

THINKING AND ACTING LIKE A SCIENTIST

TEACHER'S GUIDE

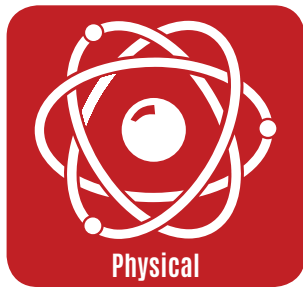
What's That Sound?

What can we observe about sound?

GRADE 1

Physical Science





What's That Sound?

Grade Level/Content	1/Physical Science
Lesson Summary	In this lesson, students will plan and conduct an investigation to discover that vibrating materials can make sound, and that sound can make materials vibrate.
Estimated Time	2, 45-minute class periods
Materials	Materials that can be vibrated to make sound, materials that can be vibrated by sound (see Investigation Plan Setup for options); Investigation Plan ; journal
Secondary Resources	<ul style="list-style-type: none"> • Sound Breaking Glass (:42) • How Your Ear Works (5:07) • Sounds All Around, by Wendy Pfeffer • All About Sound, by Lisa Trumbauer
NGSS Connection	1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
Learning Objectives	<ul style="list-style-type: none"> • Students will collaboratively develop an investigation plan and collect evidence that vibrating materials can make sound. • Students will collaboratively develop an investigation plan and collect evidence that sounds can cause materials to vibrate.
Cross-Curricular Project Connections	Do You Want to Build a Snowman?, Sing Your Heart Out

What can we observe about sound?

Sound seems like a pretty simple concept. Something makes a sound, and you hear it. But sound is quite powerful! Sound can be used as a weapon, firing a “beam” of sound at a target hundreds of meters away. It can be used to make art, by transferring the waves into a visible medium. It can even be used to fight crime! Some city officials are pumping classical music into high crime areas, as music has been shown to make people more docile and calm. With its widely varying uses, it’s important for students to understand how sound is made.

In this lesson, students collaboratively develop a lesson that allows them to observe sound and discover that vibrating materials cause sound, and that sound causes materials to vibrate. This fundamental principle sets the stage for students to later understand the concept of waves and their applications in technology for information transfer.

Investigation is based on the Van Andel Education Institute (VAEI) Instructional Model for Inquiry-Based Science. In all investigations:



Students don’t know the “answer” they are supposed to get.



Students play a driving role in determining the process for learning.



Teachers and students construct meaning together by journaling.



Students are working as hard as the teacher.

Part 1

INVESTIGATION SETUP

Students will need to collaboratively develop an investigation plan, so as a class you will decide what materials to use to show 1) that vibrations make sound, and 2) that sound makes things vibrate. You may direct the planning to use as many or as few materials as you'd like for each category. For more information on how to create each of these, see the [Instruction Sheet](#).

Materials to investigate...Vibrations Make Sounds	Materials to investigate...Sound Makes Things Vibrate
Guitar Box <ul style="list-style-type: none"> • Container with an opening (shoe box, plastic lid, food storage bowl, etc.) • Rubber bands (in different sizes) 	Dancing Beans <ul style="list-style-type: none"> • Sound (from a speaker or made by banging metal spoon against a metal pan) • Drum (or plastic wrap stretched tightly over a container) • Dry rice or beans
Bobby Pin Guitar <ul style="list-style-type: none"> • Blocks of Styrofoam (3 inches square) • Bobby pins 	Splashing Sound <ul style="list-style-type: none"> • Tuning fork • Bowl of water
Spoon Sound <ul style="list-style-type: none"> • Spoon 	Dancing Lasers <ul style="list-style-type: none"> • Metal can open on both ends • Balloon or plastic wrap • Small mirror • Laser pointer • Speaker
Human Sound <ul style="list-style-type: none"> • Your voice 	Dancing Paper <ul style="list-style-type: none"> • Speaker that paper can sit on top of • Piece of paper

Students will also need:

- [Investigation Plan](#)
- Journal

Part 2

INVESTIGATION FACILITATION



Question

Introduce the investigation question.

What can we observe about sound?

STUDENT ENGAGEMENT

Engage students in a discussion of how important sound is in our lives. You may conduct a survey of the class's favorite songs. Or you may show video clips of deaf people hearing sound for the first time. Explain that although sound is so important in our lives, we don't usually pay much attention to how sound is actually made. Then, introduce the investigation question.



Personal Knowledge

Students capture what they already know about sound.

- Find out what students already know about sound.
- Ask students to talk with a partner about different kinds of sounds.
- Call on several pairs to share their comments. (Examples may include: *cars honk, whistles blow, elephants trumpet, clocks tick, dogs bark, leaves crunch, kids yell, birds chirp, people sing, phones ring, etc.*)

DISCOURSE

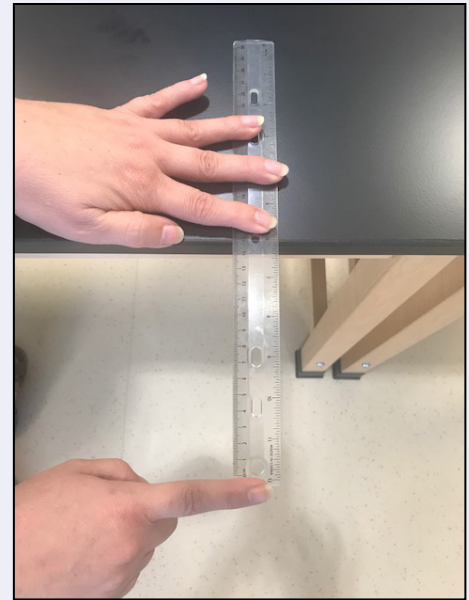
Have students think about what they know about sound. As students discuss with a partner, have them write words or draw pictures in their journal to capture their prior knowledge. Engaging in written and oral discourse helps students solidify their thoughts and prepare for new learning.



Secondary Knowledge

Students learn how to observe vibrations making sound.

- Prepare students to collaboratively develop an investigation plan by doing a demonstration to show them how to observe sound.
- Explain to students that we use our senses to observe things. Create a chart with 3 sections: *See, Hear, and Feel*. As you do the demonstration, you will record what students see, hear, and feel on the chart.
- Take a 12-inch ruler and place it on the edge of a table so that 6 inches are on the table and 6 inches extend beyond the table. With one hand, hold the ruler against the table at the 6-inch mark. With the other hand, push the ruler down, causing it to vibrate and make a sound.
- Call on students to come by individually to “play” the ruler. Ask them what they see (*the ruler moving up and down*), what they hear (*a quiet humming or buzzing sound*), what they feel (*the ruler moving against the hand that is holding it down*). (Caution children not to push too hard; plastic rulers can break.)
- If students have trouble hearing the sound, you may wish to take a slow-motion video of the demonstration. The slow motion captures the sound more clearly than in real-time.
- As you record observations, explain that the movement up and down is called *vibration*. Create a word wall and/or symbols for key concepts students may need to record their observations (*vibration, loud, soft, volume, pitch, etc.*).



Ruler Sound Demonstration

CURIOSITY

The goal of the demonstration is to provide just enough background knowledge for the students to be able to collaboratively develop an investigation plan. By not providing all the science concepts before the investigation, you replace confirmation with curiosity and discovery.

Students plan and conduct an investigation to determine what they can observe about sound.

Part 1: Vibrations Make Sound

- In Part 1 of the investigation, students will collaboratively plan an investigation to answer the question: What can we observe about vibrations that cause a sound? Display the materials available to investigate how vibrations make sound.
- Ask students which materials they think they can use to observe sound. (You do not have to use all the materials. Offer as much or as little choice as is appropriate for your class.)
- Divide the class into groups of 4 or 5 and give each group a set of materials.
- Explain that each group needs to create an investigation plan for how they will make a sound, play the sound, and observe the sound.
- Give each team an [Investigation Plan](#) template. Explain that this is a guide for their plan.
- Have teams play with the materials and discuss their plan. When they are ready, they can bring their written **Investigation Plans** to you for approval.
- If students struggle to write a plan, you may model filling in the **Investigation Plan** based on the ruler demonstration.
- When you approve a team's **Investigation Plan**, ask them to conduct their investigation.

INVESTIGATION PLAN
WHAT'S THAT SOUND?

Part 1: Vibrations Make Sound

Materials we will use to make a sound:

1. Make a sound by:

2. Play the sound _____ number _____ times.

3. Write or draw what you see, hear, and feel.

See	Hear	Feel

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Investigation Plan, Part 1

INVESTIGATION PLAN
WHAT'S THAT SOUND?

Part 2: Sound Makes Vibrations

Materials we will use to make a vibration:

1. Make a vibration by:

2. Make the vibration _____ number _____ times.

3. Write or draw what you see, hear, and feel.

See	Hear	Feel

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Investigation Plan, Part 2

CRITICAL THINKING

Use the [Fair Test](#) checklist to help students think critically about the investigation plan. Help them understand that a good investigation plan must include a test that is repeatable, generates quality data, and minimizes error. The more critically students think about their investigation plan, the more confident they can be in their results.

SHARED CONTROL

By having students collaboratively develop an investigation plan, they play a driving role in their own learning process. They learn how to find answers, which is often more valuable than the answer itself.



Observation

Students record their observations as they observe sound.

- Have students follow their **Investigation Plan** carefully and ensure they record their observations. They may write or draw their observations on the **Investigation Plan**.

PERSEVERANCE

Students may be challenged to figure out how to get their materials to make a sound and how to observe that sound. Resist the urge to rescue them when they feel challenged. Ask probing questions, such as: *Why do you think it's not working? Have you tried _____? Is the _____ able to vibrate in this setup?* Guide them to find solutions on their own.



Secondary Knowledge

Students learn how to observe sound making vibrations.

- Explain that just as vibrating materials can make sound, sound can cause materials to vibrate.
- Show students how sound vibrations turn liquid into solid with a cornstarch demo. Mix cornstarch and water into a liquid. Place plastic wrap tightly over a speaker and pour the cornstarch mixture on the plastic wrap. Play sound through the speaker and watch the cornstarch bounce and splash.
- In addition (or alternatively if you don't have the materials for the demo), show this 42-second [video clip](#) of sound causing a glass to vibrate and eventually break as a demonstration.
- Explain that the sound caused the glass to vibrate. The vibrations got so fast that the glass eventually broke.
- Create another chart with 3 sections: *See*, *Hear*, and *Feel*. Record what students observe about the video. They can share what they saw and heard, and they can imagine how the glass might have felt.



Investigation Plan

Students plan and conduct an investigation to determine what they can observe about sound.

Part 2: Sounds Make Vibrations

In Part 2 of the investigation, students will collaboratively plan an investigation to answer the question: What can we observe about sounds that cause vibrations?

- Display the materials available to investigate how sound makes vibrations. Offer as much or as little choice as appropriate to your class.
- Repeat the process in Part 1, asking students which materials they think they can use to observe sound, dividing the class into groups, and having them create an **Investigation Plan**. As in Part 1, have them bring you their written **Investigation Plans** for approval before conducting their investigations.



Observation

Students record their findings as they observe sound.

- Have students follow their **Investigation Plan** carefully and ensure they record their observations. They may write or draw their observations.

Part 3

INVESTIGATION ANALYSIS AND DEVELOPMENT OF CLAIM



Data Analysis

Students make sense of their data by organizing it and representing it visually.

Have students analyze their data. You may wish to use the [Data Analysis](#) prompt as a guide.

- Have students **evaluate** their data for trustworthiness. Did they follow their plan? Are they confident in their data?

Continued

- Then, have them analyze their data to find patterns and trends. They may **organize** the data and/or **represent** it visually to construct meaning. You may combine data across teams. You may tally how many times the class heard, felt, or saw something. You may want to graph those answers.
- Have students **interpret** what the identified patterns mean. They should see every time they made something vibrate, they heard a sound and every time they made a sound, something vibrated.
- Ensure students have enough data that it can be used as evidence to support a claim.



Secondary Knowledge

Students use secondary sources to help learn more about how we hear sound.

- Use these resources (or your own) to help develop students' understanding of sound.
 - [How Your Ear Works](#) (5:07)
 - [Sounds All Around](#), by Wendy Pfeffer
 - [All About Sound](#), by Lisa Trumbauer

After reviewing the books and videos, students should glean the idea that vibrating materials can make sound and that sound can make materials vibrate. They may also understand that sound waves travel through the air, into our ears, and to our brains.

CURIOSITY

When curious people learn new information, they continue to ask questions and make connections. Develop curiosity by encouraging students to share their learning from secondary resources using a *Fact-Question-Connection* format. They should share one fact they learned, one question they still have, and one connection from what they learned to something they already know, something they are interested in, or something another classmate said.



Explanation

Students write a claim and provide evidence and reasoning to support it.

- Have students use what they've discovered from their observations to write an explanation that answers their investigation question. You may wish to use the [Explanation](#) prompt as a guide. You may have them write their explanations in their journal or you can do a class explanation as a *Shared Writing* activity.
- Have students review the investigation question: What can we observe about sound?
- Have students develop a **claim** to answer the investigation question.
- Then, have them write down the **evidence** that supports their claim.
- Finally, have them add **reasoning** to their claim. Reasoning should include the information obtained from this investigation as well as science principles they have learned.

Claim

When I make a rubber band vibrate, I hear sounds. When I play a sound, I can make a piece of paper vibrate.

Evidence

We made a rubber band vibrate 5 times. All 5 times we heard a sound when it vibrated. We also played a sound on the speaker 5 times. All 5 times, the paper vibrated.

Continued

Reasoning

Investigation: We conducted 5 trials in Part 1 and 5 trials in Part 2. Every time we vibrated the rubber band we heard a sound. Every time we played the sound on the speaker, the paper vibrated. There was always a connection between vibration and sound.

Science: We learned from the video and class discussion that sounds are made from vibrations and that vibrations travel to our ears. We learned that sound causes materials to vibrate and vibrating materials cause sound.

- Once the explanation is written, have students discuss their results using a [Present and Defend](#).

DISCOURSE

Have students conduct a [Present and Defend](#) to develop presentation skills as well as audience participation. Research teams present a summary of their investigation to the class. The class analyzes the information presented and asks clarifying questions, challenges and/or supports the arguments made, and even presents alternative explanations as appropriate. Research teams defend their explanation with evidence and reasoning. If students are doing the same investigation plan, choose 1 or 2 groups to share.



Evaluation

Students reflect on the investigation.

Have students discuss:

- How could you make your investigation better?
- What surprised you?

Part 4

INVESTIGATION ASSESSMENT AND EXTENSION



Application

Students demonstrate understanding of the relationship between vibration and sound.

- Have students use tools and materials to design and build a device that uses sound to solve the problem of communicating over a distance (e.g., paper cup and string “telephones”)
- As a class, construct a device to see the [sound of your own voice](#).
- Study [10 Crazy Things You Can Do With Sound](#).

Assessment

Evaluate for how well:

- students collaboratively develop an investigation plan and collect evidence that vibrating materials can make sound.
- students collaboratively develop an investigation plan and collect evidence that sounds can cause materials to vibrate.

Take This Lesson Across the Curriculum

Do You Want to Build a Snowman?

Like Elsa in the movie *Frozen*, pretend you were confined to your room in the castle, separated from your brother or sister! What would life be like?

Reading/Language Arts	Math	Science	Social Studies
<p>Point of View</p> <p>Watch and discuss the movie, <i>Frozen</i>. Specifically, compare and contrast the experiences of Elsa and Anna.</p> <p>CCSS.ELA-LITERACY.RL.1.9</p>	<p>Is It Time Yet?</p> <p>Stuck in a room all day, how many times will you watch the clock? Show 5 different times of day. Draw what the clock looks like and write the time below.</p> <p>CCSS.MATH.CONTENT.1.MD.B.3</p>	<p>What's That Sound?</p> <p>Understand how to make sound so you can communicate with each other through the door.</p> <p>NGSS: 1-PS4-1</p>	<p>If Things Were Different</p> <p>How would your life be different living only inside the castle?</p> <p>NCSS: D2.Geo.4.K-2</p>

Sing Your Heart Out

You're invited to participate in a singing competition at the Sydney Opera House in Australia!

Reading/Language Arts	Math	Science	Social Studies
<p>Sing Out Loud</p> <p>Choral read the poem "Singing-Time" by Rose Fyleman. Use the poem to develop fluency and engage students in the idea of song.</p> <p>CCSS.ELA-LITERACY.RF.1.4.A</p>	<p>Stage Planning</p> <p>Select your song and plan your performance. Draw the stage and divide it into four quarters. Which parts of the song will you sing on which parts of the stage?</p> <p>CCSS.MATH.CONTENT.1.MD.A.2</p>	<p>What's That Sound?</p> <p>Understand how to make sound so you can check your vocal chords before the big performance.</p> <p>NGSS: 1-PS4-1</p>	<p>Blooming Onion</p> <p>Research the Sydney Opera House as a landmark of Australia.</p> <p>NCSS: D2.Geo.3.K-2</p>

For additional lessons or to customize this lesson, go to www.nexgeninquiry.org.



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INVESTIGATION PLAN

WHAT'S THAT SOUND?

Part 1: Vibrations Make Sound

Materials we will use to make a **sound**:

1. Make a sound by:

2. Play the sound _____ times.

number

3. Write or draw what you see, hear, and feel.

See	Hear	Feel

INVESTIGATION PLAN

WHAT'S THAT SOUND?

Part 2: Sound Makes Vibrations

Materials we will use to make a **vibration**:

1. Make a vibration by:

2. Make the vibration _____ times.
number

3. Write or draw what you see, hear, and feel.

See	Hear	Feel

INSTRUCTION SHEET

WHAT'S THAT SOUND?

Students should explore the materials and discover how to get them to make sound or make vibrations. Accept any setups that produce the sound or vibration. If students struggle, you can guide them toward one of the setups listed below.

Part 1: Vibrations Make Sound

<p style="text-align: center;">Guitar Box</p> <p>Materials:</p> <ul style="list-style-type: none">• Container with an opening (shoe box, plastic lid, food storage bowl, etc.)• Rubber bands (in different sizes) <p>Instructions:</p> <p>Wrap rubber bands around a container with an opening. Make sure the rubber bands fit tightly around the container. Pluck the rubber bands to see, feel, and hear vibrations.</p>	<p style="text-align: center;">Bobby Pin Guitar</p> <p>Materials:</p> <ul style="list-style-type: none">• Blocks of Styrofoam (3 inches square)• Bobby pins <p>Instructions:</p> <p>Open 3 or 4 bobby pins to about a 45 degree angle. Place one side of the bobby pin into the Styrofoam. Place the other bobby pins into the Styrofoam, about ½ inch apart. Pluck the part of the bobby pin that is sticking out of the Styrofoam to see, feel, and hear vibrations.</p>
<p style="text-align: center;">Sound Spoon</p> <p>Materials:</p> <ul style="list-style-type: none">• Metal spoon <p>Instructions:</p> <p>Place a spoon on a table, with the handle side on the table and the spoon side sticking off the table. Hold the spoon down at the edge of the table with one hand, and push/pluck the round part to see, feel, and hear vibrations.</p>	<p style="text-align: center;">Human Sound</p> <p>Materials:</p> <ul style="list-style-type: none">• Human voice <p>Instructions:</p> <p>Hold your hand over your throat. Talk or sing to feel the vibration of your vocal chords.</p>

INSTRUCTION SHEET

WHAT'S THAT SOUND?

Part 2: Sounds Make Vibrations

<p style="text-align: center;">Dancing Beans</p> <p>Materials:</p> <ul style="list-style-type: none">• Sound (from a speaker or made by banging metal spoon against a metal pan)• Drum (or plastic wrap stretched tightly over a container)• Dry rice or beans <p>Instructions:</p> <p>Create a drum by wrapping plastic wrap over a container. Place dry rice or beans on the plastic wrap. Play music loudly from a speaker or bang a metal pan near, but not touching, the drum. The sound causes the rice or beans to move.</p>	<p style="text-align: center;">Splashing Sound</p> <p>Materials:</p> <ul style="list-style-type: none">• Tuning fork• Bowl of water <p>Instructions:</p> <p>Strike a tuning fork against a table to make a sound. Place the tuning fork in the water while it is still making a sound. The sound causes the water to ripple and splash. The more quickly you add the fork to the water, the more dramatic the splash will be.</p>
<p style="text-align: center;">Dancing Lasers</p> <p>Materials:</p> <ul style="list-style-type: none">• Metal can open on both ends (Make sure can edges are smooth and not dangerous.)• Balloon or plastic wrap• Small mirror• Laser pointer• Speaker <p>Instructions:</p> <p>Create a drum by wrapping plastic wrap around one side of the metal can. Glue a small mirror onto the plastic wrap. Position the laser pointer so that it reflects off the mirror and onto a wall. Place a speaker at the open end of the can. Play music from the speaker and watch the laser light dance on the wall.</p>	<p style="text-align: center;">Dancing Paper</p> <p>Materials:</p> <ul style="list-style-type: none">• Speaker that paper can sit on top of• Piece of paper <p>Instructions:</p> <p>Place a speaker face up. Place a piece of paper on top of it. Play music from the speaker and watch the paper vibrate above the speaker.</p>