
Invisible Forces

2025

Format: Wonder Workshop

Grades: 6-8

Length: 45 minutes

Museum Mission: Be a catalyst! Ignite our community's passion for nature and science.

Program Goal: Explore the physical phenomena that make speakers work.

Big Idea: Complex systems can be broken down into smaller parts to understand how they work and how to improve them.

Key concepts:

- Moving a wire wound into a coil through a magnetic field induces an electric current within the wire.
- Sound travels through longitudinal waves creating pockets of high and low pressure that displace the medium they travel through. These waves have features that determine the pitch and volume of the sound you hear.
- Sound is used to communicate across distances through different mediums.

General Description

We use speakers every day to talk on the phone, listen to music, be alerted, and so much more – but do we fully understand how they work? In this program, students will break down the different physical phenomena that make speakers work, from how sound travels in the air to how the internal components of a speaker interact with each other to play your favorite songs.

Standards

Note: suggested academic standards are topics that may be reinforced by the activities described in this lesson and are not meant to replace standard curriculum. Thus, the range of standards may fall below and beyond the suggested grades for this lesson.

Colorado Academic Standards (CAS)

SC.4.1.5 - Waves are regular patterns of motion

SC.MS.1.4 - Forces that act at a distance (gravitational, electrical, magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.

SC.MS.1.8 - A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.

SC.MS.1.10 - Designed technologies can transmit digital information as wave pulses.

Next Generation Science Standards (NGSS)

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

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.