Science / 4th Grade

Energy

Subject	Grade	Unit	Suggested Timeline
Science	4th	Energy	11 weeks

Grade Level Summary
The 4th grade science curriculum focuses on giving students a broad understanding of science concepts. The focus is on physical science, earth science, life/biological science, technology and engineering education, and crosscutting concepts. Students will experience an inquiry based learning approach using observation and scientific method that encourages collaboration, critical thinking, creativity, and communication.

Grade Level Units
Energy
Soils, Rocks and Landforms
Environments

Unit Title
Energy

Unit Summary
The **Energy Module** provides first-hand experiences in physical science dealing with energy and change. Students investigate electricity and magnetism as related effects and engage in engineering design while learning useful applications of electromagnetism in everyday life. They explore energy transfer through waves, repeating patterns of motion, that result in sound and motion.
The five investigations focus on the concepts that energy is present whenever there is motion, electric current, sound, light, or heat, and that energy can transfer from one place to other. Students conduct controlled experiments by incrementally changing variables to determine how to make an electromagnet stronger and how the amount of energy transfer changes when balls of different masses hit a stationary object. Students interpret data from graphs to build explanations from evidence and make predictions of future events. They develop models to represent how energy moves from place to place in electric circuits and in waves. Students gain experiences that will contribute to the understanding of crosscutting concepts of patterns; cause and effect; systems and system models; and energy and matter.

Unit Essential Questions

1. How can one explain the structure, properties, and interactions of matter?
2. How can one explain and predict interactions between objects within systems?
3. How is energy transferred and conserved?
4. How are waves used to transfer energy and information?

Key Understandings

1. Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.
2. Interactions between any two objects can cause changes in one or both.
3. Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.
4. Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.

Focus Standards Addressed in the Unit	
3.2.4. B1	Explain how an object's change in motion can be observed and measured.
3.2.4. B2	Identify types of energy and their ability to be stored and changed from one form to another.
3.2.4. B4	Apply knowledge of basic electrical circuits to the design and construction of simple direct current circuits. Compare and Contrast series and parallel circuits. Demonstrate that magnets have poles that repel and attract each other.
3.2.4. B3	Understand that objects that emit light often emit heat.
3.2.4. B5	Demonstrate how vibrating objects make sound and sound can make things vibrate. Demonstrate how light can be reflected, refracted, or absorbed by an object.
3.2.4. B6	Energy: Give examples how how energy can be transformed from one form to another.

Important Standards Addressed in the Unit	
PS3.A	**Definitions of energy** •energy can be moved from place to place by moving objects or through sound, light,or electric currents. 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.
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.
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.
PS3.C	**Relationship between energy and forces** •When objects collide, the contact forces transfer so as to change the object's' motion.
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 the beach. •Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

Misconceptions	Proper Conceptions
● Energy is only present when there is only motion. ● Energy can be transferred between objects. ● Energy is in waves.	● Energy is present whenever there is motion, electric current, sound, light, or heat, and that energy can transfer from one place to other. ● Students conduct controlled experiments by incrementally changing variables to determine how to make an electromagnet stronger and how the amount of energy transfer changes when balls of different masses hit a stationary object. ● They develop models to represent how energy moves from place to place in electric circuits and in waves.

Concepts	Competencies	Vocabulary
● When objects touch or collide, they push on one another and can change motion or shape. Magnets create a magnetic field that can exert an attracting or repelling force on other objects that can affect motion. (PS2.B) (PS3.C) ● Magnets create a magnetic field that can exert an attracting or repelling force on other objects that can affect motion. (PS2.B) ● Materials that allow electricity to flow are conductors; those that do not are insulators. (PS3.A) ● Electrical circuits require a complete loop through which an electrical current can pass. (PS3.A) ● An open circuit is an incomplete electric pathway; a closed circuit is a complete pathway. (PS3.A) ● A core of iron or steel becomes an electromagnet when electricity flows through a coil of insulated wire surrounding it. (PS3.B) (PS2.B) ● Electromagnetic forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the	● Investigate the forces between two or more magnets to identify patterns. (3-PS2-4) (3-PS2-2) ● Investigate the push-and-pull forces between objects not in contact with one another. (3-PS2-3) ● Design and refine solutions to a problem by using magnets to move objects not in contact with one another. (3-PS2-3) ● Investigate and describe conductors and insulators (4-PS3-1) ● Construct serial and parallel circuits and describe the path of electrons in the circuit (4-PS3-1) ● Demonstrate and explain open and closed circuits utilizing switches. (4-PS3-1) ● Construct an electromagnet and plan an investigation to determine how one can make the electromagnet stronger or weaker. (4-PS3-4) (3-PS2-3) ● Plan and carry out an investigation to determine factors that affect the strength of electric and magnetic forces. (4-PS3-4) (3-PS2-3) ● Construct an explanation using data why an object subjected to multiple	Attract Collision Friction Gravity Magnets Repel Conductor Electricity Insulator Parallel circuit Serial circuit System Closed circuit Open circuit Switch Current Electromagnet Forces Pull Push Energy Force Magnet Transfer Motion Collision Electric current Energy Heat Light Magnets Sound

distances between the interacting objects. (PS3.B) (PS2.B) ● A system can appear to be unchanging when processes within the system are going on at opposite but equal rates (e.g., water behind a dam is at a constant height because water is flowing in at the same rate that water is flowing out). ● Magnets can exert forces on other magnets or on materials, causing energy transfer between them (e.g., leading to changes in motion) even when the objects are not touching. (PS2.B) ● The faster a given object is moving, the more energy it possesses. (PS3.A) ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (PS3.A) ● 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. (ESS3.A) ● Energy is present whenever there are moving objects, sound, light, or heat. (PS3.B) ● 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. (PS3.C) ● The expression "produce energy" typically refers to the conversion of stored energy into a desired form for	pushes and pulls might stay in one place or move. ● Demonstrate the energy transfer between two objects using a magnet and another object. (3-PS2-3) ● Use evidence to construct an explanation for the relationship between speed, energy and motion. (4-PS3-2) ● Carry out investigations to provide evidence that energy is transferred from place to place by sound, light, heat, electric currents, interacting magnets, and moving or colliding objects. (4-PS3-2) ● Obtain and communicate information for how technology allows humans to concentrate, transport, and store energy for practical use. (4-PS3-4) ● Design and construct a device that converts energy from one form to another using given design criteria. (4-PS3-4) ● Design and test a solution to a problem that utilizes the transfer of electric energy in the solution using given design constraints.(4-PS3-4) ● Develop a model using examples to explain differences between renewable and non-renewable sources of energy. (4-ESS3-1) ● Carry out investigations to provide evidence that energy is transferred from place to place by sound, light, heat, electric currents, interacting magnets, and moving or colliding objects.(4-PS3-4) ● Make observations to provide evidence that energy can be transferred from place to place by	Transformation conversion Non-renewable energy Renewable energy Battery Conversion Energy Production Stored Energy Amplitude Wavelength Waves Earthquake Seismic Waves Reflection Refraction Decode Digitized information Encode Pixels Transmit

practical use. It is important to be able to concentrate energy so that it is available for use where and when it is needed (e.g., batteries). (PS3.D) ● Waves are regular patterns of motion, and 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; it does not move horizontally. (PS4.A) ● 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; it does not move in the direction of the wave—observe, for example, a bobbing cork or seabird—except when the water meets the beach. (PS4.A) ● Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (PS4.A) ● Earthquakes cause seismic waves, which are waves of motion in the Earth's crust.(PS4.A) ● An object can be seen when light reflected from its surface enters the eyes. (PS4.B) ● The color people see depends on the color of the available light sources as well as the properties of the surface. (PS4.B) ● Digitized information (e.g., the pixels of a picture) can be stored for future recovery or transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode	sound, light, heat, and electrical currents. (4-PS3-2) ● Construct an explanation for the relationship between energy and motion. (4-PS3-2) (4-PS3-3) ● Construct an investigation to demonstrate the relationship between energy and motion.(4-PS3-3) ● Ask questions and predict outcomes about the changes in energy that occur when objects collide.(4-PS3-3) ● Obtain and communicate information explaining how technology allows humans to concentrate, transport, and store energy for practical use.(4-PS3-4) ● Identify the patterns of waves by observing their motion in water.(4-PS4-1) ● Provide evidence that waves transfer energy to objects as a wave passes.(4-PS4-1) ● Plan data collection methods and make observations to provide evidence that waves transfer energy to objects.(4-PS4-1) ● Use a model to describe the amplitude and wavelength of waves.(4-PS4-1) ● Describe how similar seismic waves are to other types of waves.(4-PS4-1) ● Investigate and provide evidence that the color people see depends on the color of the available light sources as well as the properties of the surface of the object reflecting the light.(4-PS4-2) ● Investigate and provide evidence that the color people see depends on	

information—convert it from digitized form to voice—and vice versa. (PS4.C)	the color of the available light sources as well as the properties of the surface of the object reflecting the light.(4-PS4-2) ● Obtain and communicate information about modern devices that are used to transmit and receive digital information.(4-PS4-3)	

Assessments:

- Energy Post Test/Survey: Energy
- Investigation 1 I check
- Investigation 2 I check
- Investigation 3 I check
- Investigation 4 I check

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction

- Science Notebook entries
- Apply Knowledge of science and technology in public discussion on relevant issues in a changing world
- Conduct investigations individually and collaboratively to answer questions
- Validate scientific claims for validity
- Think systemically

Differentiation:

- Provide multiple means of representation. Give learners various ways to acquire information and knowledge.
- Provide multiple means of action and expression. Offer students alternatives for demonstrating what they know.
- Provide multiple means of engagement. Help learners get interested, be challenged, and stay motivated.
- Use new media and technologies to improve instruction.
- Scaffold Notes

Interdisciplinary Connections:

- See FOSS and Common Core-Math Grade 4 Guide on www.fossweb.com
- See FOSS and Common Core-ELA Grade 4 Guide on www.fossweb.com

Additional Resources:

- See FOSS Digital Only Resources on www.fossweb.com

Created By:

Marianne Kirkhoff

Science / 4th Grade

Environments

Subject	Grade	Unit	Suggested Timeline
Science	4th	Environments	9 Weeks

Grade Level Summary
The 4th grade science curriculum focuses on giving students a broad understanding of science concepts. The focus is on physical science, earth science, life/biological science, technology and engineering education, and crosscutting concepts. Students will experience an inquiry based learning approach using observation and scientific method that encourages collaboration, critical thinking, creativity, and communication.

Grade Level Units
Energy, Soils, Rocks and Landforms, Environments

Unit Title
Environments

Unit Summary
The **Environments Module** has four investigations that focus on the concepts that organisms have structures and behaviors, including sensory receptors, that serve functions in growth, survival and reproduction, and living organisms depend on one another and on their environment for their survival and the survival of populations. Students design investigations to study preferred environments, range of tolerance, and optimum conditions for growth and survival of specific organisms. They conduct controlled experiments by incrementally changing specific environmental conditions to determine the range of tolerance for early growth of seeds and hatching of brine shrimp, and use these data to develop and use models to understand the impact of changes to the environment. They graph and interpret data from multiple trials of experiments and build explanations from evidence. Students gain experiences that will contribute to the understanding of crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change.

Unit Essential Questions

1. How do organisms live, grow, respond to their environment, and reproduce?
2. How and why do organisms interact with their environment and what are the effects of these interactions?
3. How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

Key Understandings

1. All organisms are made of cells and can be characterized by common aspects of their structure and functioning
2. Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment
3. Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Focus Standards Addressed in the Unit	
3.1.4.A	● Classify plants and animals according to the physical characteristics that they share ● Describe the different resources that plants and animals need to live ● Identify differences in the life cycles of plants and animals ● Describe common functions living things share to help them function in a specific environment ● Construct and interpret models and diagrams of various animal and plant life cycles
3.1.4.B	● Describe features that are observable in both parents and their offspring ● Recognize that reproduction is necessary for the continuation of life ● Identify observable patterns in the physical characteristics of plants or groups of animals
3.1.4.C	● Identify different characteristics of plants of animals that help some populations survive and reproduce in greater numbers ● Describe how environmental changes can cause extinction in plants and animals ● Describe plant and animal adaptations that are important to survival ● Compare fossils to one another and to currently living organisms according to their anatomical similarities and differences
4.1.4.A	● Explain how living things are dependent upon other living and nonliving things for survival
4.5.4.C	● Describe how human activities affect the environment
4.2.4.C	● Explain how freshwater organisms are adapted to their environment
3.1.3.A.1	● Describe characteristics of living things that help to identify and classify them

Important Standards Addressed in the Unit	
CC.RI.4.1	Refer to details/examples when explaining what the text says and when drawing inferences from text
CC.RI.4.2	Determine the main idea of a text and explain how it is supported by key details; summarize the text
CC.RI.4.4	Determine the meaning of general academic domain-specific words or phrases.
CC.RI.4.6	Compare and contrast a firsthand and secondhand account of the same topic
CC.RI.4.9	Integrate information from two texts on the same topic
CC.W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly
MP.2	Mathematically reason abstractly and quantitatively

Misconceptions	Proper Conceptions
● Living and nonliving components do not depend upon each other for survival.	● Plants and animals have internal and external structures that serve various functions to survive.
● Decomposers release some energy that is cycled back to plants.	● Decomposers break down dead organisms, returning nutrients to the soil so they can be used by plants. Some decomposers are eaten by carnivores.

Concepts	Competencies	Vocabulary
● Plants and animals have internal and external structures that serve various functions to survive. (LS1.A)	● Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (4-LS1-1)	Behaviors Cause and effect Function Offspring Reproduce Structure Survival System System Models

Assessments:

- Investigations 1 I check
- Investigations 2 I check
- Investigations 3 I check
- Investigations 4 I check
- Environment Post Test/Survey

Suggested Strategies to Support Design of Coherent Instruction

Charlotte Danielson's Framework for Teaching: Domain 3 Instruction ***(Instructional Activities, Methods of student engagement- All Pupil Responses)***

- Science Notebook entries
- Apply Knowledge of science and technology in public discussion on relevant issues in a changing world
- Conduct investigations individually and collaboratively to answer questions
- Validate scientific claims for validity
- Think systemically

Differentiation:

- Provide multiple means of representation. Give learners various ways to acquire information and knowledge.
- Provide multiple means of action and expression. Offer students alternatives for demonstrating what they know.
- Provide multiple means of engagement. Help learners get interested, be challenged, and stay motivated.
- Use new media and technologies to improve instruction.
- Scaffolded Notes

Interdisciplinary Connections:

- See FOSS and Common Core ELA- Grade 4 Guide on www.fossweb.com
- See FOSS and Common Core Math -Grade 4 Guide on www.fossweb.com

(Reference Teacher's Guide)

Additional Resources:

See FOSS Digital Only Resources on www.fossweb.com

Created By: Scott Eyster, Christine Bodisch

Science /4th Grade

Soils, Rocks, and Landforms Unit

Subject	Grade	Unit	Suggested Timeline
Science	4th	Soils, Rocks, and Landforms	9 weeks

Grade Level Summary
The 4th grade science curriculum focuses on giving students a broad understanding of science concepts. The focus is on physical science, earth science, life/biological science, technology and engineering education, and crosscutting concepts. Students will experience an inquiry based learning approach using observation and scientific method that encourages collaboration, critical thinking, creativity, and communication.

Grade Level Units
Energy; Soils, Rocks, and Landforms; Environments

Unit Title
Soils, Rocks, and Landforms

Unit Summary
The **Soils, Rocks, and Landforms Module** provides students with firsthand experiences with soils and rocks and modeling experiences using tools such as topographic maps and stream tables to study changes to rocks and landforms at Earth's surface.
This module has four investigations that focus on the concepts that weathering by water, ice, wind, living organisms, and gravity breaks rocks into smaller pieces, erosion (water, ice, and wind) transports earth materials to new locations, and deposition is the result of that transport process that builds new land. Students conduct controlled experiments by incrementally changing specific environmental conditions to determine the impact of changing the variables of slope and amount of water in stream tables. Students interpret data from diagrams and visual representations to build explanations from evidence and make predictions of future events. They develop model mountains and represent the landforms from different perspectives to look for change. Students gain experiences that will contribute to the understanding of crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; structure and function; and stability and change.

Unit Essential Questions	Key Understandings
1. What is the universe, and what is Earth's place in it? 2. How and why is Earth constantly changing? 3. How do Earth's processes and human activities affect each other?	1. The universe is composed of a variety of different objects, which are organized into systems each of, which develops according to accepted physical processes and laws. 2. The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that

	interact over a wide range of temporal and spatial scales. 3. The Earth's processes affect and are affected by human activities.

Focus Standards Addressed in the Unit	
3.3.3.A1	● Explain and give examples of the ways in which soil is formed.
3.3.4.A1	● Describe basic landforms.. ● Identify the layers of the earth. ● Recognize that the surface of the earth changes due to slow processes and rapid processes.
3.3.5.A1	● Describe how landforms are the result of a combination of destructive forces such as erosion and constructive erosion, deposition of sediment, etc.
3.3.4.A3	● Recognize that fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.
3.3.5A3	● Explain how geological processes observed today such as erosion, movement of lithospheric plates, and changes in the composition of the atmosphere are similar to those in the past.
3.3.4.A4.	● Recognize Earth's different water resources, including both fresh and saltwater. ● Describe phase changes in the forms of water on Earth.
4.2.4.B.	● Describe the characteristics of different types of wetlands.
4.3.4.A.	● Identify ways humans depend on natural resources for survival. ● Identify resources used to provide humans with energy, food, employment, housing and water.
4.4.4 C	● Use scientific inquiry to investigate the composition of various soils.
4.5.4.D.	● Describe a waste stream. ● Identify sources of waste derived from the use of natural resources. ● Identify those items that can be recycled and those that can not. ● Describe how everyday activities may affect the environment.

Important Standards Addressed in the Unit	
CC.RI.4.1	Refer to details/examples when explaining what the text says and when drawing inferences from text
CC.RI.4.2	Determine the main idea of a text and explain how it is supported by key details; summarize the text
CC.RI.4.4	Determine the meaning of general academic domain-specific words or phrases.
CC.RI.4.6	Compare and contrast a firsthand and secondhand account of the same topic
CC.RI.4.9	Integrate information from two texts on the same topic
CC.W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly
MP.2	Mathematically reason abstractly and quantitatively

Misconceptions		Proper Conceptions	

Concepts	Competencies	Vocabulary
● 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 (ESS1.C) ● 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. (ESS2.A) ● Living things affect the physical characteristics of their regions. (ESS2.E) ● The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. (ESS2.B) ● Water occurs underground, above ground, and in the atmosphere. (ESS2.A) ● Many types of rocks and minerals are formed from the remains of organisms or are altered by their activities. (ESS1.C) ● The presence and location of certain fossil types indicate the order in which rock layers were formed. (ESS1-C) ● Energy that humans use is derived from multiple natural sources and their use affects the environment in many ways. (ESS3.A)	● Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (4-ESS1-1) ● Make observations and measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or of water, speed of wind, deposition, slope, angles, etc.). (4-ESS2-1) ● Make observations and document how living things affect the physical characteristics in different regions. (4-ESS2-1) ● Analyze and interpret data from maps to describe patterns of Earth's features. (4-ESS2-2) ● Analyze and interpret data from maps to describe Earth's features (e.g., mountains, valleys, caves, sinkholes, lakes, rivers, peninsulas, lentic/lotic water systems, etc.) (4-ESS2-3) ● Identify various types of water environments in Pennsylvania. (4-ESS1-1) ● Use fossils as evidence to infer that some rocks were formed from the remains of once living organisms. (4-ESS1-1) ● Use evidence from patterns in rock formations and fossils in rock layers to support the explanation for a change in landforms and environments over time.	Fossils Rock Formations Deposition Erosion Vegetation Weathering Physical Characteristics Biogeology Earthquake Geographic Geologic Hazards Mountain Range Natural Plate Tectonics Trench Volcano Analyze Features Interpret Lakes Lentic Lotic Ponds Rivers Streams Watersheds Erosion Fossil Landform Organism Minerals Rock Layers Dams Fissile Materials Fossil Fuels Natural Resources Solar Earthquake Natural Hazard Tsunami Volcanic Eruptions Weather

● A variety of hazards result from natural processes (e.g,.earthquakes, tsunamis, etc.). Humans cannot eliminate the hazards , but can take steps to reduce the impact. (ESS3.B)	(4-ESS1-1) ● Research multiple sources to describe ways that energy and fuels are derived from natural resources and their impact. (4-ESS3-1) ● Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (4-ESS3-2)	

Assessments:

- Soils, Rocks, and Landforms Post Test/ Survey
- Investigations 1 I check
- Investigations 2 I check
- Investigations 3 I check
- Investigations 4 I check

Suggested Strategies to Support Design of Coherent Instruction

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- Science Notebook entries
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Differentiation:

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Created By:

Christine Bodisch