

Unit 9: Waves

Content Outline: Sound Waves (9.2)

I. Sound

- A. This is a *form of energy* produced and transmitted by *vibrating* matter.
- B. Sound waves travels as longitudinal waves.
- C. Sound travels more quickly through solids than liquids or gases **mediums**.
 - 1. A **medium** (media pl.) is the state of matter though which sound waves travel through.

II. Sound Waves

- A. All sound is carried through matter as sound waves.
- B. Sound waves are alternating areas of high and low pressure in the air.
- C. Sound waves move out in all directions from the origin...a *vibrating object*.
- D. Sound waves move *faster in warmer weather*. Slower in colder weather.

III. Sonar

- A. An instrument that uses reflected sound waves to find underwater objects.
For example, a submarine or battleship uses sonar to find other underwater objects
- B. Some animals, such as bats, whales and porpoises, use sonar or echolocation to find their prey.
 - 1. These sounds have such a *high pitch or frequency* that the human ear cannot hear them.
- C. The sound waves *bounce off an object* and are then bounced (reflected) back to the "collector".

IV. Volume

- A. **Volume (loudness)** is a measure of how loud or soft a sound is (*We measure the height of a wave*).
- B. Volume depends on the *amplitude (height from equilibrium)* of the sound wave.
 - 1. As wave height increases, volume increases
- C. Volume is measured in **Decibels**.

V. Pitch

- A. **Pitch (intensity)** is a measurement of how high or low (*length of a wave*) a sound is.
- B. Pitch depends on the *frequency of a sound wave*.
 - 1. As wavelength increases, pitch (intensity) decreases. *Less waves* will pass a point in a given time.
- C. Measured in **Hertz**.

For example,

Low frequency
Low **pitch**
Longer **wavelength**
Less **waves pass a point**

High frequency
High **pitch**
Shorter **wavelength**
More **waves pass a point**

What can you hear?

Decibels (dB): Volume

Normal Speech: 60dB

Library: 40dB

Close Whisper: 20dB

Jet Engine: 140dB

Loud Rock Music: 110dB

Subway Train: 100dB

Busy Street Traffic: 70dB

120dB or above usually causes pain to the ear

Hertz (Hz): Pitch or frequency

- young people can hear frequencies between 20 – 20,000 Hz

- dogs can hear frequencies that range from 67 – 45,000 Hz

-as you age your ability to hear high frequency sounds decreases

VI. Sound and Instruments

- A. Instruments can be played at *different pitches* by changing the *lengths of different parts* of the instrument.
- B. Another way to make different pitches is to change the *thickness of the material* that vibrates.
Remember...sound is a vibration. It is the back and forth movement of molecules of matter.
- C. Sound waves move through 3 parts of the ear; outer ear, middle ear, and inner ear.
 - 1. The outer ear (**Pinna**) collects sound waves.
 - 2. The Middle ear amplifies the sound waves and *converts it into mechanical energy using bones*.
 - 3. The Inner ear (**Cochlea**) *converts* the mechanical energy (vibrations) into Liquid waves inside the Cochlea. The Liquid waves are used to bend hairs and *convert* wave energy to electrical energy using nerves.
 - 4. The Auditory nerves send the electrical energy to the brain to be processed... and you get the sensation of sound.