PISCATAWAY
TOWNSHIP SCHOOLS

Dr. Frank Ranelli
Superintendent of Schools

Dr. William Baskerville
Assistant Superintendent for
Curriculum and Instruction

Science 4

Content Area: Science
Grade Span: 4
Revised by: Jeffrey Celebre
Presented by: Jeffrey Celebre
K-8 Supervisor of Science, World Language, and Engineering
Approval date: August 12, 2021

Piscataway Township Schools
1515 Stelton Road
Piscataway, NJ 08854-1332
732 572-2289, ext. 2561
Fax 732 572-1540
www.piscatawayschools.org

COURSE OVERVIEW

Description

The performance expectations in fourth grade help students formulate answers to questions such as: “What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth’s features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?” Students are able to use models of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. 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 of such processes on humans. In order to describe patterns of Earth’s features, students analyze and interpret data from maps. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. 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. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. Every instructional unit is anchored by a unique phenomenon that is drives student discovery.

Goals

This course aims to: ● develop student ability in asking questions and developing problems that are investigable ● develop student use of models as scientific explanation ● enable students to plan and conduct investigations ● develop student ability to analyze and interpret data ● advance student ability to construct explanations and design solutions clearly and effectively based on arguments from evidence ● allow students to obtain, evaluate, and communicate information ● allow students opportunities to demonstrate understanding of the core ideas within this course ● engage students in engineering practices including design and evaluation.

Scope and Sequence

Unit	Topic	Length
1: Plant and Animal Structures	Structure, Function, and Information Processing in Organisms	18-20 days
2: Earth’s Systems	Weathering and Erosion	18-20 days
3: Energy and Motion	Transfer of Energy; Forces and Motion	18-20 days
4: Waves	Wave Properties and Information Communication	18-20 days

Resources

- District-created lesson materials
- Mystery Science supplemental materials

UNIT 1: PLANT AND ANIMAL STRUCTURES

Summary and Rationale

In this unit of study, students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Additionally, students develop several models to describe the processes involved in animals receiving and processing information, including certain basic mechanics of the eye. The crosscutting concepts of cause and effect, systems and system models, and structure and function are called out as organizing concepts for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency in developing and using models and engaging in argument from evidence. Students are also expected to use this practice to demonstrate understanding of the core idea.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

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.
Boundary Statement	Assessment is limited to macroscopic structures within plant and animal systems.
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.
Boundary Statement	Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.
4-PS4-2: Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	
Boundary Statement	Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Systems and System Models:** A system can be described in terms of its components and their interactions. (4-LS1-1)
- **Cause and Effect:** Cause and effect relationships are routinely identified. (4-PS4-2)
- **Systems and System Modeling:** A system can be described in terms of its components and their interactions. (4-LS1-2)

Unit Essential Questions

- How do the internal and external parts of plants and animals support their survival, growth, behavior, and reproduction?
- What systems are involved in taking in and responding to information?
- How does an eye function to allow objects to be seen?

Objectives

Students will know (DCIs):

- **Structure and Function**

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- **Electromagnetic Radiation**
  - An object can be seen when light reflected from its surface enters the eyes.
- **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.

Students will be able to (Science and Engineering Practices):

- Construct an argument with evidence, data, and/or a model. (4-LS1-1)
- 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)

Resources

See *Grade 4 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS – English Language Arts

• 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-LS1-2), (4-PS4-2)

Connections to NJSLS – Mathematics

• MP.4 Model with mathematics. (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-PS4-2)
• 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)

UNIT 2: EARTH'S SYSTEMS

Summary and Rationale

In this unit of study, students develop understandings of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. Students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. The crosscutting concepts of patterns and cause and effect are called out as organizing concepts. Students demonstrate grade-appropriate proficiency in planning and carrying out investigations and constructing explanations. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

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.
Boundary Statement	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.
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
Boundary Statement	Assessment is limited to a single form of weathering or erosion.
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.
4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change on humans. *Integrates Engineering Design Performance Expectations*	
Clarification Statement	Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.
Boundary Statement	Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.
3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	
3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Patterns:** Patterns can be used as evidence to support an explanation. (4-ESS1-1), (4-ESS2-2)
- **Cause and Effect:** Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1), (4-ESS3-2)
- **The Nature of Science:** Science assumes consistent patterns in natural systems. (4-ESS1-1)
- **Engineering, Technology and Applications of Science:** Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2), (3-5-ETS1-2)

Unit Essential Questions

- What do the shapes of landforms and rock formations tell us about the past?
- Is it possible to engineer ways to protect humans from natural Earth?

Objectives

Students will know (DCIs):

- **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.
- **Earth Materials and Systems**
  - Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- **Biogeology**
  - Living things affect the physical characteristics of their regions
- **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.
- **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.
- **Designing Solutions to Engineering Problems**
  - Testing a solution involves investigating how well it performs under a range of likely conditions.

  Developing Possible Solutions
  - Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
  - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- **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.

Students will be able to (Science and Engineering Practices):

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1)
- Identify the evidence that supports particular points in an explanation. (4-ESS1-1)
- Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2), (3-5-ETS1-2)
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

Resources

See *Grade 4 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS – English Language Arts

• 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)

Connections to NJSLS – 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 × 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)

UNIT 3: ENERGY AND MOTION

Summary and Rationale

In this unit of study, fourth-grade students develop an understanding that energy can be transferred from place to place by sound, light, heat, electrical currents, or from objects through collisions. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. Students also are able to use evidence to construct an explanation describing the relationship between the speed of an object and the energy of that object. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of cause and effect, energy and matter, and the interdependence of science, engineering, and technology, and influence of science, engineering, and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade appropriate proficiency in planning and carrying out investigations, asking questions, defining problems, constructing explanations, designing solutions, and obtaining, evaluating, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.	
Boundary Statement	Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	
Boundary Statement	Assessment does not include quantitative measurements of energy.
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
Boundary Statement	Assessment does not include quantitative measurements of energy.
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. *Integrates Engineering Design Performance Expectations*	
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
Boundary Statement	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.
4-ESS3-1: 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; non-renewable 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

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **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)
- **Engineering, Technology, and Applications of Science:**
  - Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1)
  - Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1), (3-5-ETS1-1)
  - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (4-PS3-4), (3-5-ETS1-2)
- **The Nature of Science:**
  - Most scientists and engineers work in teams. (4-PS3-4)
  - Science affects everyday life. (4-PS3-4)

Unit Essential Questions

- Where do we get the energy we need for modern life?
- How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?
- What is the relationship between the speed of an object and the energy of that object?

Objectives

Students will know (DCIs):

- **Definitions of Energy**
  - The faster a given object is moving, the more energy it possesses.
  - Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
- **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.
  - 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.
- **Relationship Between Energy and Forces**
  - When objects collide, the contact forces transfer energy so as to change the objects' motions.

- **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.
- **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.
- **Defining and Delimiting 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.
- **Developing Possible Solutions**
  - Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
  - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- **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.

Students will be able to (Science and Engineering Practices):

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)
- Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)
- 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)
- Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)
- Apply scientific ideas to solve design problems. (4-PS3-4)
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

Resources

See *Grade 4 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS - English Language Arts

• 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)

Connections to NJSLS - 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 × 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-ESS3-2)
• 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)

UNIT 4: WAVES

Summary and Rationale

In this unit of study, students use models of waves to describe patterns of wave properties in terms of amplitude and wavelength and to show that waves can cause objects to move. Additionally, students explore various applications of waves as a means to transmit information. The crosscutting concepts of patterns; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, and constructing explanations, and designing solutions. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

Recommended Pacing

18-20 days

State Standards (Performance Expectations)

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

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.

3-5-EST1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Instructional Focus

Unit Enduring Understandings (Crosscutting Concepts)

- **Patterns:**
  - Similarities and differences in patterns can be used to sort and classify natural phenomena. (4-PS4-1)
  - Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)
- **Engineering, Technology, and Applications of Science:**
  - Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)
  - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)
- **The Nature of Science:** Science findings are based on recognizing patterns. (4-PS4-1)

Unit Essential Questions

- How do changing certain wave properties impact how we perceive a wave?
- How can we use waves to gather and transmit information?

Objectives

Students will know (DCIs):

- **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.
  - Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).
- **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.
- **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.
- **Developing Possible Solutions**
  - Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
  - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

Students will be able to (Science and Engineering Practices):

- Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1)
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (4-PS4-3), (3-5-ETS1-2)
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

Resources

See *Grade 4 NGSS Curriculum Resources* drive
Mystery Science program materials

Interdisciplinary Connections

Connections to NJSLS - English Language Arts

• 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)

Connections to NJSLS - Mathematics

• MP.4 Model with mathematics. (4-PS4-1)

• 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)