



Stackable Instructionally- embedded Portable Science (SIPS) Assessments Project

Grade 8 Science

Unit 4 Instructionally-embedded Assessment Task Specification Tool:

“I Can See You, but You Can’t See Me!”

Providing Solutions to Problems Using Simple Wave Properties

August 2023

The SIPS Grade 8 Science Unit 4 Instructionally-embedded Assessment Task Specification Tool: “I Can See You, but You Can’t See Me!” 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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Grade 8	Unit 4	Instructional Segment 3	Task Title: I Can See You, but You Can't See Me!
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Unit 4 Title: Providing Solutions to Problems Using Simple Wave Properties

Anchor Phenomenon	Problematization/Investigative Strategy for the Unit
<p>In this unit, the anchor phenomenon is about light and sound in different environments. The teacher presents students with an engineering design challenge: <i>Design a piece of equipment that a child your age could use to help cope with sensitivities to light, sound, or particular colors.</i></p> <p>The teacher can customize the anchor phenomenon, rather than using the design challenge example. Additional suggestions for the anchoring phenomenon include designing a piece of safety equipment that could be used by NASA in space or on the surface of the moon or Mars to protect individuals from sudden bright lights and loud sounds and allows them to quickly turn them on or off, or some other design challenge that challenges youth to use information about waves, light, and sound together.</p> <p>The teacher may also want to consider local industry and the community for the anchoring phenomenon. For the lesson, <i>Into the Shark Tank</i>, students are asked to present their idea as if making a pitch to investors. Potential investors could include local industry experts who could also provide guidance and feedback to students. The teacher may want to contact representatives from a local engineering group or regional industry to bring in local experts who may have additional ideas for a potential problem area.</p>	<p>If we want to understand properties of mechanical and light waves well enough to be able to design and develop effective solutions, we need to understand and compare waves' properties, including how those properties manifest in different environments. We need to understand what leads to these differences and the effect of a medium on wave behavior. What is it about the environment that causes changes to how we see and hear waves? How does the presence or absence of a medium affect wave behavior? We also need to compare frequency, amplitude, and wavelengths of different wave types. How does structure of various waves define their properties? Students engage in a variety of investigations, use mathematics, and build models as they answer these questions and develop their understanding of waves and wave behavior. Knowledge and abilities developed through Instructional Segments 1-3 are aimed at preparing students to apply them to solve problems/challenges in Segment 4.</p>

Segment 3 Overview

By engaging in the practices of asking questions, planning and carrying out investigations, and developing and using models, students learn how properties of matter affect light behavior to understand how a one-sided mirror works. Students explore various properties of light such as reflection, refraction, diffraction, and additive properties. Students utilize this learning to add to their explanatory model based on their understanding of the properties and behavior of light to refine their design solution based on the anchoring phenomenon.

Assessments for this segment focus on Big Idea 3. Students are informally assessed on differences between light and sound waves and their use of prisms, lenses, and/or media to answer questions and explain reflection and refraction. They are also informally assessed on planning and carrying out investigations about properties of light and how it interacts with different materials (including how light can travel in a vacuum). Students are formally assessed on their

ability to ask questions, construct explanations, and develop models and carry out investigations to understand how light travels through a one-sided mirror based on observations they make on a one-sided mirror.

Lesson Title(s)	Lesson Description(s)
I Can See You, but You Can't See Me!	<p>In the lesson, <i>I Can See You, but You Can't See Me!</i>, students finalize their multimodal explanatory model on how a one-way mirror works. Students develop a scientific explanation to explain why only one side can see through a one-way mirror, provide feedback to each other, and then submit their final explanation.</p> <p><u>What Students Figure Out</u></p> <p>a. Following their experiment and analysis, students revisit the anchoring phenomenon to consider what additional criteria and constraints should be considered with the problem statement based on their learning related to light.</p>

Formal Assessment Title	Assessment Description
I Can See You, but You Can't See Me!	In this assessment, students develop an explanatory model using the ray model of light to explain a phenomenon involving light, including how light moves between different mediums, interacts with different surfaces and matter, and why any changes in light occur. This qualitative assessment does not require students to measure angles.

NGSS PE(s) Code(s) & Description(s)

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.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]**

AG(s) Code(s) & Description(s)

A16. Develop a model for the path of different frequencies of light through the interface of different media that uses the ray model of light.

Evidence Statement(s)

- Develop a model to show how the path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.

Phenomenon or Phenomenon-rooted Design Problem

- The phenomenon in this task is related to the interaction of light with objects with different properties. When light hits an object, some is scattered or reflected, some is transmitted, and some is absorbed.

General Scenario Description

- Students are presented with a scenario related to students collecting evidence to show that light is transmitted through objects, and light is reflected or scattered off objects . The task provides qualitative data about a physical wave phenomenon related to light energy causing water with food coloring to warm up faster than pure water. Students then apply the data to interpret real-world examples of the interaction of light and various materials. Finally, students are presented with a set of quantitative data related to the interaction of light with objects with different properties. Using the information provided, students model two scenarios involving the interaction of light with an object, each selected from the data set.

Chain of Sensemaking

- Students interpret qualitative data related to the investigation of shining a light on beakers of clear and dyed water.
- Students use the terms emitted, transmitted, absorbed, and reflected to describe the results.
- Students apply understanding of the properties of materials to relate the interaction of different types of surfaces to various applications related to light energy.
- Students interpret a simple data set to help them understand how to create a model that best reflects the scattering, transmission, and absorption of light by different objects.
- Students then draw a model of two objects and light interactions using information from the provided data set.

Work Products

- Short response
- Model

Application of Universal Design for Learning-based Guidelines to Promote Accessibility (<https://udlguidelines.cast.org/>)

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
<input checked="" type="checkbox"/> Context or content	<input checked="" type="checkbox"/> Provide visual diagrams and charts	<input checked="" type="checkbox"/> Solve problems using a variety of strategies
<input checked="" type="checkbox"/> Age appropriate	<input checked="" type="checkbox"/> Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams	<input type="checkbox"/> Sentence starters
<input checked="" type="checkbox"/> Appropriate for different groups	<input type="checkbox"/> Activate relevant prior knowledge	<input checked="" type="checkbox"/> Embed prompts to “show and explain your work”
<input type="checkbox"/> Makes sense of complex ideas in creative ways	<input type="checkbox"/> Bridge concepts with relevant and simple analogies and limited use of metaphors	
<input checked="" type="checkbox"/> Vary the degree of challenge or complexity within prompts	<input checked="" type="checkbox"/> Highlight or emphasize key elements in text, graphics, diagrams, formulas	

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- Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships
 - Give explicit prompts for each step in a sequential process
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Targeted PE(s) Code(s) and Alternate Conception(s)

- **NGSS PE: 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.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]
 - **Common Alternate Conceptions**
 - The brightness of light is dependent on the color (frequency) as well as amplitude.
 - A sound wave is the movement of air particles.
 - A physical wave is able to move matter permanently to a new location along the wave’s direction of propagation.
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Vocabulary

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|-----------|------------|
| ● Light | ● Energy |
| ● Scatter | ● Absorb |
| ● Reflect | ● Transmit |
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