3C: Rotation, Orbits and the Seasons

Content Area: **Science**
Course(s):
Time Period: **January**
Length: **3 Weeks**
Status: **Published**

Unit Overview

Earth travels closer to the sun in January than it does in July, due to the elliptical shape of Earth's orbit. But it's colder in the Northern Hemisphere in January because the axis of the Earth tilts it away from the sun during the daily rotation; in July, the Northern Hemisphere is tilted toward the sun. In this concept, you will learn how Earth's rotation and orbit affects the seasons.

Enduring Understandings

Lesson Objectives

By the end of the lesson, students should be able to:

- Model Earth's rotation around an axis.
- Model Earth's revolution around the sun.
- Use Earth's motion to explain patterns of sunrise, sunset, and other changes in the night sky.

Essential Questions

- **Overarching Question**
    - What is the universe, and what is Earth's place in it?
- **Focus Question**
    - What are the predictable patterns caused by Earth's movement in the solar system?
- **Lesson Questions**
    - How does Earth move in space?
    - Why does Earth have seasons?
    - Why do seasons differ around the world?

- **Can You Explain?**
    - Why does the angle at which the sun's rays hit Earth change during the year, and how does this cause the seasons to differ in temperature and day length?

Instructional Strategies & Learning Activities

Allow approximately 150 minutes for this lesson.

- Observing Phenomena [10 min]: Students question why the sun appears to move across the sky during the day and the stars appear to move across the sky during the night.

Suggested Reading: Introduction

- Investigation 1: Modeling Earth's Rotation [50 min] Students model Earth's rotation using their bodies.

Suggested Reading: Section 1

Suggested Reading: Section 2

- Investigation 3: Modeling How Polaris Appears from Earth [35 min] Students use a small Earth to model how Earth rotates on an axis that points towards Polaris.

Suggested Reading: Section 3-4

- Making Sense of Phenomena [15 min]: Students explain why the sun and stars appear to move across the sky.

Suggested Reading: Lesson Summary

Integration of Career Exploration, Life Literacies and Key Skills

	Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
	An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
9.4.8.CT	Critical Thinking and Problem-solving
	Multiple solutions often exist to solve a problem.
	Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or

	misrepresentation.
	Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
9.4.8.IML.4	Ask insightful questions to organize different types of data and create meaningful visualizations.
	Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technolgy and Design Integration

Interdisciplinary Connections

CCSS.ELA-Literacy.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
CCSS.ELA-Literacy.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
CCSS.ELA-Literacy.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
CCSS.ELA-Literacy.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
CCSS.ELA-Literacy.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).
CCSS.ELA-Literacy.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
CCSS.ELA-Literacy.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
CCSS.ELA-Literacy.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.
LA.6-8.CCSS.ELA-Literacy.CCRA.W.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid

	reasoning and relevant and sufficient evidence.
LA.6-8.CCSS.ELA-Literacy.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
LA.6-8.CCSS.ELA-Literacy.WHST.6-8.2d	Use precise language and domain-specific vocabulary to inform about or explain the topic.

Differentiation

Struggling Students	ELL	Accelerated Students
1. Have students work collaboratively with accelerated students to discuss and answer the Discussion Question at the end of the teacher's guide for the Exploration "To Every Season." 2. Review vocabulary terms to make sure students have a clear understanding of the terms, particularly ones that may be unfamiliar such as revolution and rotation.	1. Provide Spanish-speaking students with the Spanish version of the reading passage "Getting to Know: Rotation, Orbits, and the Seasons" so that a language barrier does not interfere with comprehension. 2. Emphasize the difference between the vocabulary terms revolution and rotation.	1. Assign students to research the length of a day on the other seven planets of our solar system and compare those with the length of a day on Earth. Ask them whether they see a pattern. 2. Assign students to research leap years and explain how and why the calendar must be adjusted to keep it accurate. 3. Ask students to research and explain why the summer solstice is not the hottest day of the year and why the winter solstice is not the coldest.

Differentiation in science can be accomplished in several ways. Once you have given a pre-test to students, you know what information has already been mastered and what they still need to work on. Next, you design activities, discussions, lectures, and so on to teach information to students. The best way is to have two or three groups of students divided by ability level.

While you are instructing one group, the other groups are working on activities to further their knowledge of the concepts. For example, while you are helping one group learn the planet names in order, another group is researching climate, size, and distance from the moon of each planet. Then the groups switch, and you instruct the second group on another objective from the space unit. The first group practices writing the order of the planets and drawing a diagram of them.

Here are some ideas for the classroom when you are using differentiation in science:

- Create a tic-tac-toe board that lists different activities at different ability levels. When students aren't involved in direct instruction with you, they can work on activities from their tic-tac-toe board. These boards have nine squares, like a tic-tac-toe board; and each square lists an activity that corresponds with the science unit. For example, one solar system activity for advanced science students might be to create a power point presentation about eclipses. For beginning students, an activity might be to make a poster for one of the planets and include important data such as size, order from the sun, whether it

has moons, and so on.

- Find websites on the current science unit that students can explore on their own.
- Allow students to work in small groups to create a project throughout the entire unit. For example, one group might create a solar system model to scale. Another group might write a play about the solar system. This is an activity these groups can work on while they are not working directly with you.

Differentiation in science gets students excited to learn because it challenges them to expand their knowledge and skills, instead of teaching the whole group concepts they have already mastered.

Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

Modifications and Accommodations used in this unit:

IEP and 504 Accommodations will be utilized.

In addition to differentiated instruction, IEP's and 504 accommocations will be utilized.

Benchmark Assessments

Benchmark Assessments are given periodically (e.g., at the end of every quarter or as frequently as once per month) throughout a school year to establish baseline achievement data and measure progress toward a standard or set of academic standards and goals.

Schoolwide Benchmark assessments:

Aimsweb benchmarks 3X a year

Linkit Benchmarks 3X a year

Additional Benchmarks used in this unit:

The students will complete two summative benchmark tests administered by the teacher via Google Forms and Google Classroom. There is one benchmark test administered in the middle of the year around January, and a second one administered in May.

Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

Formative Assessments used in this unit:

See assessments located in the unit link above.

Summative Assessments

Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Summative assessments for this unit:

See assessments located in the unit link above.

Instructional Materials

See materials located in Unit above.

Standards

MS-PS2	Motion and Stability: Forces and Interactions
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.
MS-ESS1	Earth's Place in the Universe
ESS1.B	Earth and the Solar System 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-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Develop and use a model to describe phenomena.
ESS1.A	The Universe and Its Stars Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. Systems and System Models
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system. Assessment does not include recalling facts about properties of the planets and other solar system bodies. 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.