Instructional Support for the Idaho State Science Content and Performance Standards: Fourth Grade				
Content Domain	**Performance Standard**	**Supporting Content**	**Science and Engineering Practice**	**Cross Cutting Concept**
Physical Sciences: Energy	**PS1-4-1**. Use evidence to construct an explanation relating the speed of an object to the energy of that object.	**Speed and Energy Relationship** The faster a given object is moving, the more energy it possesses. **Limit**: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.	**Constructing Explanations and Designing Solutions** • Identify a claim that the speed of an object is related to the energy of the object. • Identify relevant evidence including the relative speed and energy of objects. • Use reasoning to connect the evidence to support an explanation relating speed and energy of an object.	**Energy and Matter** • Energy can be transferred in various ways and between objects.
	PS1-4-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	**Energy Transfers from Place to Place** Energy can be moved from place to place by moving objects or through sound, light, or electric currents. The Law of Conservation of Energy states energy cannot be created or destroyed, but transferred and transformed. 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. Light also transfers energy from place to place. 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. **Limit**: Assessment does not include quantitative measurements of energy.	**Planning and Carrying Out Investigations** • From a given investigation plan, describe the transfer and transformation of energy. • Describe data that can be collected and how it will serve as evidence of energy transfer and transformation. • Collect data to provide evidence that energy is present everywhere and transfers between objects and forms.	**Energy and Matter** • Energy can be transferred in various ways and between objects.
	PS1-4-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.	**Energy Changes When Object Collide** In addition to the Supporting Content from PS1-4-2, when objects collide, forces from the contact transfer energy and the objects' motion changes. • **Emphasis** is on the change in energy due to the change in speed, not on the forces, as objects interact. **Limit:** Assessment does not include quantitative measurements of energy.	**Asking Questions and Defining Problems** • Ask clarifying questions about changes in energy that occur when objects collide and questions that can be further investigated. • Predict outcomes of collisions between objects.	**Energy and Matter** • Energy can be transferred in various ways and between objects.
	PS1-4-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	**Energy Conversions** 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. The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. 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. • **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. **Limit:** 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.	**Constructing Explanations and Designing Solutions** • Collaboratively design a solution to a given problem that converts energy from one form to another. • Evaluate the solution relative to specific criteria and constraints. • Test the device and use results to address design problems and improve function.	**Energy and Matter** • Energy can be transferred in various ways and between objects.

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Physical Sciences: Waves	**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.	**Wave Properties and Patterns** 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. Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). • **Examples** of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves. **Limit**: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.	**Developing and Using Models** • Develop a model to make sense of a phenomenon that involves wave behavior. • The model should identify and describe relevant relationships within the model. • Use the model to describe patterns in wave behavior.	**Patterns** • Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.
	4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	**Light Reflection and Vision** An object can be seen when light reflected from its surface enters the eye. **Limit**: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.	**Developing and Using Models** • Develop a model to make sense of a phenomenon that involves the relationship between light, reflection, and visibility of objects. • Identify and describe causal relationships between light and vision. • Use the model to describe that objects must either make their own light or reflect light to be seen. • Use the model to describe the effects of changing the light that results in vision (ex: changing the light source, lines of sight, mirrors, transparent vs. translucent vs. opaque barriers, etc.).	**Cause and Effect** • Cause and effect relationships are routinely identified.
	4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.	**Transfer of Information** Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cellphones, can receive and decode information—convert it from digitized form to voice—and vice versa. • **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. Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.	**Constructing Explanations and Designing Solutions** • Generate at least two design solutions for a given problem that uses patterns to transmit information. • Identify design criteria and constraints. • Compare solutions based on criteria. • Identify similarities and differences in the patterns and accuracy of solutions.	**Patterns** • Similarities and differences in patterns can be used to sort and classify designed products.

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Life Sciences: Molecules to Organisms: structure and Processes	**LS1-4-1.** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	**Internal and External Structures of Plants and Animals have Specific Functions** Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. Animals have various body systems with specific functions for sustaining life: skeletal, circulatory, respiratory, muscular, digestive, etc. • **Examples** of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin. **Limit**: Assessment is limited to macroscopic structures within plant and animal systems.	**Engaging in Argument from Evidence** • Make a claim that includes how plant and animal structures function together as part of a system. • Describe evidence of structures and their functions. • Determine strengths and weaknesses of evidence including relevance and sufficiency. • Use reasoning to connect relevant and appropriate evidence to construct an argument (chain of reasoning) about specific functions of structures, purposes of the structures, and how they can work together as a system for specific purposes.	**Systems and System Models** • A system can be described in terms of its components and their interactions.
	LS1-4-2. 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.	**Animals Receive, Process & Respond to Information** 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. • **Emphasis** on systems of information transfer. **Limit**: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.	**Developing and Using Models** • From a given model, identify and describe relevant components for testing interactions of a natural system. • Describe relationships of components, including types of sensors, and processes of sending and receiving information. • Use the model to describe the system relationships between sensory input, the brain, and behavioral output. • Use the model to test interactions of sensory perception and its influence on animal behavior.	**Systems and System Models** • A system can be described in terms of its components and their interactions.
Life Sciences: Ecosystems: Interaction, Energy, and Dynamics	**LS2-4-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	**Movement of Matter Throughout an Ecosystem** The food animals eat 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 plant 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. 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 matter (gas, liquid, or solid) back into the environment. • **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. **Limit**: Assessment does not include molecular explanations.	**Developing and Using Models** • Develop a model that includes the movement of matter within an ecosystem and identifies relevant components: matter, plants, animals, decomposers, and the environment. • Describe the relationships between components and the exchange of matter from and back into the environment. • Use the model to describe the cycling of matter, how component interactions meet the needs of many species, that newly introduced species can affect the balance of interactions, and that changing one aspect will affect other aspects.	**Systems and System Models** • A system can be described in terms of its components and their interactions.

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Earth and Space Sciences: Earth's Place in the Universe	**ESS1-4-1.** Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time.	**Rock Formations and Fossils Reveal Changes Over Time** 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. There are three classifications of rocks produced within the rock cycle: sedimentary, metamorphic, and igneous. • **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. **Limit**: 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.	**Constructing Explanations and Designing Solutions** • From a given explanation, identify specific aspects about the idea that landscapes change over time. • Identify supportive and relevant evidence from patterns in rock layers, including global, local, and regional areas. • Use reasoning to connect evidence and describe how reasoning supports particular points of the explanation.	**Patterns** • Patterns can be used as evidence to support an explanation.
Earth and Space Sciences: Earth's Systems	**ESS2-4-1.** Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	**Effects of Weathering and Erosion** 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. Living things affect the physical characteristics of their regions. • **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. **Limit:** Assessment is limited to a single form of weathering or erosion.	**Planning and Carrying Out Investigations** • From a given investigation plan, identify and describe the purpose and necessary data to collect for evidence of the effects of weathering or the rate of erosion of Earth's materials. • Describe how data will be collected and the controlled variables. • Make and record observations to provide evidence for the effects of weathering or rate of erosion.	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change.
	ESS2-4-2. Analyze and interpret data from maps to describe patterns of Earth's features.	**Use Maps to Describe Patterns of Earth's Features** 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. • **Examples** of 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.	**Analyzing and Interpreting Data** • Organize data using graphical displays from maps of earth's features. • Identify patterns in the location of Earth features, such as locations of mountain ranges, earthquakes, and volcanoes. • Use reasoning to describe how the patterns reflect how features are formed or occur.	**Patterns** • Patterns can be used as evidence to support an explanation.

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Earth and Space Sciences: Human Activity	**ESS3-4-1.** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	**Energy and Fuels come from Natural Resources; Their Use Affects the Environment** 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. • **Examples** of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources include wood, fossil fuels, and atomic energy. Examples of environmental effects could include negative biological impacts of wind turbines, erosion due to deforestation, flood prevention due to dams, loss of habitat due to dams, loss of habitat due to surface mining, air pollution from burning of fossil fuels, prevention of air pollution from use of alternative energy sources, and maintenance of forest health through forest management.	**Obtaining, Evaluating, and Communicating Information** • Gather information from reliable sources about energy resources and fossil fuels, including how they are derived, how they address human energy needs, and positive and negative environmental effects. • Combine information about the effects of an energy resource on the environment, if the resource is renewable, and the role of technology in improving or mediating the environmental effects of that resource. • Use information to provide evidence and describe causal relationships between resources and their environmental effects and the role of technology in extracting and using an energy source.	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change.
	ESS3-4-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	**Natural earth Processes Impact Humans** 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. Testing a solution involves investigating how well it performs under a range of likely conditions. • **Examples** of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity. **Limit**: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.	**Constructing Explanations and Designing Solutions** • Given a natural Earth process that can have a negative effect, design at least two solutions that reduce its effects on humans. • Describe the cause and effect relationship between the Earth process and the effect. • Describe solution criteria and constraints. • Evaluate and compare solutions to criteria, constraints, and each other. • Describe the solution in terms of how each alters the effect of the Earth process on humans.	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change.