

How Does Sound Carry Information from Place to Place?

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Grade Level / Course: 4, [Physical Science \(Waves\)](#)

Slide Deck: [Grade 4 Waves \[Web Ver.\]](#)

A. Storyline Unit Overview:		
1. Performance Expectations: Identify all the performance expectations that support this phenomenon. (The Wonder of Science) • 4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. • 4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.		
Science and Engineering Practices What key SEP(s) will you be emphasizing in this unit? How is this emphasis appropriate for your grade band? (learning progression)	Disciplinary Core Ideas What are the Big Ideas in the bundle and how do they connect to the phenomenon? These should be sentences and not words.	Crosscutting Concepts What key crosscutting concept(s) will help students connect lessons together over time?
Students can carry out an investigation and create a model to demonstrate that waves cause materials to vibrate and that waves have different features tied to energy.	Waves are regular patterns of motion, which can be made in water by disturbing the surface. Waves of the same type can differ in amplitude and wavelength. Waves can make objects move.	Students can use the patterns within waves to describe the quality of sound.
2. Anchoring Phenomenon: <i>Does the phenomenon address concepts, accessible to students and can be leveraged for questions and thinking?</i>		3. Driving Question: <i>What question will frame the phenomenon and students revisit throughout the storyline to develop an understanding?</i>
Audio clips of various sounds or teacher generated sounds.		How might sound carry information from one place to another?
5. Summary Story/Gapless Explanation: Write an explanation of the observable & unobservable processes that explain the anchoring phenomenon.		
Sound is caused when vibrating materials are able to transmit vibrations to your ear. Sound waves transfer energy to objects as a pressure wave of energy passes through a series of particles or a medium. As waves travel, they move in an up and down repeated pattern. As each specific wave pattern enters your ear, it vibrates small structures inside and this is what causes you to hear sounds. Your ears funnel these waves to your eardrum and then to special hair cells that move differently with different sound waves. These hair cells send signals to your brain and your brain processes these signals from waves and vibrations. Our brain connects these waves to what is happening around us and we learn to attach meaning to sounds through our life experiences. The repeating pattern of a wave can be measured in wavelength (the distance between one peak and the next peak) and in amplitude (the height of each peak.) As a wave gains or loses energy, the amplitude will increase or decrease respectively. Humans have figured out ways to capture the patterns of sound waves and then store the pattern information or change (convert) it to another form of information. This process is most often used to communicate with other people using devices such as cell phones.		

Available online on the SPIRAL Project website: <https://www.spiralproject.org/storylines/waves-phenomena>

B. Storyline		
Storyline Chapter Question to Make Sense of or Figure Out:	How will the students use the SEPs to uncover the DCIs ? (What are they doing to figure out the concepts?)	What Students Figured Out about the Phenomenon
What question about the phenomenon will be used to frame this "chapter" of the story?	Investigable phenomena are small-scale experiences that help develop one or more aspects of the Anchoring Phenomenon. What types of structures and strategies will deepen student thinking ?	What should students take away and what new questions might arise from this lesson and learning?
Chapter 1 What causes sound? <i>Materials:</i> Storyline Google Slides	Focus SEP: Developing an Initial Model Introduction Teacher opens the unit by playing a favorite song and asks students to share their favorite sounds and songs. The teacher: Why is sound important to us? Process - Students will make sound observations by playing a game called "Did you hear that?" as the teacher creates various sounds and students write down what they think is causing those sounds and what the sound is used for. - In small groups, students will discuss how they believe the objects created the sounds they heard and why some sounds were louder than others. Students will end class generating a whole class list of things they want to know about sound and ideas about how they might investigate sound. Closing Students will develop an initial model of how sounds can travel and carry information. Students will share their models with their small groups and develop one small group model to share with the class. Create Summary Wall	- Sound is caused by vibrations. - Different materials vibrate differently and cause different sounds. - In order to cause a material to vibrate, you must add energy to the material.

Chapter 2 Can I see sound? <i>Materials:</i> • Salt • Rice • Rubberband • Plastic Wrap • Speakers plugged into chromebook • Good song to play for sound - Superstition - The Git Up	Focus SEP: Planning and Carrying Out an Investigation Introduction Students will review the concept from Day 1. By feeling their voice box, students will be reminded that vibrations are connected to sound (1st grade) Process 1. Teachers will then pose the question, can sound cause vibrations or cause other things to move? Students will be introduced to the materials and work together as a class to develop a tool to visualize sound vibrations. a. Invite students to play appropriate music of choice and also a shared song for the class. 2. Students will collect and record data in a graphic novel template with specific prompts. 3. Next students will watch a video of slow motion vibration in an instrument and a video to understand how sound and movement can be modeled or drawn. Graphic novels are then updated. Closing The teacher will facilitate a whole class data discussion about sound, vibrations, energy and volume. Update Summary Wall	• All sounds are caused by vibrations. Vibrations happen so quickly that they are hard to see, but you can feel them because they can cause other objects to move. • More energy causes a higher volume or amplitude.
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Chapter 3 How do vibrations travel from one place to another? <i>Materials:</i> • Airzooka at stacked cups target • Containers with water & ball • Slinkies • Rubber ducky • Tape • Marker	Focus SEP: Planning and Carrying Out an Investigation Introduction Students first draw what a speaker with high volume and soft volume might look like. Students recap what they learned from the previous lesson. Process 1. Students will rotate between two stations to explore different types of waves and how waves travel through materials. a. Stations 1 and 2: focuses on the height of the wave (amplitude) in water through a disturbance and vibration taps b. Students will then capture their learning on a graphic novel sheet and make some predicted connections to sound. 2. Students participate in another round of sound exploration stations to explore wave shape and waves in different materials. a. Stations 3 and 4 focuses on shapes of waves with Slinky (using up and down movements are transverse waves as well as pulling rings of the slinky in and releasing them are called compression or longitudinal waves) and describe b. Station 5 Airzooka Air Cannon - try to knock over as many of the six cup pyramid as possible in one shot. Explain how the energy is transferred from the Airzooka to the cups. c. Teachers will facilitate a data → consolidation discussion of key ideas Closing Students will have an opportunity to revise their initial models with evidence and data from learning experiences. Update Summary Wall	• Vibrations can travel through materials as a wave. The wave carries energy from the initial vibration and can transfer that energy to other objects (like your eardrums). • The height of a wave is called the amplitude.
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Chapter 4 What does a recording of a loud or soft sound wave look like? <i>Materials:</i> • Chromebooks with microphone access • Main Concord Website • Optional Voice Recorder	Focus SEP: Collecting, Analyzing and Interpreting Data Introduction Teachers open reviewing key learning from the prior lesson. Next, students work in groups to use their body to act out the movement of a wave (total physical response) Process 1. Students will then use the Sound Grapher on Concord Consortium lesson How Loud, How High to record themselves making different sounds with different volumes. a. This is a great place to use the tuning forks with the sound recorded to connect pitch and sound recorder. 2. Students are challenged to create the longest waves and the shortest waves on the Sound Grapher. Students will also figure out what changes the amplitude or height of the waves. Closing Students will learn more about sound waves by watching or reading about sound waves and then updating their graphic novel. Update Summary Wall	• The height of a wave is called the amplitude. The distance between two waves is called the wavelength. • Loud sounds have a high amplitude and soft sounds have a low or small amplitude.
Chapter 5 How do our brains change sounds into information? <i>Materials:</i> • Paper for drawing • Colored pencils	Focus SEP: Obtaining, Evaluating and Communicating Information Introduction: Teacher will recap what they have learned in the last lesson. Students will start with a short game called “Read my lips ?” Students will discuss their thoughts within small groups and share out with the whole class. Teachers will lipsync a series of phrases asking students what they think is being said. Students will then partner up and try the game in pairs. This introduces the question, can we hear without sound? Process 1. Next , teachers will ask students to consider if it is possible to hear the sound and not know what it means? Why?	• Humans have learned to associate specific movements with specific sounds. This is called “lipreading.” • Humans also associate specific sounds with specific meanings. This is called “language.” • Animals use specific sounds to communicate with each other. • Sound waves enter our ear and push on our eardrums. The eardrum sends vibrations farther into our ear causing special hair cells to move. The movement of these hair cells sends signals to our brain that are

	2. Student play read my lips second language edition by choosing adjectives or ideas from the summary wall into Google Translate into their language of choice. 3. In small and whole group discussions, teams discuss different ways humans can communicate with or without sound and how our brain makes sense of sound. "How do we know what specific sounds mean?" 4. Next student read/listen to an informational text and watch a video about how our ears process sound and send it to a signal to our brain. 5. Finally, teachers will ask students: "How do you think sounds move from our ears to our brain?" Students will discuss with their groups and create a quick drawing of what they think. Students will discuss what they think are the important parts of the ear system. Closing Following the discussion, students will go back to their drawings and add or revise things they learned from the video and the class discussion. *Update Summary Wall	processed as sounds.
Chapter 6 What are ways we can transfer information by waves? <i>Materials:</i> • Chromebooks with internet access and headphones	Focus SEP: Obtaining, Evaluating and Communicating Information Introduction: The class recounts the different ways we have explored communication and are challenged to consider other ways we might communicate without words. Process 1. Students translate their name into morse code and explore the symbols used to communicate with it. Students also see that morse code can be sent with light, sound or written as dots and dashes. 2. Students watch and listen to a Read aloud about: Samuel Morse & the Telegraph and video of lightning and thunder.	• Sounds transmitted through sound waves are the primary mode of communication for humans. • Humans can also use technology that uses light waves to send information extremely quickly.

	- Students are challenged to create a secret code using light or sound to send a message to another student. - Students practice communicating and summarize what they have learned through a student line up. Closing Chapter closes for students to discuss in small groups the following questions and then watch a video of how sound and light are helping those that are blind and deaf to see and hear. The teacher asks the student to revisit the driving question and Update Summary Wall. Have we been able to answer any of our initial wonderings from the beginning of the unit?	
Ch 7 How might sound carry information from one place to another? Optional: Engineering Design Challenge	Focus SEP: Design a solution Introduction: We have learned so much in this sound unit. In your science journal tell me about your favorite chapter and when you felt like a scientist in this class? We are all scientists when we ask questions and collect information and data to answer them! Process - Class works together to develop a Gotta Have list of what should be in their final model. - Provide students with a template to individually complete their Final Models of the anchoring phenomenon and our driving question. - Students compare their final and initial models to celebrate new learning. - Extra Engineering Challenge: Students will have two-three options to design a way to communicate without using a loud voice or possibly no voice at all over a long distance or across a barrier. - Option #1: Cup Phone - Option #2: Tissue Box Guitar - Option #3: Visual Telegraph - Option #4: Own Design using technology Closing	- We can design tools and use technology to transmit waves - Morse code can send information b

<u>Resources:</u>	
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| <ul style="list-style-type: none">• <u>The Science of Hearing</u> - for teachers• <u>What is sound? SciShowKids</u> - for students• <u>How your ears work - Kidshealth</u> - for students• <u>What does sound look like?</u> - for teachers• <u>How your ear works - Dr. Binocs Show</u> - for teachers• <u>PS4 Stations in Box</u> | |
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