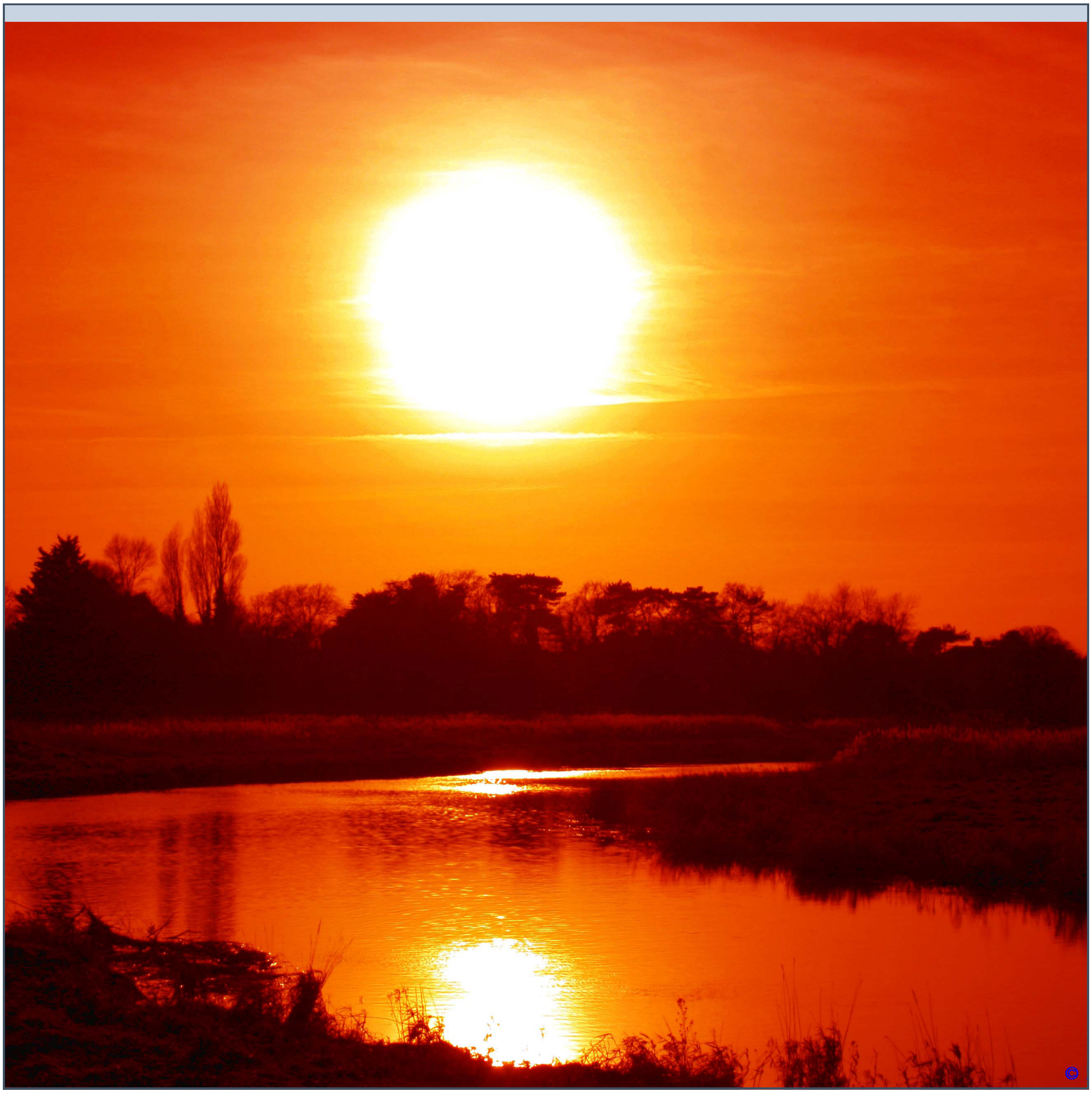
Journey To The Sun Teacher Guide Lesson 2

Grades: 6 - 8

Duration: 1 class period

Standards: MS-ESS1-1
MS-ESS2-1.2.1



Our Relationship with Sunlight

NSO National Solar Observatory

Funded by the National Science Foundation

NSF

www.nso.edu

Objectives

At the end of this lesson, students will be able to:

- Explain the relationship between Sun and Earth.
- Describe the Earth's revolution, rotation, and tilt.
- Relate the Earth's revolution, rotation, and tilt to the period of daily sunlight, summer temperatures, and differences between polar and equatorial regions.

Standards

MS-ESS1-1
Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.

MS-ESS2-1.2.1
Develop and use a model to describe phenomena.

Key Vocabulary

Equator

Hemisphere

Revolution

Rotation

Tilt

Materials

- ☐ Lesson Packet: www.nso.edu/educators/jtts-curriculum
- ☐ Slideshow: "***Our Relationship with the Sun***"
- ☐ Video: ***Maui Hawaiian Sup'pa Man*** mp4
- ☐ Activity Materials (see activity sheet)

Background

The Sun has been, and still is, an essential resource. Early civilizations were keen observers of natural phenomena. They detailed, made predictions about, and told stories of their environment, including the differences in periods of sunlight between winter and summer. There is a Polynesian legend in which the demi-god Māui captures the Sun in order to give the people longer periods of sunlight. Modern astronomy explains this phenomenon as being due to the Earth's tilt, its rotation on its axis, and revolution around the Sun.

In this lesson, students explore the relationship between the Sun and Earth, and how we depend on that relationship in our daily lives.

Directions

As students enter the classroom, have Slide 1 on display. This will give them a chance to ponder the ʻŌlelo Noʻeau or "Hawaiian Proverb".

Slide #

2. Ask students to "turn and talk" to a partner about the questions.
   Questions:
   - "How is sunlight connected with life?"
   - "What are some things that we can do during the day, but not at night?"

3-8. Have students interact with the presentation by guessing the mystery words. In this step, students are to guess the word or phrase that describes a way in which people depend on sunlight and daylight hours.

9. Lead a discussion with students about how life is tied to the Sun in many ways.

   Example: Without sunlight there would be no photosynthesis, and therefore no oxygen for living things to breathe.

10. Explain that early civilizations were keen observers of the natural world. The ancient legend of Māui is a cultural example, which describes people depending on longer sunlight periods to perform daily tasks. Optional: refer back to or replay the "***How Maui Slowed the Sun***" mp4 included in lesson one.

11. Pose these questions to the class to gauge pre-activity understanding.

12. Introduce the Learning Target: "I can relate the Earth's *revolution*, *rotation*, and *tilt* to how they affect periods of sunlight between seasons and locations"

13. Introduce and begin the activity: "When will the Sun Rise?". The activity sheet is provided in this lesson package.

14-18. These slides provide visual aids to students as they complete the steps outlined on the activity sheet.

Review

Slide 19: Review Learning Target

Slide 20: Exit Ticket

Activity - When Will the Sun Rise?

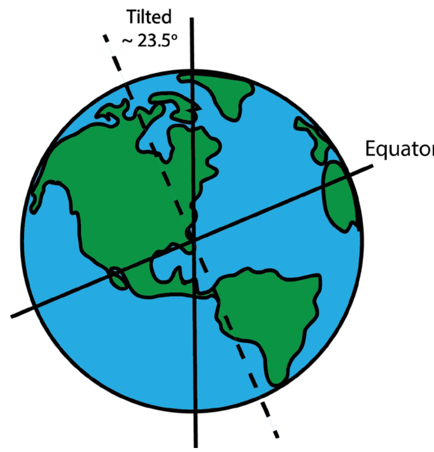
Adapted by NSO from "The Reasons for the Seasons" © 1996-2016 National Geographic Society

Objectives

1. Describe the Earth's rotation, revolution, and tilt
2. Understand how they effect Sun rise and Sun set time throughout the year

Materials

- ◻ Foam Balls
- ◻ Permanent Markers
- ◻ Flashlights
- ◻ Pushpins
- ◻ Stop Watches or other timer
- ◻ Data Sheets (included)



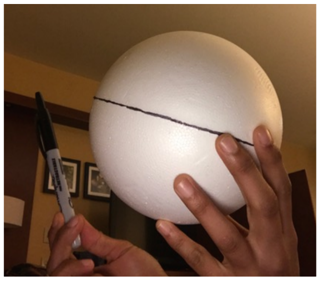
Background

Build background knowledge and curiosity about what causes there to be longer periods of sunlight during summer days and shorter periods during winter. Ask students how they would explain this phenomenon. Our planet does not stand upright, but instead tilts to the side. ***The direction of the Earth's tilt never changes***. Depending on where the Earth is during its revolution around the Sun, the tilt will cause either the northern hemisphere or the southern hemisphere to lean towards the Sun. If you live in the hemisphere leaning towards the Sun, it is summer and you will experience a longer period and more direct sunlight. If you live in the opposite hemisphere, you receive less direct sunlight, have shorter days and it is winter.

Directions

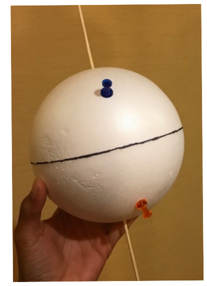
1. Use a pre-made "globe" or foam ball to review the Earth's tilt and axis. Before beginning, introduce the vocabulary terms: ***Tilt, Axis, Hemisphere, Equator, Rotation, Revolution***
2. Students team up in groups of 2 or 3. Each group will mark the "equator" of their foam ball by drawing a line around the middle.
3. Mark the north pole and south pole by drawing dots on the top and bottom of the foam ball.

4. Place one push pin in the northern hemisphere and one in the southern hemisphere. Make sure the pins are on the same side of your Earth and in line with each other longitudinally. You may also place skewers or chopsticks at the north and south poles to better demonstrate the orientation of Earth's tilt (as shown in "Step 4" picture).



Step 2

Step 3



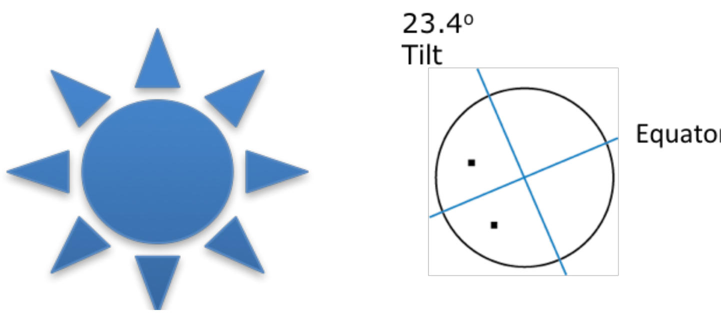
Step 4

5. Choose a point in the room (e.g. over the door) to represent the North Star, at about 23° from directly overhead. This will help students maintain the direction of Earth's tilt.

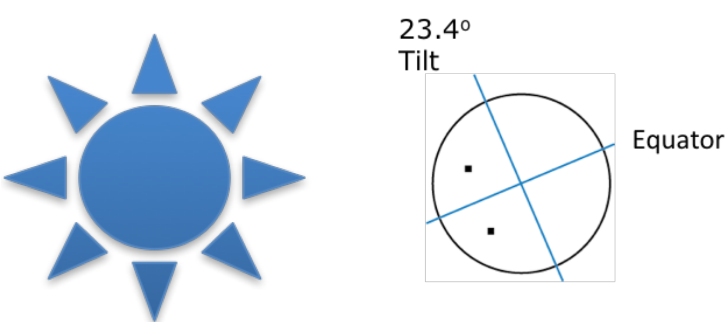
6. Choose one person in the group to represent the Earth (holds the ball). Keep the north axis of the Earth pointed at the North Star at all times. Choose another person to represent the Sun (holds flashlight).

7. The student holding the "Earth" should walk around the student holding the "Sun", while spinning the "Earth" on its axis, keeping the north axis pointed to the North Star. Students should model both the Earth's revolution around the Sun and rotation on its axis. The Earth's tilt is always about a 23.5 degree tilt away from its median, and always in the same direction. The student modeling the Earth's rotation and revolution must be sure to demonstrate this as well.

Demonstrating the Earth's tilt



8. Students develop a hypothesis for the following question: "When the Earth is in this position (refer to the graphic below), which hemisphere has longer daylight? North or South?" **Students can record their hypothesis on the data sheet provided**.

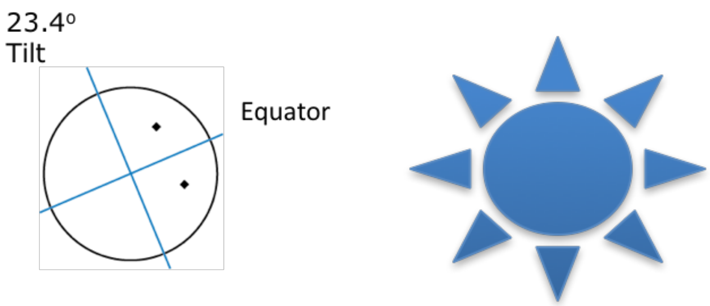


Answer: *Northern Hemisphere*

9. Students test this hypothesis by spinning the Earth one full rotation and observing which pushpin (north or south) stays in the light longer with the Earth tilted.

   Students can record their observations using the data sheets provided.

10. Repeat steps 7 & 8, except this time place the student holding the Earth in the opposite position, where the southern hemisphere is pointed towards the Sun (as shown below).



Ask: *"Which hemisphere has longer daylight now?"*

Ask: *Where is Hawaii? (close to the equator) how does length of daylight compare to somewhere like Alaska? (further from the equator)*

Check for Understanding

Question: What are the two main reasons for the difference in length of daylight between each hemisphere?

Answer: The tilt of the Earth's axis and its revolution around the Sun.

Enrichment

Do other planets in our solar system have seasons? Do they show differences in how long daylight periods are throughout their revolution around the Sun?

Have students brainstorm answers to these questions and follow-up with a research assignment on the tilts, revolutions, and seasons of other planets within our solar system.

Additional Activities

For more activities addressing questions like:

"Why are summers warmer?" and "Why are there differences in periods of sunlight between polar and equatorial regions?"

We recommend: LHS GEMS "The Real Reasons for the Seasons" curriculum book.

Student Data Sheet

Name:

Data Sheet - Earth Position 1

Study Question:

When the Earth is in this position (see picture below), which hemisphere has longer days? North or South?

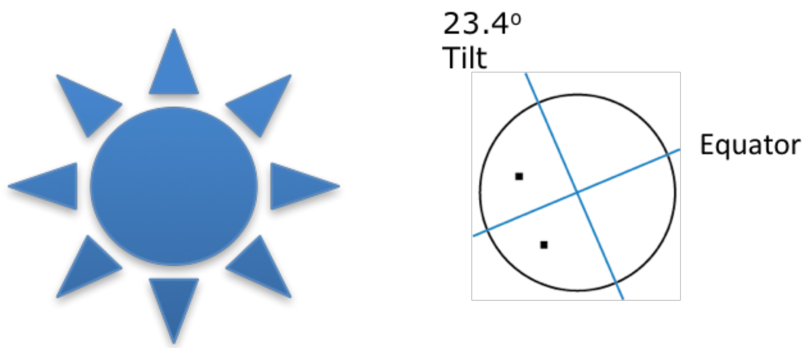


Figure 1. Earth Position 1

Hemisphere	Time (seconds)	Notes
Pushpin in the Northern Hemisphere		
Pushpin in the Southern Hemisphere		

Hypothesis: ______________________________

____

Test your hypothesis:

1. Position the flashlight "Sun" and the styrofoam ball "Earth" as you see in figure 1.
2. Slowly spin the Earth one full rotation while observing which pushpin (north or south) stays in the light longer with the Earth tilted.
3. Using two timers, measure the amount of time, during one full rotation, that each pushpin stays in the light. Be sure to measure both pushpins simultaneously to ensure that the speed of "Earth's" rotation remains the same when testing for both pushpins.
4. Record your findings in the data table.

NAME:

DATA SHEET - EARTH POSITION 2

STUDY QUESTION:

When the Earth is in this position (see picture below), which hemisphere has longer days? North or South?

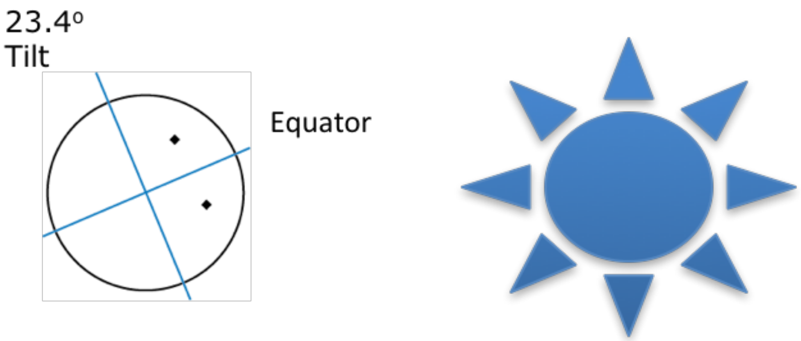


Figure 2. Earth Position 2

Hemisphere	Time (seconds)	Notes
Pushpin in the Northern Hemisphere		
Pushpin in the Southern Hemisphere		

Hypothesis: ______________________________

____

Test your hypothesis:

1. Position the flashlight “Sun” and the styrofoam ball “Earth” as you see in figure 2.
2. Slowly spin the Earth one full rotation while observing which pushpin (north or south) stays in the light longer with the Earth tilted.
3. Using two timers, measure the amount of time, during one full rotation, that each pushpin stays in the light. Be sure to measure both pushpins simultaneously to ensure that the speed of “Earth’s” rotation remains the same when testing for both pushpins.
4. Record your findings in the data table

NAME: CONCLUSIONS

1. Does the Earth's tilt ever change? Explain. ____

2. If the Earth is in this position (Figure 1.) during its revolution around the Sun, and you live in the USA (northern hemisphere), are you experiencing summer or winter? Explain your answer.

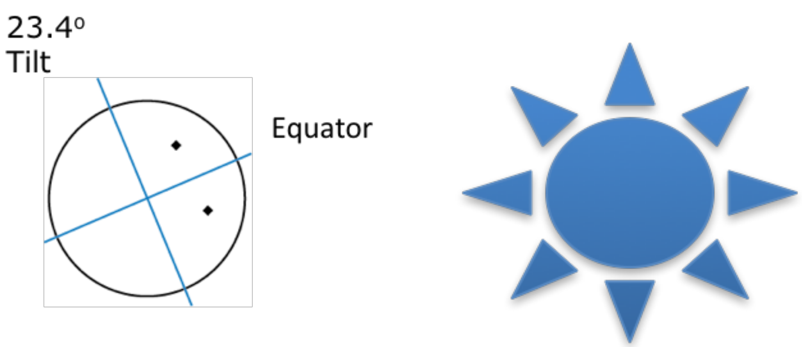


Figure 1.

____

____

____

____

____

____

____

3. What are two main reasons for differences in sunrise and sunset times between each hemisphere? Explain.

____

____

4. Hawaii is close to the equator. How do you think length of daylight during summer in Hawaii would compare to length of daylight in Alaska, which is further from the equator? Would there be a difference? Why or why not? What about during winter? Move the pushpins in your model to the approximate locations of Hawaii and Alaska to test your hypotheses.

____

____

The National Solar Observatory (NSO) is the national center for ground-based solar physics in the United States and is operated by the Association of Universities for Research in Astronomy (AURA) under a cooperative agreement with the National Science Foundation Division of Astronomical Sciences.

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 to promote the progress of science. NSF supports basic research and people to create knowledge that transforms the future. Please refer to www.nsf.gov.

www.nso.edu

www.facebook.com/NationalSolarObservatory

www.twitter.com/NatSolarObs

www.instagram/NationalSolarObservatory

www.youtube.com/NationalSolarObservatory

outreach@nso.edu

National Solar Observatory