Fairfield Public Schools
Science Curriculum

Grade 4

Course: Description

The elementary science standards are driven by questions to spark curiosity, guide instruction, deepen investigation into phenomena, acquire rigorous content knowledge and enable students to transfer the knowledge of ideas in real-world situations and to design and find solutions to problems. In the performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the disciplinary core ideas in earth science, life science and physical science. The standards define what students should know about the most essential ideas in the major science disciplines. Cross-cutting concepts provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. These standards also tie together the influence of engineering, technology, and science on society and the natural world.

The fourth grade students are expected to use the practices to demonstrate understanding of the core ideas. The overall grade level focus is on the transfer of energy. Students are expected 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. Students are able to observe phenomena and use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students investigate phenomena related to waves to describe patterns of amplitude and wavelength, and that waves can cause objects to move. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. Students investigate and look for patterns in rock formations as well as topgraphic maps to understand the forces that shape our earth. Students are expected to develop 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 on humans. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that 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.

Course: Overview

Essential Understandings
• There is a relationship between the speed of an object and the energy of the object • Energy can be transferred in various ways and energy can change forms. • Plants and animals have internal and external structures that support survival, growth, behavior, and reproduction. • Rocks tell stories that explain changes over earth's history; formations, weathering, erosion. • A variety of hazards to humans result from earth's natural processes and humans can reduce some of these impacts.

Course Essential Questions
• What is the role of energy in our world? How can energy be transferred? • What are waves and what can they do? • How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? • How can effects of weathering change the land? • What patterns of Earth's features can be determined with the use of topographic maps?

Course: Year-at-a Glance

Unit	Title	Unit Essential Questions
1	Energy	• How does the speed of an object relate to the energy of that object? • How can energy be transferred through light, sound, physical objects colliding, or electric currents? • How is energy converted from one form to another? • How can energy be used to transfer information?
2	Waves & Structure, Function, and Info Processing	• What are the properties of waves and how can waves be described as patterns of motion? • How do waves cause objects to move, and how can waves be used to transfer information? • Why does light reflecting from an object and entering the eye allow for objects to be seen? • How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?
3	Earth's Systems: Processes that Shape the Earth	• How can rock formations and fossils tell the stories of change in landscape over time? • How can the effects of weathering or erosion by water, ice, wind, and vegetation change the land? • What patterns of Earth's features can be determined by analyzing rock formations and the use of topographic maps? • How can we reduce the impact of hazards caused by natural processes?

NGSS Standards
SCIENCE AND ENGINEERING PRACTICES (SEP): **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. Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3) **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. Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2) **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 (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) **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. Obtain and combine information from books and other
CROSS-CUTTING CONCEPTS (CCC): **Cause and Effect** Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) **Energy and Matter** Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Energy Unit

Overview

The energy unit is organized for students 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. When objects collide, the contact forces the transfer of energy to change the objects' motion. The emphasis will be on the change in the energy due to the change in speed. Students will understand the faster a given object is moving, the more energy it possesses. Students will think about how energy can be used to solve a problem by designing, testing, and refining a device that converts energy from one form to another. For example, solar power converts light into heat. Students will understand that 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, others are not. Examples of renewable energy sources can include wind energy, water behind dams, and sunlight. A non-renewable energy resource is fossil fuels.

Unit Content Objectives

At the conclusion of this unit, students will be able to:
4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another**.**
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Unit Essential Questions

- How does the speed of an object relate to the energy of that object?
- How can energy be transferred through light, sound, physical objects colliding, or electric currents?
- How is energy converted from one form to another?
- How can energy be used to transfer information?

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

PS3.A: Definitions of Energy

 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)

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. (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)

PS3.C: Relationship Between Energy and Forces

 When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)

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. (4-PS3-4)

ESS3.A: Natural Resources

 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)

ETS1.A: Defining Engineering Problems

 Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria).

Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4)

SCIENCE AND ENGINEERING PRACTICES (SEP):

- **Asking Questions and Defining Problems**
- **Planning and Carrying Out Investigations**
- **Constructing Explanations and Designing Solutions**
- **Obtaining, Evaluating, and Communicating Information**

CROSS-CUTTING CONCEPTS (CCC):

- **Cause and Effect**
- **Energy and Matter**

Corresponding CT Core Standards:

Common Core State Standards Connections:

ELA/Literacy –

RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1)

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1)

W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1)

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of
sources. (4-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1),(4-ESS3-1)

Mathematics –

MP.2 Reason abstractly and quantitatively. (4-ESS3-1)

MP.4 Model with mathematics. (4-ESS3-1)

4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal
statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)

4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be
interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation
and estimation strategies including rounding. (4-PS3-4)

Waves and Information
Structure, Function, and Information Processing

Overview

The Waves and Information/Structure, Function, and Information Processing Unit will develop an understanding of waves and explain what waves can do. Students investigate a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. Models may include diagrams and physical models, such as a Slinky, to illustrate wavelength and amplitude. Students will examine similarities and differences in wave patterns to learn that waves of the same type can differ in amplitude and wavelength. Students will compare multiple solutions that use patterns to transfer information. 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. Students will also study how digitized information can be transmitted over long distances and how information can be converted from digitized form to voice. In this unit fourth graders will construct an argument to explain that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Students will use a model to describe that animals receive different types of information through their senses, and that different sense receptors are specialized for particular kinds of information. This will help them to understand how animals use their perceptions and memories to guide their actions. **S**tudents will learn how information is received through the eye by developing a model. They will describe that light reflecting from an object and entering the eye allows the object to be seen.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- **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.**
- **4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.**
- **4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.**
- **4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.**
- **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.**

Unit Essential Questions
• What are the properties of waves and how can waves be described as patterns of motion? • How do waves cause objects to move, and how can waves be used to transfer information? • Why does light reflecting from an object and entering the eye allow for objects to be seen? • How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals, and How do animals process and respond to information through their senses?

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

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. (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)
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. (4-PS4-3)
ETS1.C: Optimizing The Design Solution
Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (secondary to 4-PS4-3)
PS4.B: Electromagnetic Radiation
An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)
LS1.A: Structure and Function
Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)
LS1.D: Information Processing
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)

SCIENCE AND ENGINEERING PRACTICES (SEP):

Developing and Using Models
Constructing Explanations and Designing Solutions
Connections to Nature of Science
Scientific Knowledge is Based on Empirical Evidence
Engaging in Argument from Evidence

CROSS-CUTTING CONCEPTS (CCC):

- **Patterns**
- **Connections to Engineering, Technology, and Applications of Science**
- **Interdependence of Science, Engineering, and Technology**
- **Cause and Effect**
- **Systems and System Models**

Corresponding CT Core Standards:
Common Core State Standards Connections:
ELA/Literacy –
RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS4-3)
RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3)
SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1)
W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)
SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-2),(4-LS1-2)
Mathematics –
MP.4 Model with mathematics. (4-PS4-1) (4-PS4-2)
4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1)
4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line symmetric figures and draw lines of symmetry. (4-LS1-1)

Earth's Systems: Processes that Shape the Earth Unit

Overview

The Earth's Systems: Processes that Shape the Earth unit, students develop an understanding that rock formations and fossils tell stories. Patterns of rock formations show changes in landscape over time due to earth forces such as earthquakes. For example, rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicates a change from land to water over time. A canyon with different rock layers in the walls and a river in the bottom, indicates that over time a river cut though the rock. Students will investigate the effects of weathering and erosion by water, ice, wind, and vegetation through various experiments involving observations and measurement. 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. They will understand water, ice, wind, living organisms, and gravity breaks rocks, soils, and sediments into smaller particles and move them around. With topographic maps of Earth's land and ocean floor, students will notice the formation of earthquakes, volcanoes, locations of mountain ranges, and the occurring 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. Students will create solutions to reduce the impact of natural earth processes such as designing an earthquake resistant building and improving monitoring of volcanic activity.

Unit Content Objectives

At the conclusion of this unit, students will be able to:
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.
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.
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Unit Essential Questions

- How can rock formations and fossils tell the stories of change in landscape over time?
- How can the effects of weathering or erosion by water, ice, wind, and vegetation change the land?
- What patterns of Earth's features can be determined with the use of topographic maps?
- How can we reduce the impact of hazards caused by natural processes?

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

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. (4-ESS1-1)

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, oils, and sediments into smaller particles and move them around. (4-ESS2-1)

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. (4-ESS2-2)

ESS2.E: Biogeology

 Living things affect the physical characteristics of their regions. (4-ESS2-1)

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. (4-ESS3-2) (Note: This Disciplinary Core Idea can also be found in 3.WC.)

ETS1.B: Designing Solutions to Engineering Problems

 Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)

SCIENCE AND ENGINEERING PRACTICES (SEP):

- **Planning and Carrying Out Investigations**
- **Analyzing and Interpreting Data**
- **Constructing Explanations and Designing**
- **Solutions**

CROSS-CUTTING CONCEPTS (CCC):

- **Patterns**
- **Cause and Effect**

Connections to Engineering, Technology, and Applications of Science

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

Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural System.

Corresponding CT Core Standards:

ELA/Literacy –

RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-ESS3-2)

RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (4-ESS2-2)

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2)

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS1-1),(4-ESS2-1)

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-ESS1-1),(4-ESS2-1)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS1-1)

Mathematics –

MP.2 Reason abstractly and quantitatively. (4-ESS1-1),(4-ESS2-1),(4-ESS3-2)

MP.4 Model with mathematics. (4-ESS1-1),(4-ESS2-1),(4-ESS3-2)

MP.5 Use appropriate tools strategically. (4-ESS2-1)

4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. (4-ESS1-1),(4-ESS2-1)

4.MD.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. (4-ESS2-1),(4-ESS2-2)

4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-2)