

PHENOMENON-BASED INSTRUCTIONAL TASK | GRADE LEVEL: 5th Grade

SHADOW PATTERNS

TARGETED DCI AND/OR ASSOCIATED PE

PE | 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.

DCI | 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.

POSSIBLE DRIVING PHENOMENA



Student observation or initial interaction:

Students can trace their shadows at different times of the day looking for patterns in the shape, size, and direction of their shadow's movements over the course of the day.

Phenomenon explanation for teachers:

The Earth rotates on an axis through the North and South Poles. The Earth rotates counter-clockwise if viewed directly above the North Pole and clockwise if viewed directly above the South Pole. This rotating motion causes the Sun, Moon, and stars seen in the sky to appear to "rise" in the east and "set" in the west. This regular motion is the cause of the observable and predictable motions of the objects in the sky over the course of a 24-hour day. Other motions, such as the Earth revolving around the Sun and the Moon revolving around the Earth, cause other predictable patterns.



Student observation or initial interaction:

Students can observe time-lapse videos* of the nighttime sky over the course of the entire night to determine the patterns of the motion of the stars and other celestial bodies, such as the Moon and the Sun, as they appear to move across the sky.

*videos can be found by searching "star trail time lapse"

HOW DOES THE PHENOMENON CONNECT TO THE DCI OR PE?

The objects in the solar system move in predictable and observable patterns. The students can analyze and interpret data in order to understand the regular patterns of motion of the stars, planets, and moons. For example, the Moon's regular, cyclical orbit around the Earth and the position of the Earth and the Moon relative to the Sun can be analyzed using models to construct an explanation for the Moon's phases. Likewise, the position of the Sun, the Earth, and the Moon in relation to each other at different times within their normal paths of motion can be used to explain and predict lunar and solar eclipses. Other patterns are predictable as well, such as day and night, which are caused by the rotation of the Earth on its axis between its North and South Poles, and the changing seasons which are a result of the tilt of the Earth on its axis and the Earth's revolution around the Sun. As the seasons change, so do the patterns of stars in the nighttime sky.

GATHERING AND REASONING IN ORDER TO CONSTRUCT AND REFINE EXPLANATIONS:

How could students gather evidence using SEPs and CCCs that will help them construct/refine a supported explanation of the phenomenon?

1. INITIAL ENGAGEMENT WITH THE PHENOMENON:

- Students can make observations of the phenomena, begin collecting data, and begin to ask questions about the patterns they observe.
- Students can construct initial explanations for possible causes of these patterns.

2. CONTINUING EXPLORATION:

- Students can develop and use models to understand the relationship of Earth to the Sun and how this relationship causes the patterns observed.
- Students can analyze and interpret data that they collect or are presented with to determine the patterns caused by the rotation of the Earth.

GUIDING QUESTIONS:

- What patterns do you observe in the data you collected?
- In what ways did your shadow change over the course of the day?
- How are the stars moving over the course of the night?
- What do you think might be causing the patterns you are observing?
- What do these patterns tell you about how Earth might be moving?
- What would this motion look like from the South Pole?

COMMUNICATE FINAL EXPLANATION OF THE PHENOMENON:

How might students communicate their understanding of the targeted DCI or PE in an explanation supported by evidence?

Students can construct explanations about the causes of the predictable patterns of the Sun, Moon, and stars as they travel across the sky.

Possible formats for constructing explanations of this phenomenon.

- Students can develop models (physical or visual) to explain the patterns of the Sun, Moon, and stars in the sky.
- Students can create graphical displays that can be used to explain the motion of the Sun, Moon, and stars in the sky.