

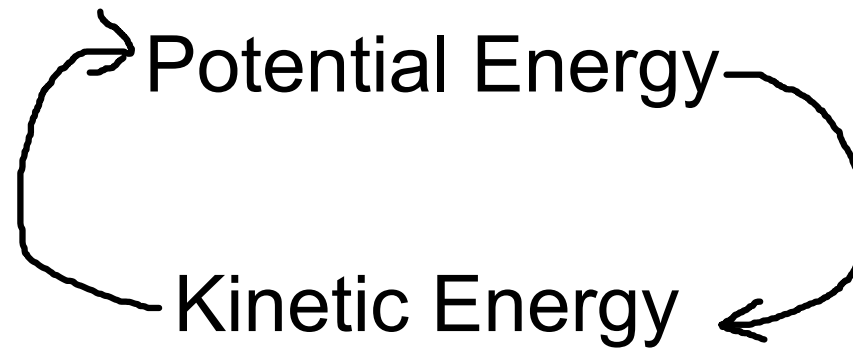
# Vibrations and Waves

## Chapter 14

<http://ionaphysics.org/ntnujava/springWave/springWave.html>

**Periodic motion - motion which repeats in a regular cycle.**

**Period - The amount of time needed for one cycle**



A pulse or wave transports energy through space without transporting matter.

A pulse is a single travelling disturbance.

A wave is periodic.

Pulse and wave parameters:

Speed

Amplitude

Additional Wave Parameters

Wavelength

Frequency

Period

**Periodic Motion** - any motion which repeats itself regularly.

**Period** -  $T$  - the time for one complete cycle

**Frequency** -  $\nu$  - the number of cycles each second.

**Amplitude** - Maximum distance from equilibrium position

**Wavelength** ( $\lambda$ ) The distance between two points in phase with each other

**Speed** means the speed of the leading edge of the wave, not of the movement of any particle.

If the speed of sound is  $3.31 \times 10^2$  m/s, how long does it take the sound of a speaker to travel the length of a football field -- assumed to be at room temperature?

$$v = f \lambda$$

Assuming the speed of sound is  $3.31 \times 10^2$  m/s, what is the wavelength of a 440 hz sound?

<http://ionaphysics.org/ntnujava/sound/sound.html>

Homework: Read pages 375-379

Resonance occurs when small forces are applied at regular intervals at a natural frequency of an object causing vibrations of increased amplitude.

<http://ionaphysics.org/lab/TacomaNarrowsBridge.mpeg>

# Classification of waves:

Transverse

Longitudinal

<http://ionaphysics.org/ntnujava/waveType/waveType.html>

Is the illustration below a pulse or a wave? Why?

Is it longitudinal or transverse?

Was energy transferred? How do you know? <http://Ionaphysics.org/classroom/Preview/dog.gif>

Can you demonstrate longitudinal and transverse waves by moving the mouse using the following applet?

<http://ionaphysics.org/lab/Wave.htm>

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Superposition:

The displacement of a medium caused by two or more waves is the algebraic sum of the displacements caused by the individual waves.

## Superposition of pulses

<http://ionaphysics.org/ntnujava/wave/impulse.html>

## Superposition of waves

<http://ionaphysics.org/ntnujava/waveSuperposition/waveSuperposition.html>

This link shows adding (superposition of) sound waves of various frequencies:

<http://ionaphysics.org/ntnujava/sound/sound.html>

Interference: The result of the superposition of two or more waves.

Constructive interference

Destructive interference

Standing waves

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Reflection

Law of reflection

a) A ray of light strikes a mirror at an angle of incidence of 40 degrees. What is the angle between the mirror and the reflected ray?

b) A ray of light strikes a mirror. The angle between the mirror and the ray is 25 degrees. What is the angle between the incident ray and the reflected ray?

c) Light is reflecting off a mirror. If the angle of incidence increases by 2 degree, how much does the angle between the incident and reflected rays increase?

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## Refraction

<http://ionaphysics.org/ntnujava/propagation/propagation.html>

**Refraction: the bending of a wave as it obliquely enters a new medium and changes speed.**

**When light slows down it bends toward the normal.  
When light speeds up it bends away from the normal.**

$$N1 * V1 = N2 * V2$$

$$N1 * \sin\theta_1 = N2 * \sin\theta_2$$

**a) Light enters** flint glass from air at an angle of incidence of 30 degrees. Calculate the angle of refraction.

b) How would the above problem change if it were worded "Monochromatic light enters flint glass from air at an angle of incidence of 30 degrees. Calculate the angle of refraction"

c) Light in water enters flint glass. How will it bend? (Toward the normal, away from the normal , not enough information)