7 Hearing and Sound

At-a-Glance:

In the last unit, students explored animal behaviors of parents and offspring that help the offspring survive and then designed a dam to stop the flow of water. In this unit, students explore how animals communicate with one another using sound. They investigate the relationship between vibrations and sound and then build kazoos.

Common Misconceptions:

- **Misconception**: You see and hear an event at the same time.
  - ✓ **Fact**: You cannot hear sound until the vibrations travel from the source to your ears.
- **Misconception**: A material's vibrations are unrelated to the sound the material makes.
  - ✓ **Fact**: There is a cause-and-effect relationship between vibrations and sound. All sounds are caused by vibrations.

A Breakdown of the Lesson Progression:

1

Sound and Senses

In the first lesson, students continue to learn about animals, exploring how some animals communicate using sound. They investigate the cause-and-effect relationship between vibrating materials and sound, using their senses of hearing, touch, and sight.

2

Making Sounds with Instruments

Once students have explored the relationship between sound and vibrations, they build a kazoo using different materials for the membrane to see how the sound changes depending on the material used.

Unit 7: Hearing and Sound

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Unit Overview:

Summer evenings in the countryside are filled with the sounds of chirps, buzzes, and whirs as insects begin to stir. Some insects make noises as they move around, such as buzzing bees or mosquitoes, but there are three groups of singing insects that make sounds with the goal of communicating with one another: cicadas, crickets, and katydids.

Crickets are singing insects.

These insects create sound by rubbing different parts of their body together to make vibrations that produce sound. Cicadas start the chorus in late afternoon, making sounds by vibrating membranes on the sides of their abdomen. At dusk, crickets join in, rubbing their wings together to make chirping sounds. Katydids end the night with their song, also rubbing their wings together.

In this unit, students explore the cause-and-effect relationship between vibrations and sound. Students begin by investigating how vibrating objects can cause sound and how sound can make matter (solids and liquids) vibrate. Students then build kazoos made up of different materials for the membrane to observe how the kind of material affects the sound of their voice.

Unit Goals:

1. Observe how vibrating objects make sound.
2. Explain how sound can cause different kinds of matter to vibrate.
3. Use evidence to support an explanation about the cause-and-effect relationship between vibrations and sound.

Applying Next Generation Science Standards

This unit covers the following **Next Generation Science Standards**. Each standard includes where it is found in the unit, as well as how it applies the relevant crosscutting concepts (listed in green) and disciplinary core ideas (listed in orange). **Note: Science and engineering practices are listed separately because multiple practices are incorporated into every unit.*

Grade-Specific Standard:

1-PS4	**Waves and Their Applications in Technologies for Information Transfer**
1-PS4-1.	**Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.** ▪ **Wave Properties:** In the first lesson, students carry out an investigation to explore how vibrating objects can cause sound and how sound can make matter (solids and liquids) vibrate. In the second lesson, students build kazoos with membranes made of different materials to observe how the kind of material affects how their voice sounds. Lessons 1 and 2 ▪ **Cause and Effect:** Students explore the cause-and-effect relationship between vibrating materials and sound, investigating how making materials vibrate can produce sound and how sound can make matter vibrate. Lessons 1 and 2

Science and Engineering Practices

Students use the following science and engineering practices in the unit's lessons.

Lesson 1: Sound and Senses

1. Asking questions (for science) and defining problems (for engineering)

- Students begin by using different materials and their senses to explore how vibrating objects can cause sound. Students then plan and carry out an investigation to help them answer the focus question: "Can sound make sand and water vibrate?"

2. Developing and using models

- Students create visual models to show how sand and water move in the presence of a vibrating tuning fork.

3. Planning and carrying out investigations

- Students explore how tuning forks and rubber bands vibrate, making sounds.
- Students then work in teams to plan and carry out an investigation to see if sound can make matter (sand and water) vibrate.

6. Constructing explanations (for science) and designing solutions (for engineering)

- Students use their observations from the investigation to construct an explanation about the relationship between vibrating materials and sound.

7. Engaging in argument from evidence

- Students work in pairs, engaging in argument to analyze vibrating materials and sound. Once student teams reach consensus and complete the investigation, students come together as a class, presenting their analysis to the class and, guided by the teacher, respectfully critiquing the analysis of other teams.

8. Obtaining, evaluating, and communicating information

- Students use information from the trade book, student reader, and their own observations to communicate with others about the cause-and-effect relationship between sound and vibrations.

Lesson 2: Making Sound with Instruments

2. Developing and using models

- Students create a visual model that shows how the different parts of their kazoo work together to make sound.

3. Planning and carrying out investigations

- Once students build their kazoo, they explore the sounds their kazoo makes with membranes made of different kinds of materials.

6. Constructing explanations (for science) and designing solutions (for engineering)

- Students use their observations from this investigation, as well as the last lesson's investigation, to explain why the kazoo made different sounds when its membrane was made of different materials.

7. Engaging in argument from evidence

- Students present their explanation to the class about why the kazoo made different sounds and, guided by the teacher, respectfully critique the explanations of other students.

8. Obtaining, evaluating, and communicating information

- Students use information from their readers and class dialogue to help them build their kazoos and as evidence in their explanations and arguments about why their kazoo sounded the way it did.

Unit 7 Pacing Guide Example

All KnowAtom units are designed to take approximately one month. Lessons may span one or two weeks. This pacing guide provides one example for how to break down the lessons in this unit over a month. **Breakdown in this guide is based on 30- to 40-minute class periods.** Communities that have longer or shorter class periods or schedules where science class occurs more frequently can modify this guide accordingly.

Any days in this guide that appear unused take into account months with holidays, vacations, times when an experiment, engineering, and/or investigation takes longer to complete, and/or days when science class does not occur.

Unit 7: Hearing and Sound				
Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Week 1				
Lesson 1 **Start:** As a class, read the trade book during circle time. **Final Goal:** Complete trade book reading and circle-time dialogue.	**Non-Science Day**	**Lesson 1** **Start:** As a class, read Section 1 of the KnowAtom student reader. **Final Goal:** Transition to Socratic dialogue.	**Lesson 1** **Start:** Socratic dialogue. **Final Goal:** Transition to Part 1 of the investigation: Vibrating Objects.	**Non-Science Day**
Week 2				
Lesson 1 **Start:** Teams carry out Part 1 of the investigation. **Final Goal:** As a class, wrap up Part 1 of the investigation. Transition to Part 2.	**Lesson 1:** **Start:** Teams carry out Part 2 of the investigation. **Final Goal:** As a class, wrap up Part 2 of the investigation.	**Non-Science Day**	**Non-Science Day**	**Lesson 2** **Start:** As a class, read the trade book during circle time. **Final Goal:** Complete trade book reading and circle-time dialogue.

Week 3				
Non-Science Day	**Lesson 2** **Start:** As a class, read Section 2 of the KnowAtom student reader. **Final Goal:** Transition to Socratic dialogue.	**Lesson 2** **Start:** Socratic dialogue. **Final Goal:** Transition to the lesson investigation.	**Lesson 2** **Start:** Students build and test their kazoos with wax paper. **Final Goal:** Students test their wax paper membrane kazoos.	**Non-Science Day**
Week 4				
Non-Science Day	**Lesson 2** **Start:** Students test their kazoos with different membrane materials. **Final Goal:** Students complete kazoo membrane tests and observations.	**Lesson 2** **Start:** Students complete kazoo diagrams. **Final Goal:** As a class, wrap up the investigation and debrief.	**Non-Science Day**	**Non-Science Day**

Science Words to Know:

Use the blank concept map visual to connect vocabulary once the unit is complete. An example concept map is displayed in Appendix 3.

1. **ear** – the part of the body that senses sound

2. **membrane** – a thin, flexible covering

3. **sense** – how an animal gets information about the outside world

4. **vibrate** – to move back and forth quickly

Teacher Background

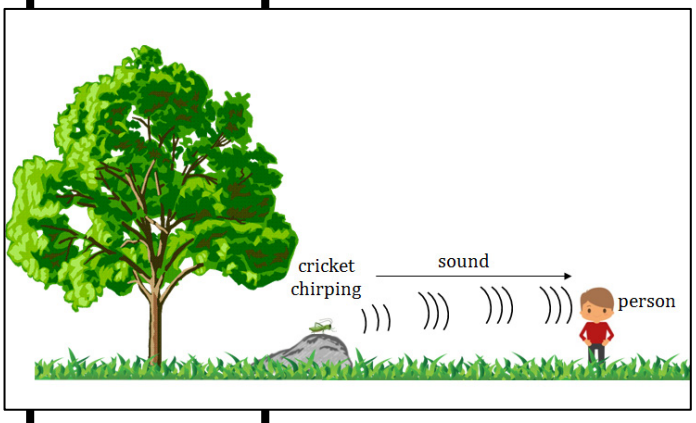
Listening to Insects' Songs

For Thomas Walker, the easiest way to determine what species of cricket or katydid different insects are is to listen to their nighttime song. Walker is an entomologist who is one of the world's leading experts on the two kinds of insects. "Without sound, we'd be in a pickle," Walker told *National Geographic News* in 2006.

Walker has been identifying different species of the insects since the late 1950s, using their songs as a way to differentiate among individual animals. Only male insects make these sounds, and their primary goal is to attract a mate. This explains why each species has a different song: females recognize the songs from males of their species and respond only to those individuals.

Crickets and katydids make sounds by rubbing their wings together because their upper wing has serrated teeth, called a file, while their lower wing has a scraper. Think about rubbing your finger down the prongs of a comb.

This motion produces sound because it creates vibrations. To **vibrate** means to move back and forth quickly. Sound is energy that is carried in waves of vibrating molecules. As forces transfer energy through a system, they disturb molecules at rest, causing them to vibrate. As energy is carried in waves of vibrating molecules, it produces sound. Sound can travel through any solid, liquid, or gas medium.



When a cricket chirps, its body produces vibrations that disturb the air molecules around it, causing them to vibrate. This disturbance travels through the air. When other crickets or animals are in range of these vibrating molecules, they hear the chirping sounds.

Sensing Sound

Most animals, including crickets and humans, have **ears** to sense sound. A **sense** is how an animal gets information about the outside world. Human senses include hearing, sight, touch, taste, and smell. People also have other senses, including the sense of balance, pain, and temperature changes. Humans and crickets both have two ears, but humans have ears on our heads, while crickets' ears are located on their front knees.

Senses are controlled by the nervous system. Our bodies are lined with specialized cells called neurons that transmit information to and from the brain. Each time a sense receptor is stimulated, electrical signals travel to the brain, where the signal is processed. It takes fractions of a second for neurons to carry a message.

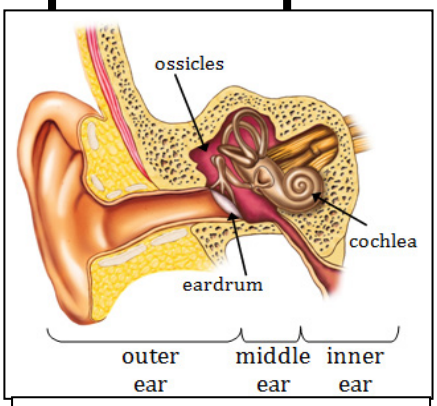


diagram of a human ear

Hearing is the ability to perceive sound and how your body interprets vibrations in the environment. The human ear is shaped like a cup so that it can focus vibrating air particles. The vibrations are transmitted through the eardrum, which is a **membrane** (a thin, flexible covering), and nerve cells communicate the strength, pitch, and frequency of the vibrations to the brain. This information is used to create the sounds that we hear.

When vibrating materials produce sound, people can use multiple senses to describe what is happening. People can describe the sounds they hear. They can also use their sense of touch to feel the vibrations. Touch is the most effective sense in the human body. The skin tells us whether we are in contact with an object, if that object is doing us harm, and whether that object is hot or cold. Nerve endings communicate this information and are found all over the body, especially in the fingertips. Insects use their antennae to touch things around them.

People can also use sight to see the vibrations in matter caused by sound. The eye is the part of the body used for sight, and it turns light into images that allow us to pinpoint objects in space and to identify their colors and shapes.

Making Music

Some musical instruments use membranes to produce sound. For example, one of the simplest musical instruments sometimes sounds like the buzzing of some insects. The kazoo has been called "the most democratic instrument" because it is so simple to play. It is made up of a hollow tube with a hole covered by a membrane. When you hum into one end of the kazoo, you produce vibrations that make the air in the kazoo vibrate. These vibrations travel through the tube, causing the membrane to vibrate and making your voice gain a "buzzing" sound.

Kazoos make sound when someone hums into them.

Kazoos are similar to drums, which also use a membrane to produce sound. There are many different kinds of drums, but they are all covered with a membrane that is hit, either with your hand or with drumsticks. This makes the membrane vibrate, producing a drumming sound.

Drums make sound when someone hits them.

Lesson 1: Sound and Senses

Objective: Students carry out a two-part investigation to explore how vibrating objects can cause sound and how sound can make matter (solids and liquids) vibrate.

Materials:

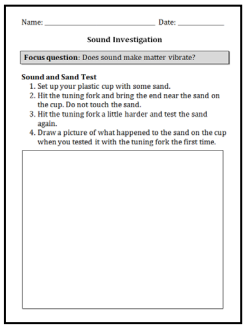
Consumable

A. Goggles – 1 per student
B. "Sound Investigation" – 1 per student (student reader)
C. Rubber bands – 1 per team
D. Plastic cups – 1 per team
E. Sand – shared
F. Bowls – 1 per team
G. Plastic wrap – shared roll

Non-Consumable

H. Tuning forks – 1 per team
I. Book: "All About Sound" by Lisa Trumbauer
J. Making Sounds Visual – (not shown)

A 

B 

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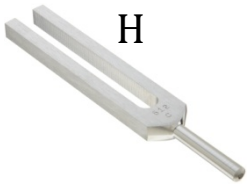
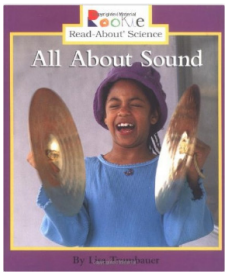
H 

I 

Teacher Preparation:

- Download the visuals from the KnowAtom Interactive website.

- There are two parts in this investigation and each part may take place on separate days. Each investigation uses specific materials. Arrange several pick-up stations for teams to access the materials during each part of the lesson. For example:

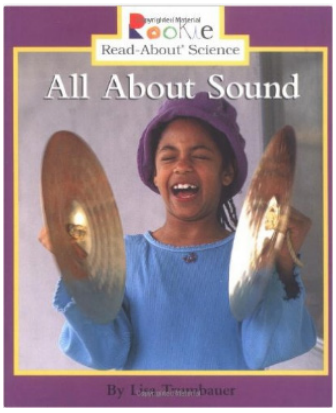
Investigation Part 1:

- Pick-Up Station 1: tuning forks
- Pick-Up Station 2: rubber bands and plastic cups

Investigation Part 2:

- Pick-Up Station 1: tuning forks, plastic cups, plastic wrap, sand, and plastic bowls pre-filled by teacher with some water

Circle-Time Dialogue:



Read aloud Lisa Trumbauer's "All About Sound." This book introduces readers to the relationship between sound and vibrations, using various examples of sounds. Ask questions such as:

1. What is the main topic of the book, and what details support this main topic? [*The main topic is to explain what sound is and to describe what makes sound. This topic is supported with details about different kinds of sounds (speaking, talking, laughing, a ringing telephone, etc.) and to explain what all of these sounds have in common—they are all caused by vibrations.*]

2. What information does the picture on page 9 give? [*The picture shows guitar strings vibrating, which means they are moving back and forth very quickly. The person strumming the guitar makes the strings vibrate.*]

3. What is the main point of pages 11- 13? [*These pages describe how we can see some vibrations when we hear the sounds they make.*]

4. What is the main point of pages 14-17? [*These pages describe how we can feel some vibrations when we hear the sounds they make.*]

<u>Student Reading Preparation</u>:

- Read Section 1 of the student reader together as a class before the Socratic dialogue and activity portion of the lesson. Model how to read closely for understanding. For example:
  - Emphasize connections between examples in the reading and broader concepts. For example, ask why a certain example was used to support the reading's main point.
  - Use "how" and "why" questions to connect ideas in the reading to student experiences.

<u>Socratic Dialogue</u>:

- The Socratic dialogue serves as the bridge between the nonfiction reading and the activity portion of the lesson.
- The example Socratic dialogue below describes one possible progression of ideas to engage students in higher order thinking. Blocks are used to divide the dialogue according to key organizing concepts. They are not meant to indicate how much time a dialogue should take; length of time may vary depending on the subject matter and student understanding of the concepts. Note that in a Socratic dialogue, the teacher is not the only one asking questions and challenging ideas. Students should be actively engaged in proposing questions, challenging assumptions, and using evidence to support their arguments. *Not sure how to set up a Socratic dialogue? Check out*

www.knowatom.com/socratic for an in-depth look at how to hold a next generation Socratic dialogue in the classroom.

Block 1: What is Sound?

1. Display *Making Sounds Visual*. Begin a dialogue with students that connects the last unit, which focused on animal behaviors, with this lesson, which introduces students to sound.

- **Big Idea 1:** Coach students toward the idea that one animal behavior is making sounds to communicate with other animals. For example:
  - *Ask one student what behaviors they explored in the last unit. (Students explored various behaviors, including babies crying and parents responding by comforting, feeding, and protecting them. Student responses may be varied; what's important is that students make connections by articulating what they have already learned.)*
  - *Ask another student to build on what the first student said, either providing additional examples to support their response or respectfully contradicting it using evidence. Provide the first student with the chance to respond so that students are engaging with one another as they evaluate each other's responses. Redirect if misconceptions arise.*
  - *Ask the first student what cricket behavior is described in the student reader. (The student reader describes how crickets make sounds to communicate with other crickets. They do this by rubbing their wings together. This rubbing makes a chirping sound.)*

- **<u>Big Idea 2</u>:** Coach students toward the idea that we use our sense of hearing to hear different sounds, which are made by vibrating materials. For example:
    - *Ask one student how they themselves can make sounds. (There are many ways students can answer this question. Talking and singing are two examples of sound, as are clapping their hands and stomping their feet. Optional: Students can make the sounds they are describing.)*
    - *One at a time, provide multiple students with the chance to respond to this question.*
    - *Ask another student what all of these sounds have in common. (All sounds come from vibrating materials. To **vibrate** means to move back and forth quickly.)*
    - *Ask the first student how they can use their senses to tell if something is vibrating. (A **sense** is how an animal gets information about the outside world. For example, they can use their sense of touch to tell if something is vibrating. One example of this is putting a hand on their throat and humming, and feeling the vibrations in their throat. Or they can use their sense of sight to see if something is vibrating by observing it move back and forth.)*
    - *Ask another student to pick a sound they described and explain how they could do the same behavior but change the sound, either making it louder or softer. (Using less force will make the sound softer, while using more force will make it louder. For example, clapping your hands with more force produces a louder sound, while clapping your hands with less force produces a softer sound.)*
    - *Ask the first student why we need ears to hear sounds. (All sounds make vibrations. These vibrations move the air. That moving air reaches our ears, which pick up the vibrations. We hear these vibrations as sound.)*
    - *Ask another student what would happen if we didn't have ears. (We wouldn't be able to hear sound.)*

- *Ask the first student what kinds of information we can find out from sounds. (There are many ways students may answer this question, based on their own experiences and observations. For example, one way that people communicate is through sound, by talking or making other sounds to convey information. Sounds can also tell us when other animals or objects are nearby, based on the sounds they are making. The chirping of crickets tells us there are crickets around, while the sound of waves tells us we are near a body of water.)*
- *Ask another student how hearing a sound can change our behaviors. (This answer may depend on what the previous student said. For example, if a teacher tells a student to do something, the student may respond accordingly. If a person hears a loud noise, they might jump.)*
- *Ask the first student what would happen if the teacher was making a sound and then moved into another room still making the sound. (It would get harder to hear the sound as the teacher moved away. If the teacher were to move far enough away, the student wouldn't be able to hear the sound anymore.)*
- *Ask another student to use vibrations to explain why students would stop hearing the sounds made by the teacher in the other room. (This question assesses whether students understand that vibrations have to move through the air from the source (the teacher making the sound) to their ears. If the teacher moves too far away, the vibrations cannot reach their ears.)*
- *One at a time, provide multiple students with the chance to explore this idea, building on what other students have said and using examples from their own experiences or the reading to support their responses.*

Investigation: Part 1 – Vibrating Objects

SAFETY: Students must wear goggles during this investigation.

1. In this part of the investigation, students use different materials and their senses to explore how vibrating objects can cause sound. Divide the class into teams of two. Stand by the materials stations to explain how the materials will be used and the amount each team will receive. Students will go to the stations to collect the materials they will use at their desks.

Pick-Up Station 1:

- tuning fork – 1 per team

Explain that each team will:

- Use the tuning fork to observe how it can vibrate.
  1. Hold the base of the tuning fork and gently strike/tap the other end with the rubber sole of your shoe, your hand, or the table. What happens to the tuning fork?
  2. Strike the tuning fork a little harder to see what effect it has.
  3. Bring the tuning fork closer to your ear and then move it farther away. What happens to the sound?

NOTE: Teachers may need to demonstrate the proper way to use the tuning fork. A tuning fork is a two-pronged steel device used by musicians. The tuning fork is designed to have a specific pitch when struck so musicians can tune their instruments to the pitch.

2. Teams collect their tuning forks from the pick-up station to start the investigation. Circulate throughout the classroom during this exploratory process to ask questions to gauge student thinking as they use the tuning forks. Encourage students to use their new vocabulary to describe what they are observing. Students will find that they can feel the tuning fork vibrate with their hands and see it with their eyes. They can stop the tuning fork from vibrating with their hands. They can also hear the vibrations with their ears. When they strike the tuning fork with less force, it will produce a softer sound compared to when they strike it with more force. When teams are finished exploring the tuning forks, move on to investigate vibrating rubber bands.

<u>Pick-Up Station 2</u>:

- rubber bands –1 per team
- plastic cup – 1 per team

Explain that each team will:

- Explore the sounds made by a rubber band wrapped around a cup:
  1. Take one rubber band and stretch it around the cup from top to bottom.
  2. Pluck the rubber band stretching across the mouth of the cup. What happens when you pluck it with more force compared to less force?

3. Teams collect their cups and rubber bands from the pick-up station to continue the investigation. Circulate throughout the classroom during this exploratory process to ask questions to gauge student thinking as they discuss their observation with their class and pluck the rubber bands. Students will find that they can see the

rubber band vibrating, feel it with their fingers, and hear the sound it makes. When the rubber band is plucked with less force, it produces a quieter sound compared to when it is plucked with more force. Students may find that the rubber band sounds different (higher or lower) when they squeeze the cup, which causes the length of the rubber band to vary.

NOTE: Save the cups for teams to use in Part 2 of the investigation.

Part 1 Wrap-Up:

1. When students have completed the exploratory process in Part 1, have a dialogue to assess student comprehension about how vibrating objects can cause sound. For example:

- Ask one student what they observed when they tapped the tuning fork against their shoe. [*Vibrations moved through the tuning fork. Students should have felt the vibrations with their hands. The tuning fork also made a deep humming-like sound.*]
- Ask another student how the vibrations they felt in the tuning fork are connected to the sound they heard from the tuning fork. [*The vibrations caused the sound. All sound is caused by vibrating materials. The sound stopped when the tuning fork stopped vibrating.*]
- If students have trouble explaining this relationship, provide multiple students with the chance to describe the relationship, redirecting if misconceptions arise.
- Ask the first student what happened when they plucked the rubber band stretched across the cup. [*The rubber band was stretched and then released, causing it to vibrate. It also made a popping-like sound when released. The rubber band may also have caused the cup to vibrate if plucked with enough force.*]

- Ask another student how the vibrations in the rubber band cup are connected to the sound they heard. [*The vibrating materials caused the sound.*]
- Ask the first student how they can use their observations of the tuning fork and the rubber band cup to explain the relationship between vibrations and sound. [*When different objects, such as the tuning fork and rubber band cup, vibrate, they make sound.*]
- Ask another student what senses they used to help them observe this phenomenon. [*Students used their senses to see, hear, and touch the vibrating objects.*]

2. Transition to the second part of the investigation by discussing how matter (anything that has mass and takes up space) can be a solid, a liquid, or a gas. For example:

- Ask one student to use observations and/or prior knowledge to explain why rubber bands, plastic cups, and tuning forks are all solids and not liquids. [*They are solid and not liquid because they keep their shape. You have to apply a force—such as stretching the rubber band—to change their shape.*]
- Ask another student what an example of a liquid is. [*Water that comes out of the faucet is liquid, as is water in ponds, lakes, and oceans. Juices are also liquid.*]
- Ask the first student how liquids are different from solids. [*Liquids change their shape more easily than solids. Liquids take the shape of whatever container they are in. If you pour liquid water into a bowl, it takes the shape of the bowl. If you pour it into a glass, it takes the shape of the glass.*]
- Ask another student to add to what the previous student said, providing additional details to support their answer.
- Ask the first student if they can name any gases. [*When water boils, it turns into steam. This is one kind of gas. The air around us is made up of different gases even though we cannot see them.*]

- Ask another student what happened to solid matter when it vibrated. [*When the solid matter (tuning forks and rubber bands around plastic cups) vibrated, it made sound.*]
- Ask the first student if they think sounds can make solids and liquids vibrate. [*Getting the right answer isn't important here. What's important is that students make predictions and use what they know about vibrations to support their prediction. This is the question that students will investigate in the second part of the investigation. Students may also provide examples of what evidence could be used to answer this question, such as using different senses (sight, touch, and hearing) to make observations of matter moving or making sounds.*]

Investigation: Part 2 – Sound and Vibrating Matter

SAFETY: Students must wear goggles during this investigation.

1. Divide the class into teams of two. Students collect their student readers and turn to the "Sound Investigation." Explain that each team will:

- ☐ Use the "**Sound Investigation**" to explore the focus question: "Can sound make sand and water vibrate?"

2. Show the class the materials available for the investigation: tuning forks, plastic cups, plastic wrap, sand, and water-filled bowls.

- Students write a prediction on their investigation sheet about how they think sound from the tuning fork will affect the sand and water, based on what they already know about sound and any prior experiences.
- Give students a few minutes to share their predictions with the class. Differences in predictions are expected and encouraged.

3. As a class, collaboratively develop a plan (procedure) for the investigation that teams will carry out to test their predictions. Student plans should involve the basics of how they will use the available materials. Use Socratic dialogue to coach students toward developing this plan. For example:

- Ask the class to think of how they could use the materials to test how sound from a vibrating tuning fork affects a small sample of sand and some water in a bowl.
    - *Students may suggest that they bring a vibrating tuning fork near some sand to see if the sound makes the sand particles move. They could then repeat this process a second time by bringing the vibrating tuning fork near the water in the bowl (or putting it in the water) to see if the water moves.*
    - *Students should be specific in how they intend to use the available materials in their plan. For example, some students may suggest simply putting particles of sand on their desks or they might cover the opening of the cup with plastic wrap and sprinkle the sand on the plastic to help them see the sand. Other students might suggest putting the vibrating tuning fork in the water while others choose to only bring it near the water. As a class, decide on a specific method for testing. Note that the motion of the water will be most visible if the vibrating tuning fork touches the water.*

Once students reach consensus on the plan, they record their plan on their investigation sheet. This step may require more facilitation and guidance from the teacher depending on the writing level of your students. What is most important is that students are generating ideas for the plan themselves and coming to an agreement on how they will use the materials to test their ideas. The following procedure is one example:

- **Testing Sand Procedure**
  1. Cover the mouth of the plastic cup with plastic wrap.
  2. Put some sand on the plastic wrap.
  3. Hit the tuning fork so it vibrates and makes sound. Bring the fork end near the sand to see if the sand moves.
- **Testing Water Procedure**
  1. Hit the tuning fork so it vibrates and makes sound.
  2. Touch the fork end to the water in the bowl to see if the water moves.

4. When student plans are complete, stand by the materials stations to point out the amount each team can collect.

Pick-Up Station 1:

- tuning forks – 1 per team
- plastic cups – 1 per team
- plastic wrap – 1 sheet per team
- sand – 1 pinch per team

5. Teams collect materials from the pick-up stations to carry out the investigation. Circulate throughout the classroom to facilitate as needed and to ask questions that gauge student thinking as they observe how sound from the tuning fork affects the sand and water.

- Encourage students to use new vocabulary to describe what they are observing.
- Students should be able to describe how sound from the vibrating tuning fork causes the sand to move, even though it doesn't touch the sand directly.
- In the water test, students should recognize that the sound from the vibrating tuning fork transferred to the water to make it move/vibrate. A non-vibrating tuning fork would not produce ripples and motion in the water when it touches it, which students can test on their own.

Photos show a vibrating tuning fork testing sand particles and water in a bowl to see if they move.

6. When students are finished carrying out their plan, each student collects observational data for the investigation. Each student will:

- Draw a picture to show what happened to the sand when they tested it with the tuning fork.
- Draw a picture to show what happened to the water when they tested it with the tuning fork.

Part 2 Wrap-Up:

1. Begin a dialogue with students to review the results of the sound investigation. For example:

- Invite different teams to share their data (pictures) and observations from the investigation. Do the data and observations support their predictions? [*Answers will vary depending on student predictions. Students should use evidence from the investigation to support their answer. For example, if students answer yes, they should cite the movement of the sand on the cup and the water. If they didn't see any vibrations, explore possibilities for this, such as not striking the tuning fork hard enough or accidently stopping its vibrations before it comes close enough to the sand and/or the water. Exploring these possibilities will help students think through the cause-and-effect relationship between the vibrations and the movement of the sand and water.*]
- What caused the sand and the water to vibrate? [*The tuning fork vibrated, and these vibrations moved through the air to the sand, making the sand move. Vibrations from the tuning fork moved through the water to make the water move.*]
- What happened when the tuning fork stopped vibrating? [*The sand and the water stopped moving.*]

Name: _____ Date: _____

Sound Investigation

Focus Question: Can sound make water and sand vibrate?

Prediction

Write a prediction for the question.

Procedure

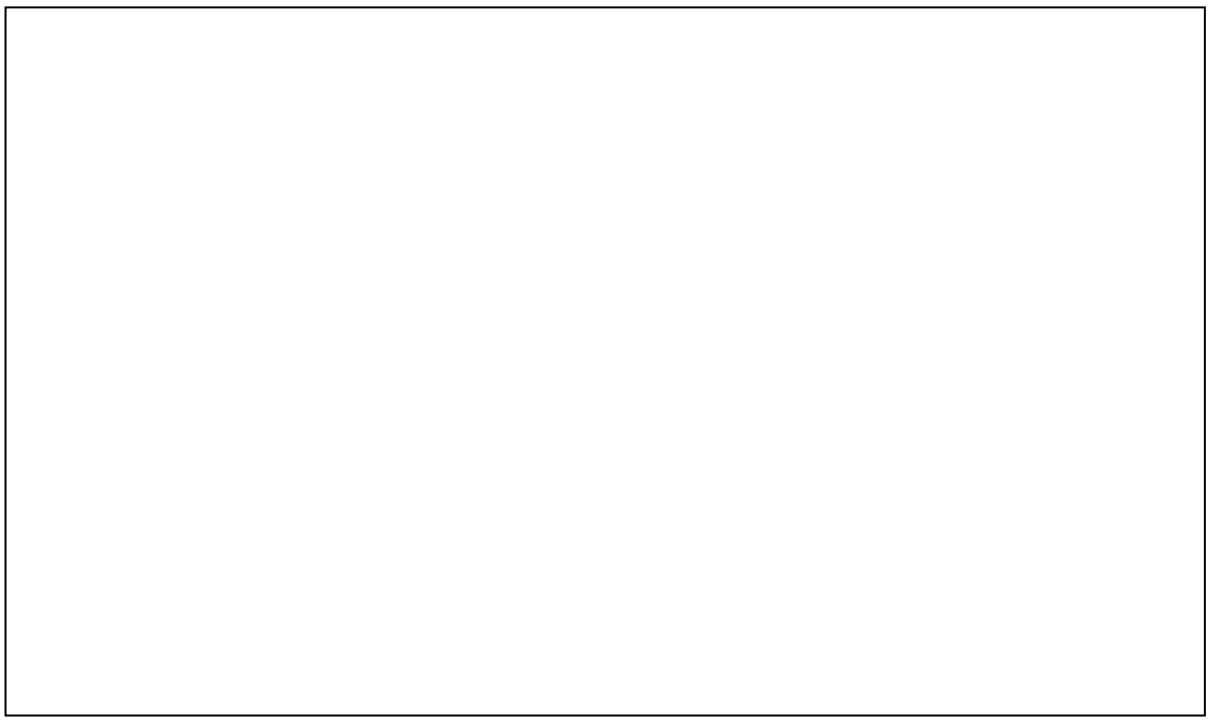
Look at the materials your team can use. Write a plan for the investigation.

Sound and Sand Test:

Sound and Water Test:

Data

1. Draw a picture to show what happened to the sand when you tested it with the tuning fork.



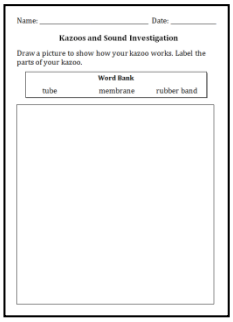
2. Draw a picture to show what happened to the water when you tested it with the tuning fork.

Lesson 2: Making Sounds with Instruments

Objective: Students build kazoos with membranes made of different materials to observe how the kind of material affects how their voice sounds.

Materials:

A 

B 

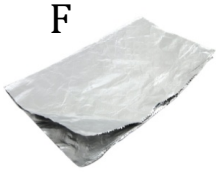
C 

Consumable

A. Goggles – 1 per student
B. "Kazoos and Sound Investigation" – 1 per student (student reader)
C. Rubber bands – 1 per student
D. Cardboard tubes with hole – 1 per student
E. Wax paper – 1 sheet per student
F. Aluminum foil – 1 sheet per student
G. Plastic wrap – 1 sheet per student
H. Paper towels – (not shown) – 1 sheet per student (teacher provides)

D 

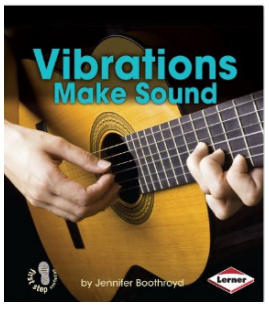
E 

F 

G 

Non-Consumable

I. Book: "Vibrations Make Sound" by Jennifer Boothroyd
J. Making Music Visual – (not shown)

I 

Teacher Tool Kit

K. Scissors – 1 per student

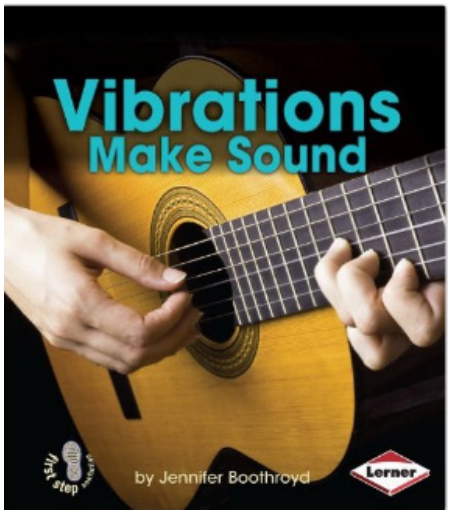
K 

Teacher Preparation:

- Download the visuals from the KnowAtom Interactive website.
- Bring in a role of paper towels for students to use in the investigation. Each student will need one paper towel sheet.
- Arrange several pick-up stations for teams to access the materials during each part of the lesson. For example:
  - Pick-Up Station 1: cardboard tubes with hole
  - Pick-Up Station 2: rubber bands, wax paper, and scissors
  - Pick-Up Station 3: student readers, aluminum foil, paper towel sheets, and plastic wrap

Circle-Time Dialogue:

Read aloud Jennifer Boothroyd's "Vibrations Make Sound." This book continues to explore the relationship between sound and vibration, focusing on different kinds of sounds and ways that people can make different sounds. Ask questions such as:



1. Why does page 8 have a picture of a dog? [*The point of this page is that some sounds last longer. When a dog howls, which is what the photo is showing, the sound can last a long time.*]

2. Why does page 9 have a picture of a girl whispering? [*She is making quiet sounds when she whispers. The main point of this page is that some sounds are quiet.*]

3. On pages 13-15, there are three different pictures: a boy playing a violin, a bat hitting a ball, and a boy blowing a whistle. What is the point of these three pictures? [*Each of the pictures represents a*

different kind of sound. Each sound is made by vibrations, but different vibrations make different sounds.]

4. What are the children on page 22 doing? [*They are all playing different musical instruments. Each musical instrument makes different kinds of sounds.*]

Student Reading Preparation:

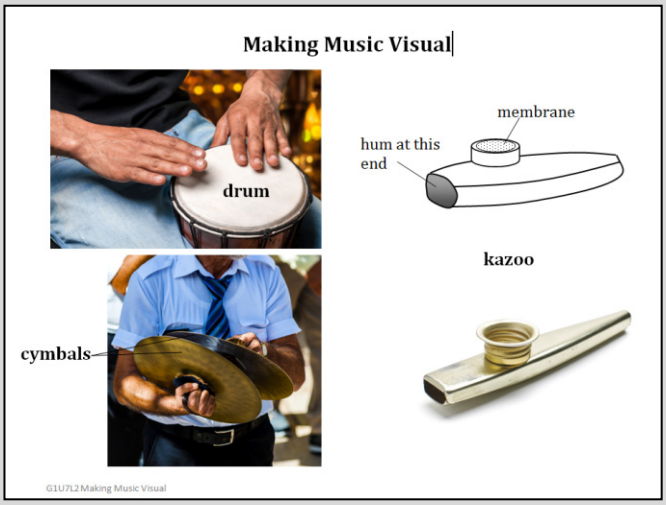
- Read Section 2 of the student reader together as a class before the Socratic dialogue and activity portion of the lesson. Model how to read closely for understanding. For example:
  - Emphasize connections between examples in the reading and broader concepts. For example, ask why a certain example was used to support the reading's main point.
  - Use "how" and "why" questions to connect ideas in the reading to student experiences.

Socratic Dialogue:

Block 2: Making Musical Sounds

1. Display *Making Music Visual*. Continue the dialogue with students from the last lesson about sound and vibrations, focusing on how people can create musical instruments that make different kinds of sound.

- **Big Idea 3**: Coach students toward the idea that different musical



instruments have different parts that give them the sounds they have. For example:

- *Ask one student why cymbals make sound. (See if student makes the connection between vibrations and sound. Some students may respond that the cymbals make sound when they are brought together without mentioning the vibrations, so you may need to ask several guiding questions, such as what happens when the two metal plates come together, or whether the player would feel any kind of vibrations when the two plates come together.)*
- *Ask another student what happens to the cymbals when they are not brought together. (The goal here is for the student to make the connection between the cause—the action of bringing the cymbals together and the effect—the resulting sound. When the cymbals remain apart, they don't make noise.)*
- *Ask the first student what has to happen for a drum to make noise. (Drums have to be hit (either by someone's hands or with drumsticks). They don't make noise on their own.)*
- *Ask another student how hitting a drum makes noise. (Drums are covered with a membrane on their top. A* ***membrane*** *is a thin, flexible covering. When the membrane is hit, the membrane vibrates, and these vibrations make sound.)*
- *Ask the first student how kazoos are similar to drums. (Students may respond to this question in several ways. For example, they may point out that both kazoos and drums make sound, that both are musical instruments, and/or that both have membranes.)*
- *Ask another student how kazoos are different from drums. (Again, there are several ways students may respond to this question. They may describe the physical differences (shape, size, color, etc.), the different sounds they make, or*

the way they are played (drums by hitting and kazoos by humming into them).

- *Begin to transition to the investigation by asking one student whether they think there is any connection between the shape of the instrument and the sound it makes, or between the materials or size of the instrument.*
- *One at a time, ask multiple students whether they think the kind of material that makes up the membrane will affect the sound it makes in any way. (There is no right answer here, as this is what students will be investigating. Students should make predictions based on what they know about vibrations and sound. If needed, coach students toward thinking about the properties of a membrane—specifically that it is thin and flexible. This might cause some students to predict that materials that are less flexible might be less able to make sound.)*

Investigation:

SAFETY: Students must wear goggles during this investigation.

1. In this investigation, students build kazoos and use membranes of different materials to observe how the materials change the sound of their voice. Stand by the materials stations to explain how the materials will be used and the amount each student will receive. Students will go to the stations to collect the materials they will use at their desks.

Pick-Up Station 1:

- cardboard tubes with hole – 1 per student

Explain that each student will:

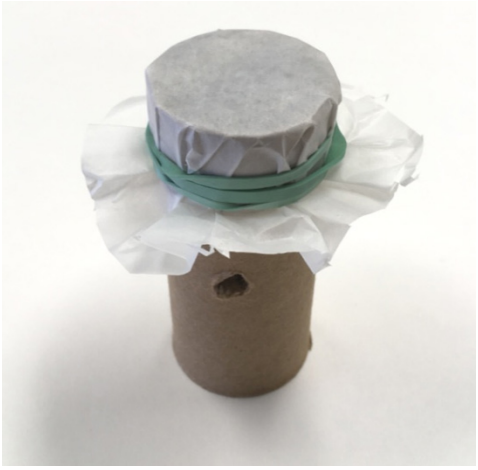
- Explore the sound your voice makes with the cardboard tube:

1. Say a few words out loud and listen to the sound of your voice. You can say or sing words like “La-La-Laaaa” or “Kaaa-zooo.”
2. Put one end of the cardboard tube to your mouth so that it touches the skin around your mouth but not your lips. Try speaking again. Draw out your words and make different sounds. How does your voice sound when it travels through the tube? Does it sound different? What is different about it?

2. Students collect the cardboard tubes from the pick-up station to start the investigation. Circulate throughout the classroom during this exploratory process to ask questions to gauge student thinking as they listen to the sound of their voices in the tubes. Bring the class together so students can share their observations. Students will find that their voices sound more resonant when they sing, hum, or talk into the cardboard tube. This is because when you speak or sing into the tube, the sound from your voice bounces off the inside walls of the tube. Your ears hear these sounds in the tube coming from different directions and at different times. This makes the sound of your voice “ring” and sound clearer or deeper than your voice did without the tube. When students are finished exploring the cardboard tubes, move on to the next step of the investigation.

<u>Pick-Up Station 2</u>:

- rubber bands – 1 per student
- wax paper – 1 sheet per student
- scissors – 1 per student



Explain that each student will:

- Turn the cardboard tube into a kazoo:
  1. Place a small sheet of wax paper over one end of the cardboard tube to create a membrane. Use the rubber band to secure

the wax paper firmly to the tube. Trim the excess wax paper with scissors.

2. Put the uncovered end of the cardboard tube to your mouth and try speaking again, making the same sounds that you did with tube before. Try humming or speaking loudly.
4. Does your voice sound different with the wax paper on the end? What is different about it? Try covering and uncovering the hole in the tube with your fingers as you continue to hum/speak. How does this change the sound of your voice?
5. While you're speaking/humming into the tube, gently touch the wax paper membrane. What happens to the sound of your voice? What is different about it? What happens if you press the wax paper a little harder?

3. Students collect materials from the pick-up station to create their kazoos. Circulate throughout the classroom during this exploratory process to ask questions to gauge student thinking as they test their kazoos with the wax paper. Students will notice that their voice may sound more muffled compared to when the cardboard tube was not covered. The wax paper absorbs some sound as sound passes through and interacts with the membrane. The hole in the tube makes it easier to hear the sound of your voice by amplifying the sound. When you hum or talk into the tube, the wax paper membrane vibrates in response to your voice. The hole in the tube allows air and sound to escape and reach your ears. When you touch the membrane while humming into the cardboard tube, you prevent the membrane from vibrating and making sound, so your voice is less resonant. When students are finished exploring the sounds their kazoo makes, move on to the next step of the investigation.

NOTE: It may take students several attempts before they figure out how to produce the typical, nasal kazoo sound with the materials. The kazoo is a musical instrument that adds a "buzzing" timbral quality to a player's voice when the player vocalizes into it. It is a type of membranophone instrument, which modifies the player's voice with a vibrating membrane. The resulting sound varies in pitch and loudness depending on the player's humming. Players can produce different sounds by singing specific syllables such as *doo*, *who*, *rrrrr,* or *brrrr* into the kazoo.

If students can't hear a change in their voices with the kazoo, they should hum louder into the cardboard tube using words like "who" or humming a familiar song. Students may try to blow into the tube, but this will not cause the membrane to vibrate and so it won't produce sound.

4. Show students some of the materials for the next part of the investigation: aluminum foil, plastic wrap, and paper towels. Start a dialogue to lead students toward making a prediction about what they think would happen to the sound of their voice if they replaced the wax paper membrane on their kazoos with the other materials. Allow students to collect the materials to examine at their desks. Ask questions to get students thinking, such as:

- Are all the materials similar? How are they different?
- Would the sound of your voice change when you played your kazoo with a foil membrane compared to a plastic wrap membrane? How would you expect it to change? Why?

There are no "correct" answers to these questions. The point of this part of the investigation is for students to think about how using materials that have different properties for the membrane might affect the kazoo's sounds when played. Record several predictions

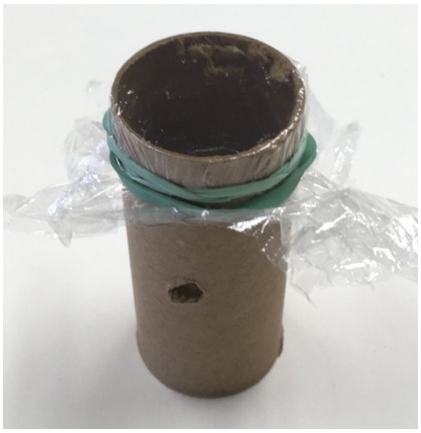
on the board for reference later on. When ready, students access materials from the pick-up station to test their predictions.

<u>Pick-Up Station 3</u>:

- "Kazoos and Sound Investigation" – 1 per student (student reader)
- aluminum foil – 1 sheet per student
- paper towel – 1 sheet per student
- plastic wrap – 1 sheet per student

Explain that each student will:

- Test different materials as your kazoo's membrane.
  1. Remove the wax paper from the end of the cardboard tube and replace it with a small sheet of plastic wrap. Trim the excess plastic wrap once the wrap is secured onto the cardboard tube with the rubber band.
  2. Test the kazoo with the plastic wrap by speaking/humming into the tube. What happens to the sound of your voice? What is different about it compared to when you used the wax paper? What happens if you gently touch the plastic wrap membrane while humming into the tube?
  3. Repeat steps 1-2 for two more tests, once with a paper towel membrane on the kazoo and then with aluminum foil membrane on the kazoo.



5. Students collect materials from the pick-up station to test different materials on their kazoos. Circulate throughout the classroom during this process to ask questions to gauge student thinking as they test their kazoos. If students notice that their voice does not have the same vibrating quality as it did with the wax paper, ask questions to connect the properties of the membrane materials to the quality of the sounds. The aluminum foil is less flexible than the wax paper, so student voices might sound different or slightly louder. The paper towel has small holes in it, which allows air and sound to pass through it without causing it to vibrate. Students may notice that the paper towel membrane causes their voices to sound similar to how they did when they hummed through the cardboard tube without a membrane at the beginning of the investigation.

6. When students are finished exploring the sounds their kazoo makes with different types of membranes, they should turn to the "Kazoos and Sound Investigation" sheet to draw a picture that shows how their kazoo works. Students should label the parts of their kazoo using the words in the word bank on the investigation sheet.

Wrap-Up:

1. Begin a dialogue with students to review the results of their kazoo and sound investigation. For example:

- As a class, revisit student predictions made before testing different membrane materials. What evidence can they use from the investigation to support or refute their prediction? [*Answers will vary based on student predictions. For example, some students may have predicted that their voice would not change when different materials were used for their kazoo's membrane. Other students may have predicted that their voices would change (be louder, softer, higher, or lower). One at a time,*

provide multiple students with the chance to respond to and share their observations and experiences. What's important here is that students articulate their thought process as they carried out the investigation. Answers will vary according to the kinds of sounds the students made (singing, saying certain words, speaking loudly or softly, etc.), as well as the kind of material used for the membrane.]

2. Continue the dialogue with students, assessing student understanding of the relationship between vibrations and the sounds they produced. For example:

- Ask one student what material made their voice sound most like a kazoo. [*Students most likely noticed that the wax paper changed their voices the most, while the paper towel changed their voices the least.*]
- Ask another student how they knew that the membrane of their kazoo was vibrating. [*Students may have seen it move as they hummed into the kazoo, or they may have seen another student's move. Or students may connect the sounds they heard with the kazoo's vibrations because all sound is caused by vibrating materials.*]
- One at a time, provide multiple students with the chance to respond to this question, using their own observations from the investigation or any prior knowledge to support their response. Redirect if misconceptions arise.

Name: _____ Date: _____

Kazoos and Sound Investigation

Draw a picture to show how your kazoo works. Label the parts of your kazoo.

Word Bank		
tube	membrane	rubber band

Name: _____

Unit 7: Hearing and Sound

Vocabulary Check

Part 1

1. Miguel plays guitar. He strums one of the strings. The string vibrates.

How does the string move?

a. It moves back and forth quickly.
b. It moves up and down slowly.
c. It moves in small circles quickly.

2. The radio is on. It is too loud for Keisha. She covers her ears.

Why does covering her ears help Keisha?

a. Ears sense touch. Covering her ears keeps Keisha from feeling the radio's sounds.
b. Ears sense sound. Covering her ears blocks the radio's sounds.
c. Ears sense light. Covering her ears keeps Keisha from seeing the radio's sounds.

3. What are **senses**? Circle all of the sentences that describe an animal using its senses. (There may be more than one.)

a) An ant feels things around it with its antennae.
b) A bird protects its babies by building a nest.
c) A person uses their ears to hear sounds.
d) A dog looks at its food bowl with its eyes.
e) A person makes music by hitting a drum.

4. Why is hearing a **sense**?

_____

_____

_____

_____

Part 2

Circle the word that matches the meaning of the phrase.

Phrase	Word Choices	
1. a thin, flexible covering	ear	membrane
2. to move back and forth quickly	sense	vibrate
3. the part of the body that senses sound	ear	membrane
4. how an animal gets information about the outside world	sense	vibrate

Name: _____

Unit 7: Hearing and Sound

Concept Check

Part 1

1. Read each sentence. Circle **true** or **false.**

- We only hear sound when it enters our ears. **true** **false**
- Vibrating materials can make sound. **true** **false**
- Sounds don't move from one place to another. **true** **false**

2. Fill in each of the blanks with a word from the word bank below:

Word Bank
sense ears

We hear sound with our _____.

Hearing sound is an example of a

_____.

Part 2

3. Shivanti is in the car. She turns on the radio. She hears the music. She also feels the radio vibrate.

Why does the radio vibrate?

a. The radio is warming up. The heat from the radio makes the radio vibrate.
b. The radio is turning on. The light from the radio makes the radio vibrate.
c. The sound from the radio makes the radio vibrate.

4. Shivanti turns off the radio. The radio stops vibrating.

What happens to the sound?

a. The sound keeps going.
b. The sound stops.
c. It is impossible to know what happens to the sounds.

5. William plays the triangle in music class. The triangle is a musical instrument. William holds the triangle in the air. (See the picture on the right.) When he taps it, the triangle makes sound.

a. What do you think happens to the motion of the triangle after William taps it?

b. What evidence can William use to explain what happens to the motion of his triangle? (Hint: Think about how you use your senses.)

Unit 7: Appendix 1
Answer Keys

Part 1

1. a. It moves back and forth quickly. [If Miguel strums one string on a guitar and the string vibrates, it means it moves back and forth quickly. To vibrate doesn't mean to move up and down slowly or to move in small circles quickly.]
2. b. Ears sense sound. Covering her ears blocks the radio's sounds. [If the radio is on and it is too loud for Keisha, covering her ears helps Keisha because ears sense sound, so covering them blocks the radio's sound. Sound travels from a source (the radio) to her ears. Ears don't sense touch or light. Touch and sight are two other senses, but we have different body parts for these senses. Our skin senses touch, and our eyes sense light.]
3. [This question assesses student understanding of what senses are. It asks students to choose the sentences that describe an animal using its senses. Three of the sentences describe animals using their senses (a, c, and d), while two of them don't (b and e). (a) An ant feels things around it with its antennae; (c) A person uses their ears to hear sound; and (d) A dog looks at its food bowl with its eyes are all examples of animals using their senses. (b) A bird protects its babies by building a nest and (e) a person making music by hitting a drum don't describe animals using their senses because they don't describe an animal getting information about the outside world.]
4. [Hearing is a sense because it is one way that animals gather information about the world. Animals hear sounds around them, and those sounds give them different kinds of information.]

Part 2

Phrase	Word Choices	
1. a thin, flexible covering	ear	membrane
2. to move back and forth quickly	sense	vibrate
3. the part of the body that senses sound	ear	membrane
4. how an animal gets information about the outside world	sense	vibrate

Concept Check

Part 1

1. [This question asks students to read each sentence, and to circle true or false.

• We only hear sound when it enters our ears.	**true**	**false**
• Vibrating materials can make sound.	**true**	**false**
• Sounds don't move from one place to another	**true**	**false**

It is true that we only hear sound when it enters our ears. Ears are the body parts that sense sound, and it is only when vibrations reach our ears that we hear sound. It is also true that vibrating materials can make sound—all sound is made by vibrating materials (although we can't always hear sounds made by vibrating materials). Finally, it is false that sounds don't move from one place to another. Sounds do move from the source—the vibrating materials—through the air (or other kind of matter). Evidence for this is that we can hear sound from across the room.]

2. [This question asks students to fill in each of the blanks with a word from a word bank:
We hear sound with our ears. Hearing sound is an example of a sense.]

Part 2

3. c. The sound from the radio makes the radio vibrate. [If Shivanti turns on the car radio and hears music while also feeling the radio vibrate, the radio is vibrating because the sound from the radio makes the radio vibrate. This question assesses whether students understand that sound can make matter vibrate because sound is made by vibrating materials. It isn't true that the radio is vibrating because of the heat or the light from the radio.]
4. b. The sound stops. [If Shivanti turns off the radio, it will stop vibrating. Given the cause-and-effect relationship between sound and vibrations, if the radio stops vibrating, it means the sound must also stop.]
5. This question presents students with a scenario about William, who plays triangle in music class, and asks them to apply what they know about investigating sound and vibrations to questions about this specific scenario.
   5a. [This question asks students what they think will happen to the motion of the triangle after William taps it. Student response should demonstrate an understanding that all sound is made by vibrating

materials, which means the triangle has to vibrate to produce sound. This means the triangle will move back and forth quickly.]

5b. [This question asks students what evidence William can use to explain what happens to the motion of his triangle, and it provides students with the hint of thinking about how they use their senses. There are several ways that William can show what happens to the motion of his triangle. He can use his eyes to observe the back-and-forth motion. He can touch the triangle so he feels it. And he can use his ears to hear the sound, which is evidence of vibrations since all sound is made by vibrating materials.]

Student Reader Answer Key

Section 1 Review

1. [All sound is caused by vibrating materials. To vibrate means to move back and forth quickly.]
2. [Crickets make sound by rubbing their wings together. This action causes their wings to vibrate, which produces the chirping sound.]
3. [A person hears a cricket's chirping with their ears. When a cricket chirps, it makes vibrations. These vibrations move the air. That moving air reaches your ears. You hear the sound of chirping.]
4. [The main idea of Section 1 is that vibrating materials can make sound. This idea is supported with examples of different kinds of sound (such as crickets chirping, a person humming) and an explanation of what a vibration is.]

Section 2 Review

1. [When a person hits the two cymbals against each other, it makes the cymbals vibrate. These vibrations are what make the clashing sound of the cymbals.]
2. [Cymbals, drums, and kazoos are all musical instruments. They all make sound, so they all involve making materials vibrate.]
3. [Section 1 connects to Section 2 because both explore the relationship between sound and vibrating materials. Section 2 expands on that idea by exploring musical instruments.]

Unit 7: Appendix 2
Common Core Connections

The following Common Core standards are covered in this unit. Questions for the *Reading Informational Texts* standards provide an example of questions about the nonfiction student reader that link to different ELA standards. Additional questions are included in the section reviews. These types of questions can also be used with other texts. Other ELA standards are covered as students work through the reading, class dialogue, and hands-on portion of the lessons.

ELA Standards	Applying ELA Connections to the Student Reader
Writing	
W.1.7. Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).	• In Lessons 1 and 2, students use their nonfiction student readers as research for their sound investigations. Independently and in teams, students collaboratively use their research to help guide them as they carry out the investigations.
Reading Informational Text	
RI.1.1 Ask and answer questions about key details in a text.	• Why does your throat vibrate when you hum? [*All sounds are caused by vibrating materials. When you hum, your throat vibrates to make the sound of the hum.*] • Why do both crickets and people have ears? [*Ears are the parts of the body that sense sound. Without ears, we wouldn't be able to hear sounds.*] • What evidence is used in the reader that sound travels from one place to another? [*Page 6 of the reader explains how sound travels from a cricket making sound to a person's ears. The sound had to move from one place (the cricket) to another place (the person's ears).*]

RI.1.2. Identify the main topic and retell key details of a text.	• What is the main topic of Section 2: Making Music? [*The main topic of Section 2 is that different musical instruments make different kinds of sounds, but they all make sound when materials on them are made to vibrate.*] • How is the main topic supported with details? [*The text gives examples of three different musical instruments: cymbals, drums, and kazoos. It explains how each instrument makes sound when its materials are made to vibrate.*]
RI.1.3. Describe the connection between two individuals, events, ideas, or pieces of information in a text.	• What is the connection between people talking and crickets chirping? [*Both of these are forms of communication because they involve sharing information with others.*]
RI.1.7. Use the illustrations and details in a text to describe its key ideas.	• On page 7, there is a photo of two girls cooking and a photo of an insect. How are these photos similar? [*The photos show the different body parts that people and insects use to touch. People touch things with our skin, while insects touch things with their antennae.*] • On page 11, there is a picture of a woman playing cymbals. How would you describe what would happen right after she brings her two cymbals together? [*There would be a clashing noise because the two metal plates would start to vibrate, making sound.*]
RI.1.10. With prompting and support, read informational texts appropriately complex for grade 1.	• Students read the nonfiction student reader together as a class, making connections between examples in the reading and broader concepts, as well as individual experiences and observations.

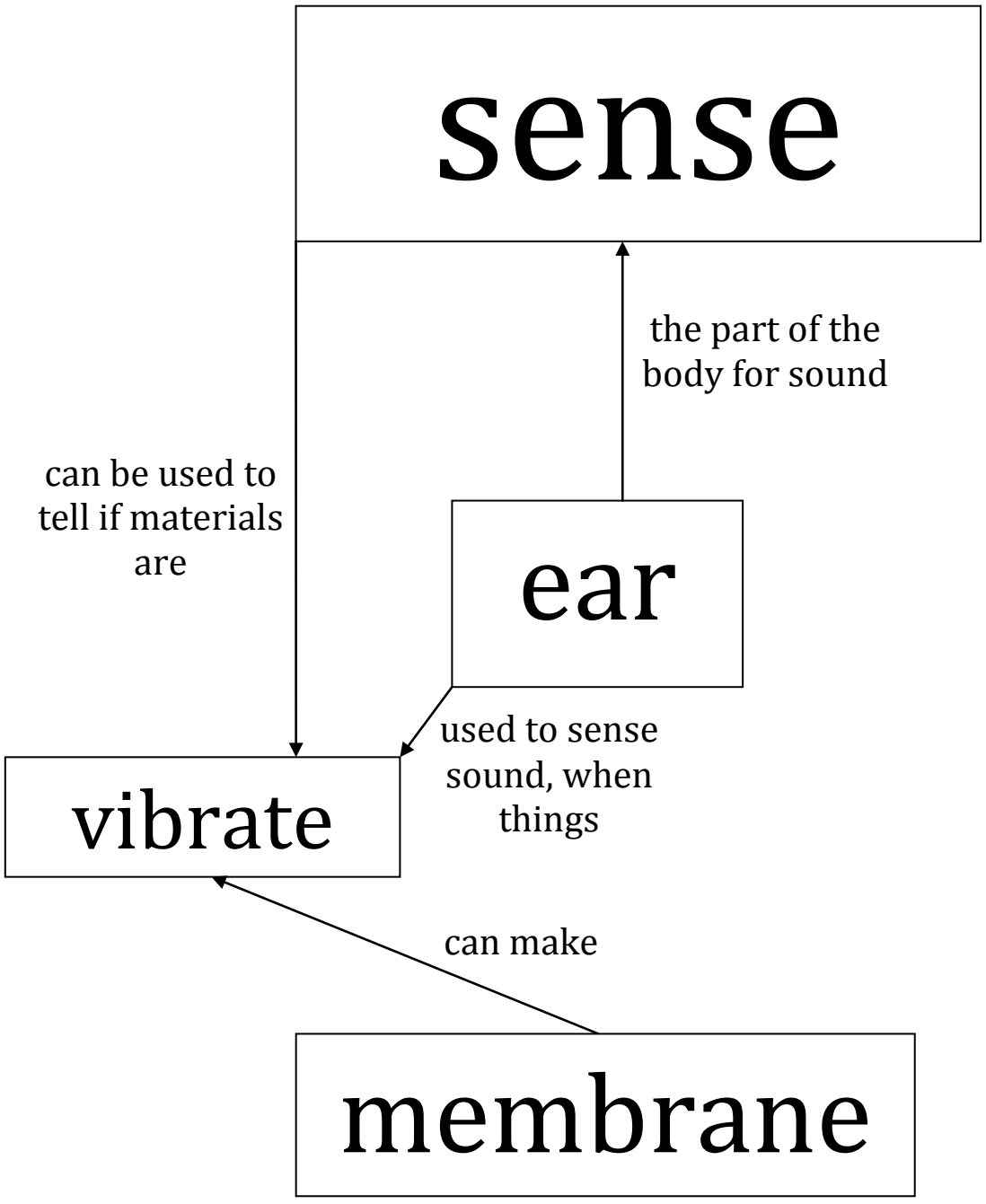
Speaking and Listening	
SL.1.1.A. Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).	• In Lessons 1 and 2, students engage in Socratic dialogue before beginning the sound investigations. Students follow agreed-upon rules whenever communicating with others. The dialogue portion of the lesson models for students how to carry out a dialogue with others, which they use as they work collaboratively in teams during the hands-on portion of the lessons.
SL.1.1.B. Build on others' talk in conversations by responding to the comments of others through multiple exchanges.	• In Lessons 1 and 2, students build on what other students have said during the Socratic dialogue, responding to the comments of others with their own observations and/or analysis. They practice these same skills in their teams, and then come together as a class to review the results of their investigations.
SL.1.2. Ask and answer questions about key details in a text read aloud or information presented orally or through other media.	• In Lessons 1 and 2, students read the nonfiction student reader together as a class. Students ask and answer questions about what they have read to ensure that there is comprehension of the text.
SL.1.4. Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.	• In Lessons 1 and 2, students practice communicating their ideas clearly, using their own observations, experiences, and examples from the reading to support their arguments presented during the Socratic dialogue, investigations, and wrap-up portions of the lessons.

SL.1.6. Produce complete sentences when appropriate to task and situation.	• In all of their spoken communications, students practice speaking in complete sentences so their ideas are communicated clearly and precisely.
Language	
L.1.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	• In Lessons 1 and 2, students practice speaking using standard English grammar and usage as they move from the Socratic dialogue to the investigations and then the wrap-up.

Use this chart to keep track of how you are connecting science to the rest of your curriculum.

Unit Connections to ELA Common Core	Unit Connections to Math Common Core	Unit Connections to History/Social Studies

Unit 7: Appendix 3
Sample Concept Map



Unit 7: Appendix 4
Support for Differentiated Instruction
Next Generation Science Standards

Core Expectation	KnowAtom Assessment Strategies	Possible Primary Evidence
1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	Low Entry Point • Identify when different materials are vibrating and when they are not vibrating. • Recognize that sound is made by vibrating matter. At Grade-Level Entry Point • Identify evidence that can be used to determine whether a material is vibrating. • Describe how an investigation can determine whether vibrating materials cause sound. • Describe how an investigation can determine whether sound can make matter vibrate.	• "Sound Investigation" completed by student • photos of student exploring the vibrations caused by a tuning fork and rubber bands • "Kazoos and Sound Investigation" completed by student

Unit 7: Appendix 5
Materials Chart

	Lesson	Quantity	Notes	Used Again
Unit Kit Consumable				
Goggles	all	1 per student	safety	✓
Plastic cups (16 oz)	1	1 per team of 2	for testing rubber bands	
Sand	1	shared bag	for testing sound and sand	
Bowls	1	1 per team of 2	for testing sound and water	
Plastic wrap	1, 2	shared roll	for observing sand and making kazoo membrane	
Rubber bands	1 2	1 per team 1 per student	for observing vibrations for securing kazoo membranes	
Cardboard tubes with holes	2	1 per student	for building kazoo	
Wax paper (shared roll)	2	1 sheet per student	for kazoo membrane	
Aluminum foil sheets	2	1 sheet per student	for kazoo membrane	
Non-Consumable				
Tuning forks	1	1 per team of 2	for observing sound vibrations	
Book: "All About Sound" by Lisa Trumbauer	1	teacher use	for circle-time dialogue	
Book: "Vibrations Make Sound" by Jennifer Boothroyd	2	teacher use	for circle-time dialogue	
Teacher Tool Kit				
Scissors	2	1 per student	for cutting kazoo materials	✓
Hand-outs				
Student readers	1,2	1 per student	for "Sound Investigation" and "Kazoos and Sound Investigation"	
Visuals	Download			
Lesson 1	Making Sounds Visual			
Lesson 2	Making Music Visual			