Connecting to the Next Generation Science Standards (NGSS Lead States 2013): 4-PS3 Energy https://www.nextgenscience.org/dci-arrangement/4-ps3-energy	
Performance Expectations	**Connections to Classroom Activity** *Students:*
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	• create a device to amplify the sound of their favorite song
Science and Engineering Practices	
Planning and Carrying Out Investigations	• research ways in which sound travels • draw and build a prototype of a device to amplify sound
Disciplinary Core Ideas	
PS3.A Definitions of Energy • Energy can be moved from place to place by moving objects or through sound, light, or elective currents.	• research and test how sound travels through different mediums to determine which materials are most effective for sound amplification.
Crosscutting Concepts	
Energy and Matter: Energy can be transferred in various ways and between objects	• investigate which materials work best for amplification of sound

Supplemental Resources on Sound

Let's Talk Science is a free online resource. Teachers can utilize the website to access free programs that include hands-on STEM classroom experiences, online forums, planning resources, action projects and professional learning to guide the inquiry process. The resources are divided by grade bands.

- For teachers; http://letstalkscience.ca/Resources/Curriculum-Aligned-Resources
- For students: http://letstalkscience.ca/Resources/Activities-Try-These/ArticleId/173/how-does-sound-travel

SCIcentre is a free online resource. Teachers can use it to locate resources to improve science knowledge and understanding. Students can use it to research information about how sound travels and what amplification is.

- For teachers: https://www.le.ac.uk/se/centres/sci/scicentre.html
- For students: https://www.le.ac.uk/se/centres/sci/selfstudy/snd6.htm

Khan Academy is a free online resource. Students can use it to research more information about what sound is and its properties (i.e., amplitude, period, frequency, and wavelength).

- https://www.khanacademy.org/test-prep/mcat/physical-processes/sound/v/sound-properties-amplitude-period-frequency-wavelength

Science.Made simple. is a free online resource that teachers can use to reinforce or present new content to students. Teachers can opt to sign up for weekly newsletters from the program by completing a free subscription to their mailing list. Students can use it to research additional information about what amplification is and how it works.

- http://www.sciencemadesimple.co.uk/curriculum-blogs/physics-blogs/how-can-we-amplify-sound

Encyclopedia Britannica is a free online resource. Students can use this to research the physics of sound.

- https://www.britannica.com/science/sound-physics

Schoolnet.org.za is a free online resource that students can use to research the physics of sound more in-depth.

- http://schoolnet.org.za/PILAfrica/en/webs/19537/physics.html
- What is Sound? http://schoolnet.org.za/PILAfrica/en/webs/19537/physics2.html
- Properties of a Sound Wave http://schoolnet.org.za/PILAfrica/en/webs/19537/physics3.html
- Speed of Sound http://schoolnet.org.za/PILAfrica/en/webs/19537/physics4.html

cK-12 Foundation is a free online resource that teachers can sign up for to create digital classes in which they post can certain articles and resources for students to read. Students can use the article(s) to research or learn about the intensity and loudness of sound.

- For teachers: https://www.ck12info.org/about/mission/?_ga=2.146322996.1475362072.1555693554-1419253296.1522353655
- For students: https://www.ck12.org/physics/intensity-and-loudness-of-sound/lesson/Intensity-and-Loudness-of-Sound-MS-PS/

STEM Learning is a free online resource that teachers can use to access resources to support the teachers and learning of STEM subjects. Students can use resources to research the factors that affect the pitch and volume of sound.

- For teachers: https://www.stem.org.uk/resources
- https://www.stem.org.uk/resources/elibrary/resource/315610/what-factors-affect-pitch-and-volume-sound

Supplementary File 1: Supplemental Resources for Inquiry and Research Process

Turn Up the Music! Evaluation Rubric

	1. Needs Improvement	2. Developing	3. Sufficient	4. Above Average
Perseverance and Disposition	The students do not consider ways to modify their design for improvement and do not explore ways to make it aesthetically pleasing.	The students do not consider ways to modify their design for improvement one time and do not explore ways to make it aesthetically pleasing.	The students do not consider ways to modify their design for improvement two times but do not explore ways to make it aesthetically pleasing.	The students do not consider ways to modify their design for improvement two times and explores ways to make it aesthetically pleasing.
Research Content	The students use no sources to help design their prototype.	The students use one source to help design their prototype.	The students use two sources to help design their prototypes.	The students use three or more sources to help design their prototype.
Diagram Content	The students include none of the following: 1. The materials planned for use 2. The shape of their design 3. An explanation for the design	The students include one of the following: 1. The materials planned for use 2. The shape of their design 3. An explanation for the design	The students include two of the following: 1. The materials planned for use 2. The shape of their design 3. An explanation for the design	The students include three of the following: 1. The materials planned for use 2. The shape of their design 3. An explanation for the design.
Materials Used	The students used one recyclable material to construct the prototype.	The students used two recyclable materials to construct the prototype.	The students used three recyclable materials to construct the prototype.	The students used four or more recyclable materials to construct the prototype.
Presentation of Prototype	The students discussed one of the following during the presentation: 1. Materials 2. Design 3. The process 4. How they used research	The students discussed two of the following during the presentation: 1. Materials 2. Design 3. The process 4. How they used research	The students discussed three of the following during the presentation: 1. Materials 2. Design 3. The process 4. How they used research	The students discussed four of the following during the presentation: 1. Materials 2. Design 3. The process 4. How they used research