

Waves

<http://www.physicsclassroom.com/Class/waves/>

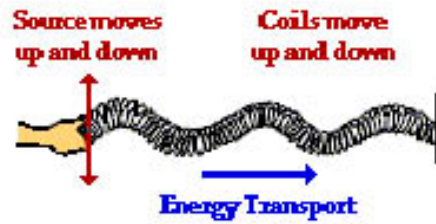
A wave is a transfer of energy through a medium.

Two basic kinds of waves

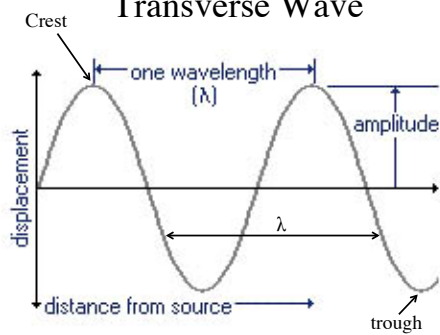
Transverse - displacement perpendicular to the direction of travel.

Longitudinal - displacement parallel to the direction of travel.

Transverse Wave

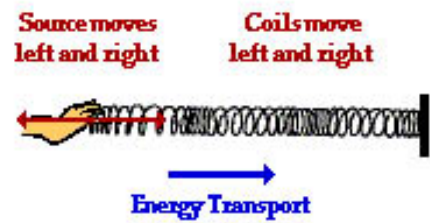


Transverse Wave

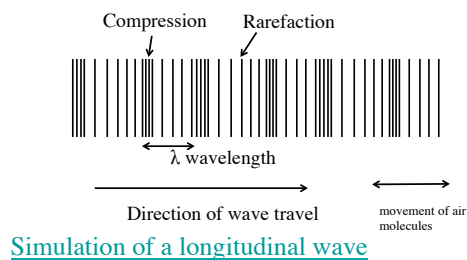


Longitudinal Wave

Longitudinal wave



Longitudinal Wave



Waves In Motion

[Simulated Waves](#)

[Crash Movie](#)

[Tachoma Narrows](#)

[Dog on the Bridge](#)

[Tachoma 2](#)

[Tachoma 3](#)

[Tachoma 4](#)

Interference

Constructive interference happens when two waves meet and the amplitude is increased.

Destructive interference happens when two waves meet and the amplitude is decreased.

[Interference](http://www.physicsclassroom.com/Class/waves/u1013c.cfm) <http://www.physicsclassroom.com/Class/waves/u1013c.cfm>

Wave Velocity

The velocity (speed) of a wave depends **ONLY** on the kind of wave and the medium it travels through.

This is not true of particles in motion.



Imagine a person watching a bus drive by at 30 mph. Imagine two people in the bus playing catch with a baseball. The baseball is moving differently for the people on the bus than for the person at the side of the road.



Relative Motion

Inside the bus: bus is standing still, baseball at 20 mph
 Outside the bus: bus at 30 mph, baseball at 50 mph (30 mph + 20 mph)

The people on the bus see the ball moving right at 20 mph, the person on the side of the road sees the baseball moving at 50 mph

Relative Motion

Inside the bus: bus is standing still, baseball at 20 mph
 Outside the bus: bus at 30 mph, baseball at 10 mph (30 mph - 20 mph)

The people on the bus see the ball moving right at 20 mph, the person on the side of the road sees the baseball moving at 10 mph

[Relative Motion](#)

Doppler Effect

Relative motion doesn't happen with waves because one wave doesn't change another wave. The velocity of the wave depends only on the kind of wave and the kind of material it is traveling through.

But waves from moving sources have to travel differently from waves produced by sources that are not moving.

[Doppler Effect](#)
[Moving Car Horn](#)

Sonic

A **sonic boom** happens when a moving object goes at or faster than the speed of sound.

Objects traveling slower than the speed of sound are **subsonic**.

Objects traveling faster than the speed of sound are **supersonic**.

An **echo** happens when sound **reflects** from a barrier.

Reverberation happens when there are multiple reflections.

Speed of Sound

- The speed of sound depends on the kind of material it is traveling through.
 - for dry air at 0°C it is 331.5 m/s and increases by $\frac{0.6\text{m/s}}{^\circ\text{C}}$
- The speed of sound depends on the material
 - sound in water is about 4 times that of sound in air
 - sound in steel is about 15 times that of sound in air