4th Grade Strand 4.4
OBSERVABLE PATTERNS IN THE SKY
Mystery Science Scope and Sequence
Salt Lake City School District 2023-24

Strand 4.4: OBSERVABLE PATTERNS IN THE SKY
The Sun is a star that appears larger and brighter than other stars because it is closer to Earth. The rotation of Earth on its axis and orbit of Earth around the Sun cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the Sun and stars at different times of the day, month, and year.

Standard 4.4.1 Construct an explanation that differences in the apparent brightness of the Sun compared to other stars is due to the relative distance **(scale)** of stars from Earth. Emphasize relative distance from Earth. (ESS1.A)

Standard 4.4.2 Analyze and interpret data of observable **patterns** to show that Earth rotates on its axis and revolves around the Sun. Emphasize patterns that provide evidence of Earth's rotation and orbits around the Sun. Examples of patterns could include day and night, daily changes in length and direction of shadows, and seasonal appearance of some stars in the night sky. Earth's seasons and its connection to the tilt of Earth's axis will be taught in Grades 6 through 8. (ESS1.B)

Instructional Sequence for Strand 4.4				
Mar 18 Anchor Lesson	Mar 25 Lesson 1	Apr 8 Lesson 2	Apr 15 Lesson 3	Apr 22 Lesson 4
Apr 29 Lesson 5	May 6 Lesson 6	May 11 Lesson 8 (Skip Lesson 7)	May 20 Performance Task & Unit Assessment	

mystery science **Storylines**

For more NGSS storylines visit
www.mysteryscience.com/storylines

Spaceship Earth: Anchor Layer Storyline

Sun, Moon, Stars, & Planets — ***Page 1 of 2***

5th Grade | NGSS Space Science

Anchor Phenomenon: Star Trails
What causes the patterns found in star trails?

Learning Sequence	Investigative Phenomena	What Students Figure Out in this Lesson	This Makes Students Wonder...	What Students Figure Out in the Anchor Connection	This Makes Students Wonder...
LESSON 1 **How fast does the Earth spin?**		Students model the rotation of the Earth and investigate why the Sun looks like it's moving across the sky. Using evidence they gathered in the investigation, students build a model that explains how the Earth's rotation around its own axis causes the Sun to appear to rise and set. **5-ESS1-2**	Can the Sun's position in the sky help us tell the time of day? *(Leads into Lesson 2)*	**Lesson 1 Anchor Connection:** The Earth is rotating, and that rotation is what causes the Sun to appear to move in the sky. The Sun doesn't move—we do!	Why do the stars appear to move in the same pattern as the Sun?
LESSON 2 **Who set the first clock?**		Students make a shadow clock (sundial) and investigate how the direction and length of shadows change with the position of the light shining on the sundial. Students realize that the Sun's position in the sky can be used to tell the time of day. **5-ESS1-2**	Is the Sun always overhead at noon? *(Leads into Lesson 3)*	**Lesson 2 Anchor Connection:** Just like the Sun, the stars appear to rise in the east and set in the west due to the Earth's rotation. The stars don't move—we do!	Do the stars always appear to move the same way the Sun does?
LESSON 3 **How can the Sun tell you the season?**		Students examine photos taken at different times of year and figure out the time of year that each photo was taken. Students discover that the Sun's path changes with the seasons, as does the time of sunrise and sunset. The Sun is always highest in the sky at noon, but that height changes with the season. **5-ESS1-2**	Does anything else in the sky change with the seasons? *(Leads into Lesson 4)*	**Lesson 3 Anchor Connection:** During the Summer, the length of time that the Sun is visible each *day* is longer and the length of time the stars are visible each *night* is shorter. The opposite is true in the winter.	Do the stars change from season to season? If so, why? If not, why not?
LESSON 4 **Why do the stars change with the season?**		Students build a model of the universe and use it to explain why different stars are visible at different times of year. Using evidence from this model, students make an argument that supports the claim that the Earth orbits the Sun. **5-ESS1-2**	The Moon looks different on different nights. Is there a pattern to the Moon's changes? *(Leads into Lesson 5)*	**Lesson 4 Anchor Connection:** While many stars do change from season to season, the stars near the North Star don't. This is because the North Pole is aimed very close to the North Star, and this part of the night sky is visible throughout the year.	Is there anything else in the sky that we can use to tell time? What about the Moon?

mystery science **Storylines**

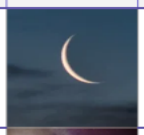
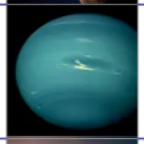
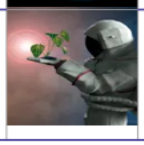
For more NGSS storylines visit
www.mysteryscience.com/storylines

Spaceship Earth: Anchor Layer Storyline

Sun, Moon, Stars, & Planets — ***Page 2 of 2***

5th Grade | NGSS Space Science

Anchor Phenomenon: Star Trails
What causes the patterns found in star trails?

Learning Sequence	Investigative Phenomena	What Students Figure Out in this Lesson	This Makes Students Wonder...	What Students Figure Out in the Anchor Connection	This Makes Students Wonder...
LESSON 5 **How does the Moon change shape?**		Students use a physical model of the Sun and Moon to investigate how the Moon's phase relates to its position relative to the Sun. Students notice that the Moon's phases repeat in a predictable pattern. **5-ESS1-2**	What other patterns can I see in the night sky? *(Leads into Lesson 6)*	**Lesson 5 Anchor Connection:** The full Moon rises at sunset and sets at sunrise. Just as the Sun is always highest in the sky in the middle of the day, the Moon is always highest in the sky in the middle of the night.	We've talked about the Sun, the Moon, and the stars. Can I see other planets in the sky?
LESSON 6 **How can the Sun help us explore other planets?**		Students create a model of the solar system in order to investigate the relative brightness of the Sun as viewed from other planets. **5-ESS1-1**	How are the other planets different from Earth? *(Leads into Lesson 7)*	**Lesson 6 Anchor Connection:** All planets rotate at varying rates. This causes objects in the sky to *appear* to move, and causes the transitions between day and night over time.	What else is different about keeping track of time on other planets?
LESSON 7 **Why is gravity different on other planets?**		Using mathematics and computational thinking, students calculate how high they could jump on planets and moons that have stronger or weaker gravity than Earth. Students analyze and interpret this data to construct an explanation for why the amount of gravity is different on other planets. **5-PS2-1**	Could people live on another planet? What would that planet have to be like to support humans? *(Leads into Lesson 8)*	**Lesson 7 Anchor Connection:** Students realize how different it is on other planets, laying the foundation for understanding that basic units of time are determined by where we are—on a spinning planet orbiting a star we call the Sun.	How could we use patterns in the sky to keep track of the time of day or night on another planet?
LESSON 8 **Could there be life on other planets?**		Students discover that the Earth is in the "Goldilocks Zone" — a distance from the Sun with the right amount of light and heat for life to exist. Students evaluate other solar systems, comparing their stars to our Sun. Based on their analysis, students plan a space mission to a planet with conditions similar to those on Earth. **5-ESS1-1**	→	**Lesson 8 Anchor Connection:** Students realize that our units of time are based on astronomy — the patterns we observe in the sky. The length of a day and a year depend on the planet where you live.	Using what I know about patterns in the sky, how can I make a clock that will tell the time with what I can see in the night sky?

Performance Task:
Invent a Night-Sky Clock

Spaceship Earth Unit Scope and Sequence

Date, SEEd Standard, & Mystery Science Lesson	Materials and Assessment
Preparing for this unit Spaceship Earth Unit (5th Grade Unit) In this unit, students explore the Earth, Sun, Moon, and stars using observations of shadows and changing patterns in the sky. Students also explore the planets of our Solar System and begin to consider what might lie beyond.	Spaceship Earth Teacher Guide Student Handouts for this Unit Pages 133-176
Mar 18 Objective: Students generate observations and questions about the phenomenon and create an initial model to explain what causes these patterns to form. **SEEd Standard 4.4.1** **Science and Engineering Practice:** Construct an explanation. **Crosscutting Concept:** Scale, Proportion, & Quantity Disciplinary Core Ideas: ESS1.A The Universe and Its Stars The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. Anchor lesson: Star Trails The anchor phenomenon for this unit is star trails that appear in long-exposure photographs. Students generate observations and questions about the phenomenon and create an initial model to explain what causes these patterns to form.	**Materials per Student:** Night Sky Patterns Printout See Think Wonder Printout. **Optional Pre-Assessment:** Unit Assessment Answer Key
Mar 25 Objective: Students model the rotation of the Earth and investigate why the Sun looks like it's moving across the sky. Using evidence, they gathered in the investigation; students build a model that explains how the Earth's	**Materials per Student** Earth Map Printout Sun Model Printout Crayons Scissors **In your Mystery Pack** Dot Stickers

rotation around its own axis causes the Sun to appear to rise and set. **SEEd Standard 4.4.2** **Science and Engineering Practice:** Analyze and Interpret Data **Crosscutting Concept:** Patterns Disciplinary Core Ideas: ESS1.B Earth and The Solar System Lesson 1: How Fast does Earth Spin? In this lesson, students come to understand that the setting Sun isn't moving, the Earth is spinning. In the activity, Spinning Earth, students use their bodies as a kinesthetic model of the Earth to understand how the speed of the Earth's spin affects the length of a day.	**Literature Connections** Newsela Mystery 1 Articles **Assessment** Lesson 1 Assessment Answer Key
Apr 8 Objective: Students make a shadow clock (sundial) and investigate how the direction and length of shadows change with the position of the light shining on the sundial. Students realize that the Sun's position in the sky can be used to tell the time of day. **SEEd Standard 4.4.2** **Science and Engineering Practice:** Analyze and Interpret Data **Crosscutting Concept:** Patterns Disciplinary Core Ideas: ESS1.B Earth and The Solar System Lesson 2: Who set the first clock? In this lesson, students will learn why our ancestors divided the day into hours and how clocks measure the Sun's apparent movement. In the activity, make a Shadow Clock, students make their own sundials. First, students use flashlights indoors to understand how the position of the light affects the time shown on the clock. Then, students take their shadow clocks outside to see how the position of the Sun can tell them the time of day.	**Materials per Student** Shadow clock template printout Blank paper Glue sticks or Tape. Rulers Scissors **In your Mystery Pack** Paper plates 9 in Toothpicks White chalk Sticky tack **In your Shared Supply Box** Bright Flashlights **Literature Connections** What do A.M. and P.M. mean? Newsela Mystery 2 Articles **Vocabulary** Student slideshow: English | Spanish Teacher printout: English & Spanish **Assessment** Lesson 2 Assessment Answer Key

Apr 15 Objective: Students examine photos taken at different times of year and figure out the time of year that each photo was taken. Students discover that the Sun's path changes with the seasons, as does the time of sunrise and sunset. The Sun is always highest in the sky at noon, but that height changes with the season. **SEEd Standard 4.4.2** **Science and Engineering Practice:** Analyze and Interpret Data **Crosscutting Concept:** Patterns Disciplinary Core Ideas: ESS1.B Earth and The Solar System Lesson 3: How can the Sun tell you the season? In this lesson, students discover how the Sun's path changes with the seasons. In the visual activity, Guess the Season, students figure out the season of the year by studying a photo. Students come to realize that they can use the time of day and length of shadows to figure out the season in each photo.	**Materials per Student** No materials required. **Literature Connections** How Does a Leaf Know When to Change Color? Newsela Mystery 3 Articles **Vocabulary** Student slideshow: English | Spanish Teacher printout: English & Spanish **Assessment** Lesson 3 Assessment Answer Key
Apr 22 Objective: Students build a model of the universe and use it to explain why different stars are visible at different times of year. Using evidence from this model, students make an argument that supports the claim that the Earth orbits the Sun. **SEEd Standard 4.4.2** **Science and Engineering Practice:** Analyze and Interpret Data **Crosscutting Concept:** Patterns Disciplinary Core Ideas: ESS1.B Earth and The Solar System Lesson 4: Why do the stars change with the seasons? In this lesson, students will be introduced to the Earth's orbital movement around the Sun, as a means of seeing why the constellations change.	**Materials per Student** Constellation Guide & Universe in a box (Northern Hemisphere) Printout Universe in a box answer key Printout. Universe in a box Teacher Tips Printout Rulers Scissors **In your Mystery Pack** Paper fasteners **Literature Connections** Newsela Mystery 4 Articles **Vocabulary** Student slideshow: English | Spanish Teacher printout: English & Spanish **Assessment** Lesson 4 Assessment Answer Key

In the activity, Universe-in-a-Box, students make a paper model that helps them visualize the Earth's yearly orbit around the Sun. They use this model to understand why some constellations are only visible during part of the year.	
Apr 29 Objective: Students use a physical model of the Sun and Moon to investigate how the Moon's phase relates to its position relative to the Sun. Students notice that the Moon's phases repeat in a predictable pattern. **SEEd Standard 4.4.2** **Science and Engineering Practice:** Analyze and Interpret Data **Crosscutting Concept:** Patterns Disciplinary Core Ideas: ESS1.B Earth and The Solar System Lesson 5: Why does the moon change shape? This lesson explores why the Moon seems to change shape (phases) over the course of a month. In the activity, Model the Moon's Phases, students use a Styrofoam ball as a model of the Moon and a flashlight as a model of the Sun to gain a better understanding of how the interactions between the Sun and Moon are responsible for the Moon's phases.	**Materials per Student** Sharpened pencil or skewer **In your Mystery Pack** Styrofoam balls 2" **In your Shared Supply Box** Bright Flashlights **Literature Connections** The Many Names for the Full Moon Newsela Mystery 5 Articles **Vocabulary** Student slideshow: English | Spanish Teacher printout: English & Spanish **Assessment** Lesson 5 Assessment Answer Key
May 6 Objective: Students gather evidence to support an argument that the apparent brightness of the Sun is dependent upon an observer's distance from the Sun. They construct a model of the solar system and gather observations of the Sun's apparent brightness from each planet within their model. **SEEd Standard 4.4.2** **Science and Engineering Practice:** Analyze and Interpret Data **Crosscutting Concept:** Patterns Disciplinary Core Ideas: ESS1.B Earth and The Solar System	Please Note: This is a NEW lesson Mystery Science is BETA Testing! If you have a Mystery Pack, you will need to gather most of the supplies listed below. **Materials per Class** Brightness Test Printout Brightness Test Answer Key Solar System Scale model printout Test Rover Printout File folder labels or Tape Scissors **In your Mystery Pack** Bright Flashlights

Lesson 6: How can the Sun help us explore other planets? In this lesson, students gather evidence to support an argument that the apparent brightness of the Sun is dependent upon an observer's distance from the Sun. In the activity, Solar Energy Explorer, students construct a model solar system and gather observations of the Sun's apparent brightness from each planet within their model. Students use those observations as evidence to support a claim about which planet is best suited to explore with a solar powered planetary rover.	**Literature Connections** A simple invention that changed the world Newsela Mystery 6 Articles **Vocabulary** Student slideshow: English | Spanish Teacher printout: English & Spanish **Assessment** Lesson 6 Assessment Answer Key
SKIP Lesson 7 (Aligns with 3rd Grade SEEd Standard 3.2.2)	
May 11 Objective: Students discover that the Earth is in the "Goldilocks Zone" — a distance from the Sun with the right amount of light and heat for life to exist. Students evaluate other solar systems, comparing their stars to our Sun. Based on their analysis, students plan a space mission to a planet with conditions like those on Earth. **SEEd Standard 4.4.1** **Science and Engineering Practice:** Construct an explanation. **Crosscutting Concept:** Scale, Proportion, & Quantity Disciplinary Core Ideas: ESS1.A the Universe and Its Stars The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. Lesson 8: Could there be life on other planets? In this lesson, students discover that the Earth is in the "Goldilocks Zone" — a distance from the Sun with the right amount of light and heat for life to exist. In the activity, Star Explorer, students plan a space mission to another planet outside our Solar System based on the amount of heat and light that reaches the planet's surface. Once students plan their space mission,	**Materials per Student** Gravity Guru & Spinning Specialist Printout. Mission plan printout Plant pro printout Plant pro, Water Wizard, and mission plan Answer Keys Printout Starlight Guide Printout Starlight Guide Answer Key Printout Water Wizard Printout Scissors **Literature Connections** Newsela ▪ Mystery 8 Articles ▪ The Sun, an engine of nuclear energy ▪ An exciting discovery deep in space ▪ Space Researchers hope to find the next Earth among 7 distant planets ▪ Water detected on planet in the livable zone of a distant red star **Vocabulary** Student slideshow: English | Spanish Teacher printout: English & Spanish **Assessment** Lesson 8 Assessment Answer Key

<table>
<tr><td>they will reflect on what our Sun would look like from this far-away planet.</td><td></td></tr>
<tr><td>May 20

Objective: Students use engineering design principles to invent a clock that uses patterns in the night sky. They evaluate possible patterns, suggest multiple ways to measure time with those patterns, and describe their final design and how it works.

SEEd Standard 4.4.1
Science and Engineering Practice:
Construct an explanation.
Crosscutting Concept: Scale, Proportion, & Quantity
Disciplinary Core Ideas:
ESS1.A the Universe and Its Stars
The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

Performance Task: How can you tell time at night?

In the Performance Task, students use engineering design principles to invent a clock that uses patterns in the night sky. They evaluate possible patterns, suggest multiple ways to measure time with those patterns, and describe their final design and how it works.</td><td>Materials per Student
Timekeeper Challenge worksheet
Timekeeper Challenge worksheet Answer Key

Literature Connections
Newsela
▪ Here’s why people picked certain stars as constellations
▪ Winter is such a cool time to see the stars twinkle

Assessment
Unit Assessment
Answer Key</td></tr>
</table>