

A **wave** is a disturbance that transmits **energy** through matter or space.

Most waves need a **medium**, which is the matter through which the wave travels.

Waves that require a medium are **mechanical waves**.

A medium could be a **solid**, **liquid** or a **gas**.

**Sound Waves** are **LONGITUDINAL** mechanical waves caused by vibrations in a medium.

Vibrations cause compressions and rarefactions.

## Sound Notes

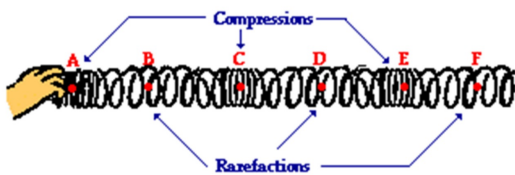


### I. Production of Sound

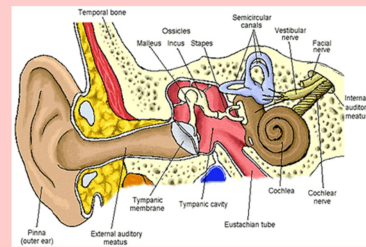
a. Begins with a vibrating object

i. Compression- air molecules pushed together

ii. Rarefaction- area of low pressure and low density of air molecules



Subtle compressions and rarefactions in the air cause our ear drums to vibrate. The auditory nerve sends a signal to the brain, which perceives these vibrations as the sounds we hear.



iii. Creates a longitudinal wave

b. Wave spreads out in all directions

<http://phet.colorado.edu/en/simulation/wave-interference>

### II. Characteristics of sound waves

a. Audible frequencies= 20-20,000 Hz

i. Frequency determines pitch.

ii. Higher frequency = higher pitch

b. Less than 20 Hz = infrasonic waves

c. Greater than 20,000 Hz = ultrasonic waves (dogs can hear)

i. used to produce images in the body (fetus)

ii. higher frequencies produce smaller wavelengths which bounce off smaller objects to get a better picture

iii. used by dolphins in echolocation

d. Speed of sound

i. travels faster through solids (generally)

ii. travels faster in hot gases than cool gases (temp doesn't affect liquids and solids as much because particles are closer together)

iii. approximately 343 m/s (5 seconds per mile)

-measuring distance of lightening storm—count seconds and divide by 5

**SOUND INTENSITY** is the perceived loudness of a sound. It is affected by the **AMPLITUDE** of the vibrations.

Sound intensity is measured in decibels (dB).

**III. Doppler Effect--Why do car sounds change in pitch as they go by?**

a. Speed of the car relative to the observer changes

b. Frequency of the wave pulse changes—thus changing the pitch

i. Car moving towards you = higher frequency/pitch

ii. Car moving away = lower frequency/pitch

<http://www.astro.ubc.ca/~scharein/applets/#Doppler>  
<http://www.colorado.edu/physics/2000/applets/doppler2.html>

**IV. Instruments use standing waves to produce notes**

a. **Standing Waves** -reflected waves that interfere with one another to produce what appears to be a wave that is standing still

b. **Nodes**- the points on a standing wave at which the waves cancel

c. **Antinodes**- the points on a standing wave at which the largest amplitude occurs

