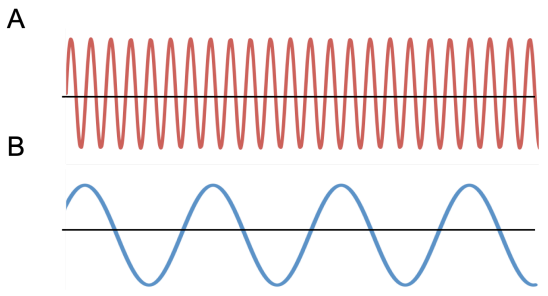
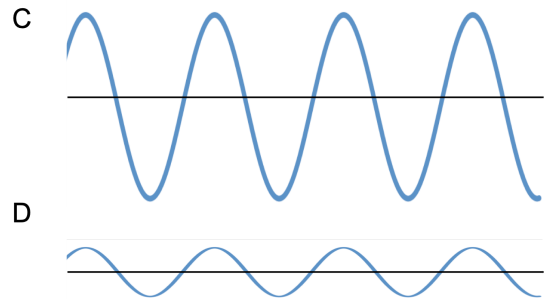


Sound as Vibrations		Grade 4: Matter and Energy - Sound	
<b>Lesson Plan</b>		<b>Safety Notes</b>	Adult supervision is recommended if using a hammer and nail to make a can horn.
<b>Description</b> In this lesson, students will learn about the properties of sound by building various instruments. Students will learn that sound is caused by vibrations and can be amplified.			
<b>Materials</b>			
<b>Harmonica:</b> <ul style="list-style-type: none"> <li>- 2 Craft sticks</li> <li>- 2 Elastics</li> <li>- 2 toothpicks</li> <li>- Wax paper strip</li> <li>- Scissors</li> </ul>		<b>Straw Flute:</b> <ul style="list-style-type: none"> <li>- Plastic Straw</li> <li>- Scissors</li> </ul>	
		<b>Can Horn:</b> <ul style="list-style-type: none"> <li>- Can or Plastic cup</li> <li>- String</li> <li>- Tool to make hole in the can or cup</li> <li>- Cup of water</li> </ul>	
<b>Science Background</b>			
<p>Sound is caused by vibrations traveling from the source of the sound to our ears. Vibrations are rapid movements back and forth. Vibrations can both be heard and felt. For example, if someone stomps their feet, you can feel the room shake and hear booming! Vibrations send energy outwards and make particles, such as air or water, in their surroundings vibrate too. The vibration energy is passed along, particle to particle, creating pressure waves, that our ears hear as sound. This wave continues until it runs out of energy. How far the vibrations go depends on what the energy is traveling through.</p> <p>Musical instruments can be classified based on what is creating the vibrations. String instruments, such as a guitar make sounds from strings vibrating when plucked. In wind instruments, air is blown across or through something to make it vibrate.</p> <p>Pitch is a way of describing sounds. The squeak of a mouse is considered high pitch and the roar of a lion is low pitch. When sound waves are graphed, high pitch waves appear closer together (A) and low pitch waves are more spread out (B). With instruments, this means that the instrument is vibrating more quickly for high pitch or more slowly for low pitch sounds.</p>			
			
<p>Loud sounds have more energy than quiet sounds. Think of a drum that is struck hard, it will make a much louder sound than if it was tapped lightly. That difference in energy changes the volume. On a</p>			

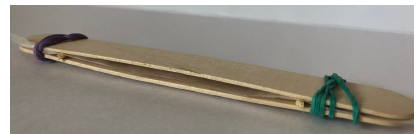
graph this makes loud sounds have higher waves (C) than quiet sounds (D). When vibrations make sounds, the sound waves travel out in all directions unless something channels them in one direction. When the same sound waves travel together, they have more energy and sound louder. This is called amplification. Many musical instruments have parts that amplify the sound. For example, the body of a guitar vibrates along with the guitar strings and channels all of the vibrations in the same direction, making the sound much louder.



## Activity Procedure

### Craft Stick Harmonica

1. Cut out a piece of wax paper about the same length and width as the craft sticks.
2. Sandwich the wax paper between two craft sticks.
3. Loop an elastic around one end of the craft sticks several times to secure them together.
4. Put a toothpick between the two craft sticks, near the elastic. This creates a space between the craft sticks. Break the toothpick so that pointy bits are not poking out.
5. Loop the second elastic around the other end of the craft sticks several times to hold them together.
6. Insert the rest of the toothpick between the craft sticks near the elastic on the newly secured side. Break off the toothpick again to remove pointy ends.
7. Play the harmonica by blowing through the craft sticks.
8. While playing, here are some things to think about:
  - What does the wax paper do when air is blown through the craft sticks?
  - What happens if the craft sticks are pressed together? Why do you think that happens to the sound?
  - What would happen if the toothpicks were removed? More toothpicks put in?
9. Challenge: Other materials can be used to make more harmonicas! Try using other materials such as cardboard, different sized sticks or an elastic band instead of wax paper! What do you think would work, and why?



## Straw Whistle

1. Flatten one end of a plastic straw with your fingers.
2. Cut the flattened end of the straw to make a triangular point.
3. Put the pointed end of the straw into your mouth and blow into the straw. Try different angles until you hear fun noises!
4. Try making more whistles! Try cutting the straw to be shorter or try a wider straw!
5. While playing, here are some things to think about:
  - What is the straw doing when it is being played?
  - What happens to the sound when the straw is shorter? Why does this happen?
  - Would a paper straw work?
6. Challenge: make a single straw whistle that can make different sounds! Here is a hint - think about different wind instruments and how they make different notes.



## Can Horn

*Note: Using a hammer should be done with parental supervision*

1. Take a can or cup and put it upside down and find the centre of the bottom.
2. Poke a hole through the bottom of the cup. For a plastic cup, a sharp pencil or paper clip could be used. For a metal can, a hammer and nail, with parental supervision is recommended.
3. Put a string through the hole.
4. Make several knots in the string on the inside of the can. Make enough knots so that the string cannot be pulled out of the can. If the string is too thin for this, tie the string onto a paperclip and tape the paper clip onto the inside bottom of the can.
5. Hold up the can, the string should dangle out the bottom.
6. Hold the string in your other hand and pull down, running your fingers tightly along the string. What do you hear?
7. Wet your fingers with water and try again! How is this different? Why?
8. Challenge: Try using different strings, a shoe lace, dental floss, yarn, check with your parents about what you can try! Make a hypothesis about how this will change the sound and test it out!



## **Debrief**

### **Harmonica**

The craft stick harmonica makes sound when the wax paper vibrates from air being blown through it. The wax paper acts as a reed, a thin material that vibrates to make sound. The popsicle sticks and toothpicks create a frame where the wax paper can vibrate. Without that space, the wax paper would not be able to vibrate, so there would be no sound. Squeezing the craft stick together changes how the wax paper can vibrate, changing the sound.

### **Straw Whistle**

The straw whistle is another example of a reed. When air goes through it at the right angle, the whole thing vibrates quickly, making sound. A long straw will make a lower pitch sound than a shorter straw. This is because a long straw takes longer to vibrate than a short straw. The longer vibrations make slower waves that sound low pitch. Short straws can vibrate more quickly, because they have less distance to travel to go back and forth. This makes faster waves that sound high pitch.

### **Can Horn**

The can horn is an example of amplification. The string vibrates when you pull on it. The vibrations travel to the can causing it to vibrate too. The cylindrical can adds to the vibrations and channels the vibrations in one direction, making sound much louder than if the string was pulled on its own. Wet fingers can have more contact with the string than dry ones, making more vibrations with more power. This makes a louder sound!

Now that you know how these three instruments work, try building your own out of materials you can find around the house! Try building a guitar with elastics and a box, or a drum with a can and a stick! Can you explain how vibrations are causing the sound in your new instrument?

1. What causes sound?
2. What happens if a straw whistle is cut to be shorter?
3. Draw a high pitch (frequency) sound wave and a low pitch sound wave.

High Pitch	Low Pitch

4. What would happen if the toothpick was not put into the craft stick kazoo? Why?

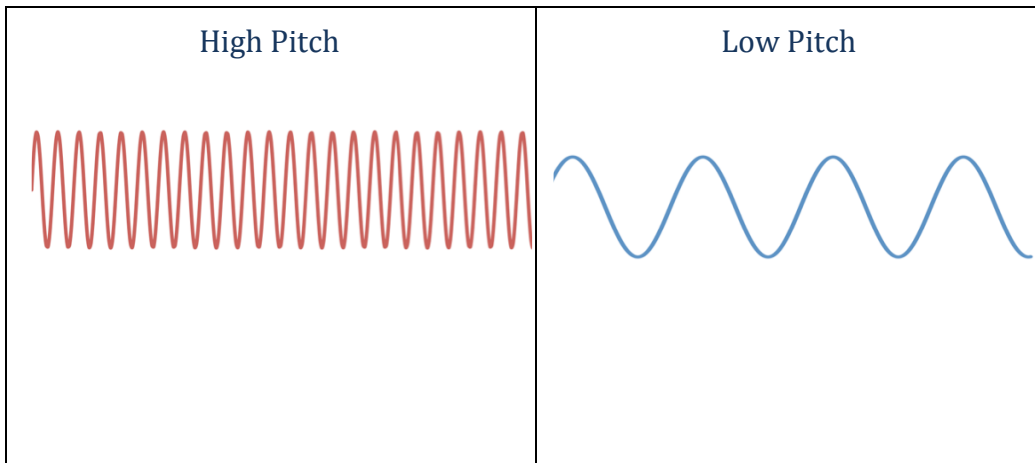
1. What causes sound?

Vibrations moving through the air.

2. What happens if a straw whistle is cut to be shorter?

The pitch of the whistle becomes higher.

3. Draw a high pitch (frequency) sound wave and a low pitch sound wave.



4. What would happen if the toothpick was not put into the craft stick harmonica? Why?

It would not work because the wax paper would not have room to vibrate.