Task Template

Grade 8 Overall Claim Students demonstrate a sophisticated understanding of the core ideas and applications of practices and crosscutting concepts in the disciplines of science.		
Explanatory Statements	Students integrate disciplinary core ideas and crosscutting concepts with scientific practices to investigate and explain how and why phenomena occur, and to design and refine solutions to problems.	Students connect knowledge across the disciplines of science to ask questions, plan and carry out investigations, and analyze and interpret data to support an argument about phenomena in a variety of contexts.

Measurement Target 2 (Topic 2 Bundle): Students are able to develop and interpret models and use mathematical representations and scientific information to make claims about how waves transfer energy and information through various materials.

Summary (Topic 2 Bundle): This bundle organizes performance expectations with a focus on helping students build understanding of how waves transfer energy and information. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards and is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

- 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.
- Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

Focal Knowledge, Skills and Abilities (fKSAs)	**8.2a** Students are able to use a mathematical model to describe wave properties and patterns relating to the amounts of energy present or transmitted.	**Rationale**	• Students will describe and predict characteristic properties of waves. • Students will recognize patterns as an organizing concept for understanding wave properties. • Students will use models and mathematical thinking to demonstrate understanding of wave properties.
Student Model	(*One overall summary variable of proficiency*) Not yet defined.		
Task Model	Given a brief real-world scenario describing an observable phenomenon, the student applies scientific concepts appropriately to construct a model (using drawings and words) and uses the model to make an accurate prediction about the phenomenon. Example: Student develops a model (drawing, image, computer simulation) to show how sound waves move from a ringing cell phone through the air and uses this model to make an appropriate prediction about whether students will hear the phone if it is put in a vacuum chamber.		
Work Product Summary	• Students construct a model and use the model to explain a phenomenon. • Students identify repeating patterns represented in the wave model (amplitude, wavelength, frequency, period). • Students construct a model and use the model to make a prediction about a phenomenon. • Students identify and explain relationships among wave properties (direct proportion between energy and amplitude; reciprocal relationship between frequency and period; inverse relationship between frequency and wavelength; speed = frequency x wavelength). • Students use a given model to make a prediction about a phenomenon (i.e., changes to frequency if the wavelength is changed).		

Task Model Variables	• Type of wave being studied (mechanical or light) • Type of model used (drawing, image, animated simulation)	**Notes on Task Features and Task Variables**	Task should focus on standard repeating waves. A variety of model types can be used to represent wave behavior.
Example Phenomena	• Mechanical waves (sound waves, water waves, waves in a Slinky or a vibrating string) • Waves traveling through different mediums/phases (gas, liquid, solid) • Light waves traveling without a medium • Patterns in wave properties can be used to show why one sound transmits more energy than another		
Measurement Model	Univariate Rasch partial-credit psychometric model		
Evaluation Model	• Does the description of patterns represent the components shown in the model? • Does the explanation of relationships among wave properties provide evidence that students can make interpretations and draw conclusions from qualitative and quantitative data? • How is the model used to support the explanation?		
Focal Knowledge, Skills, and Abilities (fKSAs)	**8.2b** Students are able to use a model to describe a phenomenon involving reflection, absorption, or transmission properties of different materials for light and matter waves.	**Rationale**	• Students will describe and predict characteristic behaviors of waves when the waves interact with matter. • Students will develop and use models to demonstrate understanding of wave behavior.
Student Model	(*One overall summary variable of proficiency*) Not yet defined.		
Task Model	Given a model, the student uses the model to make a prediction about a phenomenon. Example: The student uses a model to explain why light bends and make predictions about the behavior of light waves when they interact with different matter.		
Work Product Summary	• Students make predictions about the behavior of light when it interacts with each of the provided materials. • Students will draw conclusions based on the results from testing their predictions. • Students identify patterns of wave behavior based on test results. • Students create a drawing or a computer simulation to represent the observed wave behaviors.		
Task Model Variables	• Which type of materials provided • The number of materials provided • The type of light source • Providing more than one type of light source	**Notes on Task Features and Task Variables**	Providing a variety of light sources (flashlight, candle, laser pointer) allows students to explore how the interaction of light with a particular material can vary depending on the type of light source.

Example Phenomena	• Light is reflected from a shiny metal material. • All frequencies of light except yellow are absorbed by a banana. • Light is transmitted through transparent glass. • Light is partially transmitted through translucent glass. • Light refracts into its component wavelengths when passed through a prism. • Sound waves travel as longitudinal waves in nature and behave as a transverse wave in solids. • Sound waves are produced in our daily life (e.g., hitting a glass with a spoon, pushing a chair etc.).		
Measurement Model	Univariate Rasch partial-credit psychometric model		
Evaluation Model	• How is evidence used to support an explanation of patterns of wave behavior? • Does the explanation provide evidence that students can make interpretations and draw conclusions from qualitative data? • How is the model used to support the explanation?		
Focal Knowledge, Skills, and Abilities (fKSAs)	**8.2c** Students are able to support a claim about a phenomenon that includes the idea that digitized signals are a more reliable way to encode and transmit information than analog signals.	**Rationale**	• Students will apply an understanding of waves as a means to send digital information. • Students will apply concepts of structure and function. • Students will obtain, evaluate, and communicate information to demonstrate understanding of wave behavior.
Student Model	(*One overall summary variable of proficiency*) Not yet defined.		
Task Model	Given a brief real-world scenario describing an observable phenomenon, the student applies scientific concepts appropriately to construct an argument about the design of a device which serves a particular function. Example: The student is provided with text and/or images describing a function of a device (e.g., conversion of stored binary patterns to make sound or text on a computer screen) and appropriately clarifies claims and findings.		
Work Product Summary	• Students interpret qualitative information to explain the comparative function and reliability of an analog version and digital version of a particular tool used for communicating information. • Students use scientific and technical information to support a claim that the digitization of that technology has advanced science and scientific investigations (e.g., digital probes, including thermometers and pH probes; audio recordings).		
Task Model Variables	• The type of tool for communicating information • Boundaries for the purpose of the tool	**Notes on Task Features and Task Variables**	Providing boundaries for the purpose of the tool (i.e., it will be expected to transmit information over short distances) relates structure (analog) to function (short distances)
Example Phenomena	• Comparing an analog watch with a digital watch • Comparing an analog television with a digital television • Fiber optic cable used to transmit light pulses • Radio wave pulses in cellphones • Sound or text on a computer screen generated by converting stored binary patterns		

Measurement Model	Univariate Rasch partial-credit psychometric model
Evaluation Model	• How is qualitative evidence used to support a claim regarding the advantages of digital tools? • Does the explanation provide evidence that students can make interpretations and draw conclusions from qualitative data? • Does the explanation provide evidence of student understanding that waves can be used to send digital information? • Does the explanation provide evidence of student understanding of structure and function?