Unit 3: Spaceship Earth
5th Grade Science

25 Class Meetings

Written July 2025

Essential Questions

- How does the distance of the Sun and stars from Earth affect how bright they appear to us?
- What patterns in shadows, daylight, and star appearances can help us understand the movements of Earth and the Sun?

Enduring Understandings with Unit Goals

EU 1: The brightness of celestial objects is influenced by their distance from Earth.

- Explain how the Sun and stars can appear brighter or dimmer due to their relative distances.
- Investigate how brightness is not related to size or distance from Earth.

EU 2: Patterns in daylight, shadows, and star appearances are predictable.

- Collect, represent, and interpret data about the Sun's position, shadows, and seasonal star changes to identify and explain these patterns.
- Explain how patterns in daylight, shadows, and stars result from Earth's rotation and revolution.

EU 3: Relationships between Earth's movements and the phenomena we see in the sky exist.

- Use charts, graphs, and models to represent and communicate patterns of daily and seasonal changes in the sky

Standards

NGSS Standards and Common Core Standards:

- **5-ESS1-1.** Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.
- **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.
- **3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- **3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- **3-5-ETS1-3.** Plan and carry out fair tests in which variables are controlled, and failure points are considered to identify aspects of a model or prototype that can be improved.
- **CCSS.ELA-Literacy.RI.4.1**:Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- **CCSS.ELA-Literacy.RI.4.2:** Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- **CCSS.ELA-Literacy.RI.4.4:** Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.
- **CCSS.ELA-Literacy.RI.4.9**: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

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- **CCSS.ELA-Literacy.W.4.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- **CCSS.ELA-Literacy.W.4.2.a:** Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
- **CCSS.ELA-Literacy.W.4.2.b**: Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
- **CCSS.ELA-Literacy.W.4.2.c**: Link ideas within categories of information using words and phrases (e.g., *another*, *for example*, *also*, *because*).
- **CCSS.ELA-Literacy.W.4.2.d:** Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **CCSS.ELA-Literacy.W.4.2.e:** Provide a concluding statement or section related to the information or explanation presented.
- **CCSS.ELA-Literacy.W.4.4:** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience
- **CCSS.ELA-Literacy.W.4.5:** With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.
- **CCSS.ELA-Literacy.W.4.6:** With some guidance and support from adults, 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 one page in a single sitting.
- **CCSS.ELA-Literacy.W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- **CCSS.ELA-Literacy.W.4.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information and provide a list of sources.
- **CCSS.ELA-Literacy.W.4.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.
- **CCSS.ELA-Literacy.SL.4.1**: Engage effectively in a range of collaborative discussions (one-on one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.
- **CCSS.ELA-Literacy.SL.4.1.a:** Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- **CCSS.ELA-Literacy.SL.4.1.b**: Follow agreed-upon rules for discussions and carry out assigned roles.
- **CCSS.ELA-Literacy.SL.4.1.c**: Pose and respond to specific questions to clarify or follow up on information and make comments that contribute to the discussion and link to the remarks of others.
- **CCSS.ELA-Literacy.SL.4.1.d:** Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
- **CCSS.ELA-Literacy.SL.4.2:** Paraphrase portions of a text read aloud, or information presented in diverse media and formats, including visually, quantitatively, and orally.

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- **CCSS.ELA-Literacy.SL.4.3:** Identify the reasons and evidence a speaker provides to support particular points.
- **CCSS.ELA-Literacy.SL.4.4:** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.
Competency 2: Speak to diverse audiences in an accountable manner.
Competency 3: Develop the behaviors needed to interact and contribute with others on a team.
Competency 4: Analyze and solve problems independently and collaboratively.
Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. **Brightness of Celestial Objects**
   - Explore the concept of apparent brightness vs. actual brightness
   - Compare the Sun's brightness to other stars
   - Use models to simulate distance and brightness
   - Investigate evidence from astronomy about nearby dim stars and faraway bright stars
   - Determine how telescopes and instruments help scientists measure brightness
   - Form arguments supported by data on star distances and apparent magnitudes
2. **Patterns of Daylight, Shadows, and Starts**
   - Investigate Earth's rotation and revolution
   - Determine how shadows change in length and direction during the day
   - Explore seasonal differences in daylight hours and the Sun's position in the sky
   - Observe and chart shadow changes over several days
   - Track constellations visible in different seasons
   - Explore cultural and scientific uses of predictable patterns in the sky
3. **Relationships between Earth and the Sky**
   - Investigate how scientists collect and record sky observations over time
   - Use graphs and charts to display daily shadow lengths and daylight hours
   - Analyze star charts and sky maps to identify seasonal patterns
   - Connect data patterns to explanations of Earth's rotation and revolution

Vocabulary and Key Terms: apparent brightness, actual brightness, distance, light source, magnitude, star, Sun, constellation, telescope, Earth's rotation, Earth's revolution, axis, tilt, day, night, shadow, shadow length, shadow direction, sunrise, sunset, noon, daylight hours, season, equinox, solstice, orbit, pattern, model, data table, graph, chart, observation, star chart, sky map, evidence, argument, prediction, phenomenon

Interdisciplinary Connection:
- ELA, Math

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Daily Learning Objectives with *TWPS*

Students will be able to…

- Describe the difference between apparent brightness and actual brightness of stars.
  - *Why do some stars look brighter than others even if they are much smaller?*
- Explain why the Sun appears brighter than all other stars in the sky.
  - *If the Sun were as far away as other stars, what would it look like from Earth?*
- Use a model to show how distance affects the brightness of a light source.
  - *How does changing your distance from a light source change how bright it appears?*
- Compare the distances and brightness of different stars using data tables.
  - *How can two stars be the same size but appear very different in brightness from Earth?*
- Analyze star data to determine if apparent brightness is caused more by size or distance.
  - *What evidence can you use to prove that distance affects brightness more than size in most cases?*
- Support an argument about why the Sun and stars appear to have different brightness levels using scientific evidence.
  - *How would you convince someone that the Sun isn't the biggest star in the universe, just the closest?*
- Explain how Earth's rotation causes day and night.
  - *If Earth stopped rotating, how would our experience of day and night change?*
- Describe how Earth's revolution around the Sun causes seasonal changes in daylight.
  - *Why do some places have longer daylight hours in summer and shorter ones in winter?*
- Observe and record changes in shadow length and direction throughout the day.
  - *What patterns do you notice in how shadows change from morning to afternoon?*
- Use models to demonstrate how the Sun's position affects shadows.
  - *Why are shadows longest at sunrise and sunset and shortest at noon?*
- Identify seasonal patterns in the appearance of certain constellations.
  - *Why can we see some constellations only during certain times of the year?*
- Explain how predictable star patterns have been used for navigation and calendars.
  - *How might people in the past have used star patterns to plan travel or farming?*
- Connect seasonal daylight and star visibility patterns to Earth's movements.
  - *What would happen to our seasons if Earth's axis were not tilted?*
- Record and organize sky observation data in a table.
  - *How does organizing data help scientists make discoveries?*
- Create a graph showing changes in daylight hours over a year.
  - *What trends do you see in your graph, and what might cause them?*
- Graph shadow length data to reveal daily and seasonal patterns.
  - *How can you tell from your graph what time of day a shadow was measured?*
- Interpret star charts to identify seasonal constellations.
  - *What clues on a star chart help you know when and where to look for a constellation?*
- Compare and analyze daylight and shadow data from different seasons.
  - *How do the patterns you found connect to the tilt and revolution of Earth?*
- Communicate scientific findings about brightness, shadows, and seasonal star changes using models and data displays.

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- *What's the best way to show your evidence so others can clearly understand your ideas?*
- Present an evidence-based explanation that connects apparent brightness, Earth's movements, and observable sky patterns.
  - *How do your findings answer the essential questions for this unit?*

Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Paragraph frames and sentence starters
- Teacher modeling
- Think-write-pair-share and small-group discussions
- Graphic organizers
- Accountable talk
- Homework
- Word walls with visuals (Venn Diagrams)
- Small group instruction
- Visual exemplars with teacher and student critiques
- Text and video chunking
- Spiraling back to guiding questions
- Close reading with text-dependent questions

EL Differentiation Strategies

- Key vocabulary, Word Banks and Word Walls with visuals
- TWPS (Think, write, pair, share)
- Pre-reading strategies
- Culturally responsive teaching
- Explicit teacher modeling
- Graphic organizers
- Strategic Grouping
- Non-verbal assessments

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Assessments

FORMATIVE ASSESSMENTS:

- Do Now
- Academic Discourse
- Exit Slips
- Accountable Talk Discussions
- Completed notes
- Completed graphic organizers
- Homework
- Performance Task -- A Letter to the Future Astronomers of Earth
    - Teacher's rubric/scoring guide

SUMMATIVE ASSESSMENTS:

- Quiz: 1.Brightness of Celestial Objects, Patterns of Daylight, Shadows, and Starts, Relationships between Earth and Sky (EU1, EU2, EU3, and EU4)
- Unit Task: A Letter to the Future Astronomers of Earth (EU1, EU2 and EU3)

Unit Task

Unit Task Name: A Letter to the Future Astronomers of Earth
Description: Upon completing the unit, students will take on the role of communicators writing to a future generation of children who have never experienced Earth's skies. They will write an informative letter explaining key scientific concepts about the Sun's brightness, daily and seasonal shadow changes, and the appearance of constellations across seasons. Students will support their explanations with original data visualizations—such as graphs, star charts, or shadow diagrams.

Evaluation: Teacher's Scoring Guide

Unit Resources

- NewsEla
- Google Slides (Teacher's)
- Student Journals
- Chromebooks
- ReadWorks
- Google Classroom
- Mystery Science