UNIT 4   SPACE SYSTEMS

Fifth Grade | Rogers Public Schools

Unit 4: Space Systems   9 weeks

In this unit, students develop an understanding that we can observe, describe, and predict patterns of daily change related to the sun, moon, and stars in our solar system. Students will understand how the orbits of Earth around the sun, and the moon around the Earth, along with the rotation of Earth, cause observable patterns. Some of these patterns include: changes in length and direction of shadows during the day; day and night; and the seasonal appearance of some stars in the night sky. Students will use information gathered and observed to describe such patterns and will represent data collected in graphical displays to reveal these patterns.

Students will discover the properties of our sun and understand why it is important to life on Earth. Students will also understand that the sun is a star that is closer to Earth and appears larger and brighter than other stars due to its proximity to Earth. Students will understand that stars range greatly in their distance from Earth, and appear to move across the night sky because of Earth's rotation. They will construct and support an argument regarding why we see differences in the brightness of the sun compared to other stars.

Finally, students will use evidence, data, and/or models to describe the gravitational force exerted by Earth and how it affects objects. They will construct and support an argument that this gravitational force pulls an object "down" toward the center of the Earth.

Unit 4 Performance Expectations

- ❖ **5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]

- ❖ **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.** [Assessment Boundary: Assessment is limited to relative distances rather than sizes of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, or stage).]

- ❖ **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.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and select stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]

Unit 4 Essential Questions:

- ❖ How do mass and distance affect the force of gravity between two objects?
- ❖ What causes the cycle of day and night?
- ❖ How do lengths and directions of shadows or relative lengths of day and night change from day to day?
- ❖ Why do the sun, stars, and planets appear to move across the sky?
- ❖ How does the appearance of some stars change in different seasons?

In Unit 4, students will understand…

- ❖ The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
- ❖ The sun is a star that appears larger and brighter than other stars because it is closer to Earth.
- ❖ Stars range greatly in their distance from Earth.
- ❖ 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 patterns 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

Foundational Knowledge:

Prior to 5th grade, students should have knowledge, understanding of, and experiences with the following ideas:

- ❖ When objects touch or collide, they push one another and can change motion.
- ❖ Objects in contact exert forces on each other.
- ❖ Each force acts on one particular object and has both a strength and direction.
- ❖ An object at rest typically has multiple forces acting on it by they add to give zero net force on the object.
- ❖ The sizes of the forces in each situation depend on the properties of the objects and their distances apart or their relative orientation to each other.
- ❖ The patterns of an object's motion in various situations can be observed and measured; when the past motion exhibits a regular pattern, future motion can be predicted from it.
- ❖ Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.
- ❖ Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

With the implementation of new standards, students may not have had opportunities to engage in these foundational understandings and ideas before 5th grade. You may need to provide opportunities for students to experience these ideas as you move forward.

Additional Content Connections:
*These connections provide opportunities to score to other content standards with focused instruction.

ELA:
- ❖ Speaking and Listening
    - SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
    - SL.5.2 Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
    - SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.
- ❖ Writing
    - W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly
    - W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources: summarize or paraphrase information in notes and finished work; provide a list of sources
    - W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Math:
- ❖ Represent and Interpret Data
    - 5.MD.B.2 Make a line plot to display a data set of measurements in fractions of a unit; use operations on fractions for this grade to solve problems involving information presented in line plots.
    - (*3rd grade standard)
    - 3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled picture graphs and scaled bar graphs.
- ❖ Graph points on the coordinate plane to solve real-world and mathematical problems
    - 5.G.A.2 Represent real world and mathematical problems by graphic points in the first quadrant and on the non-negative x- and y-axes of the coordinate plane. Interpret coordinate values of points in the context of the situation.

Unit Vocabulary:

Foundational Vocabulary		Unit Vocabulary	
sun	force	gravity	planet
moon	object	gravitational force	axis
stars	motion	position	revolve
cycle	distance	phase	rotate
pattern	strength	space	orbit
season	direction	galaxy	constellation
		universe	hemisphere
		solar system	equator
		Solstice (Summer & Winter)	Equinox (Spring & Autumnal)

Space Systems

Students who demonstrate understanding can:

5-PS2-1 Support an argument that the gravitational force exerted by Earth on objects is directed down.
[Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]

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.
[Assessment Boundary: Assessment is limited to relative distances rather than sizes of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, or stage).]

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.
[Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and select stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. ▪ Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). ▪ Support an argument with evidence, data, or a model. (5-PS2-1, 5-ESS1-1)	**PS2.B: Types of Interactions** ▪ The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1) **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. (5-ESS1-1) **ESS1.B: 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. (5-ESS1-2)	**Patterns** ▪ Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2) **Cause and Effect** ▪ Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1) **Scale, Proportion, and Quantity** ▪ Natural objects exist from the very small to the immensely large. (5-ESS1-1)