

# Buzzing Hornets

**Overview:** When something vibrates, it pushes particles. These pushed particles create a longitudinal wave. If the longitudinal wave has the right frequency and enough energy, your eardrum antennas will pick it up and your brain will turn the energy into what we call sound.

**What to Learn:** Sound is made by vibrating objects and can be described by its pitch and volume.

## Materials

- index cards (2)
- scissors
- popsicle stick (tongue depressor sized)
- rubber band (thick)
- cotton string (3-4 feet)
- hot glue gun
- ruler or tape measure

## Lab Time

1. Cut two corners off one side of your index card.
2. Run a bead of glue down the length of the popsicle stick and quickly attach to the side with untrimmed corners. If your card is longer than the stick, trim it down with the scissors.
3. Cut the second index card in half. Fold each portion in half three times.
4. Put hot glue on both sides of the popsicle stick and attach one of the folded index cards to the end.
5. Take the second folded index card portion. Tie the string around the middle, then around the fold and attach it to the popsicle stick as you did the other portion of the index card.
6. When the glue dries, wrap the rubber band along the length of the popsicle stick. This is your completed hornet.
7. Now, grab the end of the string and whip the hornet around your head really fast until you hear the sound.
8. When you sling the hornet around, wind zips over the rubber band and causes it to vibrate like a guitar string... and the sound is focused (slightly) by the card. The card really helps keep the contraption at the correct angle to the wind so it continues to make the sound.
9. You can try this with different-sized rubber bands, multiple rubber bands, and without the index card attached.

## Buzzing Hornets Data Table

<b>String Length</b> <i>(measure in inches or cm)</i>	<b>Pitch Observed</b> <i>(high, medium, low)</i>

### Reading

Sound is made by things vibrating back and forth, whether it's a guitar string, drum head, or clarinet reed. The back and forth motion of an object (like the drum head) creates a sound wave in the air that looks a lot like a ripple in a pond after you throw a rock in. It radiates outward, vibrating its neighboring air molecules until they are moving around, too. This chain reaction keeps happening until it reaches your ears, where your "sound detectors" pick up the vibration and work with your brain to turn it into sound.

You can illustrate this principle using a guitar string – when you pluck the string, your ears pick up a sound. If you have extra rubber bands, wrap them around an open shoebox to make a shoebox guitar. You can also cut a hole in the lid (image left) and use wooden pencils to lift the rubber band off the surface of the shoebox.

Troubleshooting: Most kids forget to put on the rubber band, as they get so excited about finishing this project that they grab the string and start slinging it around... and wonder why it's so silent! Make sure they have a fat enough rubber band (about 3.5" x ¼" – or larger) or they won't get a sound.

Variations include: multiple rubber bands, different sizes of rubber bands, and trying it without the index card attached. The Buzzing Hornet works because air zips past the rubber band, making it vibrate, and the sound gets amplified just a bit by the index card.

**Exercises** Answer the questions below:

1. What effect does changing the length of the string have on the pitch?
2. What vibrates in this experiment to create sound?
3. Why do we use an index card?

### **Answers to Exercises: Buzzing Hornets**

1. What effect does changing the length of the string have on the pitch? (Refer to data table)
2. What vibrates in this experiment to create sound? (the rubber band)
3. Why do we use an index card? (to amplify the vibrations so we can hear them)