First Grade

The performance expectations in first grade help students formulate answers to questions such as: “What happens when materials vibrate? What happens when there is no light? What are some ways plants and animals meet their needs so that they can survive and grow? How are parents and their children similar and different? What objects are in the sky and how do they seem to move?” First grade performance expectations include PS4, LS1, LS3, and ESS1 Disciplinary Core Ideas from the NRC Framework. Students are expected to develop understanding of the relationship between sound and vibrating materials as well as between the availability of light and ability to see objects. The idea that light travels from place to place can be understood by students at this level through determining the effect of placing objects made with different materials in the path of a beam of light. Students are also expected to develop understanding of how plants and animals use their external parts to help them survive, grow, and meet their needs as well as how behaviors of parents and offspring help the offspring survive. The understanding is developed that young plants and animals are like, but not exactly the same as, their parents. Students are able to observe, describe, and predict some patterns of the movement of objects in the sky. The crosscutting concepts of patterns; cause and effect; structure and function; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the first grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.
Eco-Schools USA Pathway Alignment

The National Wildlife Federation’s Eco-Schools USA program has aligned their program pathways of sustainability to the NGSS. As a part of the Eco-Schools 7-Step Framework, linking to the curriculum, is a priority. This alignment is designed to highlight the natural connections between our national standards document and the Eco-Schools USA program.

Our program icons are used to denote pathway connections to the NGSS Performance Expectations. Not every topic, with its set of Performance Expectations are a fit with the Eco-Schools USA program and in that case an alignment will not be present.

Green STEM is an initiative of NWF’s Eco-Schools USA program and is focused on identifying best practice in the STEM fields as it relates to environment-based learning. These elements include:

- Problem-based learning
- Utilizing the school, both inside and out, as a learning laboratory
- The incorporation of two or more STEM disciplines within a single lesson, whole curricula, a set of standards, etc.
- A Maker mentality – design/create/solve
- A commitment to service learning
- An inclusive culture – where all students can learn and all students can participate
1. Waves: Light and Sound

Students who demonstrate understanding can:

1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]

1-PS4-2. Make observations to construct an evidence-based account that objects can be seen only when illuminated. [Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]

1-PS4-3. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [Assessment Boundary: Assessment does not include the speed of light.]

1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.* [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string "telephones," and a pattern of drum beats.] [Assessment Boundary: Assessment does not include technological details for how communication devices work.]

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

**Planning and Carrying Out Investigations**
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question. (1-PS4-1),(1-PS4-3)

**Constructing Explanations and Designing Solutions**
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena (1-PS4-1)
- Use tools and materials provided to design a device that solves a specific problem. (1-PS4-4)

**Connections to Nature of Science**

**Scientific Investigations Use a Variety of Methods**
- Science investigations begin with a question. (1-PS4-1)
- Scientists use different ways to study the world. (1-PS4-1)

**Disciplinary Core Ideas**

**PS4.A: Wave Properties**
- Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1)

**PS4.B: Electromagnetic Radiation**
- Objects can be seen only when light is available to illuminate them. Some objects give off their own light. (1-PS4-2)
- Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) (1-PS4-3)

**PS4.C: Information Technologies and Instrumentation**
- People also use a variety of devices to communicate (send and receive information) over long distances. (1-PS4-4)

**Crosscutting Concepts**

**Cause and Effect**
- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (1-PS4-1),(1-PS4-2),(1-PS4-3)

**Connections to Engineering, Technology, and Applications of Science**

**Influence of Engineering, Technology, and Science, on Society and the Natural World**
- People depend on various technologies in their lives; human life would be very different without technology. (1-PS4-4)

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.*

**Articulation of DCIs in first grade: N/A**

**Common Core State Standards Connections:**

**ELA/Literacy – W.1.2**
- Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure. (1-PS4-2)

**W.1.7**
- 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-PS4-1),(1-PS4-2),(1-PS4-3),(1-PS4-4)

**W.1.8**
- With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. (1-PS4-1),(1-PS4-2),(1-PS4-3)

**SL.1.1**
- Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups. (1-PS4-1),(1-PS4-2),(1-PS4-3)

**Mathematics – MP.5**
- Use appropriate tools strategically. (1-PS4-4)

**1.MD.A.1**
- Order three objects by length; compare the lengths of two objects indirectly by using a third object. (1-PS4-4)

**1.MD.A.2**
- Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. (1-PS4-4)

April 2013

NGSS Release

9
1. Structure, Function, and Information Processing

Students who demonstrate understanding can:

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.* [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]

1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. [Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).]

1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. [Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.]

[Assessment Boundary: Assessment does not include inheritance or animals that undergo metamorphosis or hybrids.]

The performance expectations above were developed using the following elements from the NGSS document A Framework for K-12 Science Education: Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and Connections to Engineering, Technology, and Applications of Science.
### 1.Space Systems: Patterns and Cycles

**Students who demonstrate understanding can:**

1-ESS1-1. **Use observations of the sun, moon, and stars to describe patterns that can be predicted.** [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-ESS1-2. **Make observations at different times of year to relate the amount of daylight to the time of year.** [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.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education:*

<table>
<thead>
<tr>
<th><strong>Science and Engineering Practices</strong></th>
<th><strong>Disciplinary Core Ideas</strong></th>
<th><strong>Crosscutting Concepts</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning and Carrying Out Investigations</strong></td>
<td><strong>ESS1.A: The Universe and its Stars</strong></td>
<td><strong>Patterns</strong></td>
</tr>
<tr>
<td>Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</td>
<td>- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1-ESS1-1)</td>
<td>• Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (1-ESS1-1),(1-ESS1-2)</td>
</tr>
<tr>
<td>Analyzing and Interpreting Data</td>
<td>1-ESS1.B: Earth and the Solar System</td>
<td><strong>Connections to Nature of Science</strong></td>
</tr>
<tr>
<td>Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</td>
<td>• Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1-ESS1-2)</td>
<td><strong>Science Knowledge Assumes an Order and Consistency in Natural Systems</strong></td>
</tr>
<tr>
<td>Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1-ESS1-1)</td>
<td></td>
<td>• Science assumes natural events happen today as they happened in the past. (1-ESS1-1)</td>
</tr>
</tbody>
</table>

### ECO-SCHOOLS USA PATHWAY ALIGNMENT

**1-ESS1-1 and 1-ESS1-2**

A tremendous opportunity exists to connect students to the natural world when observing patterns and cycles as they relate to the sun, moon, and stars. Plan a nighttime event a family track walk followed by the local astronomy club/department or museum to host a "star party". Work with the local community to help students begin to understand the patterns and cycles in the sky. Your students likely think the moon and stars are not present during the school day. What an opportunity to provide them with an "aha" moment.

This is also an opportunity to take your students outside and allow them to take pictures of a specific stationary thing. Have them do this once a week or twice a month, same day and time of the week and at the same angle. Do this for a semester. Print the pictures and place them in order with the date from first to last. Students will be able to observe how daylight changes throughout the weeks and months. Another option – take a picture of your class, using the same criteria, and have an all class example of these changes in daylight over time.

**Connections to other DCIs in first grade:** N/A

**Articulation of DCIs across grade-bands:** 3.PS2.A (1-ESS1-1); 5.PS2.B (1-ESS1-1),(1-ESS1-2) 5-ESS1.B (1-ESS1-1),(1-ESS1-2)

**Common Core State Standards Connections:**

**ELA/Literacy –**

- W.1.7 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.1.8 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)

**Mathematics –**

- MP.2 Reason abstractly and quantitatively. (1-ESS1-2)
- MP.4 Model with mathematics. (1-ESS1-2)
- MP.5 Use appropriate tools strategically. (1-ESS1-2)

**1.OA.A.1** 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.MD.C.4** 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)

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*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea. The section entitled "Disciplinary Core Ideas" is reproduced verbatim from *A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas*. Integrated and reprinted with permission from the National Academy of Sciences.*

April 2013 NGSSS Release 11