

Unit 5: Interactions within the Earth, Sun and Moon System

Content Area: **Science**
Course(s): **Generic Course**
Time Period: **Generic Time Period**
Length: **# of days**
Status: **Published**

Unit Summary (Content)

What patterns do we notice when observing the sky?

In this unit of study, students develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The crosscutting concepts of *patterns, cause and effect, and scale, proportion, and quantity* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *analyzing and interpreting data* and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

This unit is based on 5-PS2-1, 5-ESS1-1, and 5-ESS1-2.

Student Learning Objectives (Skills)

Support an argument that the gravitational force exerted by Earth on objects is directed down. [Clarification Statement: *description of the direction that points toward the center of the spherical Earth.*] [Assessment Boundary: *Assessment is limited to mathematical representation of gravitational force.*] ([5-PS2-1](#))

Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth. [Assessment Boundary: *Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).*] ([5-ESS1-1](#))

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. [Clarification Statement: *Examples of patterns could include the length and direction of shadows on the Earth with respect to the sun and selected stars that are visible only in particular months.*] [Assessment Boundary: *Assessment does not include causes of seasons.*] ([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.
- Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.
- Support an argument that the gravitational force exerted by Earth on objects is directed down.

Unit Concepts

Part A

Essential Questions

- What effect does Earth’s gravitational force have on objects?

Concepts

- Cause-and-effect relationships are routinely identified and used to explain change.
- The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.

Formative Assessments

- Identify cause-and-effect relationships in order to explain change.
- Support an argument that the gravitational force exerted by Earth on objects is directed down. (“Down” is a local description of the direction that points toward the center of the spherical Earth.) (Assessment does not include mathematical representation of gravitational force.)
- Support an argument with evidence, data, or a model

Part B

Essential Question

- What effect does the relative distance from Earth have on the apparent brightness of the sun and other stars?

Concepts

- Natural objects exist from the very small to the immensely large.
- Stars range greatly in their distance from Earth.
- The sun is a star that appears larger and brighter than other stars because it is closer.

Formative Assessments

- Support an argument that differences in the apparent brightness of the sun compared to that of other stars is due to their relative distances from Earth. (Assessment is limited to relative distances, not sizes, of stars, and does not include other factors that affect apparent brightness, such as stellar masses, age, or stage.)
- Support an argument with evidence, data, or a model.

Part C

Essential Question

- What patterns do we notice when observing the sky?

Concepts

- Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.
- 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 ☐ Different positions of the sun, moon, and stars at different times of the day, month, and year.

Formative Assessments

- Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
- 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. (Assessment does not include causes of seasons.) Examples of patterns could include: ☐ The position and motion of Earth with respect to the sun. ☐ Selected stars that are visible only in particular months.
- Sort, classify, communicate, and analyze simple rates of change for natural phenomena using similarities and differences in patterns.

Next Generation Science Standards

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| SCI.5-PS2-1 | Support an argument that the gravitational force exerted by Earth on objects is directed down. |
| SCI.5-ESS1-1 | Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth. |
| SCI.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, Disciplinary Core Ideas, Cross Cutting Concepts

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| SCI.5.5-ESS1-2.1.1 | Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. |
| SCI.5.5-ESS1-1.3.1 | Natural objects exist from the very small to the immensely large. |
| SCI.5.5-ESS1-2.4.1 | Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. |
| SCI.5.5-PS2-1.PS2.B.1 | The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. |
| SCI.5.5-ESS1-1.ESS1.A.1 | The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. |
| SCI.5.5-ESS1-2.ESS1.B.1 | 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. |
| SCI.5.5-PS2-1.2.1 | Cause and effect relationships are routinely identified and used to explain change. |
| SCI.5.5-ESS1-1.7.1 | Support an argument with evidence, data, or a model. |
| SCI.5.5-ESS2-1.2.1 | Develop a model using an example to describe a scientific principle. |

Interdisciplinary Connections

ELA Standards

Students should use information from print and digital sources to build their understanding of:

- The Earth's gravitational force on objects.
- The differences in the apparent brightness of the sun compared to that of other stars due to their relative distances from Earth.
- Patterns of change that occur due to the position and motion of the Earth, sun, moon, and stars.

As students read and gather information from multiple sources, they should integrate and use the information to answer questions and support their thinking during discussions and in their writing.

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| LA.5.RI.5.7 | Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. |
| LA.5.RI.5.8 | Explain how an author uses reasons and evidence to support particular points in a text, |

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| | identifying which reasons and evidence support which point(s). |
| LA.5.RI.5.9 | Integrate and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) information from several texts on the same topic in order to write or speak about the subject knowledgeably. |
| LA.5.RI.5.1 | Quote accurately from a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text. |
| LA.5.SL.5.5 | Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. |
| LA.5.W.5.1 | Write opinion pieces on topics or texts, supporting a point of view with reasons and information. |

Math Standards

Students reason abstractly and quantitatively when analyzing and using data as evidence to describe phenomena, including:

- The Earth’s gravitational force pulls objects “down” (toward the center of the Earth).
- The differences in the apparent brightness of the stars are due to their relative distances from Earth.
- Patterns of change, such as the day/night cycle, the change in length and direction of shadows during the day, the apparent motion of the sun across the daytime sky and the moon across the nighttime sky, the changes in the appearance of the moon over a period of four weeks, and the seasonal changes in the position of the stars in the night sky.

Students will model with mathematics as they graphically represent data collected from direct observations and from multiple resources throughout the unit, and as they describe relative distances of the sun and other stars from the Earth. Students might also express relative distances between the Earth and stars using numbers that can be expressed using powers of 10.

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| MA.K-12.2 | Reason abstractly and quantitatively. |
| MA.K-12.4 | Model with mathematics. |
| MA.5.5.G.A.2 | Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. |
| MA.5.5.NBT.A.2 | Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. |

21st. Century Life & Career Standards

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| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |
| CRP.K-12.CRP5 | Consider the environmental, social and economic impacts of decisions. |

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| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |
| CRP.K-12.CRP9 | Model integrity, ethical leadership and effective management. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP7 | Employ valid and reliable research strategies. |
| CRP.K-12.CRP1 | Act as a responsible and contributing citizen and employee. |
| CRP.K-12.CRP6 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP10 | Plan education and career paths aligned to personal goals. |
| CRP.K-12.CRP12 | Work productively in teams while using cultural global competence. |
| CRP.K-12.CRP3 | Attend to personal health and financial well-being. |

Summative Assessments

- Group project
- In-class project
- Presentation
- Quiz
- Take home project
- Unit test
- Written report

Modifications

- Collaborate with after-school programs or clubs to extend learning opportunities.
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Provide ELL students with multiple literacy strategies.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#_UXmoXcfD_UA).
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Structure the learning around explaining or solving a social or community-based issue.
- Use project-based science learning to connect science with observable phenomena.

Resources/Technology

[Gravity and Falling Objects PBS Learning Media Lesson](#)

[NASA Solar System Exploration](#)

[Our Super Star PBS Learning Media Lesson](#)

5-ESS1-1

[Unit 5: Plaid Pete is Finding Earth's Place in the Universe \(Lessons 8-11 \)](#)

[Brainpop-Stars](#)

5-ESS1-2

[Unit 4 – The Sun & Earth's Patterns](#)

5-PS2-1

[Weight, Mass, and Gravity](#)