelina?
2. How might the patterns of the sun that we observed help us solve the problem Angelina, Mylo, and Suzi are facing?