Course Title – MD Physical Science

Implement start year – 2017-2018

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Unit #4 – Waves and their Applications in Technologies for Information Transfer

Transfer Goal –

Students will be able to independently use their learning to apply concepts of light and sound waves to the physical world and current technologies used in their everyday lives. (Science 1, Special Education 3)

Stage 1 – Desired Results

Established Goals

HS-PS4 Waves and their Applications in Technologies for Information Transfer

HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4-2. Evaluate questions about the advantages of using a digital transmission and storage of information.

HS-PS4-3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

21st Century Themes
(www.21stcenturyskills.org)

_x__ Global Awareness
___Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
_x__Health Literacy
_x__Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
_x__Information Literacy
_x__Media Literacy

HS-PS4-4.	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.	_x__ICT (Information, Communications and Technology) Literacy *Life and Career Skills:* ___Flexibility and Adaptability _x__Initiative and Self-Direction _x__Social and Cross-Cultural Skills _x__Productivity and Accountability ___Leadership and Responsibility
HS-PS4-5.	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	
CCS.ELA-literacy.rh.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.	

Enduring Understandings:	**Essential Questions:**
Students will understand that . . .	
EU 1 • pitch and volume are affected by different characteristics of a sound wave.	*EU 1* • Why do different instruments make different sounds? • How can you change a sound? • How do humans and animals use sound waves to communicate?
EU 2 • light waves are made up of photons that can be absorbed, bent and reflected.	*EU 2* • How do we see colors? • How can you change the direction of a light wave?
EU 3 • waves are used within technology to transfer energy and information.	*EU 3* • How can a wave be produced? • How can waves be used to send out information?
Knowledge:	**Skills:**
Students will know . . .	*Students will be able to . . .*
EU 1 • the wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) • effects from changes in frequency and amplitude as it applies to sound waves. • the uses of echolocation by animals.	*EU 1* • label and describe the parts of a wave. • use a mathematical model to describe the pitch and volume of a sound wave. (HS-PS4-1) • predict how a sound wave will travel through a medium. • identify animals who use waves to communicate and how it is done.

EU 2 • the wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing (HS-PS4-1) • how light and matter interact. • how light can be reflected or refracted. *EU 3* • information can be digitized (e.g., a picture stored as the values of an array of pixels); In this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2) • electromagnetic radiation (e.g., radio, microwaves, visible light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. • the difference between mechanical and electromagnetic waves. • uses for electromagnetic waves in technology. • when light or longer wavelength electromagnetic radiation is absorbed in matter it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, x-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS-PS4-4) • multiple technologies based on the understanding of waves and their interaction with matter are part of everyday experiences in the modern world (e.g. medical imaging, communications, scanners) and in scientific research. (HS-PS4-5)	*EU 2* • participate in labs to bend light with water and prisms. • predict how a light wave will travel through a medium • explain how colors are created from white light. • diagram how parts of the human eye act as a lens. • communicate technical information or ideas in multiple formats. (HS-PS4-5) *EU 3* • explain different applications for electromagnetic waves. • obtain evidence to support an argument concerning the dangers and hazards associated with particular types of electromagnetic waves. • explain how waves are used in everyday technologies. • evaluate questions that challenge the validity, reliability and interpretation of data in digital technology. (HS-PS4-2, 3, 4)

Stage 2 – Assessment Evidence

Recommended Performance Tasks:

You are a sound wave originating from the diaphragm of a 4th grade student playing a wind musical instrument (your choice) at the school's spring concert. Create a poster to diagram your path from the human body, through the musical instrument, and out in to the ear of your listener. You must include how the amount of air needed and the path through the instrument affect the volume and pitch of you, the sound wave. (EU1)

You are a covert ops spy and are tasked with a communication mission that takes you all over the world. You need to send secret messages, using sound or light waves, to fellow spies working underwater, on the top of a mountain, and underground. You will need to prepare a presentation for a CIA

team to describe how messages will reach your comrades at these different locations. Your presentation must include an explanation of why you would use a light versus a sound message, for each location, a visual of how the wave will travel, and what kind of technology you will use to send the message (i.e. flashlight, sonar, speaker, etc). (EU2 ,EU3)

Other Recommended Evidence:

- Teacher created notes and worksheets
- Journal responses
- Teacher observation during class discussion
- Tests and quizzes
- Labs and lab reports
- Visual representation of topic material (i.e poster, brochure, handout, etc)

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: *Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.*

- Powerpoint notes on what waves are and where they come from (A)
- Make diagrams of a light wave being reflected and refracted (A)
- Label amplitude, wavelength, crest, and trough on different pictures of waves (A,M)
- Listen to pitch and volume change and observe the wave amplitude and wavelength change (A, M)
- Identify the sources of waves in school and at home (M,T)
- Participate in labs to determine how waves will travel thorugh different mediums (i.e. water, desks, walls, air) (M,T)
- Label diagram of sunlight traveling through a prism and coloring the rays of light (ROYGBIV) (A,M)
- Listen to instruments and describe how the sounds waves are produced and travel (M,T)
- Chart length of shadows during the day in relation with location of sun (M)
- Compare images viewed through different concave, convex and flat lenses (M)
- Journal about everyday uses of electromagnetic waves (T)
- Create a slide show video presentation about an animal that uses echolocation. (M)
- List real life uses of electromagnetic energy (M)
- Research and write an essay on one real life application of electromagnetic radiation (M,T)