Modified Template for "Hearing Sound"

Scientific Question

What will you hear when I play these notes?

Will they all sound the same?

Prediction

If . . . Then. . . .

Observations

Sounds	
Sound	What it sounds like
1	
2	
3	

Claim

What sounds did you here? Did they all sound the same?

Evidence

What data did you use to make your claim?

Reasoning

How is your evidence connected to your claim?

Modified template for Amplitude POE

Scientific Question

What will happen if you shake the slinky harder?

What will happen if you shake the slinky harder?

Prediction

Make sure to have a prediction for each question - 2 predictions!
If . . . Then. . . .

Observations

Wave Pictures		
Wave with a soft shake	Wave	Wave with a hard shake

Claim

What does shaking the slinky harder do?

What does shaking the slinky softer do?

Evidence

What data did you use to make your claim?

Reasoning

How is your evidence connected to your claim?

			this new activity change your model?
Initial Model			
Telephone Cups			
Making Waves 1			

Making Waves 2			
Making Waves 3			
Sounds on Strings			
Sounds in Tubes			

Air Cannon			

		Phenom-driven Questions	*Investigate and build knowledge through practices*	*Students incrementally build models that explain the anchoring phenomena and answer driving question. Teacher chunks out the gapless explanation into attainable lessons.*
	Anchoring Phenomena	**Driving Question**	**Analyze Data, Explain**	**Initial Model/ Gapless Explanation**

Initial Experience	Sound	How do we hear sound?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Constructing explanations and designing solutions Obtaining evaluating and Communicating information	Sound is a phenomenon that is experienced by living creatures. It is part of our senses used to communicate science.

	Supporting Phenomena	**Related Question**	**Analyze Data, Explain**	**Revised Model/ Gapless Chunk 1**

Telephone cups	Sound transmission via mediums	How does sound travel? Will sound always travel?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	Sound requires a medium (solid, liquid, gas) to transfer its energy from a source to a receiver. Sound cannot travel over distances that do not contain matter (a vacuum). Sound travels faster in solid and slowest in a gas. Since the molecules in a solid are more closely compact slight motion of these molecules is easily transferred, whereas in a gas the molecules are spread further apart; each molecule must move over large distances to come in contact and transfer their energy. The spacing between molecules in the medium accounts for the differences in energy transmission in a medium. Since a vacuum does not have any molecules to move and contact one another the energy cannot be transferred - sound cannot be heard.

	Supporting Phenomena	**Related Question**	**Analyze Data, Explain**	**Revised Model/ Gapless Chunk 2**

Making waves 1	Wave shapes	How is energy carried?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Analyzing and interpreting data Using mathematical and computational reasoning Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	Waves are composed of two distinct shapes. The first of these shapes is transverse. Where mater in a physical wave oscillates perpendicular to the direction of energy transfer. The second wave, compression, the matter oscillates parallel to the direction of energy transfer. Sound acts as a compression wave where matter is compressed and expanded (rarefaction) to transfer energy between molecules in a medium.

	Supporting Phenomena	**Related Question**	**Analyze Data, Explain**	**Revised Model/ Gapless Chunk 3**

Making Waves 2	Frequency and wavelength relationship	How do waves change?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Analyzing and interpreting data Using mathematical and computational reasoning Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	Waves and their perception vary based upon their wavelength and frequency. Wavelength is defined as the measure from crest to crest or peak to peak. It a physical measure of the length of one wave. Frequency is the rate at which wavelengths appear in a given time interval. Wavelength and frequency are inversely proportional; as one increases the other decreases. Therefore, a higher frequency wave will oscillate more often in the same amount of time as a wave with low frequency. Since more oscillations occurred, there exist more wavelengths in the same amount of time.

		Phenom-driven Questions	*Investigate and build knowledge through practices*	*Students incrementally build models that explain the anchoring phenomena and answer driving question. Teacher chunks out the gapless explanation into attainable lessons.*
	Anchoring Phenomena	**Driving Question**	**Analyze Data, Explain**	**Initial Model/ Gapless Explanation**
Making Waves 3	Amplitude	What is the cause of sound loudness?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Analyzing and interpreting data Using mathematical and computational reasoning Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	The height of a wave from the center to its maximum or minimum is defined as its amplitude. The amplitude of a wave is a characteristic of the energy associated with the wave. The greater the amplitude, than the greater the energy. In sound waves the loudness or volume we hear is related to the amount of energy the wave carries. A loud sound carries a large amount of energy and therefore has large amplitude.

	Supporting Phenomena	Related Question	Analyze Data, Explain	Revised Model/ Gapless Chunk 1
Sounds on Strings	Vibrating stings	What affects how strings vibrate?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Planning and carrying out investigations Analyzing and interpreting data Using mathematical and computational reasoning Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	Vibrating material is a source of sound waves. They can receive energy from other vibrating material or they may produce their own sounds when plucked or strummed. The vibration of a string is affected by the relationship of the waves they generate (wavelength and frequency). These waves can be changed by a change in the tension of the string and/or by the length of the string itself. These changes directly change the frequency and wavelength at which these strings may vibrate. The perceived change in sound from different vibrating strings is directly correlated with the changes in frequency/wavelength. This change in wavelength and frequency causes the sound to change pitch or its perceived sound. In essence different sounds are examples of different frequencies/wavelengths generated in an object such as a string.

	Supporting Phenomena	Related Question	Analyze Data, Explain	Revised Model/ Gapless Chunk 2
Sound sin Tubes	Vibrating air column	What affects the vibration in columns of air?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Planning and carrying out investigations Analyzing and interpreting data Using mathematical and computational reasoning Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	Like strings, columns of air generate different sounds by producing waves with varying frequencies and wavelengths. Changing the length, size, and whether the tube is open or closed will change the produced wave and therefore change the sound that is perceived.

	Supporting Phenomena	Related Question	Analyze Data, Explain	Revised Model/ Gapless Chunk 3
Air Cannon	Energy to motion	Can sound cause objects to move?	Asking Questions (science) and Designing Solutions (engineering) Developing and Using Models Planning and carrying out investigations Analyzing and interpreting data Using mathematical and computational reasoning Constructing explanations and designing solutions Engaging in argument from evidence Obtaining evaluating and Communicating information	All of this energy that is transferred through vibration is causing objects to vibrate as they transfer the energy. It is therefore, that as energy is transferred via sound it causes the matter in its vicinity to vibrate and move. The amount of energy (amplitude) of a wave will help determine how much motion will occur. More energy will cause more motion. All of these components together demonstrate how sound is perceived. As a source of sound generates waves of energy by vibrating a medium, the medium then carries the energy away from the source and out into its surroundings these vibrations eventually reach the ear drum which is forced to move/vibrate via the energy, frequency, and wavelength allowing the sound to then be interpreted.