

Desired Results

<p>ESTABLISHED GOALS/ STANDARDS:</p> <p>PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]</p> <p>PS4-3 Generate and compare multiple solutions that use patterns to transfer information.* [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]</p> <p>4-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well</p>	<p><i>Transfer</i></p>		
	<p><i>Meaning</i></p> <p>ENDURING UNDERSTANDINGS: Crosscutting Concepts <i>Students will understand that...</i></p> <ul style="list-style-type: none"> ● <i>Students identify patterns about the relationship between the tension of the string and the quality of the sound it produces. Students also investigate patterns in the how different materials affect the quality of the sound that is transmitted.</i> ● <i>Students consider the effect of vibrations on the movement of distant objects.</i> ● <i>Students identify and analyze the oscilloscope patterns made by sounds with low and high pitches.</i> 		
	<p><i>Meaning</i></p>		
	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><i>Acquisition</i></p> <p>Disciplinary Core Ideas <i>Students will know...</i></p> <ul style="list-style-type: none"> ● Sounds aren't something we can see or touch, and so it's easy to dismiss them as not fully real. But if you've experienced an echo before, then clearly there is something interesting and very real about sound--we can even feel and see that sound has something to do with vibrations. Students observe a relationship between sound and vibration, and through the activity, discover </td> <td style="width: 50%; vertical-align: top;"> <p>Science and Engineering Practices Students will be skilled at...</p> <ul style="list-style-type: none"> ● Students document their understanding of how vibrations travel using a model of their paper cup telephones. Students then design their own series of investigations to figure out how to make their telephone work better in different circumstances. Students construct an explanation of how the telephone works. Students extend the lesson by developing a way to send a message using a pattern of </td> </tr> </table>	<p><i>Acquisition</i></p> <p>Disciplinary Core Ideas <i>Students will know...</i></p> <ul style="list-style-type: none"> ● Sounds aren't something we can see or touch, and so it's easy to dismiss them as not fully real. But if you've experienced an echo before, then clearly there is something interesting and very real about sound--we can even feel and see that sound has something to do with vibrations. Students observe a relationship between sound and vibration, and through the activity, discover 	<p>Science and Engineering Practices Students will be skilled at...</p> <ul style="list-style-type: none"> ● Students document their understanding of how vibrations travel using a model of their paper cup telephones. Students then design their own series of investigations to figure out how to make their telephone work better in different circumstances. Students construct an explanation of how the telephone works. Students extend the lesson by developing a way to send a message using a pattern of
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each is likely to meet the criteria and constraints of the problem.

4-ETS1-3

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

evidence that sound isn't merely related to vibrations, but perhaps, is a vibration. DCIs: Foundational for PS4.A

- Sound can travel through lots of different materials: through water, through string... it's possible to even feel the vibrations in the string, pinch the string, and stop the vibrations from reaching the other side. It would seem that sound is a vibration that must travel from one place to another. So does that mean sound is vibrating the air? (It is.) And what happens if there is no air? (There is no sound!) DCIs: PS4.A
- Some sounds are very high-pitched, while others are low-pitched. For example, young people can even hear certain high-pitched sounds that adults can no longer hear. What makes one sound high and another low? By examining some musical instruments played in slow motion, we can begin to detect some differences in the vibrations. Special instruments enable us to visualize the resulting air vibrations, and reveal that sound vibrations travel as waves in the air. Students discover that the difference between high and low-pitched sounds has to do with the length of these waves ("wavelength"). DCIs: PS4.A

sounds.

- **Students conduct investigations with balloons to experience the vibrations caused by sound of their voices. Students construct an explanation that sound is a vibration. Students then develop a model to explain how sound travels through a medium and how it can cause distant objects to move.**
- **Students analyze and interpret data from oscilloscopes to determine how wavelengths differ between high and low pitch sounds. Students make claims and argue from evidence about which wavelength patterns were generated from different pitches. Students then use a rope to model waves created by different pitches and begin to explore the relationship between wavelength and frequency.**

Inquiry Questions:

- 1. How far can a whisper travel?**
- 2. What would happen if you screamed in outer space?**
- 3. Why are some sounds high and some sounds low?**

Evidence		
Evaluation Criteria	Assessment Evidence	
	PERFORMANCE TASK(S):	
	OTHER EVIDENCE:	
	Unit assessment	
Learning Plan		
<i>Summary of Key Learning Events and Instruction</i>		