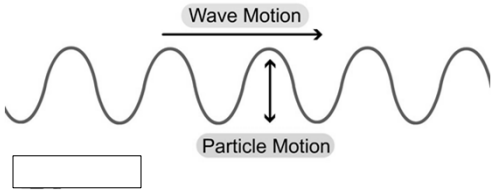
Wave Properties and Behaviors

Wave Motion

- **Wave**
  - **the rhythmic disturbance that carries energy through matter or space**
- **Medium**
  - **the material that a wave travels through**
  - **Example: Air, water**
- **Mechanical Wave**
  - **a wave that needs a medium to move through**

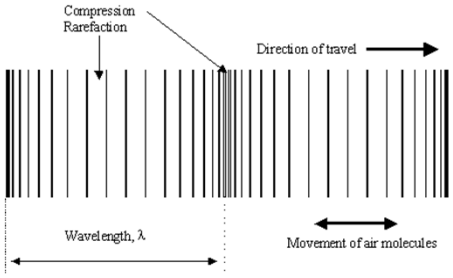
Types of Waves

- **Transverse Wave**
  - **causes the particles of the medium to vibrate <u>perpendicularly</u> to the direction of motion of the wave.**



Types of Waves (cont.)

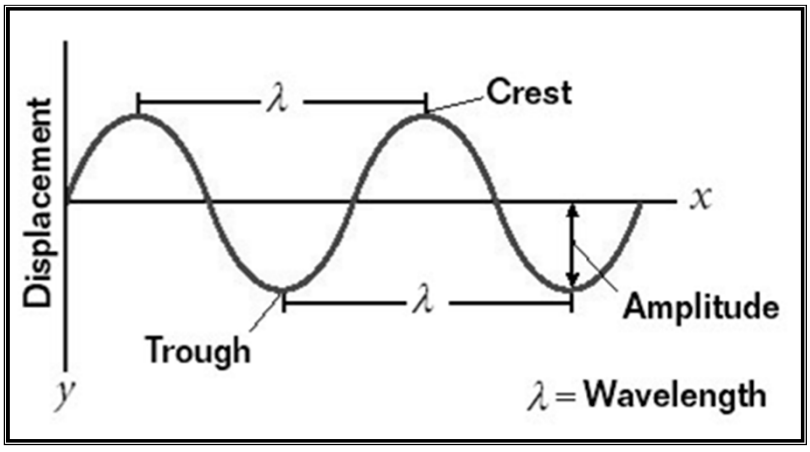
- **Longitudinal**
  - **causes the particles in the medium to move <u>parallel</u> to the direction of the wave**



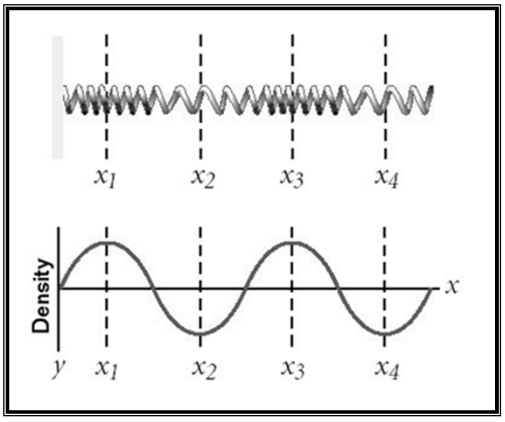
Types of Waves (cont.)

- **Pulse Wave**
  - **single non-periodic disturbance**
- **Periodic Wave (Continuous)**
  - **A wave whose source is some form of periodic motion.**

Parts of a Wave



Longitude to Transverse Comparison



Measuring a Wave (cont.)

- **Wavelength (λ)**
  - **the distance between similar points on adjacent waves**
- **Amplitude**
  - **amount of energy in a wave**
  - **Energy = amplitude^2**

Measuring a Wave

- **period (T)**
  - **the amount of time it takes a wave to pass**
- **frequency (f)**
  - **the number of times a wave passes per second**

$$f = \frac{1}{T} \quad or \quad T = \frac{1}{f}$$

Measuring a Wave (cont.)

- **Speed of a wave**
  - **Determined by the medium it is traveling through**

$$v = \lambda f \quad or \quad v = \frac{\lambda}{T}$$

As always, $v = \frac{d}{t}$

Wave Speed Sample Problem

- **A trombone produces a middle C which has a frequency of 264 Hz. If the sound wave produced has a wavelength of 1.30m,**
  - **What is the speed of the sound wave?**
  - **How long will it take the wave to travel the length of a football field, 115 m?**
  - **What is the period of the wave?**

Wave Speed Sample Problem

Frequency = 264 Hz Wavelength = 1.3 m

Distance traveled = 115 m

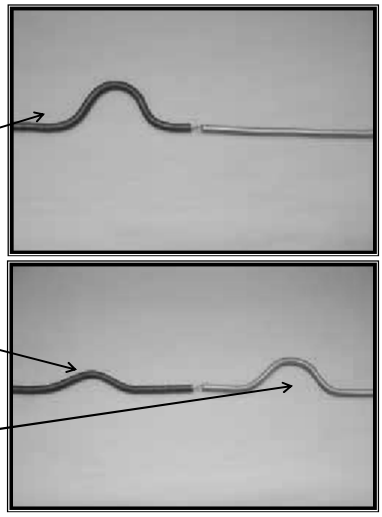
$$v = \lambda f = (1.3)(264) = 343 \text{ m/s}$$

$$v = \frac{d}{t} \rightarrow t = \frac{d}{v} = \frac{115 \text{ m}}{343 \text{ m/s}} = .335 \text{ s}$$

$$T = \frac{1}{f} = \frac{1}{264} = .00379 \text{ s}$$

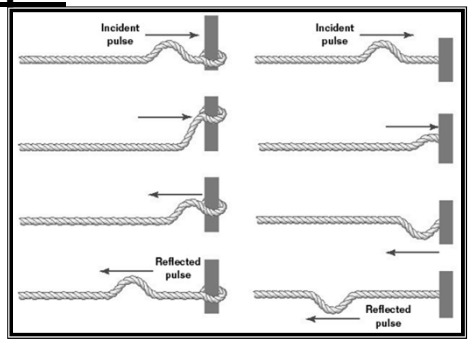
Wave Boundaries

- **Boundary**
  - **Change in medium**
  - **Part of the wave is transmitted, part is reflected.**
- **Incident Wave**
  - **Incoming wave that strikes the boundary**
- **Reflected Wave**
  - **Wave returning to the initial medium**
- **Transmitted Wave**
  - **Wave entering new medium**



Reflection

- **Example**



Visit: http://www.surendranath.org/Applets.html
In the upper left corner, click on the Menu => Wave Motion => Reflection and Transmission
Look at other examples by using the drop box in the right part of the screen.

The Medium and Reflection

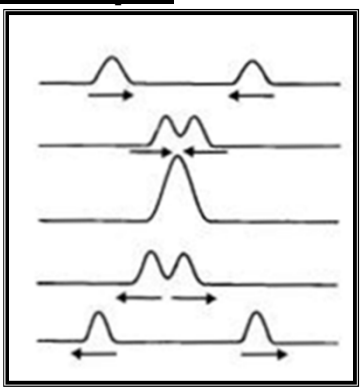
- The amount transmitted and reflected depends on the medium.
- A large difference in mediums results in a large amount of the wave being reflected.

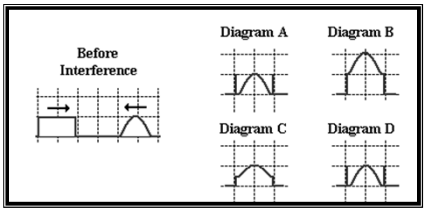
Interference

- Interference, also called superposition, occurs when two or more waves pass each other in the same medium.
- How it works
  - the displacement of the medium caused by two or more waves is the sum of the displacements of the individual waves

Constructive Interference

- **Example**





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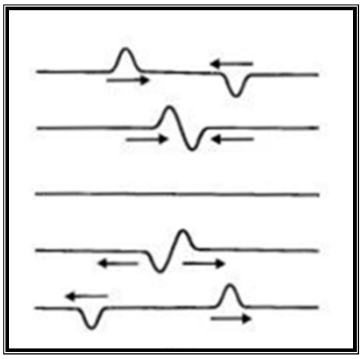
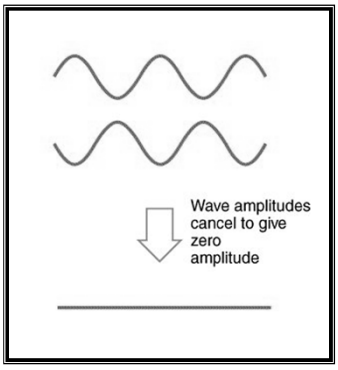
Destructive Interference

- **Example**





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Standing Wave

- **A wave pattern that results when two waves of the same frequency, wavelength, and amplitude travel in opposite direction and interfere**

Antinode

Node

Picturing Standing Waves