

The Speed of Sound

The speed of sound varies as it travels through different media. The condition of the medium, its temperature, pressure, density, and elastic rigidity affect the speed of sound. Sound travels faster in solids and liquids than in gases, as the table shows.

Speed of Sound

Material	Meters per Second
Carbon dioxide	259
Oxygen	315
Air	331
Water	1,482
Lead	1,950
Glass	5,640
Steel	5,950

Soft, porous materials absorb sound waves. Hard, rigid materials reflect some of the waves while transmitting the remainder of the waves. This can produce an **echo**, a repeated sound caused by reflection of sound waves off a surface. Bats use the echoes of high-pitched sounds to catch insects and avoid obstacles while flying at night. Porpoises use a similar technique in the sea.

The **loudness** of a sound depends upon the intensity, or energy, of the wave. This is shown by the wave's *amplitude*. Big amplitudes correspond to loud sounds; soft sounds have small amplitudes. Loudness, or volume, is measured in units called decibels. Long exposure to sounds whose loudness is more than 85 decibels can cause hearing loss. Jet planes and even live music events can reach 120 decibels.

The frequency of the sound waves governs its **pitch**, how high (shrill) or low (deep) the sound is. In music, pitch is often referred to as a note. Among singers' voices, sopranos and tenors can produce a higher frequency note such as a high C. This contrasts to the lower frequency notes of contraltos, baritones, and basses. Notice below that wave frequency does not increase just because a bell was rung with more energy. Only its amplitude increases.

