EQuIP Rubric for Science Unit
Peer Review Panel Feedback

Overall Rating:

E/I

Example of High-Quality NGSS Design *if* Improved

Unit Name: MySci Module 5 Waves
Grade Level:

Category I. NGSS 3D Design

Unit Criteria		None	Inadequate	Adequate	Extensive
		Evidence of Quality?			
	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:

Phenomenon motivate sense-making:

Phenomena motivate sense-making as student experiences and interests are the basis of all lessons in the unit. There is an overarching unit phenomenon (designing a concert experience) and embedded phenomena within each concept (sounds of a xylophone, why your singing voice is great in the shower, arrow switching direction when viewed through a glass, differences between record player and digital recordings, etc.) that motivate sense making. These phenomena are relevant to students' lives and are intriguing to them.

Students make sense of phenomena and design a solution to a problem in this unit. First, the students engage with the phenomenon of a concert. On page 1 of the Introduction document, the driving question is stated: "How can we as engineers design a concert experience for others to enjoy?" Although students may not have experienced a concert live, they experience it through a video. By doing this, all students have the same experience. Students write down questions on the graphic organizer (handout 1-2) after watching the concert videos at the start of the first module in relation to the driving question. Students are then given the task of creating a concert for others to enjoy. Throughout the unit, students are asked to explain

	phenomena in their learning logs for the driving question in each of the four concepts in the module. **Lessons support sense making:** Lessons support students in making sense of phenomenon. In general, lessons are designed for students to interact with content of the phenomenon in many ways (videos, modeling, readings, etc.). Students then draw conclusion or identify relationships based on those interactions and finally circle back to explain the phenomenon. In Concept 2, students explore the high-interest phenomenon of how a singer can shatter a wineglass with their voice. Students watch videos of the phenomenon, hear scientific discussion of what is occurring and then use a model to explain how sound waves cause the phenomenon. In Concept 3, students move through stations and they apply scientific concepts to explain how light's behavior causes many phenomena they encounter in their everyday lives. Students are prompted to ask questions and revise thinking about the phenomenon to motivate sense making and problem solving for the concert experience: • Concept 1- at the end of stations (handout 1-4). • Concept 2- at the end of CER (handout 2-12). • Concept 2- at the end of Sound Wave Interactions stations (handout 2-18). **Engineering lessons are integrated with DCI content:** The entire unit is developed around students making sense of sound and light waves to help design a solution of an enjoyable concert experience. Students also make sense of digital vs. analog music synthesizers for mixing music for the concert experience. All of this leads to the performance task where students apply their knowledge by choosing the design elements that make an ideal concert experience, including space, sound, and light.
	Suggestions for improvement: **Phenomenon motivate sense-making:** Provide a prompt for teachers to elicit students' prior experiences attending concerts or other concert hall settings either in discussion or on handout 1-2 in order to connect to student lives. (This was done at the start of Concept 3) **Lessons support sense making:** Many of the lessons provide prompts and guiding questions that lead students to sense making. It seems that students can do more sense making on their own. **Engineering lessons are integrated with DCI content:** Although heavy on physical science, good integration of ESS and LS DCIs.
Criterion B.	**Specific evidence from materials and review team consensus reasoning:** **Opportunities to develop and use SEPs**: There is extensive use of SEPs in this unit. This column shows many, but not all, examples found in the unit. Every SEP was incorporated. **SEP.1** Asking Questions *Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information*.

- In Concept 2, students are prompted to ask questions about why we dislike our voices in recordings but like the sound when we sing in the shower, Session 6, Cycle 2.
- In Concept 3, students are prompted to ask questions about the light exploration stations (handout 3-3) in order to formulate a testable question to investigate.
- In Concept 3, students are prompted to ask questions about sunscreen (handout 3-8).

SEP.2 Models

Develop and/or use a model to predict and/or describe phenomena.

Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena.

- In Concept 1, the Elicit and Engage sessions, students model waves using wave machines to find patterns in the behavior of waves. Students create wave machines and discuss possible limitations of the wave model (handout 1-3 and 1-4).
- In Concept 1, in the Explore sessions, students use computerized models and the wave machine model to discover the characteristics of waves and relationships between these characteristics. Students use PBS Learning media simulations of a pendulum to interact with amplitude and frequency computer models and wave motion (transverse and longitudinal) (handout 1-4).
- In Concept 1, the Elaborate session asks students to model and apply P and S waves to explain the destruction resulting from seismic waves.
- In Concept 2, students create a model of an eardrum (Handout 2-9) and are asked about the limitations of their model.
- In Concept 2, students create a model of how sound interacts with different materials in handout 2-15 and then revise in handout 2-17 and identify strengths and limitations of the model.
- In Concept 4, students model analog and digital synthesizers (handout 4-3).

Develop a model to describe unobservable mechanisms.

- In Concept 1, students use a slinky in station 1 to model transverse and longitudinal waves (handout 1-4).
- Students draw models of transverse and longitudinal waves in handout 1-8 after using slinky models in session 5.
- In Concept 1, students interact with PHeT "Waves on a String" model and discuss the relationship between energy and amplitude (handout 1-4).
- In Concept 2, students use information from scientific texts to revise a model of sound waves.
- In Concept 2, students use PHeT simulation on sound and Noise-O-Matic to show a visual representation of sound.
- In Concept 2, students create a sound wave model and revise in later lessons (handout 2-6).
- In Concept 2, students create and revise a sound wave interference model after participating in stations in handout 2-19.
- In Concept 3, students develop models to relate brightness with amplitude and color with frequency.
- In Concept 3, students create models of light waves in handout 3-7.

Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

- In the Performance Task, students develop a model for their design of the structure for the concert stage and venue that will optimize the sound and light experience.

SEP.3. Planning and Carrying Out Investigations

Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.

- In Concept 2, students experiment with how sound travels and interacts in Handout 2-14 and 2-15.
- In Concept 3, students formulate testable questions and design investigations to determine how different media affect the behavior of light.
- In Concept 3, students investigate light behavior in exploration stations (handout 3-3).
- In Concept 3, students design their own investigation on colored light (handout 3-4).
- In Concept 3, students investigate UV rays using UV beads in handout 3-8.

SEP.4 Analyzing Data

Analyze and interpret data to provide evidence for phenomena.

- In Concept 2, students use data from a decibel meter to analyze and interpret data to relate how loudness is affected by force used to produce the sound and distance from the sound's source.
- In Concept 3, students use data from heat lamp activity to interpret data set in question 7 about the beaches in Greece (handout 3-3).
- In Concept 3, students collect and analyze data in student designed light investigation (handout 3-4).

SEP.5 Mathematical thinking

Use mathematical representations to describe and/or support scientific conclusions and design solutions.

- In Concept 1, the Explore sessions use wave on a string model to determine the mathematical relationship between amplitude and energy.

SEP.6 Explanations

Construct an explanation using models or representations.

- In Concept 1, the Elaborate session asks students to model and apply P and S waves to explain the destruction resulting from seismic waves.
- In Concept 2, students are prompted to use evidence to support their claim about the two variables that impact the loudness of a sound in handout 2-5.
- In Concept 2, in handout 2-12, students are asked to complete a CER to address the phenomenon related to how the harp makes different pitched sounds because of the length of string.
- In Concept 3, students are prompted to cite evidence to support the claim they agree with in question 7 (handout 3-7).
- In Concept 4, students complete a CER to provide evidence that digital signals are more reliable than analog signals (handout 4-5).

Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.

- In Concept 2, students interpret patterns in data comparing length of tuning forks to the size of the wavelengths being produced to determine relationships among wavelength, frequency, pitch, energy, and length of tuning forks.

Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events.

- In Concept 1, students are prompted to use evidence from readings and activities to agree with a claim that either energy is lost in a wave or that it is conserved in a wave.
- In Concept 2, students use scientific ideas to explain the role of resonance in using sound to shatter glass.
- In Concept 2, students apply scientific ideas of how sound interacts with various media to explain and model how an upstairs radio can be heard downstairs in a two-story house.
- In Concept 2, students explain sound interference and what happens if frequency is changed in handout 2-19.
- In Concept 3, students move through stations and they apply scientific concepts to explain how light's behavior causes the phenomena they see.

SEP.7 Argumentation

Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system, based on empirical evidence concerning whether or not the technology meets relevant criteria and constraints.

- In Concept 4, students build arguments and debate digital vs. analog synthesizers (session 4-5 of cycle 1).
- In the Performance Task, students need to justify their design choices (handout 5-4).

SEP.8 Obtaining Information

Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).

- In Concept 1, the Explain sessions, students read articles to examine relationships between wave properties, behavior and energy. In the Extend session, students research tsunamis to explain their destructive potential.
- In Concept 2, students use information from scientific texts to revise a model of sound waves.
- In Concept 3, students are prompted to complete a graphic organizer on Structure and Function using one of four articles in Cycle 1, Session 6.

Gather, read, synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.

Communicate scientific and/or technical information (e.g. about a proposed object, tool, process, system) in writing and/or through oral presentations.

- In Concept 1, students answer questions in handout 1-5 while using evidence from CK-12 articles.
- In Concept 4, students research digital technologies to explain the design and reliability of the technology and then present the information.

Opportunities to develop and use DCIs:
PS4.A

A *simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude*.

- In Concept 1, the Explore activities, students go through stations about wave behaviors and properties. In Explain sessions, the activities focus on wave behaviors, properties and

	energy. The Elaborate and Extend activities apply wave on wave behaviors, properties and energy to earthquakes and tsunamis. • In Concept 2, simple wave models are created with wavelength, frequency, and amplitude in relation to sound waves and how sound waves travel. *A sound wave needs a medium through which it is transmitted*. • In Concept 2, students apply scientific ideas of how sound interacts with various media to explain and model how an upstairs radio can be heard downstairs in two-story house. **PS4.B** *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*. *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*. • In Concept 3, students move through stations and they apply scientific concepts to explain how light's behavior causes the phenomena they see. • In Concept 3, students formulate testable questions and design investigations to determine how different media affect the behavior of light. *A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media*. • In Concept 3, students develop models to relate brightness with amplitude and color with frequency. **PS4.C** *Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information*. • In Concept 4, students research digital technologies to explain the design and reliability of the technology and then present the information. • In Concept 4, students build arguments and debate digital vs. analog synthesizers. **LS1.A and LS1.D** *In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions*. *Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories*. • In Concept 2, students use models to describe how the structure of the human ear allows humans to hear and interpret sound waves. **PS1.A** *In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations*. • In Concept 2, students apply scientific ideas of how sound interacts with various media to explain and model how an upstairs radio can be heard downstairs in a two-story house.

ESS2.A

- In Concept 1, ESS2.A is brought in with earthquakes in session 5.

ETS1.B

Models of all kinds are important for testing solutions.

- In the Performance Task, students develop a model of the design of the structure for the concert stage and venue that will optimize the sound and light experience.

ETS1.C

The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.

- In the Performance Task, students refine the structure for the concert stage and venue that will optimize the sound and light experience, based on peer feedback.

Opportunities to develop and use CCCs:
CCC.1. Patterns

Patterns can be used to identify cause and effect relationships.

- In Concept 1, the Elicit and Engage sessions, students model waves using wave machines to find patterns in the behavior of waves.
- In the Explore sessions, students use computerized models and the wave machine model to discover the characteristics of waves and relationships between these characteristics.
- In Concept 1, in handout 1-4, students are asked to identify patterns in the transverse and longitudinal waves made by Slinkys.
- In Concept 2, students interpret patterns in data comparing length of tuning forks to the size of the wavelengths being produced to determine relationships.
- Students are asked in handout 2-2 about patterns found in the tones of the xylophone and handout 2-3 about patterns making sound with rulers.
- Students are asked in handout 2-5 to identify patterns when experimenting with amplitude using rulers.
- In handout 2-7, students are asked to identify patterns in the data using the PHeT simulation.
- In Concept 3, students are asked to use the patterns from the heat lamp activity to explain the data of the beach temperatures in Greece (handout 3-3).

CCC.2 Cause/Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

- In Concept 1, the Explore sessions, students use computerized models and the wave machine model to discover the characteristics of waves and relationships between them.
- In Concept 1, the Elaborate session asks students to model and apply P and S waves to explaining the destruction resulting from seismic waves.

	• In Concept 2, students use data from a decibel meter to analyze and interpret data to relate how loudness is affected by force used to produce the sound and distance from the sound's source. • In Concept 2 in handout 2-7, students are asked to identify the relationship between sensor location and amplitude & length of tuning fork and wavelength/frequency. • In Concept 3, students move through stations and they apply scientific concepts to explain how light's behavior causes the phenomena they see. • In Concept 3, students formulate testable questions and design investigations to determine how different media affect the behavior of light. **CCC.5** Energy and Matter *Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter*. • In Concept 1, the Elaborate session asks students to model and apply P and S waves to explaining the destruction resulting from the energy transferred through seismic waves. • In Concept 1, the Extend session, students explain the destruction caused by the energy transfer through tsunami waves. • In Concept 1, students are prompted to answer questions in handout 1-6 on energy and energy transfer of a wave. • In Concept 2, students are asked to infer about the amount of energy the sound waves produced in handout 2-5. **CCC.6** Structure and Function *Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function*. • In Concept 2, students use models to describe how the structure of the human ear allows humans to hear and interpret sound waves. • In Concept 2, students are asked to write a CER about the pitch created by different string lengths of a harp. • In Concept 3, students are prompted to complete a graphic organizer on Structure and Function using one of four articles in Cycle 1, Session 6. • In Concept 4, students compare the structure of digital vs. analog tapes and their functions *Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used*. • In Concept 2, students apply scientific ideas of how sound interacts with various media to explain and model how an upstairs radio can be heard downstairs in two-story house. • In Concept 3, students are to relate the materials structure to light behavior (handout 3-4). • In the Performance Task, students develop a model of the design of the structure for the concert stage and venue that will optimize the sound and light experience. **CCC.7** Stability and Change *Stability might be disturbed either by sudden events or gradual changes that accumulate over time*. • In Concept 2, students apply scientific ideas to explain the role of resonance in using sound to shatter glass.

	Suggestions for improvement: Opportunities to develop and use SEPs: Strong evidence of SEPs throughout the lessons Opportunities to develop and use DCIs: Strong evidence of DCIs throughout the lessons Opportunities to develop and use CCCs: The crosscutting concepts of patterns are explicitly addressed in questions found in handouts, but some of the others such as structure and function and cause and effect are more implicit. Consider making the CCCs bold and stand out in the questions so students realize they are trying to include them in answers or that they are actually using a CCC in their sense making.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** Performance Task • In order for students to complete the performance task, they must be proficient in modeling all types of waves and providing evidence and reasoning for their design elements. Students must also be able to identify patterns within the space and the structure of materials to determine their function in the design solution. For example, they must know how the waves will bounce off the walls and how the walls will reflect, absorb, or refract the light and sound. Concept 1 • In Concept 1, the Elicit and Engage sessions, student model waves using wave machines to find patterns in the behavior of waves. (SEP.2, CCC.1, PS4.A) • In Concept 1, the Explore sessions, students use computerized models and the wave machine model to discover the characteristics of waves and relationships between these characteristics. (SEP.2, CCC.2, PS4.A) • In Concept 1, the Elaborate session asks students to model and apply P and S waves to explain the destruction resulting from seismic waves. (SEP.2, CCC.4, PS4.A) • In Concept 1, the Explore sessions use a wave on a string model to determine the mathematical relationship between amplitude and energy. (SEP.5, CCC.3, PS4.A) • In Concept 1, the Elaborate session asks students to model and apply P and S waves to explain the destruction resulting from seismic waves. (SEP.6, CCC.5, PS4.A) • In Concept 1, the Explain sessions, students read articles to examine relationships between wave properties, behavior, and energy. In the Extend session, students research tsunamis to explain their destructive potential. (SEP.8, CCC.2, PS4.A) • In Concept 1, the Extend session, students explain the destruction caused by the energy transfer through tsunami waves. (CCC.5, PS4.A) Concept 2 • In Concept 2, students use information from scientific texts to revise a model of sound waves. (SEP.2, PS4.A) • In Concept 2, student use data from a decibel meter to analyze and interpret data to relate how loudness is affected by force used to produce the sound and distance from the sound's source. (SEP.4, CCC.2. PS4.A) • In Concept 2, students interpret patterns in data comparing length of tuning forks to the size of the wavelengths being produced to determine relationships among wavelength, frequency, pitch, energy, and length of tuning forks. (SEP.6, CCC.1, PS4.A) • In Concept 2, students use scientific ideas to explain the role of resonance in using sound to shatter glass. (SEP.6, CCC.7, PS4.A)

	• In Concept 2, students apply scientific ideas of how sound interacts with various media to explain and model how an upstairs radio can be heard downstairs in a two-story house. (SEP.6, CCC.6, PS4.A, PS1.A) • In Concept 2, students use information from scientific texts to revise a model of sound waves. (SEP.8, PS4.A) • In Concept 2, students use models to describe how the structure of the human ear allows humans to hear and interpret sound waves. (CCC.6, LS1.A, LS1.D, PS4.A) Concept 3 • In Concept 3, students formulate testable questions and design investigations to determine how different media affect the behavior of light. (SEP.1, CCC.2, PS4.B) • In Concept 3, students develop models to relate brightness with amplitude and color with frequency. (SEP.2, PS4.B) • In Concept 3, students formulate testable questions and design investigations to determine how different media affect the behavior of light. (SEP.3, CCC.2, PS4.B) • In Concept 3, students move through stations and they apply scientific concepts to explain how light's behavior causes the phenomena they see. (SEP.6, CCC.2, PS4.B) Concept 4 • In Concept 4, students build arguments and debate digital vs. analog synthesizers. (SEP.7, PS4.C) • In Concept 4, students research digital technologies to explain the design and reliability of the technology and then present the information. (SEP.8, PS4.C) Daily • Each session ends with a 5-minute closing activity where students are asked to complete their Learning Logs for the day's activities and learning, and review the CCCs and SEPs. Students have a grid with all the CCCs and SEPs listed and room to check off the appropriate elements found in the CCCs and SEPs as they relate to the DCI that was the topic of the session.
	Suggestions for improvement: The performance task is an excellent way for students to apply their learning throughout the unit to a design challenge. Of the three, the CCCs are the weakest element that appears in the performance task. As stated above, consider making the CCCs bold and stand out in the questions so students realize they are trying to include them in answers or that they are actually using a CCC in their sense making.
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** **Lessons builds on prior lessons**: The lessons are centered around the driving question, "How can we as engineers design a concert experience for others to enjoy?" The four concepts progress through the targeted DCIs PS4.A, PS4.B, and PS4.C in that sequential order. Students progressively build an understanding of the four concepts: 1. wave characteristics 2. sound waves 3. light waves 4. digital vs. analog signals, in order to apply them in the design challenge. Some specific evidence can be found in: • In Concept 1, students use models to explore the characteristics of waves. These characteristics are examined to determine their relationship to energy transfer. Then these concepts are applied to seismic waves and tsunamis. • At the start of concept 2 on sound waves, students are presented with the xylophone example and are asked questions in handout 2-2 about how it makes different tones. Students return to revise their thinking about the xylophone in session 2-3 of cycle 1 for concept 2.

- Students are prompted to ask questions about sound waves in handout 2-9 before reading an article on properties of sound waves.
- Students are prompted to ask questions about how human ears work in handout 2-10 before reading an article about human hearing which will eventually connect to how we enjoy music in a concert experience.
- Students are prompted to ask questions about why people tend to dislike how their voice sounds on an audio recording and like how it sounds in the shower and begin to explore how sound travels through different media in handout 2-14. They ask questions again after completing the experiment.
- Students are prompted to "generate questions based on today's activities" (handout 3-3 Light Behavior Stations) to lead into the evidence needed to investigate light phenomenon and develop a testable question.

Some lessons did build on prior lessons by addressing questions raised in those lessons, but this criterion was not met as extensively as others.

- In Concept 2, Cycle 2 Explore lessons, students are asked what questions they still have at the end of the lesson. The obvious answer, why do hard surfaces reflect sound differently than soft surfaces, becomes the focus of subsequent lessons.
- In Concept 3 about light behavior, students revisit the phenomena in Concept 2 of the iPhone in the bell jar to explain why they can't hear it but can see it.
- In Concept 3, Students are asked to generate specific questions based on the Driving Question about the concert creation and the activities in which they just engaged involving light. They are asked to formulate a testable question to further investigate the phenomenon. Students will select a testable question from the list they generated and design an experiment to investigate the phenomenon.

Lessons help students develop toward proficiency of performance expectations:
The lessons build toward proficiency in the middle school PS4 performance expectations about waves, MS-PS4-1, MS-PS4-2, and MS-PS4-3. For each Concept, the lessons center around one of these PEs. Concept 1 centers around MS-PS4-1, Concept 2 centers around MS-PS4-2 for sound waves, Concept 3 centers around MS-PS4-2 for light waves, and Concept 4 centers around MS-PS4-3. After engaging in the 5E Learning Cycle embedded in each Concept, students should have a thorough understanding of each PE. The Performance Task helps build proficiency for ETS PEs: MS-ETS1-2, MS-ETS1-3, and MS-ETS1-4.

Specific evidence can be found in:

- Concept 2 of sound waves builds upon concept 1 characteristics of waves by connecting pitch to differences in frequency, and intensity to differences in amplitude. (PE PS 4-1)
- Concept 2 of how sound waves interact with media (handouts 2-16 and 2-18) are then built upon in concept 3: light wave interactions with media. (sessions 1-5) (PE PS4-2)
- Concept 4: Analog and Digital signals build upon knowledge of wave characteristics. (concept 1) (PE PS4-3)

Suggestions for improvement:

Lessons builds on prior lessons by addressing questions:
Most of the evidence provides examples of when students are prompted to ask questions throughout the progressive learning experience. However, there are more opportunities for students to ask new questions, address old questions, and connect to prior student experiences. Consider a strategy that brings students back to the process of generating new questions outside of the journals to help the questions lead the class discussions. Another suggestion is at the end of lessons, ask for questions or have students put them in their Learning Logs. Most likely, the next lesson will address some of those questions. This will improve unit coherence and make learning more their own.

<table>
<tr>
<td rowspan="2">Criterion E.</td>
<td>Specific evidence from materials and review team consensus reasoning:

Disciplinary core ideas from different disciplines are used together to explain phenomena:
Disciplinary core ideas from different disciplines are used together to explain the anchoring phenomenon of a concert experience. Earth science is discussed in Concept 1 when students study S waves and P waves. In Concept 2, students consider how light and sound waves are processed by people incorporating life science into the concert phenomenon. In Concept 3, the topic of bioluminescence is discussed in the Extend portion of the Concept.

Evidence of Life Science DCIs MS LS1.A and LS1.D is brought in with how we perceive sound and is then applied to help explain the phenomenon/design a solution for an ideal concert experience using DCIs PS4.A, PS4.B, and PS4.C in the performance task.

Use of crosscutting concepts is highlighted:
The CCCs are used as a focus for reflection in the student's Learning log.
Student attention is brought to the CCC of patterns in many questions found throughout the handouts.
In Concept 1, students use patterns, cause and effect relationships, scale, proportions, the concept of systems, and the transfer of energy to understand waves.
Concept 2 is similar, using patterns, cause and effect, systems, and structure/function.
Concept 3 continues the integration of multiple crosscutting concepts.</td>
</tr>
<tr>
<td>Suggestions for improvement:

Disciplinary core ideas from different disciplines are used together to explain phenomena:
Although the Earth Science DCI is introduced in Concept 1 with earthquakes in the study of waves, this is not used to explain the phenomenon or design a solution. Consider including how the building or concert venue would hold up in an earthquake as a part of the design challenge. In addition, the Life Science DCIs MS LS1.A and LS1.D are brought in with how we perceive sound, but are not used in justification for their concert experience. Considerations of seating might be able to include this concept including raised stadium versus flat floor seats.

Use of crosscutting concepts across science domains is highlighted:
The crosscutting concepts do not explicitly appear in the final design solution. Consider using the CCCs and placing them in bold in the rubric to bring attention to their usefulness in student explanations.</td>
</tr>
<tr>
<td rowspan="2">Criterion F.</td>
<td>Specific evidence from materials and review team consensus reasoning:

Math and ELA skills are used throughout the lessons, but no connections to Common Core standards are explicitly stated.
Students complete CERs a couple times in the lessons which connect to LA CCSS, but the standards are not explicitly stated.
Students conduct research on digital vs analog recordings. They also engage in a debate about which is the best way make recordings and support their assertions based on evidence.
Graphs of waves are used to compare amplitude, frequency and wavelength.</td>
</tr>
<tr>
<td>Suggestions for improvement:

The unit incorporates many ELA and Math Common Core standards. They just need to be called out in the lesson plan. Consider connecting to historical venues like the Colosseum in Italy or emphasizing the mathematical relationship of wave characteristics.</td>
</tr>
</table>

Category II. NGSS Instructional Supports:

	Criteria	None	Inadequate	Adequate	Extensive
Unit Criteria		Evidence of Quality?			
	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:

Students experience phenomena or design problems as directly as possible:

Concept 1:

- Introduction: concert experience videos
- Session 1-2: wave machines
- Students use a variety of tools such as Slinkys, springs, and online simulations in order to model waves. Students use the models to explore wave properties and apply the learning to earthquake waves.

Concept 2:

- Cycle 1- Session 1: tone simulator, Session 2: oscilloscopes and tuning forks, extension- video of shattering glass
- Cycle 2- Session 6-7: labs to explore how sound interacts with media, Session 9: exploration of sound using two speakers and a decibel meter

Concept 3:

- Session 1-3: arrow flips on index card when looking through water (handout 3-2) and pencils and disappear washers (handout 3-3), and Session 4-5 videos from Exploratorium on colored shadows
- Students use their learning about light waves and apply this learning to UV light and sunscreen.

Concept 4:

- Session 1 video or in class demo of digital vs. analog sound using tape and digital tape or record player
- Students consider the difference between digital and analog recordings and create a debate about which one is better with such things as expense vs sound quality.

Suggestions for how to connect instruction to the students' home, neighborhood, community:

	The instruction connects to teen culture of music. Most students enjoy music and concerts and this unit explores that connection. Since middle school age students often listen to music and like to go to concerts, there is implicit evidence that the music students use in the final performance task or the concerts they may talk about connect to their home life, community, and/or culture. For Concept 1, students hear about communities or live in areas that could be affected by earthquakes and tsunamis. This is relevant to their lives or the friends and family's lives. In Concept 4, students start to understand the technologies that fill their everyday lives and the ancient technologies of their parents. **Students connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience**: At the start of Concept 3, Session 1, students are asked to "share out experiences that they had with concerts/light shows" and "how the light element of the show increased their enjoyment of the experience." The final performance assessment gives students the opportunity to choose a song, personalize the design of the concert hall, design the sound and light experience, and connect it to the concepts learned.
	Suggestions for improvement: It seems that there are opportunities to explicitly ask students about the music they listen to, the concerts they may have attended, the concerts they would like to attend, or cultural events they attend that use lights and sound to entertain an audience. Connect concert to church, dance performances, school band and choir, etc. Consider prompting teachers to make a strong connection to student interests and experiences, especially at the start of the unit and start of the performance task.
Criterion B.	**Specific evidence from materials and review team consensus reasoning:** **Opportunities for students to express their ideas and respond to peer and teacher feedback**: Concept 1: • It was not clear how/when students received teacher and/or student feedback. Concept 2: • Students complete handout 2-1 Making a sound probe and then turn and talk to their partner before engaging in a class discussion about how all sound is created by vibrations. • Students are prompted to turn and talk at the end of the tuning fork activity to apply new learning to the xylophone phenomenon and again in session 5 of cycle 2 including how different sounds are produced and heard. • Students provide feedback on each other's sound wave interference models in handout 2-19 using color coded sticky notes for revisions needed, new ideas, inaccurate/incomplete info, and questions. Concept 3: • Students use the iterative design process in Concept 3 for the light experiment they create. Additional learning is provided after they pose their testable question and are given the opportunity to revise and conduct the revised experiment based on the new learning. Students share their models within their group and modify them based on feedback given by peers using the PBL Tuning protocol. Finally, students develop a consensus model as a class, once they have given each other feedback and discussed the usefulness and limitations of the models created by their peers. Concept 4: • In session 1, Students "turn and talk" to discuss what it means to be digital and then share out to the class. • In session 1, teachers are prompted to "ask the students a series of discussion questions, allowing students opportunities to Turn and talk or Think, Pair, Share." Performance task:

	• Students use peer feedback to refine the models of their designs and receive teacher feedback too.
	Suggestions for improvement: Consider providing more teaching tips on ways that students can express their ideas and provide peer feedback beyond the turn and talk and revising of models. Possibly use a peer review and feedback process on the digital presentations or other student products throughout the unit. In all the Concepts, students expressed their understanding mostly through handouts. These opportunities could be diversified. Some alternatives could be using 'foldables' to record and draw main points like wave characteristics or wave types. Students could form human waves to show their understanding of wave characteristics and behavior. Students could work in groups to create graphs from data and orally describe the relationships shown by the data.
Criterion C.	**Specific evidence from materials and review team consensus reasoning:** **Explicitly identifying prior student learning for all three dimensions**: Prior learning is implicitly identified in the student completed handouts for each lesson and the following lesson builds on that prior knowledge in the learning progression. Several prompts are provided for teachers to "ask students" or "discuss as a class." In concept 4, session 1, students are prompted to discuss "what does it mean to be digital?" Teacher is prompted to record the responses on white board or chart paper to keep for later reference. However, no explicit evidence of supports for teachers is provided to identify prior learning in all three dimensions. No evidence was found of explicit learning from prior grades. **Clearly explaining how the prior learning will be built upon**: Implicit evidence is provided explaining how prior learning will be built upon in each lesson through following the 5E sequence of each cycle.
	Suggestions for improvement: Strategies for identifying students prior learning could be suggested to teachers through checking journal entries, exit tickets, surveys, initial models, etc.
Criterion D.	**Specific evidence from materials and review team consensus reasoning:** The scientific information used in this unit is accurate and grade-appropriate and stays within the boundaries of the NGSS evidence statements. The phenomena are connected to the scientific information appropriately to support students' three-dimensional learning. In Concept 1, the PBS Learning Media Aspire Labs and PhET simulations use concise, grade-appropriate language and science terminology. Subsequent Concepts also include scientifically accurate, grade appropriate supplemental videos. Concept lessons include scientific textbook style readings. Students are exposed to many scientific resources.
	Suggestions for improvement: Lessons use accurate and grade-appropriate scientific information and representations.
Criterion E.	**Specific evidence from materials and review team consensus reasoning:** **Appropriate reading, writing, listening, and/or speaking alternatives for students who are English language learners, have special needs, or read well below the grade level**: Teaching Tips are provided to help modify curriculum in: • Concept 1: Session 3- "consider creating reading groups and have students rotate reading roles for each reading."

<table>
<tr><td></td><td>

- Concept 2: Session 3- "you may choose to do this reading together as a class, pausing to watch the videos and discuss diagrams together, or you may assign the reading to be done independently or in small groups."
- Concept 3: Specific strategies such as Think Pair Share can be found in Concept 3 when students relate their light models back to the Cathedral Probe.

However, no explicit evidence is provided of reading, writing, listening, and/or speaking alternatives are provided for ELL or students who need modifications.

Extra support for students who are struggling to meet the targeted expectations:
No evidence of additional supports are provided for students who are struggling to meet the targeted expectations.

Extensions for students with high interest or who have already met the performance expectations:
Evidence of extensions are provided in:
Concept 1:

- Extension is provided with an article on tsunamis and students answer synthesis questions.

Concept 2:

- Cycle 1 extension is provided to explain the role of resonance in using sound to shatter glass.
- Cycle 2 extension is provided to explain how sound travels faster in liquid than in air.

Concept 3:

- Extension is provided on bioluminescence and chemiluminescence with videos and articles. Students may complete a Frayer Model for one source of visible light.

Concept 4:

- Extension is provided using code.org learning modules

</td></tr>
<tr><td></td><td>

Suggestions for improvement:

Consider providing strategies for modification throughout the lessons. Some could include: modified handouts, graphic organizers for writing, word banks, sentence frames, sentence stems, leveled articles for different readers, alternative assignments

Consider the pacing. The pacing of this unit implies that all student will be learning at the same and somewhat rapid pace. How can more time be provided for students who struggle?

</td></tr>
<tr><td>**Criterion F.**</td><td>

Specific evidence from materials and review team consensus reasoning:

Strategies for linking student engagement across lessons:
The overall setup of the unit with a main phenomenon and associated large chunks of curriculum (Concepts) centered around other phenomena provide coherence. Lessons within Concepts are linked using the 5E Learning Cycle which helps provide a meaningful progression to the lessons. Students are asked probing questions both at the beginning and end of a lesson helping students connect the learning to the days phenomenon and overarching phenomena. Evidence is provided of supports for teachers to prompt students to ask questions at the end of the lesson: "generate questions based on today's activities" (handout 3-3 Light Behavior Stations) to lead into the evidence needed to investigate light phenomenon and develop testable questions.

Students are prompted to ask questions and revise thinking about the phenomenon to motivate sense making and problem solving for the concert experience:

- Concept 1- at the end of stations (handout 1-4)
- Concept 2- at the end of CER (handout 2-12)
- Concept 2- at end of Sound Wave Interactions stations (handout 2-18)

</td></tr>
</table>

	Strategies for ensuring student sense-making in all dimensions: Strategies for ensuring sense-making are found through the peer feedback and revision process when modeling during the performance task and in concept 2 on each other's sound wave interference models in handout 2-19 using color coded sticky notes for revisions needed, new ideas, inaccurate/incomplete info, and questions. There is implicit evidence for ensuring sense-making and problem-solving in all three dimensions within the learning log reflections.
	Suggestions for improvement: The unit incorporates good strategies for linking the learning experiences and ensuring sense-making. It is the piece about questions, "cultivating new student questions at the end of a lesson in a way that leads to future lessons," that could use some enhancement. Here are some suggestions: **Strategies for linking student engagement across lessons**: One possible strategy for students to ask questions at the end of the lesson is to include it in their learning log at the end of the day's activities and then share out at the start of the next class. A graphic organizer showing students a weekly/daily progression of their learning and the holistic perspective of how it fits together. **Strategies for ensuring student sense-making in all dimensions**: Consider using checklist rubrics for students to use while creating models or reflection questions that incorporates all three dimensions for entries in learning logs.
Criterion G.	**Specific evidence from materials and review team consensus reasoning:** **Scaffolded differentiation over time:** Evidence is provided by the many lessons and hands on investigations that gradually build knowledge and sense making through the 5E lesson cycle in each concept. All four concepts are used in the student products of the performance task when they design a solution to the problem. The unit progresses so that students take more of the role of designing solutions and explaining phenomena. In the first concept, they are modeling and learning about waves. In the second concept, they learn about sound waves and compare them to waves that require a medium for traveling. In the third concept, they learn about light waves and how these waves travel differently than mechanical waves.
	Suggestions for improvement: The unit provides support for students to become increasingly responsible for making sense of phenomena and designing a concert experience. The adequate score was given only because daily differentiation needed some improvement; otherwise, the big picture perspective on scaffolded differentiation over time works well.

Category III. Monitoring NGSS Student Progress

Unit Criteria		Evidence of Quality? None	Inadequate	Adequate	Extensive
	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:

There is extensive direct, observable evidence of 3D learning. Handouts show evidence of 3D learning by students. The unit provides a pre/post-test. There is a grid in the answer key that aligns each of the three dimensions with every question on the test.

Concept 1:
- Session 6: Students complete an assessment on wave properties and are asked to identify patterns in data and cause and effect relationships between wavelength and frequency & amplitude and energy. Students are also asked about the predictability of a model they draw.

Concept 2:
- Handout 2-11 assessment using multiple choice and constructed response questions. Wave models are used within the assessment and students need to construct explanations.
- Handout 2-20 assessment using multiple choice and constructed response questions on “How Sound Interacts with matter.”

Concept 3:
- Handout 3-10 assessment using multiple choice and constructed response questions on light waves and behaviors.

Concept 4:
- A CER was used to evaluate student understanding of digital and analog technologies.

Performance Task:
- The models and final performance task provides direct evidence of three-dimensional learning and design solutions.

Suggestions for improvement:

The assessments provide explicit evidence of 3D learning, however if one dimension needs to be emphasized it would be the CCCs.

<table>
<tr><td rowspan="2">Criterion B.</td><td>Specific evidence from materials and review team consensus reasoning:

Formative assessment is embedded in lessons but it is not always explicitly stated in the lesson plans. Handouts are used extensively, but it is not clear how or when they are evaluated or if students receive feedback. Although not specifically stated, each handout and learning log could be used as a formative assessment.
At the beginning of each Concept, students complete a probe to identify prior knowledge about the learning that is about to occur.
Each Concept ends with an evaluation which seems to be discussed for immediate feedback. No rubrics are provided.
Teachers are prompted throughout to ask students questions and their answers could be used to evaluate student learning.
Answer keys are provided for each handout to support teachers in assessing student work.
However, no supports are provided to teachers on how to use the formative assessment data to adjust or inform instruction.</td></tr>
<tr><td>Suggestions for improvement:

It might be helpful to explicitly reference when teachers could use a learning activity or questioning technique as a formative assessment. Also, consider providing additional phenomena, resources, or mini lessons that could support students when their sense-making contains misconceptions or inaccuracies.

If the learning logs are to be used as formative data, it might be useful to provide supports for teachers on what to look for or key terms that should be included.</td></tr>
<tr><td rowspan="2">Criterion C.</td><td>Specific evidence from materials and review team consensus reasoning:

All daily handouts and evaluations include keys with correct data, answers and expected student responses. Rubrics and Scoring Guidelines are provided for larger assignments, but rubrics are missing for other assignments.
In Concept 4, students have a checklist/rubric for their presentation about a digital technology, the argument about analog vs. digital synthesizers, and the CER evaluation. The Performance Task gives a rubric for peers and the teacher to assess the design solution.
There is no explicit evidence of the three dimensions within the rubrics or scoring guidelines. The rubric provides more of a checklist of what needs to be included in the models.
Peer feedback:
Peer feedback is provided on a couple of models when using sticky notes and using a rubric for the oral argument for the debate in handout 4-4.
Another peer rubric is provided in handout 5-5 when assessing the final student products of the performance task as well as a teacher rubric in handout 5-6.</td></tr>
<tr><td>Suggestions for improvement:

Consider using and bolding the SEPs and CCCs within the rubrics. Also, maybe provide a list of words that may be needed or used for labels or in writing for teachers to search for when interpreting student performance related to the DCIs.

It was not clear how handouts and other assignments could be used in the grade book. Is everything graded? How might each assignment be weighted or fit into the final grade? Should some learning activities be used just as formative data to guide and inform instruction? If so, which ones? A model or suggestions of how this could be accomplished in the classroom would be helpful to provide for teachers.</td></tr>
</table>

Criterion D.	**Specific evidence from materials and review team consensus reasoning:** **Unbiased tasks/items:** • Videos of the concert experience are provided for students who may not have ever attended a concert. • A combination of modeling and writing is used in the final performance task. A combination of writing and multiple-choice questions is used at the end of concept lesson series. • Vocabulary is provided throughout to help build capacity for the final performance assessment. • There is a heavy emphasis on written assessments during the concept lessons within the handouts.
	Suggestions for improvement: Consider providing alternative ways to assess students who struggle with reading or writing. If the student experiences were connected to in the beginning of the unit, then the concert experience could be more culturally relevant and accessible to students. Side note: The video listed in Concept 1, Session 5 about earthquakes (destruction due to earthquakes) may be sensitive for some students. A note to teachers may be suitable here.
Criterion E.	**Specific evidence from materials and review team consensus reasoning:** **Coherent Assessment system:** • A Pre/Post Assessment is provided with some constructed response, multiple choice, and modeling. • Pre-Learning logs are used throughout the unit in order for students to express initial ideas and demonstrate sense-making throughout the lessons. Students also use their learning log to review the CCCs and SEPs covered in each learning session. • Formative-student handouts are used. • Summative-End of Concept Assessments and a Final Performance Task are used. • Self-assessment is not consistently used but found in handout 4-4 when reviewing the research for the debate. A self-assessment rubric was provided for the CER in handout 4-5.
	Suggestions for improvement: More explicit evidence is needed for assessing the three dimensions. Incorporate more periodic self-reflections on learning. Add formative assessment strategies and call out existing ones.
Criterion F.	**Specific evidence from materials and review team consensus reasoning:** **Provides multiple opportunities for students to demonstrate 3D learning and receive feedback:** • There are multiple ways for students to learn the content and use the crosscutting concepts and practices, but fewer choices for expressing what they have learned. There is a heavy emphasis on written responses in handouts. • Multiple Opportunities are provided for students to demonstrate performance using handouts and the final performance task. • Students summarize learning in Learning Logs, create a testable question and an experiment, do a research report, engage in a debate, take a written test, and complete a final performance task based on the anchor phenomenon. • A few opportunities were provided for students to give and receive peer feedback. Teacher feedback was provided with a final rubric at the end of the performance task.
	Suggestions for improvement: There is too heavy of an emphasis of student writing and use of handouts. Consider alternative ways for students to demonstrate learning. Give them choices: making a video, creating a

	website, creating a board game, etc. Let them figure out how to provide evidence of their learning.

Summary Comments

By numeric score, this unit should receive an R rating of Revision Needed. While improvements are needed, this unit provides an excellent example of building student knowledge through phenomena-based learning. Many opportunities are provided for students to explore and investigate scientific concepts and demonstrate understanding of the three dimensions of NGSS. Consequently, we thought a rating of E/I Example of High Quality NGSS Design *if* Improved, was a more appropriate rating. However, there is a definite need for differentiating or modifying for students who need additional support including ELL and students with special needs. The teacher-directedness of these lessons does not allow for the differences students may need in pacing or scaffolded supports. The handouts are also very teacher-directed. Consider finding alternative ways for students to demonstrate learning.

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)