

SOUND EFFECTS

Principles of Sound



Activity Overview

In this activity, students will learn about the principles of sound and how to amplify and reduce sound volume. Students will construct an absorption muffler to dampen sound and experiment with different designs to maximize noise reduction. Students should be familiar with the basics of sound, sound dampening, and acoustic quieting.

STEPS:

- 1 (Optional) Divide students into teams of 2-3 and assign job duties. Suggestions include:
 - Project Manager: Oversees the design, ensures design parameters are met, keeps track of time, coordinates decision-making.
 - Lead Engineer: Leads device construction
 - Lead Scientist: Takes measurements, assesses devices for defects, leads device tests
- 2 Find the center of one side of the cardboard box and trace the end of the tube with a pencil. Use scissors to cut out the shape and make sure the tube fits snugly into the cutout. Repeat this step on the opposite side of the box so the cut out holes line up.
- 3 Fit the tube through both holes in the cardboard box. Ensure both ends of the tube stick out of the sides of the box at least 2 inches. Keep one side, or the top, of the box open.
- 4 Remove the tube from the box, then drill, poke, or cut holes into the tube to mimic the design in Figure A. Reinsert the tube through the holes in the box and use duct tape to secure the tube to the sides of the box.
- 5 Pack a muffling material of your choice around the tube inside the box. Don't pack it too tightly - real mufflers allow engine exhaust to flow through. When you're done, tape the box closed.
- 6 Play a constant tone or engine noise through a speaker out loud, then into one end of the muffler. Note the differences in volume. If you have a decibel meter, compare the two measurements.



CHALLENGE: What modifications can you make to the design of your muffler to further dampen noise? What other methods of sound dampening can you employ in your redesign? How do the different methods of acoustic dampening affect the sound passing through the muffler?

RESEARCH: *Noise pollution, NASA-developed aircraft chevrons, automotive mufflers, turbulence, sound dampening, acoustic quieting*



High School Activity

Materials:

- Paper towel tubes and/or poster tubes
- Cardboard box
- Muffling Material (i.e. fabric, towels, stuffing, bandanas, etc.)
- Scissors
- Tape/Duct Tape
- Pencil/Pen
- Smartphone or similar device

Suggested Items:

- Sound/Decibel meter
- Oscilloscope (app versions available)



Figure A. Cutout of an absorption (or glasspack) muffler.

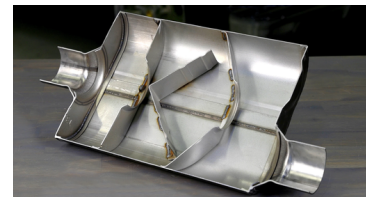


Figure B. Cutout of a chambered muffler that manipulates soundwaves to cancel specific frequencies.

Other types: Laminar flow, turbo, straight pipe, resonator