

# Unit 4: Waves and Information

Content Area: **Science**  
Course(s): **Science - Grade 4**  
Time Period: **8 weeks**  
Length: **Weeks**  
Status: **Published**

## Unit Overview

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Students work with a partner to annotate models of three examples of waves: water waves, waves on a string, and sound waves. They annotate a diagram, a video, and a simulation for each. Students develop a model that describes the patterns of waves. Then, using objects and diagrams, they model the properties of amplitude and wavelength. Finally, they act out these properties. Students observe videos showing water waves, waves on a string, and sound waves. They discuss what causes these waves and what effects the waves have on objects. They present their findings to the class. Students use their bodies to model how Earth's crust moves during three types of seismic waves that occur during earthquakes. They compare seismic waves and play a game. Students use patterns of sound to communicate information about geometry concepts. Students act as engineers to design digital devices that send secret messages. They determine which device works best.

## Transfer

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Students will be able to independently use their learning to...

- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify designed products.
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
- 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.

## Meaning

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## Understandings

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Students will understand that...

- there are different examples of waves.
- there are different properties of waves.
- waves affect objects.

- waves travel through earth.
- sound waves can be used to send messages.
- patterns can be used to send messages.

## **Essential Questions**

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Students will keep considering...

- what are some examples of waves?
- what are some properties of waves?
- how do waves affect objects?
- which waves travel through earth?
- how can sound waves be used to send messages?
- how can patterns be used to send messages?

## **Application of Knowledge and Skill**

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### **Students will know...**

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Students will know...

- here are different examples of waves.
- there are different properties of waves.
- waves affect objects.
- waves travel through earth.
- sound waves can be used to send messages.
- patterns can be used to send messages.

### **Students will be skilled at...**

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Students will be skilled at...

- Students will be able to independently use their learning to...
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify designed products.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.
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## **Academic Vocabulary**

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crest

matter

rest position

trough

wave

amplitude

dependent

frequency

independent

wavelength

vibrate

earthquake

seismic waves

digitize

digital device

telegraph

## **Learning Goal 1 - Lessons 1, 2, 3, 4**

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Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

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can cause objects to move.

MA.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.

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.

### **Target 1 - Lesson 1**

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Waves, which are regular patterns of motion, can be made in water by disturbing the surface.

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface.

### **Target 2 - Lesson 1**

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When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave except when the water meets the beach.

- When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave except when the water meets the beach.

### **Target 3 - Lesson 1**

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Describe waves that occur in materials other than water.

- Describe waves that occur in materials other than water.

### **Target 4 - Lesson 1**

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Model the similarities and differences among the types of waves.

- Model the similarities and differences among the types of waves.

### **Target 5 - Lesson 2**

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Describe the properties of waves.

- Describe the properties of waves.

### **Target 6 - Lesson 2**

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Compare the properties of waves created by different materials.

- Compare the properties of waves created by different materials.

### **Target 7 - Lesson 3**

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Make inferences about how different types of waves affect objects.

- Make inferences about how different types of waves affect objects.

### **Target 8 - Lesson 4**

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Describe the parts of a seismic wave.

- Describe the parts of a seismic wave.

### **Target 9 - Lesson 4**

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Propose a plan to use wave data to predict an earthquake and provide an early warning to people in the area.

- Propose a plan to use wave data to predict an earthquake and provide an early warning to people in the area.

### **Learning Goal 2 - Lessons 5 & 6**

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Generate and compare multiple solutions that use patterns to transfer information.

- Generate and compare multiple solutions that use patterns to transfer information.

MA.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.

SCI.4-PS4-3

Generate and compare multiple solutions that use patterns to transfer information.

### **Target 1 - Lesson 5**

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Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

### **Target 2 - Lesson 5**

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Explain how waves can be used to send information.

- Explain how waves can be used to send information.

### **Target 3 - Lesson 5**

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Discuss how waves are used to take measurements.

- Discuss how waves are used to take measurements.

## **Target 4 - Lesson 6**

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Understand how digitized information can be transmitted over long distances without significant degradation.

- Understand how digitized information can be transmitted over long distances without significant degradation.

## **Target 5 - Lesson 6**

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Discuss how high-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.

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## **Learning Goal 3 - Engineering and Design Standard**

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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.

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MA.K-12.2

Reason abstractly and quantitatively.

MA.K-12.4

Model with mathematics.

MA.K-12.5

Use appropriate tools strategically.

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.

## **Target 1**

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Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

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## **Formative Assessment and Performance Opportunities**

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Interactive Notebook

Lesson Games

Quizzes

Written Assessments (can be modified)

## **Summative Assessment**

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Class Participation

Vocabulary Cards

Interactive Tutorial

Cooperative Groups

Centers

Investigations

## **Accommodations/Modifications**

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Support the Processing Assignment

Focus on One Type of Wave Per Day

Modify the Investigation Prompts in the Interactive Student Notebook

Read the Student Text Before Doing the Investigation

Use the Act-It-Out to Motivate Students

Reduce the Number of Different Types of Waves Students Model

Apply Measurement to Waves' Properties

Come Up With New Models for Waves

Scaffold the Investigation Prompts in the Interactive Student Notebook

Walk Through the Interactive Tutorials Together

Use Step 1 to Model the Process

Apply Energy Concepts to Waves

Scaffold the Processing Assignment

Use Positive Redundancy to Get the Most Out of the Experiential Exercise

Use the model in the Experiential Exercise to explain more properties of seismic waves:

Work with the Term *Digitizing*

Make the Drums Before Class

Review the Geometric Terms in More Detail

Skip Step 4 of the Investigation

Demonstrate Digitizing with Musical Instruments

Draw a Picture Using Codes

Fully Model the Building and Testing of a Solution

Reduce the Amount of Decoding

Provide a Sample Solution That Doesn't Work Very Well

Add Color

## **Unit Resources**

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TCI website

TCI material kits

## **21st Century Life and Careers**

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CAEP.9.2.4.A.1	Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.
CAEP.9.2.4.A.2	Identify various life roles and civic and work - related activities in the school, home, and community.
CAEP.9.2.4.A.3	Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes.
CAEP.9.2.4.A.4	Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.

## **Interdisciplinary Connections**

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LA.W.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
LA.W.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic.
LA.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.
LA.W.4.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.RI.4.9	Integrate and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) information from two texts on the same topic in order to write or speak about the subject knowledgeably.
LA.SL.4.5	Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.
MA.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.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.