ELEMENTARY SCIENCE MADE EASY™

Activity-Based Curriculum That Meets Your Classroom Needs

All About Sounds and Vibrations

DEVELOPED BY: SCIENCE DELIVERED!

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Overview Sheet

INTRODUCTION

This unit teaches children about sounds and vibrations. It is aligned with the Next Generation Science Standards (NGSS). We align to Disciplinary Core Ideas (DCI), Crosscutting Concepts (CCC) and Scientific Practices.

This unit includes reading lessons with assessments, a song, and three interactive science activities for the students. For you, the teacher, we include science background, teacher keys, and suggested scripts with quick and easy demos.

Ideally, this unit supplements your regular science curriculum. This unit is a great place to begin for those just getting started with activity-based science.

NGSS: GRADE 1

DCI Standard 1-PS4-1

MATERIALS INCLUDED IN THIS UNIT

BEFORE YOU BEGIN

- **A** NGSS Standard Alignment
- **B** Science Background for Teachers

DAY 1 IN THE CLASSROOM

- **C1** Story and Assessment I: "Jackson Learns About Vibrations" and Teacher Key

DAY 2 IN THE CLASSROOM

- **C2** Story and Assessment II: "Jackson Learns Examples of Vibrations" and Teacher Key

DAY 3 IN THE CLASSROOM

- **C3** Story and Assessment III: "Jackson Learns that Sounds Are Vibrations" and Teacher Key

DAY 4 IN THE CLASSROOM

- **C4** Story and Assessment IV: "Jackson Creates Vibrations" and Teacher Key
- **D** Activity: "Your Voice and Vibrations" and Teacher Key

DAY 5 IN THE CLASSROOM

- **E** Activity: "Sounds in the Classroom" and Teacher Key

DAY 6 IN THE CLASSROOM

- **F** Teacher Demonstration: "Making Salt Bounce with Your Voice"

ADDITIONAL MATERIALS

- **G** Teacher Scripts

NGSS Standards Alignment

INTRODUCTION

Elementary Science Made Easy's unit "All About Sounds and Vibrations" is shaped around the NGSS DCI standard:

> ***1-PS4-1: Waves and Their Applications in Technologies for Information Transfer***
>
> *Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.*

In other words, students should:

- Understand that vibrating materials can make sound
- Understand that sound can make materials vibrate
- Plan and conduct investigations to provide evidence for these statements

CROSSCUTTING CONCEPTS

- Patterns
- Cause and Effect
- Scale, Proportion and Quantity
- Systems and System Models
- Energy and Matter
- Structure and Function
- Stability and Change

How to Talk About Crosscutting Concepts

Cause and Effect

Have students use the words *cause* and *effect* as they discuss sound. Discuss examples such as:

- If you knock two items together (cause) a sound will be produced (effect).
- If you knock together two metal items (cause) you might create a ringing sound (effect).
- If you whisper (cause) you will make a quiet sound (effect), and if you yell (cause) you will make a loud sound (effect). (The physical act of creating the whisper or yell is the cause.)

Scale, Proportion and Quantity

- Sounds have different levels of loudness, which is measured on the decibel scale.
- Hitting something softly will produce a soft sound, while hitting something harder will produce a loud sound. Therefore, the loudness of the sound you create is often *proportional* to the movements you made to produce it.

In this unit, we focus on suggestions for how to talk about Cause and Effect and Scale, Proportion, and Quantity. However, remember that other crosscutting concepts also fit this material.

NGSS Standards Alignment *continued*

SCIENTIFIC PRACTICES

- Asking questions
- Constructing explanations and designing solutions
- Obtaining evaluating and communicating information
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

How to Integrate Scientific Practices

Asking Questions

- Have students tell you what they are wondering about at different point of the lessons and activities. What do they want to know?
- Remind students that science is about asking questions.

Constructing Explanations and Designing Solutions

- Have students explain why different noises sound different. (Answers: Some sounds are loud; some are quiet. Some are high-pitched; some are low-pitched. Different materials will create different types of sound, etc.).
- Have students explain why they can hear sound waves/vibrations. (Answer: Vibrations move their eardrums. The eardrums tell their brain that they heard a sound).
- Remind students that scientists make explanations for things they study and discover.

In this unit, we focus on suggestions for how to talk about Asking Questions and Constructing Explanations. However, remember that other scientific practices also fit this material.

Science Background for Teachers

AN OVERVIEW OF SOUND

Sound and sound waves are one of those topics that seem more complicated to learn than they actually are. With clear instruction even first graders can understand what sound *is*.

What *is* sound?

Well, all sounds are created from vibrations. One might even say that sounds *are* vibrations. When people talk about "sound waves" they are talking about the vibrations that travel through the air (or water, or other materials).

What *creates* sound?

Vibrations are created from two objects hitting, your voice, or even moving air. All these things create vibrations in the air. The vibrations travel through the air and into your ear.

How do you hear sounds?

Inside your ear sound vibrations vibrate your *eardrum*. The eardrum is thin and easy to vibrate (think of a trampoline). When your eardrum vibrates, your ear sends signals to your brain that it heard a sound.

Close-up photograph of an eardrum.

IMPORTANT DEFINITIONS

Vibration: A back and forth movement. These movements can occur in an object (like a washing machine on the spin cycle) in water, or in air.

Sound Wave: Vibrations that travel through air, water and other materials.

Eardrum: A membrane in the ear that vibrates in response to sound.

Amplitude: The amplitude of a sound is related to how loud it is. Sounds with bigger amplitudes are louder.

Decibel: The unit that describes the loudness of a sound. For reference, a whisper would be around 20 decibels (dB), normal talking is about 50 dB and a blender about 80–90 dB.

Pitch: A word used to describe how high or low a sound is. For example, nails on a chalk board are high-pitched, and a burp is low-pitched. In an instrument like a xylophone, longer keys make low-pitched sounds, and shorter keys make high-pitched sounds.

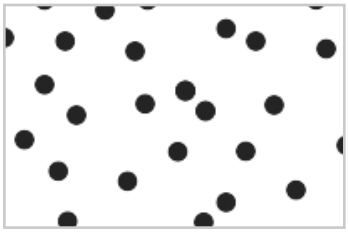
Speed of Sound: Sound travels at 741 mph in air. This is much, much, much slower than light, which travels at 670 million miles per hour.

SOUND: THE NITTY GRITTY

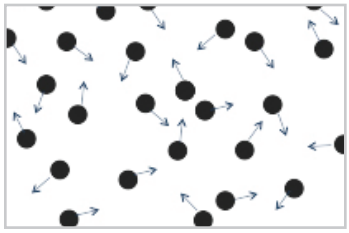
Let's back up so we can fully understand sound, sound waves and vibrations.

First, remember that air is made of small molecules. These molecules can be moved and pushed around. (The force from air molecules can be strong—think of wind knocking down a tree).

Let's say you hit a table with a spoon. The force from the spoon hitting the table creates small movements, or vibrations, in the table and the spoon. The vibrations in the spoon and table



Air is made of molecules. You can think of air as being made of tiny invisible balls, like above.



Air molecules are always moving. The movement is shown in this picture with arrows.

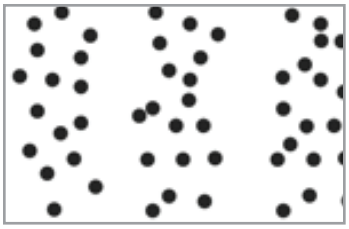
All About Sounds and Vibrations

Science Background for Teachers *continued*

vibrate the air molecules right around the spoon and table. Those air molecules in turn vibrate the molecules around them, and so on.

When vibrations travel through the air, it pushes the air molecules back and forth in a wave like- pattern. Air molecules get *compressed* in some places and spread out in other. These sound waves move through the air in the same way that a wave moves through a slinky.

The movements, or vibrations, created by the force of the spoon hitting the table can travel quite a long distance through the air. But the farther you get from the source of the sound, the weaker the vibrations will get. To visualize sound waves, imagine ripples in water. Like ripples, the sounds waves will get smaller and smaller in size or *amplitude* before they die out.



In this figure, each dot represents an air molecule. Vibrations traveling through the air create patterns like the one shown here. The air molecules are pushed, or compressed together by the sound wave in repeating patterns.

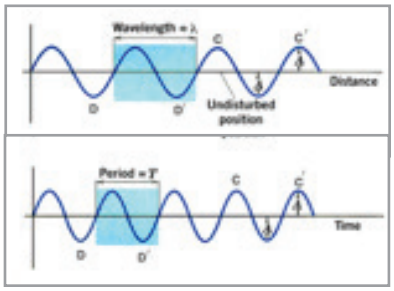
Looking at ripples in the water can help us envision how sound waves move through air.

The easiest way to describe sounds with young children is to discuss loudness and pitch. On a xylophone, for example, short keys will produce a higher pitch, and long keys will produce a lower pitch. All other things being equal, on a guitar or other string instrument, thick strings will produce lower pitches and thin strings will produce higher pitched sounds.

Pitch is determined by the *frequency* of the sound waves. A high frequency wave creates higher sounds and a lower frequency wave produces lower sounds. (No need to discuss frequency with first graders.)

Another quality of sound is the *timbre*. Timbre is harder to describe and can also be called the "tone quality" or "tone color" of a sound. For a real life example, a piano and violin can both produce sounds with the same loudness and pitch, but the sounds still sound different. This difference would be referred to as different timbres.

Note that sound waves are often represented by graphs like the one to the right. However, this graph only represents features of the wave, it is *not* how the actual sound waves look when they move through the air.



Features of sound waves are often put in graphs like these. This is *not* what the sound waves actually look like.

RELATING SOUND TO REAL LIFE

Burst Eardrum

Have you ever heard of a burst eardrum? Burst eardrums can happen in response to very loud sounds. Loud sounds create big vibrations. When the vibration is *too* big it can stretch the eardrum to the point of ripping, or popping.

The Loudest *Known* Sound Ever on Earth

The Krakatoa volcanic eruption in 1883 was so loud you could hear it 3,000 miles away. That is greater than the distance from California to New York. Needless to say, sound this loud would kill you. Even 40 miles away, this sound popped people's eardrums.

No Sound in Space

A lot of kids have heard that there is no sound in space, and this is correct! The reason is that there is no air or atmosphere in space. As we have learned, sound moves through air by vibrating through it. Sound *needs* molecules to vibrate, or the vibrations will not spread. Because there are very few air molecules in space to vibrate, sound will not travel. (There will be sound on some planets because some planets have atmospheres).

Dog Whistles

Sounds are simply vibrations traveling through the air. There are vibrations that travel through the air that we cannot hear, they just do not stimulate our eardrums in the right way! Dogs can hear sounds at higher frequencies (higher-pitched) than humans can. This is why dogs can hear a high-pitched dog whistle but humans cannot.

Over time, most people suffer some hearing loss. The most easily damaged part of our ear are those that respond to high frequency sounds. Therefore, many kids can hear high frequency sounds that adults cannot hear.

All About Sounds and Vibrations

Science Background for Teachers *continued*

Sound in Water

Although most of the time we hear sounds that are traveling through air, sound can travel through water too. Think about it—water can vibrate and sounds are vibrations, so sound can travel through water. However, when your ears are submerged under water, the sound will be distorted compared to what you are used to hearing.

COMMON MISCONCEPTION

Kids might think sound cannot travel through materials. Show them that sound can travel through "stuff" by closing the door to your classroom and yelling "Hello" to them. Can they hear you? This is because the sound literally vibrated the door, and then vibrated the air on the other side of the door. (Of course, "sound-proof" materials will not transmit sound.)

RESOURCES

Articles

Wait, But Why (great graphics of sound waves): https://waitbutwhy.com/2016/03/sound.html

Decibel Comparison Chart (great, if slightly advanced, overview of sound, excellent pictures to show sound waves): https://ehs.yale.edu/sites/default/files/files/decibel-level-chart.pdf

Loudest Known Sound on Earth: https://kottke.org/14/10/the-worlds-loudest-sound and https://fivethirtyeight.com/features/the-loudest-sound-in-the-world-would-kill-you-on-the-spot/

Video

NASA segment on sound. Around 3:15 has a nice animation of vibrations in the ear: https://www.youtube.com/watch?v=_ovMh2A3P5k

Goes over parts of the ear (some advanced vocabulary): https://www.youtube.com/watch?v=HMXoHKwWmU8

More Fun Sound Activities

Spoons on a string: http://www.metrofamilymagazine.com/October-2014/Simple-Science-Experiment-The-Ringing-Spoon

Rubber Band Guitar (this can be done in a simple way—by just putting rubber bands on open boxes—or a more complicated way, as shown in this link): https://diy.org/skills/instrumentmaker/challenges/8/make-a-string-instrument

Sound eggs—fill them with anything! http://homelearningfrombirth.blogspot.co.uk/2010/08/sound-eggs.html

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Eardrum: Michael Hawke MD CC BY-SA 4.0 https://en.wikipedia.org/wiki/Eardrum#/media/File:TM_RIGHT_NORMAL.jpg

Sound Waves: Kulayada - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=39787509

STORY AND ASSESSMENT I

Jackson Learns About Vibrations

READ THE SHORT STORY

"Boom, boom, boom!" went the music coming from the speakers. Jackson's school was having a fun outdoor party and the music was very loud! Jackson noticed that the front of the speakers seemed to move as the music played. This made him very curious.

"Ms. Rodriguez," Jackson said, "why do the speakers look like they are moving?"

"That's a great question Jackson!" Ms. Rodriguez said. "The speakers ARE moving. They are *vibrating*."

"What does "vibrating" mean?" asked Jackson.

"That's a great question, Jackson!" Ms. Rodriguez said. "Vibrations are a certain kind of movement. A vibration happens when something moves back and forth really fast."

"Vibrations sound really cool, Ms. Rodriquez," said Jackson. "Can we make our hands vibrate?"

"That's a great idea, Jackson," said Ms. Rodriguez. "Let's all move our hands back and forth really quickly to mimic a vibration!"

All About Sounds and Vibrations Worksheet

C1

NAME _____ DATE _____

ANSWER EACH QUESTION

1. What is a vibration?

(Hint: Ms. Rodriguez in the story tells us what it is.)

_____

_____

_____

_____

2. Circle one:

I understand what vibrations are.

I still need help understanding vibrations.

Jackson Learns About Vibrations

TEACHER KEY

ANSWER EACH QUESTION

1. What is a vibration?

(Hint: Ms. Rodriguez in the story tells us what it is.)

A vibration is when something moves back and forth really fast.

- OR -

A vibration is when something shakes really fast.

2. Circle one:

I understand what vibrations are.

I still need help understanding vibrations.

STORY AND ASSESSMENT II

Jackson Learns Examples of Vibrations

READ THE SHORT STORY

Jackson walked into his classroom the day after the school's fun party. He was thinking about *vibrations*.

"Ms. Rodriguez," Jackson said, "I starting to understand what a vibration is, but I'm still a little confused. Can you give me an example of something that vibrates?"

"Of course." said Ms. Rodriguez, "I have a great example. Have you ever sat in a car while it's not moving but the engine is on?"

"Yes I have Ms. Rodriguez!" said Jackson. "When we are stopped at a red light I can feel the car moving a little. Are those vibrations?"

"Yes, that small movement you feel is the car *vibrating*."

"I have another example!" said Jackson. "Sometimes our laundry machine moves back and forth really fast. Is that a vibration?"

"Yes, Jackson! Washing machines often vibrate."

"Let's think of other examples of vibrations as a class." Jackson said.

"Great idea." said Ms. Rodriguez. "What examples of vibrations can YOU think of?"

All About Sounds and Vibrations Worksheet

C2

NAME _____ DATE _____

ANSWER EACH QUESTION

1. What is one example of a vibration **written in the story**?

_____

_____

_____

_____

2. Circle the examples below where the object is vibrating:

A stopped car with the engine on

Water in a dish

A plucked guitar string

A speaker playing music

A cell phone ringing "on vibrate"

A rainbow

A cloud in the sky

A drum while you play it

Jackson Learns Examples of Vibrations

TEACHER KEY

ANSWER EACH QUESTION

1. What is one example of a vibration **written in the story**?

There are two examples in the story:
1. Laundry machine moving back and forth really fast (during the spin cycle)
2. A car with the engine on, but not moving

Note: Kids with hybrid vehicles might not be as familiar with the latter phenomenon.

2. Circle the examples below where the object is vibrating:

A stopped car with the engine on

Water in a dish

A plucked guitar string

A speaker playing music

A cell phone ringing "on vibrate"

A rainbow

A cloud in the sky

A drum while you play it

Note: All objects can vibrate. However, we give no indication that the "Water in a dish" or the "cloud in the sky" are vibrating, so they should not be circled. If a child points out that these objects are capable of vibrating, they are exhibiting deep thinking! A rainbow is made of light and cannot be vibrated by sound waves.

STORY AND ASSESSMENT III

Jackson Learns that Sounds Are Vibrations

READ THE SHORT STORY

Jackson had been having so much fun learning about vibrations.

"Attention Class!" said Ms. Rodriguez. "Today we will be talking about sound and vibrations." Jackson was so curious about what Ms. Rodriguez had to say.

"We all know about sounds. A sound is something you hear. But what exactly IS a sound?" Ms. Rodriguez asked.

Jackson thought about it. He knew he could hear sounds, but he couldn't see sounds, or hold a sound in his hand. So what was a sound?

"A sound," Ms. Rodriguez said, "is a vibration."

"A sound is a vibration? What?" asked Jackson.

"Yes!" said Ms. Rodriguez. "Vibrations travel through the air and into your ears. So when you hear sounds, in a way, you are hearing vibrations!"

"But I don't see any vibrations in the air," said Jackson.

"That's true!" said Ms. Rodriguez. "The vibrations traveling in the air are invisible. You can't see them."

"Wow," said Jackson, "I didn't know that sound was so interesting!"

All About Sounds and Vibrations Worksheet

C3

NAME _____ DATE _____

ANSWER EACH QUESTION

1. Are sounds vibrations? Answer in a complete sentence.

_____

_____

2. Have your teacher help you fill in the blanks:

Sounds are _____ that travel through the _____ and into your _____.

SING THIS SOUND AND VIBRATION SONG

To the tune of "Twinkle, Twinkle Little Star":

VERSE 1

Vibrations, vibrations all around,
They move through the air and ground
What stuff vibrates? So many things!
Like phones and drums and guitar strings.
Vibrations, vibrations all around,
Vibrations are what give us sound.

VERSE 2

Noises, noises in the air
I hear noises everywhere
Sounds come from vibrations and that is great
Sounds in the air make my eardrums vibrate
Vibrations, vibrations in the air
I hear vibrations everywhere

All About Sounds and Vibrations Worksheet

Jackson Learns That Sounds are Vibrations

TEACHER KEY

ANSWER EACH QUESTION

1. Are sounds vibrations? Answer in a complete sentence.

Yes, sounds are vibrations.

2. Have your teacher help you fill in the blanks:

Sounds are *vibrations* **that travel through the** *air* **and**

into your *ears*.

Note: Sounds and vibrations can travel through water and other materials, but most commonly the sounds you are hearing travel through air.

SING THIS SOUND AND VIBRATION SONG

To the tune of "Twinkle, Twinkle Little Star":

VERSE 1

Vibrations, vibrations all around,
They move through the air and ground
What stuff vibrates? So many things!
Like phones and drums and guitar strings.
Vibrations, vibrations all around,
Vibrations are what give us sound.

VERSE 2

Noises, noises in the air
I hear noises everywhere
Sounds come from vibrations and that
is great
Sounds in the air make my eardrums vibrate
Vibrations, vibrations in the air
I hear vibrations everywhere

STORY AND ASSESSMENT IV

Jackson Creates Vibrations

READ THE SHORT STORY

Jackson had been thinking about sounds and vibrations. He was thinking of how he could make sounds by talking. So was he making vibrations with his voice?

"Ms. Rodriguez, do we make vibrations when we talk?" Jackson asked.

"We do make vibrations when we talk," said Ms. Rodriguez. "In fact, you can feel the vibrations with your fingers! Take your thumb and index finger and gently place them on the bump on your throat. Now go "hmmmmmm".

Jackson went "hmmmmmm".

"Do you feel the vibrations?" asked Ms. Rodriguez. Jackson did feel the vibrations, it was so cool!

"Now go 'ahhhhhhh,'" said Ms. Rodriguez.

"Ahhhhhhhh," said Jackson.

"When you speak," said Ms. Rodriguez, "you make vibrations which travel through the air. Those vibrations will travel into your ears and other peoples' ears so they can hear you!"

"I can't believe how much I've learned about sound and vibrations," said Jackson.

All About Sounds and Vibrations Worksheet

C4

NAME _____ DATE _____

ANSWER EACH QUESTION

1. Do you make vibrations when you talk? Answer in a complete sentence.

_____

_____

2. Do you make vibrations when you cough? Answer in a complete sentence.

_____

_____

3. How do you know you make vibrations when you talk or cough?

_____

_____

_____

_____

Jackson Creates Vibrations

TEACHER KEY

ANSWER EACH QUESTION

1. **Do you make vibrations when you talk? Answer in a complete sentence.**

   Yes, I make vibrations when I talk.

2. **Do you make vibrations when you cough? Answer in a complete sentence.**

   Yes, I make vibrations when I cough.

3. **How do you know you make vibrations when you talk or cough?**

   I know I make vibrations when I talk or cough because I'm making sounds and sounds are made of vibrations.

   Note: Students may need help to answer this question, however it's useful for them to start to learn how to reason and use logical thinking.

NAME _____ DATE _____

Your Voice and Vibrations

Attention Junior Scientists! You have learned that sounds are vibrations. You can make sound with your voice. Does this mean you are making vibrations with your voice? Find out with this activity.

DIRECTIONS

1

2

1. **Make a "L" with your hand, like in the picture to the right.**
2. **_Gently_ place your three fingers on the "bump" in your throat.**
3. **Say: "Ahhhhhhh"**
4. **Say: "Ohhhhhhh"**
5. **Say: "Eeeeeeeee"**
6. **What do you observe? Write down your observations.**

_____

_____

7. **Say: "I like to do science."**
8. **Say: "Sounds are vibrations."**
9. **What do you observe? Write down your observations.**

_____

_____

Your Voice and Vibrations

TEACHER KEY

LEVEL 1

Why It's Easy for You

- Students use their own bodies for the activity—no materials required.
- Worksheets are ready to print.

Conditions and Challenges

- Classroom will get noisy. It's a sound lab after all!

Attention Junior Scientists! You have learned that sounds are vibrations. You can make sound with your voice. Does this mean you are making vibrations with your voice? Find out with this activity.

DIRECTIONS

1. **Make a "L" with your hand, like in the picture to the right.**
   Demonstrate this to students.
2. ***Gently* place your three fingers on the "bump" in your throat.**
   Students have to bend their fingers to place their hands on their throat.
3. **Say: "Ahhhhhhh"**
4. **Say: "Ohhhhhhh"**
5. **Say: "Eeeeeeeee"**

1

2

All About Sounds and Vibrations Worksheet

6. What do you observe? Write down your observations.

Help students observe that their throat vibrates *as they make sounds. Remind them that those vibrations travel through the air and into their ears and other people's ears to make sounds. Students can write "I observe that I feel vibrations when I make noises". They might also be interested in their "Adam's Apple" moving up and down.*

We encourage students to learn the word "observation". You can describe an observation as something you see or hear and think about. *(We are always seeing and hearing things, but the things you truly observe are those you pay attention to).*

7. Say: "I like to do science."

8. Say: "Sounds are vibrations."

9. What do you observe? Write down your observations.

Help students observe that when they say words, like when they made the sounds in steps 3–5, their throat vibrates. Students may also have other observations they wish to write about.

+ **Suggested follow-up:** Teacher Scripts—Section G, Page 1, Script 1: Sounds and Materials

NAME _____ DATE _____

Sounds in the Classroom

Attention Junior Scientists! Different materials can make different types of sounds. Let's explore the *sounds* of different materials in the classroom!

DIRECTIONS

1. **Pick two items from around the classroom. You will use these items to make sounds.**
2. **Fill in the blanks below.**

The name of my first item is _____.

My first item is made from the material _____.

The name of my second item is _____.

My second item is made from the material _____.

3. **Follow the instructions:**

A. Take your first item and gently tap it against the table.
B. Listen for the sound.
C. Talk about the sound with your partner.

D. Take your second item and gently tap it against the table.
E. Listen for the sound.
F. Talk about the sound with your partner.

All About Sounds and Vibrations Worksheet

4. Were the sounds you made with your first and second items similar or different? How so?

_____

_____

_____

_____

+ Extra Exploration: What else do you want to explore with sound? Write down something you want to try, a question you have, or an extra experiment you did. You can even draw a picture!

_____

_____

_____

Sounds in the Classroom

TEACHER KEY

LEVEL 2

Why It's Easy for You

- Students use materials from around the classroom.
- Worksheets are ready to print.

Conditions and Challenges

- All students are engaged in the activity, so more classroom management. Classroom might get noisy—it's a sound lab, after all!

Before You Begin

- Students should know information in Teacher Scripts 1–3 before starting this lab.

Tips

- If students have questions and interests beyond the scope of the lesson go with it! Encouraging students to follow their curiosity helps them learn and retain knowledge.

Attention Junior Scientists! Different materials can make different types of sounds. Let's explore the *sounds* of different materials in the classroom!

DIRECTIONS

1. **Pick two items from around the classroom. You will use these items to make sounds.**

   Directions to give students:

   1. Students can work in groups of two.

   2. Items should be something they can hold at their desk (if they are interested in exploring a leg of a desk or chair or some other large item, they can incorporate that in the Extra Exploration section at the end.)

   3. Suggest to them that they get two items that are different from each other.

   4. Encouarge them to use "Science Language" as they work with their partners. Use words like "materials", "volume" and "pitch".

   Suggestions for materials: Recycled Paper, book, pencil, crayon, eraser, scissors, hair clip, fabric (from sweatshirt, coat etc.), finger, hand, fingernail.

All About Sounds and Vibrations Worksheet

2. Fill in the blanks below.

If an item is made of two materials, have students write down both. For example, a hair clip might be metal and plastic. (Note: Hardcover books are usually made of cardboard, wrapped in cloth or paper.)

The name of my first item is *crayon, pencil, book, etc.* _____.

My first item is made from the material *wax, wood, paper, etc.* _____.

The name of my second item is *crayon, pencil, book, etc.* _____.

My second item is made from the material *wax, wood, paper, etc.* _____.

3. Follow the instructions:

A. Take your first item and gently tap it against the table.

B. Listen for the sound.

C. Talk about the sound with your partner.

Students can talk about the sounds being loud or quiet, or the pitch *being high or low. They can compare the sounds to other sounds they've heard before.*

While students should stay on task in terms of exploring sounds, if they become curious about other aspects of sound encourage their exploration! *The objective of these activities is to spark student interest and curiosity. For example, if students start tapping the material against their hands, and comparing that to the sound of tapping against the table, that is a good outcome for this activity. Another good outcome would be students crinkling a piece of paper to hear the sound that it made.*

D. Take your second item and gently tap it against the table.

E. Listen for the sound.

F. Talk about the sound with your partner.

4. Were the sounds you made with your first and second items similar or different? How so?

Students can talk about the sounds being similar or different pitch (high or low) or volume. They can compare the two sounds to different or similar sounds they have heard before.

+ Extra Exploration: What else do you want to explore with sound? Write down something you want to try, a question you have, or an extra experiment you did. You can even draw a picture!

This is a place where students can explore their curiosity and/or write down questions they have. Based on how the activity went, you can customize the final instruction for this section. For example, let's say the class became very curious about how it would sound if they all clapped at the exact same time. You could run that activity and then have all the students write about what they observed about the sound. Alternatively, each student could do their own investigation on something they became interested in during the earlier experiments. Another idea is having each student write a question they have, and then you can address some questions as a class—or encourage the students to answer to the questions at home with their parents.

TEACHER DEMONSTRATION

Making Salt Bounce with Your Voice

LEVEL 2

OVERVIEW

The teacher makes salt bounce using only his/her voice.

LEARNING OBJECTIVE

Students **see** the vibrations that are created by sound and by your voice.

Materials

- Condiment cup (like you put ketchup in at a fast food place) *Alternatives: a glass jar, baby food jar, dixie cup or other cup*
- Balloon
- Scissors
- Rubber Band
- Salt
- Bowl *(optional—keeps things cleaner)*
- Plastic Wrap *(optional)*

Summary

First you will make a "eardrum-like" device. The balloon will serve as a "membrane" pulled over the top of the condiment cup. You will then place salt on this device, and yell near it to make the salt bounce.

Why It's Easy for You

- You do the demo
- An elegant demonstration of concepts
- Materials are inexpensive
- Scripts are included where appropriate (indicated by the purple dots.)

Conditions and Challenges

- You need multiple materials
- The "device" can be tricky to make
- You need a document camera

INSTRUCTIONS

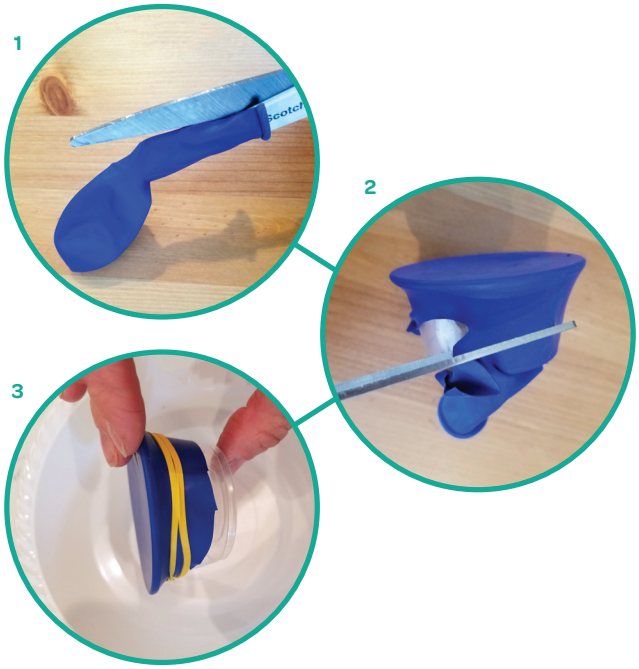
Making your device

1. Use scissors to cut along one side of the balloon, about 2/3 of the way to the top, as shown in the picture. **Leave enough of the balloon intact so that it can cover your cup.**

2. Stretch the balloon across the top of the condiment cup, as shown in the picture. The balloon should be taut and flat across the opening of the condiment cup.

3. Secure the balloon around the cup with a rubber band. Make sure the rubber band is the right size to keep the balloon secure.

4. Adjust the tightness of the balloon so that it's taut and flat across the top.



Making Salt Bounce with Your Voice *continued*

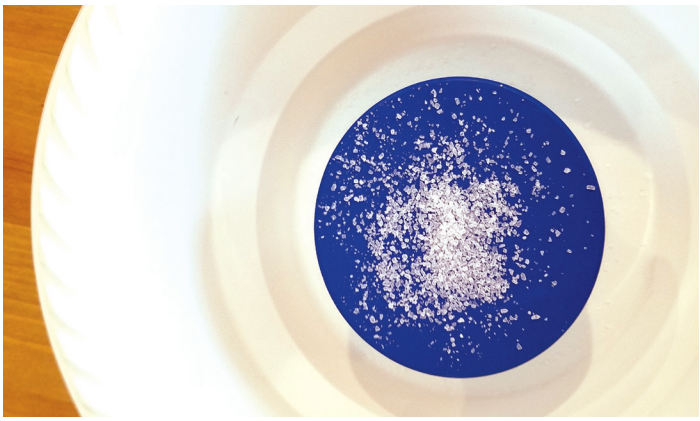
Making the Salt Bounce

5. If you prefer to keep things tidy, place your device in a bowl.

6. Place the device in the bowl under the document camera, so the class can observe.

Script A

Here I have a condiment cup, the type you might put ketchup into in a fast food restaurant. I stretched a balloon over this cup, you can see the balloon is held tight with a rubber band. This is a lot like a trampoline, or a drum. Or—your eardrum!



7. Sprinkle some salt on the balloon. You want enough salt that it is visible, but not so much that it weighs the balloon down (see image above).

8. Cup your hands around your mouth and "yell" directly towards the balloon membrane. We recommend a low, strong yell; try to mimick a fog horn.

9. What happened? You should see the salt bouncing.

Script B

When I yelled, the sounds, or the vibrations, came out of my throat, traveled through the air, and *vibrated* the balloon. When the balloon vibrated, it made the salt bounce. I actually made something move using only my voice!

Blowing Vs. Vibrating

10. Ask students "Do you think vibrating the salt with sound will look different than blowing on the salt?"

11. Gently blow on the salt.

Script C

When I blew on the salt, all the salt moved in one direction. Basically I made *wind* that moved the salt. This is different than moving the salt with my voice.

When I moved the salt with my voice, I vibrated the balloon up and down (show with hands), so the salt also bounced up and down.

Making Salt Bounce with Your Voice *continued*

Sound Moving Through Materials

Note: You need plastic wrap and bowl for this part.

12. Place the plastic wrap over the top of the bowl. Make sure the salt is still visible on the overhead projector.

13. "Yell" in a low, strong voice again at the salt/balloon device. The salt should bounce.

14. Test if you can *blow* the salt through the plastic wrap. The plastic wrap will block the wind.

Script D

Hold up a piece of plastic wrap.

Do you think that if I put this plastic wrap over the top of the bowl that I will still be able to make the salt move with my voice?

Can sound go through plastic wrap?

Let kids answer—there is often some disagreement on this. Don't tell them the answer yet!

Before I see if we can make the salt bounce through the plastic wrap, lets see if sound can travel through a door. What do you think? Can sound travel through the door?

Let the kids answer. Go outside and close the door. Yell through the door, give the kids a question they can answer. (e.g. "Can you hear me?"). Come back inside.

Did you hear me through the door? Since you could hear me through the door, did sound travel through the door?

Proceed with the following steps to provide the answer.

Suggested Script E

The plastic wrap blocked the *wind* but not the *sound*. That is because the sound actually vibrated the plastic wrap! The sound and vibrations traveled through the plastic and vibrated the balloon to make the salt bounce. When I blew on the plastic however, I created wind. The plastic blocked the wind.

Making Salt Bounce with Your Voice *continued*

HANDS-ON STUDENT ACTIVITY

Feeling ambitious? Make a bunch of these devices and let the kids try them out! You might be worried about the children yelling, but we have done this activity successfully in dozens of classrooms. With the right preparation, the children behave nicely. When it gets too noisy, we simply end the activity.

Materials for Each Pair of Children

- One balloon/cup device
- One bowl
- One small container of salt (we use condiment cups)

Note: Remind students they are not to eat the salt.

Instructions for Children

1. Instruct the students to be ***gentle*** with the balloon device. They can ***gently*** tap their finger to make a drum sound. They may ***not*** press roughly on the balloon, or dig their fingers into the balloon.
2. The students should yell, not scream. The difference is that screaming is what they might do if they are in danger. Students are instructed to make a *low* yell with their hands cupped toward the bowl. If they get too loud, the activity will stop.
4. Students are to place the bowl between the two partners and take turns making the salt bounce by yelling.
5. Students may compare yelling and blowing but they should blow gently, otherwise they may end up with salt in their eyes.
6. Remind students they are to stop the yelling as *soon* as the teacher instructs them to stop.
7. When blowing the salt, students should blow ***gently*** to avoid getting salt in their eyes.

ADDITIONAL NOTES

Tips for the Activity Running Smoothly

We have found that students will generally follow these instructions, however, it is easy for them to forget and start to get too loud. A kind but firm correction usually does the trick.

- Because of the young age of the children, **we do not recommend pulling them from the activity for minor misbehavior**. The nature of science experiments is that they are exciting, and students can struggle with remembering all the rules. Kind but firm corrections work well for most students.
- After a certain number of minutes, even the best behaved classrooms start to become rowdy. This means it's time to end the activity.
- Encourage students to discuss their observations with their partners.
- **Allow students to explore!** If they are frustrated help them do the activity "correctly" but let them try adding more salt or less, making different types of yells (as long as they are not screaming, etc.). They can go beyond the exact letter of the activity.

General Notes for the Demonstration

- When yelling at the salt, sometimes you'll see the salt making a pattern. This is due to the wave-like nature of sound.
- When using the device, sometimes a tight seal/vacuum is created and the balloon dips into the cup. If that happens, just let a little air into the cup.
- If you put a large amount of salt on the balloon it will be harder to vibrate the balloon for the same reason it would be harder to jump on a trampoline if the trampoline has big rocks on top of it. The weight of the salt will dampen the vibrations.

Teacher Scripts

HOW TO USE THE SCRIPTS

Teaching scripts get a bad rap! We know that as teachers, you know the best way to converse with your class. However, scripts can make your life easier by providing examples of explanations that have worked for us. Mix and match, take what's useful and leave the rest. You can use these scripts to introduce material, or to talk about sounds generally.

The scripts are in black, roman type. Teacher notes are indented, grey, italic type.

Vocabulary Words Used within These Scripts

- Materials
- Volume
- Force
- Pitch
- High-pitch
- Low-pitch

SCRIPT 1: SOUNDS AND MATERIALS

Sometimes in science we study things that, in some ways, you already know about. For example, you already know that there are different types of sounds. You know that my voice sounds different than the sound of a door slamming which sounds different than running water out of a faucet.

As scientists, however, we need to think more deeply about things like sound. We need to be able to answer the question: "*Why* are these sounds different?"

As scientists, we also need to be able to have language to talk about scientific things like sounds. We are going to learn about some language we can use to talk about sounds.

When two items hit together, they make a sound.

Teacher Note: Make a loud sound by hitting the table with book or other object to get the kids' attention.

One way to think about sounds, is to think about the different materials that create the sound. A material is what something is made out of.

For the next part, find different items around the room and hit them together. Have the class listen to the different sounds. Are the sounds similar or different? Does the type of material make a difference? One demo students really enjoy is listening to a piece of paper be ripped in half.

Additional suggestions for materials:

- *Crayons, made of wax*
- *Pencils, made of wood*
- *Scissors, made of plastic and metal*
- *Paper, made of paper*
- *Erasers, made of rubber or gum-like material*
- *Cloth, made of cotton/other fabrics.*

Not only does the type of *material* matter, but the size or shape of an object matters, too. For example, think of a xylophone. The keys of a xylophone are all made of the same material. But do all the keys make the same sound? No! What is different about the keys? The size of the keys!

If you have your own xylophone bring it in for the demo—or show a video of someone playing a xylophone online.

The amount of something makes a difference too. Imagine one rock dropping to the ground. Now imagine 100 rocks! ◂

All About Sounds and Vibrations

Teacher Scripts *continued*

SCRIPT 2: SOUNDS AND VOLUME

Sounds can be hard to describe. But one way you can describe a sound is by the *volume*. The volume is how loud or quiet it is.

Everyone clap your hands together *very softly*. Did you all hear that sound?

Now clap your hands together with more force.

Were the sounds different? Yes! One of the sounds was much *louder* than the other. You used the same materials to make the sounds—the material was your hands, or we could say your flesh. Your hands were the same size in both cases, but one time you hit your hands together hard, and one time you hit them together softly, and that made the sound louder or quieter.

Work with your partner to make louder and softer sounds. Try to use "Science Language" or vocabulary while your talk to your partner. Use words like "volume" and "materials". ◂

SCRIPT 3: SOUNDS AND PITCH

Sounds can be hard to describe. But one way we can describe sounds is by talking about pitch. The pitch of the sound is whether it's high or low.

Say this in a high-pitch voice:

For example, I am talking in a high-pitch voice.

Say this in a low-pitch voice:

Now I am talking in a low-pitch voice.

Can you talk to your partner in a high- and low-pitch voice? Make sure to tell your partner that you are using a "high-pitch" or "low-pitch" voice.

Let's think of other sounds that are high or low-pitch.

High-pitch examples:
- *Tea kettle whistle*
- *Chalk scratching on a chalkboard*
- *Rubber shoes squeaking on the floor*
- *Chair legs squeaking on the floor*
- *Dolphins "talking"*
- *Some electrical equipment (think of a whirling drill)*

Low-pitch examples:
- *Lion's roar*
- *Thunder*
- *Gong*
- *Earthquake rumble*
- *Cow's moo*
- *Tuba*

Instruments like a piano can create both high and low pitches.

There are a lot of sounds that are going to be hard to definitively call high- or low-pitch. You can say they are in the middle. ◂

Teacher Scripts *continued*

SCRIPT 4: SOUNDS AND DISTANCE

Sound are loudest at their source. As a sound travels it gets quieter, until eventually you cannot hear the sound at all. Let's explore this.

If I whisper right near your ear, will you be able to hear what I'm saying?

Try to whisper near the students.

What if I whisper from the other side of the room?

Whisper far away from the students, and see if they can figure out what you are saying.

If I drop a paperclip, can you hear it fall? Does it matter how far away from the paperclip you are?

Try getting the class quiet and dropping the paper clip near them. Then try doing it far away. Drop it from a low distance so the sound is quiet. Try not letting them see when you drop it so they can't just guess if they heard it.

When you play at recess today, see how you hear different sounds when you are close to them, or far away from them.

For more science on this, see our "Ripple" photograph in "Science Background for Teachers" (Section B), under the header "Sound: The Nitty Gritty". ◀