Unit 10: Waves and Sound

Content Area: **Template**
Course(s):
Time Period:
Length:
Status: **Published**

State Mandated Topics Addressed in this Unit

This unit aligns with the following NJ Student Learning Standards for Science (NJSLS-S) and supports exploration of wave behavior, particularly sound waves, and their applications:

NJSLS-S Performance Expectations:

- **HS-PS4-1**: Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- **HS-PS4-3**: Evaluate the claims, evidence, and reasoning behind the idea that digital transmission and storage of information is more reliable than analog.
- **HS-PS4-5**: Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Integrated Mathematics Standards (NJSLS-M):

- **A-CED.A.2**: Create equations in two or more variables to represent relationships between quantities.
- **F-IF.C.7**: Graph functions expressed symbolically and show key features of the graph.

Science & Engineering Practices (SEPs):

- SEP 2: Developing and Using Models
- SEP 4: Analyzing and Interpreting Data
- SEP 5: Using Mathematics and Computational Thinking
- SEP 6: Constructing Explanations and Designing Solutions
- SEP 8: Obtaining, Evaluating, and Communicating Information

Crosscutting Concepts:

- Cause and Effect
- Systems and System Models
- Energy and Matter
- Structure and Function

These standards support instructional objectives including:

- Describing how sound is produced and transmitted
- Analyzing wave properties (frequency, wavelength, amplitude)
- Interpreting mathematical models of wave behavior
- Exploring technological applications of sound and wave interference
- Conducting investigations using sound equipment and simulations

Unit Summary

This unit explores the fundamental principles of wave behavior with an emphasis on sound waves and their interaction with various media. Students will investigate how sound is produced, how it travels, and how properties like frequency, wavelength, and amplitude influence what we hear. They will use mathematical representations to describe wave speed and analyze how sound waves behave when they encounter different substances. Additionally, students will examine how interference patterns are used in technologies such as musical instruments, noise-canceling devices, and sonar. Through experimentation, data analysis, and engineering applications, students will connect wave principles to real-world uses and communicate technical information about sound and related technologies in alignment with NJ state standards.

Learning Objectives

- Can cell phones ring in space?
- How do mathematical relationships among frequency, wavelength, and wave speed help us understand wave behavior?
- How do the properties of a medium affect the speed of a wave?
- How do waves interact?
- How do waves transfer energy?
- How does interference influence sound quality in music and technology?
- In what ways do modern technologies rely on our understanding of wave behavior?
- What determines the pitch and loudness of a sound?

Essential Skills

- Analyze constructive and destructive interference patterns and their applications.
- Compare analog and digital signals and describe their advantages in transmitting sound.
- Contrast transverse and longitudinal waves.
- Describe how waves are reflected and refracted at boundaries between media and explain how waves diffract.

- Design and evaluate simple devices that use wave properties (e.g., basic musical instruments or soundproofing).
- Explain the Doppler effect and provide real-world examples (e.g., sirens, radar).
- Identify how waves transfer energy without transferring matter.
- Interpret wave behavior using labeled diagrams and real-life phenomena (e.g., echo, sonar, noise cancellation).
- Investigate resonance and its effects in natural and human-made systems.
- Model how sound travels through solids, liquids, and gases at different speeds.
- Relate a wave's speed to the medium in which the wave travels.
- Relate the physical properties of sound waves to the way we perceive sound.
- Use the wave equation ($v = f\lambda$) to solve problems involving wave speed, frequency, and wavelength.

Standards

SCI.HS-PS4-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
9-12.HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
9-12.HS-PS3-2.2.1	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.

Instructional Tasks/Activities

- Common assessment chapter test
- Common assessment quiz
- Constructed response
- Do now's and/or exit slips
- Exit Cards (answer to daily objective questions)
- Graphic organizers or models
- Guided practice
- Homework
- Homework
- Individual, small, and large group work
- Laboratory investigations within small groups
- Review Activity
- Section Review Questions
- Study Guide Packets
- Vocabulary flash cards or map (word, picture, sentence, example)

Assessment Procedure

- Flashcards and/or drill and practice
- Inquiry based activities with reflective discussion
- Laboratory groups
- Lecture with note taking or guided notes
- Online models and simulators
- Power point presentations
- Whole and small group discussions

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Chromebook
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Forms
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates

- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Resources

- Resource 1
- Resource 2
- Resource 3
- Resource 4
- Resource 5