OpenSciEd Massachusetts Standards Guidance
6th Grade: Sound Waves

This document is to provide guidance to Massachusetts 6th grade teachers who are implementing OpenSciEd. This guidance assumes the OpenSciEd curriculum is being implemented across grades 6-8, following the MA coherent sequence by grade level *(download)*. The following guidance identifies the MA standards addressed in the *Sound Waves* unit, and the most effective use of the OpenSciEd materials for 6th grade teachers.

Scope and Sequence Recommendation

Implement the *Sound Waves* unit in 6th grade after *Light and Matter* and before the *Forces at a Distance* unit. *Sound Waves* addresses MA grade 6 physical science standards and builds a foundation for coherent transition to the *Forces at a Distance* unit. Refer to the MA coherent sequence by grade level *(download)* for the complete scope and sequence recommendation.

6th Grade Standards in *Sound Waves*

Standards in unit	Lessons building towards standards
6.MS-PS4-1. Use diagrams of a simple wave to explain that (a) a wave has a repeating pattern with a specific amplitude, frequency, and wavelength, and (b) the amplitude of a wave is related to the energy of the wave.	Lessons 1- 7, 10-14

6.MS-PS4-2. **[Partial]** Use diagrams and other models to show that both light rays and mechanical waves are reflected, absorbed, or transmitted through various materials.
• **Why partial?** *Sound Waves* addresses mechanical wave transmission in depth, but not the reflection and absorption of mechanical waves; *Sound Waves* does not address light waves.
  ○ **See recommendations below** for how to address the reflection and absorption of mechanical waves as an extension of this unit
  ○ *Light & Matter* address the transmission, reflection, and absorption of light waves, and is coherently sequenced in 6th grade before *Sound Waves.*
	Mechanical Waves:
	Lessons 1-3, 8-12, 14
	
	Light Waves:
	Addressed in *Light & Matter*

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Recommendations for Addressing Standards in *Sound Waves*

Extend *Sound Waves* to address the reflection and absorption of mechanical waves in standard **6.MS-PS4-2**. To best address standard **6.MS-PS4-2** students should **experience the phenomena of echoes and soundproofing** (e.g., a room sometimes has an echo, and sometimes does not, depending on what is in the room). Students **conduct further investigations to explain how sound is transmitted when it meets certain materials** (e.g., reflection causing an echo, and absorption causing soundproofing). Students then **revise their models** to include how echoes and soundproofing can affect how we detect sounds from a distance.

Lesson	Support for maintaining content coherence
Lessons 8-11	These lessons address that sound requires a medium to propagate. Student models from these units include particle diagrams of sound waves through a medium. This part of the unit is the most coherent point to include how sound waves interact with another medium - through absorption, reflection, or transmission of the waves.
Lesson 12: What goes on in people's ears so they can detect certain sounds?	Sound is transmitted through the air particles so that we can hear (Lessons 8-12), but sometimes the energy of the waves are absorbed (soundproofing) or reflected (echoes), resulting in us not hearing something or hearing something twice! Use Lesson 12 to navigate towards student questions about echoes. An experience such as an echoey gym or a soundproofed music room, or videos of an echo through a natural space could serve as phenomena for students to start questioning what is happening.
Additional Lesson Possible Lesson Questions: • Why do we sometimes hear sounds twice? • What types of spaces cause echoes and what types of spaces prevent echoes? • How can you change a space to cause, or remove an echo? • How do the properties of the materials in the space influence the strength of an echo?	Student investigations should focus on materials and how those materials absorb or reflect sound. Possible investigations: • Using classroom materials to design earmuffs/plugs • Analyze materials used for soundproofing • Investigate a space with poor acoustics After investigations, students should be asked to make sense of how materials interacted with the sound waves, and how the materials' properties changed how they heard the sound. Teachers should support students in applying the vocabulary for transmission, absorption, and reflection of the soundwaves in their models of the experience.
Lesson 13: What transfers more energy, waves of bigger amplitude or waves of greater frequency?	Student understandings from the additional lesson can become part of the discussion of the energy of propagating waves. For example, considering which properties of waves might help the sound get through soundproofing materials.