



5-Minute Refresher: SOUND AND HEARING

SIEMENS | Foundation

Discovery
EDUCATION™

Sound- Key Ideas

- Sound is a type of energy that involves the vibration of molecules in a medium, such as air or water.
- Sound is transmitted through a medium as a pressure wave.
- Sound vibrations are caused by an initial disturbance in a medium that causes molecules around it to vibrate.
Examples: a guitar string being plucked, vocal chords vibrating, vibrations of a diaphragm in a stereo speaker
- The rate at which sound vibrates is called the frequency of the sound. Frequency is measured in Hertz (Hz).
- The amplitude of a sound wave is related to the loudness of the sound. Loudness is measured in decibels.

Hearing- Key Ideas

- Our ears receive and transmit sound wave vibrations to our brains so that we can interpret the sounds around us.
- Humans can hear a range of frequencies from 20 to 20,000 Hz. Different animals can hear different ranges of sound frequencies.
- Loud or high-frequency sounds can cause damage to our ears, causing hearing damage or hearing loss.

Sound and Hearing- The Ears

- Human ears consist of three primary regions: the outer, middle, and inner ear.
- **Outer ear:**
 - Consists of the ear canal
 - Funnel sound waves from the environment towards the ear drum.
- **Middle ear:**
 - Consists of the ear drum (thin membrane) and three small bones (hammer, anvil, and stirrup).
 - When sound waves strike the ear drum, it vibrates and transmits these vibrations to the three bones in the middle ear.
- **Inner ear:**
 - Consists of the cochlea (spiral-shaped tube filled with fluid) and hair cells.
 - The vibrating bones in the middle ear cause the fluid in the cochlea to vibrate. Hair nerve cells sense these vibrations and convert them into electric signals that are sent to the brain.

Sound and Hearing- Learning Objectives for Grades K - 3

- Different objects, people, and animals can make sounds.
- Sounds travel through air, water, and solid objects.
- Sounds can make things vibrate (move back and forth quickly).
- Our ears allow us to hear sounds.
- Some sounds, especially loud sounds, can damage our ears.
- Deafness is the inability to hear sounds.

Sound and Hearing- Learning Objectives for Grades 4 - 6

- A wave is an oscillation, or vibration, that moves back and forth.
- Sounds travel through gas, liquid, and solid objects as waves.
- Our ears have different structures, such as the ear canal, ear drum, and hair cells, that allow us to hear sounds.
- Loud sounds or high frequency (high-pitched) sounds can damage the structures in our ears and cause deafness.
- Our ears can also be damaged by physical contact, such as cotton swabs or ear infections.

Sound and Hearing- Prior Knowledge for Grades K - 3

- Most students have heard a variety of sounds, including voices, animal noises, traffic, and music. Students should be able to identify sounds that are associated with different sources.
- Students should be familiar with the five senses.

Sound and Hearing- Prior Knowledge for Grades 4 - 6

- Students should understand the meaning of the words vibration and wave.
- Most students have observed the vibrational nature of sound waves when they feel the floor or other objects vibrate in the presence of loud or bass-heavy sounds.
- Most students have probably heard of deafness, hearing damage, or hearing aids, but they may have different ideas about what these are. Encourage students to discuss what they already know about hearing impairment.

Sound and Hearing- Common Misconceptions

- Rockets sound just as loud on the moon.
 - **Reality:** Rockets do not make any sound on the moon! In fact, there is no sound in outer space. Sound is the vibration of molecules in matter, but outer space is nearly a vacuum, meaning there are no molecules to vibrate and transmit sound.
- All hearing loss is permanent.
 - **Reality:** This depends on the type of hearing loss. Some hearing loss is due to an obstruction, such as ear wax or fluid, that prevents the ear drum from vibrating. If these obstructions are removed, hearing can be restored. Other hearing loss is caused by damage to nerve hairs in the inner ear. Usually, this damage cannot be reversed.

Sound and Hearing- Additional Information

For more information about sound and hearing,
watch the video on the following page:

http://siemensscienceday.com/activities/lets_hear_it_for_the_ears.cfm