

# Unit: Waves

Content Area: **Science**  
Course(s): **Integrated Science 7**  
Time Period: **Week**  
Length: **10 weeks**  
Status: **Published**

## Unit Overview

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Students explore mechanical waves and their properties by looking at patterns in data, waves in different media, the wave model of light, properties of light waves, and technologies using waves to transfer information.

## Transfer

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

- Become better prepared for using knowledge of waves properties and information transfer to understand the planning and use of a disaster relief system.
- Compare and contrast reliability of analog and digital versions of the same device.
- Investigate a career in design engineering as it applies to STEM careers.
- Explain how global communications systems rely on information technology designs which use wave properties to encode and transmit information.

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For more information, read the following article by Grant Wiggins.

[http://www.authenticeducation.org/ae\\_bigideas/article.lasso?artid=60](http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60)

## Meaning

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## Understandings

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Students will understand ...

- There are different types of waves.
- How repeating patterns in waves are identified.
- How to measure the energy carried by waves.
- Changes occur when waves move from one medium to another.
- The wave-like properties of light.
- Properties of mechanical waves can be used to describe light waves.
- Wave pulses are useful for transmitting information.
- Digital signals are more reliable than analog signals.

## **Essential Questions**

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Students will keep considering...

- What are waves?
- How can you measure the energy carried by waves?
- How does the sun cause sunburn?
- What is ultraviolet radiation?
- How can waves be used to communicate information from one place to another?
- How can we use models to understand wave properties?
- How do waves behave when they interact with matter?
- How do we use waves to encode and transmit information?
- How are the properties of electromagnetic waves useful for human communication, navigation, and medical diagnoses?
- Why are digital signals more reliable than analog signals?
- How can properties of mechanical waves be used to describe light?
- What evidence is there that light is a wave?
- Why do we see colors?

## **Application of Knowledge and Skill**

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

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Students will know...

- Models can be used to understand wave properties.

- Types, properties, and behavior of different types of waves.
- Waves properties and behavior changes when interacting with matter.
- Waves are used in communication, navigation and medical diagnosis.
- Properties of waves can be used to describe light.
- Digital signals are more reliable than analog signals.
- Waves change behavior in different mediums.
- Identify measurable properties of waves.
- Identify the relationship between color and light.
- Colors of the visible spectrum.
- Reflection, refraction, and absorption

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

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- Students will be skilled at...
- Using models to make predictions.
- Research and design solutions to wave erosion.
- Gathering data on energy carried by waves.
- Construct models of light and color using prisms, lenses and mirrors.
- Design and build a communication system.
- Comparing digital versus analog communications.

### **Academic Vocabulary**

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**absorption**

**amplitude**

**analog encoding**

**binary code**

**constraints**

**criteria**

**digital encoding**

**electromagnetic spectrum**

**energy**

**fiber-optic cable**

**frequency**

**lens**

**light intensity**

**light ray**

**light wave**

**longitudinal wave**

**mechanical waves**

**medium**

**model**

**noise**

**proportional relationship**

**ratio**

**ray**

**receiver**

**reflection**

**refraction**

**scale model**

**signal**

**surface waves**

**transmission**

**transmitter**

**transverse wave**

**unit rate**

**visible light**

**wave**

**wave cycle**

**wavelength**

**wave pulse**

**wave relationship**

**wave speed**

**Wi-Fi**

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### **Learning Goal 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.

SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.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.

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### **Target 1 (Lesson 1-3)**

Students will understand that amplitude, wavelength, frequency, and wave speed are all properties of waves which can be measured and have a proportional relationship.

### **Target 2 (Lesson 1-3)**

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Students will be able to explain that waves carry energy in the direction of the wave's motion.

### **Target 3 (Lesson 1-3)**

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Students will differentiate mechanical waves as either transverse (light; matter moves perpendicular to the wave) or longitudinal (sound; matter moves parallel to the wave).

### **Target 4 (Lesson 1-3)**

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Students will recognize surface waves as matter moving in a circular pattern of motion both perpendicular and parallel to the wave.

### **Learning Goal 2**

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Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

SCI.MS-ETS1-4

Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

SCI.MS-PS4-2

Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

### **Target 1 (Lesson 4-6)**

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Students can differentiate between reflection and refraction of waves.

### **Target 2 (Lesson 4-6)**

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Students will understand the amount of refraction is related to the speed change of the wave and degrees away from perpendicular.

### **Target 3 (Lesson 4-6)**

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Students will be able to define and give examples of wave transmission as waves passing from one media type to another.

### **Target 4 (Lesson 4-6)**

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Students will be able to explain and recognize how energy of a wave transfers to its medium by absorption.

### **Learning Goal 3**

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Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

### **Target 1 (Lesson 7-8)**

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Students will compare and contrast the effectiveness, speed, and reliability of different methods of sending messages over a distance.

### **Target 2 (Lesson 7-8)**

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Students recognize analog signals have values which can vary continuously, while digital signals have specific values.

### **Target 3 (Lesson 7-8)**

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Students will be able to explain why the digital version of a product is more reliable than the analog version of the same device.

### **Formative Assessment and Performance Opportunities**

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- Anchoring phenomena checkpoints
- Constructed response
- Exit tickets
- Group work
- Interactive science notebook
- KWL charts
- Misconception check
- Performance assessments
- Quizzes
- Rubrics
- Teacher observation

### **Summative Assessment**

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#### **Common Assessment in Linkit**

**Unit 1 Performance Assessment** - Write a proposal for an engineering solution to the wave erosion problem threatening the Las Olas Hermosas restaurant.

**Unit 2 Performance Assessment** - Put your understanding of light into practice by using lenses, prisms, and mirrors to design a fun and interactive art show that will leave visitors with a deeper understanding and appreciation of light.

**Unit 3 Performance Assessment** - Design an advertisement that explains to people why the digital version of a technology is a more reliable choice to use than the analog version.

### **Accommodations/Modifications**

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- Allow choice of presentation format when students present investigation results of experimental designs
- Ask follow up questions to ensure comprehension when students view sections tutorials
- Create stations for students to record data in groups
- Flexible groupings
- Graphic organizers
- Group investigations
- Learning stations
- Read aloud when there is lengthy screen text
- Require students to make claims and provide evidence for the claim when identifying wave types outside the lesson
- Re-word, Re-teach and Clarify
- Scaffold learning when reviewing properties of waves and linear //proportional relationships in data
- Use bullet points rather than sentences when making sense of phenomena
- Use of collaboration during various activities
- Use of games and tournaments
- Use of models
- Use Quizlet for vocabulary review
- Varied supplemental materials
- When analyzing the relationship between wave amplitude and energy data, model calculation ratios and identify patterns

## **Unit Resources**

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TCI on-line	Chromebooks	Science World Magazines
TCI kits	Supplemental textbooks	Review Games
Bill Nye Series	Digital Resources	Google Hangouts
Document Camera	Interactive Science Notebook	Blackline Masters

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

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CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

## Interdisciplinary Connections

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MA.7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
MA.7.RP.A.2	Recognize and represent proportional relationships between quantities.
LA.RI.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RI.7.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of a specific word choice on meaning and tone.
LA.RI.7.7	Compare and contrast a text to an audio, video, or multimedia version of the text, analyzing each medium's portrayal of the subject (e.g., how the delivery of a speech affects the impact of the words).
LA.RI.7.8	Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.
LA.RI.7.9	Analyze and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) how two or more authors writing about the same topic shape their presentations of key information by emphasizing different evidence or advancing different interpretations of facts.
LA.W.7.1.A	Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.7.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
LA.W.7.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
LA.W.7.2.A	Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia).
LA.W.7.2.B	Develop the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.
LA.W.7.2.F	Provide a concluding statement or section that follows from and supports the information or explanation presented.
LA.W.7.7	Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

- LA.W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- LA.W.7.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- LA.SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
- LA.SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- LA.L.7.4.A Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
- LA.L.7.4.B Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., belligerent, bellicose, rebel).
- LA.L.7.4.C Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.
- LA.L.7.4.D Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).