Phoenixville Area School District UbD Science Unit Plan

Grade Level: 7th Grade **Unit Name:** Waves & Their Applications in Technology **Author:** A. Gottschall

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="3">Overarching NGSS & PA Standards:

3.2.6-8.Q
Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

3.2.6-8.R
Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

3.2.6-8.S
Integrate qualitative scientific and technical information to</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

1. Ask questions and/or define problems
2. Develop and/or use models
3. Plan and/or carry out investigations
4. Analyze and interpret data using computational thinking
5. Obtain, evaluate, and communicate information (supported by evidence)
6. Construct explanations and design solutions</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>Students will understand that…

• A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude.
• The amplitude of a wave is related to the amount of energy in a wave.
• The characteristics of light and sound waves change with amplitude and frequency.
• A sound wave needs a medium through which it is transmitted.
• Waves are reflected, absorbed, or transmitted through various materials
• Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...

• What is the relationship between wavelength and frequency?
• How is the amplitude of a wave related to its energy?
• How does the amplitude and frequency of sound waves affect how we perceive them?
• How can a wave be modeled mathematically?
• How does the medium a wave travels through affect its speed of travel?
• What is the most reliable way to encode</td></tr>
</table>

support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. **Which branch(es) of science apply:** **PS**		and transmit information?
	Knowledge and Skills Acquisition	
	Students will understand that… • The greater a wave's wavelength, the lower it's frequency. • The greater a wave's amplitude, the greater the energy of the wave. • The greater the amplitude of sound waves the louder sound is perceived. • The higher the frequency of a sound wave, the higher the pitch. • Waves are not much affected when passing through objects that are small compared to their wavelength. • The change of speed of a wave when passing from one medium to another can cause the wave to change direction or reflect. These wave properties are used in many applications (e.g., lenses, seismic probing of Earth). • Light waves, radio waves, microwaves, and infrared waves are applied to communications systems. • Many communication systems use digitized signals (i.e., sent as wave pulses) as a more reliable way to convey information. • Information can be recorded, stored for future recovery, and transmitted over long distances without significant degradation when digitized. • Signals that humans cannot sense directly can be detected by devices (e.g., telescopes, cell phones, wired or wireless computer networks).	*Students will be skilled at…* • Develop and use a model to describe phenomena. • Use mathematical representations to describe and/or support scientific conclusions and design solutions. • Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. • Cite specific textual evidence to support analysis of science and technical texts • Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. • Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. • Draw evidence from informational texts to
	KEY VOCABULARY • Wavelength • Frequency • Amplitude • Compression • Rarefaction • Crest • Trough • Mechanical waves • Sound waves • Reflect • Absorb • Transmit • Analog signal • Wave pulses	

		support analysis, reflection, and research. • Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. • Reason abstractly and quantitatively. • Model with mathematics. • Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities • Use ratio and rate reasoning to solve real-world and mathematical problems • Recognize and represent proportional relationships between quantities. • Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
Stage 2 – Evidence		
Evaluative Criteria	***Assessment Evidence***	
	PERFORMANCE TASK(S): 1. Students will develop a report given data about a repeating physical phenomenon that can be represented as a wave (e.g., frequency corresponding to sound pitch, amplitude corresponding to sound volume), and amounts of energy present or transmitted. Student reports will include:	Differentiation Considerations: • Different modes of presentation a. Written Report

Sound Wave Report Rubric	a. Simple mathematical wave model. b. Waves as repeating quantities. c. Frequency of the wave. d. Amplitude of the wave. e. Wavelength of the wave. f. Patterns in the energy of the wave being proportional to the square of the amplitude. g. Patterns in the amount of energy transferred in a given time being proportional to frequency. h. Prediction of the change in energy of the wave if any one of the parameters of the wave is changed.	b. Verbal Report c. PowerPoint d. Poster e. Physical model f. Other choice approved by teacher • Use of notes and resources • Chunked Assignments/check lists
Sound Waves and Materials Model Rubric	2. Develop a model to explain why materials with certain properties are well-suited for particular functions (e.g., sound absorbers in concert halls, sound barriers next to highways). Student models will include: a. Sound waves and their amplitudes and frequencies b. Materials through which waves are reflected, absorbed, or transmitted c. Relevant characteristics of the wave (e.g., frequency amplitude, wavelength), after it has interacted with a material d. Position of the source of the wave	• Variety of research materials: o Articles o Videos o Recordings
Scientific Argument Rubric	3. Gather evidence and write an argument to support a claim about a phenomenon that includes the idea that using waves to carry digital signals is more reliable way to encode and transmit information than using waves to carry analog signals. Student arguments should include: a. Features that make digital transmissions of signals more reliable than analog (e.g., recorded reliably, stored for future recovery, transmitted over long distance without significant degradation) b. A description of a technology that uses digital encoding and transmission of information and how the digitization of that technology has advanced science and scientific investigations (e.g., digital probes, including thermometers and pH probes; audio recordings)	

	OTHER EVIDENCE:	Differentiation Considerations:
Lab Report Rubric Content Criteria Lab Report Rubric Lab Report Rubric	1. Wave Investigation a. Follow the Scientific Method to form a hypothesis, gather evidence, and form a conclusion b. Investigate varying wave frequencies with slinkies. c. Identify and label the crest of a wave d. Identify and label the trough of a wave e. Identify and label the amplitude of a wave f. Identify and label the wavelength of a wave g. Gather and organize data in a chart using PHET simulation h. Identify and explain the relationship between wavelength and frequency 2. Graphing a Sound Wave a. Use data provided to graph higher and lower frequency sound waves b. Identify the wavelength, frequency, and amplitude of the waves c. Compare waves and identify patterns in the energy and amplitude of the waves d. Compare waves and identify patterns in the energy and frequency of the waves 3. Sound Wave Investigation a. Follow the Scientific Method to form a hypothesis, gather evidence, and form a conclusion. b. Investigate the relationship between sound wave amplitude and frequency and our perception of the sound using a PHET simulation. c. Identify and explain the relationship between amplitude and sound volume d. Identify and explain the relationship between frequency and sound pitch 4. Waves and Materials Investigation a. Follow the Scientific Method to form a hypothesis, gather evidence, and form a conclusion b. Investigate the relationship between the speed of a wave when passing through a medium and the direction or reflection of that wave (reflection, absorption, and transmission of waves)	• Modified Quizzes • Flexible grouping • Guided/Cloze Notes • Pictures and videos to support vocabulary • Sentence Starters • Product modification in place of writing: a. Drawing b. Verbal explanation

Content Criteria	5. Science Notebook Entries a. Concept maps b. Vocabulary/Glossary entries c. Guided Research d. Lab Reports described above e. Daily Journal Entries 6. Checklists of collaborative behaviors in labs and activities 7. Checklists of collaborative behaviors in class discussions 8. Self-assessments for Performance Tasks 9. TO CONSIDER FOR LATER: UNIT TEST(S)	