

Apparent Motion

Background Information

From our position on Earth, the Sun seems to move across the sky throughout the day. Actually, the sun isn't really moving – instead, the Earth is spinning. Still, this apparent motion plays a major role in how the Sun affects the days and seasons on Earth.

NOTE: This activity should be done on a sunny day. It should be started as early in the morning as is possible and continued into the afternoon. You will need to locate directional South before beginning the activity.

Objectives

By the end of this activity, students will be able to:

- identify the Sun as the source of Earth's light.
- observe and describe changes in the Sun's altitude and position.
- recognize that day and night are determined by our view of the Sun.

Instruction Time

45 minutes to all day

Materials

- Astronomer Journal pages 15-16
- Easel with sheet of large paper
- Markers
- Compass
- Stick-on Dots
- Globe

Procedure – What is the Sun?

1. Have the students complete the shadow worksheet on page 17 of the Astronomer Journal.
2. Initiate a class discussion on the meaning of "a day". You might ask, "If your birthday is one day from now, how can you tell when the day has ended and your birthday has come?"
3. Ask about regularly occurring events that let you know time is passing and the "next day" is getting closer and closer. If students do not mention changes in the Sun, ask what happens during the day to change it into night. Does it become night all at once or does the change from day to night happen slowly?
4. Propose doing an outside experiment to find out whether people can see day turning into night.
5. Take the students and materials outside. Tell the students they will help you study the Sun, but warn them never to look directly at the Sun.

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6. Have everyone face South. Set up the easel. Mark its location in a manner that will allow it to be returned to exactly the same position throughout the day.
7. Tell students that you want to draw a picture of the view in front of them. Ask students for suggestions of what should be included in the drawing.
8. The student's suggestions should be drawn on the easel paper, and students should also draw them in their Astronomer Journals.
9. Help students to describe objects they want included in the drawing in relation to one another (taller than, in front of, behind, etc.). As each object is added to the drawing, ask students to verify that it is in the correct location.
10. Warn students once again to never look directly at the Sun.
11. Ask students where in the picture the Sun should be placed. Compared to the height of the tallest object in the drawing, how high should the Sun be drawn?
12. Draw the Sun in the agreed upon location in the picture. Write the time of the observation on the Sun. (Students should also draw and label the sun and time in their Astronomer Journals.)
13. Ask students if there is any way to tell the Sun's location when their eyes are closed. Have them close their eyes and answer the question.
14. Return the easel to the classroom. Tell the students that in one hour, they will go back outside to see whether the Sun is in the same location or seems to have moved.
15. Ask students to predict where the Sun will be in one hour. Give each student a stick-on dot to be put on the drawing in the place they think the Sun will be in one hour.
16. In an hour's time, take the easel and students to the same location outside. Be sure the easel is in the exact location as it was earlier.
17. With the help of the students, locate on the previously drawn picture the Sun's current position.
18. Add a second Sun to the picture in the new location. Again write the time of this observation on the Sun. (Students should also draw and label the sun and time in their Astronomer Journals.)
19. Back in the classroom, discuss the accuracy of the students' predictions of where the Sun would be after an hour.
20. Have the students carefully remove their dots and place them where they think the Sun will be located in the next hour.
21. Continue adding Sun positions to the drawing and marking the student predictions at least 4 more times during the day. Make sure one of the views is around noon. Be sure to write the time of the drawing on each Sun.

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Expected Results & Explanation

During the classroom discussion that takes place after the last Sun is drawn, ask questions such as:

- a. When was the Sun highest in the sky?
- b. At what time was it lowest?
- c. Do the changing Sun locations make any kind of shape or pattern?
- d. Connect the various Sun locations with a smooth curved line. Ask students why they think the Sun makes this shape as the day goes by.
- e. Ask where the Sun goes in the evening.
- f. Discuss whether students have ever traveled to another state or another country and heard adults talk about how the "time has changed". Discuss what that means.
- g. Ask whether it is daylight at the same time all over the world.
- h. Ask students what would happen if we did the experiment again tomorrow, what would the results be.
- i. Close the discussion by play-acting the Earth's rotation. Use a stick-on dot to mark your school's location on a globe. Give one student a flashlight to hold. That student represents the Sun. Allow another student to slowly turn the globe counterclockwise in front of the Sun. Turn off all of the other room lights. Ask students whether they think it would be daylight or night when their location is facing the Sun; what about when their location is turned away from the Sun. Ask whether their outside observations could be explained by a rotating Earth.

The above activity can be modified for more advanced students. The same basic procedure should be followed, however the students should:

- be taught to use a compass to locate South for themselves
- make individual drawings
- assume the responsibility for marking their location in a manner which will allow them to find that exact location throughout the day
- make and compare observations extending over a longer period of time

New observations should be made as close as possible to the same times of day over a period of several months. Have students use the same sheet of paper and add on the new Sun locations. Different colors can be used for different weeks or months.