

## Unit 4: Waves of Energy

### 4<sup>th</sup> Grade Science

35 Class Meetings

*Revised September 2025*

#### Essential Questions

- What patterns can we observe in waves, and how do these patterns help us understand how waves move energy?
- How can we use patterns to send and receive information?
- What are some ways people use light and sound to communicate?
- How can we design and test different solutions to transfer information using patterns?

#### Enduring Understandings with Unit Goals

##### EU 1: Pattern Transfer and Technology

- Information can be transferred using patterns of light, sound, or symbols.
- Patterns in technology can be used to communicate quickly and clearly across distances.
- Different solutions can be created to solve the same problem, and each may work better in different situations.
- Designing, testing, and improving a solution is an important part of how scientists and engineers solve problems.

##### EU 2: Sound and Vibrations

- Sound is caused by vibrations that travel through materials in waves.
- Observe patterns in sound waves, such as pitch and volume, which are affected by the speed and size of the vibrations.
- Sound can travel through solids, liquids, and gases, but behaves differently in each.
- Use what we know about sound and vibrations to design solutions that help people communicate.

##### EU 3: Sound Waves and Wavelength

- Sound travels in waves that move energy from one place to another.
- Waves have patterns, such as amplitude and wavelength, that affect how they look, sound, and behave.
- The properties of a wave determine how it can cause objects to move.
- Models help us understand how waves work, even when we can't see them.

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#### Standards

##### NGSS Standards and Common Core Standards:

- **4-PS4-3.** Generate and compare multiple solutions that use patterns to transfer information.
- **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.
- **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.
- **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.
- **CCSS.ELA-Literacy.RI.4.1:** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- **CCSS.ELA-Literacy.RI.4.2:** Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- **CCSS.ELA-Literacy.RI.4.4:** Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.
- **CCSS.ELA-Literacy.RI.4.9:** Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- **CCSS.ELA-Literacy.W.4.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- **CCSS.ELA-Literacy.W.4.2.a:** Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
- **CCSS.ELA-Literacy.W.4.2.b:** Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
- **CCSS.ELA-Literacy.W.4.2.c:** Link ideas within categories of information using words and phrases (e.g., *another, for example, also, because*).
- **CCSS.ELA-Literacy.W.4.2.d:** Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **CCSS.ELA-Literacy.W.4.2.e:** Provide a concluding statement or section related to the information or explanation presented.
- **CCSS.ELA-Literacy.W.4.4:** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience
- **CCSS.ELA-Literacy.W.4.5:** With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.
- **CCSS.ELA-Literacy.W.4.6:** With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.
- **CCSS.ELA-Literacy.W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.

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- **CCSS.ELA-Literacy.W.4.8:** Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information and provide a list of sources.
- **CCSS.ELA-Literacy.W.4.9:** Draw evidence from literary or informational texts to support analysis, reflection, and research.
- **CCSS.ELA-Literacy.SL.4.1:** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.
- **CCSS.ELA-Literacy.SL.4.1.a:** Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- **CCSS.ELA-Literacy.SL.4.1.b:** Follow agreed-upon rules for discussions and carry out assigned roles.
- **CCSS.ELA-Literacy.SL.4.1.c:** Pose and respond to specific questions to clarify or follow up on information and make comments that contribute to the discussion and link to the remarks of others.
- **CCSS.ELA-Literacy.SL.4.1.d:** Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
- **CCSS.ELA-Literacy.SL.4.2:** Paraphrase portions of a text read aloud, or information presented in diverse media and formats, including visually, quantitatively, and orally.
- **CCSS.ELA-Literacy.SL.4.3:** Identify the reasons and evidence a speaker provides to support particular points.
- **CCSS.ELA-Literacy.SL.4.4:** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

### 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.

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### Unit Content Overview

#### 1. Patterns Transfer Information

- Describe how patterns in light and sound can be used to send information.
- Create simple communication devices or models that use patterns to transfer messages.
- Compare the effectiveness of different solutions for transferring information.
- Design, test, and revise communication models or tools.

#### 2. Sounds and Vibrations

- Identify that sound is produced by vibrating objects.
- Describe how sound travels through different materials (solids, liquids, and gases).
- Observe and explain patterns in sound related to pitch (frequency) and volume (amplitude).
- Construct simple models to demonstrate how sound waves move and how vibrations create sound.
- Apply knowledge of sound and vibration to design a device that uses sound to send or receive information.

#### 3. Soundwaves and Wavelengths

- Identify and describe the parts of a wave, including amplitude and wavelength.
- Use models to show how sound waves travel and transfer energy.
- Explain how changing the amplitude or wavelength affects a wave.
- Demonstrate how waves can cause objects to move.
- Recognize wave patterns in everyday sounds and vibrations.

**Vocabulary and Key Terms:** sound, vibration, wave, frequency, amplitude, wavelength, pitch, volume, echo, sound wave, compression, rarefaction, energy, medium, air molecules, speed of sound, reflection, absorption, transmission, resonance

#### **Interdisciplinary Connection:**

- ELA

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#### Daily Learning Objectives with TWPS

##### Students will be able to...

- Define what a pattern is in science and technology.
  - *Describe what a pattern is and how does that apply to science and technology?*
- Give examples of how people use light and sound to send messages.
  - *How can we use sound or light patterns to send messages?*
- Explain how patterns can be used to send information.
  - *Explain how patterns could benefit sending information.*
- Recognize repeating patterns in sound and light communication (e.g., Morse code).
  - *When would someone need to use a pattern of sound or light to communicate? How could these systems of communication help?*
- Send a message using a sound pattern.
  - *How do devices like cell phones or walkie-talkies send information?*
- Design a device that uses patterns to send a message.
  - *What makes a pattern easy or hard to understand?*
- Test how well the design works to send information.
  - *How can you determine if a design is working well? What indicators would you use?*
- Improve design based on test results.
  - *Explain restrictions to your design and how you will overcome them?*
- Compare my design to another and explain which worked better and why.
  - *What are some questions that you can ask another engineer about their design?*
- Describe what sound is and how we hear it.
  - *What do you think causes sound?*
- Explain that sound is caused by vibrations.
  - *How can you tell if something is vibrating?*
- Observe and record how different objects make sound.
  - *What happens to the sound if the object vibrates faster?*
- Identify high and low pitch sounds.
  - *What clues can you use to tell whether a sound has a high pitch or a low pitch, and how can you explain your thinking to a classmate?*
- Investigate how the speed of vibration affects pitch.
  - *How does changing the speed of a vibration change the pitch of a sound, and what evidence from your investigation supports your thinking?*
- Identify loud and soft sounds in the environment.
  - *What's the difference between a loud sound and a soft sound?*
- Explain how amplitude affects the volume of sound.
  - *How might a musician use their understanding of amplitude to change the way their music sounds, and why would this be important?*
- Describe how sound needs a medium to travel through.
  - *If sound can't travel through space, what does that tell us about how important a medium is, and how do we know?*
- Compare how sound moves through solids, liquids, and gases.
  - *Why do you think sound moves faster through some materials than others, and what does that tell us about the properties of those materials?*

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- Use a model to show how vibrations create sound.
  - *How could a model help you and others understand the invisible parts of how sound works?*
- Describe the parts of a sound wave, including crest and trough.
  - *What might change in a wave's crest and trough if the sound becomes louder or higher-pitched, and why?*
- Define amplitude and wavelength in a wave.
  - *Why is it helpful to know both amplitude and wavelength when trying to describe or measure a sound?*
- Show how changes in amplitude affect loudness.
  - *Can you think of a real-life situation where controlling amplitude is really important? What might happen if you didn't?*
- Show how changes in wavelength affect pitch.
  - *Why do you think shorter or longer wavelengths make different pitches, and how can you tell in an instrument or a model?*
- Observe wave patterns using classroom models.
  - *What patterns do you notice in waves, and how can those patterns help you predict or understand sound behavior?*
- Identify wave patterns in musical instruments.
  - *What do you notice about how different instruments create different wave patterns, and how does that affect the sounds we hear?*
- Explain how waves transfer energy.
  - *If waves carry energy, how can we prove that energy was transferred from one place to another?*
- Describe how waves can cause objects to move.
  - *Why do you think a wave can move an object even though we can't always see the wave itself?*
- Build and test a simple model that shows sound wave motion.
  - *What did you learn from building your model that you might not have understood just by watching or reading?*
- Explain how a wave model helps us understand sound.
  - *What are the strengths and limits of using a model to explain how sound works? What could your model not show?*
- Explain the connection between sound, vibrations, and waves.
  - *How do vibrations, waves, and sound all connect to each other like parts of a system?*
- Describe how sound and wave patterns help us understand energy transfer.
  - *How can looking at wave patterns help scientists or engineers understand how energy moves through different materials?*
- Present communication model to explain how it uses sound patterns.
  - *How do different parts of a communication system work together to send and receive sound, and what would happen if one part broke down?*
- Reflect on the engineering process.
  - *What was one challenge you faced while building or testing, and how did solving it help you better understand sound or waves?*

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#### Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Paragraph frames and sentence starters
- Teacher modeling
- Think-write-pair-share and small-group discussions
- Graphic organizers
- Accountable talk
- Homework
- Word walls with visuals (Venn Diagrams)
- Small group instruction
- Visual exemplars with teacher and student critiques
- Text and video chunking
- Spiraling back to guiding questions
- Close reading with text-dependent questions

#### **EL Differentiation Strategies**

- Key vocabulary, Word Banks and Word Walls with visuals
- TWPS (Think, write, pair, share)
- Pre-reading strategies
- Culturally responsive teaching
- Explicit teacher modeling
- Graphic organizers
- Strategic Grouping
- Non-verbal assessments

#### Assessments

##### **FORMATIVE ASSESSMENTS:**

- Do Now
- Academic Discourse
- Exit Slips
- Accountable Talk Discussions
- Completed notes
- Completed graphic organizers
- Homework
- Performance Task -- Body Systems in Action: A Day in the Life of Your Body
  - Teacher's rubric/scoring guide

##### **SUMMATIVE ASSESSMENTS:**

- Quiz: Muscles and Skeletons, Eyes, Lights, and Vision, The Brain (EU1, EU2, EU3, and EU4)
- Unit Task: Body Systems in Action: A Day in the Life of Your Body (EU1, EU2 and EU3)

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#### Unit Task

**Unit Task Name:** Body Systems in Action: A Day in the Life of Your Body

**Description:** Upon completing the unit, students will work individually to create a detailed poster that demonstrates how the body's systems work together to perform everyday activities. The task will require students to showcase their understanding of how the muscles, skeleton, eyes, vision, and brain interact to complete common tasks, such as playing a sport, riding a bike, or reading a book (EU1, EU2, EU3, and EU4). Students will choose an activity they enjoy or do often then describe how the muscles and skeleton work together to produce movement during the activity, explain how light is necessary for them to see the environment during the activity, and describe how the brain controls the activity. Students will then create a diagram, model, or series of illustrations that show how these systems interact during the chosen activity. They label the major parts of each system (e.g., muscles, bones, eyes, brain) and use arrows or other visual cues to show how information and movement flow between them. Finally, students will write a brief narrative that explains how their body's systems work together during the activity.

**Evaluation:** Teacher's Scoring Guide

#### Unit Resources

- NewsEla
- Google Slides (Teacher's)
- Student Journals
- Chromebooks
- ReadWorks
- Virtual Fieldtrips
- Google Classroom
- Mystery Science