



Marietta City Schools

District Unit Planner

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

*Accelerated Physical Science*

<b>Unit title</b>	<i>Waves</i>	<b>MYP year</b>	3	<b>Unit duration (hrs)</b>	<i>11.25 Hours</i>
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**Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): *What will students learn?***

### GSE Standards

#### Standards

**SPS9. Obtain, evaluate, and communicate information to explain the properties of waves.**

- Analyze and interpret data to identify the relationships among wavelength, frequency, and energy in electromagnetic waves and amplitude and energy in mechanical waves.
- Ask questions to compare and contrast the characteristics of electromagnetic and mechanical waves.
- Develop models based on experimental evidence that illustrate the phenomena of reflection, refraction, interference, and diffraction.
- Analyze and interpret data to explain how different media affect the speed of sound and light waves.
- Develop and use models to explain the changes in sound waves associated with the Doppler Effect.

#### MCS 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)**

Students taking this course as 8<sup>th</sup> graders have not been exposed to the 8<sup>th</sup> grade Physical Science GSE.

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

- Plan and carry out investigations to observe and record how light interacts with various materials to classify them as opaque, transparent, or translucent.
- 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.
- Plan and carry out an investigation utilizing everyday materials to explore examples of when light is refracted. (Clarification statement: Everyday materials could include prisms, eyeglasses, and a glass of water.)

#### **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 an investigation 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.

Teacher Background Info:

[Vibration and Waves](#)

[Sound Waves and Music](#)

[Light and Color](#)

[Reflection and Mirrors](#)

[Refraction and Lenses](#)

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

- Electromagnetic and Mechanical Waves
- Reflection, Refraction, Interference, and Diffraction
- Doppler Effect
- Energy
- Energy Transformations

### **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, Refraction, Diffraction, Interference, Medium (Media), Density, Elasticity, Wave speed, Frequency (High, Low), Wavelength (Long, Short), Amplitude (High, Low), Pitch, Perpendicular, Parallel, Doppler Effect, normal (center line)

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

How does matter and energy interact within the universe?

### **Unit Phenomena (LEARNING PROCESS)**

How can we use our understanding of electromagnetic and mechanical waves to explain how wave behaviors impact our ability to observe matter around us?

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

- Students may have difficulty visualizing how waves transfer energy, not matter.
- Students may confuse the relationship between energy, wavelength, frequency, and amplitude in electromagnetic vs. mechanical waves.
- 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 confuse the types of wave behaviors with one another.
- Students may have difficulty conceptualizing that the apparent shift in frequency that occurs during the Doppler Effect is dependent upon the position of the observer.

Key concept	Related concept(s)	Global context
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<p style="text-align: center;"><b>Relationships</b></p> <p>Relationships are the connections and associations between properties, objects, people and ideas— including the human community’s connections with the world in which we live. Any change in relationship brings consequences—some of which may occur on a small scale, while others may be far-reaching, affecting large networks and systems such as human societies and the planetary ecosystem.</p>	<p style="text-align: center;">Models (MYP/CCC)</p>	<p style="text-align: center;"><b>Scientific and Technical Innovation</b></p> <p>Students will explore the natural world and its laws; the interaction between people and the natural world; how humans use their understanding of scientific principles; the impact of scientific and technological advances on communities and environments; the impact of environments on human activity; how humans adapt environments to their needs.</p>
<b>Statement of inquiry</b>		
<p>Models allow us to examine patterns in wave behavior in order to identify relationships between energy, frequency, wavelength, and amplitude.</p>		
<b>Inquiry questions</b>		
<p><b>Factual:</b></p> <p>What is a wave?          What are the categories of waves?          What is the anatomy of a wave?          What are the relationships among wavelength, frequency, and energy in electromagnetic waves?          What is the relationship between amplitude and energy in mechanical waves?          What are examples of typical wave behaviors?          What is the Doppler effect?</p> <p><b>Conceptual:</b></p> <p>How are electromagnetic and mechanical waves similar/different?          How can I use the electromagnetic spectrum to determine whether a wave is high energy or low energy?          How do waves interact with various types of media?          How will the speed of a wave be affected as it transitions from one medium to another?          How does a phenomenon like the Doppler effect occur?</p> <p><b>Debatable:</b></p> <p>How might life be different if light and/or sound did not travel in waves?          What part of the electromagnetic spectrum is the most essential to the continued pursuit of scientific and technical innovations?</p>		
<b>MYP Objectives</b>	<b>Assessment Tasks</b>	

What specific MYP <b>objectives</b> will be addressed during this unit?	<b>Relationship</b> between summative assessment task(s) and statement of inquiry:	List of common formative and summative assessments.
Science A: Knowing and Understanding I. describe scientific knowledge Iii. analyze information to make scientifically supported judgments Science C: Processing and Evaluating I. present collected and transformed data Ii. interpret data and describe results using scientific reasoning Science D: Reflecting on the Impacts of Science I. apply scientific language effectively	SOI: Models allow us to examine patterns in wave behavior in order to identify relationships between energy, frequency, wavelength, and amplitude.  In Waves Unit Assessment Paper I and Paper II, students will be exposed to a variety of models depicting the anatomy and behaviors of waves. Using their prior experience with hands-on classroom tasks and digital simulations, students are required to interpret patterns of wave behavior, identify wave characteristics and key aspects of a wave's structure, and predict a wave's behavior and change in speed when encountering various media. Students will use multiple sources of data to identify relationships between energy, frequency, wavelength, and amplitude, including the electromagnetic spectrum.	<b>Formative Assessment(s):</b> Waves CFA  <b>Summative Assessment(s):</b> Waves Unit Assessment Paper I and Paper II

**Approaches to learning (ATL)**

**Category:** Communication  
**Cluster:** Communication Skills  
**Skill Indicator:** Negotiate ideas and knowledge with peers and teachers.

**Learning Experiences**

Add additional rows below as needed.

Objective or Content	Learning Experiences	Personalized Learning and Differentiation
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<p><b>SPS9. Obtain, evaluate, and communicate information to explain the properties of waves.</b></p> <p>a. Analyze and interpret data to identify the relationships among wavelength, frequency, and energy in electromagnetic waves and amplitude and energy in mechanical waves.</p>	<p>DE Exploration - Describing Waves + Speed of Sound Research: EM Spectrum Device Research Activity (Science: A,C,D)</p>	<ul style="list-style-type: none"> <li>Discovery Education High School Physics 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><b>SPS9. Obtain, evaluate, and communicate information to explain the properties of waves.</b></p> <p>b. Ask questions to compare and contrast the characteristics of electromagnetic and mechanical waves.</p>	<p>Research: EM Spectrum Device Research Activity (Science: A,C,D) Electromagnetic vs. Mechanical Waves Venn Diagram</p>	<p>All information included by PLC in the differentiation box is the responsibility and ownership of the local school to review and approve per Board Policy IKB.</p>
<p><b>SPS9. Obtain, evaluate, and communicate information to explain the properties of waves.</b></p> <p>c. Develop models based on experimental evidence that illustrate the phenomena of reflection, refraction, interference, and diffraction.</p>	<p>Elaboration: Wave Behavior Scenarios (Science: A,D)</p>	<p>Task-Specific Differentiation</p> <ul style="list-style-type: none"> <li>Scaffolding of Practice</li> <li>Visual Modeling</li> <li>Small Group</li> <li>Multiple Means of Engagement</li> <li>Multiple Means of Content Representation (laboratories, SIM, DE Techbook)</li> <li>Multiple Means of Action and Expression</li> </ul>
<p><b>SPS9. Obtain, evaluate, and communicate information to explain the properties of waves.</b></p> <p>d. Analyze and interpret data to explain how different media affect the speed of sound and light waves.</p>	<p>DE Exploration - Describing Waves + Speed of Sound</p>	
<p><b>SPS9. Obtain, evaluate, and communicate information to explain the properties of waves.</b></p> <p>e. Develop and use models to explain the changes in sound waves associated with the Doppler Effect.</p>	<p>Elaboration: Wave Behavior Scenarios (Science: A,D)</p>	
<p><b>Content Resources</b></p>		

Discovery Education High School Physics Textbook

Unit 5: Waves

- Concept 5.1 Wave Characteristics
- Concept 5.2 Reflection and Refraction

GaDOE Instructional Segment: Properties of Waves - Doppler Effect

PhET:

- Waves Intro
- Wave on a String
- Wave Interference