

Unit Summary		
<p><i>Can we predict how the sky will change over time?</i></p> <p>In this unit of study, students observe, describe, and predict some patterns in the movement of objects in the sky. The crosscutting concept of <i>patterns</i> is called out as an organizing concept for the disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in <i>planning and carrying out investigations</i> and <i>analyzing and interpreting data</i>. Students are also expected to use these practices to demonstrate understanding of the core ideas.</p> <p>This unit is based on 1-ESS1-1 and 1-ESS1-2.</p>		
Student Learning Objectives		
<p>Use observations of the sun, moon, and stars to describe patterns that can be predicted. <i>[Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.] [Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.] (1-ESS1-1)</i></p>		
<p>Make observations at different times of year to relate the amount of daylight to the time of year. <i>[Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.] [Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.] (1-ESS1-2)</i></p>		
Quick Links		
Unit Sequence p. 2	Research on Learning p. 4	Sample Open Education Resources p. 6
What it Looks Like in the Classroom p. 3	Prior Learning p. 4	Teacher Professional Learning Resources p. 6
Connecting ELA/Literacy and Math p. 3	Future Learning p. 5	Appendix A: NGSS and Foundations p. 7
Modifications p. 4	Connections to Other Units p. 5	

Unit Sequence	
Part A: What patterns of change can be predicted when observing the sun, moon, and stars?	
Concepts	Formative Assessments
<ul style="list-style-type: none"> Science assumes that natural events happen today as they happened in the past. Many events are repeated. Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. Patterns in the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. 	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"> Observe and use patterns in the natural world as evidence and to describe phenomena. Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. Use observations of the sun, moon, and stars to describe patterns that can be predicted. Examples of patterns could include: <ul style="list-style-type: none"> ✓ The sun and moon appear to rise in one part of the sky, move across the sky, and set. ✓ Stars other than our sun are visible at night but not during the day. <i>(Assessment of star patterns is limited to stars being seen at night and not during the day.)</i>

Unit Sequence	
Part B: What is the relationship between the amount of daylight and the time of year?	
Concepts	Formative Assessments
<ul style="list-style-type: none"> Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. Seasonal patterns of sunrise and sunset can be observed, described, and predicted. 	<p><i>Students who understand the concepts can:</i></p> <ul style="list-style-type: none"> Observe and use patterns in the natural world as evidence and to describe phenomena. Make observations (firsthand or from media) to collect data that can be used to make comparisons. Make observations at different times of the year to relate the amount of daylight to the time of year. <i>(Note: The emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall; assessment is limited to relative amounts of daylight, not to quantifying the hours or time of daylight.)</i>

What It Looks Like in the Classroom

In this unit of study, students observe, describe, and predict some patterns of the movement of objects in the sky. Throughout the unit students look for patterns as they plan and carry out investigations and analyze and interpret data.

In this unit's progression of learning, students develop the understanding that natural events happen today as they happened in the past, and that many events are repeated. In addition, they observe and use patterns in the natural world as evidence and to describe phenomena. First graders ask questions and use observations of the sun, moon, and stars to describe apparent patterns of change in each. These patterns are then used to answer questions and make predictions. Some examples of patterns include:

- ✓ The sun and moon appear to rise in one part of the sky, move across the sky, and set.
- ✓ The shape of the moon appears to change over a period of time in a predictable pattern.
- ✓ Stars, other than our sun, are visible at night but not during the day.

After students observe and document these types of patterns over a period of time, they need opportunities to describe the patterns and to make predictions about the changes that occur in the objects in the sky. It is important that they use observed patterns as evidence to support predictions they might make about the sun, moon, and stars.

In this unit, students also learn that seasonal patterns of sunrise and sunset can be observed, described, and predicted. They relate the amount of daylight to the time of year by making observations at different times of the year. Over time, they collect and use data in order to identify the relationship between the amount of sunlight and the season. Grade 1 students are expected to make relative comparisons of the amount of daylight from one season to the next, and assessment should be limited to relative amounts of daylight, not quantifying the hours or time of daylight.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

In this unit of study, students need opportunities to participate in shared research and writing projects about patterns of change in the sky. For example, students can use online resources or books to research the patterns of change that are visible over time when we observe the objects in the sky. With guidance from adults, students could create books that describe and illustrate the different patterns of change observed in objects in the sky. They could also describe and illustrate the relative amount of daylight in relation to the season using a sequenced set of journal entries or in a sequence-of-events foldable.

Mathematic

Students need opportunities to represent and interpret data and to use addition and subtraction. The following examples from NGSS Appendix L could provide guidance for instruction and should be done with teacher support:

- ✓ Science example 1: There were 16 hours of daylight yesterday. On December 21, there were 8 hours of daylight. How many more hours of daylight were there yesterday than on December 21?
- ✓ Science example 2: Based on the data collected and posted on the bulletin board so far, which day has been the longest of the year so far? Which day has been the shortest?

Modifications

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: [All Standards, All Students/Case Studies](#) for vignettes and explanations of the modifications.)

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Research on Student Learning

The ideas "the sun is a star" and "the earth orbits the sun" appear counter-intuitive to elementary-school students. The ideas "the sun is a star" and "the earth orbits the sun" and are not likely to be believed or even understood in elementary grades. Whether it is possible for elementary students to understand these concepts even with good teaching needs further investigation.

Explanations of the day-night cycle, the phases of the moon, and the seasons are very challenging for students. To understand these phenomena, students should first master the idea of a spherical earth, itself a challenging task. Similarly, students must understand the concept of "light reflection" and how the moon gets its light from the sun before they can understand the phases of the moon. Finally, students may not be able to understand explanations of any of these phenomena before they reasonably understand the relative size, motion, and distance of the sun, moon, and the earth ([NSDL, 2015](#)).

Prior Learning

This is the first opportunity for students to encounter these ideas.

Future Learning
<p>Grade 3 Unit 2: Forces and Motion</p> <ul style="list-style-type: none"> Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. <i>[Note: The emphasis is qualitative and conceptual understanding of forces. Quantitative understanding is at a later grade level.]</i> The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. <i>[Note: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.]</i> <p>Grade 5 Unit 6: Interactions within the Earth, Sun, Moon Systems</p> <ul style="list-style-type: none"> The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; 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.

Connections to Other Units
N/A

Sample of Open Education Resources
<p><u>The Dynamic Trio</u>: In this lesson, students will learn about the stars, planets, and moons found in our solar system and how they relate to one another. The video segment enhances the learning. After a non-fiction read aloud, students work in groups to create models of the Solar System.</p> <p><u>Our Super Star</u>: This is a three part lesson where students use observations, activities, and videos to learn basic facts about the Sun. Students also model the mechanics of day and night and use solar energy to make a tasty treat. One of the videos is a time-lapse video of a sunrise and a sunset.</p> <p><u>Keep a Moon Journal</u>: The National Wildlife Federation's "Keep a Moon Journal" page allows students to get acquainted with the phases of the moon by keeping a moon journal to record their nightly observations for one month. The page has links to diagrams, a student printable, and activities connecting the journal to other content. The page is set up as a "family activity" and could be used as nightly homework for students then discussed weekly in class.</p> <p><u>Patterns of Daylight</u>: This is a mini-unit that can be taught directly after Space Part 1 or independently. The author chose to teach the Space Part 1 unit (also available on Better Lesson! at http://betterlesson.com/lesson/613469/introduction-and-pre-assessment) during January, and follows up at the end of the year in a recap in May. This lesson uses prior student knowledge and a video simulation.</p> <p><u>Observing the Sun</u>: This lesson is an activity where students create a sun tracker and monitor the sun's position over the course of a day. Examples of student journals and connections within a larger unit are provided.</p>

Teacher Professional Learning Resources**Teaching NGSS in Elementary School—First Grade**

The presenters were Carla Sembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director at Michigan Mathematics and Science Centers Network, and Kathy Renfrew, K-5 Science Coordinator, VT Agency of Education and NGSS Curator introduced the NGSS Web seminar Series for K-5 educators.

After a brief overview of this NGSS for First Grade web seminar, Mary discussed the science and engineering practices in relation to teaching first grade. The web seminar focused on the concept of sound, and how performance expectations should be incorporated into teaching. Sound was further considered as a disciplinary core idea within first grade teaching. Participants viewed a video of a teacher supporting students in developing towards the performance expectations. The science and engineering practices of explanation and argument was considered within the lesson presented. Claim, evidence, reasoning and rebuttal were discussed, and a CER framework was shared. Carla introduced the KLEWS chart and discussed its use in an elementary classroom. Kathy shared the importance of classroom discourse and science talk. The web seminar closed with the sharing of resources in relation to the NGSS and teaching K-5 grades. Ted, in closing, shared NSTA resources in relation to the NGSS.

Visit the [resource collection](#).

Continue discussing this topic in the [community forums](#).

NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence

Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the NGSS for K-5th grade. The web seminar focused on the three dimensional learning of the NGSS, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

To view related resources, visit the [resource collection](#).

Continue discussing this topic in the [community forums](#).

NGSS Core Ideas: Earth's Place in the Universe

The presenter was Julia Plummer from Penn State University. The program featured strategies for teaching about Earth science concepts that answer questions such as "What goes on in stars?" and "What patterns are caused by Earth's movements in the solar system?"

Dr. Plummer began the presentation by discussing what students should know about the disciplinary core idea of Earth's Place in the Universe. She talked about using the scientific and engineering practices to help engage students. Participants shared their ideas about applying this core idea to the classroom, and then Dr. Plummer shared strategies for effective instruction. She also discussed the importance of spatial thinking for students to begin thinking scientifically about these concepts.

Continue the discussion in the [Community Forums](#).

Appendix A: NGSS and Foundations for the Unit		
<p>Use observations of the sun, moon, and stars to describe patterns that can be predicted. <i>[Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.]</i> <i>[Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.]</i> (1-ESS1-1)</p>		
<p>Make observations at different times of year to relate the amount of daylight to the time of year. <i>[Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.]</i> <i>[Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.]</i> (1-ESS1-2)</p>		
The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education :		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(1-PS4-3) <p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1-ESS1-2) <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1-ESS1-1) 	<p>ESS1.A: The Universe and its Stars</p> <ul style="list-style-type: none"> Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1-ESS1-1) <p>ESS1.B: Earth and the Solar System</p> <ul style="list-style-type: none"> Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1-ESS1-2) 	<p>Patterns</p> <ul style="list-style-type: none"> Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-ESS1-1),(1-ESS1-2) <p>-----</p> <p>Connections to Nature of Science</p> <p>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> Science assumes natural events happen today as they happened in the past. (1-ESS1-1) Many events are repeated. (1-ESS1-1)

English Language Arts	Mathematics
<p>Participate in shared research and writing projects (e.g., explore a number of “how-to” books on a given topic and use them to write a sequence of instructions). (1-ESS1-1),(1-ESS1-2) W.1.7</p> <p>With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-ESS1-1),(1-ESS1-2) W.1.8</p>	<p>Reason abstractly and quantitatively. (1-ESS1-2) MP.2</p> <p>Model with mathematics. (1-ESS1-2) MP.4</p> <p>Use appropriate tools strategically. (1-ESS1-2) MP.5</p> <p>Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations to represent the problem. (1-ESS1-2) 1.OA.A.1</p> <p>Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. (1-ESS1-2) 1.MD.C.4</p>