

DRAFT 4th Grade Unit Guide

<p style="text-align: center;">What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem? What are waves and what are some things they can do?</p>	<p style="text-align: center;">How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?</p>	<p style="text-align: center;">How can water ice, wind and vegetation change the land? What patterns of Earth's features can be determined with the use of maps?</p>
<p>4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object. [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.]</p> <p>4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [Assessment Boundary: Assessment does not include quantitative measurements of energy.]</p> <p>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.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]</p> <p>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, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]</p> <p>4-ESS3-1.¹ Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; nonrenewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]</p> <p>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 could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]</p> <p>4-PS4-2.¹ Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]</p> <p>4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.* [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]</p>	<p>4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]</p> <p>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.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]</p> <p>4-PS4-2.¹ Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]</p>	<p>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.] [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.]</p> <p>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.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]</p> <p>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, and earthquakes.]</p> <p>4-ESS3-1.¹ Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; nonrenewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]</p> <p>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 an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]</p>

¹ This content can be integrated into multiple units; mastery is expected at the end of the year.

Science and Engineering Practices	Disciplinary Core Ideas
<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> <ul style="list-style-type: none"> • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3) <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 analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1) • Develop a model to describe phenomena. (4-PS4-2) • Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2) <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"> • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-PS3-2), (4-ESS2-1) <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> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2) <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> <ul style="list-style-type: none"> • Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) • Apply scientific ideas to solve design problems. (4-PS3-4) • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3), (4-ESS3-2) • Identify the evidence that supports particular points in an explanation. (4-ESS1-1) <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"> • Construct an argument with evidence, data, and/or a model. (4-LS1-1) <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 other reliable media to explain phenomena. (4-ESS3-1) 	<p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> • The faster a given object is moving, the more energy it possesses. (4-PS3-1) • Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2), (4-PS3-3) • 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. (4-PS3-2), (4-PS3-3) • Light also transfers energy from place to place. (4-PS3-2) • 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. (4-PS3-2), (4-PS3-4) <p>PS3.C: Relationship Between Energy and Forces</p> <ul style="list-style-type: none"> • When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3) <p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> • The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4) <p>PS4.A: Wave Properties</p> <ul style="list-style-type: none"> • 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. (Note: This grade band endpoint was moved from K–2). (4-PS4-1) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1) <p>PS4.B: Electromagnetic Radiation</p> <ul style="list-style-type: none"> • An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2) <p>PS4.C: Information Technologies and Instrumentation</p> <ul style="list-style-type: none"> • 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. (4-PS4-3) <p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) <p>LS1.D: Information Processing</p> <ul style="list-style-type: none"> • Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2) <p>ESS1.C: The History of Planet Earth</p> <ul style="list-style-type: none"> • 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. (4-ESS1-1) <p>ESS2.A: Earth Materials and Systems</p> <ul style="list-style-type: none"> • 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. (4-ESS2-1) <p>ESS2.B: Plate Tectonics and Large-Scale System Interactions</p> <ul style="list-style-type: none"> • 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. (4-ESS2-2) <p>ESS2.E: Biogeology</p> <ul style="list-style-type: none"> • Living things affect the physical characteristics of their regions. (4-ESS2-1) <p>ESS3.A: Natural Resources</p> <ul style="list-style-type: none"> • 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. (4-ESS3-1) <p>ESS3.B: Natural Hazards</p> <ul style="list-style-type: none"> • 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. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.) <p>ETS1.A: Defining Engineering Problems</p> <ul style="list-style-type: none"> • 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. (Secondary to 4-PS3-4) <p>ETS1.B: Designing Solutions to Engineering Problems</p> <ul style="list-style-type: none"> • Testing a solution involves investigating how well it performs under a range of likely conditions. (Secondary to 4-ESS3-2) <p>ETS1.C: Optimizing The Design Solution</p> <ul style="list-style-type: none"> • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (Secondary to 4-PS4-3)
<p>Patterns</p> <ul style="list-style-type: none"> • Similarities and differences in patterns can be used to sort and classify natural phenomena or designed products. (4-PS4-1), (4-PS4-3) • Patterns can be used as evidence to support an explanation. (4-ESS1-1), (4-ESS2-2) <p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. (4-PS4-2), (4-ESS2-1), (4-ESS3-1), (4-ESS3-2) <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. (4-LS1-1), (4-LS1-2) <p>Energy and Matter</p> <ul style="list-style-type: none"> • Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4) <p>Crosscutting Concepts</p>	

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