MYP/3D Science Unit Planner

Marietta City Schools

Grade & Course: Physics	**Topic:** Waves	**Duration:** 3 weeks
Teachers: Physics PLC Teachers		

Georgia Standards and Content:

SP4. Obtain, evaluate, and communicate information about the properties and applications of waves.

a. Develop and use mathematical models to explain mechanical and electromagnetic waves as a propagating disturbance that transfers energy. (Clarification statement: Mathematically describe how the velocity, frequency, and wavelength of a propagating wave are related.)

b. Develop and use models to describe and calculate characteristics related to the interference and diffraction of waves (single and double slits).

c. Construct an argument that analyzes the production and characteristics of sound waves. (Clarification statement: Includes, but not limited to, Doppler Effect, standing waves, wavelength, the relationship between amplitude and the energy of the wave, and the relationship between frequency and pitch.)

d. Plan and carry out investigations to characterize the properties and behavior of electromagnetic waves. (Clarification statement: Properties of waves include, but not limited to, amplitude, frequency, wavelength, and the relationship between frequency or wavelength and the energy of the wave.)

e. Plan and carry out investigations to describe common features of light in terms of color, polarization, spectral composition, and wave speed in transparent media.

Analyze experimentally and mathematically aspects of reflection and refraction of light waves and describe the results using optical ray diagrams.

Perform calculations related to reflections from plane surfaces and focusing using thin lenses.

f. Plan and carry out investigations to identify the behavior of light using lenses. (Clarification statement: Investigations concerning Snell's Law, optical ray diagrams, and thin lens equation should be conducted.)

g. Plan and carry out investigations to describe changes in diffraction patterns associated with geometry and wavelength for mechanical and electromagnetic waves.

Narrative / Background Information

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

From 8th grade Physical Science

Basic algebra

Exposed to Wavelength, Amplitude, and Frequency

Basic wave equation calculation $v=\lambda f$ using triangle method.

Electromagnetic spectrum.

Year-Long Anchoring Phenomena: (LEARNING PROCESS)

The laws of physics dictate the interactions of our physical world.

Unit Phenomena (LEARNING PROCESS)

Vibrations propagate in the form of waves. Waves transfer energy without transferring mass.

MYP Inquiry Statement:
The nature of waves can be discovered by examining their interactions with matter.

MYP Global Context:
Scientific and Technical Innovation

Approaches to Learning Skills:

Research Skills
Thinking Skills
Collaboration Skills
Communication Skills

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

Electromagnetic radiation
Transverse Waves
Properties of Waves
Wave Patterns
Boundary Behavior

Crosscutting Concepts: (KNOWLEDGE & SKILLS)
Patterns (CC)
Scale Proportion & Quantity (CC)
Systems & System Models (CC & MYP)

MYP Key and Related Concepts:
Select one Key Concept:

Systems & System Models (CC & MYP)

Select one or more RC:

Patterns (CC)
Scale Proportion & Quantity (CC)

Movement & Energy

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Misconception: Waves cause matter to move with it.
Basic understanding of Sound vs Light waves and the waves' respective speeds.
Misconception: Students believe “light” is only the visible part of the electromagnetic spectrum.
Students mix up wave period and wavelength even though being taught it in Physical Science.

Key Vocabulary: (KNOWLEDGE & SKILLS)

Period
Wavelength
Frequency
Wave Velocity
Transverse waves
Compressional/Longitudinal waves

Intensity
Refraction, Reflection, and Diffraction
Snell's Law
Interference
Doppler Effect
Polarization

Inquiry Questions:

Factual

What is reflection, refraction, and diffraction?
What is the difference between transverse and longitudinal waves?
What is meant by the term "superposition" of waves?
What is Snell's Law?

Conceptual

What are the properties of light?
What are the properties of sound?
What occurs to the pitch of a sound wave as you move towards/away from it?
How does interference occur?
What causes a "sonic boom"?
How does the velocity of a wave entering a new medium affect its wavelength and angle?

Debatable

Which type of wave transmits the most energy?

MYP Objectives	Summative assessment	
MYP A	Summative Waves Test: MYP A	Relationship between summative assessment task(s) and statement of inquiry: The assessment measures student understanding of different types and applications of waves and how they transfer energy.

Unit Objectives: Waves Need to Know - https://docs.google.com/document/d/1M1ItyjUGkC9qNCC1mifk87pLateZTaCu9M1zzlxPz9o/edit?usp=sharing			
Learning Activities and Experiences	**Inquiry & Obtain: (LEARNING PROCESS)**	**Evaluate: (LEARNING PROCESS)**	**Communicate: (LEARNING PROCESS)**
Week 1:	Students observe properties of transverse, longitudinal, sound, and light waves in a rotation lab.	Students record observations about waves to understand frequency, period, wavelength, amplitude, velocity, and intensity.	Student groups are assigned a type of wave which they diagram on a white board to explain to another group.
Week 2:	Students observe superposition of waves and interference patterns caused by single and double slit interference.	Students calculate the amplitude of resulting waves after superposition has occurred, and explain what single and double slit interference through the use of path difference.	Student groups diagram an assigned type of interference and explain how it occurs to another group.
Week 3:	Students observe refraction of light waves through a rectangular glass prism and different types of lenses.	Students calculate the refractive index of glass using Snell's Law from data collected using the rectangular glass prism, and draw ray diagrams involving thin lenses.	Student groups create a white board of their Snell's Law calculation or their thin lens ray diagram on a white board for a gallery walk.
Week 4: Remediation	Students complete a review quiz to diagnose strengths and weaknesses in the content.	Students complete review activities based upon quiz results.	

Resources (hyperlink to model lessons and/or resources): (click here for description)
Discovery Education Science Techbook
pHet Simulations to use:
https://phet.colorado.edu/en/simulation/waves-intro
https://phet.colorado.edu/en/simulation/bending-light
https://phet.colorado.edu/en/simulation/wave-interference
https://phet.colorado.edu/en/simulation/color-vision
https://phet.colorado.edu/en/simulation/legacy/geometric-optics

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
(click here)	(click here)	(click here)