Unit 1: Sound Waves
8th Grade Honors Science

12 Class Meetings

Revised October 2025

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Essential Questions

- How can sound waves transfer enough energy to disrupt matter?

Enduring Understandings with Unit Goals

EU 1: A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.

- Apply the simple mathematical wave model to a physical system or phenomenon to identify how the wave model characteristics correspond with physical observations.
- Calculate that the energy of the wave is proportional to the square of the amplitude.
- Describe that the amount of energy transferred by waves in a given time is proportional to frequency.

EU 2: A sound wave needs a medium through which it is transmitted.

- Plan an investigation and gather evidence to develop a logical conclusion for how waves interact with surrounding matter.
- Plan an investigation and develop a logical conclusion based on evidence for how waves affect objects at a distance.

Standards

Next Generation Science Standards:

- **MS-PS4-1:** Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- **MS-PS4-2:** Develop and use a model to describe how waves are reflected, absorbed, or transmitted through various materials.

Common Core State Standards:

- **CCSS.MATH.8.F.B.5:** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
- **CCSS.MATH.8.F.A.2:** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- **CCSS.MATH.6.RP.A.2:** Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship.
- **CCSS.MATH.6.SP.B.5:** Summarize numerical data sets in relation to their context.
- **CCSS.MATH.7.RP.A.2:** Recognize and represent proportional relationships between quantities.
- **CCSS.MATH.8.F.A.3:** Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
- **CCSS.ELA-LITERACY.RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts.
- **CCSS.ELA-LITERACY.RST.6-8.1:** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- **CCSS.ELA-LITERACY.RST.6-8.9:** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

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ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.
Competency 2: Speak to diverse audiences in an accountable manner.
Competency 3: Develop the behaviors needed to interact and contribute with others on a team.
Competency 4: Analyze and solve problems independently and collaboratively.
Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. **Objects vibrate when they make sounds.**
   - Determine that patterns of differences in vibrations are tied to differences in characteristics of the sounds being made.

2. **Characteristics of sound waves.**
   - Conduct experiments and gather data on how objects vibrate when making different sounds.
   - Characterize how a vibrating object's motion is tied to the loudness and pitch of the sounds they make.

3. **Sound needs matter to travel.**
   - Conduct experiments and gather evidence to support the idea that sound needs matter to travel through.
   - Use models and simulations to explain how sound travels through matter at the particle level.

Interdisciplinary Connection:

- Language Arts- Students compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. Students cite specific evidence to draw conclusions about the properties of sound waves. Students will also write their first formal lab report based on their investigations.
- Math- Students collect and analyze data in the form of distance vs. time graphs showing the motion of a vibrating stick over time. Students characterize the shape of these graphs as wave patterns and describe differences in properties. Students discuss and use mathematical methods of finding the average of data sets, including calculating mean and median. Students use data to describe and graph functions that represent the relationships between energy and frequency and energy and amplitude.

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Daily Learning Objectives with *TWPS*

Students will be able to…

- Explain how mechanical waves transfer energy without transporting matter.
  - *Can energy move without matter moving with it? Why or why not?*
- Explore how energy is transferred through waves when particles don't physically move with the wave (with models and examples).
  - *If particles don't travel with the wave, what exactly is moving?*
- Analyze and graph wavelength, amplitude, and frequency and interpret how they relate to energy.
  - *What changes a wave's energy more—its height or how fast it wiggles?*
- Design and carry out an investigation to determine how wave amplitude affects energy transfer.
  - *Does increasing amplitude always increase energy? Could there be limits?*
- Investigate how variations in frequency impact energy transfer and analyze patterns in graphs.
  - *Are high-frequency waves always more energetic? What's your evidence?*
- Use particle models to explain why sound requires a medium and how material properties affect wave speed and strength.
  - *Why is sound silent in space—but loud underwater?*
- Design and interpret experiments showing how amplitude and frequency affect the ability of sound waves to move or disrupt objects.
  - *Can sound act like a force? Under what conditions?*
- Construct a CER argument using data and models to explain how sound waves can disrupt flames (e.g., sonic fire extinguisher).
  - *How do we know when sound has enough energy to cause real-world effects—and how can we prove it?*
- Use evidence from investigations to compare and critique competing claims and argue that something (medium) is needed to hear sound or move an object at a distance. **
  - *Air is not moving all the way from the sound source to our ears. If the air is not moving, then what is?*
- Develop and use a model to describe how sound is traveling through a solid, liquid, and gas.
  - *Draw an initial model of different states of matter after sound has moved through it? Explain your model to your partner.*
- Demonstrate mastery of the unit goals. (Unit task following last lesson's investigation. End of unit assessment

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Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Guided notes
- Interactive Notebook
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Graphic Organizers
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Homework
- Word walls with visuals
- Small group instruction
- Investigations/labs

EL Differentiated Instruction:

- Sentence starters
- Simplified directions
- Prompting and questioning
- Alternate responses when needed
- Explicit modeling
- Key vocabulary
- Visuals
- Graphic organizers
- KWL charts
- Venn diagram
- Glossary
- Frayer Model
- Chunking
- Pre Teaching Vocabulary
- Teaching Morphology for prefixes, roots

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Assessments

FORMATIVE ASSESSMENTS:

- Do Now
- Notebook checks
- Mid-class check-ins
- Exit Slips
- Accountable Talk Discussions- TWPS
- Homework
- NGSS Interim Assessment

SUMMATIVE ASSESSMENTS:

- Quiz – EU 1 & EU 2
- Lab Report- How does the energy of a vibration change when we change the amplitude or frequency of the vibration?
- Unit Task- Following lab investigation- How does the energy of a vibration change when we change the amplitude or frequency of the vibration?
- Unit Test

Unit Task

Unit Task Name: Energy Transfer Lab

Description: Following the Energy Transfer Lab and formal write-up of the lab report, students will watch a video of an invention called a "sonic fire extinguisher". Students are asked to simulate the work of the inventors by first filling in a data set using what they learned from the lab investigation to figure out what kind of sound would transfer enough energy to put out fires. Students will identify patterns in how the energy of a vibration changes when we change the amplitude or frequency of the vibration (EU 1). Students will then construct an explanation for how they selected the numbers they filled in the data table with (EU 2). Lastly, using the evidence from the sets of data, as well as the patterns they saw in the lab investigation they did, students will make a claim, evidence, reasoning response to answer the question: *Which type of sound do you think would be best to transfer enough energy to put out a fire, a louder sound or a higher-pitch sound?*

Evaluation: Claim, Evidence, Reasoning Response Rubric

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Unit Resources
● NGSS educational resources ● Science notebooks ● Laptops ● NGSS Interim Assessments Physical Science Items ● Pear Assessment ● Newsela.com ● Diffut.com ● PHET Simulators ● Turner's Graph