

Waveforms

Waveforms

A waveform is a graphical representation of a sound wave as it moves through a medium over time. Any waveform has 4 fundamental characteristics:

- Wavelength
- Amplitude
- Frequency
- Velocity

Remember not to confuse a waveform, which displays a **transverse** wave, with the true nature of sound. A real soundwave is **longitudinal**. The waveform which represents the longitudinal wave is usually shown in audio diagrams as a transverse wave to help us visualize the soundwave better.

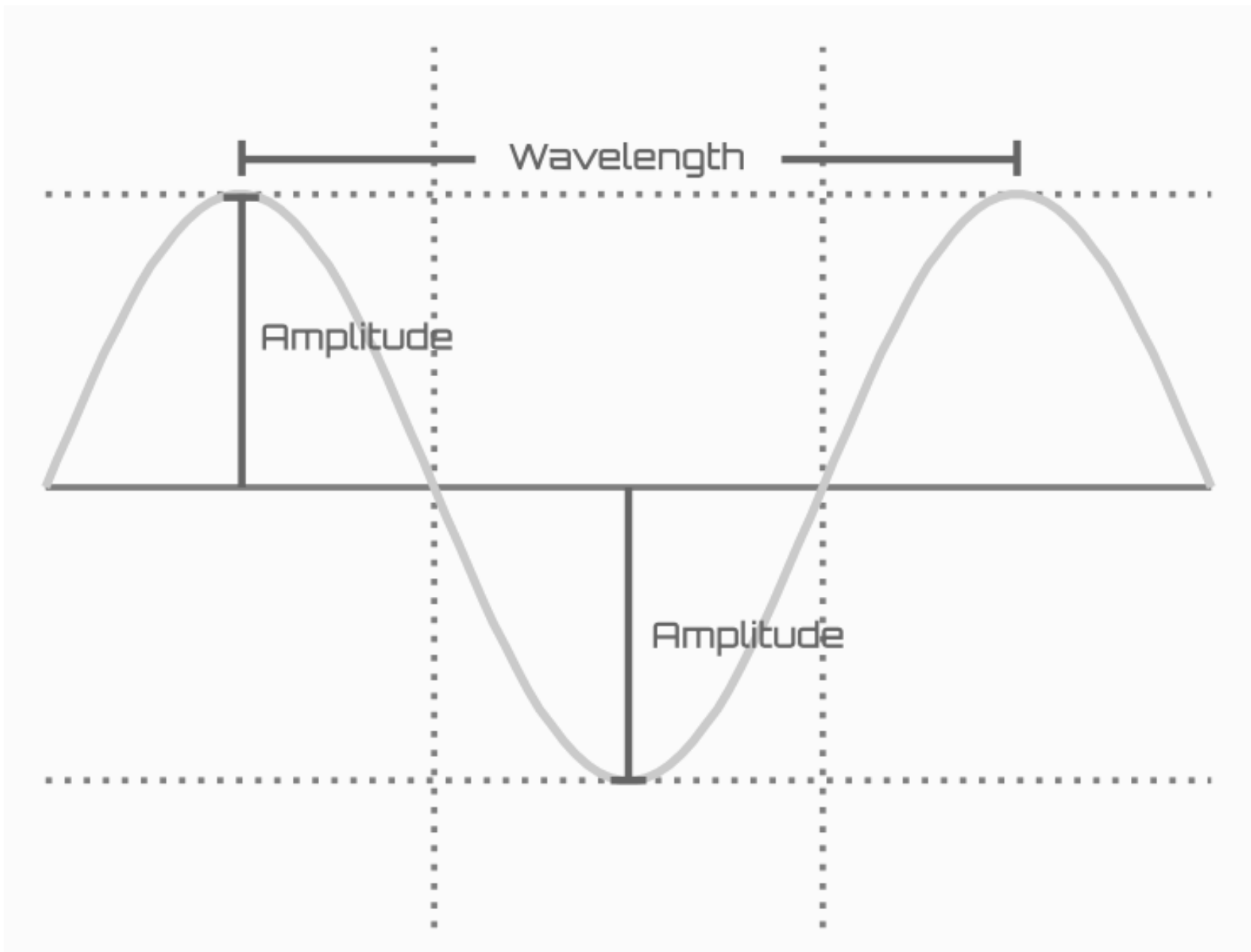


Figure above - Waveform diagram showing the wavelength and amplitude of a soundwave

Wavelength

The **wavelength** of a wave is the length in meters from the start to the end of one full cycle of the waveform e.g. from crest to crest.

Amplitude

The **amplitude** is the maximum displacement of a wave from the centerline to the peak, not from peak to peak. The greater the distance from the centerline of a waveform, the more intense the pressure variation will be within a medium, hence the **louder** it is perceived.

Amplitude is measured in two ways:

1. **Zero to peak** value which measures the maximum positive or negative signal level
2. **Root-mean-square (RMS)** value measures a more meaningful average level, like that at which humans hear.

Frequency

Frequency is how many complete waves there are per second passing a certain point. The frequency indicates the rate of pressure variations or **cycles per second** of a wave.

Frequency is measured in **Hertz**.

The frequency of a sound determines the **pitch**, the sensation of how **low** or how **high** a sound is.

- **Lower frequency** sound waves have longer wavelengths and lower pitch
- **Higher frequency** sound waves have shorter wavelengths and a higher pitch.

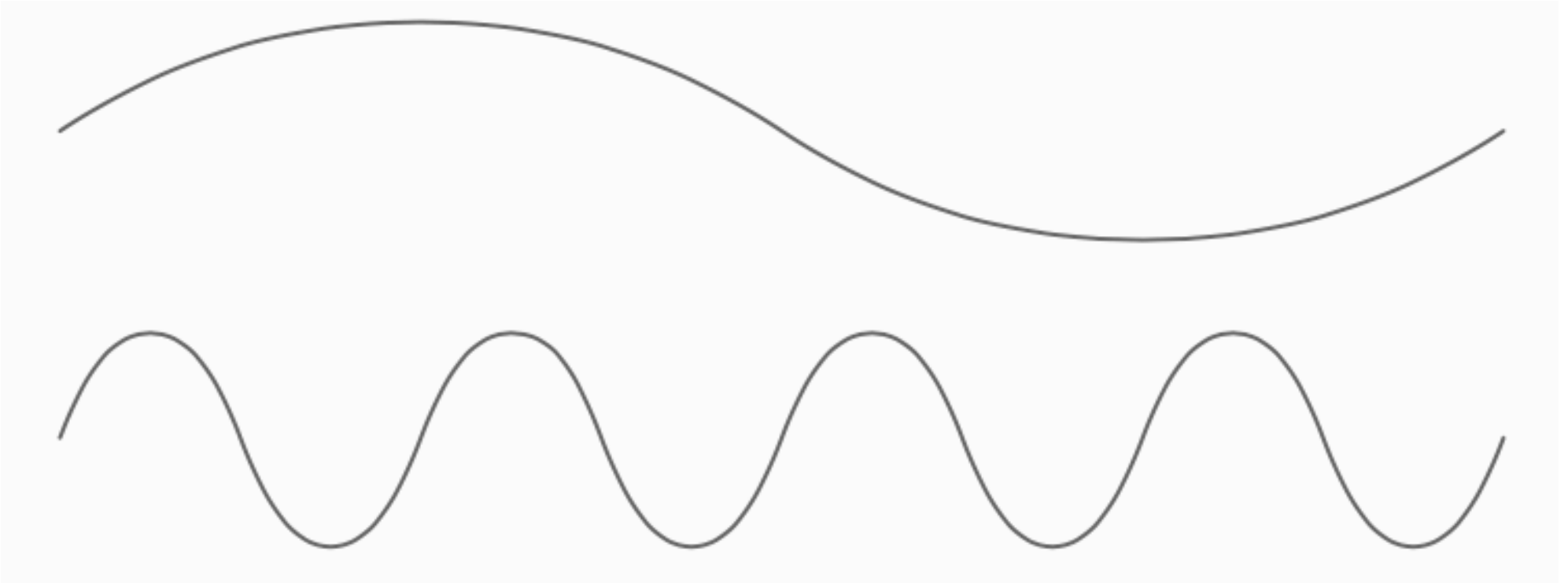


Figure above - Low-frequency wave (top position) in comparison to a high-frequency wave

The frequency range in which humans can hear is 20Hz to 20,000Hz and is called the **audible range**, or the audio spectrum.

Velocity

The **velocity** is the speed and direction of a soundwave.

Soundwaves travel at different speeds through different mediums. Through the air, sound travels at **344 meters per second**.

Generally speaking, the denser the medium the faster sound travels through it.

To find the velocity of a wave the following equation is used:

Velocity (V) = Frequency (f) x Wavelength (λ)