Unit 5 Waves and Their Applications

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Curriculum Guide

Physical Science, Grade 6

Waves & Their Applications

Belleville Board of Education

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Unit Overview

In Unit 5, students will:

- develop an understanding that waves are evergy traveling through matter, ina repaetong patern.
- use terms such as wavelenght, freguency,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 proerties of light to determine how humans percieve color and brightness.
- examine refraction and reflection at the boundry of two media.
- explain refraction, tranmission, or absorbtion of light through different materials.
- explain how elcetromagnetic waves are used and modified to carry information for communication.
- explore differences between analog and digital signals to evaluate the reliability of these signals.
- analyze advancements in communicsation 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 relflected, refracted, or absorbed by an object, depending on the object's material and the light wave's frequency.
- light waves traqvel in straight lines except at the surface of different transpparent 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 f the properties and behaviors of light.
- light can travel through space it can not be a matter wave.
- digital signals are more reliable way to encode information than analog.

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 can we distinquish different sounds and colors?
- How do electric devices send and recieve infrmation?
- How do waves get "sent" and "received"?
- How has wireless technology changed our society ad where will it take us in the future?
- 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 bewteen waves and other phenomena.
- analyze models to identify patterns of 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 t explain how the amplitude of a wave decreases as it travels over a large area.
- apply their understanding wave properties to explain how an ultrasound machine prduces visual images.
- describe how light waves contribute to a beautiful sunset or sunrise.
- use mathmateical 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 mdulation.
- evaluate different models to determine if information being shared is analog or digital.

New Jersey Student Learning Standards (NJSLS-S)

SCI.MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
SCI.MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
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.
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.
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-PS4-1.5.1	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-PS4-1.1.1	Graphs and charts can be used to identify patterns in data.
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-PS4-2.2.1	Develop and use a model to describe phenomena.
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-PS4-2.6.1	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	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-PS4-3.8.1	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-PS4-3.PS4.C.1	Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.
6-8.MS-PS4-3.6.1	Structures can be designed to serve particular functions.
SCI.MS	Waves and Electromagnetic Radiation
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.

Interdisciplinary Connections

LA.6-8.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.6-8.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.6-8.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.6-8.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.6-8.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.
LA.6-8.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LA.6-8.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.6-8.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.6-8.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.6-8.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.6-8.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.6-8.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.6-8.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.6-8.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.6-8.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.6-8.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.6-8.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.6-8.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.6-8.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.

Learning Objectives

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

- recognize that a simple wave has a repeating patern.
- differntiate bewteen longitudinal and transverse waves.
- explain the measurable properties of a wave amplitude, frequency, and wavelenght.
- correlate the behavior of waves to the properties of waves.
- describe the behavior of waaves and particles through different types of materials.
- model and graph the amplitude of a wave in realtion the distance it travels.
- analyze the reflection of waves at the boundry of two media.
- model the properties of waves in relation to how they correspnd to properties of light.
- detremine why light does not need to travel through matter.
- express te relationship between wavelength, frequency, and amplitude in mathmatetical models.
- recognoze patterns in data between the brghtness of light and specific amplitude.
- evaluate how structure affects interactations 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 reliabilty of analog and digital signals.
- discover how the structure of a wave can be designed to encode and trnsmit information.
- analyze the ways in which communcications 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

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; hisitory of science and how the Scientific method has connections to World and American history expansion. Discuss the inpactof scence 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 - Science Dollars
- Guided Notes
- Teacher reads assessments allowed
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Dictation to scribe

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Multiple texts
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
-

Lo-Prep Differentiations

- Exploration by interest
- Flexible grouping
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Varied journal prompts
- Correcting summative and formative assessments
- Retaking the test

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 workpresented 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 clarif
- 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 workpresented 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 whenever 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 Applications

NJLSL: See link

Interdisciplinary Connection: see link

Visual Arts - diagraming laboratory activities

Statement of Objective: SWDAT explain refracted light using the concepts of bending light waves passing through different mediums.

Anticipatory Set/Do Now: SW observe two PBS video - the Law of Refraction of Light

http://www.pbslearningmedia.org/resource/lsps07.sci.phys.energy.lightrefract/observing-refraction-of-light/

http://www.pbslearningmedia.org/resource/lsps07.sci.phys.energy.lightspeed/speed-of-light/

Learning Activity:

1.Videos 20 minutes

2.TW demonstrate the dissappearing Coin trick using a quarter, plastic cup, and water.

3. TW explain the two activities and ask three students to repeat the directions (CFU)

4. SW will work in small homogenous froups to perform activity.

a.)They will look trough a plastic cup of water while aother students passes a piece of paper with arrows drawn on it.

b.) Next they will place dime in cup and try to spear it through a straw. The refraction should caue them to miss completely.

5. Work with group to diagram each of the activities in their notebook with an explanation of how the behavior of waves caused the phenomena they observed.

Student Assessment/CFU's: Fist to Five, Green, Yellow, Red index card, teacher observation of activity, notebook diagrams

Materials: textbook, smartboard, notebooks, Plastic cups, straws, wooden skewers, dimes, strips of paper with arrows drawn on them

21st Century Themes and Skills: Communication and Collaboration, Media Literacy, Creativity and Innovation.

Differentiation: small group projects, visual learning, center based hands on activity

Integration of Technology: Smartboard, PBS videos

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