

Sound & Acoustics: Mitigating Noise Pollution

NEW FOR 2025-2026!

- Added **new suggested materials** for students to consider (textbooks, jackets, ziploc bags)
- Added sound barrier design thickness and **material constraints**
- Suggested teachers designate a “**quiet area**” to test sound barriers
- Added more in-depth learning about material types and how they interact with sound
- Provided more examples and clearer instructions for students

SUGGESTED LESSON PLAN - 50 minute periods

Total Time ~90-110 minutes

- ~35 minutes to watch the lab introduction video
- ~25-30 minutes for students to build their initial sound barrier and fill out Student Workbook or Abbreviated Worksheet
- ~20-30 minutes to build and test second iterations
- ~10-15 minutes for a closing activity or discussion

(Note: An optional 30-45 minutes can be scheduled to do a Wrap-Up and QA with an Engineer and College Mentor at Teacher's discretion).

Hook/Essential Question

- How old are your ears? What is the highest frequency you can hear?
<https://onlinetonegenerator.com/>
- What sound levels do you think can affect long-term hearing?

Supplies to Have in Class

[ET Sound & Acoustics Kit](#) materials can be found at the end of this file.

Additional Items to Consider Having on Hand:

- Any additional materials that could serve as sound dampening (i.e. tissues, cotton balls, towels, quilts, etc...)
- A quiet space to make observations and recordings of the sound levels. (This may mean that groups will need to take turns when to test).
- Phone or computer to use the decimeter app.
 - <https://apps.apple.com/us/app/niosh-sound-level-meter/id1096545820>
 - <https://play.google.com/store/apps/details?id=com.gamebasic.decibel>

NOTE: Some sites referred to in the workbook may be blocked by school internet protocols. Please request admin access for the sites **below** in advance so that you students will have access before they begin working through the student workbook/worksheet

What Frequency Range do Animals Hear?

- <https://onlinetonegenerator.com>

Bubble Curtain

- <https://dosits.org/galleries/audio-gallery/anthropogenic-sounds/bubble-curtain/>

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	<p>The videos below should be unblocked for teachers-only if presenting the student workbook to the whole class OR for all students if they are completing the student workbook on their school devices</p> <ul style="list-style-type: none"> • https://www.youtube.com/watch?v=3-xKZKxXuu0 • https://www.youtube.com/watch?v=VxcbppCX6Rk
Optional Pre-Work	Have students watch the first 15 minutes of the intro video providing the background for the challenge and answer the questions through slide 8 of the student workbook.
Class #1 Introduction and Procedure	<p>Watch the <u>Engineering Tomorrow: Sound & Acoustics Intro Recording</u> on the Sound & Acoustics webpage either as a class or assign background section as pre-work (see above).</p> <ul style="list-style-type: none"> → Have students answer the comprehension questions in the first 8 slides of the student workbook → Watch the rest of the video that outlines the instructions for the challenge. <p>Students study the concepts of Sound and Acoustics → research designs to minimize sound pollution, generate an initial design concept and describe in their student workbook or abbreviated worksheet. (1 workbook or worksheet per student suggested)</p>
Class #2 Work Time and Testing Possible Closing Questions and Activities	<p>Students will finish their designs, test, and summarize findings in the Student Workbook or the Abbreviated Worksheet.</p> <p>NOTE: If possible, teachers should try to dedicate a “quiet space” for students to have an effective testing area. This testing area can be a corner of the classroom or a space in the outside hallway.</p> <p>Class Discussion Question: After learning about Sound Pollution and the damage that it can do (at seemingly low levels of noise), how much hearing loss do you think you’ve suffered?</p> <p>Consider watching short Ted Talk suggested by Therese Stockard of Lewisville High School on how hearing can be damaged: https://www.ted.com/talks/heather_malyuk_can_loud_music_damage_your_hearing</p>

INTRODUCTION TO ENGINEERING TOMORROW:

- Click [here](#) to see an introduction of what Engineering Tomorrow can do for your students.

INTRODUCTION TO THE ENGINEERING DESIGN PROCESS:

- Students should complete the [Engineering Design Process Introduction Activity](#) before starting the lab
 - NOTE: This activity only needs to be completed before the student’s **first** ET lab, not repeated for every lab.

TEACHER NOTES:

- In this lab, students are introduced to the basics of sound, where they will learn about vibrations,

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- frequency, pitch, and real world examples of how these affect our ears. The students will then conduct a lab experiment, trying to reduce the noise pollution of a certain sound.
- Students will work through the Sound & Acoustics: [Student Workbook](#) or the [Abbreviated Student Worksheet](#).
 - When assigning this lesson on Google Classroom, first make a copy of the slides to save within your Google Drive, then assign so that each student has their own copy.
 - The workbook and worksheet are designed to be interactive so that students can type directly into the files. It is suggested that the workbook or worksheet be completed over a few class periods (as the information is delivered to students).
 - Students may work individually or within groups at the discretion of the instructor.
- We have provided students with post-lab activities to look into in case they finish the lab early or if they are waiting while other students are testing their sound barriers. These post-lab activities can be found at the end of the Student Workbook.

ASSESSMENT:

- Informal assessments can be completed by looking at the reflection slides within the Student Workbook and/or the discussion questions in the Abbreviated Worksheet.
- Answer Keys** can be found here for the:
 - [Student Workbook Answer Key](#)
 - [Abbreviated Worksheet Answer Key](#)

TROUBLESHOOTING TIPS:

- Make sure students understand definitions and concepts of sound before creating their own sound barrier
- Caution students not to leave their buzzer connected to the battery for extended periods so that the buzzer works at peak level when testing their design iterations.

OPTIONAL ACTIVITIES:

- Continue research into Noise pollution, architectural acoustics, musical acoustics
- Describe echolocation and harmful effects extraneous noise may have for this process.
- Delve into a Digital Audio Workstation to create, manipulate and put sounds together to create a sound file (Examples include: Logic Pro, FL Studio, Ableton)

ADDITIONAL TEACHING RESOURCES:	
Curriculum Connections: <ul style="list-style-type: none"><u>Acoustic Engineering</u>: Design, analysis and control of sound<u>Sound Engineering</u>: Design and manage sound levels and outputs. Takes care of sound equipment for live recording	Students will be able to: <ul style="list-style-type: none">Identify basic terms related to soundUnderstand the effects of noise pollutionDesign a sound barrier to reduce levels of noise pollutionLearn about career opportunities related to soundLearn about how to record data related to sound

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Content Vocabulary/Terms:




- Pitch: the quality of a sound (high / low)
- Sound: created when something vibrates and sends out waves of energy
- Frequency: is the number of times per second that a sound pressure wave repeats itself
- Vibration: causes the air molecules next to it to move, which causes a chain reaction all around that we call a sound wave

NEXT GENERATION SCIENCE STANDARDS:

[HS-ETS1-2](#): Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

MATERIALS:

TEACHER'S KIT		
<i>Materials will be distributed throughout the class.</i>		
Item/Link	Quantity	Photo
Jumper Wires	6	
Buzzers	3	 OR
Masking Tape	1	

STUDENT KIT ITEMS		
<i>1 kit: 3 students</i>		
Item/Link	Quantity	Photo
AA Battery	1	
Buzzer	1	 OR
Battery Holder	1	

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Jumper Wires	2	
Sound Panel	1	