



## Curiosity Guide #407

### Sense of Hearing

Accompanies Curious Crew, Season 4, Episode 7 (#407)

## Design a Pair of Ear Defenders

STEM Challenge

### Description

Protect those ears in style!

### Materials

- Foam, bubble wrap, foam peanuts, and other cushioning materials
- Sponges
- Rubber gloves
- Cloth, like wool and fleece scraps, or other fabrics and sewing materials
- Headbands
- Styrofoam cups, plastic bowls, measuring cups
- Pompons and cotton balls
- Pipe cleaners
- Balloons
- Rubber bands
- String
- Tape and hot glue
- Radio

### Procedure

1. Design a pair of ear defenders that can reduce the level of radio sound entering your ears.
2. Design and test two prototypes. Redesign as necessary.
3. What changes did you make and why?

## My Results

Keep a record of your designs here. You can do sketches or make a chart of your designs, the modifications, and the results.

## Explanation

The decibel is the measurement of sound intensity. Someone whispering is about 30 decibels, but a running lawn mower produces 95 decibels. Prolonged loud noises over 80 decibels can damage the tiny hair cells in the cochlea. The initial stiff, shorter hairs in the cochlea vibrate with high frequencies. The hairs deeper in the cochlea, which are long and flexible, vibrate with lower frequencies.

The shorter hairs are the first impacted by loud sounds, and in time can become brittle. As a result, older people begin to lose the ability to detect higher frequencies. Protecting your ears with headphones or defenders is a good way to protect those hair cells. Foam is likely to be a good defender and is used in an Anechoic Chamber, which is a no-echo chamber or extremely quiet space. In those rooms, the walls, floor, and ceiling are covered in large foam wedges. A metal grate is positioned above the wedges for you to stand on. Low-frequency sounds hit the foam wedges and bounce indefinitely inward, getting lost in the wall, while high-frequency sounds get absorbed into the foam itself. Such a room feels claustrophobic because there are no sounds reverberating in the space to make the room feel larger. This special room certainly would protect your ears, though!

**Think about this:** Have you ever used earbuds to listen to music? If so, you know that the sound can get really loud! Sound that's too loud isn't safe for your ears. You could possibly damage your ears in just over an hour. Inside your inner ear is the cochlea, where incoming sounds resonate the fibers and fluids, and cause tiny hair cells to wiggle. The hairs are kind of like a harp, with the shorter hairs first, and longer ones further in. Having your earbuds' volume higher than 60 per cent for more than 60 minutes could destroy those tiny hair cells. A good rule is that if you can't hear what is going on around you, then the volume is too high, and it's time to turn the music down.

Parents and Educators: use **#CuriousCrew** **#CuriosityGuide** to share what your Curious Crew learned!



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