

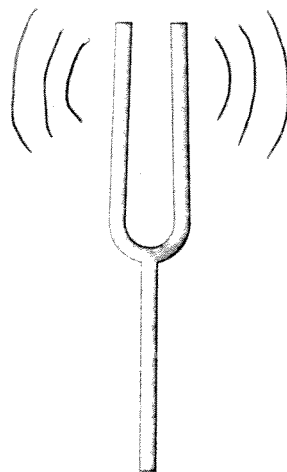
Sound Energy

How is sound produced?

Your sister is practicing her drums, and the music is loud. You don't only hear the music—you can actually feel its vibrations. **Sound** is energy produced by objects that vibrate.

When an object vibrates, it causes molecules in the air around it to vibrate, too. These molecules cause more air around them to vibrate. In this way, the vibrations spread out from the source in all directions.

Most of these vibrations are too small for you to feel. But you can hear them. When vibrating air molecules enter your ear and hit the eardrum, the eardrum starts to vibrate, too. These vibrations travel through the middle ear to the inner ear. There, they cause tiny hairs in the inner ear to bend. This causes signals to be sent to the brain. The brain interprets



Vibrations from a tuning fork

these signals, and you know what the sound is.

Stronger vibrations produce louder sounds. Imagine playing the piano. In one song, you barely press on the keys. The hammers

in the piano hit the strings lightly and cause small vibrations. In the next song, you hit the keys harder. The hammers hit the strings harder, and the vibrations are stronger. What is the difference in the sounds? The second song sounds louder than the first song.

Show What You Know

Explain how hitting the head of a drum with a drumstick creates sound.

Sound Waves

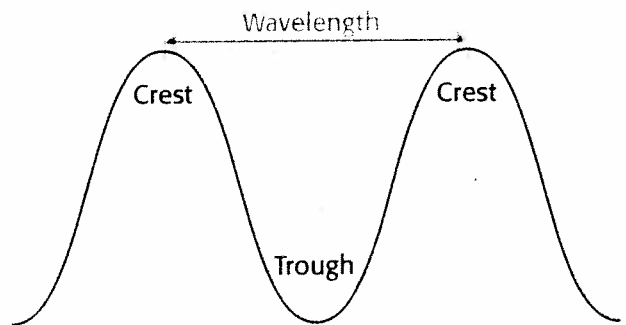
How do sound waves move?

Like light, sound travels in waves, but sound waves are different from light waves. Sound waves can travel through matter, but they cannot travel through space. That's because there are no molecules to vibrate in empty space. Sound waves travel faster through solids (where molecules are packed together tightly) than liquids, and faster through liquids than through gases.

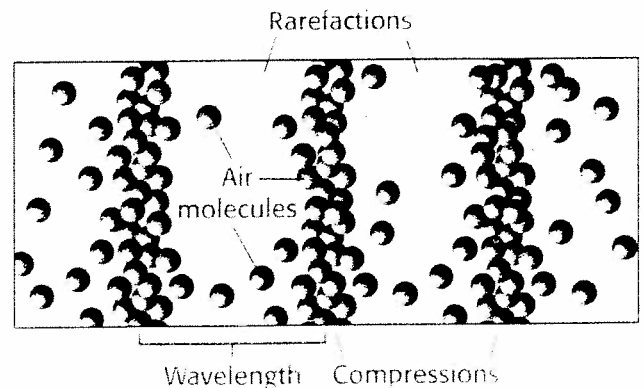
Also like light waves, sound waves have wavelengths. But sound waves have no crests and troughs. Instead, they have areas called **compressions**, where molecules are closer together. They also have areas called **rarefactions**, where molecules are farther apart. The wavelength of a sound wave is the distance between two compressions.

Just as light waves have frequency, so do sound waves. The frequency of a sound wave is the number of compressions that pass a point in one second. The frequency of a wave determines its **pitch**. High-frequency

waves produce high-pitched sounds. A flute, for example, produces high-pitched sounds. Low-frequency waves produce low-pitched sounds. A tuba produces low-pitched sounds.



A light wave



A sound wave

Show What You Know

Sound travels at 1,500 m/s in material A. It travels at 4,200 m/s in material B, and 340 m/s in material C. One material is a solid, one is a liquid, and one is a gas. Identify each material's state of matter.

1. Material A: _____
2. Material B: _____
3. Material C: _____