Stackable Instructionally-embedded Portable Science (SIPS) Assessments

Grade 8 Unit 4
Providing Solutions to Problems using Simple Wave Properties

Storyline Overview
March 2023

The Grade 8 Unit 4 Providing Solutions to Problems using Simple Wave Properties: Storyline Overview 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 guide do not represent the policy of the U.S. Department of Education, and no assumption of endorsement by the Federal government should be made.

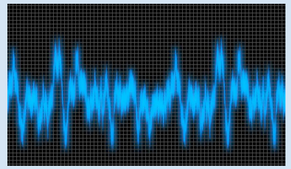
Grade 8 Unit 4: Storyline, Phenomena, and Segments

Storyline Overview

Students make sense of the key disciplinary ideas of properties and types of simple waves and provide design solutions to problems that involve these properties.

Anchor Phenomenon

The anchor phenomenon is an engineering design challenge involving either light or sound waves in different environments. Students are shown scenarios that demonstrate how people use waves to solve problems on Earth to spark their interest.



The teacher presents students with an engineering design challenge, such as "Design a piece of equipment that a child your age could use to help cope with sensitivities to light, sound, or particular colors."

Measurement Target

Students can apply Science and Engineering Practices with an emphasis on developing and interpreting models and using mathematical representations related to how waves transfer energy and information through various materials and utilizing elements of structure and function of an object's material to determine and describe why light is reflected, absorbed, or transmitted through different materials.

Relationship to Prior and Subsequent Learning

Unit 4 focuses on the properties of mechanical and light waves and how they can be used to define and delimit engineering problems. In Unit 3, students use the practice of developing and using models and the cross-cutting concept of cause and effect to understand adaptation and changes of life on Earth. Their understanding of these SEPs and CCCs are further explored in Unit 4 through their investigation of simple waves, their properties and types, and how students can determine success criteria and constraints needed to solve problems related to waves. The wave model introduced in this unit is useful for explaining many features of electromagnetic radiation explained in later grades. The criteria and constraints they specify in this unit are later quantified and applied to global challenges facing humanity for potential solutions. .

Segment 1: Students define problems, use investigations, questions, models, and data to explore wave phenomena and understand properties of waves and their application to the real world. They are also introduced to a design challenge. The relationship between wavelength and frequency is also explored through mathematical and computational thinking.

- Define a problem that is presented by a design challenge involving light or sound waves
- Investigate the longitudinal and transverse nature of waves
- Carry out an investigation involving mechanical waves
- Use mathematical and computation thinking to relate wavelength and frequency to wave speed
- Identify criteria and constraints of a design challenge involving dangerous mechanical waves

Segment 2: Students use models, carry out investigations, define problems, and construct explanations to answer scientific questions about the ability of sound waves to transfer energy without overall displacement. The importance of a medium for soundwaves to move is also modeled and applied to real world phenomena.

- Develop and use models to understand the properties of sound
- Investigate and develop models of how sound is created, how it travels, and how its properties can be changed
- Investigate and use models to explain how sound moves in a vacuum compared to how it travels in the presence of air
- Develop an explanatory model about a sound phenomenon
- Revise criteria and constraints related to the design challenge

Segment 3: Students ask questions, develop and use models, and carry out investigations to understand how properties of matter affect light behavior in a one-sided mirror. The process of reflection, refraction, diffraction, and additive properties of light are also explored.

- Develop a model that explains how one-sided mirrors work
- Construct explanations about the differences and similarities between mechanical and electromagnetic waves
- Carry out investigations to understand how one-sided mirrors work
- Investigate and use models to describe different properties of light
- Use properties of light to explain how one-sided mirrors work

Segment 4: Students define a problem related to waves and their properties, construct explanations, design a solution, and use models to document criteria and constraints that need to be considered for the performance of a device that uses waves to solve a problem.

- Design a solution to address a problem involving waves
- Develop and use models to justify how light and sound waves enable a design solution to work
- Identify criteria and constraints of a design solution
- Compile and present a final draft of a design specification