Sound Basics

What is sound?

- American Heritage dictionary: "A vibratory disturbance in the pressure and density of a fluid, or in the elastic strain in a solid, with frequency in the approximate range between 20 and 20,000 cycles per second, and capable of being detected by the organs of hearing.“

Sound Propogation

- Air particles in compression/rarefaction when viewed from a single point
- We can graph as a “waveform”

Frequency

$$Frequency = \frac{Cycles}{Second}$$

- Sound is a cyclic phenomenon
- Frequency is the number of cycles occurring in one second.
- Measured in Hertz (after Mr. Hertz)
- Also known as Pitch

Getting to know Frequency

- Listen to frequencies
- View frequencies MAC Oscope

Speed of Sound

- Speed 1130 ft/sec at 59°F, or “Standard Temperature”
- Travels roughly 1 mS/Foot
- Remember this number!!!

Intensity

- Intensity or amplitude = loudness
- Measured in deciBels (dB) to correspond with the way our ears perceive loudness

Wavelength

$$Wavelength = \frac{Speed}{Frequency}$$

- Length of one cycle is the distance per second divided by the frequency in cycles per second
- Speed of sound changes with air temperature

What is the wavelength of a 1000Hz sound wave?

$$Wavelength = \frac{Speed}{Frequency}$$

$$Wavelength = \frac{1130\ ft/s}{1000 cycles/s (Hz)}$$

What is the wavelength of a 1000Hz sound wave?

$$Wavelength = \frac{1130\,ft/s}{1000 cycles/s(Hz)}$$

$$1.13 = \frac{ft}{cycle}$$

What is the wavelength of a 60Hz sound wave?

$$Wavelength = \frac{1130\,ft/s}{60\,Hz}$$

$$18.83\,ft$$

What is the wavelength of a 6000Hz sound wave?

$$Wavelength = \frac{1130\ ft/s}{6000\ Hz}$$

$.19\ ft$

Period

$$Period = \frac{1}{Frequency}$$

- Frequency is Cycles per Second
- Period is time one cycle takes
- Period is inverse of frequency

What is the period of a 1000Hz sound wave?

$$Period = \frac{1s}{1000 cycles / s}$$

$$.001s$$

$$1ms$$

Sound exists in time

Ears can not be turned off

Senses

- Live Entertainment works for primarily two senses: sight and hearing.
- Sets/Costume/Lighting work for sight, only sound works for hearing.

Assignment

- Read Chapter 2
- Homework: Calculate the wavelengths of the following frequencies:
  - 92Hz
  - 1630Hz
  - 9504Hz