

Fifth Grade

The performance expectations in fifth grade help students formulate answers to questions such as: “When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?”

Fifth grade performance expectations include PS1, PS2, PS3, LS1, LS2, ESS1, ESS2, and ESS3 Disciplinary Core Ideas from the NRC Framework.

Students are able to describe that matter is made of particles too small to be seen through the development of a model. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun. Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; energy and matter; and systems and systems models are called out as organizing concepts for these disciplinary core ideas.

In the fifth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and 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 the National Wildlife Federation'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



5. Structure and Properties of Matter

5. Structure and Properties of Matter		
Students who demonstrate understanding can:		
<p>5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]</p> <p>5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that forms new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]</p> <p>5-PS1-3. Make observations and measurements to identify materials based on their properties. [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]</p> <p>5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.</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>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <ul style="list-style-type: none"> ▪ Develop a model to describe phenomena. (5-PS1-1) <p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> ▪ Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4) ▪ Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3) <p>Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.</p> <ul style="list-style-type: none"> ▪ Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2) 	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> ▪ Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model shows that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon; the effects of air on larger particles or objects. (5-PS1-1) ▪ The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2) ▪ Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3) <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none"> ▪ When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4) ▪ No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2) 	<p>Cause and Effect</p> <ul style="list-style-type: none"> ▪ Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4) <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> ▪ Natural objects exist from the very small to the immensely large. (5-PS1-1) ▪ Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2),(5-PS1-3) <p style="text-align: center;">-----</p> <p style="text-align: center;">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 consistent patterns in natural systems. (5-PS1-2)
<p style="text-align: center;">ECO-SCHOOLS USA PATHWAY ALIGNMENT</p> <div style="display: flex; align-items: center;"> <div style="flex: 1;">  </div> <div style="flex: 2; padding-left: 10px;"> <p>5-PS1-3 and 5-PS1-4</p> <p>As students address consumption and waste at their school this would be a time you could reuse and repurpose some of those items found while auditing. These recyclables could be used when conducting investigations of properties of matter. Although you may not find all the items to complete a full exploration of the properties of matter within this Performance Expectation you will find many.</p> <p>Healthy Schools is about the indoor air quality and use of chemical cleaners and pesticides inside and outside the school. While NWF's Eco-Schools USA DOES NOT condone the mixing of chemicals together we do support students investigating natural alternatives to chemical cleaners and pesticides. Many natural products contain vinegar, water, essential oils, baking soda, and lemon juice to name a few. Students could conduct investigations to create their own natural alternatives, such as, window cleaner, all-purpose cleaner, pest deterrent, etc.</p> </div> </div>		
Connections to other DCIs in fifth grade: N/A		
Articulation of DCIs across grade-bands: 2.PS1.A (5-PS1-1),(5-PS1-2),(5-PS1-3); 2.PS1.B (5-PS1-2),(5-PS1-4); MS.PS1.A (5-PS1-1),(5-PS1-2),(5-PS1-3),(5-PS1-4); MS.PS1.B (5-PS1-2),(5-PS1-4)		

*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.

Common Core State Standards Connections:

ELA/Literacy –

- RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)
- W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2),(5-PS1-3),(5-PS1-4)
- W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-2),(5-PS1-3),(5-PS1-4)
- W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2),(5-PS1-3),(5-PS1-4)

Mathematics –

- MP.2** Reason abstractly and quantitatively. (5-PS1-1),(5-PS1-2),(5-PS1-3)
- MP.4** Model with mathematics. (5-PS1-1),(5-PS1-2),(5-PS1-3)
- MP.5** Use appropriate tools strategically. (PS1-2),(PS1-3)
- 5.NBT.A.1** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1)
- 5.NF.B.7** Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1-1)
- 5.MD.A.1** Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems. (5-PS1-2)
- 5.MD.C.3** Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1)
- 5.MD.C.4** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. (5-PS1-1)

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5.Matter and Energy in Organisms and Ecosystems

5.Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

- 5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.** [Clarification Statement: Examples of models could include diagrams, and flow charts.]
- 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]
- 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

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>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <ul style="list-style-type: none"> ▪ Use models to describe phenomena. (5-PS3-1) ▪ Develop a model to describe phenomena. (5-LS2-1) <p>Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p> <ul style="list-style-type: none"> ▪ Support an argument with evidence, data, or a model. (5-LS1-1) <p style="text-align: center;">-----</p> <p style="text-align: center;">Connections to Nature of Science</p> <p>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</p> <ul style="list-style-type: none"> ▪ Science explanations describe the mechanisms for natural events. (5-LS2-1) 	<p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> ▪ The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) <p>LS1.C: Organization for Matter and Energy Flow in Organisms</p> <ul style="list-style-type: none"> ▪ Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1) ▪ Plants acquire their material for growth chiefly from air and water. (5-LS1-1) <p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> ▪ The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) <p>LS2.B: Cycles of Matter and Energy Transfer in Ecosystems</p> <ul style="list-style-type: none"> ▪ Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste 	<p>Systems and System Models</p> <ul style="list-style-type: none"> ▪ A system can be described in terms of its components and their interactions. (5-LS2-1) <p>Energy and Matter</p> <ul style="list-style-type: none"> ▪ Matter is transported into, out of, and within systems. (5-LS1-1) ▪ Energy can be transferred in various ways and between objects. (5-PS3-1)





ECO-SCHOOLS USA PATHWAY ALIGNMENT

5-PS3-1, 5-LS1-1, and 5-LS2-1

Each of the Performance Expectations is more easily accomplished by students who have spent significant time outdoors using their schoolyard as a learning laboratory. Students will be able to use models with greater precision and understanding to describe that energy in animals' food was once energy from the sun because they have had several experiences, K-5 in the school's Schoolyard Habitat(s)[™], sustainable food gardens, and/or through investigations of biodiversity. Many of the students' experiences with plants have been done in soil and a lot of emphasis has been placed on soil health. Utilize hydroponics and/or air gardens to allow students the opportunity to become familiar with this type of gardening and as it will give students the supporting details for an argument that plants get the materials they need for growth chiefly from air or water. <http://science.howstuffworks.com/life/31024-discovery-earth-disney-gardens-ditch-dirt-video.htm> For those students who have been a part of the creation and care of a Schoolyard Habitat[™], sustainable food garden, or biodiversity studies, developing a model based on those experiences will allow them to describe the movement of matter through ecosystems with greater depth and understanding. Models in texts are 2D and do not allow students to explore the depths and intricacies of the cycle components, whereas schoolyards allow for full-on, sensory-packed learning experiences.

Connections to other DCIs in fifth grade: **5.ESS2.A** (5-LS2-1); **5.PS1.A** (5-LS1-1),(5-LS2-1)

Articulation of DCIs across grade-bands: **K.LS1.C** (5-LS1-1),(5-PS3-1); **2.PS1.A** (5-LS2-1); **2.LS2.A** (5-PS3-1),(5-LS1-1); **2.LS4.D** (5-LS2-1); **4.PS3.A** (5-PS3-1); **4.PS3.B** (5-PS3-1); **4.PS3.D** (5-PS3-1); **4.ESS2.E** (5-LS2-1); **MS.PS3.D** (5-PS3-1),(5-LS2-1); **MS.PS4.B** (5-PS3-1); **MS.LS1.C** (5-PS3-1),(5-LS1-1),(5-LS2-1); **MS.LS2.A** (5-LS2-1); **MS.LS2.B** (5-PS3-1),(5-LS2-1)

Common Core State Standards Connections:

ELA/Literacy –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1),(5-LS2-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)

W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)

SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1),(5-LS2-1)

Mathematics –

MP.2 Reason abstractly and quantitatively. (5-LS2-1)

MP.4 Model with mathematics. (5-LS2-1)

5.MD.A.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1-1)

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5.Earth's Systems

5.Earth's Systems

Students who demonstrate understanding can:

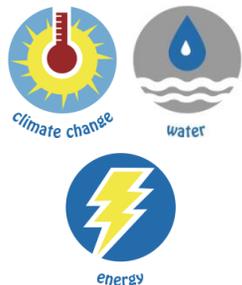
- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.** [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]
- 5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.** [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]
- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.**

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>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <ul style="list-style-type: none"> Develop a model using an example to describe a scientific principle. (5-ESS2-1) <p>Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.</p> <ul style="list-style-type: none"> Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2) <p>Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.</p> <ul style="list-style-type: none"> Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1) 	<p>ESS2.A: Earth Materials and Systems</p> <ul style="list-style-type: none"> Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1) <p>ESS2.C: The Roles of Water in Earth's Surface Processes</p> <ul style="list-style-type: none"> Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2) <p>ESS3.C: Human Impacts on Earth Systems</p> <ul style="list-style-type: none"> Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1) 	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Standard units are used to measure and describe physical quantities such as weight, and volume. (5-ESS2-2) <p>Systems and System Models</p> <ul style="list-style-type: none"> A system can be described in terms of its components and their interactions. (5-ESS2-1),(5-ESS3-1) <p style="text-align: center;">-----</p> <p style="text-align: center;">Connections to Nature of Science</p> <p>Science Addresses Questions About the Natural and Material World</p> <ul style="list-style-type: none"> Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)

ECO-SCHOOLS USA PATHWAY ALIGNMENT

5-ESS2-1, 5-ESS2-2, and 5-ESS3-1



Systems' thinking is a valuable tool especially when we consider the interactions between the Earth's various systems. Instead of teaching each Performance Expectation individually, tie them together. Weather and climate affects each of the systems mentioned and could be the commonality that ties each PE together.

We all know that we turn off the water while brushing our teeth, work to take shorter showers, and buy water wise appliances, but why? Students often think there is an abundant amount of water on Earth, while there is, they don't understand how much of that water is usable for human consumption and daily needs. <http://ga.water.usgs.gov/edu/earthwherewater.html>

What are some unique innovations that have impacted our resources and the environment? Do students have any ideas? Have students think about natural resource conservation, marine sanctuaries, and national parks with protected waterways. What about rain barrels and water pump systems to recycle gray water? How do we feed a world with a growing population? What is Eco-agriculture and what innovations have been created and successfully used to protect our resources and the environment? What role do solar and wind energy companies play in protecting our resources and the environment? The possibilities for sustainability innovation are endless.

Connections to other DCIs in fifth grade: N/A

Articulation of DCIs across grade-bands: **2.ESS2.A** (5-ESS2-1); **2.ESS2.C** (5-ESS2-2); **3.ESS2.D** (5-ESS2-1); **4.ESS2.A** (5-ESS2-1); **MS.ESS2.A** (5-ESS2-1); **MS.ESS2.C** (5-ESS2-1),(5-ESS2-2); **MS.ESS2.D** (5-ESS2-1); **MS.ESS3.A** (5-ESS2-2),(5-ESS3-1); **MS.ESS3.C** (5-ESS3-1); **MS.ESS3.D** (5-ESS3-1)

Common Core State Standards Connections:

ELA/Literacy –

- RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)
- RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
- RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)
- W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS2-2),(5-ESS3-1)
- W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)
- SL.5.5** Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1),(5-ESS2-2)

Mathematics –

- MP.2** Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
- MP.4** Model with mathematics. (5-ESS2-1),(5-ESS2-2),(5-ESS3-1)
- 5.G.2** Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1)

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3-5.Engineering Design

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Students who demonstrate understanding can:

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

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

Asking Questions and Defining Problems

Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS-1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS-2)

ECO-SCHOOLS USA PATHWAY ALIGNMENT

3-5-ETS1-1, 3-5-ETS1-2, AND 3-5-ETS1-3

While all the Eco-Schools USA pathways lend themselves to engineering design, these pathways have been chosen because they are found in many of the other Performance Expectations for second grade. To strengthen the concepts that students have been learning, it is logical to allow them opportunities to design solutions to real world issues that affect the issues of sustainability they have been working to address.

Design solutions could include:

- Methods of water distribution that conserve water for the school gardens
- A return on investment study for water wise facets and toilets
- The use of trees and gardens to conserve energy
- Creation and marketing of natural cleaning products



Connections to other DCIs in this grade-band:

Connections to 3-5-ETS1.A: Defining and Delimiting Engineering Problems include:

4th Grade: 4-PS3-4

Connections to 3-5-ETS1.B: Designing Solutions to Engineering Problems include:

4th Grade: 4-ESS3-2

Connections to 3-5-ETS1.C: Optimizing the Design Solution include:

4th Grade: 4-PS4-3

Articulation of DCIs across grade-bands: **K-2.ETS1.A** (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); **K-2.ETS1.B** (3-5-ETS1-2); **K-2.ETS1.C** (3-5-ETS1-2),(3-5-ETS1-3); **MS.ETS1.A** (3-5-ETS1-1); **MS.ETS1.B** (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3); **MS.ETS1.C** (3-5-ETS1-2),(3-5-ETS1-3)

Common Core State Standards Connections:

ELA/Literacy –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS-2)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS2)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS-2)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)

Mathematics –

MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)

MP.4 Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)

MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)

3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1),(3-5-ETS1-2)