Coherence and Alignment Among Science Curriculum, Instruction, and Assessment (CASCIA) Project

Grade 5 Unit 4: Earth and its Gravitational Force and Motion

Interpretive Guidance and Instructional Strategies for Educators

May 2025

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Purpose

The purpose of this document is to help educators understand their students' performance on the Grade 5 Unit 4 Science Assessment and to provide instructional strategies and resources for planning and adjusting instruction to help students learn, whether it involves reteaching previously addressed concepts and skills from the prior instructional unit or planning additional learning opportunities or interventions in the subsequent unit.

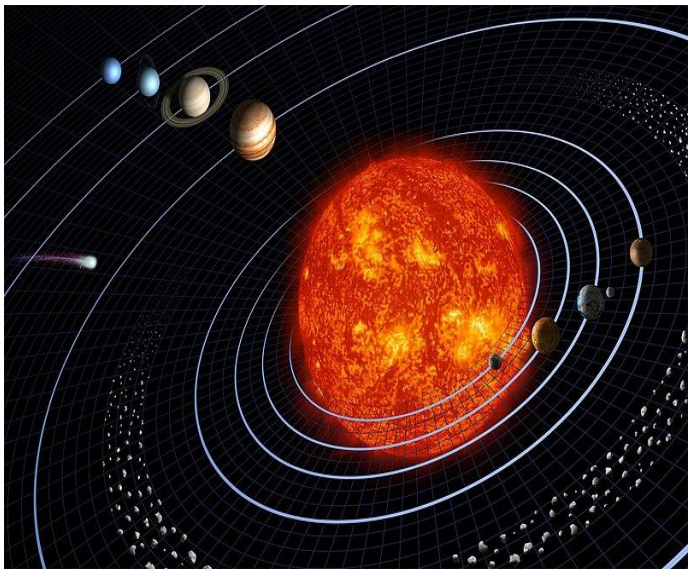

Image: The Solar System
Credit: Harman Smith and Laura Generosa
Source: Based on Image:Solar_sys.jpg, with Pluto removed
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Unit Overview

By engaging in this unit, students deepen their knowledge of the direction of the Earth's gravitational forces and how distance from the Earth influences the brightness of the sun and stars. Focusing on developing and using models, constructing explanations and designing solutions, analyzing and interpreting data, and engaging in argument from evidence, students learn about the gravitational force of Earth, how these cause observable patterns, and the brightness of the sun and other stars.

Instructions for Educators

1. Based on your analysis of student work from the assessment, in combination with additional assessment evidence gathered over the course of the instructional unit, consider themes or trends in your students' performance. Refer to your students' scores on the Classroom Roster Report to determine the degree to which students in your classroom require additional instructional support based on their instructional needs levels—red, yellow, or green—for each performance category.
2. For each performance category, use the provided interpretive guidance (i.e., *What These Results Mean*, *Next Instructional Steps*, and *Example Scored and Annotated Student Work* located in the Grade 5 Unit 4 EOU Assessment Scoring Guide) to understand what your students likely know and are able to do and to consider next instructional steps based on their instructional needs levels. Scored and annotated student work samples are provided for each performance category to demonstrate the evidence students might demonstrate in response to each prompt for each possible score point. The student responses represent the full range of score points possible for each prompt based on the scoring rubric.
3. For each performance category, use the *Instructional Strategies and Resources* organized by Universal Design for Learning (UDL) principle to support the design and delivery of accessible instruction and learning opportunities for all students based on their performance on the Grade 5 Unit 4 Assessment and their recommended instructional needs. These instructional recommendations can be selected and used to intentionally plan instruction and learning opportunities for students across the range of instructional needs levels (i.e., red, yellow, green).

Universal Design For Learning

The instructional strategies and resources provided in this document are organized by the Universal Design for Learning (UDL) principles. UDL is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn." (CAST, 2022). Taking time to reflect on prior instruction when planning for accessible, differentiated, and culturally responsive instruction for diverse learners and culturally diverse classrooms serves to identify ways to improve future instructional practices. The UDL Guidelines provide a framework for this reflection. The guidelines include three principles: Multiple Means of Engagement, Multiple Means of Representation, and Multiple Means of Action & Expression as ways to focus on variety and flexibility in instructional practices.

 Multiple Means of Engagement	*The WHY of Learning* - provide options for recruiting student interest, sustaining effort, and promoting motivation.
 Multiple Means of Representation	*The WHAT of Learning* - provide options for displaying information, including alternatives for auditory and visual information, use multi-media, clarify vocabulary and symbols, support comprehending text, and guide information processing and visualization.
 Multiple Means of Action & Expression	*The HOW of Learning* – vary the methods for student responses and collection of evidence of their learning, optimize access to tools and technologies, use multiple tools for construction and composing responses, facilitate managing information and resources, and enhance student capacity for monitoring progress.

By examining instruction and instructional materials through the lens of each of these principles, we can identify and thus reduce or remove barriers to diverse learners to promote accessible and equitable teaching and learning opportunities. Application of UDL guidelines and principles allows all students to engage with and be provided with multiple means of representing instructional content and expressing what they know and can do, which is similarly the purpose of the use of accommodations for students receiving special education, students who have a 504 plan, and emerging Bilinguals.

Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System

Interpretive Guidance for Performance Category 1: **Support Arguments Related to Interactions Within the Earth, Sun, and Moon System** *Task 1, Prompt 1, Part A (3 Points); Task 1, Prompt 1, Part D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2, Part C (2 Points); Task 3, Prompt 3 (2 Points)*		
Red (0-3 score points earned) ➢ **Extensive** additional instruction and reteaching of these skills is recommended. ➢ The student needs significant opportunities to reinforce and apply these skills in future learning.	**Yellow (4-9 score points earned)** ➢ **Moderate** additional instruction on these skills is recommended. ➢ The student needs additional opportunities to strengthen these skills in future learning.	**Green (10-12 score points earned)** ➢ **Minimal to no** additional instruction on these skills is recommended. ➢ The student is ready to extend these skills in future learning.
What These Results Mean		
This student is likely able to: • Present an **inaccurate** representation of the position of the sun, the direction, **and/or** the length of an object's shadow. • State **some** science ideas or information to provide an **inaccurate** description or conclusion about the length and direction of shadows over the course of a day **and**/**or** a year. • **Use some** science ideas **and/or** information about the motion of objects in the Earth-moon system to **attempt** to refute a claim. • **Use some** science ideas or information related to gravity or a lunar eclipse to **attempt** a description or conclusion.	**This student is likely able to:** • **Partially complete** a diagram **with a minor error** to represent the position of the sun, the direction, **or** the length of an object's shadow. • Use **some correct and relevant** science concepts, mathematical representations, or information to construct an **accurate but incomplete** argument about the length and direction of shadows over the course of a day **and/or** a year (i.e., change in shadows' length from summer to winter). • Use **some relevant** concepts, mathematical representations, **or** information to demonstrate understanding of the pattern of motion of objects in the Earth-moon	**This student is likely able to:** • **Complete** a diagram to **correctly** represent relationships among the position of the sun and the direction **and** the length of an object's shadow. • Use **correct and relevant** science concepts, mathematical representations, or information to construct a **clear and convincing** argument about the length and direction of shadows over the course of a day **and** a year (i.e., change in shadow length from summer to winter). • Use **relevant** science concepts, mathematical representations, **and** information to demonstrate understanding of the pattern of motion of objects in the

Interpretive Guidance for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1, Part A (3 Points); Task 1, Prompt 1, Part D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2, Part C (2 Points); Task 3, Prompt 3 (2 Points)*		
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	system to **partially** refute a claim with **minor errors**. • Use **some relevant** science information about gravity **and** a lunar eclipse and **apply some** of these concepts to construct an argument.	Earth-moon system to **accurately** refute a claim with **at least two pieces** of evidence. • **Correctly** use **relevant** science concepts or information about gravity **and** a lunar eclipse to construct a **clear and convincing** argument.

Interpretive Guidance for Performance Category 1:
Support Arguments Related to Interactions Within the Earth, Sun, and Moon System

Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2, Part C (2 Points); Task 3, Prompt 3 (2 Points)

Red (0-3 score points earned)	Yellow (4-9 score points earned)	Green (10-12 score points earned)
➢ **Extensive** additional instruction and reteaching of these skills is recommended. ➢ The student needs significant opportunities to reinforce and apply these skills in future learning.	➢ **Moderate** additional instruction on these skills is recommended. ➢ The student needs additional opportunities to strengthen these skills in future learning.	➢ **Minimal to no** additional instruction on these skills is recommended. ➢ The student is ready to extend these skills in future learning.
Next Instructional Steps		
Provide opportunities for the student to: • Identify examples and non-examples of representations of the position of the sun and the direction and length of an object's shadow. • Select from and correctly use provided terminology and concepts to engage in discussion to develop conclusions related to 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. • Identify provided science ideas and information that support or refute a provided claim. • Collaboratively brainstorm and generate ideas and reasons to support a provided argument.	**Provide opportunities for the student to:** • Correctly use relevant terminology and concepts to engage in argumentation. • Discuss and apply scientific concepts from the unit to explain decision-making, data analysis, and reasoning to construct an argument. • Identify and use multiple sources of relevant evidence, data, and/or models to construct and support or refute a claim related to the orbits of Earth around the sun and the moon around Earth. • Evaluate the strength of a provided argument based on the relevance and sufficiency of the reasoning and evidence.	**Provide opportunities for the student to:** • Connect scientific theories and laws to justify an argument clearly and logically. • Compare and refine arguments based on an evaluation of the evidence presented. • Develop and use multiple forms of data and information (e.g., graphs or tables) to identify patterns and make a prediction related to the orbits of Earth around the sun and the moon around Earth.

Interpretive Guidance for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2, Part C (2 Points); Task 3, Prompt 3 (2 Points)*		
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• Collaboratively select from provided evidence, data, and/or models that are relevant to support a provided argument.		

Instructional Strategies and Resources for Performance Category 1:
Support Arguments Related to Interactions Within the Earth, Sun, and Moon System

Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)

Instructional Strategies and Resources

	Teaching Strategies	***Resources***
	*Argumentation through Discourse* Provide varied opportunities (stations, small groups, partners, whole class) for students to engage in interactive discourse, building on each other's ideas to coordinate claims, evidence, and reasoning in a scientific argument. Opportunities for scientific discourse related to interactions within the Earth, sun, and moon system should be in authentic, interest-driven scientific investigations.	• What is the Relationship Between the Earth, Sun, and Moon? – This video provides key information about the Earth, sun, and moon and describes the orbit of the Earth around the sun and the moon around the Earth. [www.youtube.com/watch?v=6xvuk25penAarth] • Earth and Space Science: Patterns in the Sky – These Google slides are organized by a set of lessons that include multiple teaching resources, videos, graphic organizers, and tools that students can use to explore and document their understanding of each object in the Earth, sun, and moon system and their relationships. [https://docs.google.com/presentation/d/1TpFzimva7AGCTgNAWqsLeExpd2IxbnKwl2He2nQ8xBo/copy] • Talk Activities that Can Scaffold Argumentation and Talk Activities Flowchart – This PDF tool highlights talk formats and explains when, how, and why to use each talk format in support of student investigations. The PDF is available in Spanish. [http://stemteachingtools.org/brief/35] • Smithsonian Science Education Center: Techniques for Encouraging a Culture of Argumentation in Your Classroom – This article from the *Smithsonian* discusses avenues for creating a culture of argumentation in a science classroom. [https://ssec.si.edu/stemvisions-blog/techniques-encouraging-culture-argumentation-your-classroom]

Instructional Strategies and Resources for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		• The Lawrence Hall of Science: Practicing Oral Discourse Skills – This website provides teachers with a 'Collection of Reteaching Loops,' including reading arguments, writing (basic components, relevant evidence, reasoning), and discourse. [https://argumentationtoolkit.lawrencehallofscience.org/wp-content/uploads/sites/10/2022/08/SG5-Practicing_Oral_Discourse_Skills.pdf]
	*Culturally Responsive Argumentation* Foster culturally responsive argumentation, drawing from and respecting students' cultural resources, backgrounds, and personal experiences. Provide a range of ways for students to engage in cooperative learning (e.g., think-pair-share, jigsaw, round robin) with diverse groupings of students. • Explore cultural explanations on why the Earth and sun move as they do.	• The Science of Argumentation – Using a reality pedagogy video [7:40] approach to teaching that focuses on understanding student experiences, the narrator, Kevin, shares stories that students are passionate about as a starting point for instruction. He notes, "It is our responsibility to create scientifically literate students with a zeal for learning." [https://youtu.be/-MWkN9iIo6I?si=-VmdS6ZxofvaCCse] • A Brief History of the Beliefs of the Sun – This article from the *Science and Industry Museum* provides insights about and explains beliefs humans have had throughout history about the sun (some of which have been disproved). Shared insights include believing it to have divine powers, the ability to heal sickness, and the potential to provide a clean, lasting power source. [https://blog.scienceandindustrymuseum.org.uk/beliefs-about-the-

Instructional Strategies and Resources for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		sun/#:~:text=One%20of%20the%20most%20famous,the%20centre%20of%20the%20Universe.]
	***Modeling and Critiquing Scientific Arguments*** Use spoken and written examples to model scientific arguments related to the Earth, sun, and moon system. Encourage students to critique and challenge scientific arguments by identifying strengths and weaknesses in reasoning and evidence.	• How We Figured Out the Earth Goes Around the Sun – This video [4:40] from SciShow Space shows that most of the world believed that Earth was the center of the universe for a long time. Then, a few scientists decided to take a closer look. [https://www.youtube.com/watch?v=khIzr6610cQ] • Student-Friendly Video on Scientific Argumentation – This brief, animated video [5:13] from *Concord* explains scientific argumentation in simple terms. Non-examples are also provided. [https://concord.org/blog/student-friendly-video-on-scientific-argumentation/] • Argumentation and Practical Work – This document provides examples of how practical work in the classroom can be used alongside argumentation. Section 5 of this document (page 14) offers an example of how students can critique arguments. [https://www.nuffieldfoundation.org/sites/default/files/files/Argumentation%20Introduction.pdf]
	***Promoting Engagement through Interactive, Collaborative Games*** Use interactive games and collaborative formats to reinforce disciplinary core ideas related to science, such as ideas about the interactions within the Earth, sun, and moon system.	• Wordwall Interactive Games – This website offers quick interactive games to reinforce the concepts and vocabulary about interactions within the Earth, sun, and moon system. All grade levels are included, so scroll until you find an appropriate level.

Instructional Strategies and Resources for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		[https://wordwall.net/en-us/community/sun-moon-earth] • Classroom Review Games – These ten innovative and entertaining classroom review games are designed to improve knowledge retention and engagement. [https://blog.classpoint.io/classroom-review-games/] • Space Place: Explore Earth and Space – This *NASA* website offers games to show the movement of the sun, moon, and Earth. [https://spaceplace.nasa.gov/menu/sun/]
	***Develop Self-assessment and Reflection*** For many learners, recognizing that they are progressing toward greater independence is highly motivating. Alternatively, one key factor in learners losing motivation is their inability to recognize their progress. Learners must have multiple models and scaffolds of different self-reflection techniques to identify and choose the optimal ones.	• Self-Reflection – This website will fill your teacher toolbox with prompts and strategies that promote reflection on both the content and the practice of science. [https://www.calacademy.org/educators/science-notebooks-for-reflection] • Reflecting in STEM Space Science – This article shows how reflection in STEM is essential to student understanding and teacher evaluation of students' learning. Reflecting helps students make connections, understand their successes and failures, and become aware of their learning. Reflections help teachers identify where different students are in their learning process. [https://creativeeducator.tech4learning.com/2016/articles/reflecting-in-STEM]

Instructional Strategies and Resources for Performance Category 1:
Support Arguments Related to Interactions Within the Earth, Sun, and Moon System

Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)

Instructional Strategies and Resources

	Teaching Strategies	***Resources***
	*Vocabulary* Provide varied opportunities for students to learn and apply vocabulary in diverse situations and contexts. Vocabulary retention improves when academic terminology is layered on conceptual understanding. To maximize vocabulary building, support students in conceptual understanding and apply the academic terminology using the strategies outlined below. • Build an understanding of domain-specific vocabulary using a multi-sensory approach or by having students participate in simulations. • Make connections between vocabulary and real-life or future opportunities. ○ Explain, describe, give real-world examples, or provide concrete representations of vocabulary words rather than formal definitions. Vocabulary.com (see Resources) provides explanations of words using real-world examples. Once signed in, an educator can create word lists for students. ○ Build a vocabulary word wall for students to add and reference during instruction and self-guided activities or tasks. ○ Have students restate the vocabulary word in their own words. Take this opportunity to help students connect	• NASA-Space Place – This *NASA* Website includes vocabulary and definitions related to Earth and space. [https://spaceplace.nasa.gov/glossary/en/] • STEM Teaching Tools – Practice Brief 66 – This article explains how to support emerging multilingual learners as they develop language that interprets and explains phenomena. [https://stemteachingtools.org/brief/66] • Vocabulary.com – This website provides explanations of words using real-world examples. Once signed in, an educator can create word lists for students. [https://www.vocabulary.com/] • Text Project – Word Pictures – This website provides Word Pictures that are free for educators to use. Their site includes word pictures for core vocabulary and various content areas, including science and social studies. [https://textproject.org/wp-content/uploads/qrwp/QRWP_C3_Plants.pdf] • The Science Penguin – This website provides ideas for teaching science vocabulary. The vocabulary demonstration activity uses real objects to teach vocabulary terms. [http://thesciencepenguin.com/2013/12/science-solutions-vocabulary.html]

Instructional Strategies and Resources for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	new vocabulary, especially general vocabulary, to prior knowledge. • Read books or watch videos related to vocabulary words and concepts. • Sort words, photographs, or concrete representations into categories. Text Project (see Resources) provides free Word Pictures for educators to use. It includes word pictures for core vocabulary and various content areas, including science and social studies. • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Define domain-specific vocabulary (e.g., predator) using domain-specific and common terms. • Embed visual, non-linguistic supports for vocabulary clarification (pictures, videos, etc.). • Have students create their glossary of terms.	• Interactive Word Walls Enliven Vocab Learning – This article includes teaching strategies to support students' use of a word wall to build an understanding of key vocabulary. [https://www.middleweb.com/37209/interactive-word-walls-enliven-vocab-learning/]
	***Presenting Information in Different Modalities*** Provide information using a variety of multimedia (e.g., videos, interactives, simulations), informational texts, and formats to teach and reinforce disciplinary core ideas related to interactions within the Earth, sun, and moon system.	• Earth and Space Science – This site provides Earth and space science videos, interactive activities, teaching materials, and more. [https://alaskapublic.pbslearningmedia.org/resource/ssecgoodthinking15/good-thinking-tis-the-season-for-a-reason/]

Instructional Strategies and Resources for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		• Moon Journal – *Learning Space* webpage has video tutorials, DIY projects, slideshows, games, and links to more you can see and do with NASA. [https://www.youtube.com/watch?v=rFXsXAPVl3Q]
	*Scaffolds for Communicating through Argumentation* Provide scaffolds for argumentative writing and discussions to justify or describe a phenomenon or support a design solution (e.g., sentence frames, graphic organizers, norms for whole class discussion, roles for students during small group activities) to support communicating in science-specific ways that may seem unnatural. • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Embed visual, non-linguistic supports for vocabulary clarification (pictures, videos, etc.).	• National Science Foundation – Tools for Ambitious Science Teaching – This website discusses a tool that provides scaffolds for writing that support learners in constructing explanations with evidence. These take the form of sentence frames, guides for how to help English learners practice final explanations, norms for whole-class discussion that are developed by students, roles that students can take in small group activities, and others. [https://ambitiousscienceteaching.org/revising-models/] • Bozeman Science: Engaging in Argumentation – In this video [6:50], Paul Andersen explains how to have your students engage in argumentation in the science classroom. [https://www.youtube.com/watch?v=L96LiRDWgmI] • Stem Teaching Tool – Practice Brief 25: Equitable Argumentation – This article describes how supporting multiple modes of expression can increase how students communicate their arguments. [https://stemteachingtools.org/brief/25]

Instructional Strategies and Resources for Performance Category 1:
Support Arguments Related to Interactions Within the Earth, Sun, and Moon System

Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)

Instructional Strategies and Resources

	Teaching Strategies	***Resources***
	*Expressing Learning in Multiple Modalities* Provide multiple, flexible options for students to communicate their arguments and learn about the Earth, sun, and moon system. • Use technologies that facilitate student participation and communication, such as discussion boards, podcasts, or blogs. • Allow students to choose a multi-modal project they would like to complete to demonstrate their learning, such as a poster presentation, debate, short film, lab report, blog, infographic, drawing, poetry, writing and performing a song, creating a game, etc. • Provide a variety of ways in which students can "write" to respond to questions (e.g., traditional form of writing, with sentence starters, using pictures, etc.).	• Upper Elementary Students Explore Earth and Space Science by Modeling – Articles to explain modeling in space science education. [https://www.academia.edu/26763311/Upper_elementary_students_explore_Earth_and_space_science_by_modeling_and_observing_patterns] • Deepen Academic Knowledge – This website uses disciplinary facets to deepen academic vocabulary knowledge. [https://www.readwritethink.org/professional-development/strategy-guides/using-disciplinary-facets-deepen] • Read, Write, Think – In this strategy guide, you will see how one lesson utilizes tiered texts and multiple modalities to meet the learning style needs of students. [https://www.readwritethink.org/professional-development/strategy-guides/using-jigsaw-cooperative-learning] • How to Make Infographics – In this video [2:17], discover five ways to use infographics in the virtual or physical classroom. [https://www.youtube.com/watch?v=CGFjy-Hqr7U] • Digital Lab Notebook – This digital notebook offers students a digital option for recording lab results, writing lab reports, journaling, drawing, planning, or creative writing. It can also be saved as a copy.

Instructional Strategies and Resources for Performance Category 1: Support Arguments Related to Interactions Within the Earth, Sun, and Moon System *Task 1, Prompt 1 A (3 Points); Task 1, Prompt 1 D (3 Points); Task 1, Prompt 2 (2 Points); Task 3, Prompt 2 C (2 Points); Task 3, Prompt 3 (2 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		[https://virtualscienceteachers.org/virtual-labs/]

Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System

Interpretive Guidance for Performance Category 2: **Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System** *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Red (0-5 score points earned) ➢ **Extensive** additional instruction and reteaching of these skills is recommended. ➢ The student needs significant opportunities to reinforce and apply these skills in future learning.	**Yellow (6-9 score points earned)** ➢ **Moderate** additional instruction on these skills is recommended. ➢ The student needs additional opportunities to strengthen these skills in future learning.	**Green (10-13 score points earned)** ➢ **Minimal to no** additional instruction on these skills is recommended. ➢ The student is ready to extend these skills in future learning.
What These Results Mean		
This student is likely able to: • **Partially** complete a mathematical model/graph **with multiple inaccuracies** to represent relationships between the time of day and the length of an object's shadow **and/or** make an **inaccurate** prediction. • Use **no or limited** evidence and/or information to support a description of the pattern of movement of the position of the Big Dipper **or** its appearance at regular intervals during the year. • Make **little or no attempt to** utilize data to compare sunrise and sunset times at regular intervals during the year. • **Partially c**omplete a mathematical model/graph **with multiple inaccuracies and incorrectly predict** phases of Earth's moon.	**This student is likely able to:** • **Partially** complete a mathematical model/graph with **few inaccuracies** to represent relationships between the time of day and the length of an object's shadow to make a **reasonable** prediction. • **Accurately** identify **at least one** relationship shown in a diagram **or** graph to describe the pattern of movement of the position of the Big Dipper **and** its appearance at regular intervals during the year. • **Attempts** to identify or utilize **some** data to compare sunrise and sunset times at regular intervals during the year. • **Partially** complete a figure or diagram with **some inaccuracies** to predict the phases of Earth's moon **with minor errors**.	**This student is likely able to:** • **Complete** a mathematical model/graph with **no inaccuracies** to represent relationships between the time of day and the length of an object's shadow to make an **accurate** prediction. • **Accurately** identify **more than one relationship** shown in a diagram **or** graph to describe the pattern of movement of the position of the Big Dipper **and** its appearance at regular intervals during the year. • **Correctly** identify **and** utilize **sufficient** data to compare sunrise and sunset times at regular intervals during the year. • **Complete** a figure or diagram with **few inaccuracies** to **accurately** predict phases of Earth's moon.

Interpretive Guidance for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Red (0-5 score points earned) ➢ **Extensive** additional instruction and reteaching of these skills is recommended. ➢ The student needs significant opportunities to reinforce and apply these skills in future learning.	**Yellow (6-9 score points earned)** ➢ **Moderate** additional instruction on these skills is recommended. ➢ The student needs additional opportunities to strengthen these skills in future learning.	**Green (10-13 score points earned)** ➢ **Minimal to no** additional instruction on these skills is recommended. ➢ The student is ready to extend these skills in future learning.
Next Instructional Steps		
Provide opportunities for the student to: • Use provided data sets and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to identify and describe patterns related to the orbits of Earth around the sun and of the moon around Earth. • Identify a correct statement from a list of statements written in simple, non-academic terms about the relationship between the orbits of Earth around the sun and of the moon around Earth, within the context of the given phenomenon, based on data from a graph and/or table. • Identify patterns related to cause-and-effect relationships (e.g., sunrise and sunset) that exist in the apparent motion of the sun, moon, and Earth.	**Provide opportunities for the student to:** • Organize data in a way that facilitates analysis and interpretation. • Identify the correct statement from a list of statements written in grade-level academic terms about the relationship between the orbits of Earth around the sun and of the moon around Earth within the context of a given phenomenon based on data from a graph or table. • Use graphs and charts to identify patterns in data and use patterns to identify cause and effect relationships.	**Provide opportunities for the student to:** • Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships related to the orbits of Earth around the sun and the moon around Earth. • Use patterns in large data sets at different scales to identify temporal and spatial relationships related to objects in the Earth-sun-moon system.

Instructional Strategies and Resources for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	*Data Analysis through Discourse* Provide varied opportunities (stations, small groups, partners, whole class) for students to engage in interactive discourse. Students build on each other's ideas to coordinate claims, evidence, and reasoning in a scientific argument about observable patterns related to the Earth, sun, and moon system. Opportunities for scientific discourse should be situated in authentic, interest-driven science investigations.	• Forced Perspective Video – Pause the *Quirkology* video at 0:07 seconds and ask students to turn and talk to a partner about which objects are the biggest and which are the smallest. Play the entire video and have students discuss the relative sizes of the objects again. Ask students to connect the difference between an object's size and appearance with how the moon and the sun appear similar in the sky. [https://youtu.be/zNbF006Y5x4] • Discourse Strategies for Inquiry Science: Prompts as Discourse Tools – This *Fairfax Network* video [5:04] shows how students can analyze and clarify scientific information using prompts within and between group activities. Discourse tools are also used during consensus placemat and gallery walk learning activities. [https://www.youtube.com/watch?v=2sN0jlIXi88] • Length of Daylight Data – This data services site provides a method for creating a table of the duration of daylight or darkness for any year between 1700 and 2100 for any location worldwide. Generate the length of daylight for your location across one year, then have students discuss the patterns they notice in the data showing the length of day throughout a year. (Continued in the *Expressing Learning in Multiple Modalities* strategy on page 25.) [https://aa.usno.navy.mil/data/Dur_OneYear]

Instructional Strategies and Resources for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	***Promoting Mastery Through Feedback*** Feedback that promotes mastery of content strives to promote effort and practice instead of intelligence or ability. Feedback should be specific, timely, and frequent.	• Meaningful Feedback Article – This article provides five useful tips for improving the quality of feedback teachers give students. [https://www.edutopia.org/blog/tips-providing-students-meaningful-feedback-marianne-stenger] • How to Give Feedback that Students Will Use – This article describes the importance of effective feedback and provides tips about improving the quality of feedback to improve student learning. [https://www.edweek.org/teaching-learning/heres-how-to-give-feedback-that-students-will-actually-use/2023/04]
	***Promoting Engagement through Interactive, Collaborative Activities*** Use interactive activities and collaborative formats to reinforce disciplinary core ideas related to science ideas, such as describing the patterns in data about the Earth's sun-moon system.	• Sundial Video – Play the *Canada Science and Technology* video [2:31; stop at 1:20] describing what a sundial is; then have students discuss why sundials work in terms of the Earth-sun system. [https://youtu.be/tI0GqYJha1Q] • Storylines – This website provides an example of a storyline related to making sense of shadows. It includes a storyline matrix, storyline slides, student resources, a supply list, and teacher prep guidance. At some point, most teachers have heard the exasperated voice of a student as they ask, "Why are we doing this?" This resource can help students better understand phenomena by analyzing and interpreting data related to observable patterns in the Earth-sun system. [https://www.seedstorylines.org/4-4]

Instructional Strategies and Resources for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		• Observing Shadows Interactive – This interactive simulation has students rotate planet Earth and observe shadows as they start, stop, and reverse the rotation. Students discuss with a partner the differences in shadow length and position of the stick figures as the Earth is being turned. [https://contrib.pbslearningmedia.org/WGBH/buac18/buac18-int-shadowsonglobe/index.html]
	***Maximize Transfer and Generalization*** Provide templates, graphic organizers, and concept maps to support note-taking and help students generalize and transfer knowledge to new scenarios and situations.	• Make a Moon Phase Calculator – This *NASA* website provides a tutorial and step-by-step directions for making a moon phases calendar and calculator to see which moon phases will be visible each day for the rest of 2024. [https://www.jpl.nasa.gov/edu/learn/project/make-a-moon-phases-calendar-and-calculator/] • Sky Patterns Graphic Organizer – This site provides a graphic organizer that students can independently complete or, after looking at images shown on the teacher answer key, to identify daily and yearly patterns in the sky. (Continued in the *Expressing Learning in Multiple Modalities* strategy on page 24.) [https://static1.squarespace.com/static/59c3bad759cc68f757a465a3/t/5e18a809d0ce055ea0e8b2e1/1578674185755/5-ESS1-2+Sky+Patterns+%28Student+Version%29.pdf and https://static1.squarespace.com/static/59c3bad759cc68f757a465a3/t/5e18a810af81e00261c01397/1578674193228/5-ESS1-2+Sky+Patterns+%28Teacher+Version%29.pdf]

Instructional Strategies and Resources for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	***Presenting Information in Different Modalities*** Provide information using a variety of multimedia (e.g., videos, interactives, simulations), informational texts, and formats to teach and reinforce disciplinary core ideas about the availability of observable patterns related to the Earth, sun, and moon system.	• Teacher Made – This site provides 25 examples of multimodal learning using visual, auditory, kinesthetic, and tactile sensory modalities. Explore how information can be presented in different formats to cater to students' varied learning preferences and increase learning outcomes. Promote accessibility and engagement by providing a range of multimodal learning opportunities. [https://teachermade.com/25-examples-of-multimodal-learning/] • Using Learning Modalities – This *Academic Sciences* article details the modalities and how to best use them for student engagement. [https://asc.tamu.edu/study-learning-handouts/using-learning-modalities]
	***Activate or Supply Prior Knowledge*** Anchor instruction by linking to and activating relevant prior knowledge regarding data analysis and/or human impacts on the environment (e.g., using visual imagery, concept anchoring, or concept mastery routines).	• Learning by Inquiry – This website refers to a learning approach in which students conduct investigations by asking questions, proposing solutions, and solving problems while gaining knowledge about the natural world. [https://www.learningbyinquiry.com/how-to-use-scientific-inquiry-in-the-elementary-classroom/] • Identifying Patterns in the Sky Video – Activate learning by watching the video [1:13] and asking students to identify the sun, moon, and star patterns they see in the sky.

Instructional Strategies and Resources for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		[https://contrib.pbslearningmedia.org/WGBH/buac18/buac18-int-patternssky/index.html]
	*Scaffolds for Communicating through Data Analysis* Provide scaffolds for data analysis and discussions to justify or describe a phenomenon or support a design solution (e.g., sentence frames, graphic organizers, norms for whole class discussion, roles for students during small group activities) to support communicating in science-specific ways that may seem unnatural. • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Embed visual, non-linguistic supports for vocabulary clarification (pictures, videos, etc.).	• 60 Developmental Elementary Science Writing Prompts – What are the best ways to ask kids to write about science in your science classroom? This resource looks at how 12 American scientists write about science and then suggests some developmentally appropriate elementary science writing and journal prompts based on the scientist's work. [https://mimshousebooks.com/blogs/books/prompts] • Daily Patterns Worksheet – Have students complete the worksheet to analyze data about the length of shadows and determine what time of day the length of a given shadow was collected. [https://docs.google.com/document/d/1AEFCANfimNzSV3PhpZXNsn7zL7bdT4cFPGePpxK9OrA/template/preview]
	*Expressing Learning in Multiple Modalities* Provide multiple, flexible options for students to communicate their learning in class. • Use technologies that facilitate student participation and communication, such as discussion boards, podcasts, or blogs. • Allow students to choose a multi-modal project they would like to complete to demonstrate their learning, such as a poster presentation, debate, short film, lab report,	• Sky Patterns Worksheet – Once students have completed their worksheets, have them prepare posters or presentations in teams of two to showcase the learning they have accomplished during the unit. (Continued from the *Maximize Transfer and Generalization* strategy on page 22.) [https://static1.squarespace.com/static/59c3bad759cc68f757a465a3/t/5e18a809d0ce055ea0e8b2e1/1578674185755/5-ESS1-2+Sky+Patterns+%28Student+Version%29.pdf]

Instructional Strategies and Resources for Performance Category 2: Analyze Data to Describe Observable Patterns Related to the Earth, Sun, and Moon System *Task 1, Prompt 1, Parts B & C (4 Points); Task 2, Prompt 1 (2 Points); Task 3, Prompt 1 (3 Points); Task 3, Prompt 2, Parts A & B (4 Points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	blog, infographic, drawing, poetry, writing and performing a song, creating a game, etc. • Provide a variety of ways in which students can "write" to respond to questions (e.g., traditional form of writing, with sentence starters, using pictures, etc.).	• Length of Daylight Data – Generate the length of daylight for another location across one year, then have students create a poster to describe the patterns they notice in the data compared to the original location, showing the length of day throughout a year. (Continued from the *Data Analysis and Discourse* strategy on page 20.) [https://aa.usno.navy.mil/data/Dur_OneYear]

Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars

Interpretive Guidance for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Red (0-2 score points earned) ➢ **Extensive** additional instruction and reteaching of these skills is recommended. ➢ The student needs significant opportunities to reinforce and apply these skills in future learning.	**Yellow (3-7 score points earned)** ➢ **Moderate** additional instruction on these skills is recommended. ➢ The student needs additional opportunities to strengthen these skills in future learning.	**Green (8-9 score points earned)** ➢ **Minimal to no** additional instruction on these skills is recommended. ➢ The student is ready to extend these skills in future learning.
What These Results Mean		
This student is likely able to: • Present an **incomplete and/or inaccurate** representation of the positions of stars to **attempt** to support **or** refute claims about the apparent brightness of stars viewed from Earth. • State **some** science ideas or information to provide an **inaccurate and/or partial** description or conclusion about the motions of stars as seen from Earth.	**This student is likely able to:** • Develop a diagram **with minor errors** to represent the positions of stars to **accurately** support **or** refute **at least one** claim about the apparent brightness of stars viewed from Earth. • Use **some relevant** science concepts or information to construct an **accurate** argument related to the motions of stars as seen from Earth supported with at least one piece of evidence.	**This student is likely able to:** • **Complete** a diagram to **correctly** represent the positions of stars to **accurately** support or refute **two** claims about the apparent brightness of stars viewed from Earth. • Use **correct and relevant** science concepts or information to construct a **clear and convincing** argument related to the motions of stars as seen from Earth supported with **at least two** pieces of evidence.

Interpretive Guidance for Performance Category 3:
Support Arguments Related to the Apparent Brightness of Stars

Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)

Red (0-2 score points earned)	Yellow (3-7 score points earned)	Green (8-9 score points earned)
➢ **Extensive** additional instruction and reteaching of these skills is recommended. ➢ The student needs significant opportunities to reinforce and apply these skills in future learning.	➢ **Moderate** additional instruction on these skills is recommended. ➢ The student needs additional opportunities to strengthen these skills in future learning.	➢ **Minimal to no** additional instruction on these skills is recommended. ➢ The student is ready to extend these skills in future learning.
Next Instructional Steps		
Provide opportunities for the student to: • Order stars based on their relative distances from Earth using small data sets. • Select from and correctly use provided terminology and concepts to engage in discussions related to how a luminous object that is close will appear larger and brighter than a similar one that is far away. • Collaboratively brainstorm and generate ideas and reasons to support a provided argument. • Identify evidence, data, and/or models that are relevant to support a provided argument.	**Provide opportunities for the student to:** • Correctly use relevant terminology and concepts to engage in argumentation. • Apply scientific concepts from the unit to explain why the evidence/data are or are not relevant and sufficient to justify the claim or support an argument. • Identify and use multiple sources of relevant evidence, data, and/or models to construct and support an argument related to the apparent brightness of stars and their relative distances from the Earth. • Construct an argument containing a claim, evidence/data, and appropriate reasoning about how the apparent brightness of stars is due to their relative distances from the Earth.	**Provide opportunities for the student to:** • Apply scientific concepts to correctly select the argument from a list of arguments with different justifications to support a claim about how the apparent brightness of stars is related to relative distances from the Earth, with the most convincing and appropriate justification. • Evaluate the strength of arguments based on how reliable the sources of the evidence/data are (e.g., such as science journals, news reports, and fiction books). • Develop and use graphs or tables to identify patterns and make a prediction related to the apparent brightness of stars and their relative distances from the Earth.

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	*Argumentation through Discourse* Provide varied opportunities (stations, small groups, partners, whole class) for students to engage in an interactive discourse. Students build on each other's ideas to coordinate claims, evidence, and reasoning in a scientific argument. Opportunities for scientific discourse should be situated in authentic, interest-driven science investigations related to the apparent brightness of the stars.	• Talk Activities that Can Scaffold Argumentation and Talk Activities Flowchart – These tools highlight talk formats and strategies that foster curiosity and student engagement through a range of talking activities and explain when, how, and why to use each talk format to support student investigations. PDF is available in Spanish. [http://stemteachingtools.org/brief/35] • Smithsonian Science Education Center: Techniques for Encouraging a Culture of Argumentation in Your Classroom – This article discusses avenues for creating a culture of argumentation in a science classroom. [https://ssec.si.edu/stemvisions-blog/techniques-encouraging-culture-argumentation-your-classroom] • The Lawrence Hall of Science: Practicing Oral Discourse Skills – This website provides teachers with a 'Collection of Reteaching Loops', including reading arguments, writing (basic components, relevant evidence, reasoning), and discourse. [https://argumentationtoolkit.lawrencehallofscience.org/wp-content/uploads/sites/10/2022/08/SG5-Practicing_Oral_Discourse_Skills.pdf]
	*Modeling and Critiquing Scientific Arguments* Use spoken and written examples to model scientific arguments about the apparent brightness of the stars and encourage students to critique and challenge scientific	Students need phenomena about which to write claims to support their development of a scientific argument. Use any of the articles below to provide debatable questions for students to argue about

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	arguments by identifying strengths and weaknesses in reasoning and evidence.	star brightness. For each article, example prompts have been provided. • PBS "Brightest Object in the Universe" Article – Astronomers have discovered what may be the brightest object in the universe, a quasar with a black hole at its heart growing so fast that it swallows the equivalent of a sun daily. [https://www.pbs.org/newshour/science/quasar-with-black-hole-at-its-center-may-be-brightest-object-in-the-universe-astronomers-say] • Nature "Satellite Brighter than Most Stars" Article – How could bright satellites affect astronomy? Support your answer by using what you know about the relationship between star brightness and distance. [https://www.nature.com/articles/d41586-023-03132-0] • Looking at the Moon from Apollo 8 – Put yourself in the shoes of the Apollo astronauts. What would the similarity be between our view from Earth and looking at the stars from the moon in terms of star brightness? What would be the difference? [https://www.pbs.org/wgbh/americanexperience/features/moon-looking-moon-apollo-8/]
	***Develop Self-assessment and Reflection*** For many learners, recognizing that they are progressing toward greater independence is highly motivating. Alternatively, one key factor in learners losing motivation is	• Four Steps of Student Self-Assessment – This article presents a multi-step technique for developing students' ability to self-assess, fostering independent learning, and promoting student metacognition of their own progress.

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
	their inability to recognize their own progress. It is important that learners have multiple models and scaffolds of different self-reflection techniques so that they can identify and choose the optimal ones.	[https://www.edutopia.org/practice/mastering-self-assessment-deepening-independent-learning-through-arts] • The Importance of Student Self-Assessment – This article by an ELA educator outlines practices for incorporating student self-assessment to build students' metacognition and self-efficacy skills. [https://www.nwea.org/blog/2021/the-importance-of-student-self-assessment/] • Common Misconceptions – This *Operation Physics* article shows how to have students check their misconceptions in their explanations and arguments. For example, while apparent star brightness and distance are related, that's not the only factor. Also, intrinsic star brightness is different from apparent star brightness! [http://amasci.com/miscon/opphys.html]
	***Clarifying Academic Vocabulary through Argumentation*** Give students practice using academic vocabulary in context by providing opportunities for students to use relevant words in authentic models.	• The Argumentation Toolkit – Use any of the resources to refine students' academic knowledge by creating a prompt that requires a robust understanding of a vocabulary word a student is struggling with. Evaluating the validity of claims or evidence due to misconceptions in key vocabulary can help strengthen argumentation skills while clarifying academic vocabulary in context. [https://argumentationtoolkit.lawrencehallofscience.org/argument-elements/evidence/]

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		• Let's Talk About Stars! – Use this Georgia Youth Science lesson to build an academic vocabulary about Star brightness through modeling and argumentation. [https://gystc.org/wp-content/uploads/2020/04/s2e1-stars-lesson_1.docx] • From dung beetles to seals, these animals navigate by the stars – Use this article to surface phenomena through which students can argue using academic vocabulary. [https://www.nationalgeographic.com/animals/article/stars-milky-way-navigation-dung-beetles#:~:text=Some%20recognize%20the%20movement%20of,food%2C%20or%20searching%20out%20mates]
	***Presenting Information in Different Modalities*** Provide information using a variety of multimedia (e.g., videos, interactives, simulations), informational texts, and formats to teach and reinforce disciplinary core ideas related to the apparent brightness of stars.	• NASA: Check Your Sky Quality – This online resource will help students understand star brightness better, beginning with their perspectives. "Their" sky allows them to see certain stars or not based on other environmental factors beyond star brightness. Starting here might be a window into the complicated relationship between brightness and distance. [https://science.nasa.gov/solar-system/skywatching/night-sky-network/check-your-sky-quality-with-orion/] • Mighty Owl Science Video – This video [6:32] creatively presents discoveries about stars and our universe through the lens of an astronomer to support understanding the relationships between star brightness, mass, and distance from Earth.

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		[https://www.youtube.com/watch?v=nwAS0HhRk5M] • Using Sound to Describe Star Brightness – This activity designed by the Perkins School for the Blind promotes accessibility for students with visual impairment by using the volume of sound to represent the brightness of stars to represent the concepts of apparent and absolute magnitude. [https://www.perkins.org/resource/using-sound-describe-star-brightness/]
	*Scaffolds for Communicating through Argumentation* Provide scaffolds for argumentative writing and discussions to justify or describe a phenomenon or support a design solution (e.g., sentence frames, graphic organizers, norms for whole class discussion, roles for students during small group activities) to support communicating in science-specific ways that may seem unnatural.	• Short Performance Assessment from Wonder of Science – This Google Doc has a targeted and scaffolded practice assessment that can be used individually, in pairs, or in small groups to build grade-level scientific argumentation about the brightness of stars. [https://docs.google.com/document/d/1hjUD_wcW07eN0pfLmYrQPy1rT_nrhvhSfDSyxEUxcxQ/template/preview] • Washington State Science OER lesson – Need to reteach the class an entire lesson, complete with driving phenomenon, anchor charts, investigations, and assessments? Use this lesson about patterns in the sky, complete with slides, materials, vocabulary, and procedures, or take what works and leave the rest! [https://oercommons.org/courseware/lesson/85181/student/?section=3] • Stellar Brightness Formative assessment – This assessment scaffolds students' ability to utilize two kinds of data to build an

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		argument to support or refute a claim about stars' distance from Earth and their brightness. [https://oercommons.org/authoring/59756-stellar-brightness-formative-assessment/view]
	***Expressing Learning in Multiple Modalities*** Provide multiple, flexible options for students to communicate their arguments and learning in class. • Use technologies that facilitate student participation and communication, such as discussion boards, podcasts, or blogs. • Allow students to choose a multi-modal project they would like to complete to demonstrate their learning, such as a poster presentation, debate, short film, lab report, blog, infographic, drawing, poetry, writing and performing a song, creating a game, etc. • Provide a variety of ways in which students can "write" to respond to questions (e.g., traditional form of writing, with sentence starters, using pictures, etc.).	• Constellation Creation – Students can show you what they know about star brightness by creating a flip book of constellations. How do they know how bright each star is in the constellation, distance away from Earth, size, etc.? [https://oercommons.org/courseware/lesson/91796/overview] • Space School Musical – Join Hannah on a trip through the solar system using song and dance to introduce the planets, moons, asteroids, and more. Download the lyrics for students to learn, perform, or play the videos in class. [https://www.jpl.nasa.gov/edu/teach/activity/space-school-musical/]
	***Build Fluencies with Graduated Levels of Support for Practice and Performance*** It can be tricky to get students to think about the apparent brightness of stars. Teachers can use the "I do, we do, you do" model when teaching this topic.	• SEEd Storylines – This website provides an example of a storyline related to making sense of the brightness of stars. It includes a storyline matrix, storyline slides, student resources, a supply list, and teacher prep guidance. At some point, most teachers have heard the exasperated voices of students as they ask, "Why are we doing this?" This resource can help students better

Instructional Strategies and Resources for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars *Task 2, Prompt 2, Parts A-C (6 points); Task 2, Prompt 3 (3 points)*		
Instructional Strategies and Resources		
	Teaching Strategies	***Resources***
		understand the phenomenon of the brightness of stars by developing models and constructing arguments from evidence from real-world examples. [https://www.seedstorylines.org/4-4] • Earth and Our Place in the Universe – This guide from the National Air and Space Museum - Smithsonian presents a variety of lessons to help students better understand our universe and Earth's place within it. Lessons include sending students on a mission to identify a meteorite, a sorting puzzle on the size, distance, and age of different components in our solar systems, and more. [https://oercommons.org/courses/earth-and-our-place-in-the-universe-content-guide]