

What is Acoustics?

Acoustics is the study of sound. The word “acoustic” is derived from the Greek word ἀκουστικός (akoustikos), meaning “ready to hear”. The Latin synonym is “sonic”. Frequencies above and below the audible range are called “ultrasonic” and “infrasonic”, respectively.

Sound

Sound is a vibration, or wave, that travels through matter (solid, liquid, or gas) **and** can be heard (or perceived).

How does sound move (propagate)?

Sound vibrations can only travel through a material substance. This material is called the medium. The sound vibration is started by a mechanical movement, such as a volcanic eruption, plucking a guitar string, or knocking on a door. This mechanical action creates a vibration within the substance. When part of a substance vibrates it affects the neighboring parts, causing the vibration to propagate.

Speed of Sound

The speed of sound is a measurement of how fast sound vibrations travel through a medium. The type of matter has a large effect on the speed at which sound travels. For example, sound travels faster in water than air. Sound travels even faster in steel. In dry air, sound travels at 343 meters per second (768 mph). At this rate sound will travel one mile in about five seconds. Sound travels 4 times faster through water (1,482 meters per second), and around 13 times faster through steel (4,512 meters per second).

Doppler Effect

You can the Doppler Effect when listening to a car approach and then drive by at a high speed. The sound of the car will be higher pitched as it come toward you and lower as it moves away. This is because the sound waves the car produces are closer together as the car approaches and further apart it departs.

Sonic Booms and the Sound Barrier

When airplanes break the sound barrier they also create something called a sonic boom. This is an explosive noise is generated when multiple sound waves are forced together.

When airplanes go faster than the speed of sound (also called Mach 1), we call this breaking the sound barrier. As they pass through the sound barrier, the airplane sheds water drops that have condensed on the plane. This creates a mysterious white halo.

Volume

The volume of sound is a measure of its loudness. We use Decibels to measure sound volume. The more decibels, the louder the sound. Decibels are a logarithmic scale. Every 3 decibels is equal to twice the volume.

Common Sounds	Decibels(DBs)
Quiet forest	15
Human whisper (about 3 feet away)	20
Human voice	60-70
Power saw	110

Yelling in someone's ear	118
Thunder (nearby)	120
Threshold of pain to the human ear	120-130
Police siren (very close)	134
Jet engine (75 feet away; on the side)	140
Rock concert (front row)	150
Blue whale songs	188
Volcanic explosion (loudest naturally occurring sound on Earth)	272