SCILLSS Classroom Science Assessment Workshop

# SCILLSS Grade 8 Task Administration Guide

**Task Title:** Interactions Between Sound Waves and Matter **Grade:** Middle School **PE:** MS-PS4-2

# Task Introduction

This task is about waves. In this task, students will demonstrate their ability to develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials (MS-PS4-2). This task consists of two questions. In question one, students are asked to develop a model and describe this phenomenon using a bowl with plastic cling wrap as the sound detector and a radio speaker as the sound source. In question two, students are asked to explain how sound waves are reflected, absorbed, or transmitted through a material.

## Purpose and Use

This task is intended for use at a point in instruction when the teacher wants to determine if students can use their models about phenomena involving sound waves to describe the differences between how sound and matter waves interact with different materials. The results of the tasks will be used to adjust instruction as appropriate.

**Elements of the Task**

This task is designed to measure students’ ability to integrate the dimensions and demonstrate their knowledge, skills, and abilities (KSAs) as represented by the PE, MS-PS4-2 “Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.”

Table 1 specifies the dimensions and the key aspects of the PE that are assessed by the task. In addition, expectations for students’ prior knowledge are indicated. Table 2specifies the KSAs, work products, and task features represented by the task.

**Table 1. Specific Practices, Disciplinary Core Ideas, and Crosscutting Concepts to be Assessed**

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| --- | --- | --- | --- | --- |
| **NGSS 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.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.] | | | | |
|  | **Science and Engineering Practices (SEP)** | **Disciplinary Core Ideas (DCI)** | **Crosscutting Concepts**  **(CCC)** | |
| **Foundations** | **SEP: Developing and Using Models**   * Develop and use a model to describe phenomena. | **PS4.A: Wave Properties**   * A sound wave needs a medium through which it is transmitted. | **CCC: Structure and Function**   * Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. | |
| **Key Aspects** | * Develop a model to predict phenomena * Develop a model to describe phenomena * Identify appropriate aspects of a given phenomenon to include in a model * Explain the relationships among the components of a model * Specify or identify the limitations of the model and describe why these limitations exist | * Sound waves need a medium (air, water, or solid material) to travel through | * Design structures to serve different functions * Design structures based on the properties of its materials * The shape and stability of structures of natural and designed objects are related to their function(s) | |
| **Prior Knowledge** | * Knowledge of units and unit conversions * Knowledge of ratio relationships * Ability to interpret qualitative data * Ability to represent proportional relationships * Knowledge of linear relationships | * Waves can cause objects to move * Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks) | **Relationships to SEPs** | * A sense of scale is necessary in order to know what properties and what aspects of shape or material are relevant at a particular magnitude or in investigating particular phenomena * Data analysis serves to demonstrate the relative magnitude of some properties or processes |

**Table 2. Components of the Assessment Task**

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| --- |
| **Knowledge, Skills, & Abilities:**   * **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:** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various material. |
| **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 * Describes correctly how waves transmit energy * Describes accurately that vibrations in materials set up wavelike disturbances that spread away from the source, such as sound waves * Describes correctly 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:**   * All tasks require evidence of qualitative and quantitative thinking. * All tasks must prompt students to make connections between observed phenomena or evidence and reasoning underlying the observation/evidence. * Students use scientific reasoning and process skills in observational (nonexperimental) investigations. * All tasks must elicit core ideas as defined in the PE. * All tasks must include elements from at least two dimensions of the NGSS. |

# Task Administration

## Materials and Set-up

### Materials

To administer the task, educators will need:

* Task administration guide
* Student task worksheet (one per student)
* Student survey (one per student)
* Projection screen/SmartBoard

### Duration

This task can be administered in approximately one class period.

### Set-up

Prior to administration, print copies of the student task worksheet and student survey. Each student will receive a copy of the worksheet and survey. The survey will be distributed after students have completed the task. Prepare a Smartboard or projector/projection screen to play a short Internet video to students as a whole class.

## Directions for Administration

During administration, educators should:

1. **Provide each student with a pencil and the student task worksheet that corresponds to his or her assigned ID number located at the top right corner of the task.**
2. Instruct students to watch the first 60 seconds of the video demonstration at <https://www.youtube.com/watch?v=a08cawnJinw>. (The video should be played for the whole class).
3. Introduce the task to the students. Address questions related to expectations for completing the task. However, ensure that the discussion does not include information that provides an unfair advantage for students to complete the task/items. Tell the students the task includes two questions. Remind students to check their work and to ensure that all parts of the task are completed.
4. Allow students to complete the task. While the task should take approximately one class period to complete, students can take additional time as needed to finish. While students are working, walk around and monitor student progress, noting any misconceptions or areas in which students are struggling. Follow up with individual students as needed.
5. Once students have completed the task, collect student task worksheets, and administer the student survey. **Be sure each student completes the correct survey according to his or her assigned ID number located at the top right corner of the survey.** The survey should take approximately 5 to 10 minutes for the student to complete.
6. Collect student surveys.

# Guidelines for Evaluating Student Performance

Following the administration of the task, please evaluate each student response using the provided task evaluation spreadsheet. However, before you begin your review, locate the student ID numbers in the first column of the Excel Spreadsheet. Using the provided dropdown menu, indicate if you would consider each student a high performer, moderate performer, or low performer based on his/her typical performance in the classroom and on other measures of assessment. Use the definitions provided in column B to guide your considerations. Next, follow the steps below to evaluate each individual student’s response and to record your findings in the spreadsheet. For each student response:

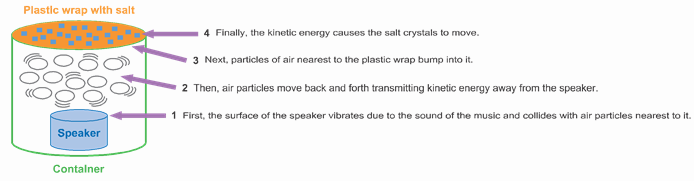
1. Starting with the first dimension, read and familiarize yourself with the evidence of student performance elicited by the task.
2. Identify the evidence of what each student knows and can do with regard to the dimension. Using the provided dropdown menus, record the evidence demonstrated by the student in his or her responses. E.g., “model describes some of the relationships between components,” or “model is used to describe why materials with certain properties are well-suited for particular functions,” etc.
3. Next, assign each student a “score” in order to classify the student’s performance and to inform how he or she may be grouped with other students for instruction. Determine if the student has mastery/an understanding of the assessed skills and is ready for new, more sophisticated instruction (a “3”); has a partial understanding and needs additional instruction on some concepts before new instruction is provided (a “2”); or has not learned the material and/or has misconceptions and reteaching of the key concepts is required (a “1”).

Repeat the steps above for the remaining dimensions measured by the task. Once all dimensions are evaluated, and the spreadsheet is populated for each student that completed the task, collectively evaluate the performance of all students. For all responses:

1. Collectively consider the evidence of student performance across all students. Do any patterns or trends emerge with regard to students’ demonstrated knowledge, skills, and abilities related to this standard/performance expectation? Do you notice any common misconceptions or misunderstandings? In cell J4, please summarize your observations about what you have learned from the collected evidence of student understanding.
2. Next, consider how you might address students’ needs. How will you adjust instruction based on the observed patterns and trends? Consider what aspects of the standard/performance expectation (i.e., dimensions) require additional instruction for individuals, small groups, or the class. In cell K4, please summarize your instructional adjustments.

## Student Exemplar(s)

### Question 1: Construct a Model



### Question 2: Constructed Response

“The vibrating speaker gives out sound. The sound travels through the air as longitudinal waves. The air particles next to the plastic wrap vibrate as the sound energy reaches it, making the salt crystals move. When the sound of the music is louder, it is more intense. This causes the salt crystals to move even more. The salt stops moving when the sound stops. This is why the plastic wrap is a good sound detector.”

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