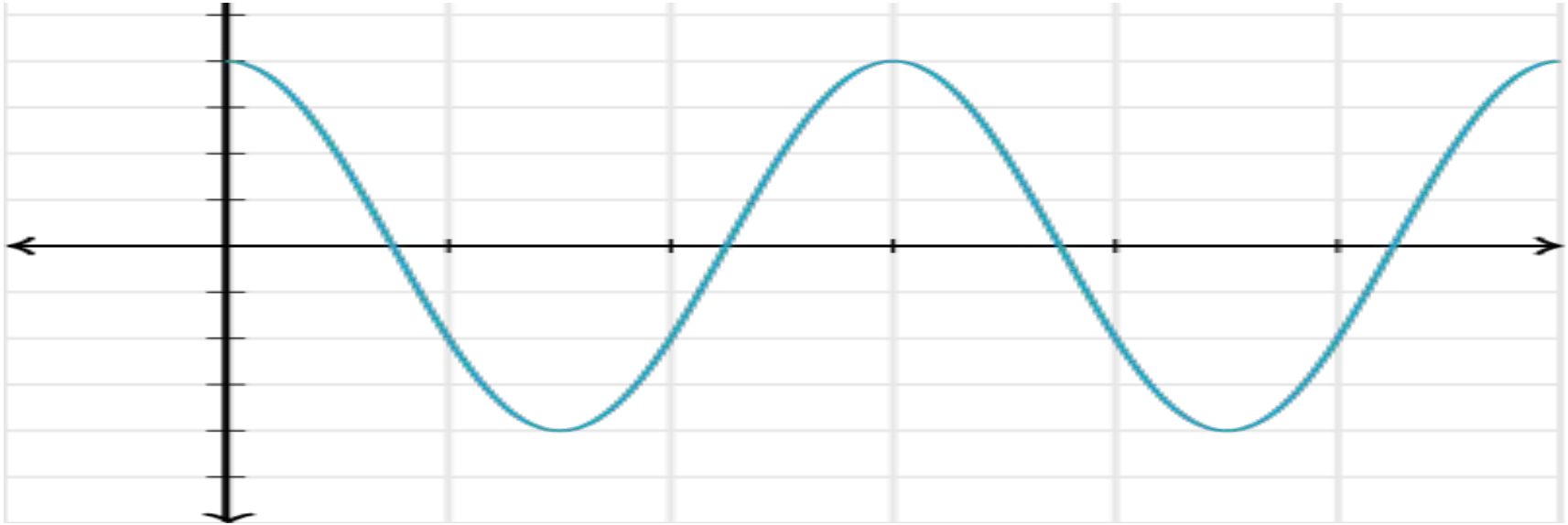
Wave Mechanics and Sound

Colin K, Alexa V, Miye S

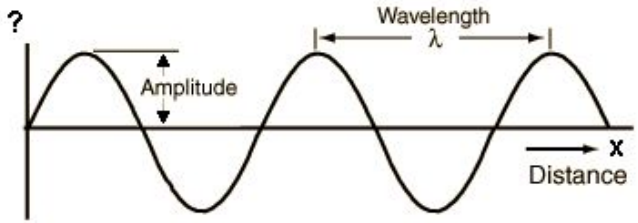
Waves?

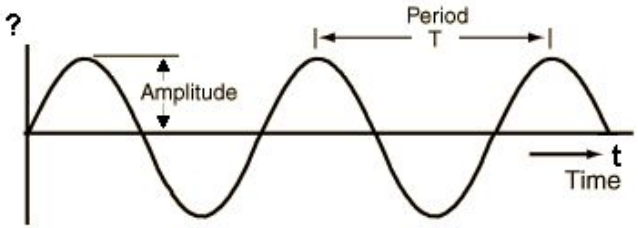
- A wiggle in time and space
- Cause: vibration
  - Vibration: a wiggle in time
- Basically: a travelling vibration

Parts of a Wave



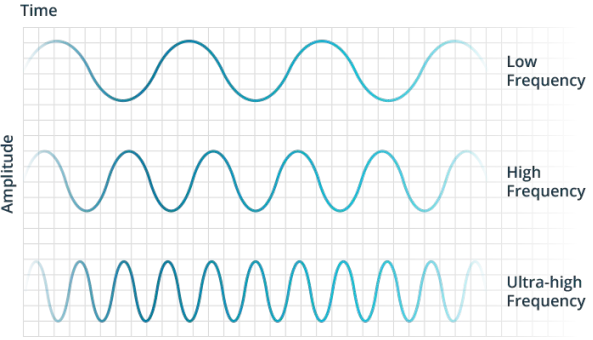
Period & Wavelength



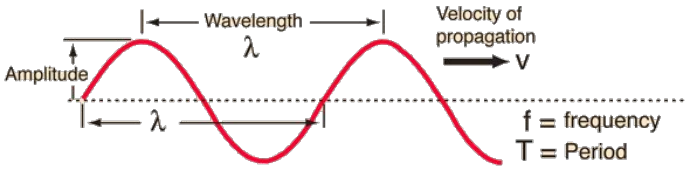


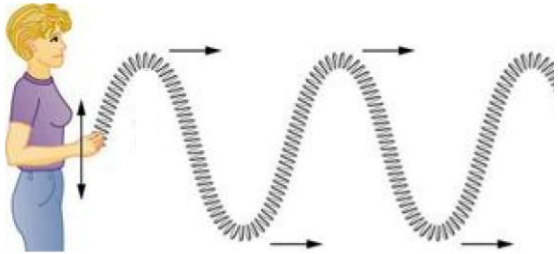
- Period
  - Denoted by T
  - In seconds (s)
  - The time taken for one complete cycle of vibration to pass a given point
- Wavelength
  - Denoted by the greek letter λ
  - In meters (m)
  - Distance between corresponding points of two consecutive waves

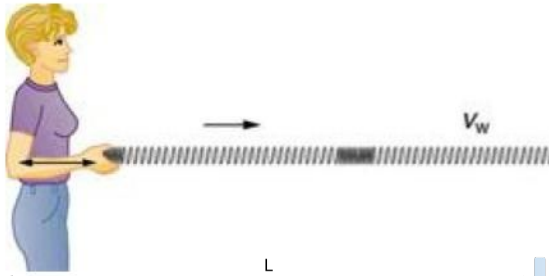
Frequency & Velocity

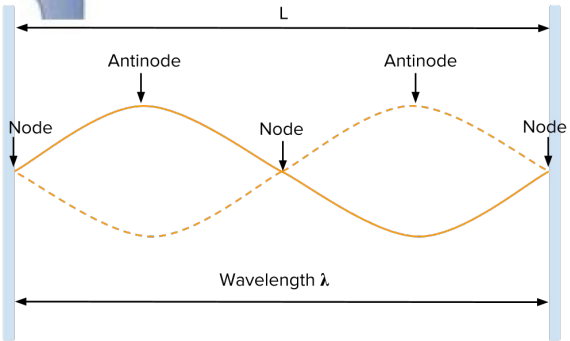


- Frequency
  - Denoted by the letter f
  - In Hertz (Hz)
  - f = 1/T
  - Number of waves that pass a fixed point in a given amount of time
- Velocity
  - Speed and direction of a wave
  - In m/s
  - v = λf









Types of Waves

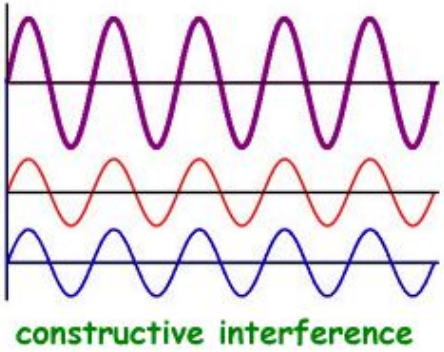
Transverse Waves - motion of medium is perpendicular to direction in which the wave travels (e.g. ripples, light)

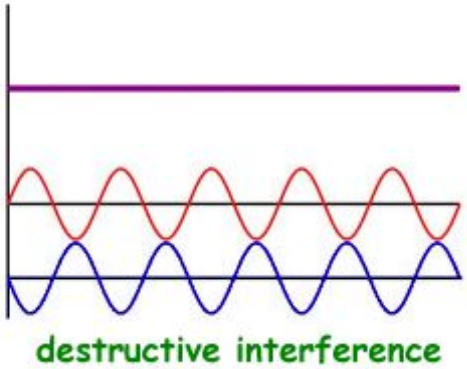
Longitudinal Waves - motion of medium is in the same direction in which the wave travels (e.g. sound)

Standing Waves/Stationary Waves - particular points on wave are stationary

- Fixed points - nodes
- Positions on a standing wave with the largest amplitudes - antinodes
    - Occur halfway between nodes

Interference

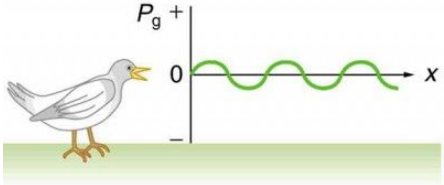


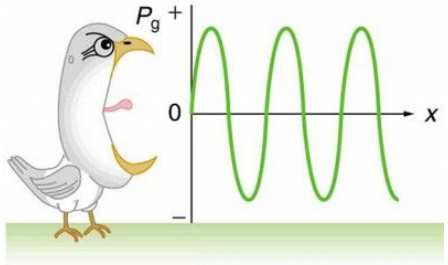


- a phenomenon that occurs when two waves meet while traveling along the same medium
  - When these waves meet:
    - they can overlap and form an interference pattern
- Two types of interference:
  - Constructive Interference
    - the crest of one wave overlaps with the crest of another, their individual effects add up
  - Destructive Interference
    - the crest of one wave meets the trough of another, their individual effects decrease

Sound

- Produced by vibrations that compress and decompress the medium around the vibrating object
  - Frequency of vibrating source is almost always equal to the frequency of the sound waves





Intensity and Frequency

Loudness - brain's interpretation of intensity

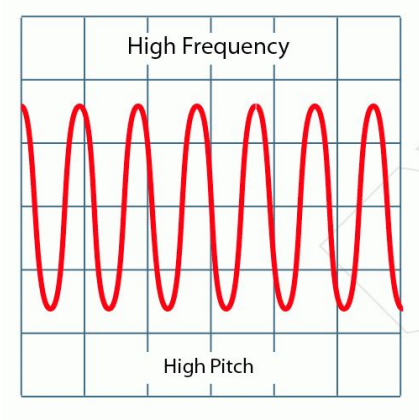
- Measured in dB

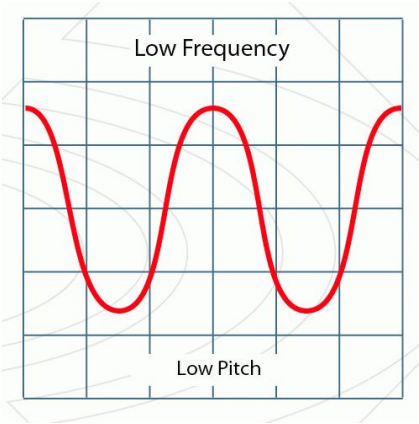
Pitch - brain's interpretation of frequency

High frequency→ high pitch

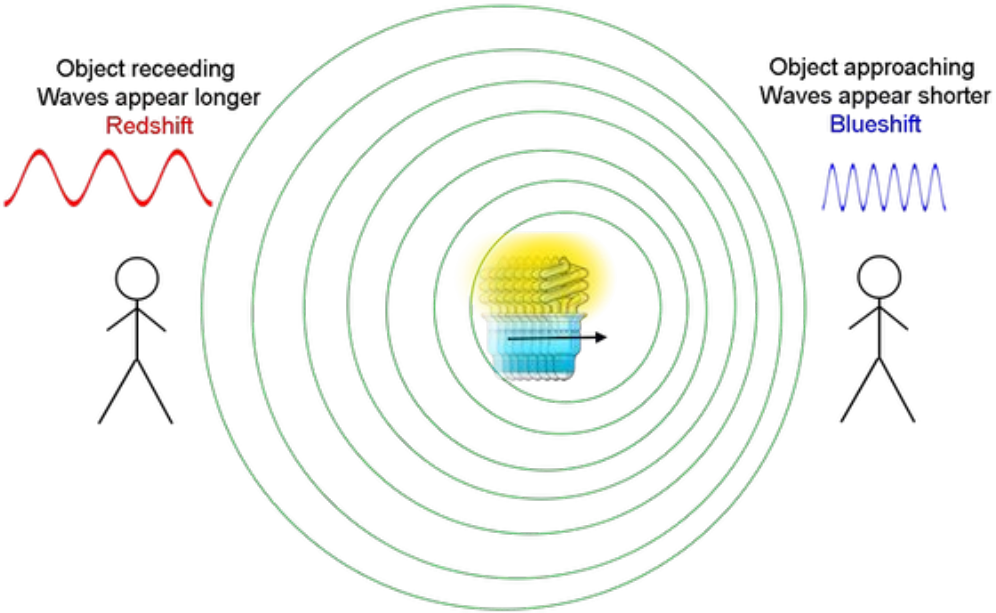
Low frequency→ low pitch

- Measured in Hz





Doppler Effect



- The Doppler Effect is the apparent change in frequency due to the motion of the source (or receiver)

- The pitch sounds higher when the source is moving toward you and lower when it’s moving away

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