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Student Exploration: Seasons: Earth, Moon, and Sun

Vocabulary: altitude, axis, azimuth, equinox, horizon, latitude, revolution, rotation, solstice

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

- 1. Suppose you were stranded on a desert island without a calendar or clock. How would you know when a day, a month, or a year had passed? Using the sun
- 2. How could you tell what time of year it was? The weather?

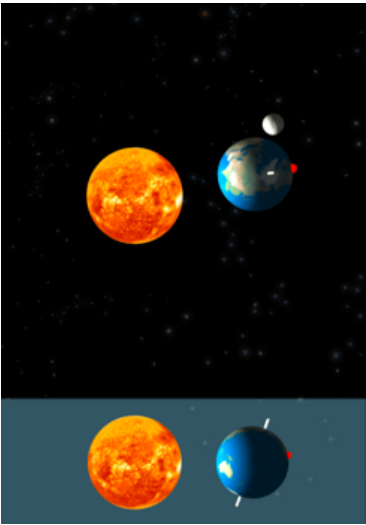
Gizmo Warm-up

Thousands of years ago, people told time by looking at the sky. You may not think about it, but you probably do this as well. For example, you know a day has passed when the Sun rises, it grows light outside, and then Sun sets again.

In the Seasons: Earth, Moon, and Sun Gizmo, you will learn how you can relate the passage of time to different astronomical events.

Drag the Simulation speed slider all the way to the left. Click Play () and observe the SIMULATION pane.

- A. What happens? The earth rotates on its axis
- B. Click on the 2D VIEW tab. What do you see? The sun and the moon in the sky day by day
- C. Click on the DAY GRAPH tab. What do you see? Solar Intensity going up throughout the year
- D. Click on the SHADOWS tab. What do you see? A sundial changing shadows based on the time of day.



Activity A: Days, months, and years	Get the Gizmo ready: Click Reset. Select the 2D VIEW tab.
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Question: What astronomical events coincide with the passage of a day, month, or year?

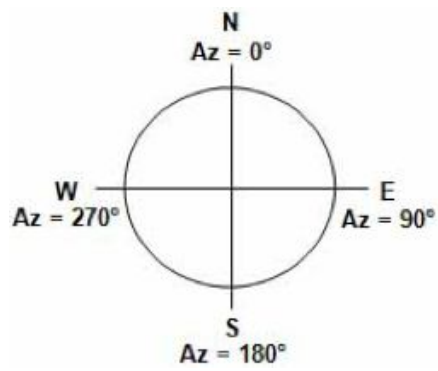
- 1. Observe: Click Play. Observe how the position of the red dot in the SIMULATION pane relates to the cycle of night and day on the 2D VIEW tab.
What astronomical event causes day and night? The rotation of the moon around the sun.

- Every time Earth finishes one rotation on its axis, a complete cycle of day and night occurs. In the SIMULATION pane, Earth’s axis is represented by the red line that goes through the center of the planet.
- 2. Describe: Months are another unit of time based on an astronomical event. Click Reset, and move the Simulation speed slider to the right a quarter of the way. Click Play, and observe the movements of Earth and the Moon for one month. (Note: You can use the calendar in the upper right corner of the 2D VIEW tab to determine when a month has passed.)





- A. Describe the movements of Earth and the Moon over the course of a month. The moon will rotate around the Earth and the Earth will rotate around the Sun.
- B. What astronomical event corresponds to the passage of one month? The moon rotating around the earth



It takes approximately 28 days for the Moon to revolve around Earth. **Revolution** is the elliptical motion of a body traveling around another body in space.

- 3. **Diagram:** Click **Reset**. Set the **Simulation speed** to maximum. Click **Play**, and observe the movement of Earth over the course of one year. In the diagram below, draw how the position of Earth changes.
 - A. What astronomical event corresponds to the passage of 1 year? The earth rotating around the sun
 - B. How long does it take Earth to revolve around the Sun? 1 year

Activity B: Sun’s path	Get the Gizmo ready: Click Reset . Set the Simulation speed to minimum.
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Question: What causes the Sun to appear to move in a path across the sky?

- 1. **Observe:** Select the 2D VIEW tab. Click **Play**, and watch the apparent motion of the Sun across the sky. In the diagram at right, draw an arrow to show the Sun’s direction and path.

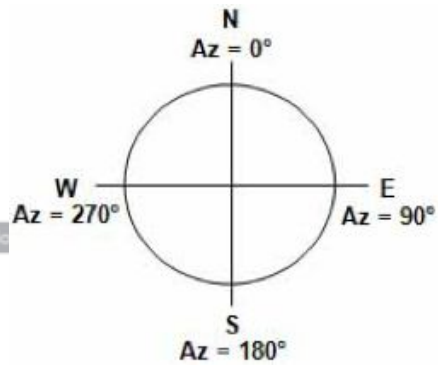
Mark the highest **altitude** the Sun reaches with an X. Altitude is the distance an object appears to be above the **horizon**. The horizon is the line along which the sky and the Earth appear to meet.

- 2. **Make a rule:** On the 2D VIEW tab, *E* stands for *east* and *W* stands for *west*. Knowing this, you can conclude that the Sun rises in the east and sets in the west.



- 3. **Analyze:** The Sun’s **azimuth** is the direction of the Sun in the sky. Azimuth is measured in degrees. Look at the diagram.

- A. What is the Sun’s approximate azimuth when it rises? east
- B. What is the Sun’s approximate azimuth when it sets? West





4. Summarize: Select the SHADOWS tab. Click **Play**, and observe the **Azimuth**. How does the Sun’s azimuth change over the course of the day?
It goes from South to West throughout the day
5. Describe: Click **Reset**. Select the 2D VIEW tab. On the SIMULATION pane, the red dot on Earth represents where the observer who is seeing the scene on the 2D VIEW tab is standing. Describe the position of the red dot in the SIMULATION pane at midnight.
0 solar intensity
6. Observe: Click **Play**. When the Sun begins to rise on the 2D VIEW, click **Pause** (). How has the position of the red dot changed?
Higher Solar Intensity
7. Observe: Click **Play** again. When the Sun begins to set on the 2D VIEW, click **Pause**. How has the position of the red dot changed?
Lower Solar Intensity
8. Draw conclusions: What causes the apparent motion of the Sun across the sky: the movement of Earth or the movement of the Sun? Explain.
Movement of the earth on its axis because the sun does not rotate around the earth.
9. Predict: A shadow is caused when an object blocks sunlight. For example, when your body blocks sunlight, you may see a shadow of yourself on the ground. How do you think the shadow of an object, such as a flagpole, would change over the course of the day as the Sun appears to move across the sky?
Because it is at a different point in the sky causing a different angle of the shadow of the flagpoles
10. Observe: Click **Reset**. Select the SHADOWS tab, and click **Play**. Observe the **Overhead** and **Projection** view of the **Shadow of a stick**. What do you notice?
It changes angle over the course of the day
11. Compare: As you watch the shadow move, observe how its length changes in comparison to the **Altitude** of the Sun.
- A. Describe the length of the shadow when the Sun is at its highest altitude. *Shorter shadow*
 - B. Why does the Sun’s altitude affect shadow length?
Because the angle of the sun determines the length of the shadow

Activity C: Sunrise and sunset times	<u>Get the Gizmo ready</u> : Click Reset . Select the DESCRIPTION tab. Set the Simulation speed to minimum.
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Question: What factors affect sunrise and sunset times?

1. On your own: **Latitude** is a location’s distance north or south of the equator. You can use Google™ or another search engine to look up your town’s latitude.

What is the latitude of your town? **33.9815° N**

Use the **Latitude** slider on the DESCRIPTION tab to set the Gizmo to your town’s latitude.

