

## Extend

### Acoustics

To extend understanding of sound waves and how they travel through different mediums students will learn about acoustics, designing spaces or objects to amplify or reduce sound. They will then engineer a device that makes sound louder, such as acoustic speakers for a cell phone, or makes sound quieter like a sound-proof phone box or noise cancelling head phones.

Show the video [Acoustic Architecture](#) (6:05 minutes) which shows how the cathedral in Raleigh is designed for sound.

Ask the students to apply what they saw in the video to their own school.

- What is the loudest room in the school? (Usually the cafeteria or gym)

Does this room have any features that help control the level of sound? You may want to take photos ahead of time to show the students. Looks for fabric covered panels on the wall or ceiling, fabric wall hangings or artwork and other features that absorb sound.

- What rooms in the school are specifically designed for sound?

If your school has an auditorium for school plays or musical performances, take photos of this space to share as well. Or even have an in school field trip to visit the room. If your school does not have such a space, take photos of the auditorium at the local high school or at a local movie theater.

- What do you notice about the shape of the room?
- What is on the ceiling?
- What is on the walls?
- Do the chairs help control sound too?
- Are there speakers? Which way are they pointed?
- How does all of this work together to control and direct sound?
- If you visit the room have a student speak on the stage and another speak from the audience seats. Compare how well you can hear each of these from the audience.

## Build It

Let students choose which engineering challenge their small group will tackle. Allow them to submit their own acoustic and sound related ideas as well.

- Design and build cell phone speakers
- Design and build a sound proof box to hold one or more cell phones during class
- Design and build noise blocking headphones
- Design and build another acoustic device with approval from the teacher

Scaffold the process using the Engineering Design Process and the student handout. Add restrictions for space, materials and time as needed.

*Problem:* Choose from the list above.

*Research:* The investigations and discussions from previous parts of this lesson.

*Brainstorm:* Come up with at least 3 ideas for solving the problem. Draw pictures or describe the idea with words.

*Plan:* Select one idea to build. Draw and label a diagram. List the materials and tools you will need. Get approval from the teacher before moving to the next step.

*Create:* Build your solution to the problem. Make adjustments to the plan as needed.

*Test:* Try out the solution and see if it meets the stated requirements

*Improve:* If the solution doesn't meet the requirements, make improvements so that it does.

The materials student use depends on what you have on hand. You can solicit recyclable items from parents such as egg cartons, plastic bottles, cardboard boxes, toilet paper tubes, fabric, cotton balls, batting and other types of foam. As usual, plenty of tape and glue will be needed as well.