Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 8 Science
Unit 4 End of Unit Assessment Design Patterns
Providing Solutions to Problems Using Simple Wave Properties
September 2023

The SIPS Grade 8 Science Unit 4 End of Unit Assessment Design Patterns, Providing Solutions to Problems Using Simple Wave Properties was developed with funding from the U.S. Department of Education under the Competitive Grants for State Assessments Program, CFDA 84.368A. The contents of this paper do not represent the policy of the U.S. Department of Education, and no assumption of endorsement by the Federal government should be made.

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SIPS Grade 8 Unit 4 End of Unit Assessment Design Patterns (MS-PS4-1, MS-PS4-2)

Grade 8 SIPS Design Pattern for MS-PS4-1

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • understand that a simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. • use mathematical representations to describe and/or support scientific conclusions and design solutions. • apply logical and conceptual connections between evidence and explanations. The crosscutting concept of applying graphs and charts to identify patterns in data is the organizing concept for these DCIs.
Performance Expectation	**MS-PS4-1.** 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. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.]
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Create a graphical representation of a simple wave that demonstrates a repeating pattern. **KSA2:** Use models and mathematical thinking to demonstrate understanding of wave properties. **KSA3:** Identify patterns as an organizing concept for understanding wave properties. **KSA4:** Use a graph to describe how the amplitude of a wave is related to the energy in a wave.
Student Demonstration of Learning	• Model accurately represents the observable phenomena. • Model accurately captures all mechanistic features of the observable phenomena. • Model accurately shows relationships among wave properties. • Correctly applies a simple mathematical wave model to a physical system or phenomenon to identify how the wave model characteristics correspond with physical observations. • Correctly predicts the change in the energy of the wave if any one of the parameters of the wave is changed. • Identifies relevant or meaningful patterns that address a scientific question. • Identifies and describes relevant relationships between components of the model.

	● Shows patterns in waves that accurately interpret the relationship between frequency and wavelength.
Work Product	● Draw a model. ● Complete a model. ● Mathematical representations. ● Constructed-response.
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task prompts students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance. ● The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. ● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, students who are English learners, or those who are working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes. ● The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. ● The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. ● All tasks elicit core ideas as defined in the PE. ● The task uses information that is scientifically accurate. ● The task elicits core ideas as defined in the PE. ● The task uses active voice and present tense. ● The task is written at or below grade level.

Variable Features - Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus	● Complexity of scientific concept(s) to be represented.
	● Function of the representation:
	  ○ To explain a mechanism underlying a phenomenon.
	  ○ To predict future outcomes.

	○ To describe a phenomenon. ○ To generate data to inform how the world works. ● The representation may be provided for revision or one that is created from scratch. ● What type of wave is being modeled? ● Use or purpose of the representation. ● Type of representation (e.g., mathematical/picture). ● Core idea targeted (e.g., sound sources, the medium, deformation, and vibration of an instrument's string).
Assessment Boundaries	• Assessment does not include electromagnetic waves and is limited to standard repeating waves. • Assessment should be limited to qualitative applications pertaining to light and mechanical waves.
Technical Terms	• Waves, amplitude, frequency, absorb, medium, trough, crest, nodal line/rest line, interface

Grade 8 SIPS Design Pattern for MS-PS4-2

Element	Description
Knowledge and Practices (DCI, SEP, CCC)	In this task, students: • understand that a sound wave needs a medium through which it is transmitted. • understand that when light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. • understand that the path light travels can be traced as straight lines, except at surfaces between different transparent materials where the light path bends. • understand that a wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. • understand that because light can travel through space, it cannot be a matter wave, like sound or water waves. • develop and use a model to describe phenomena. The crosscutting concept of applying the knowledge that structures can be designed to serve particular functions is the organizing concept for these DCIs.
Performance Expectation	**MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions]
Knowledge, Skills, & Abilities (KSAs)	**KSA1:** Develop a model to describe the transmission of waves. **KSA2:** Use a model to make sense of given phenomena involving reflection, absorption, or transmission properties of light and matter waves. **KSA3:** Identify characteristics of the wave after it has interacted with a material (e.g., frequency, amplitude, wavelength). **KSA4:** Use a model to describe that waves are reflected, absorbed, or transmitted through various materials. **KSA5:** Develop a model to describe that waves are reflected or absorbed.
Student Demonstration of Learning	• Model accurately represents the observable phenomena. • Model accurately captures all mechanistic features of the observable phenomena. • Model accurately shows the transmission of waves. • Accurately describes how waves transmit energy.

	• Accurately describes that vibrations in materials set up wavelike disturbances that spread away from the source, such as sound waves. • Correctly describes whether the model shows how waves are reflected, absorbed, or transmitted through a material.
Work Product	• Draw a model. • Complete a model. • Constructed-response. • Short-response.
Task Features	● The task focuses on performances for which students' opportunity to learn has prepared them. ● The task is based on the assessed KSA(s) and driven by a high-quality scenario that focuses on a phenomenon or design problem. ● The task scenario is grounded in the phenomena and problems being addressed. ● The task prompts students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. ● The task provides ways for students to make connections of meaningful local, global, or universal relevance. ● The task scenario is sufficient, engaging, relevant, and accessible to a wide range of students. ● The task is accessible, appropriate, and cognitively demanding for all learners, including students with disabilities, students who are English learners, or those who are working below or above grade level. ● All prompts within a task are fair and equitable and include a range of presentation and response modes. ● The task requires students to use scientific reasoning and process skills to produce evidence that can be used by educators to make inferences about student learning. ● The task requires students to use reasoning and integrate multiple dimensions (i.e., SEP, DCI, CCC) to support sense-making about phenomena or problems. ● All tasks elicit core ideas as defined in the PE. ● The task uses information that is scientifically accurate. ● The task elicits core ideas as defined in the PE. ● The task uses active voice and present tense. ● The task is written at or below grade level.

Variable Features - Aspects of an assessment task that <u>can be varied</u> to shift complexity or focus	• Type of wave presented (e.g., sound, electromagnetic, mechanical, light). • Format of "real-world" phenomenon under investigation: image, data, text, combination. • Standard units used (e.g., grams, liters). • Use or purpose of the model. • Type of model (e.g., physical/virtual). • Core idea targeted in a model (e.g., light sources, the materials, polarization of light, ray diagrams).
Assessment Boundaries	• Assessment is limited to qualitative applications pertaining to mechanical waves. • Assessment is limited to standard repeating waves and should not include electromagnetic waves. • Assessment should be limited to qualitative applications pertaining to light and mechanical waves.
Technical Terms	• Mechanical waves, electromagnetic waves, wavelength, transverse wave, longitudinal wave, wave speed, visible light, spectrum, vacuum, refraction, reflection, transmit, transparent

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