

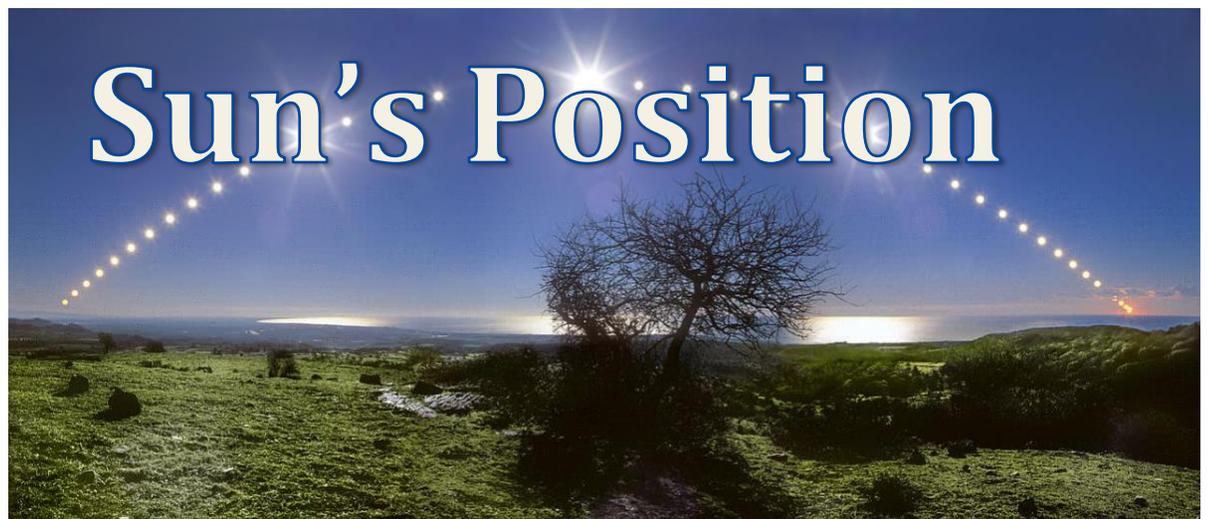


National Aeronautics and Space Administration



# Guide Lites

Interactive Lesson: Sun's Position



**National Education Standards:**

ESS1.B: Earth and the Solar System

The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

MS-ESS1-1 Earth's Place in the Universe

Develop and use a model to describe phenomena of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

This document is based upon work supported by NASA under award No. NNX16AB91A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration (NASA).

Published August 2017

### Student Misconception

Students incorrectly think that the sun rises in the exact spot in the east and sets in the exact spot in the west every day. Students don't realize that the sun doesn't really rise and set.

### Objective

Students will explain why the location of where the sun appears during sunrise and sunset changes over the year. Through watching a NASA Spotlite video and follow-up class discussion, and building an understanding of the vocabulary through a collaborative activity, students will be able to explain how the tilt and movement of Earth determines the path the sun travels during different seasons.

### Time Frame

Approximately 45 minutes (pretest, video review and discussion (20 minutes), collaborative vocabulary with Frayer Model (25 minutes), posttest. Additional time needed for completion of extension activities.

### Materials:

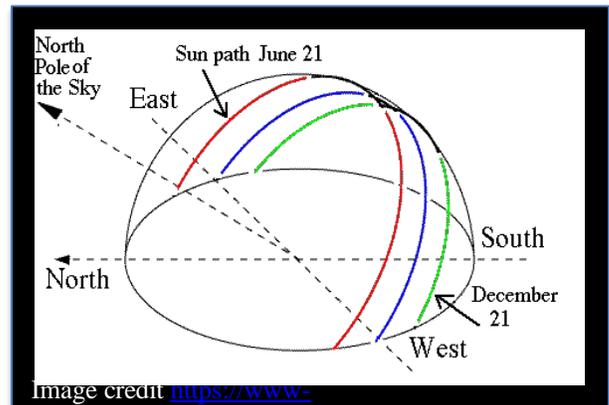
Per student: copy of pretest and posttest (alternatively, these can be completed online)

Per small group: copy of Frayer Model (alternatively, these can be completed online)

Per classroom: chart paper for posting final vocabulary definitions

### Background information:

- The sun stays in the center of the solar system.
- The sun is not actually rising or setting, but appears to rise and set because of Earth's rotation on its axis.
- Earth makes one complete rotation (spin) about every 24 hours.
- Earth rotates toward the east.
- As Earth rotates, different locations on Earth pass through the sun's light.
- The actual position of the sun (rising and setting) in the sky is affected by the season, time of day and location on Earth.



### Pre-Assessment

Probe for students' prior knowledge using one or both of these pre-assessments.

1. The Pre-test can be found at:

<https://prod.classflow.com/classflow/#!/product/itemId=89395acf6ffe43f7a6e94131e47abe4f>

2. Discussion questions:

- Where is the sun in the sky?
- Why does the sun appear to be moving across the sky?
- What effect does the position of the sun have on seasons?
- How does the rotation of Earth change how people at different locations see the sun?
- In which direction is Earth spinning?

## Engage

1. Ask students to watch the Spotlight video on **Sun's Position** that can be found at the following link, <https://youtu.be/kGD37FBokWs>. After viewing the video, lead a discussion with students to identify the misconception addressed in the video.

(Misconception: Students incorrectly think that the sun rises in the exact same spot in the east and sets in the exact same spot in the west every day.)

2. Identify key vocabulary words and phrases in the video.

(Examples: sun, rotate, revolve, solar, seasons, pattern, position, location. Additional words should be added as needed.)

\*\*These words, and other key vocabulary terms, can be found in the NASA eClips™ Virtual Vocabulary, <https://nasaclips.arc.nasa.gov/teachertoolbox>

## Explore and Explain

Use the Frayer Model provided to help students develop a conceptual understanding of key vocabulary.

Using a digital interactive Frayer Model enables students to explore ideas collaboratively and simultaneously on the same digital document.

Several digital Frayer models can be found at:

- ClassFlow:  
<http://tinyurl.com/FrayeronClassFlow>
- PDF Filler:  
<http://tinyurl.com/FrayeronPDFfiller>
- Google Slides  
<https://docs.google.com/presentation/d/1a8RaLcmOmSwlYxZBFPWHgbkoEZrInnp5gicNeElXzjc/edit?usp=sharing>

### Implementation Note

Within the Frayer Model, students EXPLORE concepts through brainstorming and researching AND EXPLAIN and synthesize their understanding.

**Example:** Place the word **position** in the center of the graphic organizer.

1. Facilitate a discussion with students exploring why this word is key vocabulary to understanding the sun's position.
2. **(EXPLORE):** Ask students to brainstorm *characteristics of position* and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their text book and notes.
4. **(EXPLAIN):** Next, ask students to add *examples* and *non-examples* in the Frayer model. (*Emphasize the higher level thinking skill of comparing and contrasting. How are the examples alike/different than the non-examples?*)
5. Using the information provided, ask students to develop their own definition of the word **position** that is clear and concise. An example to guide work is started below.
6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively.
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word.
8. Compile final definitions and post so all students have access for later work.

### Implementation Note

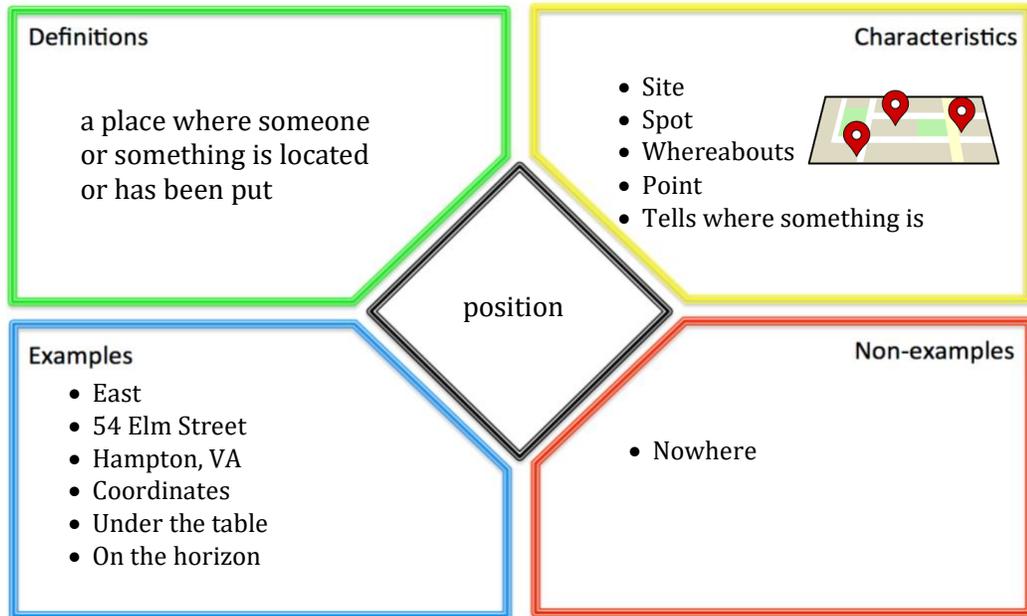
Doing this activity in pairs or teams builds students' collaboration skills.

### Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.

#### Implementation Note

Developing their own definitions helps students build conceptual understanding.



#### Evaluate

Return to these discussion questions:

- Where is the sun in the sky?
- Why does the sun appear to be moving across the sky?
- What effect does the position of the sun have on seasons?
- How does the rotation of Earth change how different locations see the sun?
- In which direction is Earth spinning?

Compare student responses to Pre-assessment and Evaluate questions to determine if students have a clear understanding of the vocabulary.

**Sun's Position** Pre / Post Test is included in this packet. For an electronic version, use this link to view to the NASA Spotlite Interactive Lesson Plan – **Sun's Position** Pre / Post Test at ClassFlow: <https://prod.classflow.com/classflow/#!/product/itemId=89395acf6ffe43f7a6e94131e47abe4f>

#### Extend

To reinforce and extend content knowledge, ask students to complete Eye on the Sky activity **Sundials: Observing and Using Shadows**. Students build sundials and observe changes in shadows over the course of one or more days. Students identify patterns in the shadows and discuss how shadows may be used to tell time.

[http://wayback.archive-it.org/5717/20140812002300/http://www.eyeonthesky.org/lessonplans/14sun\\_sundials.html](http://wayback.archive-it.org/5717/20140812002300/http://www.eyeonthesky.org/lessonplans/14sun_sundials.html)

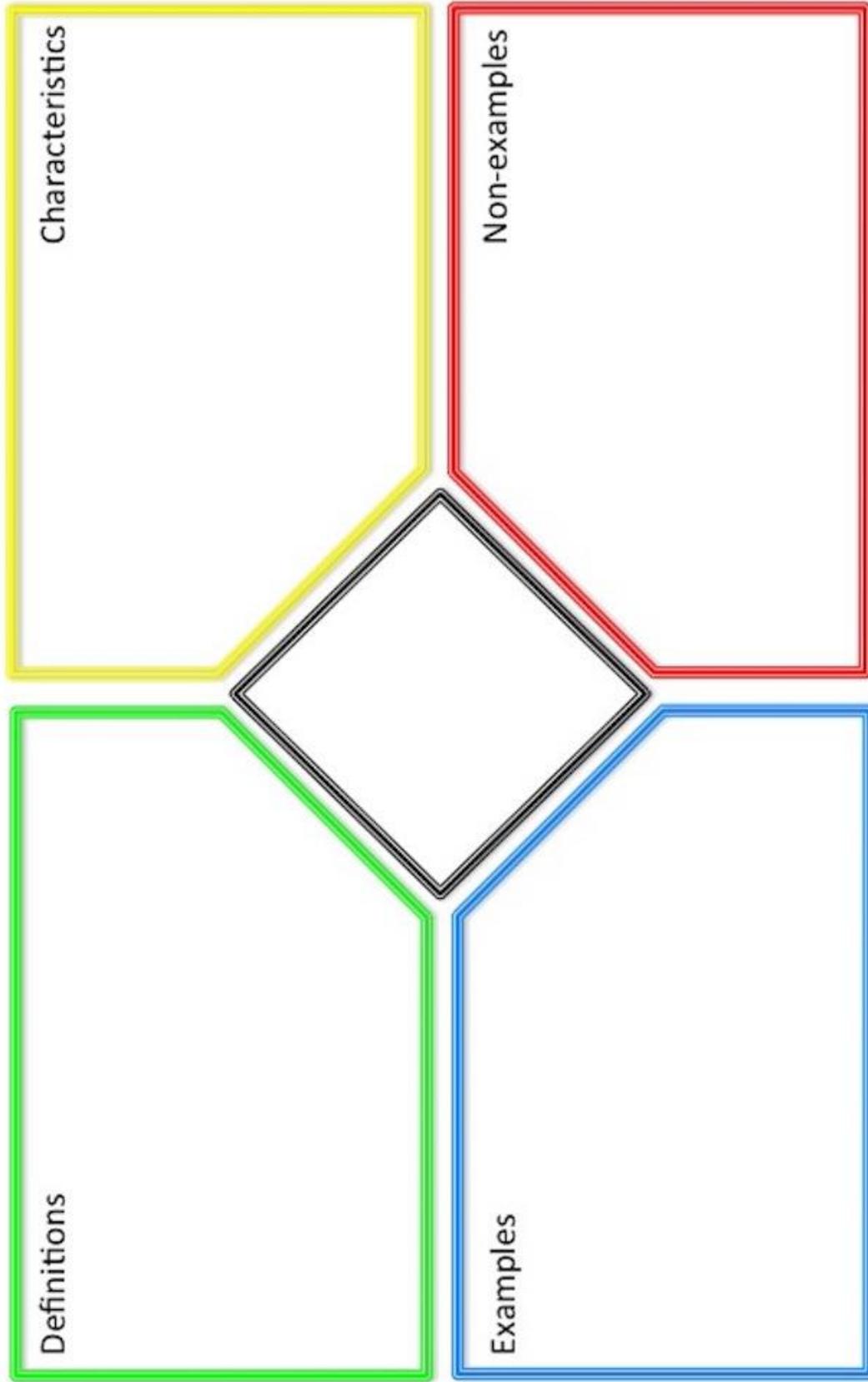
What Can We Learn About the Sun from Shadows?

[https://www.nasa.gov/pdf/145908main\\_Sun.As.A.Star.Guide.pdf#page=18](https://www.nasa.gov/pdf/145908main_Sun.As.A.Star.Guide.pdf#page=18)

Ask an astrophysicist

## Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.



The diagram is a Frayer Model graphic organizer. It consists of a central diamond shape with a double black border. Four rectangular boxes are attached to the sides of the diamond, each with a different colored border: a green box on the left, a blue box on the right, a yellow box on the top, and a red box on the bottom. Each box is labeled with a category: 'Definitions' in the green box, 'Examples' in the blue box, 'Characteristics' in the yellow box, and 'Non-examples' in the red box. The labels are oriented vertically within their respective boxes.



Science for students by students

## Sun's Position Pre / Post Test NASA Spotlight Interactive Lesson

This assessment was designed for the student produced NASA Spotlight video **Sun's Position**.  
<https://youtu.be/kGD37FBoKWs>

- The center of the solar system is the \_\_\_\_\_.
  - Earth
  - Milky Way
  - Jupiter
  - Sun
- The sun does not actually rise and set, but appears to because of Earth's \_\_\_\_\_ on its axis.
  - Revolution
  - Tilt
  - Rotation
  - Orbit
- Earth rotates toward the \_\_\_\_\_ .
  - North
  - South
  - West
  - East
- The actual position of the sun in the sky is affected by of the following **EXCEPT** \_\_\_\_\_.
  - The seasons
  - The location on Earth
  - The revolution of Earth
  - The time of day
  - The amount of light
  - The number of clouds
- Earth's tilt and \_\_\_\_\_ around the sun causes the sun to take different paths across the sky giving us seasons.
  - Revolution
  - Tilt
  - Rotation
  - Spin
- Your cousin who lives in New York has been recording the times of sunrise and sunset. She uses this information to determine the number of daylight hours. This project was started in September, and by November your cousin observed that the number of daylight hours were getting shorter. Why are the days getting shorter as winter approaches in the North?
  - The sun moves faster across the sky in winter.
  - The angle of sunlight makes the days shorter.
  - It is daylight savings time.
  - The tilt of Earth causes the sun to be farther away in winter.
  - The sun's path in the sky gets shorter in winter.

\*\*This question is adapted from Page Keeley's Probe, Uncovering Students Ideas in Astronomy page 69.

**Sun's Position Pre / Post Test**  
**NASA Spotlight Interactive Lesson**

This assessment was designed for the student produced NASA Spotlight video **Sun's Position**.  
<https://youtu.be/kGD37FBoKWs>

- The center of the solar system is the \_\_\_\_\_.  
A. Earth  
B. Milky Way  
C. Jupiter  
D. Sun
- The sun does not actually rise and set, but appears to because of Earth's \_\_\_\_\_ on its axis.  
A. Revolution  
B. Tilt  
C. Rotation  
D. Orbit
- Earth rotates toward the \_\_\_\_\_.  
A. North  
B. South  
C. West  
D. East
- The actual position of the sun in the sky is affected by of the following **EXCEPT** \_\_\_\_\_.  
A. The seasons  
B. The location on Earth  
C. The revolution of Earth  
D. The time of day  
E. The amount of light  
F. The number of clouds
- Earth's tilt and \_\_\_\_\_ around the sun causes the sun to take different paths across the sky giving us seasons.  
A. Revolution  
B. Tilt  
C. Rotation  
D. Spin
- Your cousin who lives in New York has been recording the times of sunrise and sunset. She uses this information to determine the number of daylight hours. This project was started in September, and by November your cousin observed that the number of daylight hours were getting shorter. Why are the days getting shorter as winter approaches in the North?  
A. The sun moves faster across the sky in winter.  
B. The angle of sunlight makes the days shorter.  
C. It is daylight savings time.  
D. The tilt of Earth causes the sun to be farther away in winter.  
E. The sun's path in the sky gets shorter in winter.

\*\*This question is adapted from Page Keeley's Probe, Uncovering Students Ideas in Astronomy page 69.

For an electronic version use this link to view to the NASA Spotlight Interactive Lesson Plan **Sun's Position** Pre / Post Test at ClassFlow:  
<https://prod.classflow.com/classflow/#!/product/itemId=89395acf6ffe43f7a6e94131e47abe4f>