



# High Touch High Tech®

Science Experiences That Come To You™

## Harmonica

### Supplies:

- 2 x Craft sticks
- 1 x Wide/Thick rubber band (#64 size is ideal)
- 2 x Smaller rubber bands (narrower)
- 1 x Straw
- Scissors
- Ruler (*optional*)

### Instructions:

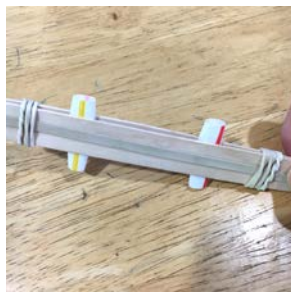
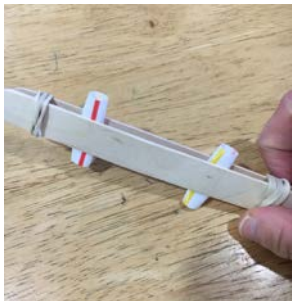
1. Cut 2 pieces of straw that are each 1.5 inches.
  2. Stretch the thick rubber band lengthwise around one of the craft sticks. (The rubber band will lay flat on the craft stick).
  3. Place one of the straws under the rubber band. Move it to one end of the craft stick.
  4. Place the second craft stick on top.
  5. Wrap the small rubber band around both craft sticks on the same end as the straw. You want the small rubber band closer to the end of the craft sticks than the straw. This is securing the craft sticks together, so wrap the rubber band multiple times to make sure it pinches the sticks tightly together.
  6. Place the second straw at the other end of the craft sticks. This piece will go on top of the wide rubber band. (But, it is still sandwiched between both craft sticks.)
  7. Wrap the second small rubber band around the end of the craft sticks. (The 2 small rubber bands are at opposite sides of the craft sticks.)
  8. Ensure both ends are pinched together. There should be a small space between the 2 craft sticks where the straws are placed. You have created a straw harmonica!
- To play, blow between the 2 craft sticks. Do not “hum” against the harmonica, you must blow air between the craft sticks.
  - When you blow, the wide rubber band vibrates. This vibration makes a sound.
  - Try blowing through different areas of the harmonica. Do you notice a difference in vibration and pitch?
  - To change the pitch, slide the straws closer together or farther apart. By sliding the straws, the section of rubber band becomes shorter or longer. When the section of the vibrating rubber band is shorter, it creates a higher pitch because it vibrates faster. To make a lower pitch, slide the 2 straws to the opposite ends of the craft stick.
  - Try cutting 1 or 2 more pieces of straw. Add them to your harmonica. Do you notice any difference? In the sound louder? Is the pitch higher or lower?



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## Steps





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## The Science Behind It:

### **Sound Vibrations**

Sit quietly for 30 seconds and just listen. What do you hear? Maybe the refrigerator is running, you might hear a car drive by, a dog barking, or music playing. All of these sounds are different; however, they have one thing in common. Sounds are made when objects **vibrate**.

When an object vibrates, it quickly moves back and forth and shakes the air molecules around it creating **Sound Waves**. These waves of vibration enter your ear. The **ear lobe** helps direct the sound waves into your **ear canal** and finally to your **ear drum**. The air molecules inside your ear begin to shake from the vibrations and wobble the tiny hairs. These tiny hairs in your ear are connected to **auditory nerves** under your skin. These auditory nerves send signals to your brain indicating that you hear a sound!

The stronger the vibrations, the louder the sound. Some sounds are high (like a squeaky chair) and some sounds are low (like a deep voice.) This is called **pitch**. The faster an object vibrates (called **frequency**), the higher pitched the sound. If a sound has a low pitch, the frequency is also low. This means the sound is not vibrating as quickly.

We all love listening to music. What is your favorite type of music? Do you like calm, slow music or do you prefer louder, fast-paced music? We can listen and create music because of sound vibrations.

### Real World Relevance: Harmonica

Did you know that the harmonica is the best-selling instrument in the world?! The harmonica originated in the early 1800s in Germany. It gained popularity in the US in the early 1900s.

Think of a harmonica as a 5-layer tin sandwich. The top and bottom layers are the covers. These layers are made of thin, shiny metal. The covers protect the inside layers and hold the harmonica together. They also protect the sound of the harmonica. The layers below and above the covers are called **reed plates**. The reed plates are brass. There are **10 reeds** mounted on top of each reed plate by a tiny screw. A **reed** is a thin strip of brass that vibrates against the plate when you breathe into the harmonica. The reed is attached to the reed plate at one end of the thin strip. Therefore, the reed is free to vibrate.

The center of the harmonica sandwich is called the **comb**. This is a slab of wood, metal, or plastic. There are 10 slits cut into the comb. (This is how it got its name. It looks like a hair comb.) The slits allow air to reach the reed plates.



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When a musician blows into the harmonica, the reed vibrates up and down. Each musical note from the harmonicas is a reed vibrating hundreds or thousands of times per second!

The pitch of a musical note is how high or low it sounds. If a reed vibrates slowly, the pitch is low. If the reed vibrates very quickly, it makes a higher pitch.

Harmonicas are played in many genres of music. The most popular are jazz, country, blues, and rock. Although there are more types of harmonicas now, the basic science of vibration and pitch provides the musical sound waves.

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