4th Grade Unit 4 - Waves and Information

Content Area: **Science**
Course(s): **Science Grade 4**
Time Period: **MP1**
Length: **16 days**
Status: **Published**

NJSLS - Science

SCI.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.
SCI.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.
SCI.4-PS4-3	Generate and compare multiple solutions that use patterns to transfer information.
SCI.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.

Science and Engineering Practices

Developing and Using Models

Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1)

Constructing Explanations and Designing Solutions

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)(3-5-ETS1-2)

Planning and Carrying Out Investigations

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)

Disciplinary Core Ideas

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.B: 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. (3-5-ETS1-2)

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. (3-5-ETS1-2)

Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

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. (3-5-ETS1-3)

Crosscutting Concepts

Patterns

Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. (4-PS4-1)

Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)

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

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Rationale and Transfer Goals

In this unit of study, students use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. 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.

Enduring Understandings

Similarities and differences in patterns can be used to sort and classify natural phenomena.

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)

Similarities and differences in patterns can be used to sort and classify designed products.

Knowledge of relevant scientific concepts and research findings is important in engineering.

Essential Questions

If a beach ball lands in the surf, beyond the breakers, what will happen to it?

Which team can design a way to use patterns to communicate with someone across the room?

Content - What will students know?

- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- 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).
- Similarities and differences in patterns can be used to sort and classify designed products.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- 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—that is, convert it from digitized form to voice and vice versa.
- Different solutions need to be tested in order to determine which of them best solve the problem, given

the criteria and the constraints.

- 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.

Skills - What will students be able to do?

- Plan and carry out investigations.
- Analyze and interpret data.
- Construct explanations.
- Develop and use models to describe patterns of waves in terms of amplitude and wavelength.
- Show that waves can cause objects to move.
- Observe and describe a number of similarities and differences in wave patterns.
- Develop a model of wave properties using drawings, diagrams, and physical models.
- Discuss real world examples of waves including sound and light waves.
- List ways in which patterns have been used in the past to communicate over distance.
- Research possible ways of communicating using patterns over distances.
- Collaboratively design and build a device or design a process for communicating information over a distance.

Activities - How will we teach the content and skills?

- Mystery Science Waves of Sound Anchor Phenomenon
- Mystery Science Waves of Sound Lesson 1
- Mystery Science Waves of Sound Lesson 2
- Mystery Science Waves of Sound Lesson 3

Evidence/Assessments - How will we know what students have learned?

- Mystery Science Waves of Sound Lesson 1 Assessment
- Mystery Science Waves of Sound Lesson 2 Assessment
- Mystery Science Waves of Sound Lesson 3 Assessment
- Mystery Science Waves of Sound Performance Assessment
- Daily Exit Ticket
- Daily Formative Assessment
- Grade 4 Science Unit 4 Benchmark

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
Definition of a wave Definition of a force How forces affect an object's motion	Grade 1: People also use a variety of devices to communicate (send and receive information) over long distances. Grade 2: A situation that people want to change or create can be approached as a problem to be solved through engineering. Grade 2: Asking questions, making observations, and gathering information are helpful in thinking about problems Grade 2: Before beginning to design a solution it is important to clearly understand the problem.	1-PS4-4 Activities K-2-ETS1-1 Activities K-2-ETS1-2 Activities K-2-ETS1-3 Activities 3-PS2-1 Activities 3-PS2-2 Activities

	Grade 2: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. Grade 2: Because there is always more than one possible solution to a problem, it is useful to compare and test designs. Grade 3: Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative, addition of forces is used at this level). Grade 3: The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)	

Key Resources

Mystery Science

Video Links

Developing and Using Models: http://www.bozemanscience.com/ngss-analyzing-interpreting-data

Wave Properties: http://www.bozemanscience.com/ngs-ps4a-wave-properties

Patterns: http://www.bozemanscience.com/ngs-patterns

Classroom Resources –

NSTA Curators Project – http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=16

21st Century Life and Careers

WRK.9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
WRK.9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.5.CI.1	Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
TECH.9.4.5.CI.2	Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
TECH.9.4.5.IML.3	Represent the same data in multiple visual formats in order to tell a story about the data.

Interdisciplinary Connections/Companion Standards

NJSLS ELA

NJSLSA.R4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

NJSLS Mathematics

4.MD.A Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

4.MD.B Represent and interpret data.