

### Materials Needed

- Paper drinking cup
- 1-inch square of brightly colored paper
- A partner to serve as “paper dropper”
- Scissors

### Grade Range

3-5

### Topics/Skills

Sound  
Energy  
Body Structures & Systems

### Learning Standards

NGSS: [Life Science](#); [Physical Science](#)

### Duration

10-20 mins

### Prep Time

5 minutes

## A Little Drop in the Bucket

### How Well Do the Ears Work?

Could a piece of paper be heard if it were dropped into a cup? How small would the paper need to be for it not to be heard anymore? This quick and simple activity produces some amazing results!

### Activity Challenge

The listener holds a paper cup to an ear while a partner drops a piece of paper into the cup adjusting the paper size with each drop.

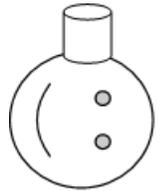
### Preparation

Cut a 1-inch square from a sheet of paper and grab a paper cup. If no paper cup can be found, consider using paper and tape to make a cup-shaped vessel.

### To Do

1. Guess (hypothesize) the smallest size paper that can be dropped into a cup and still be heard by the listener.
2. The listener tilts the head (as shown) and holds the cup to an ear. The cup should be open-side-up.
3. The partner drops the 1-inch paper square into the cup. The listener indicates if the paper can be heard when dropped.
4. Cut the paper in half.
5. Repeat steps 1-4 until the paper is too small to hear.
6. Switch listener and paper dropper roles and repeat.

Cup on tilted head  
open-side-up



### Observations

- Share observations. Was the paper able to cut small enough so that the listener couldn't hear it drop? How small was the piece?
- Based on this experiment, how well do the ears work?

### Extensions

- Try flipping the cup over and repeating the experiment. What do the results indicate about the role of the cup in amplifying sound?
- Figure out the fraction of the original piece you could still hear.

### The Science Behind the Activity

The limiting factor in this activity is the ability to cut the paper rather than the inability of hearing the sound; at some point, it just becomes impossible to cut the paper any smaller! In most cases, no matter how small the paper is, the listener can still hear it hit the bottom of the cup. Since the solid cup is placed over the ear, the tiny sound of the paper hitting the cup travels quickly and efficiently into the ear. The shape of the cup also amplifies the sound. Sound is caused by vibrations that travel in compression waves through the medium and into the ear. Once hitting the eardrum, the sound is sent to the brain's auditory cortex where it is analyzed and interpreted.