

## Sound Waves: Basics

3 basic components:

- amplitude (volume)
- frequency (pitch)
- time

A sine wave represents:

- height shows the amplitude (how loud the sound is/amount of air pressure)
- period shows the frequency (how many times it repeats in a second/pulses)
- length shows the time

Measuring Amplitude: decibel (dB)

- 0dB SPL- Quietest 1kHz tone humans can hear
- 45dB SPL- Suburban home at night
- 65dB SPL- Average conversation (3 ft away)
- 90dB SPL- Heavy traffic (5 ft away)
- 110+dB SPL- Rock Concert (10 ft away)
- 120dB SPL- Threshold of Pain**
- 140dB SPL- Immediate hearing damage
- 180dB SPL- Space Shuttle Launch

Hearing damage is also caused by length of exposure to loud sound. These are the OSHA limits:

- 90dB SPL for 8 hours
- 95dB SPL for 4 hours
- 100dB SPL for 2 hours
- 110dB SPL for 30 minutes
- 115dB SPL for 15 minutes

Measuring Frequency: Hertz (Hz)

- 20Hz- lowest we can hear
- 80Hz- bass singer's bottom notes
- 261.63Hz- C4 (Middle C)
- 440Hz- A4 (tuning reference)
- 2kHz- near the top violin note
- 4,186Hz- C8 (top note on piano)
- 20kHz- highest humans can hear

Measuring Time: milliseconds (ms)

- Usually measured in milliseconds (noticeable time delay starts at about 15-20ms)
- Speed of Sound: 1130ft/sec (depends on temperature and humidity) »11.3 ft = 10ms