ACTIVITIES 26&27

Solar Journal (Sessions I and II)

BROWARD COUNTY ELEMENTARY SCIENCE BENCHMARK PLAN

Grade 5—Quarter 3
Activities 26 & 27

SC.E.1.2.1
The student knows that the tilt of Earth on its own axis as it rotates and revolves around the Sun causes changes in season, length of day, and energy available.

SC.E.1.2.3
The student knows that the Sun is a star and that its energy can be captured or concentrated to generate heat and light for work on Earth.

SC.H.1.2.1
The student knows that it is important to keep accurate records and descriptions to provide information and clues on causes of discrepancies in repeated experiments.

SC.H.1.2.2
The student knows that a successful method to explore the natural world is to observe and record, and then analyze and communicate the results.

SC.H.1.2.3
The student knows that to work collaboratively, all team members should be free to reach, explain, and justify their own individual conclusions.

SC.H.1.2.4
The student knows that to compare and contrast observations and results is an essential skill in science.

SC.H.3.2.2
The student knows that data are collected and interpreted in order to explain an event or concept.

ACTIVITY ASSESSMENT OPPORTUNITIES

The following suggestions are intended to help identify major concepts covered in the activity that may need extra reinforcement. The goal is to provide opportunities to assess student progress without creating the need for a separate, formal assessment session (or activity) for each of the 39 hands-on activities at your grade.

1. **Session I—Activity 26:** After students have used their directional compasses outdoors, have them use their compasses in the classroom to identify the directions of north, east, south, and west. Ask, *If this class met at sunrise, would we have to lower the window shades in the room to keep the light out? Why? What if the class met at sunset?* (Answers will vary based on orientation of the room as well as time of year.)

2. **Session II—Activity 27:** Have students use their sunrise journal to predict what time they think the Sun would rise on day 15 if they continued their observations. (Answers will vary.) Similarly, have students use their sunset journal to predict the location of the sunset on day 15 by placing a red dot and label on their activity sheet. (Answers will vary.)

3. Use the Activity Sheet(s) to assess student understanding of the major concepts in the activity.

In addition to the above assessment suggestions, the questions in bold and tasks that students perform throughout the activity provide opportunities to identify areas that may require additional review before proceeding further with the activity.

ACTIVITIES 26&27

Solar Journal

OBJECTIVES

To gain an understanding of the relationship between the apparent motions of the Sun and the actual motions of Earth, students keep a daily journal of sunrise and sunset times and positions for a given location.

The students

- keep an ongoing record of the times and positions of sunset and sunrise
- recognize the apparent motion of the Sun
- prepare data for use in future activities

SCHEDULE

Session I—Activity 26 About 40 minutes, with continuing observations for 10–14 days

Session II—Activity 27 About 20 minutes, 10–14 days after completing Session I

VOCABULARY

horizon
sunrise
sunset

MATERIALS

For each student

1 Activity Sheet 26, Parts A and B

For each team of four

1 compass, directional

For the class

1 Activity Sheet 26, Parts A and B
1 chart, Class Sunrise/Sunset Data
DSR *Earth, Moon, and Sun*

PREPARATION

Session I—Activity 26

1. Make a copy of Activity Sheet 26, Parts A and B, for each student and for yourself. Hang the Class Sunrise/Sunset Data chart in a prominent location.
2. Session I should be conducted first thing in the morning. Select a section of the schoolyard where students can look east and west for a sample observation.
3. As an alternative, have students research times for sunrises and sunsets on the Internet or in your local newspaper. If you prefer, you or a parent can provide these times.

BACKGROUND INFORMATION

Students know that the days change length throughout the year, but the subtle daily changes in the Sun's apparent path that cause these changes frequently escape their detection. In this activity, students observe that there is a noticeable change in the time and location of ***sunrise*** and ***sunset*** in relation to the horizon over a relatively short time interval.

These changes in the Sun's position are caused by the movement of Earth, not the Sun. As Earth travels in its nearly circular orbit around the Sun, the Sun seems to change its location in our sky. As students observe and record changes in the daily position of the Sun against the ***horizon,*** they build a base that will help them understand more abstract concepts such as why we have seasons.

▼ **Activity Sheet 26, Part A**

Solar Journal: Sunrise

1. Record the time of sunrise to the nearest minute each day. Do this for 2 weeks.

Day/Date	Time	Day/Date	Time
1	Times will vary.	8	
2		9	
3		10	
4		11	
5		12	
6		13	
7		14	

2. Draw the eastern horizon. Make a dot at the location of sunrise each day.

north east south

Drawings will vary.

Times and locations of sunrise will vary depending on the time of year. The Sun may rise later and farther south, or earlier and farther north.

▼ **Activity Sheet 26, Part B**

Solar Journal: Sunset

1. Record the time of sunset to the nearest minute each day. Do this for 2 weeks.

Day/Date	Time	Day/Date	Time
1	Times will vary.	8	
2		9	
3		10	
4		11	
5		12	
6		13	
7		14	

2. Draw the western horizon. Make a dot at the location of sunset each day.

south west north

Drawings will vary.

Times and locations of sunset will vary depending on the time of year. The Sun may set earlier and farther south, or later and farther north.

Guiding the Activity

Session 1—Activity 26

1 Break the class into teams of four students. Distribute a copy of **Activity Sheet 26, Parts A and B,** to each student and a directional compass to each team of four. Write *horizon, sunrise,* and *sunset* on the board. Explain that you will be going outside for a short time to take a look at two horizons and to talk about sunrise and sunset.

Tell students to bring along their compasses and activity sheets, and be sure to bring your own copy. Proceed outdoors to the site you have chosen in the schoolyard. Ask, **From which direction did the Sun rise this morning?**

Additional Information

Note: *Laying simple ground rules for your outdoor stay—such as staying together and designating a signal for listening to the teacher—will make the time more productive.*

Students who know how to use a compass may find east and point in that direction. Others may look at the Sun's current position and guess. Some students may recall the direction from which they saw the Sun rise in the past.

Guiding the Activity

	Additional Information
Ask, **Which direction is that?**	*Most students should respond, "East."*
Tell everyone to find east with their compasses. Ask, **Did the Sun rise directly east of us this morning?**	*You and other students can help those who do not know how to read a compass. Students may disagree whether the Sun rose exactly in the east this morning. Do not confirm or deny either viewpoint at this time.*
Ask, **Where will the Sun set tonight?**	*Students should be aware that the Sun sets in the general direction of west.*
Once again help students who are unfamiliar with a compass to find west. Ask, **Since that is directly west, will the Sun set there tonight?** Allow students time to discuss their views.	*Again, do not agree or disagree with either side in the discussion.*
2 Explain to students that they will be keeping a Solar Journal in which they will record the positions and the times of sunrise and sunset every day over the next 10–14 days. Ask, **What is sunrise? How do scientists decide exactly when the Sun has risen?**	***Sunrise*** *occurs when any part of the Sun's disk becomes visible above the horizon.*
Ask, **What is a horizon?**	*The word* horizon *means "boundary." In astronomy, the* ***horizon*** *is the point where the sky appears to touch the ground.*
Ask, **What would happen if we did not agree on a definition of sunrise before we began recording our observations?**	*Students should realize that some might record the time of the first light of dawn as sunrise, while others would wait for the entire Sun to appear.*
Ask, **What do you suppose is the definition of a sunset that we will use in our observations?**	***Sunset*** *is when the Sun first completely disappears behind the horizon.*
Show students an example of as clear a view as possible of the eastern and western horizons. Explain that they will need to find a spot near home that views to the east and one that views to the west. Preferably the view should contain no major obstacles blocking the horizon. If their home windows face east and west, students may observe from the windows. The viewing spot(s) must be the same each day.	*If no clear view is available, students can choose any location as long as they consistently record when the Sun first appears or disappears behind the building or hill that obstructs their view. Class sunset and sunrise data will vary more if some students' views are blocked by mountains or tall buildings since the Sun will appear to rise later and set earlier in these places.*

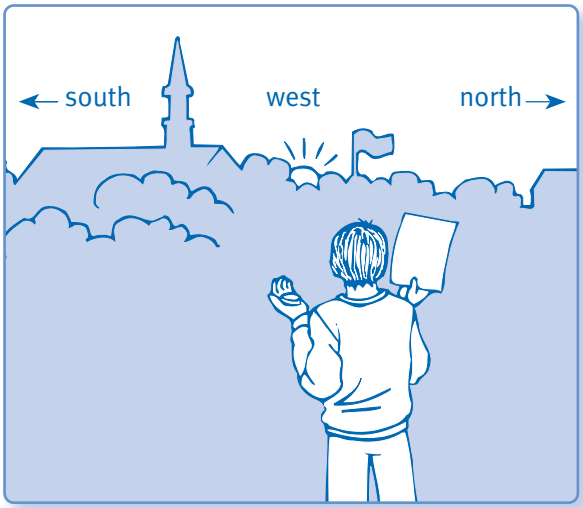
Guiding the Activity

Instruct students to mark their viewing location with a stick or stone pushed into the ground or by using some other identifiable mark to note exactly where they should stand each day (Figure 26-1).

Remind students that staring at the Sun for an extended length of time is dangerous, even at sunrise and sunset (Figure 26-2).

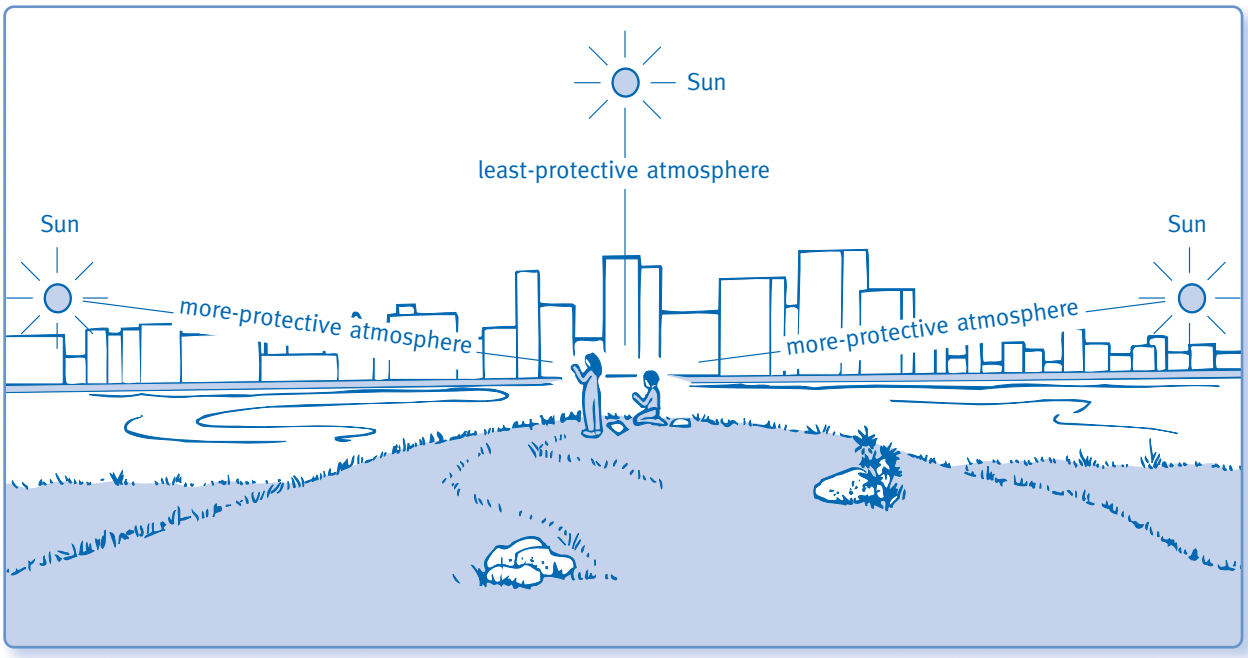
As appropriate, read or review pages 6–8 and 20 of the Delta Science Reader *Earth, Moon, and Sun*.

Additional Information



▲ ***Figure 26-1.*** *Recording the time and location of sunset.*

Safety Note: *At sunrise and sunset students' eyes are somewhat protected by the thick cushion of atmosphere between them and the Sun so they can look for a few seconds. They should never try to look directly at the Sun at any other time of the day.*



▲ ***Figure 26-2.*** *At sunrise and sunset, students' eyes are somewhat protected by a thicker cushion of atmosphere.*

Guiding the Activity

		Additional Information
	Explain to students that noting horizon features, such as a distant tree, house, or mountain, will allow them to keep better track of where the Sun actually sets or rises. After they choose their viewing spot, they should draw the eastern horizon on Activity Sheet 26, Part A, and the western horizon on Activity Sheet 26, Part B.	*Students need not draw the entire 180° horizon, just the section straight ahead. You might want to suggest that they cup their hands along their temples as they face the Sun. The area between their hands is what they should draw.*
	Next, students should mark the location of the Sun at sunrise and sunset on that particular day and label it "Day 1." Students should also record the time, to the nearest minute, that the Sun rises and sets.	*Demonstrate drawing the eastern and western horizons on your own copy of the activity sheets. Show how to write the time of sunset and make a dot at its location.*
3	Each day that the weather permits, students should make an attempt to record sunrise/sunset information.	*For some students, gathering sunrise and sunset data may be too problematic. In these cases, consider the following alternative. Students may find the local sunset/sunrise times in a variety of sources such as the local newspaper, almanacs, and even local television and radio reports. The students should be assigned the task of finding a reliable source of this information and then should record the information on their activity sheets.*
	On their copy of the activity sheets, students should note the local time, to the nearest minute, at which the Sun just disappeared below the horizon (sunset) or just appeared above the horizon (sunrise). Return to the classroom and replace the compasses in the kit.	*Even on cloudy days, the position of the Sun is usually apparent.*
4	On each day of the assignment, allow a few minutes to gather the sunrise/sunset data from students. Fill in the Class Sunrise/Sunset Data chart with the average or most common time of sunrise and sunset recorded by the class.	*Taking a few minutes to record the data in class should increase interest in the topic and allow an opportunity to answer any questions.*

Guiding the Activity

Session II—Activity 27

	Additional Information
5 After students have completed their journals and all the data have been recorded on the class chart, ask, **Did the Sun rise directly east and set directly west of us?**	*Students probably found that the Sun rose slightly north or south of due east.*
How did the position of sunrise and/or sunset change during the period of observation?	*If the activity is performed from July through December, students should respond that the location of both sunrise and sunset moved progressively south of the starting points. If the activity is performed from January through June, students should respond that the locations of both sunrise and sunset moved progressively north of the starting points.*
Ask, **How did the time of sunrise and/or sunset change during the period of observation?**	*If the activity is performed from July through December, students should respond that sunrise gets later each day and sunset earlier. From January through June, sunrise is earlier each day and sunset is later.*
Ask, **Why do you think the positions and times of sunrise and sunset changed as they did?**	*Students may provide a variety of explanations. The purpose of the question is to generate brainstorming. Record all answers offered on the board and use this as the starting point for Activities 28 and 29.*

Reinforcement

Save newspapers during the period of observation and use the sunrise reports to track daily changes in the Sun's apparent position in the sky. Students can draw a possible horizon on paper, marking north on the left side, east in the middle, and south on the right. Then, students should use a protractor to measure the degrees between directly left (north) on the horizon line and the position of the Sun at sunrise as specified in the paper.

Science Notebooks

Have students place their completed activity sheets in their science notebooks.

Cleanup

Leave student ideas on the board for Activities 28 and 29 and the Class Sunrise/Sunset Data chart where students can examine it at their leisure.

Connections

Science Challenge

Challenge students to learn as much as they can about the Sun. What chemicals is it composed of, and what techniques do scientists use to determine the chemical composition of celestial objects? What are some theories about how the Sun was formed? What are the darker patches, called sunspots, that are sometimes visible on the Sun's surface? What is the temperature of the Sun's surface, and how do scientists calculate it?

Science Extension

- Have someone with an instant camera take a photograph of the sunset from the same viewpoint each day. Display the series of photos beside the Class Sunrise/Sunset Chart.
- Have students continue their Solar Journals, marking the Sun's position once a week throughout the year. Can they identify the week of a solstice by looking only at their data? Where was the Sun at each of the equinoxes?

Science and the Arts

Sunlight causes chemical reactions used in a variety of artistic media. Have students pin heavy paper shapes onto various bright fabrics and hang them in direct sunlight for 2 weeks. Students may be surprised at how much the fabric bleaches where it is not covered. Do any of the fabric dyes change hue as a result of the interaction with sunlight?

Students also can experiment with other media that react with the Sun: diazo paper (sunprints), photographic media, and video cameras.

Science and Language Arts

- The word *Sun* is one of the basic words that appear in all human language groups. Ask each student to learn the word for Sun in another language. Assign languages so that the results are as diverse as possible. Then compare the words. Which are similar? Which are different?
- Have students develop questions based on various names for the Sun and terms derived from them. For instance, what is the common name for a plant of the genus Helianthus? (sunflower) What is a heliotrope? (an organism attracted by sunlight) Who was the first person to present convincing proof of heliocentricity? (Copernicus) What does a solarimeter measure? (sunlight) What is a solarium? (a room that collects sunlight) Why might a country name its coinage "sol"? (because the king's image was stamped on the coin, and the king was associated with the powerful Sun)

Science, Technology, and Society

- For millennia people have used the Sun's free, nonpolluting energy to cook food. Have students use the Sun to cook their lunches one day. A simple solar cooker can be made by cutting away one-third of the rounded length of a cornmeal or oatmeal box. Tape the lid back onto the container and then line the entire container with aluminum foil. Then, cut a length from a wire hanger. Skewer a marshmallow on the wire, and insert it through the top and bottom of the container. Prop the cooker so that its back reflects the Sun directly onto the marshmallow. Leave the food to warm for an hour or so. Is the Sun still shining directly into the cooker when students return?
- As appropriate, encourage supervised use of the Internet for research projects related to the Earth, Moon, Sun, and planets. A list of pertinent websites is provided in the References and Resources section.