EQuIP Rubric for Science Unit
Peer Review Panel Feedback

Overall Rating:

R

Revision Needed

Unit Name: MS Sound
Grade Level: 6, 7, & 8

Category I. NGSS 3D Design

		Evidence of Quality?			
		None	Inadequate	Adequate	Extensive
Unit Criteria	A. **Explaining Phenomena/Designing Solutions**: Making sense of phenomena and/or designing solutions to a problem drive student learning.				X
	B. **Three Dimensions**: Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) *that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions*.			X	
	i. *Provides opportunities to develop and use specific elements of the SEP(s).*				*X*
	ii. *Provides opportunities to develop and use specific elements of the DCI(s).*			*X*	
	iii. *Provides opportunities to develop and use specific elements of the CCC(s).*				*X*
	C. **Integrating the Three Dimensions:** Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.				X
	D. **Unit Coherence**: Lessons fit together to target a set of performance expectations.				X
	E. **Multiple Science Domains**: *When appropriate*, links are made across the science domains of life science, physical science and Earth and space science.		X		
	F. **Math and ELA:** Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.			X	

Category I Rating: **2**

At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C

Criterion A.

Specific evidence from materials and review team consensus reasoning:

Students directly experience phenomena at the beginning of each lesson when they:

- observe a sewing needle and cone moving over a record (Lesson 1).
- look at the record under a magnifying glass and microscope, and observe how a needle moves over the grooves of a record (Lesson 2).
- observe how instruments move while making noise through sight and touch, and watch the movement of an instrument in slow motion (Lesson 3).
- observe the reflected laser of a mallet striking a drum head with a mirror on it (Lesson 4).
- observe the vibration in a wooden yard stick (lesson 5).
- observe how differences in structure (length of bar on xylophone, etc.) affect the sound produced (lesson 6).
- watch a video of music blasting in a truck (Lesson 7, 9).
- deconstruct an old speaker (Lesson 8).
- measure the mass of a Ziploc bag full of air, containing a cell phone playing music (Lesson 10).
- observe that striking two objects underwater creates a noise if you put your ear next to the container (Lesson 11).

	The purpose of the phenomena throughout the unit is to create common experiences or help students recall prior experiences in order drive sense-making. Students relate to prior experience when they: • are asked to reflect on when they have heard noises across a distance in the past (Lesson 1). Also, the nature of the unit applies to student prior experience, as all/ most students hear noise across a distance daily. Student sense making is supported through • observation (found throughout the unit), • journaling (evidence in student activity sheets), • discussion (found throughout the unit in small group and full class settings), and • reaching a consensus at the end of each lesson (found throughout the unit).
	Suggestions for improvement:

Criterion B.	**Specific evidence from materials and review team consensus reasoning:**
	
	Students develop and use specific elements of
	• Asking questions
	  ○ When students develop questions based on phenomena of each lesson as driving questions for the next lesson (evidenced throughout the unit), they have the opportunity to develop skills in "asking questions that arise from careful observation of phenomena, or unexpected results, to seek additional information."
	• Developing and Using Models
	  ○ When students draw models of what they believe is happening that would allow them to hear noise from across the room (pg. 5), they have the opportunity to "develop and/or use a model to predict and/or describe phenomena" and "develop a model to explain unobservable mechanisms" (L1).
	  ○ When students update their models based on their exploration of instruments, they have the opportunity to "modify a model – based on evidence – to match what happens if a variable or component of a system is change (evidenced throughout the unit storyline).
	• Analyzing and Interpreting Data
	  ○ When students record patterns from a vinyl record (L2), record patterns of instrument movement when sound is created (L3), and analyze patterns from a motion detector (L5), they have the opportunity to "construct, analyze, and/or interpret graphical displays of data," and "analyze and interpret data to provide evidence for phenomena."
	• Use Math and Computational thinking
	  ○ When students graph motion of a wooden stick and identify repeating patterns; compare time & peak (L5 & L6), they have the opportunity to "use digital tools to analyze very large data sets for patterns and trends."
	• Construct Explanations
	  ○ When students consistently modify the model of the system throughout the unit (evidenced throughout), they have the opportunity to construct an explanation using models or representations.
	  ○ Students explain the chain of cause and effect based on the structure of the vinyl record which causes the needle to make sound (L4).

The primary DCIs in this unit are related to PS4.A: WAVE PROPERTIES

- A simple wave has a repeating pattern of specific wavelength, frequency, and amplitude (MS PS4-1).
- A sound wave needs a medium through which it is transmitted (MS PS4-2).
- Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1) → In Lesson 4 students conclude that "Vibrating objects make sound."

Students develop and use specific elements of

- Patterns
    - When students explore patterns of grooves in the record (L1-2), they have the opportunity to develop an understanding that "macroscopic patterns are related to the nature of microscopic structure."
    - When students identify the patterns of vibration in instruments (L3) and other objects as they make noise, they have the opportunity to develop an understanding that "patterns can be used to identify cause and effect relationships."
- Structure / Function
    - When students explore "The structure of the groves causes a push on the needle in different directions as the record spins. This generates an effect: the needle is moved back and forth in different patterns" (L2 P7), they have the opportunity to explore how complex and microscopic structure and systems can be visualized, modeled, and used to describe how their function depends on their shape". This is also evident in:
        - Lesson 3 Part 5: cause and effect of force & vibration.
        - Lesson 6 Part 1: similar structure of instrument produces similar function.
- System and System Models
    - When students create and modify their models based on new evidence (throughout the unit) and investigate the movement of air in a closed system (L10), they have the opportunity to develop and understanding that "models can be used to represent systems and their interactions… and energy flows within systems."

Suggestions for improvement:

SEPs

Throughout the unit, students often design investigations (Lesson 1) or participate in investigations to collect data (Lessons 2,6). There is an opportunity to incorporate more grade-band specific elements within these investigations. Suggestions include:

- Scaffolding the planning of investigations to guarantee students are including necessary components (IV, DV, materials, how data will be collected, etc.).
- Providing students the opportunity to evaluate the accuracy of data collection methods.

Throughout the unit, students are often asked to make claims (Student Activity Sheet), which provides opportunity to address the SEP of Engaging in Argument from Evidence with grade-band appropriate elements. Some suggestions are:

- Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.
- Provide students an explicit outlet for providing feedback and critiques to claims and arguments.
- Compare and critique two arguments on the same topic and analyze whether they emphasize similar or difference evidence and/or interpretations of facts - This opportunity

	presents itself specifically with the modification of student models throughout the unit, if students are given an explicit method of critiquing student claims of the model. DCIs Lessons 1-4 build toward "vibrating objects make sound" as students look for various examples (1-PS4-1 and 4-PS4-1). Lessons 5 & 6 start to touch on amplitude & frequency which is part of MS-PS4-1. Maybe Lessons 1-4 (almost half of the unit) can be condensed as students should've already learned this in elementary school. Since this unit is designed for middle school, more lessons should focus on MS-PS4-1, MS-PS4-2, and MS-PS4-3. To align more to the evidence statement for MS-PS-4-1, the lessons can also incorporate more energy and discuss the relationship between energy of waves vs. amplitude & frequency. Lesson 8 touches on MS-PS4-3; more emphasis can be given to comparing similarities & differences between analogue vs. digital signal. CCCs While cause and effect is referenced often throughout the unit, there are not many opportunities for students to develop strong grade-level appropriate elements of this CCC. The cause and effect relationships that are identified can be built upon by the following: • Students can be asked to explicitly identify a relationship as causal or correlational. • Ask students to use the cause and effect relationships that they identify throughout to explicitly make predictions about phenomena. This idea is implied in the Student Activity Sheet, but not explicitly outlined. System and System Models are addressed throughout the unit, but it is recommended that this crosscutting concept is used more explicitly by students, with students reflecting on the grade appropriate elements. Suggestions include: • Asking students to reflect on the consensus model to identify limitations in its ability to represent aspects of the system.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** In each lesson, and throughout the unit, student sense-making is dependent on the integration of elements of the SEPs, CCCs, and DCIs. **Suggestions for improvement:**
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** At a start of a new day, the teacher always reviews/summarize the previous day lesson (entrance slip, ask students to summary what they figured out from the investigation from the previous day, Lesson 2 Part 5, Lesson 3 Part 1) → having a recap from the previous day reminds the students what they were investigating and how this leads to the new study/focus. Phenomena uses are related and build in complexity from lesson 1 to lesson 11. At the end of each lesson, there is a "next step" where students raise new question, make predictions, and update DQB & Investigation Plan Poster. • Lesson 1 next step: how does needle interact with the moving record?

	• Lesson 2 next step: what are other objects doing when they make sounds? Part 8: "Have a Consensus Building Discussion to help the class narrow in on the next steps and future investigations." • Lesson 3: do all things vibrate when making sounds? • Lesson 4: do loud vs. soft sounds vibrate differently? • Lesson 5: vibration of different pitches. • Lesson 6: apply model to other phenomenon; update DQB model. • Lesson 7 (formative assessment). • Lesson 9: blocking air. • Lesson 10: replacing air with water. ➔ The students make connection to personal experiences as they generate additional question and decide on the "Next Step" for the investigation. Students are developing proficiency in 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), and parts of MS-PS4-2 and MS-PS3-5.
	Suggestions for improvement:
Criterion E.	**Specific evidence from materials and review team consensus reasoning:** This unit is focused primarily on performance expectations within the physical science domain. While CCCs are highlighted throughout the document, they are not referenced across science domains.
	Suggestions for improvement: This unit presents the opportunity to address performance expectations within life and earth science domains. MS-LS1-3 could be addressed in reference to the structure of an ear as an organ specialized for the particular body function of hearing. MS-ESS2-2 can be addressed in reference to the waves of earthquakes.
Criterion F.	**Specific evidence from materials and review team consensus reasoning:** Each lesson includes CCSS connections in ELA, specifically in regard to comprehension and collaboration, CCSS.ELA-LITERACY.SL.6.1 • Various methods of discussion (small group, whole class, guided) for a variety of purposes makes this connection very strong. Lessons 5 & 6 address CCSS.MATH.CONTENT.8.F.B.5, when students describe qualitatively the functional relationship between two quantities by analyzing a graph → students use the pattern on the graph to describe the behavior of sound waves.
	Suggestions for improvement: In the way the unit is currently written, there is a lack of opportunity for students to read and analyze text. It may be beneficial to add explicit opportunities for students to use reading standards. Suggestions include asking students to read and summarize informational text related to the content.

Category II. NGSS Instructional Supports:

		Evidence of Quality?			
		None	Inadequate	Adequate	Extensive
Unit Criteria	A. **Relevance and Authenticity**: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.				X
	B. **Student Ideas:** Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.				X
	C. **Building Progressions**: Identifies and builds on students' prior learning in all three dimensions, including providing support to teachers.		X		
	D. **Scientific Accuracy**: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.				X
	E. **Differentiated Instruction**: Provides guidance for teachers to support differentiated instruction.		X		
	F. **Teacher Support for Unit Coherence:** Supports teachers in facilitating coherent student learning experiences over time.				X
	G. **Scaffolded differentiation over time:** Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.			X	

Category II Rating: **2**

Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A

Criterion A.

Specific evidence from materials and review team consensus reasoning:

Throughout the unit, students are engaged in authentic and meaningful scenarios.

- Each phenomena outlined in Lessons 1-11 allow students to experience the phenomena as directly as possible through observation or "doing." All students observe sound being made through the lazy Susan/record device (L1) and the opportunity is provided for students to participate in the sound-making as well, by allowing them to spin the lazy Susan. Students each participate in the generation of sound and the measurements of the sound produced (L5,6). When the opportunity does not present itself for students to witness phenomena in person, media representations allow students to explore the phenomena (L7,9).
- The personal connection is inherent in that most students have experienced the relationship between sound and distance throughout their lives.
- The use of these particular phenomena create shared experiences between students, which becomes a part of their own experience. Questions throughout the unit are largely student generated, after reflection on the phenomena.

Suggestions for improvement:

There may be an opportunity for more direct reflection on how sound is used in daily lives, or how the information gained can be applied to situations outside of school. One suggestion is to engage students in music indigenous to various cultures represented in the classroom to explore similarities and differences in the patterns of the music.

Criterion B.

Specific evidence from materials and review team consensus reasoning:

This unit provides opportunities for students to express, clarify, justify, interpret, and represent ideas when:

- Students develop models to support/illustrate their thinking. They share their models with peers and circulating teacher. Teacher stimulates deeper thinking and more specific modeling by asking appropriate probing questions.

	• Whole class discussions provide opportunities for additional feedback and for some students to generate ideas and clarify thinking resulting in improvement and refining of models. • The discussion strategies/discourse that are provided throughout the lesson under "Teacher Supports & Notes" provide ample support to guide teachers in talking points throughout the unit. • The student activity sheet provides students with opportunity to express their learning throughout the unit.
	Suggestions for improvement: The unit provides opportunity for students to respond to teacher and peer feedback through small group and full group discussion, but is limited in its opportunities for students to respond to feedback in written form. It may be beneficial for students to complete self-assessment rubrics in response to teacher feedback.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** There is no overarching identification of student learning in all three dimensions prior to the beginning of this unit, and there is no explanation for how the prior learning will be built upon.
	Suggestions for improvement: It is helpful for teachers to have an understanding of what prior knowledge is expected of students for them to be able to accurately complete this unit. Suggestions to include progressions in all three dimensions include: • The incorporation of expected student prior knowledge into the Getting Ready: Teacher Preparation pages of the unit. • The inclusion of a pre-assessment, a performance task around explaining with a model how sound is created and how it travels, a KWL, or other inventory of prior knowledge would provide a baseline and illuminate what experience some or all students bring to the lesson in terms of understanding the science and the skills they might have mastered to communicate that understanding. Lessons 1-7 focus primarily on building toward performance expectations and DCIs within the K-2 and 3-5 grade band. If this unit is assuming that middle school students have no prior knowledge of PS4.A, it would be appropriate to outline that assumption for teachers. If a teacher using this lesson can show that their students have strong foundational knowledge on 1-PS4-1 and 4-PS4-1, it would be beneficial to outline how teachers can begin this unit with a lesson further in the progression.
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** The science contained throughout this unit in information presented, phenomena, and representations is accurate and grade appropriate, and supports student three-dimensional learning. The teacher guide, "teacher supports" section provides teachers with information on how to help students transition from everyday language to scientific vocabulary. • Teachers introduce terms such as amplitude, frequency, and period (L3). • Teachers are guided to replace the word ear with "ear/detector" in consensus models (L1).
	Suggestions for improvement:

Criterion E.

Specific evidence from materials and review team consensus reasoning:

The student activity sheets provide graphic organizers for students to organize and record information in an organized way.

There are videos embedded throughout the unit (L3- slow motion, L7,9 - video of truck) to help students visualize patterns.

"Alternate Activities" provided in the Teacher Supports section of the teacher guide will provide some opportunities for alternatives, such as providing students with classroom discussion expectations (L1), "stop and jot" opportunities for students who need to write down ideas before sharing verbally (L2,3), draw their model opportunities in the student activity sheet prior to group discussion (L10).

L10 offers a video link as a source of possible extension activities, but does not outline specific activities that could be completed. L2 suggests using student-created questions to complete an enrichment investigation at the end of the unit.

Suggestions for improvement:

The unit provides little guidance for teachers to support differentiated instruction. Some suggestions on how to do so include:

- Add specific notes to the plan that outline techniques for ELL, LD, and other struggling populations. Most of the activities are hands-on following by discussions. There was not a lot of reading involved. It may help the linguistic learners to read articles that are related to the phenomena (e.g., invention of vinyl record or various musical instruments). When providing reading opportunities for students, it is beneficial to include various Lexiles to support students of different reading levels. Special Ed students or those who struggle in math skills may need added support in interpreting the graph. More practices can be given and help them become familiar with wave model. While all phenomena are hands on, it may be beneficial to advise teachers to record or photograph phenomena for students to refer back to for reference as needed, or to provide videos/photographs of the phenomena for teachers.
- There are not many formative tasks outside of discussion embedded in the unit, which may make it difficult to identify students who are struggling to meet targeted expectations. Providing teachers with links to resources such as videos or articles that can help reinforce material to struggling learners will be beneficial, especially if tied to the result of a formative assessment. A good place for intervention is after the formative assessment at Lesson 7, identify the struggling students and provide additional review (reteach the concept, more practices on identifying amplitude & frequency using instruments/sound device they are familiar with).
- There are not many specific extension opportunities incorporated into the lesson for students who have high interest or have already met the performance expectation. Suggestions include:
    - Measuring the output of various instruments or surfaces with the logger lite probes and comparing the wave patterns as was done in lesson 6.
    - A more advanced speaker test for lesson 8, part 2.
    - Provide explicit instructions for extension activities related to the video in Lesson 10.

Criterion F.	**Specific evidence from materials and review team consensus reasoning:** Lessons are linked primarily through the generation of student questions at the end of a lesson that drives the learning of the next or subsequent lesson. Discussion guidelines provided for teachers and expected student responses provide guidance for the expected storyline. The provided guide to interpreting a storyline helps teachers see the overall structure and flow of the unit format The article on "Four types of discussion for supporting teacher shifts in NGSS" linked in the guide to interpreting a storyline document provides strategies for teachers in supporting student engagement and questioning across the unit The "Teacher Supports" column in the teacher guide provides a variety of resources for teachers, including sample classroom artifacts, strategies for discussion, and additional guidance that helps support student sense-making across all three dimensions.
	Suggestions for improvement:
Criterion G.	**Specific evidence from materials and review team consensus reasoning:** Lessons progress from building basic understanding to building on that understanding. One question drives a lesson and the lesson generates a more complex question which is usually addressed in subsequent lessons. Students become more independent as the unit progresses from somewhat teacher led to very student centered.
	Suggestions for improvement: The amount of scaffold from the teacher seems constant throughout the unit. By Lesson 9, it seems like each student group should be able to come up with different investigative plans on "How would we know for example whether air is being moved from the sound source to the window when sound is being made?" and carry out their plan (instead of the whole class doing the same plan/procedure the next day).

Category III. Monitoring NGSS Student Progress

		Evidence of Quality?			
		None	Inadequate	Adequate	Extensive
Unit Criteria	A. Monitoring 3D student performances: Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.				X
	B. Formative: Embeds formative assessment processes throughout that evaluate student learning to inform instruction.			X	
	C. Scoring guidance: Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.	X			
	D. Unbiased tasks/items: Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.			X	
	E. Coherent Assessment system: Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.		X		
	F. Opportunity to learn: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback			X	

Category III Rating: **1** Adequate evidence for at least three criteria in the category

Criterion A.

Specific evidence from materials and review team consensus reasoning:

In every lesson, the teacher monitors small group discussion and what students record in the journal/ student activity sheet. Evidence includes:

- Lesson 3 Part 3, "As the videos are playing, be sure to walk around the room to observe what each student records in their Activity Sheet."
- Lesson 1 Part 4, "Have students turn in their first page of their activity sheets so that you can look through their models before day 2 to pick 3 or 4 students with different models."

"Consensus Building" discussion makes sure the class reaches consensus on claim & evidence that answers the DQ (Lesson 4 Part 3; larger force produces larger vibration & sound).

Students complete "making sense" and "conclusions" on the activity sheet at the end of every lesson.

Suggestions for improvement:

Criterion B.

Specific evidence from materials and review team consensus reasoning:

The primary source of formative assessment throughout the unit is monitoring of small group and full class discussions. The inclusion of "expected student responses" in the teacher guide provides teachers with an understanding of the ideas students should be sharing in order to show understanding.

Twice throughout the unit (L1, L2) it is suggested that students complete entrance tickets where they list three things needed to hear sound across a room based on the consensus model.

Throughout the unit, it is suggested that the teacher collect student activity sheets and look at them before next time (L1, L10).

	Suggestions for improvement: It is suggested that the teacher collects student brainstorming ideas (L9, 10) in order to start class by sharing student ideas. This is also an opportunity for teachers to formatively assess student understanding. While it is suggested that the teacher collect student activity sheets and look at them before the next lesson, there is no explicit guidance provided to the teacher on what to do with the results of the activity sheets. It may be beneficial to provide teachers with tools to provide extra support to the class if this formative assessment shows that many students are not meeting targeted expectations Most of the formative assessments are done through discussions and spot checks. This may not identify the struggling students who need intervention, if not all students are participating in discussion. Entry tickets and exit tickets are recommended for more formal assessment of all ideas from all students.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** An answer key is provided to the student assessment in Lesson 7. The teacher goes over the answer right away with the students after they take the quiz (Lesson 7 Part 3).
	Suggestions for improvement: The only assessment provided for students (L7) is focused primarily on content ideas, and does not assess student understanding of SEPs or CCCs. For all student products that are being produced (investigations, student activity guides, claims, and discussion), it is recommended that rubrics and scoring guidelines are provided for the teacher. A discussion rubric can help track students' performance and ensure equity (all students are speaking up and contributing productively during discussions). It is important that teachers are able to accurately assess student performance across all three dimensions. Tasks should explicitly provide evidence of student understanding of SEPs and CCCs. One suggestion is to ask students to write an argumentative response related to the claims they present in their Student activity guide, and provide teachers with an aligned rubric for argumentation.
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** The phenomena provide students with shared common experiences, which create a unit that does not include bias based on student past experience. When home-learning is assigned, the work is based on in-class activities.
	Suggestions for improvement: It is important to be cognizant of differing student abilities and backgrounds in the classroom. For example, when referring to hearing and sound, be aware of students who may be hard of hearing. It is also important to be aware of students' home situations and the possibility that students may not be able to complete extensive home-learning activities.

Criterion E.	**Specific evidence from materials and review team consensus reasoning:** Student prior knowledge is assessed through the construction of the initial model, but does not assess student knowledge across all three dimensions. Formative assessment is embedded throughout the lesson, primarily in the form of discussion. Lesson 7 offers the opportunity for a more formal formative assessment, in which students apply the knowledge they have gained to a new phenomenon.
	Suggestions for improvement: There is little opportunity for students to show prior knowledge across all three dimensions. While the initial model assesses some prior understanding, it is also based on a phenomenon. It is recommended that students be assessed through discussion, evaluation of a model, or analysis of data related to the sounds and vibrations prior to the beginning of this unit to help the teacher guide learning. It is our understanding that this unit is not yet complete, and therefore a summative assessment has not yet been created to assess three-dimensional learning. Students revise their understanding of how sound travels often throughout the unit, and record information on their student activity sheet. It is recommended that students are asked to reflect on their learning through self-assessment embedded throughout.
Criterion F.	**Specific evidence from materials and review team consensus reasoning:** Students repeatedly develop and use models to express their understanding and to make sense of phenomena. Additionally, they ask questions, engage in argument from evidence, and use mathematical thinking. They apply the concepts of scale, structure function, patterns, and cause and effect. Students have several home learning opportunities that practice the content they learn in class. For example, in Lesson 1 Part 9, students plan an investigation at home about needle and record. In Lesson 3 Part 5, students draw a second model of instrument vibration. Students have multiple opportunities to practice the concepts they learn in class. Home-learning is always followed by a discussion with teacher's feedback
	Suggestions for improvement: Feedback is often provided to students through discussion. It may be beneficial for some students to receive written feedback throughout the course of the unit.

Summary Comments

As reviewers of this unit, we believe that the main reason this falls under the category of "Revision needed" is due to the fact that it is incomplete. We believe that the implementation of this storyline would provide all students with the opportunity to learn and develop understandings across all three dimensions of NGSS. Each lesson is engaging, appropriately challenging for middle school students, and provides all students with shared experiences which minimizes bias in instruction and promotes a culture of learning in the classroom. The layout of the unit provides all teachers access to the tools to properly implement the unit.

Our biggest areas of feedback center around the inclusion of grade appropriate DCIs and assessments. The first seven lessons in the unit build toward an understanding of performance expectations in the elementary school grade bands, with little to no focus on DCIs within the 6-8 grade band. It is recommended that the developer supply a pre-assessment for teachers to use in order to determine

student understanding of these DCIs prior to beginning the lesson. If teachers determine that students have a significant understanding of 1-PS4-1 and 4-PS4-1, recommendations on where to start the unit would be helpful. It is also recommended that assessments of three-dimensional learning be embedded throughout the unit, using various methods. Much of the assessment is done through small group and full group discussion, which may not provide equity in the assessment of all students. Assessments can include written or drawn formative assessments, or conferencing with individual students. In addition to formative tasks, guidelines for teachers on how to address students who are struggling to meet targets would be beneficial. The addition of a final summative task would tie the pieces of the unit together and help provide more coherence for students.

Overall, we are impressed with the flow and coherence of the lessons within this unit. We believe that as the unit is completed, it will easily fall into the E/I range.

Unit Rating Scale for Category I (Criteria A–F):

3: At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C

2: At least some evidence for all unit criteria in Category I (A–F)**;** adequate evidence for criteria A–C

1: Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C

0: Inadequate (or no) evidence to meet any criteria in Category I (A–F)

***Unit* rating scale for Category II (Criteria A-G):**

3: At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria

2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A

1: Adequate evidence for at least three criteria in the category

0: Adequate evidence for no more than two criteria in the category

Unit Rating scale for Category III (Criteria A–F):

3: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion

2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A

1: Adequate evidence for at least three criteria in the category

0: Adequate evidence for no more than two criteria in the category

Overall Rating:

E: Example of high quality NGSS design—High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)

E/I: Example of high quality NGSS design if Improved—Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)

R: Revision needed—Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)

N: Not ready to review—Not designed for the NGSS; does not meet criteria (total 0–2)