



Anchoring Phenomenon

Emergency sirens make loud sounds.



Lesson Concept

Plan and conduct an investigation to provide evidence that **sound causes matter to vibrate**.



Investigative Phenomenon

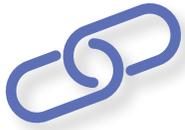
Sound causes matter to vibrate.



Standards

Refer to Appendix 1.3 for NGSS, CCSS (ELA), and California ELD Standards.

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Storyline Link

This is the third lesson in the learning sequence. In the previous two lessons students explored the idea that vibrations cause sound. They also designed, built, and tested a device that used sound to communicate over a distance. This lesson builds on students' prior experience planning investigations and observing cause and effect relationships; students explore sound causing matter to vibrate, which completes the cause and effect relationship between sound and vibrations.

Throughout the lesson, a flag (▶) denotes formative assessment opportunities where you may change instruction in response to students' level of understanding and making sense of phenomena.



Time

270 minutes

Part I	10 minutes	(Engage)
	35 minutes	(Explore Part A)
Part II	45 minutes	(Explore Part B)
Part III	45 minutes	(Explain)
Part IV	45 minutes	(Elaborate)
Part V	45 minutes	(Evaluate)
Part V	45 minutes	(Extend)

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Materials

Whole Class

- Speaker with the ability to play music from your computer
- Large bowl with plastic wrap over it (see 1.3.R1: How to Make a Sprinkle Dancing Bowl)
- Handful of rice or sprinkles or salt
- Song (preferably one with a strong beat)
- What I Wonder T-chart from Lesson 1.1: Sound Vibrations
- Investigation Planning chart from Lesson 1.1: Sound Vibrations

Group

- Small drum (a small pot works well).
- 2 large pieces of paper (chart or construction) or large whiteboard
- Tuning Fork
- Cup or bowl (see 1.3.R1: How to Make a Sprinkle Dancing Bowl)
- Rubber band that fits around the cup or bowl
- Plastic wrap
- Colored sprinkles or salt.
- Large plate or tray (to catch the sprinkles/salt)
- Chart paper or large piece of construction paper

Individual

- Science notebook

Teacher Use

- 1.3.R1: How to Make a Sprinkle Dancing Bowl
- 1.1.R2: Performance Assessment Checklist from Lesson 1.1: Sound Vibrations

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Advance Preparation

1. Choose a song to play in the Engage portion of the lesson. Test the song on the speaker to make sure it makes the rice move enough. A song with a strong beat is better.
2. Construct a large dancing bowl for the classroom demo and smaller dancing bowls for each group. (See **1.3.R1: How to Make a Sprinkle Dancing Bowl**).

Note: Rice, sprinkles, and salt are interchangeable in this investigation. However, the rice moves well with the speaker and is easier to see for the whole class demonstration, but does not move as well with the tuning fork or drum. Sprinkles or salt work better in the stations.

3. Choose a place in the room to display the science words for this lesson.
4. Inform your colleagues next door that you will be playing loud music for a few minutes.
5. Review **1.1.R2: Performance Assessment Checklist** from Lesson 1.1: Sound Vibrations.

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Procedure

Part I

Engage (10 minutes)

Observe that *sound causes matter to vibrate*.

1. Ask students to answer the focus question from lesson 1, “What causes sound?” Have a few students share out their responses.

TEACHER NOTE

Student responses may include their use of senses to hear sound and that vibrating matter causes sound from Lesson 1.1: Sound Vibrations. They may also share ideas about how sound is used to communicate over a distance from Lesson 1.2: Communicate with Sounds.

2. Seat students in an area where they can all easily see the speaker, preferably in a circle with the speaker in the middle. Introduce the speaker, asking students if anyone knows what the device is and what it is used for. If no one knows that it is a speaker, briefly introduce the device and explain what we use it for.
3. Put the large bowl next to the speaker and add rice on top of the plastic, at the center. Ask students to make predictions, drawing on prior experiences, about what they might observe or what will happen when you play music. Have students share their predictions with a partner and choose a few groups to report out.
4. Begin to play music through the speaker. *If you have students who are hard of hearing or deaf, let them know when the speaker is on. (Ideally you would use a speaker that has a small light that turns on when the speaker is on, and a scale of lights as it gets louder.)* Have students closely observe what is happening. After students have observed for a few minutes, have them record their observations in their notebook using drawings and words. Ask students to use the following sentence frame: I saw ___ when the speaker began to play music.

Explore Part A (35 minutes)

Plan and conduct an investigation to provide evidence that sound causes matter to vibrate.

5. Ask students what questions they have about what they just observed. Add questions from the group to the What I Wonder T-chart from Lesson 1.1: Sound Vibrations. (At least one student should ask “Why did [what caused] the rice move on top of the bowl next to the speaker?”)
6. Go through the class questions together. Ask students to show thumbs up if they think the question can be answered by doing a science investigation. Ask students to give thumbs down if they think the questions cannot be answered with a science investigation. Circle the

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questions that students identify as being able to be answered with a science investigation. This should narrow the list of possible questions to investigate. Help students narrow down which question on the list they would like to investigate, leading them to “What caused the material, in this case rice, to move on top of the bowl?”

7. Ask students to turn to a partner and share their ideas for what they think caused the rice to move on top of the bowl next to the speaker. Have a few students share as a whole group and chart these ideas.
8. For each idea (claim) that students share, ask them to think about how they might test it. Have a few students share their tests. Ask what kind of evidence the test might give the class. Have a few students share. Let students know that we will be using two tests to gather evidence for our question: What caused the rice to move on top of the bowl next to the speaker?
9. Refer students to the Investigation Planning chart from Lesson 1.1: Sound Vibrations (Step 6 of Procedure). Ask them to read the three areas necessary to plan an investigation:
 - i. the question that we are trying to answer
 - ii. the materials we are using
 - iii. the data that we are collecting and how we are collecting it
10. Show students the materials that they will be using for the investigation (drum, bowl with plastic wrap over it, sprinkles or salt—see **1.3.R1: How to Make a Sprinkle Dancing Bowl**). As you introduce the materials that will be used, find a way to display the item, or a picture of it, with its name. This will provide a reference for students during their planning.
11. Have students independently think about how they could use the objects introduced in Step 10 of Procedure (drum, bowl with plastic wrap over it, sprinkles or salt) to answer the question, “How can we use the drum to make the sprinkles move on top of the bowl?”
12. Distribute a set of materials to each group. Have students stand, push in their chairs, and stand behind their chairs. While standing behind their chairs, have students talk to their group and verbalize a plan to answer this question, which should include what data they will be collecting. Give the groups about 5 minutes to talk through the plan. As groups are talking, be listening for a group or two that are discussing a plan that will help them answer the investigation question. (Using the drum to make the sprinkles jump without touching the bowl.)
13. Bring the class back together. Using the preselected groups that you identified during their work time in Step 12 of Procedure, have a couple of groups share out their verbal plan. If no group has thought about not touching the bowl while playing the drum, ask them to predict what would happen to the sprinkles if they played the drum close to but not touching the bowl. Have students share with a partner, then as a whole group.

As groups are sharing out, record a few key points for class reference. Here are some examples that might help scaffold the planning process for students:

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- i. the question that we are trying to answer (What caused the sprinkles (or salt) to move on top of the bowl?)
 - ii. the materials we are using (drum, bowl with plastic wrap over it, sprinkles)
 - iii. the data that we are collecting and how we are collecting it (drawing what happened to the sprinkles when they played the drum; use of labels or writing could also be added)
14. Have each group get back together to finalize their investigation plans orally.
15. Have students work individually to write their plan in their notebook.

TEACHER NOTE

The purpose of having students work on their plan individually is that it provides an opportunity for you to see how each student is doing in their ability to plan investigations. While students are being scaffolded through the group conversations and the resulting key points on the board in Step 13 of Procedure, the plan students actually write up in their notebook will provide evidence for each student's development in this SEP.



Procedure

Part II

Explore Part B (45 minutes)

Plan and conduct an investigation to provide evidence that sound causes matter to vibrate.

16. Working with their same groups from the previous session, ask students to get out their notebooks with their plans for the investigation and share out what question they are investigating.
17. Distribute a set of materials to each group. Students should conduct their investigation based on their plans. Remind them to collect their data in their notebooks. While groups are working, circulate around the room and listen to the conversations the groups are having. Specifically listen for how students are describing the movement of the sprinkles and notice if anyone is using the word vibrate. Students should specifically be discussing what causes the movement to occur. Look at the data (drawing and writing) students are collecting in their notebook, noticing the patterns among the students' observations. ► Use **1.1.R2: Performance Assessment Checklist** from Lesson 1.1: Sound Vibrations to make quick notes on how students are doing in all three dimensions. (Later, use the Grade 1 Sounds Instructional Rubric on pages 1.0.14–1.0.15 of the Introduction to determine each student's level of understanding of DCI, CCC, and SEP.) As students explore, ask questions about what they see happening to cause a sound. Encourage students to use the sentence frames to explain the cause and effect relationship.

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Procedure

Part III

Explain (45 minutes)

Construct an explanation that describes how sound causes matter to vibrate.

18. Provide each group with a large piece of paper (chart paper or construction paper) or whiteboard. Have each group draw up a picture of the drum, bowl, and sprinkles, and ask students to label what is vibrating and what is causing the vibrations to happen. (The drum's sound caused the sprinkles to vibrate.)

TEACHER NOTE

Circulate as the groups work, looking at each group's drawing. Be sure to look for their labels and their explanation of the sound causing vibration. If there still seems to be some confusion for a group, look for another group who could share their model to help. These group models will serve as a consensus model, which gives another opportunity for students to further think about what they observed about the cause and effect relationship between sound and vibration.

19. Collect the materials and bring the class back together as a whole group on the carpet. Ask students what test they designed to gather information on what might cause the rice to move on top of the bowl next to the speaker. Have each group present their drawings and explain what they observed in their investigation. Ask students what causes the rice to move on top of the bowl. Ask how they know this. Give students time to provide feedback to each other as they present their models.
20. Ask students to think about what is similar about the effect of sounds from the drum. Lead a class discussion about the observable patterns in the effects of sound using the drum. Explain that events, like the moving rice, always have causes, and that identifying patterns helps us understand cause and effect relationships.
21. Ask students if they have more questions about what causes the rice to move on top of the bowl next to the speaker. Let them know that scientists always look for more data to understand how the things work, and they will be gathering more evidence through another investigation.

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Procedure

Part IV

Elaborate (45 minutes)

Construct an explanation that describes how sound can make matter vibrate.

22. Show students a tuning fork. Let them hear it, and briefly describe what it is used for. Add one or a picture of one to your science word wall.
23. Tell students that they will be gathering more evidence to explain what caused the rice to move on top of the bowl next to the speaker. Show students how to tap the tuning fork on the side of the table. Have them turn to a partner and explain what they can do with the tuning fork, the bowl, and the sprinkles, then share ideas as a class. (Make sure that students know not to touch the sprinkles with the tuning fork). Ask students to pay close attention to what the effect of the tuning fork is. Now distribute the materials to each group (tuning fork, bowl with plastic wrap on a tray, and sprinkles). Add a few sprinkles at the center of the plastic covering the bowl and instruct students to have each member of their group take a turn with the tuning fork. Once all students have had a turn, have them turn to a partner and explain what happened and why. Students might use the sentence frame:

The tuning fork caused the sprinkles to _____. I think this happened because _____. This is similar to the drum because _____.

You can also have students observe what happens to the sprinkles if they hum close to the plastic wrap.

24. Identify a couple of students who would be able to provide their explanation orally to the class. Have students compare what they hear from their classmates to what they wrote for their explanations.

TEACHER NOTE

As you look at their notebooks and listen to the group conversations, you are listening or looking for the idea that students recognize that the sound from the tuning fork caused the sprinkles or salt to jump (vibrate).

25. Bring the class back together. As the teacher, again, demonstrate by tapping the tuning fork on the side of the table and making the sprinkles jump. Ask for some students to come up and explain to the class what is happening. Once again, having students hear multiple explanations that are about the same observation may help add further clarity for students who are still developing their understanding or are still developing language to explain their thinking. To help deepen their understanding of the relationship between the sound of the tuning fork and the sprinkles jumping, have pairs of students act out (pantomime) the tuning fork making sound and the sprinkles vibrating.

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26. After students have shared, have them record their observations of what happened in their notebook.



Procedure

Part V

Evaluate (45 minutes)

Construct an explanation that describes how sound can make matter vibrate.

27. Seat students in an area where they can all easily see the speaker, preferably in a circle with the speaker in the middle. Ask students to recall the speaker from the beginning of this lesson. Explain that you are going to play the same music through the speaker again and once again ask them to observe what happens.
28. Have students return to their desks. They need to write a scientific explanation to answer the question “What caused the rice to move on top of the bowl next to the speaker?” Remind students that they need to use evidence from their investigations with the drum and sprinkles and the tuning forks. Provide students with the sentence frame:

The rice moves on top of the bowl next to the speaker because _____. My evidence for this from the drum and sprinkles is _____. My evidence for this from the tuning fork is _____.

29. Reintroduce the tabletop emergency siren that was used to demonstrate the anchoring phenomenon from lesson one. Provide an opportunity for students to feel the siren and the table near the siren, to see what observations they can make.

TEACHER NOTE

Feeling the siren does not build towards students understanding of how sirens communicate emergencies but serves as a link between the student ideas that sound causes vibrations and that vibrations cause sound.

30. Ask students to think about the anchoring phenomenon: *Emergency sirens make loud sounds.*

Ask students to discuss with a partner the answers to the following questions:

- › *What causes the siren to make sound?*
- › *What does the siren sound do?*

Ask students to write and/or draw a scientific explanation to answer the questions. Provide students with the following sentence stems, if needed:

- › *I think sirens _____.*
- › *My evidence for this is _____.*
- › *The sound _____.*

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TEACHER NOTE

Expected student responses may include that something inside the siren vibrates and makes a loud sound. Evidence for this is that the vibrating (rubber band, kalimba, spoons, tuning fork, drum, etc.), made sounds. The sound of the siren makes people move away and/or the sound of the siren makes other things vibrate. ► Use the Grade 1 Sounds Instructional Rubric on pages 1.0.14–1.0.15 of the Introduction to assess each student’s level with respect to DCIs, CCCs, and SEPs.

Revisit the T-chart with the list of questions from Lesson 1.1: Sound Vibrations, Steps 3 and 4 of Procedure, and discuss which questions have been answered. Continue adding, revising, and connecting to their learning by recording what they found out in this lesson under What I Found Out. Ask what they could do to find answers to their other questions. Depending on classroom constraints, available materials, and alignment with established learning goals, have students plan investigations to answer their other questions.



Procedure

Part VI

Extend (45 minutes)

Obtaining, evaluating, and communicating information using Informational text.

31. At this time, it would be appropriate to have students interact with text to extend their understanding of sound. This can be done during their language arts time using reading strategies, such as close reading. Suggested books include the following:
 - › *What Makes Different Sounds?* by Lawrence Lowery, illustrated by Susan Dolesch
Description: On their walk home from school, twins Jane and Jim explore why sounds can be startling (like sirens), soothing (like music), or mysterious (like eerie creaking in an empty house). By coming along, young readers of *What Makes Different Sounds?* can learn as the twins do.
 - › *Sound* by Delta Education
Description: Students read about what causes sound, how sound travels, and how sounds differ. They learn how our voices and ears work to allow us to speak and hear. They discover how different types of musical instruments make sounds.

References

Lowery, L. F. & Dolesch S. (Illustrator). (2012). *What Makes Different Sounds?* Arlington, VA: NSTA Kids. ISBN: 978-1-9369-5944-0

Delta Education. (2004). *Sound*. Delta Education. ISBN: 1-592-42377-9

Toolbox Table of Contents

1.3.R1 How to Make a Sprinkle Dancing Bowl

1.3.13

How to Make a Sprinkle Dancing Bowl

Materials:

- Plastic bowl (or any unbreakable bowl)
- Plate or tray (to catch sprinkles that fall off the bowl)
- Plastic wrap
- Rubber band
- Sprinkles or salt



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Instructions:

- Stretch a piece of plastic wrap across the top of the bowl.
- Use a rubber band to hold the plastic wrap in place.
- Adjust the plastic wrap so it is as tight and as flat as possible with no wrinkles.
- Put the bowl onto a plate or tray to catch any sprinkles or salt that fall off.
- Add a few sprinkles or salt over the plastic at the center of the bowl.



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Next Generation Science Standards (NGSS)

This lesson is building toward:

PERFORMANCE EXPECTATIONS (PE)

1-PS4-1	Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]
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NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.

SCIENCE AND ENGINEERING PRACTICES (SEP)

Asking Questions and Defining Problems

Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.

- Ask questions based on observations to find more information about the natural and/or designed world(s).
- Ask and/or identify questions that can be answered by an investigation.

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

DISCIPLINARY CORE IDEAS (DCI)

PS4.A: Wave Properties

- Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1)

Appendix 1.3

CROSSCUTTING CONCEPTS (CCC)

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

“Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts” are reproduced verbatim from A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. DOI: <https://doi.org/10.17226/13165>. National Research Council; Division of Behavioral and Social Sciences and Education; Board on Science Education; Committee on a Conceptual Framework for New K-12 Science Education Standards. National Academies Press, Washington, DC. This material may be reproduced for noncommercial purposes and used by other parties with this attribution. If the original material is altered in any way, the attribution must state that the material is adapted from the original. All other rights reserved.

Common Core State Standards (CCSS)

CCSS ELA SPEAKING & LISTENING

CCSS.ELA-LITERACY.SL.1.1.B

Build on others’ talk in conversations by responding to the comments of others through multiple exchanges.

CCSS.ELA-LITERACY.SL.1.5

Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.

CCSS ELA WRITING

CCSS.ELA-LITERACY.W.1.2

Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.

CCSS.ELA-LITERACY.W.1.8

With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

CCSS ELA READING: INFORMATIONAL TEXT

CCSS.ELA-LITERACY.RI.1.10

With prompting and support, read informational texts appropriately complex for grade 1.

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Appendix 1.3

California English Language Development (ELD) Standards

CA ELD		
Part 1.1.5: Listening actively to spoken English in a range of social and academic contexts		
EMERGING	EXPANDING	BRIDGING
P1.1.5 Demonstrate active listening to read-alouds and oral presentations by asking and answering <i>yes-no</i> and <i>wh</i> -questions with oral sentence frames and substantial prompting and support.	P1.1.5 Demonstrate active listening to read-alouds and oral presentations by asking and answering questions with oral sentence frames and occasional prompting and support.	P1.1.5 Demonstrate active listening to read-alouds and oral presentations by asking and answering detailed questions with minimal prompting and light support.
<p>In addition to the standard above, you may find that you touch on the following standards in this lesson as well:</p> <p>P1.1.1: Exchanging information and ideas with others through oral collaborative conversations on a range of social and academic topics</p> <p>P1.1.3: Offering and supporting opinions and negotiating with others in communicative exchanges</p> <p>P1.1.10: Writing literary and informational texts to present, describe, and explain ideas and information, using appropriate technology</p> <p>P1.1.11: Supporting own opinions and evaluating others' opinions in speaking and writing</p>		

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