

STEM ACTIVITY 2 | MUFFLING SOUND

PROTECTING HEARING IN NOISY ENVIRONMENTS

WHAT TYPES OF MATERIALS BEST REDUCE LOUD SOUNDS IN A BUILDING?

Have you ever been to a NASCAR race? While the speed of NASCAR fascinates most people, everyone remembers the noise of NASCAR. Racecars roaring around the tracks, blasting their ears with sound. The crowd thunders as the winner crosses the finish line. Though this limited exposure to sound probably wouldn't damage hearing, think about the drivers and others who work at the track. Because of all the loud noise, NASCAR requires that workers wear hearing protection. Teams build their cars with insulation to protect the driver's hearing.

Hearing is one of our most important senses. You may not think much about protecting your hearing, but once it is gone, you can never get it back. That's why good employers think about hearing protection, especially since noise-induced hearing loss is the most common workplace injury in the United States. During this project, you will act like an engineer and design interior coverings to reduce the overall sound level in a simulated building.

DESIGN PARAMETERS

Note: Record all notes, designs, data, calculations, analyses, and conclusions in a project log.

As you design your sound-reducing covering, you must consider both the structure and surfaces of the enclosure. Your design parameters are as follows:

- 1 Your teacher will tell you types of materials and thickness limitations for your surface coverings. The walls and ceiling may have different parameters because more soundproofing material is often installed in ceilings than in walls.
- 2 The surface coverings must fit within the dimensions of each wall area and the ceiling area of the enclosure.
- 3 The surface coverings must fasten easily to the walls and ceiling of the enclosure.
- 4 The surface coverings must consist of household materials or materials that you can purchase at a local home improvement store or discount department store.

Key Questions

- » How can surface material affect sound levels?
- » How can surface structure affect sound levels?
- » How can surface texture affect sound reflection?

Equipment

test enclosure
 tone-generating device (iPod, cell phone, tablet, or a speaker connected to one of these devices with a tone generator app)
 sound-measuring device (sound meter or cell-phone/iPod with sound meter app)
 project log
 surface coverings
 meter stick

PROCEDURE

Plan the Design

- 1 Conduct research on materials for sound reduction, as well as the effect of loud sounds on hearing.
- 2 Measure the inside dimensions of the enclosure to determine the dimensions for your surface coverings.
- 3 Draw and label your proposed design.
- 4 Report your findings to your team members and discuss your options for wall and ceiling coverings. Reach a consensus on the materials and design that your team will use. Determine who will obtain materials for and construct wall and ceiling coverings.

Test the Design

- 1 Before you install the sound-reducing materials, measure the sound level as a benchmark so you can determine the degree of sound reduction.
 - » Place the sound-measuring device in its place and begin recording.
 - » Place the tone-generating device in its place and turn it on.
 - » Install the roof of the enclosure.
 - » Allow the measuring device to record 15–30 s after putting the roof on.
 - » If you are recording with an app that records the data, download the data to a spreadsheet and produce a graph. If the app produces a graph, print it out.
 - » Record the decibel level inside the enclosure.
 - » Repeat using three different tones (high, middle, and low frequency) for 15–30 s each.
- 2 Install your surface coverings. Repeat Step 1 with the surface covering and record your data.
- 3 Based on your results from Step 2, make any necessary modifications to your surface covering and retest.
- 4 Share your team's data with the other teams in your class.
- 5 Compare your team's design with the other designs in a team discussion. Try to explain why the different designs performed the way they did.
- 6 From what you've seen, come to a conclusion about which materials and design provide the best soundproofing. Include any supporting information for your conclusion.

