

# 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-PS4-1	Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
SCI.4-PS4-3	Generate and compare multiple solutions that use patterns to transfer information.

## **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

## Formative Assessments

---

- Mystery Science Sound, Waves, & Communication Lesson 1 Assessment
- Mystery Science Sound, Waves, & Communication Lesson 2 Assessment
- Mystery Science Sound, Waves, & Communication Lesson 3 Assessment
- Mystery Science Sound, Waves, & Communication Lesson 4 Assessment
- Daily Exit Ticket
- Daily Formative Assessment

## Summative Assessments

---

- Mystery Science Sound, Waves, & Communication Performance Assessment
- [Mystery Science Sound, Waves, & Communication Unit 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	Grade 1: People also use a variety of devices to communicate (send and receive information) over long distances.	<a href="#">1-PS4-4 Activities</a>
Definition of a force	Grade 2: A situation that people want to change or create can be approached as a problem to be solved through engineering.	<a href="#">K-2-ETS1-1 Activities</a>
How forces affect an object's motion	Grade 2: Asking questions, making observations, and	<a href="#">K-2-ETS1-2 Activities</a>
		<a href="#">K-2-ETS1-3 Activities</a>

	<p>gathering information are helpful in thinking about problems</p> <p>Grade 2: Before beginning to design a solution it is important to clearly understand the problem.</p> <p>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.</p> <p>Grade 2: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.</p> <p>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).</p> <p>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,</p>	<p><a href="#">3-PS2-1 Activities</a></p> <p><a href="#">3-PS2-2 Activities</a></p>
--	--	---

	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>

## Career Readiness, Life Literacies, & Key Skills

---

PFL.9.1.5.CR.1	Compare various ways to give back and relate them to your strengths, interests, and other personal factors.
WRK.9.2.5.CAP.1	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
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.

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.DC.4	Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).
TECH.9.4.5.DC.8	Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).
TECH.9.4.5.TL.2	Sort and filter data in a spreadsheet to analyze findings.
TECH.9.4.5.TL.3	Format a document using a word processing application to enhance text, change page formatting, and include appropriate images graphics, or symbols.
TECH.9.4.5.IML.2	Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
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**

---

### **NJSLS ELA**

RI.CR.4.1. Refer to details and examples as textual evidence when explaining what an informational text says explicitly and make relevant connections when drawing inferences from the text. (4-PS4-3)

RI.CR.5.1. Quote accurately from an informational text when explaining what the text says explicitly and make relevant connections when drawing inferences from the text. (3-5-ETS1-2)

RI.MF.5.6. Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. (3-5-ETS1-2)

RI.CT.5.8. Compare and contrast the authors' approaches across two or more informational texts within the same genre or about texts on the same or similar topics. (3-5-ETS1-2)

W.WR.5.5. Establish a central idea about a topic, investigation, issue or event and use several sources to support the proposed central idea. (3-5-ETS1-3)

W.SE.5.6. Gather relevant information from multiple valid and reliable print and digital sources; summarize or paraphrase information in notes and finished work, making note of any similarities and differences among ideas presented; and provide a list of sources. (3-5-ETS1-3)

SL.UM.4.5. Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1)

## **NJSLS Mathematics**

MP.2 Reason abstractly and quantitatively. (3-5-ETS1-2, 3-5-ETS1-3)

MP.4 Model with mathematics. (4-PS4-1, 3-5-ETS1-2, 3-5-ETS1-3)

MP.5 Use appropriate tools strategically. (3-5-ETS1-2, 3-5-ETS1-3)

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)

3-5.OA Operations and Algebraic Thinking (3-5-ETS1-2)