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

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

Family Guidance and Learning Resources for Performance Category 3

April 2024

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Purpose

The purpose of this document is to help families understand their student's performance on the Grade 5 Unit 4 Science Assessment and to provide resources and recommendations for engaging their student in science learning at home.

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. With a focus 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.

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

Prompts for this performance category require students to support an argument with evidence, data, or a model to explain how:

- the effect of distance on the apparent brightness of the sun compared to that of other stars can be used to support or refute a claim related to the brightness of stars
- living organisms rely on the predictable patterns of the position and motion of objects in the sky

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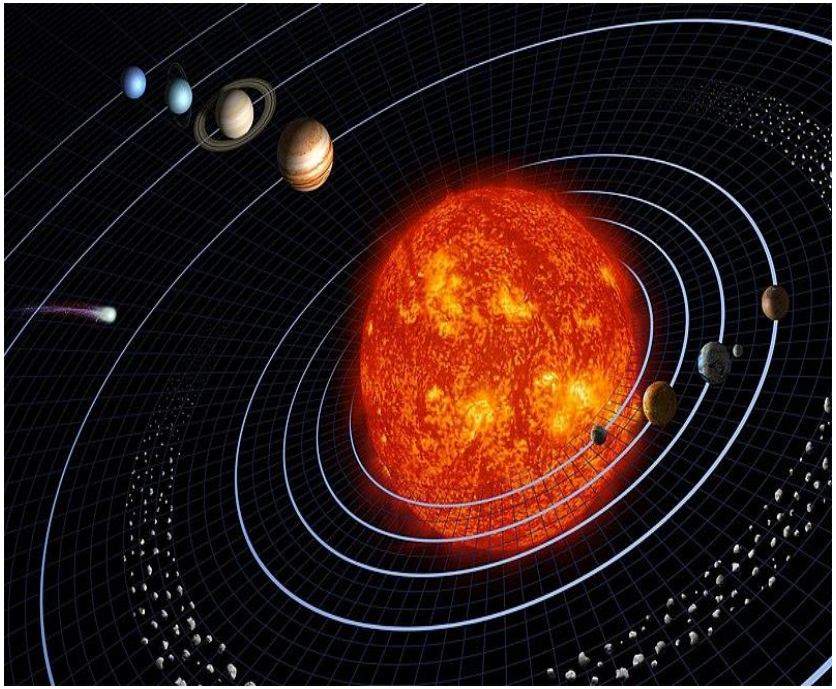

Image: The Solar System
Credit: Harman Smith and Laura Generosa
Source: Based on Image:Solar_sys.jpg, with Pluto removed
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Instructions for Parents/Guardians

1. Refer to your student's score report to determine their instructional needs level—green, yellow, or red—for this performance category.
2. Use the Interpretive Guidance (see page 2) to understand what your student likely knows and is able to do based on their instructional needs level.
3. Use the Family Resources and Recommendations (see page 3) to engage with and support your student's science learning at home.

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

Family Resources and Recommendations for Performance Category 3: Support Arguments Related to the Apparent Brightness of Stars	
Resources and Recommendations to Support Science Learning at Home	
Engage with the Topic: • *What is migration?* • *How do birds know where they are going?*	Migration is like a long trip animals make at certain times of the year to find food, shelter, nesting sites, or escape bad weather. Birds can migrate hundreds of miles—or more—every year. Watch this simulation with your student, which shows the migration routes of many types of birds at different months of the year. Ask your student if they have ever seen a group of birds flying overhead and wondered where they were going. How do the birds know how to get to where they want to migrate? Do you think they might get lost?
Explore the Topic: • *How do birds migrate?* • *How can birds use the pattern of the stars to navigate?*	One way that birds migrate across long distances is by using the position of the sun and stars to keep on the route. Learn more about how birds use the location of star constellations to know which way they are going when they are migrating at night. Watch the video clip, **Star Compass,** in this video [3.27-4:21] with your student. 1. What is a star compass? How do birds use it? (A star compass is a way that birds use star patterns to navigate. Because stars move in predictable ways (in a pattern) across the sky over the course of a night and year, birds can tell which direction they are flying in. These patterns let birds know where a particular constellation should be at a particular time.) Wrap up your conversation by saying that birds use the pattern of the stars' positions at different times of the night to navigate where they are going. Remember that the pattern of stars moving in an arc across the sky is due to Earth's rotation on its axis around the sun.
Explore the Topic • *What is **light pollution**?*	During migration, animals face many challenges on land and in the sky. Watch this video [0:00-1:27] with your student to learn about **light pollution**. Then, discuss what you learn about light pollution and its harmful impacts on sea turtles. Bright lights in a large city are a type of light pollution that makes it hard to see the stars even on a moonless night. Share that people on Earth can see about 2,500 individual stars when they look up at the night sky. But because of light pollution, we may only see less than a dozen stars.
Explain the Topic: • *How does **light pollution** affect a bird's ability to use*	Click on the "**+**" for "Bird migration in Denver" and "How are buildings a threat to migratory birds?" in this article to read with your student and learn more about **light pollution** and the risks they cause to birds that are migrating at night.

the patterns of stars to navigate? • *How do birds depend on patterns of objects in the sky to navigate?*	Imagine a group of birds migrating over a city where there are a lot of bright lights. Use the following questions to have your student explain how bright city lights create challenges for birds. Think about the relationship between lights on Earth and star brightness and how this relationship impacts bird migration. 1. What would birds experience when migrating near a city with light pollution? (Birds are attracted to artificial lights at night, which attracts them to light-polluted city areas. They are more likely to fly into a building. Birds may confuse building lights for stars and fly in circles around the buildings. The birds could get lost. This could lead to the birds becoming too tired and dying or colliding with the windows.) 2. What do birds depend on to navigate? Why? (Birds that fly at night depend on the patterns of the stars (i.e., constellations) in the night sky. They use the moon and stars to aid in navigation. Most of the stars are not visible in places with brightly lit buildings. Although there is a pattern of where the stars appear in the night sky, the bright lights block out the light from the stars. What do you think would happen to their ability to use their star compass to navigate where they are going? (Birds may not be able to use their star compass to navigate and know where they are going. The stars are not easy to see due to light pollution, especially in large cities. So, birds would not be able to use their star compass to make sure they were on the correct route.)
Elaborate the Topic: • *What have you learned about star constellations and how birds use them to navigate where they are going during migration?* • *What can humans do to reduce the effect of light pollution on birds that are migrating?*	Watch this video [1:39 – 2:50] with your student to build on their understanding of the relationships between star constellations and the seasons. Then, discuss the following: 1. Explain the connection between the seasonal migration of birds and the seasonal appearance of the stars. (As the seasons pass, we see different groups of stars in a given direction at any given time of night. So, the birds are using the appearance of certain constellations during the year to migrate.) 2. What is the cause of the seasonal appearance of constellations? (The apparent motion of the constellations is caused by the Earth's rotation and its orbit around the Sun. This means that we see the stars (and constellations) drift from east to west every night. We also see the stars and constellations drift to the west over the year.) To extend your students' learning, try out this optional activity. Read the What Can We Do? section of the text with your student. Discuss how humans can support bird migration. Discuss how humans can reduce light pollution, help birds use star navigation, and support bird migration.

Resources

1. Mesmerizing Migration, *CornellLab All About Birds*
   [https://www.allaboutbirds.org/news/mesmerizing-migration-watch-118-bird-species-migrate-across-a-map-of-the-western-hemisphere/]
2. How Do Birds Navigate, *BioBush*
   [https://www.google.com/search?q=star+compass+and+bird+navigation&sca_esv=0e9d35a69ed69d23&biw=1249&bih=655&tbm=vid&sxsrf=ACQVn08-E6zFvz46sGaU5f8CDErppTo8BA%3A1714172772444&ei=ZDMsZp3pGrOYptQPvaitCA&oq=star+compass+and+bird+navi&gs_lp=Eg1nd3Mtd2l6LXZpZGVvIhpzdGFyIGNvbXBhc3MgYW5kIGJpcmQgbmF2aSoCCAAyBRAhGKABMgUQIRigATIFECEYnwUyBRAhGJ8FMgUQIRifBTIFECEYnwUyBRAhGJ8FSOg7UABY1CRwAHgAkAEAmAG4AaAB5x2qAQQwLjI2uAEByAEA- -eRAQ&sclient=gws-wiz-video#fpstate=ive&vld=cid:9e8f60e4,vid:sHmdzXjgrHA,st:0]
3. Light Pollution 101, *National Geographic*
   [https://www.youtube.com/watch?v=V_A78zDBwYE]
4. Lights Out Denver, *The Denver Local*
   [https://www.denvergov.org/Government/Agencies-Departments-Offices/Agencies-Departments-Offices-Directory/Parks-Recreation/Trees-Natural-Resources/Wildlife/Lights-Out-Denver]
5. Let's Look at Constellations! | How We Study Space, *SciShow Kids*
   [https://www.youtube.com/watch?v=U7yqx1hSqlw]
6. Threats to Birds: Collisions - Nighttime Lighting, *U.S. Fish and Wildlife Service*
   [https://www.fws.gov/story/threats-birds-collisions-nighttime-lighting]