

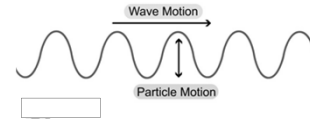
Wave Properties and Interactions Notes

Wave Motion

- **Wave**
 - the motion of a disturbance
- **Medium**
 - the material that a wave travels through
 - Example: Air, water
- **Mechanical Wave**
 - a wave that needs a medium to move through

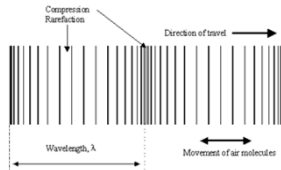
Types of Waves

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



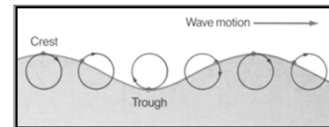
Types of Waves (cont.)

- **Longitudinal**
 - causes the particles in the medium to move parallel to the direction of the wave



Types of Waves (cont.)

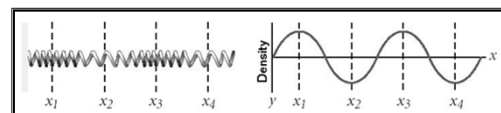
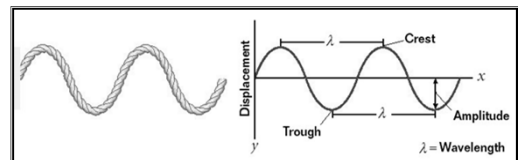
- **Surface**
 - Particles on the surface of the medium move in a circular motion



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



Wave Properties and Interactions Notes

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

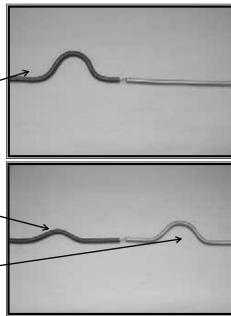
$$f = \frac{1}{T} \quad \text{or} \quad T = \frac{1}{f}$$

Measuring a Wave (cont.)

- **Wavelength (λ)**
 - the distance between similar points on adjacent waves
- **Velocity (v)**
 - $v = \lambda f$
- **Amplitude**
 - amount of energy in a wave
 - Energy = amplitude²

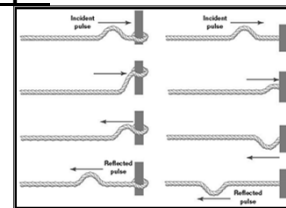
Wave Boundaries

- **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://surendranath.tripod.com/GPA/Menu.html>
Click on Animation Menu => Wave Motion =>

Reflection and Transmission

Look at other example by using the drop box in the lower left part of the screen.

Changing Mediums and Reflection

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

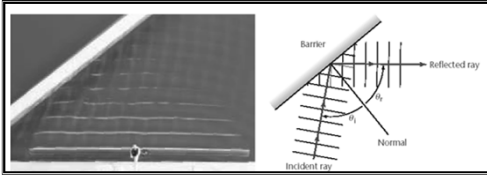
Density of the Medium and Reflection

- When a wave passes from a less dense to a more dense medium, the reflected wave is inverted. (like fixed end reflection)
- When a wave passes from a more dense to a less medium, the reflected wave remains upright. (like open end reflection)

Wave Properties and Interactions Notes

Reflection in Two Dimensions

- Angle of Incidence = Angle of Reflection

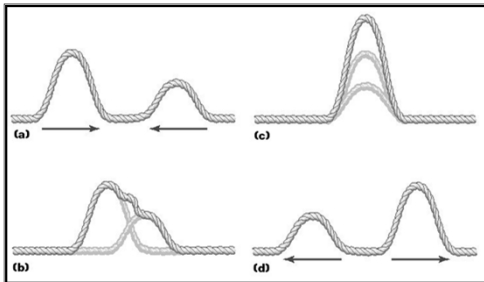


Interference

- 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

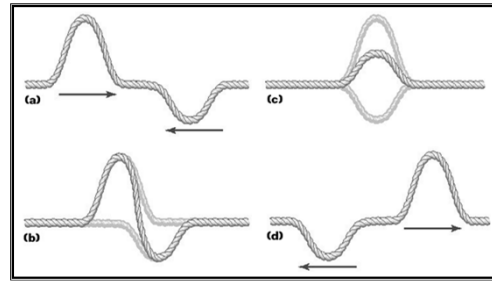
Constructive Interference

- Example



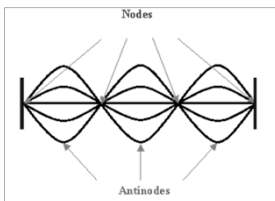
Destructive Interference

- Example



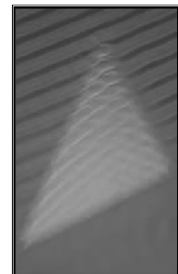
Standing Wave

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



Refraction

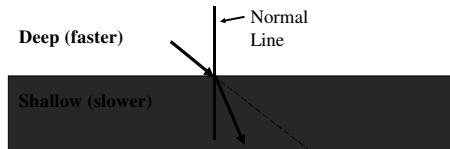
- Change in direction of waves at a media boundary
- The speed of the wave changes as it enters the new medium, causing the change in direction.



Wave Properties and Interactions Notes

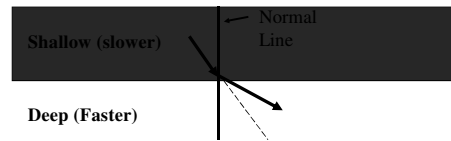
Refraction (cont.)

- As a water wave travels from deeper water to shallow water, the wave bends towards the normal.



Refraction (cont.)

- As a water wave travels from shallow water to deep water, the wave bends away from the normal.



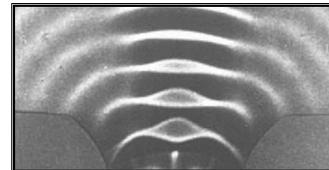
Refraction (cont.)

- As the velocity of a wave decreases in a new medium, the wavelength of the wave decreases.
- The frequency remains the same, satisfying the wave velocity equation

$$v = \lambda f$$

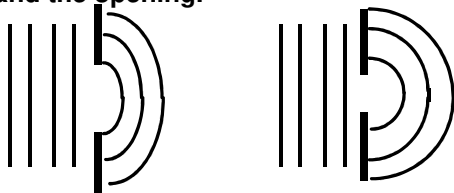
Diffraction

- Spreading of waves around the edge of a barrier



Diffraction (cont.)

- The amount of diffraction depends on the relative size of the wavelength and the opening.



Diffraction

- Diffraction from two openings in a barrier produces interference

