Unit 2 Interactions Within the Earth, Sun, and Moon Systems

Content Area: **Science**
Course(s):
Time Period: **Trimester 2**
Length: **10-12 Weeks**
Status: **Published**

Summary

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. Additionally, students are able to describe ways in which the geosphere, biosphere, hydrosphere, and atmosphere interact. At the end of this unit, students will describe and graph data to provide evidence about the distribution of water on Earth.

The crosscutting concepts of patterns, cause and effect, 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, using mathematics and computational thinking, obtaining, evaluating and communicating information in order to engage in argument from evidence. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

This unit will be taught utilizing Earth Science: Earth and Sun FOSS program kit.

Revision Date: July 2021

Standards

MA.5.NBT.A	Understand the place value system.
MA.5.NBT.B.5	Fluently multiply multi-digit whole numbers using the standard algorithm.
LA.RI.5.2	Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
LA.RI.5.3	Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
LA.RI.5.4	Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
LA.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.W.5.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and

	information.
SCI.5-PS2	Motion and Stability: Forces and Interactions
SCI.5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.
LA.W.5.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
LA.W.5.2.A	Introduce a topic clearly to provide a focus and group related information logically; include text features such as headings, illustrations, and multimedia when useful to aiding comprehension.
	The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
LA.W.5.6	With some guidance and support from adults and peers, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
LA.W.5.7	Conduct short research projects that use several sources to build knowledge through investigation of different perspectives of a topic.
SCI.5-ESS1	Earth's Place in the Universe
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.A	The Universe and its Stars
	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-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.
SCI.5.ESS1.B	Earth and the Solar System
SCI.5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
	Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.
SCI.5-ESS2-2	Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
TECH.9.4.5.CT.3	Describe how digital tools and technology may be used to solve problems.
TECH.9.4.5.IML	Information and Media Literacy

Essential Questions

Essential Questions:

- *What patterns can be noticed while observing the sky?*
- *To what extent does Earth's gravitational force have an effect on objects?*
- *To what extent does the relative distance from Earth have on the Sun?*
- *How do individuals and communities use science and engineering to protect Earth's resources and environment?*
- *To what extent do the geosphere, biosphere, hydrosphere and atmosphere interact?*
- *To what extent have human beings had on the environment?*
- *How can human beings impact Earth in a positive way?*
- *To what extent do scientists and engineers contribute to the development and use of models?*

Enduring Understandings:

- The orbit of Earth around the Sun and of the Moon around Earth, together with the rotation of Earth about its axis between its North and South Poles, cause observable patterns.
- The pulling force of gravity keeps the planets and other objects in orbit.
- Earth's climate and human activities affect each other.
- If Earth's mean temperature continues to rise, organisms including humans, will be affected in various ways.
- Individual communities use science ideas to protect Earth's resources and environment.
- Weather and climate are influenced by interactions of the Sun, the ocean, the atmosphere, ice, landforms, and living things.
- The redistribution of water in our atmosphere has made it possible for life to thrive on Earth.
- Humans depend on Earth's land, ocean, atmosphere, and biosphere for various resources.
- The atmosphere plays a major role in determining Earth's surface and acts as a medium of transportation for both matter and energy.
- Scientists and engineers create conceptual and physical models to explain how something works. These models develop the theory and act as a proof for the law.
- Engineers improve existing technologies or develop new ones as people's needs, wants, and demands change.

Objectives

Students will know:

- how shadows change in direction and length due to the position of the Sun.
- that the solar system includes stars, the Sun, and the objects that orbit it.
- that the relationship of the Sun, Moon, and Earth can be explained through creating models and calculating size and distance.
- that patterns in the night sky can be observed and change due to Earth's rotation and revolution.
- that air is a mixture of gases held by gravity near Earth's surface.
- that air is matter, has mass, takes up space, and is compressible.

- that most of Earth's air resides in the troposphere, which is where the weather happens.
- that weather is a condition of Earth's atmosphere at a given time in a given place.
- how weather can be described in several variables: temperature, humidity, precipitation, wind and air pressure.
- how a model can be used to demonstrate and describe natural objects that exist from the very small to the immensely large
- how working in collaborative groups is important in the scientific and engineering process.

Students will be skilled at:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

Learning Plan

Part 1

Students explore the effects of gravity and determine the effect that relative distance has on the apparent brightness of stars. They also collect and analyze data in order to describe patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Suggested Activities:

- Students explore the effects of gravity by holding up and releasing a variety of objects from a variety of heights and locations.
- Students record and use their observations to describe the interaction that occurs between each object and the Earth.
- Students use their observations as evidence to support an argument that the gravitational force exerted by the Earth on objects is directed "down" (towards the center of the Earth), no matter the height or location from which an object is released.
- Students investigate the effect of distance on the apparent brightness of stars.
- Use information from a variety of print or digital sources to teach students that natural objects vary in size, from very small to immensely large. Ex: Stars, which vary in size, also range greatly in their distance from the Earth. The sun, which is also a star, is much, much closer to the Earth than any other star in the universe.
- Once students understand these concepts, they should explore the effect of distance on the apparent brightness of the sun in relation to other stars. This can be accomplished by modeling the effect using a light source, such as a bright flashlight. As students vary the distance of the light from their eyes, they should notice that the farther away the light is, the less bright it appears. Observations should again be recorded and used as evidence to support the argument that the differences in the apparent

brightness of the sun compared to that of other stars is due to their relative distances from the Earth.

Students investigate the following observable patterns of change that occur due to the position and motion of the Earth, sun, moon, and stars.

Suggested Activities:

- Day and night: This pattern of change is a daily, cyclical pattern that occurs due to the rotation of the Earth every 24 hours. Students can observe model simulations using online or digital resources, or they can create models in class of the day/night pattern caused by the daily rotation of the Earth.
- The length and direction of shadows: These two interrelated patterns of change are daily, cyclical patterns that can be observed and described through direct observation. Students need the opportunity to observe a stationary object at chosen intervals throughout the day and across a few days. They should measure and record the length of the shadow and record the direction of the shadow (using drawings and cardinal directions), then use the data to describe the patterns observed.
- The position of the sun in the daytime sky: This daily, cyclical pattern of change can also be directly observed. Students will need the opportunity to make and record observations of the position of the sun in the sky at chosen intervals throughout the day and across a few days. Data should then be analyzed in order to describe the pattern observed.
- Optional: The appearance of the moon in the night sky: This cyclical pattern of change repeats approximately every 28 days. Students can use media and online resources to find data that can be displayed graphically (pictures in a calendar, for example), which will allow them to describe the pattern of change that occurs in the appearance of the moon every four weeks.
- Optional: The position of the moon in the night sky: This daily, cyclical pattern of change can be directly observed, but students would have to make observations of the position of the moon in the sky at chosen intervals throughout the night, which is not recommended. Instead, students can use media and online resources to learn that the moon, like the sun, appears to rise in the eastern sky and set in the western sky every night.
- The position of the stars in the night sky: Because the position of the stars changes across the seasons, students will need to use media and online resources to learn about this pattern of change.

***Note: Whether students gather information and data from direct observations or from media and online sources, they should organize all data in graphical displays so that the data can be used to describe the patterns of change. (Utilize interactive science notebook)**

<u>Foss Investigations that support the above:</u>

Investigation 1 Part 1: Shadow Shifting

Investigation 1 Part 2: Sun Tracking

Investigation 1 Part 3: Day and Night

Investigation 2 Part 1: Night-Sky Observations

Investigation 2 Part 2 : How Big and How Far? (Note: students need to understand how relative distance affects the brightness of stars. The size of star/planet/body does not matter at this juncture. Your Focus in this lesson should be about relative distance)

Investigation 2 Part 3: Phases of the Moon (Optional) Phases of the moon are covered in middle school standard: MS-ESS1-1

Gizmos that support above:

5-ESS1: Earth's Place in the Universe

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.

Seasons: Earth, Moon, and Sun

Summer and Winter

Part 2

Students develop models to describe the interactions that occur within and between major Earth systems and conduct research to learn how humans protect the Earth's resources.

Suggested Activities:

- Give opportunities to review familiar examples of systems, such as plants and animals, listing external and internal structures and processes and describing the interactions that occur within the system.
- Students begin to think about Earth's major systems, identifying the components and describing the interactions that occur within each. For example: The geosphere is composed of solid and molten rock, soil, and sediments. Some processes that occur between the components of the geosphere include erosion, weathering, deposition, sedimentation, compaction heating, cooling, and flow. These processes cause continual change to rock, soil, and sediments. The hydrosphere is composed of water in all its forms. Water, unlike the vast majority of earth materials, occurs naturally on the Earth as a solid, liquid, or gas, and it can be found on, above, and below the surface of the Earth. Some processes that occur in the hydrosphere include evaporation, condensation, precipitation, run-off, percolation, freezing, thawing, and flow. These processes cause water to change from one form to another in a continuous cycle.
- The atmosphere is a critical system made up of the gases that surround the Earth. The atmosphere helps to regulate Earth's climate and distribute heat around the globe, and it is composed of layers with specific properties and functions. This system, composed mainly of nitrogen, oxygen, argon, and carbon dioxide, also contains small amounts of other gases, including water vapor, which is found in the lowest level of the atmosphere where weather-related processes occur. In addition to weather processes, radiation, conduction, convection, carbon cycling, and the natural greenhouse effect are processes that occur in the atmosphere.
- The biosphere comprises living things, including humans. Living organisms can be found in each of the major systems of the Earth (the atmosphere, hydrosphere, and geosphere). Some processes that occur within the biosphere include transpiration, respiration, reproduction, photosynthesis, metabolism, growth, and decomposition.

As students become more comfortable with describing each system in terms of its components and interactions, they should begin to think about and discuss the interactions that occur between systems.

Suggested Activities:

- Students should develop models that describe ways in which any two Earth systems interact and how these interactions affect the living and nonliving components of the Earth. Some examples include: As a class, students can brainstorm additional examples, use any type of model, such as diagrams or physical replicas, to describe the interactions that occur between any two systems, and they can choose

to enhance the model with multimedia components or visual displays.

Once students have an understanding of the components and interactions that occur within and between Earth's major systems, they should gather information about the ways in which individual communities use science ideas to protect Earth's resources and environment.

Suggested Activities:

- Students can work individually, in pairs, or in small groups to conduct research using books and other reliable media resources. They then paraphrase and summarize information as they take notes, then use their information to support their finished work. (Their research should help them determine: How human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space? What individuals and communities are doing to help protect Earth's resources and the environment.)
- Students can share their work in a variety of ways and should provide a list of sources for the information in their finished work.

Although engineering design is not explicitly called out in this unit, students could incorporate engineering design in a number of ways as they explore human impact on the environment.

Suggested Activities:

- Students may design a way to promote local, sustainable agriculture, making healthy food available to more people in their communities while having minimizing the impact on the local environment.
- Students can design ways to capture and use rainwater throughout their community to lessen the impact on local freshwater reserves.
- Students can design and implement a variety of recycling projects that have a positive impact on the environment by increasing the reuse of materials that normally end up in landfills and decreasing our reliance on earth resources.
- Students can research and design ways to increase the use of environmentally friendly fertilizers and pesticides that do not harm the local environment. Students can create pamphlets, presentations, or even commercials that inform the local community of the impact that chemical fertilizers and pesticides have when used in and around homes and businesses and offer information on safer alternatives that are just as effective. (Students will need time to conduct research, determine criteria for success, consider constraints on available resources, and design solutions based on the information they gather. Students will need access to reliable sources of information that will help them as they work through the design process.)

Foss Investigations that support the above:

Investigation 3 Part 1: The Air Around Us

Gizmos that support above:

5-ESS2: Earth's Systems

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Carbon Cycle

Coastal Winds and Clouds

Coastal Winds and Clouds - Metric

Erosion Rates

Greenhouse Effect

Greenhouse Effect - Metric

Hurricane Motion

Hurricane Motion - Metric

River Erosion

Rock Cycle

Water Cycle

Weathering

PART 3

Students need to understand that Earth is a system made up of subsystems, all of which have multiple components that interact.

Suggested Activties:

- Students conduct research, using informational texts and online resources, to determine the distribution of freshwater and saltwater among Earth's oceans, rivers, lakes, glaciers, groundwater, and polar ice caps Students organize their data into graphs or charts, showing the allocation of freshwater and saltwater on Earth. (Amounts should be described in terms of volume, as well as in percentages). After comparing and analyzing data, students should be able to conclude the following: Nearly all of Earth's available water is in the ocean, freshwater makes up less than 3% of the total amount of water on the Earth, most freshwater is found in glaciers or underground, only a tiny fraction of the freshwater on Earth is in streams, lakes, wetlands, and the atmosphere.
- Students conduct research in order to determine ways in which individuals and communities help to protect the Earth's resources and environments. Using books and other reliable media resources, as well as first-hand observations in the local community, students gather information about the ways in which humans affect the environment. They should look for examples of human activities in agriculture, industry, and in their everyday lives, and should describe, both orally and in writing, the ways in which these activities affect the land, oceans, streams, groundwater, air, and other organisms (both plants and animals). Students will need the opportunity to share their findings with the class, and then should conduct further research to find ways in which individual communities use science ideas to protect the Earth's resources and environments.
- Working in pairs or small groups, students should gather relevant information from both observations and reliable resources to prepare a presentation that explains one way in which a community is minimizing the effects of human activities on Earth's resources and environment. The presentation should include both writing and speaking components, as well as a list of sources that were used to provide information. As a result of conducting research and creating a presentation, students should come to understand that the ecosystem is a system that includes both living and nonliving components that interact with one another. These interactions cause changes to the system and its components.

Humans are just one of many components in an ecosystem, yet our activities affect all parts of the ecosystem, many times in adverse ways.

Foss Investigations that support the above:

Investigation 5 Part 3: Water Cycle

Gizmos that support above:

5-ESS2: Earth's Systems

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Carbon Cycle

Coastal Winds and Clouds

Coastal Winds and Clouds - Metric

Erosion Rates

Greenhouse Effect

Greenhouse Effect - Metric

Hurricane Motion

Hurricane Motion - Metric

River Erosion

Rock Cycle

Water Cycle

Weathering

5-ESS2-2: Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

Water Cycle

5-ESS3: Earth and Human Activity

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Water Pollution

Assessment

Formative: teacher observation, student responses during lessons, exit tickets, science notebook questions/observations

Summative: investigation response sheets, science notebooks, quizzes, Survey/Posttest Questions

Benchmark: iChecks , Science Notebook

Alternative: oral presentation with visual model such as a Google slideshow to demonstrate understanding of concepts, drawing models, FOSS extensions, Google Applied Digital Skills Classroom lessons, Gizmo Lesson Assessment

Materials

FOSS kit- Unit 2: Earth and Sun

Bill Nye Science Guy/BrainPOP

Science notebook for assessment and journaling

Gizmos (grades 3-5) See learning plan for which Gizmo supports each investigation/concept.

Core Book List

Science Web Apps for the Classroom

Integrated Accommodation and Modifications

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education, and those with 504s

This link includes content specific accommodations and modifications for all populations:

https://docs.google.com/spreadsheets/d/1Pp6EJOCsFz5o4-opzsXpQDQoa6aClW-bkRGPDRHXVrk/edit?usp=sharing

These additional strategies are helpful when learning Science content and skills:

- Reading texts aloud for students for difficult concepts by utilizing Foss Interactive Science Resource Book, Audio version, or FOSS APP
- Providing opportunities for text-to-speech for written responses.

- Use visual presentations of all materials to include graphic organizers for writing.
- Mark texts with a highlighter.