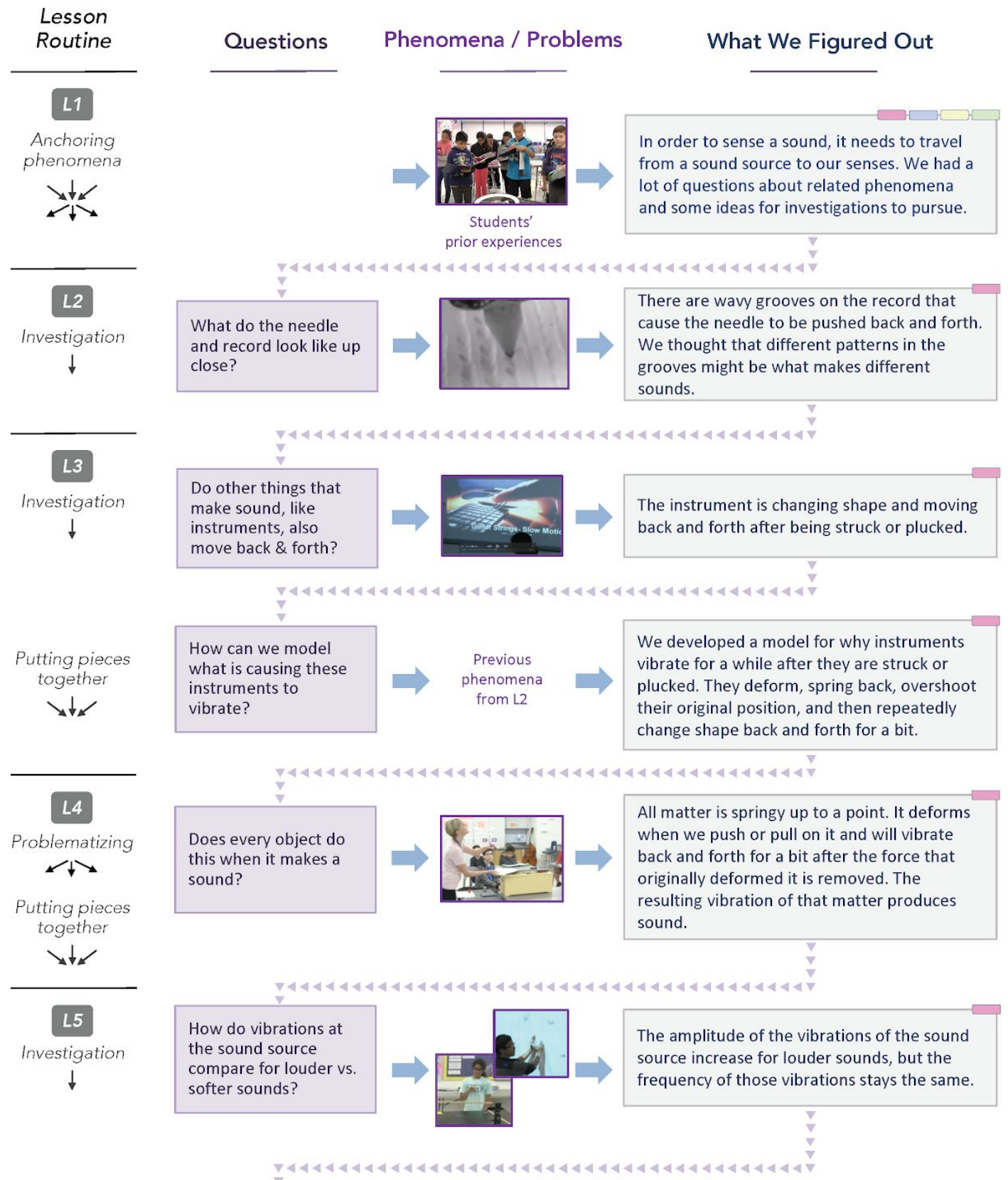




How Can We Sense So Many Different Sounds from a Distance?

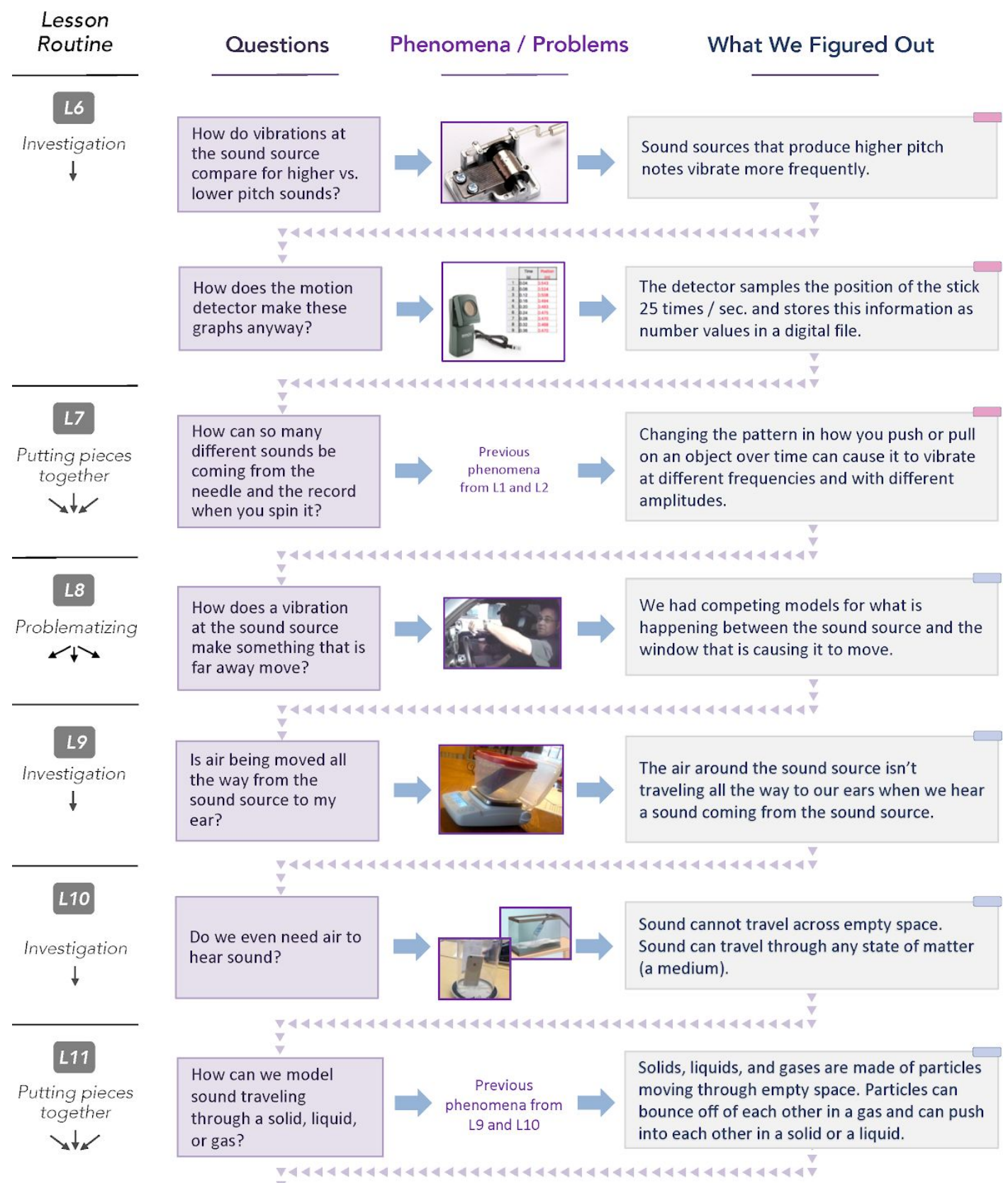
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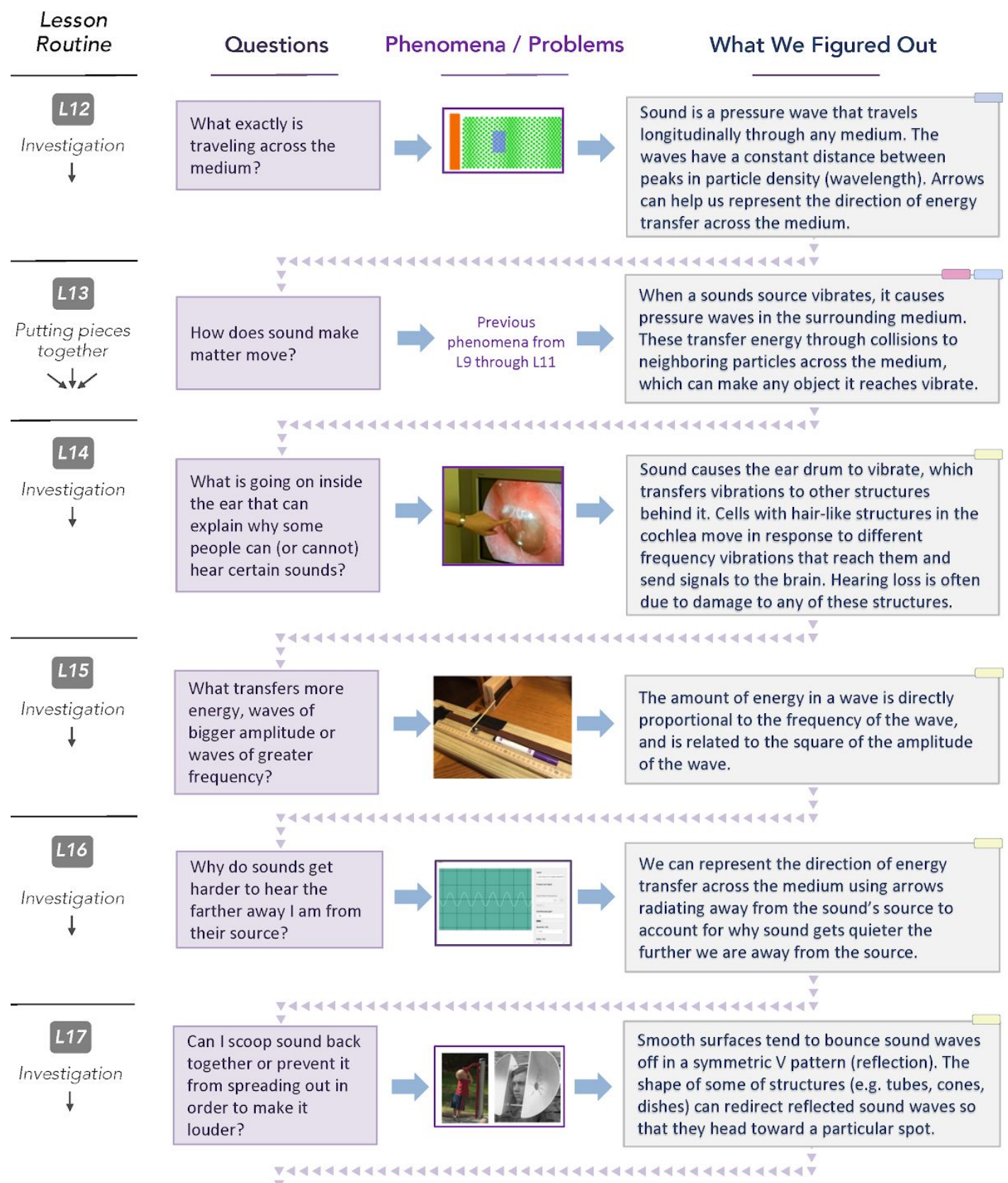
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Each lesson identified on the previous pages has a gray box that describes what we figured out for that lesson. In the top right corner of that box is a color coded identification tag. The four colors of those tags correspond to four subsets of ideas (DCIs and CCCs) developed in four distinct bends in the storyline. Most lessons have one tag. Lesson 1, however, has multiple tags, because students form questions in it that motivate the four major bends of the unit. Other lessons, such as lesson 13 and 20, have multiple tags, because students put together pieces of ideas from across multiple bends in that lesson.

Each of the Four Bends Addresses A Different Portion of the DCIs:

Bend 1

Bend 2

Bend 3

Bend 4

Disciplinary Core Ideas - DCI(s)

PS4.A: Wave Properties

- Sound can make matter vibrate, and vibrating matter can make sound. (1-PS-4-1)
- Waves of the same type can differ in amplitude and wavelength. (4-PS4-1)
- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

LS1.D: Information Processing

- 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. (MS-LS1-8)

PS1.A: Structure and Properties of Matter

- Matter of any type can be subdivided into particles that are too small to be seen... (5-PS1-1)

PS4.B: Electromagnetic Radiation

- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)
- When light* shines on an object, it is reflected, absorbed, or transmitted through the object. (*sound is also referenced in the evidence statements for MS-PS4-2 for these wave like properties in its interaction with matter)

PS4.C: Information Technologies and Instrumentation

- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

PS3.B: Conservation of Energy and Energy Transfer

- When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)

PS2.B: Types of Interactions

- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)

Connections to the Preamble for PS4.A

- Sound is a pressure wave in air or any other material medium.
- The human ear and brain working together are very good at detecting and decoding patterns of information in sound (e.g., speech and music) and distinguishing them from random noise.
- When a wave meets the surface between two different materials or conditions (e.g., air to water), part of the wave is reflected at that surface and another part continues on.

Each of the bends uses different combinations of cross-cutting concepts. These are listed below:	bend			
	1	2	3	4
Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.	yes			
Graphs and charts can be used to identify patterns in data.	yes		yes	
Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.	yes		yes	yes
Cause and effect relationships may be used to predict phenomena in natural or designed systems.	yes	yes	yes	yes
The transfer of energy can be tracked as energy flows through a designed or natural system.			yes	yes
Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations.	yes	yes	yes	
Advances in technology influence the progress of science and science has influenced advances in technology.	yes		yes	yes

