

Winter Solstice

Do you ever feel some days seem longer than others? While each day lasts 24 hours; we experience light in different ways on different days. Explore the Earth's axis and how Earth orbits the Sun to create the winter solstice.

TEKS:

M 4.7D: The student is expected to draw an angle with a given measure.

SCI 3.8C: The student is expected to construct models that demonstrate the relationship of the Sun, Earth, and Moon, including orbits and positions.

SCI 7.3C: The student is expected to identify advantages and limitations of models, such as size, scale, properties, and materials.

SCI 8.7A: The student is expected to model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun, causing changes in seasons.

Materials:

- Ball (soccer ball, volleyball, etc.) or inflatable globe (can be purchased [here](#))
- Crate or box - to elevate the ball
- Duct tape
- Lamp with lightbulb
- Permanent marker
- Protractor
- Ruler
- Sticker or colored tape

How To:

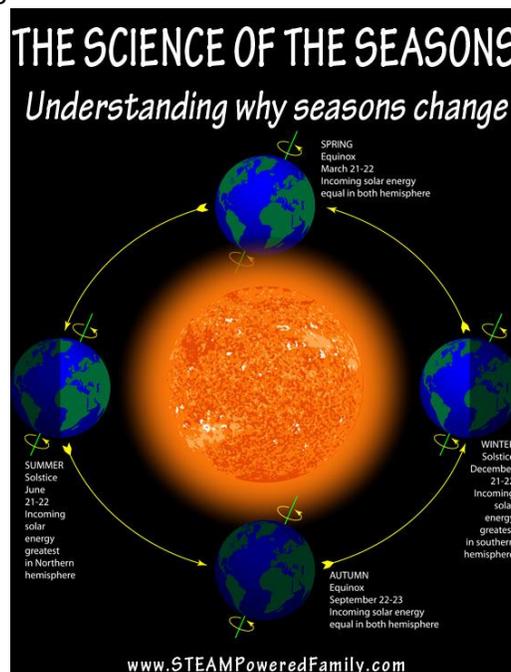
1. Inflate your globe or choose a ball to represent Earth.
2. Using permanent marker, draw a thick line around the center of the ball/globe. After you have drawn the line, orient the ball/globe so that the line is horizontal. This line will represent the equator.

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3. Draw another thick line around the center of the ball/globe perpendicular to the equator. Using a protractor to make a 90° angle, align the protractor's straight edge with the equator and draw a line vertically around the ball/globe spanning what would represent the north and south poles. The ball/globe should now have four equal quadrants.
4. Use a sticker or colored tape to mark the United States on your ball/globe. The U.S. is in one of the upper quadrants, centered and about $1/3$ of the way below the north pole within the quadrant. You can also mark other countries you want to explore by referring to a map!
5. Place a lamp on a table or the floor with space around it. Remove the lamp shade and turn on the lightbulb so that light can be seen all around it. This represents the Sun!
6. Place your ball/globe on a crate, box, or other object that elevates the ball/globe. Your goal is to try and center the lightbulb with the equator line.
7. Aim your U.S. mark towards the lightbulb and align the equator parallel to the floor. When aligning the protractor's straight edge with the crate elevating your ball/globe, the vertical line that spans what would be the north and south pole should be positioned at 90° . Tape the ball/globe in place.
8. Move the crate with your ball/globe figure in an orbit around the lamp and observe how the amount of light changes on your marker of the U.S.
9. Now we are going to tilt the ball/globe to the angle of Earth's axis. Remove the old tape and point the U.S. marker towards the light bulb. Align the straight edge of the protractor with the crate and position the vertical line with 90° again. Hold the protractor steady and tilt the ball/globe until the vertical line aligns with 113.5° . This represents the 23.5° angle of Earth's axis. Tape the ball/globe down at this angle.
10. Rotate your crate to represent each day and move the ball/globe around the lamp to represent the Earth's orbit around the Sun. Observe how the light on the U.S. marker has changed when the Earth is tilted on its axis.
11. Explore how the amount of light on your U.S. marker changes as the ball/globe is moved in an orbit around the lamp. When your U.S. marker receives the most light from the lamp, this represents the summer solstice. In contrast, the winter solstice is represented by the orbital position when the U.S. marker receives the least light!



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STEM Explanation:

The solstices represent the shortest and longest days throughout the year, as well as the beginning of winter and summer. The summer solstice is the longest day because light shines on the U.S. for the most amount of time, and light shines the least amount of time for the winter solstice. Since Earth is tilted on a 23.5° axis, different amounts of light hit parts of Earth throughout its orbit around the Sun. For the U.S., the summer solstice occurs when Earth's north pole is tilted towards the Sun because more light hits north of the equator. Places like Alaska experience close to 24 hours of light during this time. The winter solstice occurs when the Earth's north pole is tilted away from the Sun so that more light is concentrated on the southern hemisphere. During the winter solstice, the U.S. receives the fewest hours of light from the Sun. The days of Earth's orbit around the Sun where light hits evenly is called the equinox. This occurs when the poles are not tilted towards or away from the Sun, and the day experiences exactly 12 hours of light and darkness. This same phenomenon explains the reason we have four seasons: summer, autumn, winter, and spring. The amount of light hitting the U.S. during the Earth's orbit around the Sun also affects the amount of heat we receive.

Career Connection:

Astronomers study planets, moons, stars, galaxies, meteors, comets and their interactions with each other. They must have an in-depth knowledge of physics in order to understand how forces such as gravity change throughout space. Astronomers work together sharing their knowledge to better understand how the universe works at microscopic and macroscopic levels.

Resources:

<https://www.steampoweredfamily.com/activities/summer-solstice-science-activity/>

[https://www.amazon.com/Learning-Resources-Inflatable-inch-](https://www.amazon.com/Learning-Resources-Inflatable-inch-Globe/dp/B0009K3116/ref=sr_1_5?ie=UTF8&qid=1508947747&sr=8-5&keywords=earth+ball)

[Globe/dp/B0009K3116/ref=sr_1_5?ie=UTF8&qid=1508947747&sr=8-5&keywords=earth+ball](https://www.amazon.com/Learning-Resources-Inflatable-inch-Globe/dp/B0009K3116/ref=sr_1_5?ie=UTF8&qid=1508947747&sr=8-5&keywords=earth+ball)

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