Membranophone

Build a Water Bottle Membranophone

Recommended Grade Level:
6th to 12th grade

Time: 20 minutes prep, 30 minutes activity

Materials Needed:
- A clean empty water bottle, any size
- (bottles with ridges are best)
- Scissors
- Latex, rubber, or vinyl gloves
- Rubber band
- Hole punch
- 1 straw
- Construction paper

Background Information:
In this activity, you’ll use a water bottle and a paper tube to make an instrument.

To Do and Notice:
1. Cut the bottle in half, about 3 inches from the top. Make sure to cut evenly along the edges, and trim off any bumpy ridges.

2. You will be working with the top half. Take your hole punch and punch a hole close to the rim.

3. Put the straw through the hole to test the size; it should be a tight fit. If the hole isn’t large enough for the diameter of the straw, re-punch the hole in nearly the same spot, making it slightly larger. Remove the straw (temporarily).

4. Cut the fingers of the glove. The glove should now look like a wide tube.

5. Cut the top open to form a sheet of pliable material, or a membrane.
6. Stretch the membrane over the opening, making sure the punched hole on the side of the bottle isn’t hidden by the excess glove material.

7. Attach the membrane to the bottle with a rubber band. Wrap the rubber band around the bottle several times, making sure the membrane is taut.

8. Twist off the bottle top. Roll a piece of construction paper into a tube on a flat surface. Make the tube as tight and as straight as possible.

9. Put the rolled tube into the large open hole on the bottle where the cap had been. Let go of the tube when it barely touches the bottom of the membrane. It should fit securely in the hole.

10. Insert the straw in the hole on the side of the bottle and blow into the straw; your bottle membranophone should play!

11. Try adjusting the position of the paper tube. Find a position you like and tape the paper tube so it stays in place.

**What’s Going On?**
As you blow into the straw, you’re creating a lot of pressure in the space between the outer wall of the construction-paper tube and the inner wall of the water bottle. That pressure forces the membrane to rise, allowing air to flow into the top of the tube and escape out the bottom. As the air escapes, the membrane returns to its initial position. But you’re continuing to blow air into your membranophone, so the membrane rises and falls very rapidly over and over. If you place your finger over the top of the membrane, you can feel it vibrate. These vibrations produce sound.

**Going Further:**
To make different sounds, add finger holes. To do this, pinch the paper tube slightly and cut out a diamond shape; repeat to make more finger holes. Opening or covering the finger holes changes the pitch of the sound because opening a hole has the same effect as shortening the length of the pipe. The “shorter” the pipe, the higher the pitch.
Popsicle Stick Harmonica

Build a Harmonica with household materials

Recommended Grade Level:
5th-8th grade

NGSS Science & Engineering Practices:
- Asking questions and defining problems
- Planning and carrying out investigations
- Designing solutions
- Obtaining, evaluating, and communicating information

Time: 10 minutes prep, 15 minutes activity

Materials Needed:
- 2 popsicle sticks
- 1 big rubber band
- 2 smaller rubber bands
- masking tape

Background Information:
The blowing air makes the rubber band and sticks vibrate, and that vibration makes the sound.

To Do and Notice:
1. Wrap masking tape about 10 times around each end of the two sticks.
2. Stretch the longer rubber band around the length of one of the sticks.
3. Place the other stick on top and secure the ends by wrapping the shorter bands around each end.
4. Blow through the middle and make a beautiful sound.

What’s Going On?
As you blow across the rubber band it vibrates. The vibrating rubber band causes the sticks and surrounding air to vibrate; that vibration is translated through the air to our ears.
Going Further:
Try different sized “big” rubber bands. Try covering your ears, can you still hear it?
Hear Silent Sounds of Vibrating Objects

Secret Bells

Recommended Grade Level:
6th -12th grades

NGSS Science & Engineering Practices:
- Asking questions and defining problems
- Planning and carrying out investigations
- Designing solutions
- Obtaining, evaluating, and communicating information

Time: 10 minutes prep, 15 minutes activity

Materials Needed:
- Scissors
- String
- Wire hanger, and/or spoon, and/or cake rack

Background Information:
You hear sounds when vibrations get inside your ears and stimulate nerves to send electrical signals to your brain.

To Do and Notice:
1. With your scissors, cut a piece of string about 3 to 4 feet long.
2. Hold the two ends of the string in one hand. The rest of the string will make a loop.
3. Lay the loop over the hook part of the hanger. Push the two ends through the loop, and pull them all the way through the other side (this is easier to undo than a knot).
4. Wrap the loose ends of the string two or three times around the first fingers on each hand.
5. Swing the hanger so it gently bumps against the leg of a table, or against a door. What did it sound like? Probably not much.
6. Now put your first fingers over the opening of your ears (don’t put your fingers into your ear). Lean over and gently bump the hanger again. What did it sound like?

**What’s Going On?**

When you bump the hanger into the wall, the hanger starts to vibrate. The vibrating hanger makes the string vibrate. To reach your ears, the vibrations in the string must push on the air molecules to make sound waves that travel through the air, but the string doesn’t push on very many air molecules. So, sound vibrations don’t travel easily from the string into the air.

When your fingers are covering your ears, the sound can take a more direct route to your ears. Rather than traveling through the air, the vibrations can travel through your hands and through the bone of your skull directly to the fluid inside your cochlea, in your inner ear. Instead of traveling from solid to air and back to solid, the vibrations move from one solid (the string) to another (your bones), and then into the fluid of your cochlea. As a result the sound you hear is much louder and richer.

**Going Further:**

Try this with other items from your kitchen or classroom.