

# Sound Science

## Collect

- 11" paper towel tubes (8)
- Rigid material, at least 2' in length, to serve as the backbone of the sound receiver:
  - foam pool noodle, yard stick, cardboard all work well
- Scissors
- Tape
- Hot glue gun and glue sticks
- Adult safety partner

## Create a sound receiver

1. Cut and tape the cardboard tubing to create five tubes of different lengths.
  - Cut two tubes in half, creating two 5.5" tubes
  - Tape a half tube onto a whole tube, creating a 16.5" tube
  - Tape two whole tubes together, creating a 22" tube
  - Tape two whole tubes and a half tube together, creating a 27.5" tube
2. Use hot glue to attach the tubes to the rigid backbone in order of size; half tube, whole tube, one-and one-half tube, two tube, and two-and-one half tube.

## Start listening and take notice

1. Head to a space with lots of background noise—a cafeteria, mall, or playground will all work. Listen through each tube and compare the sounds you hear.
2. Observe how the sounds change as you move your ear against the end of the pipe so that the end is completely sealed off by your ear.
3. The background noise in a room is a mixture of many sounds with different pitches. Normally, these pitches blend, but you can separate them by listening through different lengths of the tube. Which length of tube allows you to hear high-pitched sounds? Which length or tube allows you to hear low-pitched sounds?

## What's happening?

Any given sound we hear is often a mixture of many different frequencies. For example, an ambulance siren makes its distinct sound with frequencies that are very fast and others that are slower and longer.

Objects have natural frequencies, that is, the way they vibrate when making a sound. When you listen through the receiver tubes the "object" that's vibrating is the air inside the tubes. The longer the column of air in the tube, the more slowly it vibrates. Because each tube has a different length, it selects for a different set of frequencies from the many frequencies in the many noises around you. When you put your ear to the longest tube, you hear the lowest frequencies; when you listen to the shortest tube, you hear the highest frequencies.