Barrington School District | Haddon Heights School District | Lawnside School District | Merchantville School District

Course Name: Science
Grade: Fourth Grade
Board Approved:

*All curriculum is aligned with the NJSLS in accordance with the Department's curriculum implementation timeline and includes all required components (NJ.A.C.6A:8).
**Resource and activity lists are compiled from all four districts and may not necessarily be reflected in each district or school.

Introduction

New Jersey Student Learning Standards for Science

Michael Heinz, Coordinator

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering.

Mission: Scientifically literate individuals possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.

Vision: The science standards are designed to help realize a vision for education in the sciences and engineering in which students, over multiple years of school, actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields. The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. Throughout grades K-12, students should have the opportunity to carry out scientific investigations and engineering design projects related to the disciplinary core ideas (pp. 8-9, NRC, 2012).

STANDARD:
4-PS4 - Waves and their applications in Technologies for Information Transfer
3-5-EST 1 - Engineering Design

Unit 8: Waves and Information

ESTABLISHED GOALS (INDICATOR #)	TRANSFER (How will this apply to their lives?)	
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.** **3-5-EST-1-2 - 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.**	*Students will be able to independently use their knowledge to…* ● Develop and use models to describe patterns of waves in terms of amplitude and wavelength. ● Explain how waves can cause objects to move.	
	MEANING	
	UNDERSTANDINGS: ● 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	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?

	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.	

Unit 8: Grade 4 - Lessons

In this unit of study, students plan and carry out investigations, analyze and interpret data, and construct explanations. They also develop and use models to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. Waves, which are regular patterns of motion, can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Students can model the properties of waves by disturbing the surface of water in a variety of pans and buckets. Students should make observations as they strike the surface of the water with small and large objects, such as marbles and rocks. In addition, smaller pans can be tilted in different directions in order to observe the effect on the wave patterns created on the surface of the water. Students should observe and describe a number of similarities and differences in the wave patterns created, including

the following:

• When an object hits the surface of water, waves move across the surface.

• Waves move up and down across the surface of the water away from the point of contact.

• Waves on the surface of the water move away from the point of contact in increasingly larger circles.

• When waves hit another surface, the waves change direction and move away from the surface with which they come into contact.

• The height of the wave (amplitude) and the distance between the peaks of waves (wavelength) varies depending upon the intensity of the disturbance, and/or the size (mass, volume) of the object disturbing the surface of the water.

When describing the properties of waves, students should also develop a model using drawings, diagrams, or physical models (such as a slinky or jump rope) to show the basic properties of waves (amplitude and wavelength). In addition, the class should discuss other real-world examples of waves, including sound and light waves, using understandings developed in prior units of study.

To begin the engineering design process, students are challenged to design a way to use patterns to transfer information. This process should include the following steps:

• As a class, brainstorm a list of ways in which patterns have been used in the past to communicate over distance. Some examples include the use of smoke signals, drums, and Morse code on a telegraph.

• Small groups collaboratively conduct research to determine other possible ways of communicating using patterns over distances.

• As a class, determine criteria and possible constraints on the design solutions.

− Criteria might include that groups must communicate information using patterns, the design solution must communicate over a predetermined distance, and groups must be able to describe how patterns were used in the design to communicate over a distance.

− Possible constraints might include materials available to build/create a device and the amount of time available to design and build.

• Small groups work collaboratively to design and build a device or design a process for communicating information over a distance. Some examples could include:

− Drums sending coded information through sound waves.

− Use a flashlight to convey information using a pattern of on and off.

− Use Morse code to send information.

− Build an instrument with a box and rubber bands of varying sizes that can be plucked in a pattern to communicate information.

− Use musical patterns on a xylophone or tuning forks to convey information.

− Use string and cups to build a simple “phone” to send information.

• After small groups finish designing and building, they should put together a presentation that includes a written description/explanation of how patterns are used to communicate information. They can also include pictures, video or audio recordings, and/or models to support their explanation.

• Each group presents their design solution to the class. After observing each design solution, students should classify each based on the type or types of patterns used to communicate (e.g., sound, light, or both).

• Students investigate how well the solutions perform under a range of likely conditions (e.g., environmental noise or light, increases in distance). This may involve additional research, planning and conducting multiple investigations to produce data, and collecting and analyzing additional data that can be used as evidence to support conclusions. All tests that are planned and carried out should be fair tests in which variables are controlled and failure points are considered in order to identify elements of the design solution that do and do not meet criteria and constraints.

• Students compare the solutions, determining which can be used to successfully communicate information over a distance using patterns.

Students should determine how well each design solution meets criteria, using data as evidence to support their thinking. Throughout this process, communicating with peers is important, and can lead to better designs. After completing the engineering design process, students should discuss ways in which we use patterns in today's technology to communicate over long distances and how engineers have improved existing technologies over time in order to increase benefits, decrease known risks, and meet societal demands. Integration of engineering.

Engineering design is an integral part of this unit of study. Students are expected to research a problem and communicate proposed solutions to others; define a simple design problem including specified criteria for success and constraints on materials time, or cost; and plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of the design solution that can be improved. This process is outlined in greater detail in the previous section.

Mystery Science Suggested Lessons:

Waves of Sound: Sound, Waves and Communication

Unit Starter: Sound Waves and Conceptual Modeling: Seeing Sound

Mystery 1: Sound and Vibrations: How far can a whisper travel?

Mystery 2: Sound and Vibrations: What would happen if you screamed in outer space?

Mystery 3: Sound, Vibrations, and Waves: Why are some sounds high and some sounds low?

Better Lesson Suggested Units:

- What are waves? *SWBAT understand that waves carry energy, and explore different types of waves.*
- Pop Bottle Waves and Hair Dry Ripples *Students investigate how motion and wind create waves on water.*
- Catching the Waves (extension to previous lesson) *Students learn the meaning of amplitude, crests and troughs.*
- Binary Code *SWBAT read and write numbers and words written in binary form.*
- Mini-Lesson: A Big Splash *Students learn about waves created through displacement.*
- What is visible light? *SWBAT explain that light can be considered an electromagnetic wave.*

Suggested Sound Unit:

*Introduce topic by viewing a video where a singer is able to break glass with sound.
Sound Unit *SWBAT understand the sound energy phenomenon. SWBAT develop their own models using their current levels of understanding to explain why the singer could shatter the glass. SWBAT make observations and develop initial models to explain how the singer was able to shatter the glass. SWBAT record and share their ideas and questions about what allows the singer to make sound, properties of sound such as volume and pitch, proximity to sound source, how sound travels from one place to another, and how sound energy can cause changes.*

Summary:

- Human Voice
- Decibels at a Distance

- "Seeing"Sound Waves
- Sound Travels Through Matter
- Absorbing or Reflecting Sound Energy
- Resonance

Students have to design and test a design that uses sound to move an object.
Example

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting concepts
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) • 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) - Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence • Science findings are based on recognizing patterns. (4-PS4-1) 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)	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) 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	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) - Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology • Knowledge of relevant scientific concepts and research findings is important in engineering. (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)

	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)	

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Students who understand the concepts can: ● Sort and classify natural phenomena using similarities and differences in patterns. ● Develop a model using an analogy, example, or abstract representation to describe a scientific principle. ● Develop a model (e.g., diagram, analogy, or physical model) of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move. (Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength). ● Sort and classify designed products using similarities and differences in patterns. ● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. ● 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. ● Generate and 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 ones and zeroes representing black and white to send ○ information about a picture; ○ Using Morse code to send text. ● Plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. ● Plan and carry out fair tests in which variables are controlled and failure points are	*Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.* **Mystery Science Assessments:** ***(all resources are accessible on google drive)*** Waves of Sound: Sound, Waves and Communication

considered to identify aspects of a model or prototype that can be improved.

Waves of Sound: Sound, Waves and Communication:

Mystery 1: Sound and Vibrations

Mystery 2: Sound and Vibrations

Mystery 3: Sound, Vibrations and Waves

Alternative Assessments

Evaluative Criteria	Assessment Evidence
Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments:	Suggested Performance Tasks include but are not limited to: **Performance Task:** Mystery Science- Sound Waves and Engineering: How can you make sound waves visible? **Resources for Performance Task:** My Sound Wave Watcher Rubric for Sound Wave Watcher

4 - Innovating:	Advanced understanding and application of the standard
3 - Applying:	Consistently applies skills independently
2 - Developing:	Progressing towards independent application of skills
1 - Beginning:	Early stages of development, need assistance

District/School Texts	District/School Supplementary Resources
Haddon Heights - Unit Kits for Science Labs and References Lawnside - Houghton Mifflin Harcourt : Science Fusion Merchantville- Exploring Science (National Geographic Learning)	**-Scholastic News** **-Brain POP** **-NewsELA** **-Read Works**

Interdisciplinary Connections		
ELA ● Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3) RI.4.9 ● Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1) SL.4.5 ● Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2) RI.5.1 ● Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2) RI.5.9 ● Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-3) W.5.7 ● Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-3) W.5.8 ● Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-3) W.5.9	**Math** ● Reason abstractly and quantitatively. (3-5-ETS1-2),(3-5-ETS1-3) MP.2 ● Model with mathematics. (4-PS4-2),(3-5-ETS1-2),(3-5-ETS1-3) MP.4 Use appropriate tools strategically. (3-5-ETS1-2),(3-5-ETS1-3) MP.5 ● Operations and Algebraic Thinking (3-ETS1-2) 3-5.O ● A 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.1	**21st Century Skills/Career Education** ● CRP2. Apply appropriate academic and technical skills. ● CRP4. Communicate clearly and effectively and with reason ● CRP11. Use technology to enhance productivity.
Technology		

8.2.5.C.2 Explain how specifications and limitations can be used to direct a product's development. 8.2.5.C.4 Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.		
Modifications and Accommodations		
Special Education Students Small group Direct instruction restate/rephrase graphic organizers modified assignments chunking leveled text intentional grouping read text extended time breaks Teacher records/ student dictates	**English Language Learners** Labels word banks visuals student friendly definitions extended time chunking intentional grouping	**Students at Risk of School Failure** leveled text graphic organizers modified assignments kinesthetic activities restate/rephrase chunking intentional grouping
Gifted and Talented extension project leveled text leadership roles intentional grouping Targeted learning from assessment	**Students with 504 Plans** breaks chunking preferential seating visual reminders restate/rephrase check-in/check-out system visual time Teacher records/ student dictates	
Unit Duration: 20 Days		