



LESSON PLAN

EARTH'S ORBIT AND ROTATION GRADES 3-5

SUMMARY

Students will learn about the apparent motion of the Earth, sun, stars, and planets by studying observable patterns.



5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Science & Engineering Practices	Connections to Classroom Activity
<p>Analyzing and Interpreting Data</p> <p>Additional SEP addressed by this lesson: Developing and Using Models</p>	<ul style="list-style-type: none"> • Students create a pictograph or chart revealing patterns in the relationship between the stars visible in the night sky and the time of year indicative of a relationship between the motion of the Earth and the Sun (extension). • Students observe and develop models to help visualize the motion of the Earth in relation to the sun and other planets.
Disciplinary Core Ideas	Connections to Classroom Activity
<p>ESS1.B: Earth and the Solar System</p> <p>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;</p>	<ul style="list-style-type: none"> • Students observe patterns related to the rotation of the Earth (day and night, length of shadows, apparent motion of the Sun) and orbit of the Earth around the Sun (changes in stars visible at certain times of year).

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.

Additional DCI addressed by this lesson:

Some objects in the solar system can be seen with the naked eye. Planets in the night sky change positions and are not always visible from Earth as they orbit the sun. Stars appear in patterns called constellations, which can be used for navigation and appear to move together across the sky because of Earth's rotation.

- Students observe and discuss evidence that Earth is rotating on its axis and evidence that Earth is orbiting the Sun (vs. the Sun orbiting the Earth).
- Students observe and discuss objects seen through a telescope vs. the naked eye.
- Students observe and determine why planets are not always visible from Earth as they also orbit the Sun.

Crosscutting Concepts

Patterns (3-ESS2-1, 3-ESS2-2)

Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

Connections to Classroom Activity

- Students explore patterns related to night and day, apparent motion of the sun, shadow lengths, changing visible stars and constellations, Foucault's pendulum, calendars and time zones.

DURATION

3 x 10 min outside for shadow observation (different times of day), then one 45-minute classroom period, then 3 x 10 min outside for sundial observation (different times of day).

PRE-ASSESSMENT QUESTIONS

Please see Discussion Questions located under the video. These can be discussed as a group or answered individually in student science notebooks.



ENGAGE

On a sunny day during the morning, take students outside to a parking lot or other surface you can draw on with chalk. Give each student a piece of chalk. Instruct them to draw an "x" in a location of their choosing. Then ask them to write their initials near the x. Working with a partner, have one student stand on the x with their initials, while their partner loosely traces their shadow on the ground. Then the partners should trade places. The time of day should be written inside this shadow. This process should be repeated around noon, and again later in the day.

MATERIALS

- Chalk
- Access to parking lot or playground
- Watch
- Toothpicks (at least one per group of 4 students)
- Clay
- Ball or globe
- Flashlights (at least one per group of 4 students)
- Science notebooks & pencils (1 per student)

DIY Activity Materials

- Paper plate
- Glue stick
- A bendable straw
- Tape
- A compass
- Sundial face printout (located under video)
- Sharpened pencil
- Watch





EXPLORE

After the entire Engage exercise has been completed, ask students to discuss the phenomena they observed using sunlight, shadows, and chalk. What do they think happened? Students may know, or think they know (but they may think the sun moved across the sky). Break students into small groups and give each group a flashlight, toothpick, and small piece of clay. Let them explore using these tools to model what they observed outside and attempt to construct an explanation. A sketch of their model explaining what each piece represents (flashlight represents sun, toothpick represents person, etc.), along with a written explanation of what they think is happening, should be written into their science notebooks.



EXPLAIN

Facilitate a group discussion about how and why shadows change length and direction. Some students will have will have correctly modeled this phenomena by moving the flashlight. Show students an alternative model with a toothpick stuck to a ball using clay. Have a volunteer hold the flashlight in one place and rotate the ball. Does this produce the same effect? Is the sun moving across the sky or is the Earth moving? How can we be sure?



WATCH THE *GENERATION GENIUS EARTH'S ORBIT AND ROTATION* VIDEO AS A GROUP

Then facilitate a conversation using the Discussion Questions.



ELABORATE

Use the DIY Activity to build your own sundials just like Zoë's from the video. More advanced concepts related to the motion of the Earth can be explored using the sundial as a starting point.



EVALUATE

In their science notebooks, each student should use words and/or labeled drawings to explain the motion (rotation and orbit) of the Earth in relation to the sun, and list some of the patterns that motion causes (apparent motion of sun, shadows, day and night, visibility of certain stars throughout the year).



EXTENSIONS

Research or observe which stars/constellations are visible where you live over time to create a chart showing when different constellations are visible throughout the year. Explain why we can see these different constellations in a repeating pattern (because the Earth orbits the sun once a year and the pattern repeats each year).