

You can transmit sound via light? An engineering activity to demonstrate energy conversion among different types of waves (Resource Exchange)

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Erica Marti completed her PhD in Civil and Environmental Engineering at the University of Nevada, Las Vegas (UNLV). She holds a Master of Science in Engineering and Master of Education from UNLV and a Bachelor of Science in chemistry from the University of Illinois at Urbana-Champaign. Prior to graduate studies, Erica joined Teach for America and taught high school chemistry in Las Vegas. While her primary research involves water and wastewater, she has strong interests in engineering education research, teacher professional development, and secondary STEM education. In 2021, Erica received the ASEE Pacific Southwest Early Career Teaching Award and two awards at UNLV for mentoring undergraduate and graduate students. She also received the Peter J. Bosscher Outstanding Faculty Advisor Award in 2019 from Engineers Without Borders and was recognized as a Nevada Woman in STEM by Senator Jackie Rosen.

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Target Grades: 8-12

Overview

This activity engages upper middle school and high school students in the hands-on construction of a device that converts energy among multiple forms: sound, light and electricity. Using a digital signal (music) as the input, the device amplifies and transforms the signal, transmits the signal as light pulses with a laser, and finally converts the electric signal to sound.



Students become familiar with building circuits that involve solderless breadboards, resistors, jumper wires, and other electronic compounds. For many students, this might be their first exposure to building electronics, which could encourage them to pursue a pathway as an electronics technician or electrical engineer. As a connection to their daily life, students use their cell phone as the source of the signal. In addition, the activity may appeal to STEAM-oriented students because it incorporates music.

Students may have a misconception that sound, light, and electricity are not related. In fact, they are all forms of energy and part of the electromagnetic spectrum. Consequently, they can be converted from one form to another. After completing this activity, students should have a better understanding of how electronics, like their cell phone, convert energy and send signals.

Through this activity, students are asked to read and follow instructions, view diagrams, and complete quality assurance checks (e.g., did the LED turn on?) at various stages. This provides practical experience for jobs like manufacturing and technical support specialists; therefore, a discussion of careers could be integrated as a follow-up to the activity. In addition, NGSS Science and Engineering Practices may be incorporated. Students should be able to draw a model to show how energy changes from the input to the output of the device they built. Also, they should be able to communicate how the technology works.

Relevant Standard: HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy

Featured Activity	Phenomenon / Issue	Questions	Student's Task
<i>Solar Audio Kit</i>	Due to the lack of atmosphere and the cold temperature, making it impossible to survive without specialized suits, astronauts cannot directly communicate by talking face-to-face like we do on Earth.	What devices can be used to communicate in outer space? How is energy converted among different forms?	Using provided materials and instructions, students will build a device that can convert energy and transmit sound from one location to another.



Full activity, parts list to build your own kit and other lessons available at <http://techtrekker.egr.unlv.edu/>

