



Musical Instruments: Part I

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Students experiment with various sounds sources, including straw instruments and water bottles, to gain an understanding of the connection between sound and vibration.

This lesson was designed for use after the [Sound and Music](#) introductory lesson.

Science Topics	Process Skills	Subject Integration	Grade Level
Sound Vibrations Resonance Frequency	Observing Scientific Inquiry Predicting Comparing	Physical Science Musical acoustics Speech	6-12

Time Required

Advanced Preparation Gather materials	Set-Up 5 minutes	Activity 35-45 minutes	Clean-Up 5 minutes
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Learning Goals

Students will be able to describe how sounds are produced with vibrations.

Students will be able to describe how tones can be varied by changing the length of a resonant cavity.

Students will know some of the instruments found in the woodwind, brass, percussion and string families.

Materials

- Packet* -- 1 per student (see pages 5-7)
- Straw instruments from Introductory lesson
 - Or materials to make new straw instruments
- Long straws** -- 1 per student
- Scissors
- Water bottle -- 1 per group
- Water (to add to the bottles)
- Source to refill water bottle (sink, containers of water, etc.)

Optional Materials:

- ***Computers to access website: <http://www.dsokids.com/> (optional)

*We like to give each student a worksheet to keep students engaged in the activity. Every student fills one out and is responsible for their learning even when they work in groups.

Please forward any questions or comments to:

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**The longer the straw the better, but any length of straw will work.
***Optional – see not under extensions/modifications section.

Advanced Preparations

- Gather materials
- Complete the sound and music introductory lesson

Set Up

- Prepare materials to be handed out to students as they need them during the lesson:
 - 1 water bottle per group of 2 or 3
 - 1 long straw per person
 - Scissors
- Give each student a packet.

Introducing the Activity

Begin with a short pre-assessment, where students complete three questions making predictions about the upcoming activity. Students will answer questions 1-3 in their packets.

After the students have written the answers down on their packet, they should discuss their answers in small groups.

Explain that each station has all the required materials before students divide into groups for the activity. Students will need to use their straw instruments, from the [Sound and Music lesson](#), to create sounds.

Doing the Activity



Creating the Instruments – *if not previously done in Sound and Music lesson.*

Model the building of the instrument for the class, and explain safety procedures to the students. To make the straw instrument they:

- Cut the tip of the straw into a point
- Gently chew on the straw to soften the tip
- Blow really hard into the pointy end to create a sound.



Activities with the Straw Instruments

After creating their instruments students should answer questions 4-5 in their packets.

Next students will create a new straw instrument out of one long straw.

For questions 6-7 students will blow into their straws and note how the pitch sounds. They will then cut a small section (~one inch at a time) off of the straw and blow again, noting how the pitch has changed. Students will continue to cut their straws down, writing down how the pitch changes with each change in length.

Cut the straws down until there is nothing left to use.

Question 8 expects students to have heard of resonance previously. If they did the Sound and Music lesson, they will have heard a definition before ([pasta/raisin](#) demo).



Activities with the Water Bottles

After students complete work with their straw instruments, they should take out the water bottles. They will work through the questions with their group.

They will begin by using the water bottle, blowing over the top of the water bottle until they have a tone and answer questions 9-11.

Students will try to make a new tone with the water bottle (by adding water) to figure out where resonance is happening in the bottle. They will answer questions 12-13 in their packets.

Explanation

In-depth background information for teachers and interested students

1. The straw instruments create sound when the reed (cut tip of the straw) vibrates. The cavity in the straw allows the vibrations in the air to resonate with the straw's natural frequency. The natural frequency is lower if the straw is longer and higher if the straw is shorter. This not only defines the pitch of the straw but also makes it loud. In the next two lessons, [Musical Instruments Part II](#) and [How musical Instruments Work](#), students continue to investigate the source of sound, the way to change pitch and what amplifies the sound for musical instruments. The water bottle makes a higher tone the more water is in it. This is the same general principle as the straw instrument. The natural frequency is determined by the air space of the bottle.

Key Terms:

- Natural frequency – the frequency at which an object likes to vibrate.
- Resonance – When one object is vibrating and it is put in contact with another object, if the *frequency* of the first object is at the *natural frequency* for the second object, the second object will start vibrating vigorously at its *natural frequency*. (pasta demo is an nice clean example of resonance)
- Pitch – How low or high a tone sounds to a person – it is how a person perceives the *frequency* of a sound. High *frequency* sound has a high pitch or tone (treble notes), but low *frequency* has a low/deep pitch or tone (bass notes). High sounds are usually above 2000 Hertz and low below 200 Hertz.
- Tone – a musical sound of a specific *frequency* or *pitch*

- Vibrations (oscillations) - a shaking back and forth movement

Optional Extensions /Modifications

Modifications:

- Hard of hearing students can feel the vibrations with their hands and mouths.
- Visually impaired students can be assisted with cutting and descriptions of visual attributes can be given in detail.
- If the class does not have access to a computer for all students:
 - The section using computers could be completed as homework.
 - If there are limited computers, students could go in small groups to the computers to find information.

Optional Extensions:

- Research on the Computer:
 - Students will go to the website: www.dsokids.com under Listen By Instrument to research to following question:
 - *Would the straw instrument and the bottle instrument be woodwinds, strings, or brass?*
- Students can create a vocabulary sheet to keep track of the terms used in the lesson.
- Students can complete the Musical Instruments Part 2 Activity
- Students who play a woodwind instrument can bring their instrument to class to show how the learning translates to real life.

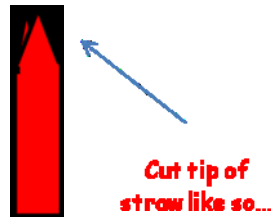
Make a new straw instrument unless you have your instrument from the previous lesson.

You will need:

- Straws
- Scissors

Here's what you do:

- Take the straw and the scissors, and cut off the tip of the straw to a point, like so. (Try to get both sides to be the same.)



- Now, *gently* chew on the straw to soften the tip, and to get the edges to be smooshed together. You would like the two tips to be *almost* touching each other.
- Now, put the pointy end in your mouth, and *blow really hard*. If you do it right (it might take some practice), you will get a very loud sound from the straw instrument.

4. How do you make the lowest possible pitch with your “straw trombone” (that’s when you slide a second straw over the initial straw)

5. How do you make the highest possible pitch with your “straw trombone”?

Make a new straw instrument with one long straw.

6. Test out how your straw instrument sounds after you cut about an inch off.

7. Keep cutting sections off, and compare how the sound changes.

8. Think about the natural frequency of something or the frequency it likes to vibrate at. What do you think determines the natural frequency of your straw instrument? *Hint: What determines its pitch?*

9. Now use the water bottle. Blow over the top of the water bottle until you have a tone. Would you describe it as a low pitch or a high pitch?

10. What kind of instrument does the bottle remind you of?

11. Figure out how to make a new tone with the same water bottle. Describe what you did to vary the tone.

12. What determines the natural frequency of the water bottle instrument?

13. Would the straw instrument and the bottle instrument be woodwinds, strings, percussion or brass? Look at www.dsokids.com for information. Look under Listen By Instrument.