



Marietta City Schools

District Unit Planner

Everything on the unit planner must be included on the unit curriculum approval statement.

Honors Science 8

Unit title	Waves	MYP year	3	Unit duration (hrs)	25 Hours
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Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): *What will students learn?*

#### GSE Standards

##### Standards

**S8P4. Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.**

- Ask questions to develop explanations about the similarities and differences between electromagnetic and mechanical waves. (*Clarification Statement: Include transverse and longitudinal waves and wave parts such as crest, trough, compression, and rarefactions*)
- Construct an explanation using data to illustrate the relationship between the electromagnetic spectrum and energy.
- Design a device to illustrate practical applications of the electromagnetic spectrum (e.g., communication, medical, military).
- Develop and use a model to compare and contrast how light and sound waves are reflected, refracted, absorbed, diffracted, or transmitted through various materials. (*Clarification Statement: Include echo and how color is seen but do not cover interference and scattering.*)
- Analyze and interpret data to predict patterns in the relationship between density of media and wave behavior (i.e., wave speed).
- Develop and use a model (e.g., simulations, graphs, illustrations) to predict and describe the relationships between wave properties (e.g., frequency, amplitude, and wavelength) and energy.
- Develop and use models to demonstrate the effects that lenses have on light (i.e., formation of an image) and their possible technological approaches.

##### Gifted Standards

**MCS.Gifted.S4B.** Recognize and examine the value of others strengths, thoughts, ideas, and feelings during collaboration.

**MCS.Gifted.S4C.** Establish a common goal utilizing strengths of each group member.

**MCS.Gifted.S4E.** Use a variety of multi-media and innovative technologies as tools to effectively communicate the individual or collaborative group work.

**MCS.Gifted.S5D.** Develop a shift in actions, feelings and thoughts.

**Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)**

**In fourth grade, students should have mastered:**

S4P1. Obtain, evaluate, and communicate information about the nature of light and how light interacts with objects.

- a. Plan and carry out investigations to observe and record how light interacts with various materials to classify them as opaque, transparent, or translucent.
- b. Plan and carry out investigations to describe the path light travels from a light source to a mirror and how it is reflected by the mirror using different angles.
- c. Plan and carry out investigations utilizing everyday materials to explore examples of when light is refracted.

S4P2. Obtain, evaluate, and communicate information about how sound is produced and changed and how sound and/or light can be used to communicate.

- a. Plan and carry out investigations utilizing everyday objects to produce sound and predict the effects of changing the strength or speed of vibrations.
- b. Design and construct a device to communicate across a distance using light and/or sound.

At the start of the Light Waves unit, middle school students will likely have some everyday experience with the ways that light can affect a material, such as by warming an object, changing an object's color, or causing a sunburn. They are also likely to understand that energy is required to make things happen. However, few students will have experience with the idea of light as a wave, or the fact that light carries energy that can be absorbed by a physical material, which is what causes that material to change. Students are also not likely to be familiar with the idea that there are types of light outside of the visible spectrum, and that various types of light can pass through objects that appear opaque, or bounce off of objects that appear clear. Students may think that all light is the same, that the only way that light can affect things is by warming them up, or that only certain kinds of "special" light can affect materials. Students also may not understand the concept of different light sources, such as the sun or a lamp, or that different types of light have different wavelengths. Students' experience and prior knowledge can be built on and refined, which the Light Waves Progress Build and unit structure are designed to do.

**Concepts/Skills to be Mastered by Students**

- Wave Properties (frequency, amplitude, wavelength, and energy)
- Energy (electromagnetic spectrum)
- Light and Sound
- Wave Propagation (reflection, refraction, absorption, diffraction, transmission)
- Lenses

**Key Vocabulary: (KNOWLEDGE & SKILLS)**

Mechanical Waves, Electromagnetic Waves, Transverse, Longitudinal, Crest, Trough, Compression, Rarefaction, Electromagnetic Spectrum, Energy, Radiation, Vacuum, Gamma Ray, X-Ray, Microwave, Radio Waves, Visible Light, Ultraviolet, Infrared, Light, Sound, Emit, Reflection, Absorption, Refraction, Diffraction, Transmission, Echo, Color, Medium (Media), Density, Wave speed, Frequency (High, Low), Wavelength (Long, Short), Amplitude (High, Low), Perpendicular, Parallel, Lens, Concave, Convex, Image, Increase, Decrease

**Year-Long Anchoring Phenomena: (LEARNING PROCESS)**

How does matter and energy interact within the universe?

**Unit Phenomena (LEARNING PROCESS)**

Electromagnetic waves behave differently than mechanical waves.

**Aviation Phenomena:**

How are the characteristics and properties of EM and mechanical waves applied in aeronautics?

**CER:** Students answer the phenomenon in a Claim-Evidence-Reasoning constructed response as a formative and summative assessment. Allow students to make edits to their constructed response throughout the unit for a final submission.

**Capstone Connective Theme:** Aeronautical Applications of Waves

**UN Sustainable Development Goals:** Industry, Innovation, and Infrastructure

**Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)**

- Students may have difficulty visualizing that waves transfer energy, rather than matter.
- Students may have difficulty with the concept that mechanical wave energy is determined by the wave’s amplitude, while electromagnetic wave energy is dependent upon wave frequency.
- Students may have difficulty interpreting electromagnetic spectrum diagrams. Students should be exposed to a variety of EM spectrum diagrams (ex. highest to lowest frequency vs. lowest to highest frequency).
- Students may have difficulty equating transverse waves with vertical particle motion and longitudinal waves with horizontal particle motion relative to the direction of the wave’s motion.
- Students may confuse the types of wave behaviors.
- Students may have difficulty interpreting tables that display wave speed through various media.
- Students may have difficulty predicting the location and orientation of an image produced by converging and diverging lenses.

Key concept	Related concept(s)	Global context
<p align="center"><b>Development</b></p> <p>Development is the act or process of growth, progress or evolution, sometimes through iterative improvements.</p>	<p align="center">Effects (MYP/CCC)</p>	<p align="center"><b>Scientific and technical innovation</b></p> <p>How the world works: an inquiry into the natural world and its laws; the interaction between the natural world (physical and biological) and human societies; how humans use their understanding of scientific principles; the impact of scientific and technological advances on society and on the environment.</p>

**Statement of inquiry**

Advances in science and technology have developed humans’ understanding of the uses, behaviors, and effects of electromagnetic and mechanical energy.

**Inquiry questions**

- Factual**
- What is the electromagnetic spectrum?
  - How do scientists organize the electromagnetic spectrum in terms of energy?
  - Is all light the same?
  - How are images formed using light?
  - What is a mechanical wave?

- What are the parts of a transverse and longitudinal wave?
- What is sound?

**Conceptual**

- Why can light from the sun cause skin cancer?
- Why can light cause materials to change?
- What makes types of light different?
- What can happen to light as it travels?
- What happens to energy when light is transmitted through or reflected off of a material?
- How do light/sound waves behave? How does a medium affect the speed of a wave?
- How do our eyes and ears perceive different changes in the properties of a wave?
- How are mechanical waves different from electromagnetic waves?
- How do the different properties (wavelength, frequency, amplitude and speed) relate to energy?

**Debatable**

- How can we design a device to help someone who is deaf or blind detect light waves or sound waves?
- How are waves used in aviation?

MYP Objectives	Assessment Tasks	
<i>What specific MYP <b>objectives</b> will be addressed during this unit?</i>	<i>Relationship between summative assessment task(s) and statement of inquiry:</i>	<i>List of common formative and summative assessments.</i>
Science: Criterion A: Knowing and Understanding I. describe scientific knowledge ii. apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations iii. analyze information to make scientifically supported judgments	SOI: Advances in science and technology have developed humans’ understanding of the uses, behaviors, and effects of electromagnetic and mechanical energy.  In this unit, students are tasked with exploring the behaviors of both mechanical and electromagnetic waves, as well as wave properties. This includes an investigation into the electromagnetic spectrum, along with the uses of each type of light that makes up the electromagnetic spectrum. Students will create an EM spectrum foldable that can be referenced throughout the unit. Additionally, students will complete a final multiple choice unit assessment, reflective of the GA Milestones, that assesses their understanding of mechanical and electromagnetic waves, in terms of their properties (energy, amplitude, wavelength, and frequency) and behaviors (reflection, refraction, absorption, transmission, diffraction). Part II of the assessment will challenge students to make a claim, supported by evidence and reasoning, to answer a question regarding the uses and behaviors of electromagnetic and mechanical energy. Students will also participate in a design challenge that tasks them with designing a device to help someone who is blind or deaf detect sound or light waves.	<b>Formative Assessment(s):</b> Electromagnetic Waves CFA  <b>Summative Assessment(s):</b> Waves Unit Assessment Paper I and Paper II

<p>Criterion D: Reflecting on the Impacts of Science</p> <p>lii. apply scientific language effectively</p> <p>Design:</p> <p>Criterion A: Inquiring and Analyzing</p> <p>I. explain and justify the need for a solution to a problem</p> <p>Criterion B: Developing Ideas</p> <p>Iv. develop accurate planning drawings/diagrams and outline requirements for the creation of the chosen solution</p>	<p>This allows students to elaborate on the uses of electromagnetic and mechanical energy. Honors students will investigate connections between types of waves and their applications in aviation.</p>	
<p><b>Approaches to learning (ATL)</b></p>		
<p><b>Category:</b> Thinking  <b>Cluster:</b> Critical Thinking  <b>Skill Indicator:</b> Use models and simulations to explore complex systems and issues.</p>		

**Learning Experiences**

Add additional rows below as needed.

Objective or Content		Personalized Learning and Differentiation
<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>a. Ask questions to develop explanations about the similarities and differences between electromagnetic and mechanical waves. (<i>Clarification Statement: Include transverse and longitudinal waves and wave parts such as crest, trough, compression, and rarefactions</i>)</p>	<ul style="list-style-type: none"> <li>● Lab: Exploring Wave Properties (Slinky Lab and Reading Article)</li> <li>● Electromagnetic vs. Mechanical Waves Graphic Organizer</li> </ul>	<ul style="list-style-type: none"> <li>● Capstone Connections</li> <li>● Discovery Education High School Science Techbook</li> <li>● NGSS Case Studies for Differentiated Learners</li> <li>● Next Generation Science Standards: “All Standards, All Students”</li> <li>● Extensions – Enrichment Tasks/Projects</li> </ul> <p>Task-Specific Differentiation</p> <ul style="list-style-type: none"> <li>● Scaffolding</li> <li>● Extended Learning</li> <li>● Sentence Starters</li> <li>● Leveled Tasks</li> <li>● Mode/Method of Presentation</li> <li>● Type of Product</li> </ul>
<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>b. Construct an explanation using data to illustrate the relationship between the electromagnetic spectrum and energy.</p>	<ul style="list-style-type: none"> <li>● Creating an Electromagnetic Spectrum Foldable</li> <li>● Analyzing and Interpreting the Electromagnetic Spectrum Practice</li> <li>● Electromagnetic Spectrum in Aviation</li> </ul>	
<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>c. Design a device to illustrate practical applications of the electromagnetic spectrum (e.g., communication, medical, military).</p>	<ul style="list-style-type: none"> <li>● Engineer a Solution for Individuals Who Cannot Detect Light or Sound Waves</li> </ul>	

<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>d. Develop and use a model to compare and contrast how light and sound waves are reflected, refracted, absorbed, diffracted, or transmitted through various materials. <i>(Clarification Statement: Include echo and how color is seen but do not cover interference and scattering.)</i></p>	<ul style="list-style-type: none"> <li>● Lab: Exploring Wave Behaviors and CER</li> </ul>	
<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>e. Analyze and interpret data to predict patterns in the relationship between density of media and wave behavior (i.e., wave speed).</p>	<ul style="list-style-type: none"> <li>● DE Exploration: The Speed of Sound</li> <li>● Data Analysis and Interpretation: Wave Speed Through Various Media</li> </ul>	
<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>f. Develop and use a model (e.g., simulations, graphs, illustrations) to predict and describe the relationships between wave properties (e.g., frequency, amplitude, and wavelength) and energy.</p>	<ul style="list-style-type: none"> <li>● Lab: Exploring &amp; Modeling Wave Properties (Slinky Lab and Reading Article)</li> <li>● Creating an Electromagnetic Spectrum Foldable</li> <li>● Analyzing and Interpreting the Electromagnetic Spectrum Practice</li> </ul>	
<p><b>S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves.</b></p> <p>g. Develop and use models to</p>	<ul style="list-style-type: none"> <li>● Lab: Lenses</li> </ul>	

<p>demonstrate the effects that lenses have on light (i.e., formation of an image) and their possible technological approaches.</p>		
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**Content Resources**

[Georgia Grade 8 Science GaDOE Instructional Segment](#)  
 Part One: Electromagnetic Waves  
 Part Two: Sound Waves

[Discovery Education Grade 8 Science Techbook](#)

[Discovery Education Physics Science Techbook](#)

[Discovery Education: Boeing Partnership](#)

[PhET:](#)  
 Waves on a String

Argument-Driven Inquiry in Physical Science:  
 Lab 19: Wave Properties  
 LAb 20: Reflection and Refraction

**Capstone Connections**

Capstone Action Plan Proposal (Sections A-D)

Capstone Action Plan Feedback

Electromagnetic Spectrum in Aviation