

Fourth Grade

South Carolina fourth-grade students engage in thinking and solving problems the way scientists and engineers do to help them better see how science is relevant to their lives. To capitalize on the natural curiosity all students have about the world around them, learning experiences are built around the three dimensions of science: **Science and Engineering Practices (SEPs)**, **Crosscutting Concepts (CCCs)**, and **Disciplinary Core Ideas (DCIs)**. This three-dimensional approach to teaching and learning helps educators provide meaningful learning experiences that offer varied entry points for students from diverse backgrounds.

The performance expectations in fourth grade help students engage in inquiry questions such as, **but not limited to:**

What are waves and what are some things they can do?

Students use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move.

What is energy and how is it related to motion?

Students use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object.

What patterns of Earth's features can be determined with the use of maps?

Students analyze and interpret data from maps to describe patterns of Earth's features.

How can energy be used to solve a problem?

Students apply their understanding of energy to design, test, and refine a device that converts energy from one form to another.

How is energy transferred?

Students ask questions and make observations to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions.

How can water, ice, wind and vegetation change the land?

Students develop an understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans.

How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?

Students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye.

***The PEs should be bundled to design classroom experiences. There are multiple ways to bundle the PEs to help students lead inquiry and see connections between ideas, and help teachers facilitate phenomenon-driven learning with efficient use of instructional time.**

Fourth Grade

Through the fourth-grade performance expectations, students demonstrate grade-appropriate proficiency in each of three dimensions. When students explore **Disciplinary Core Ideas** (Dimension 3), they will do so by engaging in **Science and Engineering Practices** (Dimension 1) and should be supported in making connections to the **Crosscutting Concepts** (Dimension 2) to link their understanding across the four disciplinary core domains.

Each performance expectation contains one **SEP** and one **CCC** to be assessable and represents the student performance goal for the end of instruction; however, other **SEPs** and **CCCs** should be applied by students to support their progress leading up to the end of instruction. In fourth grade, these **end-of-instruction SEPs, DCIs, and CCCs** include:

SEPs	DCIs	CCCs
<ul style="list-style-type: none"> Asking Questions and Defining Problems Developing and Using Models Planning and Carrying Out Investigations Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, Evaluating, and Communicating Information 	<ul style="list-style-type: none"> Physical Science (PS3, PS4) Life Science (LS1) Earth and Space Science (ESS1, ESS2, ESS3) Engineering, Technology, and Applications of Science (ETS1, ETS2) 	<ul style="list-style-type: none"> Patterns Cause and Effect Systems and System Models Energy and Matter

Hyperlinks within the Standards Document

SC Conceptual Vertical Articulation links: Hover over the above underlined and hyperlinked titles to view links for all SEPs, DCIs, and CCCs.

A Framework for K-12 Science Education links: Hover over titles found within the foundation boxes under each PE to link the guiding research for all SEPs, DCIs, and CCCs.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Analyzing and Interpreting Data Analyzing data in K-2 builds on prior experiences and progresses to collecting, recording, and sharing observations.</p> <p>Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. NRC Framework Link</p>	<p>LS1.C: Organization for Matter and Energy Flow in Organisms All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. NRC Framework Link</p>	<p>Patterns Patterns in the natural and human designed world can be observed and used as evidence. NRC Framework Link</p>

*Equity in science education requires that all students are provided with equitable opportunities to learn science and become engaged in science and engineering practices; with access to quality space, equipment, and teachers to support and motivate that learning and engagement; and adequate time spent on science. In addition, the issue of connecting to students' interests and experiences is particularly important for broadening participation in science (NRC Framework, p. 28).

Energy (PS3)

4

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

State Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>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.</p> <p>Use evidence (e.g., measurements, observations, patterns) to construct an explanation. NRC Framework Link</p>	<p>PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. NRC Framework Link</p>	<p>Energy and Matter Energy can be transferred in various ways and between objects. NRC Framework Link</p>

Energy (PS3)

4

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

State Assessment Boundary: Assessment does not include quantitative measurements of energy or the difference between transferring and transforming energy.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<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> <p>Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. NRC Framework Link</p>	<p>PS3.A: Definitions of Energy Energy can be moved [transferred] from place to place by moving objects or through sound, light, or electric currents. NRC Framework Link</p> <p>PS3.B: Conservation of Energy and Energy Transfer Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.</p> <p>Light also transfers energy from place to place.</p> <p>Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. NRC Framework Link</p>	<p>Energy and Matter Energy can be transferred in various ways and between objects. NRC Framework Link</p>

Energy (PS3)

4

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.

State Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object (acceleration) or quantitative measurements of energy.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Asking Questions and Defining Problems Asking questions and defining problems in grades 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships.</p> <p>Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause-and-effect relationships. NRC Framework Link</p>	<p>PS3.A: Definitions of Energy Energy can be moved from place to place by moving objects or through sound, light, or electric currents. NRC Framework Link</p> <p>PS3.B: Conservation of Energy and Energy Transfer Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. NRC Framework Link</p> <p>PS3.C: Relationship Between Energy and Forces When objects collide, the contact forces transfer energy so as to change the objects' motions. NRC Framework Link</p>	<p>Energy and Matter Energy can be transferred in various ways and between objects. NRC Framework Link</p>

Energy (PS3)

4




4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, and time to design the device.

State Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy (batteries) to cause motion or produce light or sound.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>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.</p> <p>Apply scientific ideas to solve design problems. NRC Framework Link</p>	<p>PS3.B: Conservation of Energy and Energy Transfer Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. NRC Framework Link</p> <p>PS3.D: Energy in Chemical Processes and Everyday Life The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. NRC Framework Link</p> <p>ETS1.A: Defining and Delimiting an Engineering Problem 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). (Continued Next Page)</p>	<p>Energy and Matter Energy can be transferred in various ways and between objects. NRC Framework Link</p>

	<p>ETS1.A: Defining and Delimiting an Engineering Problem (Cont.) 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. NRC Framework Link</p> <p>ETS1.B: Developing Possible Solution 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. NRC Framework Link</p> <p> ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World Engineers improve existing technologies or develop new ones. (<i>secondary</i>) NRC Framework Link</p>	
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Waves and their Applications in Technologies for Information Transfer (PS4)

4

4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

Clarification Statement: Examples of models include diagrams, analogies, or physical models using (but not limited to) stringed beads, rubber bands, wire, or yarn to illustrate amplitude of waves and wavelength.

State Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.

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> <p>Develop a model using an analogy, example, or abstract representation to describe a scientific principle. NRC Framework Link</p>	<p>PS4.A: Wave Properties Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.</p> <p>Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). NRC Framework Link</p>	<p>Patterns Similarities and differences in patterns can be used to sort and classify natural phenomena. NRC Framework Link</p>

Waves and their Applications in Technologies for Information Transfer (PS4)

4

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

State Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.

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> <p>Develop a model to describe phenomena. NRC Framework Link</p>	<p>PS4.B: Electromagnetic Radiation An object can be seen when light reflected from its surface enters the eyes. NRC Framework Link</p>	<p>Cause and Effect Cause-and-effect relationships are routinely identified. NRC Framework Link</p>


Waves and their Applications in Technologies for Information Transfer (PS4)

4



4-PS4-3. Generate and compare multiple solutions that use patterns to transmit information.

Clarification Statement: Examples of solutions include drums sending coded information through sound waves, using a grid of 0s and 1s representing black and white to send information about a picture, QR codes, barcodes, and using Morse code to send text. The coding method does not need to be electronic or digital, and the code should only be two possible values such as on/off, 0/1, black/white.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>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.</p> <p>Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. NRC Framework Link</p>	<p>PS4.C: Information Technologies and Instrumentation Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.</p> <p>When in digitized form, information can be recorded, stored for future recovery, and transmitted over long distances without significant degradation of the wave. NRC Framework Link</p> <p>ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of the best solves the problem, given the criteria and the constraints. NRC Framework Link</p> <p> ETS2.A: Interdependence of Science, Engineering, and Technology Knowledge of relevant scientific concepts and research findings is important in engineering. NRC Framework Link</p>	<p>Patterns Similarities and differences in patterns can be used to sort and classify designed products. NRC Framework Link</p>

From Molecules to Organisms: Structures and Processes (LS1)

4

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function together in a system to support survival, growth, behavior, and reproduction.

Clarification Statement: Examples of structures could include thorns, roots, heart, lungs, or skin.

State Assessment Boundary: Assessment does not include microscopic structures within plant and animal systems.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<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> <p>Construct an argument with evidence, data, and/or a model. NRC Framework Link</p>	<p>LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. NRC Framework Link</p>	<p>Systems and System Models A system can be described in terms of its components and their interactions. NRC Framework Link</p>

From Molecules to Organisms: Structures and Processes (LS1)

4

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Clarification Statement: Emphasis is on systems of information transfer.

State Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

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> <p>Use a model to test interactions concerning the functioning of a natural system. NRC Framework Link</p>	<p>LS1.D: Information Processing Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal’s brain.</p> <p>Animals are able to use their perceptions and memories to guide their actions. NRC Framework Link</p>	<p>Systems and System Models A system can be described in terms of its components and their interactions. NRC Framework Link</p>

Earth's Place in the Universe (ESS1)

4

4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.

State Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>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.</p> <p>Identify the evidence that supports particular points in an explanation. NRC Framework Link</p>	<p>ESS1.C: The History of Planet Earth Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. NRC Framework Link</p>	<p>Patterns Patterns can be used as evidence to support an explanation. NRC Framework Link</p>

Earth's Systems (ESS2)

4

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.

State Assessment Boundary: Assessment is limited to a single form of weathering or erosion.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<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> <p>Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. NRC Framework Link</p>	<p>ESS2.A: Earth Materials and Systems Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. NRC Framework Link</p> <p>ESS2.E: Biogeology Living things affect the physical characteristics of their regions. NRC Framework Link</p>	<p>Cause and Effect Cause-and-effect relationships are routinely identified, tested, and used to explain change. NRC Framework Link</p>

Earth's Systems (ESS2)

4

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, or earthquakes.


Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Analyzing and Interpreting Data Analyzing data in 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <p>Analyze and interpret data to make sense of phenomena using logical reasoning. NRC Framework Link</p>	<p>ESS2.B: Plate Tectonics and Large-Scale System Interactions The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. NRC Framework Link</p>	<p>Patterns Patterns can be used as evidence to support an explanation. NRC Framework Link</p>

Earth and Human Activity (ESS3)

4

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and how their uses affect the environment.

Clarification Statement: Examples of renewable resources could include wind energy, water behind dams, and sunlight; non-renewable resources are fossil and nuclear fuels.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3-5 builds on K-2 experiences and progresses to evaluate the merit and accuracy of ideas and methods.</p> <p>Obtain and combine information from books and other reliable media to explain phenomena. NRC Framework Link</p>	<p>ESS3.A: Natural Resources All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. NRC Framework Link</p> <div style="text-align: center;">  </div> <p>ETS2.A: Interdependence of Science, Engineering, and Technology Knowledge of relevant scientific concepts and research findings is important in engineering. NRC Framework Link</p> <p>ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World Over time, people’s needs and wants change, as do their demands for new and improved technologies. NRC Framework Link</p>	<p>Cause and Effect Cause-and-effect relationships are routinely identified and used to explain change. NRC Framework Link</p>

Earth and Human Activity (ESS3)


4



4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Clarification Statement: Examples of solutions could include designing earthquake or hurricane resistant buildings, improving the monitoring of tornadic or volcanic activity, and constructing waterways for floodwaters.

State Assessment Boundary: Assessment is limited to earthquakes, floods, hurricanes, tornadoes, and coastal erosion.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>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. Use evidence in creating multiple solutions to design problems.</p> <p>Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. NRC Framework Link</p>	<p>ESS3.B Natural Hazards A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. NRC Framework Link</p> <p>ETS1.B: Developing Possible Solutions Testing a solution involves investigating how well it performs under a range of likely conditions. Communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. NRC Framework Link</p> <p> ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. NRC Framework Link</p>	<p>Cause and Effect Cause-and-effect relationships are routinely identified, tested, and used to explain change. NRC Framework Link</p>