

Unit 5 Waves and Their Applications

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Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

ADVANCED PHYSICAL SCIENCE, GRADE 6

WAVES and THEIR APPLICATIONS

Belleville Board of Education

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Unit Overview

In Unit 5, students will:

- develop an understanding that waves are energy traveling through matter, in a repeating pattern.
- use terms such as wavelength, frequency, and amplitude to describe the properties of waves.
- explore how the type of media a wave travels through affects the properties of a wave.
- gather evidence on the unique properties of light to determine how humans perceive color and brightness.
- examine refraction and reflection at the boundary of two media.
- apply understanding of sound waves in the designing of sound proof rooms.
- explain refraction, transmission, or absorption of light through different materials.
- apply understanding of light waves to decide color selection when painting various surfaces.
- explain how electromagnetic waves are used and modified to carry information for communication.
- compare and contrast AM and FM radio waves.
- explore differences between analog and digital signals to evaluate the reliability of these signals.
- analyze advancements in communication technology in relation to advancements in science.

Enduring Understanding

At the conclusion of Unit 5, all students will understand that:

- all waves have a repeating pattern with a specific wavelength, frequency, and amplitude.
- sound waves need matter to travel through.
- a light wave will be reflected, refracted, or absorbed by an object, depending on the object's material and the light wave's frequency.
- light waves travel in straight lines except at the surface of different transparent materials, where the light path bends.
- development of technology and advances in science are mutually supportive in driving innovation in both fields.
- wave models are useful in explaining all of the properties and behaviors of light.
- light can travel through space it can not be a matter wave.
- digital signals are a more reliable way to encode information than analog.
- computers use binary code to transmit information.

Essential Questions

- How does energy move about the universe?
- How does the way light waves interact with materials allow us to perceive our surroundings?
- Compare and contrast echoes and reflections.
- How would you create a sound proof room?
- What colors would be best to paint a doghouse?
- How can we distinguish different sounds and colors?
- How do electric devices send and receive information?
- How do waves get "sent" and "received"?
- What is the difference between Am and FM radio waves?
- How has wireless technology changed our society and where will it take us in the future?
- What is the basic code that computers use to send and receive signals?
- What scientific concepts do we need to understand to overcome the challenges of designing systems to send and receive wave information?

Exit Skills

Upon completion of Unit 5 Waves and their Application, students will be able to:

- differentiate between waves and other phenomena.
- analyze models to identify patterns on waves.
- compare and contrast transverse and longitudinal waves.
- use charts and graphs to present data on amplitude and frequency of waves.
- generate mechanical waves to describe wave properties.
- use knowledge of wave properties to explain how the amplitude of a wave decreases as it travels over a large area.
- apply their understanding of wave properties to explain how an ultrasound machine produces visual images.
- describe how light waves contribute to a beautiful sunset or sunrise.
- use mathematical thinking to explore relationship between a wave's energy and frequency and the resulting effects on living things.
- use models to interpret the relationship between a wave's energy and its amplitude.
- integrate scientific and technical information about waves and wave application.
- use text in media and visual displays to compare types of modulation.
- evaluate different models to determine if information being shared is analog or digital.

New Jersey Student Learning Standards (NJSLS-S)

6-8.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.
6-8.MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
6-8.MS-PS4-1.1.1	Graphs and charts can be used to identify patterns in data.
6-8.MS-PS4-2.2	Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
6-8.MS-PS4-2.2.1	Develop and use a model to describe phenomena.
6-8.MS-PS4-1.5	Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
6-8.MS-PS4-1.5.1	Use mathematical representations to describe and/or support scientific conclusions and design solutions.
6-8.MS-PS4-2.6.1	Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.
6-8.MS-PS4-3.6.1	Structures can be designed to serve particular functions.
6-8.MS-PS4-3.8	Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods.
6-8.MS-PS4-3.8.1	Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.
6-8.MS-PS4-2.PS4.A	Wave Properties
6-8.MS-PS4-1.PS4.A.1	A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.
6-8.MS-PS4-2.PS4.A.1	A sound wave needs a medium through which it is transmitted.
6-8.MS-PS4-2.PS4.B.1	When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light.
6-8.MS-PS4-2.PS4.B.2	The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
6-8.MS-PS4-2.PS4.B.3	A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
6-8.MS-PS4-2.PS4.B.4	However, because light can travel through space, it cannot be a matter wave, like sound or water waves.
6-8.MS-PS4-3.PS4.C	Information Technologies and Instrumentation
6-8.MS-PS4-3.PS4.C.1	Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.

Interdisciplinary Connections

LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and

phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.

LA.RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
LA.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.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.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.WHST.6-8.1.A	Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.WHST.6-8.1.B	Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
LA.WHST.6-8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
LA.WHST.6-8.1.D	Establish and maintain a formal/academic style, approach, and form.
LA.WHST.6-8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.6-8.2.A	Introduce a topic and 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) when useful to aiding comprehension.
LA.WHST.6-8.2.B	Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
LA.WHST.6-8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
LA.WHST.6-8.2.E	Establish and maintain a formal/academic style, approach, and form.
LA.WHST.6-8.2.F	Provide a concluding statement or section that follows from and supports the information or explanation presented.
LA.WHST.6-8.3	(See note; not applicable as a separate requirement)
LA.WHST.6-8.4	Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.
LA.WHST.6-8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
LA.WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
LA.WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

LA.WHST.6-8.8	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.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Learning Objectives

At the conclusion of Unit 5, students will be able to:

- recognize that a simple wave has a repeating pattern.
- differentiate between longitudinal and transverse waves.
- explain the measurable properties of a wave amplitude, frequency, and wavelength.
- correlate the behavior of waves to the properties of waves.
- describe the behavior of waves and particles through different types of materials.
- model and graph the amplitude of a wave in relation to the distance it travels.
- analyze the reflection of waves at the boundary of two media.
- model the properties of waves in relation to how they correspond to properties of light.
- determine why light does not need to travel through matter.
- express the relationship between wavelength, frequency, and amplitude in mathematical models.
- recognize patterns in data between the brightness of light and specific amplitude.
- evaluate how structure affects interactions between light and matter.
- synthesize knowledge of signals and waves to explain how waves can be designed to carry signals.
- compare and contrast, and evaluate the reliability of analog and digital signals.
- discover how the structure of a wave can be designed to encode and transmit information.
- analyze the ways in which communications are used in technology.
- design a telephone timeline to illustrate how telephone technology transformed with scientific advancement.

Suggested Activities

From HMH Curriculum Activities:

- Engage: Lesson Phenomenons
- Explore/Explain: Hands on Labs and Engineer It
- Unit Projects
- Unit Performance Tasks

From Defined Stem:

- Performance Tasks

- Literacy Tasks
- Constructed Response

Evidence of Student Learning - Checking for Understanding (CFU)

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources & Materials

HMH Module L Workbook

Laboratory Kits and Materials

Defined Stem

BrainPop

Ancillary Resources

Guest Speakers

Other Internet sources

Outdoor area of school

Laptop Carts for further research

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Technology Infusion

- Smart board
- DefinedStem.com
- Document Camera
- Pod-casts video streams
- Discovery Education video streams
- You Tube video streams
- Brain-pop video streams
- Laptops
- Khan Academy
- Power Point presentation
- MS Word

Alignment to 21st Century Skills & Technology

These skills will be aligned to the following core content areas:

- English Language Arts; reading informational text, following procedural steps, orally presenting predictions and opinions, and creating written laboratory reports
- Mathematics; measuring
- Science and Scientific Inquiry (Next Generation); see above
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics; history

of science and how the Scientific method has connections to World and American history expansion. Discuss the impact of science on society and what kind of moral questions scientists must address.

- World languages; discussion of root words and linguistic origin of vocabulary words.
- Technology; see above
- Visual and Performing Arts: oral and graphic presentation of procedures, results, and conclusion.

21st Century/Interdisciplinary Themes

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

Differentiation

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches

- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts

- Varied supplemental materials

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Special Education Learning

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format

- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- Provide native language translation when possible
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Sample Lesson

Unit Name: Waves and Their Application

NJSLS: See link

Interdisciplinary Connection: See link

Statement of Objective: SWDAT research and explain how waves carry light and sound from one place to another.

Anticipatory Set/Do Now:SW work with their science table team to log onto laptop and read over the assignment directions and test linkage to the web.

(Word document [Wave Webquest Instructions.docx](#)

or Hyperlink to teacher's webpage

http://ms.bellevilleschools.org/apps/pages/index.jsp?uREC_ID=562636&type=u&pREC_ID=855497)

Learning Activity:

1.) Do Now

2) TW display instructions on Smartboard and demonstrate how the links work and how the different sites function.

2) SW work in preassigned teams of three to research the characteristics of sound and light waves. All groups would be homogenous as this is an advanced class.

3) SW complete a teacher prepared worksheet as they perform the "Treasure Hunt"

[Wave Webquest W.S..docx](#)

4) TW circulate and assist as needed.

Student Assessment/CFU's: Webquest W.S.

Materials: Laptop cart, Smartboard, Laptop Cart, Webquest W.S.

21st Century Themes and Skills: Information Literacy, IT Literacy, Media Literacy

Differentiation: Restate written instructions, Visual Smartboard) presentation of instructions, small group activity, varied visual and kinesthetic on line activities.

Integration of Technology:Smartboard, Laptop cart, Teacher prepared webquest see document for websights invovled (Word document [Wave Webquest Instructions.docx](#)

or Hyperlink to teacher's webpage

http://ms.bellevilleschools.org/apps/pages/index.jsp?uREC_ID=562636&type=u&pREC_ID=855497)

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LA.WHST.6-8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
6-8.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.

6-8.MS-PS4-2

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

6-8.MS-PS4-1.1.1

Graphs and charts can be used to identify patterns in data.

6-8.MS-PS4-1.5.1

Use mathematical representations to describe and/or support scientific conclusions and design solutions.

6-8.MS-PS4-1.PS4.A.1

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

6-8.MS-PS4-2.PS4.A.1

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

6-8.MS-PS4-2.PS4.B.1

When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.

6-8.MS-PS4-2.PS4.B.2

The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.

6-8.MS-PS4-2.PS4.B.3

A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.

6-8.MS-PS4-2.PS4.B.4

However, because light can travel through space, it cannot be a matter wave, like sound or water waves.