**

**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**

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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 can be varied 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 can be varied 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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