Englewood Public School District
Science
Grade 6
Fourth Marking Period

Unit 5: Space Systems

Overview: This unit is broken down into three sub-ideas: the universe and its stars, Earth and the solar system, and the history of planet Earth. Students examine the Earth's place in relation to the solar system, the Milky Way galaxy, and the universe. There is a strong emphasis on a systems approach and using models of the solar system to explain the cyclical patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories explaining the formation and evolution of the universe. Students examine geosciences data in order to understand the processes and events in Earth's history. The crosscutting concepts of *patterns, scale, proportion, and quantity* and *systems and systems models* provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in *developing and using models* and *analyzing and interpreting data*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Time Frame: 60 to 65 Days

Enduring Understandings:
The changes in relative positions of the sun, moon, and Earth cause cyclical patterns for seasons, lunar phases, eclipses, and tides.
Gravity and inertia account for orbital motions within galaxies and the solar system.
Scale models can be used to understand phenomena that are too large to be observed directly.

Essential Questions:
What pattern in the Earth–sun–moon system can be used to explain lunar phases, eclipses of the sun and moon, and seasons?
What is the role of gravity in the motions within galaxies and the solar system?
What are the scale properties of objects in the solar system?

Standards	Topics and Objectives	Activities	Resources	Assessments
(MS-ESS1-1) **Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.**	**Topics** Earth in Space Gravity and Motion Phases, Eclipses, and Tides Earth's Moon	Students will complete the text activities: 1. Discover Activity (p6) What causes Day and Night? 2. Reasons for the Seasons Lab (p14) 3. Discover Activity (p16) Can You Remove the	**Text:** Prentice Hall Science Explorer: Astronomy **Materials:** For Discover Activity (p6) What causes Day and Night? • Lamp with bare bulb • Globe	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Benchmark Assessment**: Exact Path

(MS-ESS1-2)
Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Twenty-First Century Themes and Skills include:

- The Four C's
- Life and Career Skills

Objectives

Students will:

Explain the cause of day and night, the cycle of seasons, moon phases, eclipses, and tides

Explain how gravity and inertia keep objects in orbit

Bottom Penny?

4. Discover Activity (p20) How Does the Moon Move?
5. A "Moonth" of Phases Lab (p28)
6. Discover Activity (p30) Why Do Craters Look Different From Each Other?

(MS-ESS1-1, CRP4)

Students will play Seasons Simon Says. In the game the student's head will represent the sun and they will tilt their hand to represent the direction of earth's axis. To represent summer, tilt right hand toward head near right ear. To represent winter tilt right hand away from head near left ear. To represent spring or fall, keep hand at an angle in front of face or behind head (it should not tilt toward or away from head).
(MS-ESS1-2)

Student will complete the Coin Drop Activity and the Inverted Bucket Activity to explore gravity and inertia.
(CRP8)

Students will explore planets' gravity by completing the Pull of the Planets Activity.
(6.EE.6)

Student will explore digital models of seasons, moon

For Reasons for the Seasons Lab (p14)

- Books
- Flashlight
- Paper
- Pencil
- Protractor
- Toothpick
- Acetate sheet with thick grid lines drawn on it
- Plastic foam ball marked with poles and equator

For Discover Activity (p16) Can You Remove The Bottom Penny?

- 25 pennies per group
- Ruler

For the Coin Drop Activity

- Glass or beaker
- Index card
- Coin

For Inverted Bucket Activity

- Bucket with sturdy handle
- Water (or balled up wads of paper for less mess)

For Discover Activity (p20) How Does the Moon Move?

- Quarter per group
- Penny per group

For A "Month" of Phases Lab (p28)

- Lamp or flashlight
- Pencils
- Plastic foam balls

Summative Assessments:
Student learning needs and progress will be assessed based on follow up questions for Seasons Interactive, Lunar Phase Interactive, and Eclipse Interactive websites.

Students will receive a grade for *Reasons for the Seasons Lab (p14), A "Moonth" of Phases Lab (p28)*, and Graphing Tides and Moon Phases Lab conclusion questions.

Alternative Assessments:

Students will support an argument with evidence, data, or a model.

Checklists

Journals

Peer Reviews

Graphic organizers

Self-Assessments

Visual Representations

		phases, and eclipses by visiting Seasons Interactive, and Eclipse Interactive websites. Student will draw Models of Tides complete Graphing Tides and Moon Phases Lab. Student will reinforce concept by watching Weight, Mass, and Gravity Song, Famous Scientists - Newton, and Phases of the Moon Song videos. **Enrichment Activity:** Students will build a digital model of the solar system. Students will digitally explore gravity on different planets. (6.EE.6)	For Discover Activity (p30) Why Do Craters Look Different From Each Other? • Safety goggles • Plastic basin • Sand • 3 marbles of different masses • Ruler or measuring tape **Websites:** • Seasons Interactive • Lunar Phases Interactive • Eclipse Interactive • Pull of the Planets Activity • NASA Solar System Exploration: • NJ Tide Charts **Videos:** • Weight, Mass, and Gravity Song • Famous Scientists - Newton • Phases of the Moon Song **Enrichment Lesson Plans:** Solar System Builder Interactive Gravity Variations Interactive	
(MS-ESS1-3) **Analyze and interpret data to determine scale properties of objects in the solar system.**	**Topics** Solar System Sun Structure Planets	Students will complete the text activities: 1. Discover Activity (p72) What is at the Center? 2. Discover Activity (p78) How Can You Safely Observe the Sun?	**Text:** Prentice Hall Science Explorer: Astronomy **Materials:** For Discover Activity (p72) What is at the Center?	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries

Comets, Asteroids, and Meteors

Life Beyond Earth

Twenty-First Century Themes and Skills include:

- The Four C's
- Life and Career Skills
- Information and Media literacy

Objectives

Students will:

Compare and contrast geocentric and heliocentric solar system models.

Identify evidence that supports the heliocentric solar system model.

Relate the structure and features of the sun to how each impacts Earth.

Identify the major features or the planets and group them based on similarities.

Compare and contrast features of comets, asteroids, meteors, and planets.

Identify the conditions needed for living things to survive beyond Earth

3. Stormy Sunspots Lab (p83)
4. Discover Activity (p84) How does Mars Look from Earth?
5. Discover Activity (p94) How Big are the Planets?
6. Speeding Around the Sun Lab (p102)
7. Micrometeorites Lab (p106)
8. Discover Activity (p108) Is Yeast Alive?

Student groups will design an Ancient Astronomer Advertisement about one of the following early astronomers: Ptolemy, Copernicus, Galileo, Tycho Brahe, or Kepler. The ad should include a slogan about the astronomer's theories. It should convince the reader about the astronomer's theories regarding the Universe and state whether the astronomer's theory was a geocentric or heliocentric model. (MS-ESS1-3)(9.2.8.B.3)

Student will view Solar System Rap and Why Pluto Isn't a Planet and debate Pluto's classification while developing a working definition of a planet.

Students will complete the Planet Scavenger Hunt.

- Flashlight

For Discover Activity (p78) How Can You Safely Observe the Sun?

- Ring stand
- Clamp
- Binoculars
- 20cm x 28cm sheet of thin cardboard
- Tape
- Sheet of white paper

Discover Activity (p84) How does Mars Look From Earth?

- Paper
- Ruler
- Pencil or pen

For Discover Activity (p94) How Big are the Planets?

- Quarter
- Ruler
- Paper
- Pencil or pen
- Calculator (optional)

For Speeding Around the Sun Lab (p102)

- String, 1.5 m
- Plastic tube, 6 cm
- Meter stick
- Weight or several washers
- One-hole rubber stopper
- Stopwatch

For Micrometeorites Lab (p106)

- String
- Freezer bag

Summative Assessments: Students understanding of solar system models will be assessed based on *Ancient Astronomer Advertisement* presentations.

Students will be assessed on responses to the *Stormy Sunspots Lab (p83)* and *Speeding Around the Sun Lab (p102)*.

Students will demonstrate understanding of solar system and planet features during the Planet Scavenger Hunt.

Students will be assessed based on the accuracy and feasibility of information presented in the *Create a Colony Activity*.

Alternative Assessments: Students will develop and use models to explain the relationship between the tilt of Earth's axis and seasons.

Models

Practice Presentations

Students will develop and use a physical, graphical, or conceptual model to describe patterns in the apparent motion of the sun, moon, and stars in the sky.

Simulations

		Based on research about the solar system, students will *Create a Colony* by selecting a place for future colonization and developing a plan for addressing all basic human needs in that environment. This can be done in any of the following formats: a persuasive letter to NASA proposing the plan and describing the colony, a detailed blue print drawing of the colony and paragraph(s) describing it, a travel brochure convincing people to visit your colony. **Enrichment Activity:** Students will create a scale model of the solar system (p 71) (RST.6-8.1)	• Microscope slide • Petroleum jelly • Microscope For Discover Activity (p108) Is Yeast Alive? • Yeast package • Bowl • Warm water • Sugar • Spoon **Websites:** • Planet Scavenger Hunt • NASA Solar System Exploration: **Videos:** • Solar System Rap • Why Pluto Isn't a Planet **Enrichment Lesson Plans:** Scale Model of the Solar System (see chapter project (p71))	
	Topics Characteristics of Stars Lives of Stars Star Systems and Galaxies The Expanding Universe Twenty-First Century Themes and Skills include: • The Four C's • Life and Career Skills **Objectives**	Students will complete the text activities: 1. Discover Activity (p126) How Does Your Thumb Move? 2. Star Bright (p129) 3. How Far Is That Star Lab (p134) 4. Discover Activity (p136) What Determines How Long Stars Live? 5. Discover Activity (p141) Why does the Milky Way Look Hazy? 6. A Spiral Galaxy (p145) 7. Discover Activity (p148)	**Text:** Prentice Hall Science Explorer: Astronomy **Materials:** For Star Bright (p129) • 2 flashlights For How Far Is That Star Lab (p134) • Masking tape • Paper clips • Pen • Black and red pencils • Metric ruler • Paper	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Summative Assessments:** Student will receive a grade for *How Far Is That Star Lab (p134).* Student learning needs will be assessed based on responses to *Discover Activity (p136) What Determines How Long*

Students will:

Identify criteria used to classify stars.

Explain how distances to stars can be calculated.

Trace the life cycle of a star.

Compare and contrast star systems and galaxies.

Evaluate evidence for the big bang and expanding universe.

How Does the Universe Expand?

Student will complete Exploring How Stars are Classified Activity.

Students will create an H-R graph by completing Star Classification. (6.RP.A.1)

Students will *Adopt a Star* and draw a diagram or write a story explaining its life cycle. (CRP4)

Student will complete the Cosmic Survey Activity.

Student will model the big bang theory in the Big Bang Balloon Lab.

Students will review concepts by watching 20 Amazing Facts About the Universe, Travel Inside a Black Hole, and What is Dark Matter?

Student will explore SciLinks webites to watch supplemental videos and conduct simulations. (CRP8)

Enrichment Activity:
Students will digital manipulate characteristics of a star on the H-R Diagram Interactive website. (RST.6-8.7)

- Meter stick
- Calculator
- Lamp without shade with 100w bulb
- Copier paper box
- Flat rectangular table about 1m wide

For Discover Activity (p141) Why does the Milky Way Look Hazy?

- Pencil
- Paper
- Tape
- Dark colored wall or paper

For A Spiral Galaxy (p145)

- 2 pipe cleaners per student or group

For Discover Activity (p148) How Does the Universe Expand?

- Permanent marker
- Balloon

For Big Bang Balloon Lab

- 12-inch (30-cm) round latex balloon
- A permanent felt-tip marking pen
- Inch (60-cm) piece of string
- Metric ruler

Websites:

- Scilinks.org, Code scn-0645 http://www.scilinks.org/MyScilinks/SearchByCode.aspx?Enc=1&Scilink=YxwxT/Fk4WHESGd//1XIKLg==&EntPt=YpCP484+

Stars Live?, Discover Activity (p141), Why does the Milky Way Look Hazy?, A Spiral Galaxy (p145), and *Discover Activity (p148) How Does the Universe Expand?*

Student will demonstrate understanding of how stars are classified by accurately completing *Exploring How Stars are Classified Activity* and *Star Classification.*

Students will be graded on the accuracy of their *Adopt a Star* diagram or story.

Student understanding and misconceptions will be assessed based on responses to the Cosmic Survey Activity.

Students will accurately create a list of evidence for the big bang and expanding universe theories after completing the Big Bang Balloon Lab.

Alternative Assessments:

Checklists

Journals

Peer Reviews

Graphic organizers

Self-Assessments

		Students will explore black holes with the Black Hole Interactive website. (8.1.8.A.3)	5TCuAeBxVz3SU4w== • Black Hole Interactive **Videos:** • 20 Amazing Facts About the Universe • Travel Inside a Black Hole • What is Dark Matter? **Enrichment Lesson Plans:** See H-R Diagram Interactive **Additional Resources:** https://www.goodreads.com/list/show/9655.Best_Space_Books_For_Kids http://spaceplace.nasa.gov/lisagwaves/en/ http://cosmictimes.gsfc.nasa.gov/teachers/downloads/lessons/all_years/CosmicTimes_Jigsaw.pdf http://phet.colorado.edu/en/simulations https://www.brainpop.com/ **Books:** **https://books.google.com/books/about/Fundamentals_of_Space_Systems.html?id=uTwb7d8PTXMC** **https://www.goodreads.com/list/show/9655.Best_Space_Books_For_Kids** **http://astronauticsnow.com/AstroBooks/index.html**	Visual Representations Peer Assessments

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be Reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity In planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Give page numbers to help the students find answers ● Speak and display terminology ● Teacher modeling ● Peer modeling ● Provide ELL students with multiple literacy strategies. ● Word walls ● Use peer readers ● Provide a computer for written work ● Provide two sets of textbooks, one for home	● Pre-teach vocabulary ● Utilize modifications & accommodations delineated in the student's IEP ● Work with paraprofessional ● Use multi-sensory teaching approaches. ● Work with a partner ● Provide concrete examples ● Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-	● Using visual demonstrations, illustrations, and models ● Give directions/instructions verbally and in simple written format. Oral prompts can be given. ● Peer Support ● Increase one on one time ● Teachers may modify instructions by modeling what the student is expected to do ● Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. ● Review behavior expectations and make adjustments for personal space or other behaviors as needed.	● Students will act as peer models ● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Real world scenarios ● Student Driven Instruction ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understand -ings. ● Use project-based science learning to connect science with observable phenomena.

and one for school ● Provide visual aides ● Provide additional time to complete a task ● Use graphic organizers	auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • 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).	● Structure the learning around explaining or solving a social or community-based issue. ● Collaborate with after-school programs or clubs to extend learning opportunities.

Interdisciplinary Connections:

ELA-NJSLS/ELA:

RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

Mathematics:

6.EE.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)

6.RP.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)

Career Ready Practices:

CRP4: Communicate clearly and effectively and with reason.

CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Integration of Technology Standards NJSLS 8:
8.1.8.A.3: Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Integration of 21st Century Standards NJSLS 9:
9.2.8.B.3
Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career**.**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2) **Analyzing and Interpreting Data** • Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3)	**ESS1.A: The Universe and Its Stars** • Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) • Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) **ESS1.B: Earth and the Solar System** • The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3) • This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1) • The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)	**Patterns** • Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) **Scale, Proportion, and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-3) **Systems and System Models** • Models can be used to represent systems and their interactions. (MS-ESS1-2) --- ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3) --- ***Connections to Nature of Science***

		<u>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</u> • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1),(MS-ESS1-2)