Sound

The Nature of Sound
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Using Sound

The Nature of Sound

- What is sound?
  - Sound is a disturbance that travels through a medium as a longitudinal wave.

The Nature of Sound

- How do sound waves interact?
  - Sound wave reflect off objects, diffract through narrow openings and around barriers, and interfere with each other.
    - Echo: a reflected sound

The Nature of Sound

- What factors affect the speed of sound?
  - The speed of sound depends on the elasticity, density, and temperature of the medium the sound travels through.
    - Elasticity: the ability of a material to bounce back after being disturbed
    - Density: the ratio of the mass of a substance to its volume

Properties of Sound

- What factors affect the loudness of a sound?
  - The loudness of a sound depends on two factors: the amount of energy it takes to make the sound and the distance from the source of the sound.
    - Loudness:perception of the energy of a sound
    - Intensity: the amount of energy per second carried through a unit area by a wave
    - Decibel (dB): a unit used to compare the loudness of different sounds

Properties of Sound

- What does the pitch of a sound depend on?
  - The pitch of a sound that you hear depends on the frequency of the sound wave.
    - Pitch: perception of the frequency of a sound
    - Ultrasound: sound waves with frequencies above 20,000 Hz
    - Infrasound:sound waves with frequencies below 20 Hz
    - Larynx: two folds of tissue that make up the human voice box

Properties of Sound

- What causes the Doppler effect?
  - When a sound source moves, the frequency of the waves changes because the motion of the source adds to the motion of the waves.
    - Doppler effect: the change in frequency of a wave as its source moves in relation to an observer

Music

- What determines the sound quality of a musical instrument?
  - Sound quality results from the blending of a fundamental tone with its overtones. Resonance also plays a role in sound quality.
    - Music: a set of tones and overtones combined in ways that are pleasing
    - Fundamental tone: the lowest natural frequency of an object
    - Overtone: a natural frequency that is a multiple of the fundamental tone's frequency

Music

- What are the basic groups of musical instruments?
  - There are three basic groups of musical instruments: stringed instruments, wind instruments, and percussion instruments.

Music

- How is acoustics used in concert hall design?
  - Acoustics is used in the design of concert halls to control reverberation and interference.
    - Acoustics: the study of how sounds interact with each other and the environment
    - Reverberation: the echoes of a sound that are heard after a sound source stops producing sound waves

How You Hear Sound

- What is the function of each section of the ear?
  - The outer ear funnels sound waves, the middle ear transmits the waves inward, and the inner ear converts sound waves into a form that travels to your brain.
    - Ear canal: a narrow region leading from the outside of the human ear to the eardrum
    - Eardrum: a small, tightly stretched, drumlike membrane in the ear
    - Cochlea: a fluid-filled cavity in the inner ear that is shaped like a snail shell

How You Hear Sound

- What causes hearing loss?
  - There are many causes of hearing loss, including injury, infection, exposure to loud sounds, and aging.

Using Sound

- Why do some animals use echolocation?
  - Some animals, including bats and dolphins, use echolocation to navigate and to find food.
    - Echolocation: the use of reflected sound waves to determine distances or to locate objects

Using Sound

- What are ultrasound technologies used for?
  - Ultrasound technologies such as sonar and ultrasound imaging are used to observe things that cannot be seen directly.
    - Sonar: a system that uses reflected sound waves to detect and locate objects underwater
    - Sonogram: an image formed using reflected ultrasound waves