Marietta City Schools

District Unit Planner

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

Science Grade 8

Unit title	*Waves*	**MYP year**	*3*	**Unit duration (hrs)**	*25 Hours*

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.

a. 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)*
b. Construct an explanation using data to illustrate the relationship between the electromagnetic spectrum and energy.
c. Design a device to illustrate practical applications of the electromagnetic spectrum (e.g., communication, medical, military).
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. (*Clarification Statement: Include echo and how color is seen but do not cover interference and scattering.)*
e. Analyze and interpret data to predict patterns in the relationship between density of media and wave behavior (i.e., wave speed).
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.
g. Develop and use models to demonstrate the effects that lenses have on light (i.e., formation of an image) and their possible technological approaches.

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
In first grade, students should have mastered:
S1P1. Obtain, evaluate, and communicate information to investigate light and sound.

a. Use observations to construct an explanation of how light is required to make objects visible.
b. Ask questions to identify and compare sources of light.
c. Plan and carry out investigations of shows by placing objects at various points from a source of light.
d. Construct an explanation supported by evidence that vibrating materials can make sound and that sound can make materials vibrate.
e. Design a device that can serve as an emergency alert using light and/or sound to communicate over a distance.

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 warm.

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.

<u>Concepts/Skills to be Mastered by Students</u>

- 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)

Human Need for Energy

Unit Phenomena (LEARNING PROCESS)

Electromagnetic waves behave differently than mechanical waves.
Where are the best seats in the house?

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
Development Development is the act or process of growth, progress or evolution, sometimes through iterative improvements.	Effects (MYP/CCC)	**Scientific and technical innovation** 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.

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

- Why does Australia have a higher rate of skin cancer than other countries?
- How can we design a device to help someone who is deaf or blind detect light waves or sound waves?
- How can we use our understanding of wave behaviors to design a concert venue that maximizes light/sound effects?

MYP Objectives	**Assessment Tasks**	
*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Science A: Knowing & Understanding I. describe scientific knowledge Ii. apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations	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 a collaborative EM spectrum anchor chart 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	**Formative Assessment(s):** Electromagnetic Waves CFA **Summative Assessment(s):** Waves Unit Assessment Paper I and Paper II

Iii. analyze information to make scientifically supported judgments Science D: Reflecting on the Impacts of Science Iii. apply scientific language effectively Design A: Inquiring and Analyzing I. explain and justify the need for a solution to a problem Design B: Developing Ideas Iv. develop accurate planning drawings/diagrams and outline requirements for the creation of the chosen solution	make a claim, supported by evidence and reasoning, to answer a question regarding the uses and behaviors of electromagnetic and mechanical energy. Using Mosa Mack, 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. This allows students to elaborate on the uses of electromagnetic and mechanical energy.	
Approaches to learning (ATL)		
Category: Thinking **Cluster:** Critical Thinking **Skill Indicator:** Use models and simulations to explore complex systems and issues.		

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. a. 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)*	Exploring Wave Properties (Slinky Lab and Reading Article) Electromagnetic vs. Mechanical Waves Graphic Organizer	● Discovery Education Science Techbook ● NGSS Case Studies for Differentiated Learners ● Next Generation Science Standards: "All Standards, All Students" ● Extensions - Enrichment Tasks/Project All information included by the PLC in the differentiation box is the responsibility and ownership of the local school to review and approve per Board Policy IKB. Task-Specific Differentiation ● Scaffolding ● Leveled Tasks ● Experimental Design Choices ● Mode/Method of Representation/Presentation (text, videos, laboratory investigations, SIMs)
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. b. Construct an explanation using data to illustrate the relationship between the electromagnetic spectrum and energy.	Creating an Electromagnetic Spectrum Foldable Exploring Wave Properties (Slinky Lab and Reading Article)	
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. c. Design a device to illustrate practical applications of the electromagnetic	Mosa Mack Waves: Lesson 3: Engineer: Engineer a Solution for Individuals Who Cannot Detect Light or Sound Waves	

spectrum (e.g., communication, medical, military).		
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. 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. (*Clarification Statement: Include echo and how color is seen but do not cover interference and scattering.)*	Lab: Exploring Wave Behaviors and CER	
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. e. Analyze and interpret data to predict patterns in the relationship between density of media and wave behavior (i.e., wave speed).	DE Exploration: The Speed of Sound	
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. 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	Exploring Wave Properties (Slinky Lab and Reading Article) Creating an Electromagnetic Spectrum Foldable	

energy.		
S8P4 Obtain, evaluate, and communicate information to support the claim that electromagnetic (light) waves behave differently than mechanical (sound) waves. g. Develop and use models to demonstrate the effects that lenses have on light (i.e., formation of an image) and their possible technological approaches.	Lab: Lenses	

Content Resources

GaDOE Instructional Segment: Part One: Electromagnetic Waves

GaDOE Instructional Segment: Part Two: Sound Waves

Mosa Mack: Waves: Lessons 1-3

PhET: Waves Intro

PhET: Waves on a String

Argument-Driven Inquiry in Physical Science:

- Lab 19: Wave Properties
- Lab 20: Reflection and Refraction