Physical Science
Ch. 10: Waves

- A wave is a rhythmic disturbance which carries **energy** NOT **matter**.
- Many waves, but not all, require a medium to move between points, these are called mechanical waves.
- A wave will travel as long as **it has energy**
- All waves are produced by **vibrations**

A medium is a material through which a wave transfers energy.

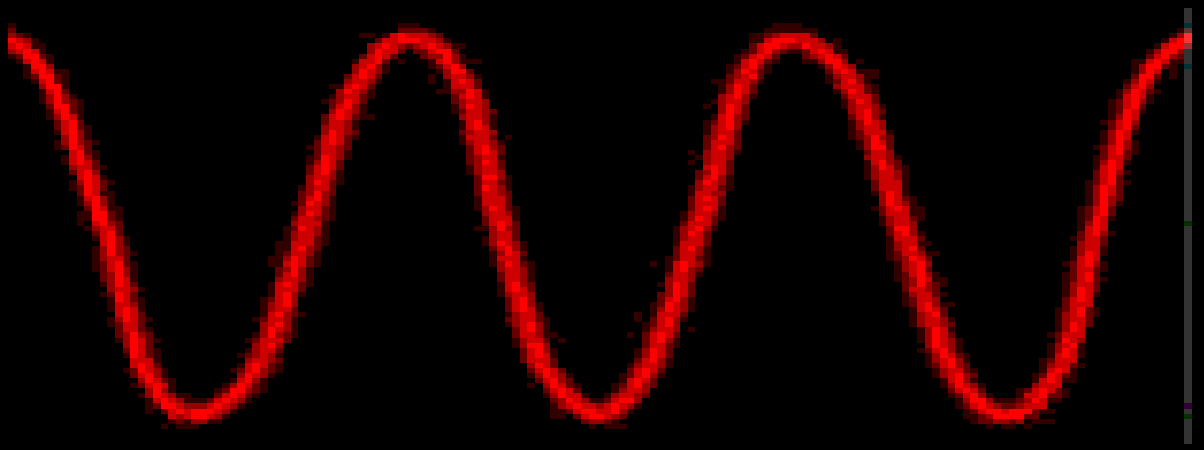
Types of Waves

- Based on the way they move, there are 2 different types of mechanical waves:

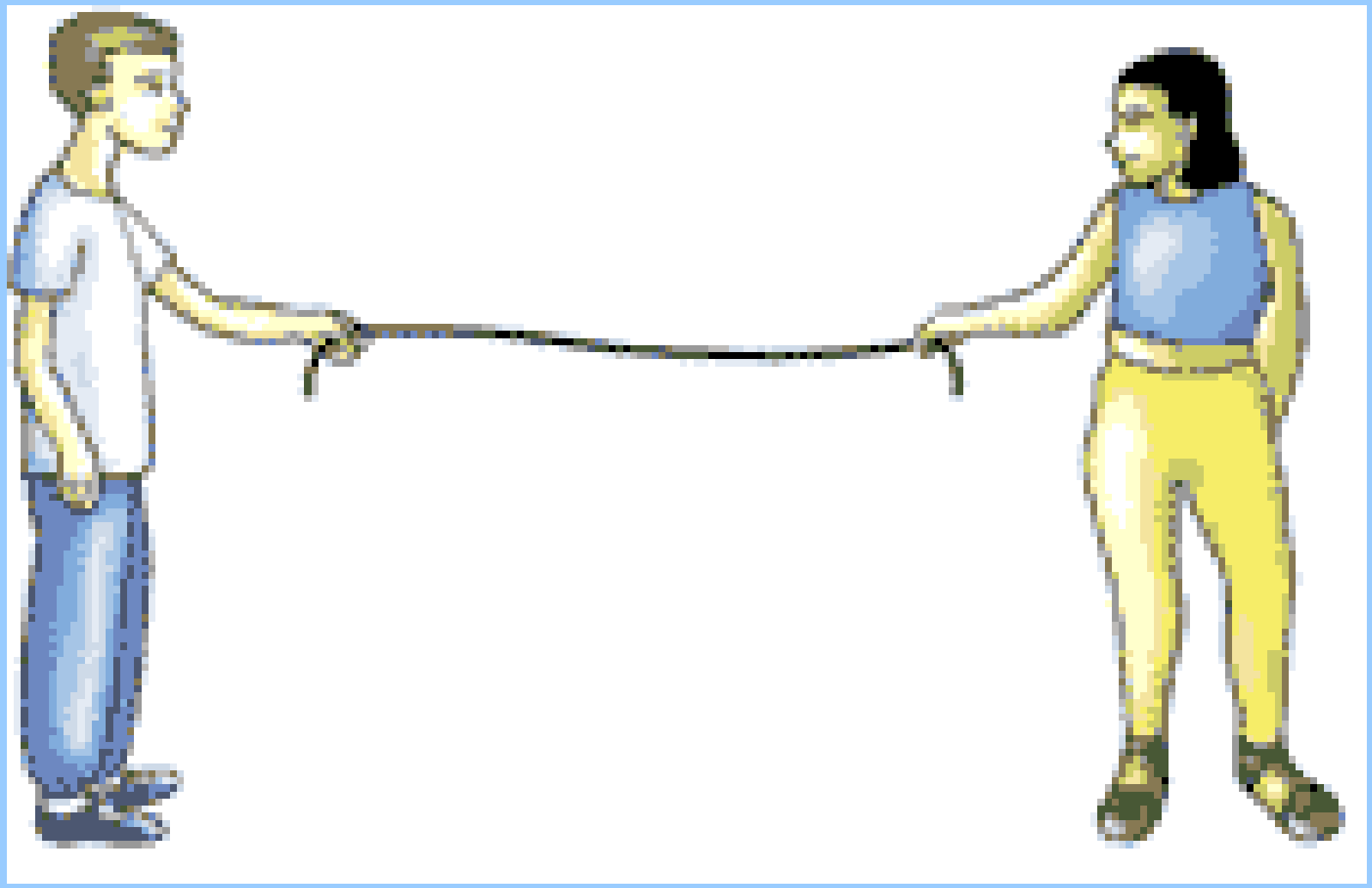
1. Transverse Waves
2. Compressional Waves

Transverse Waves

- In a transverse wave, the wave's medium move perpendicular to the direction of the wave. Ex. ocean waves, light waves
- For example, as the wave moves left to right, the medium moves up and down.



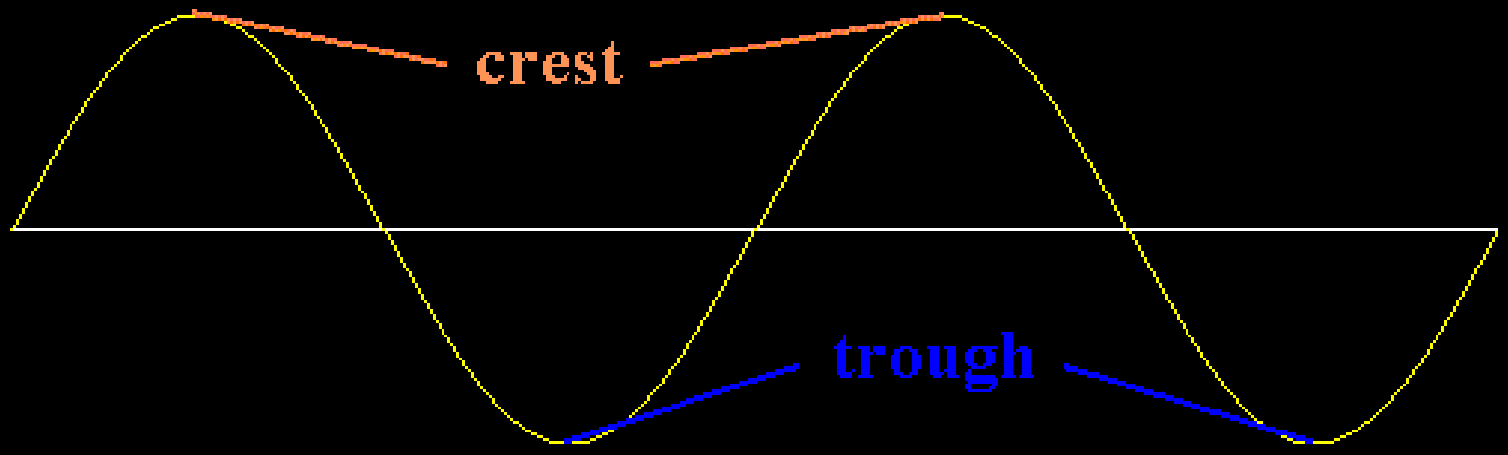
- Say you're waterskiing down at the lake and you wipe out. As you float in the water and a wave goes by, what does your body do as the wave passes?



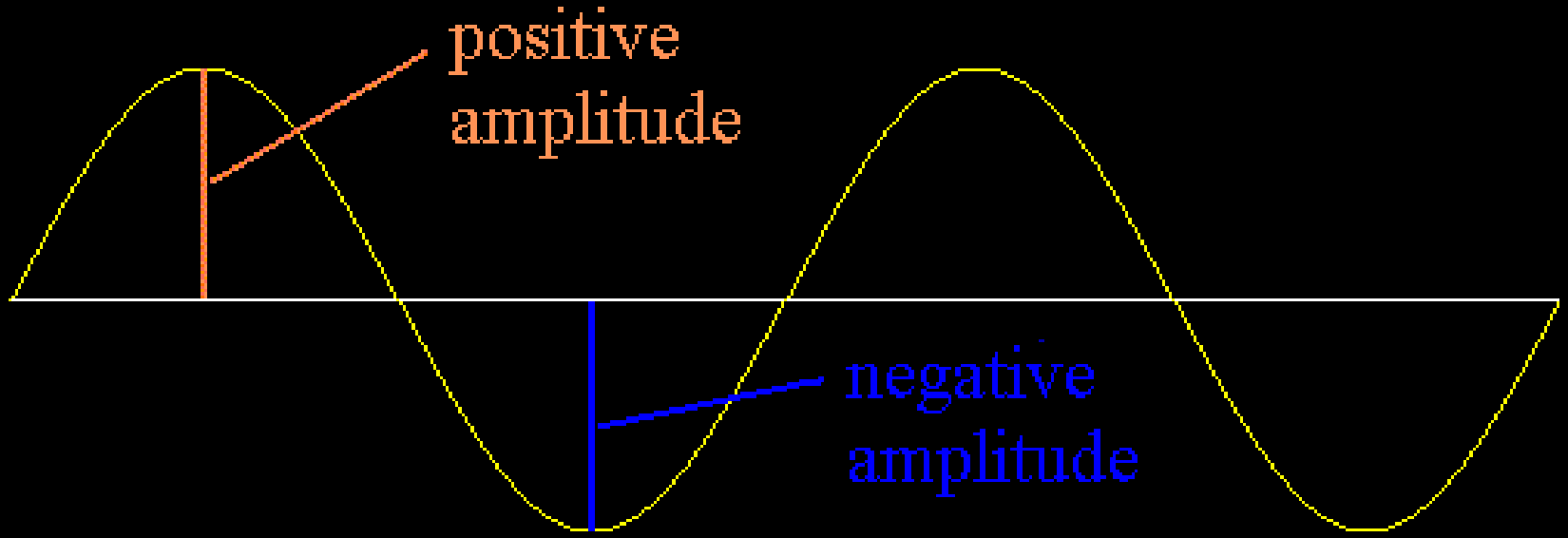
Parts of a Transverse Wave

There are 4 main parts to a transverse wave:

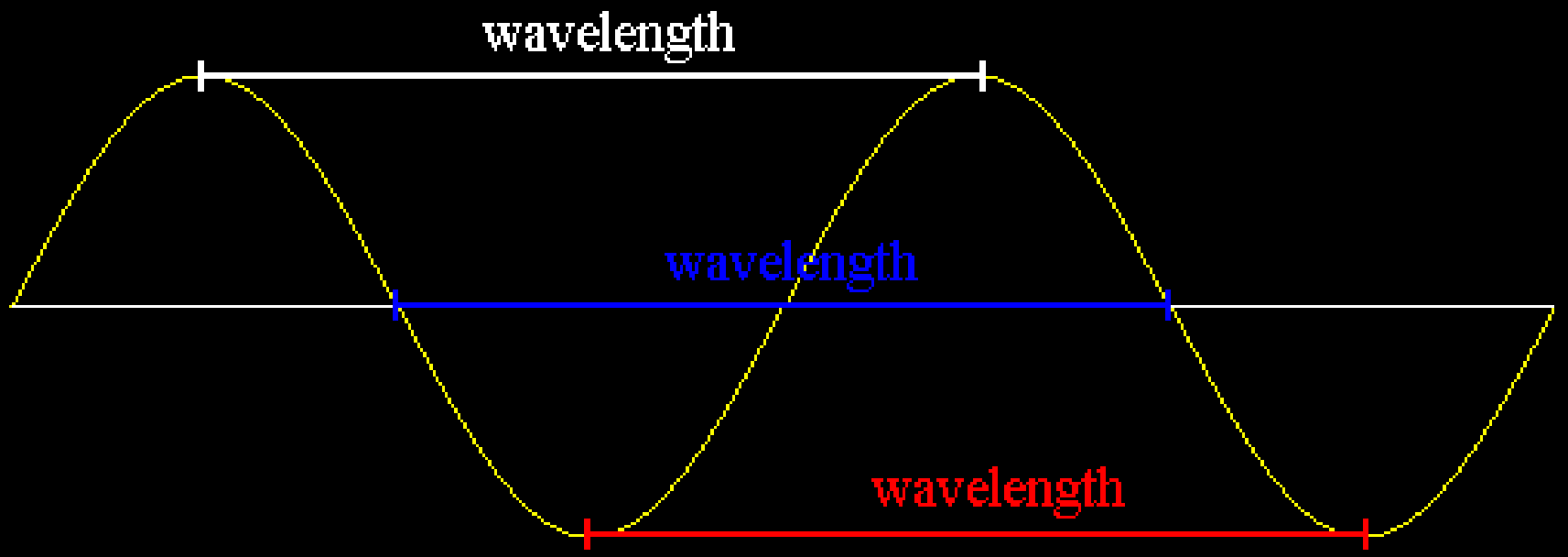
- Crest- the highest point on a transverse wave
- Trough- the lowest point on a transverse wave

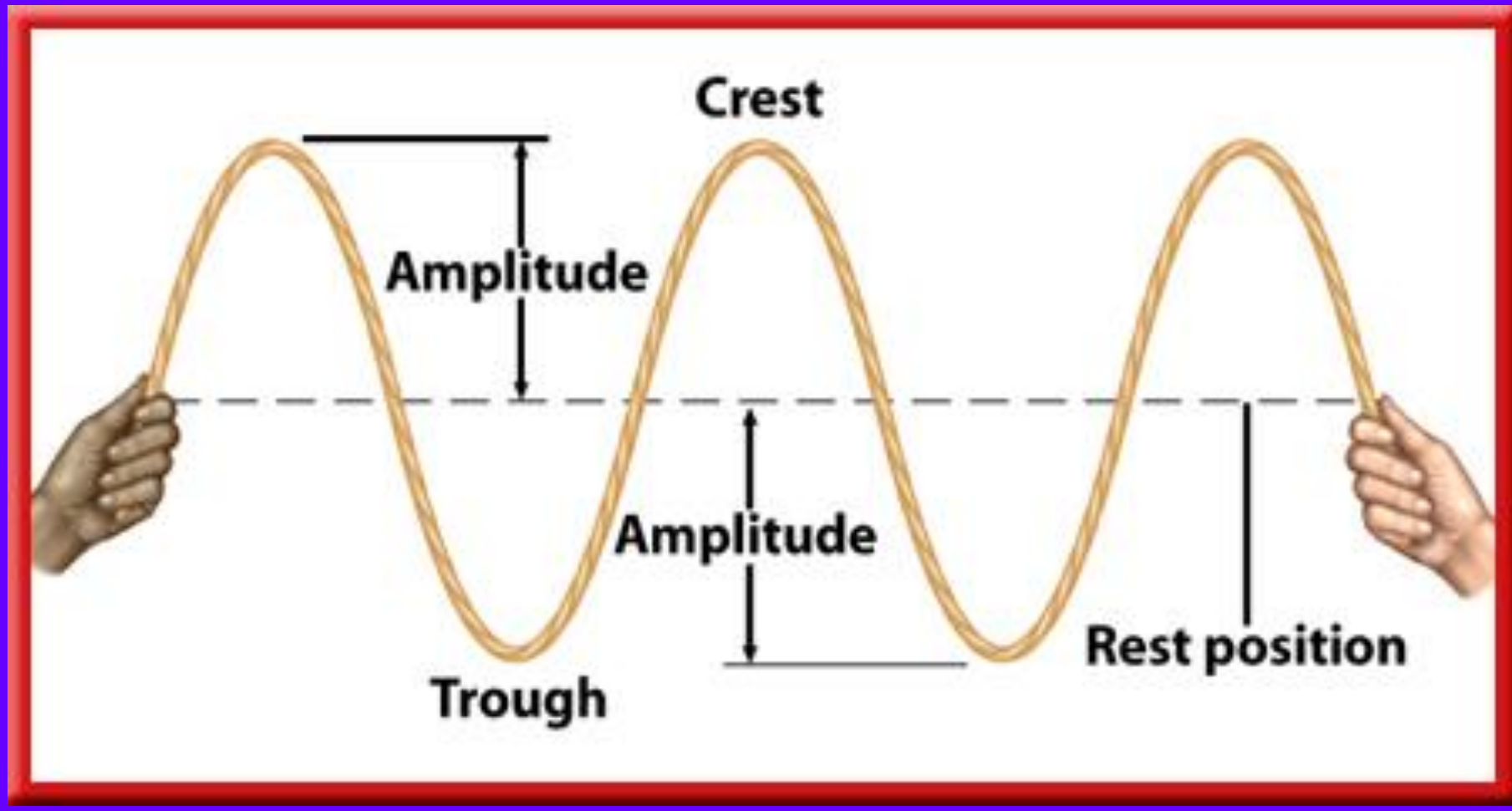


- Amplitude- the distance from either the crest or trough to the resting point of the wave



- Wavelength- distance from crest to crest or trough to trough on a wave

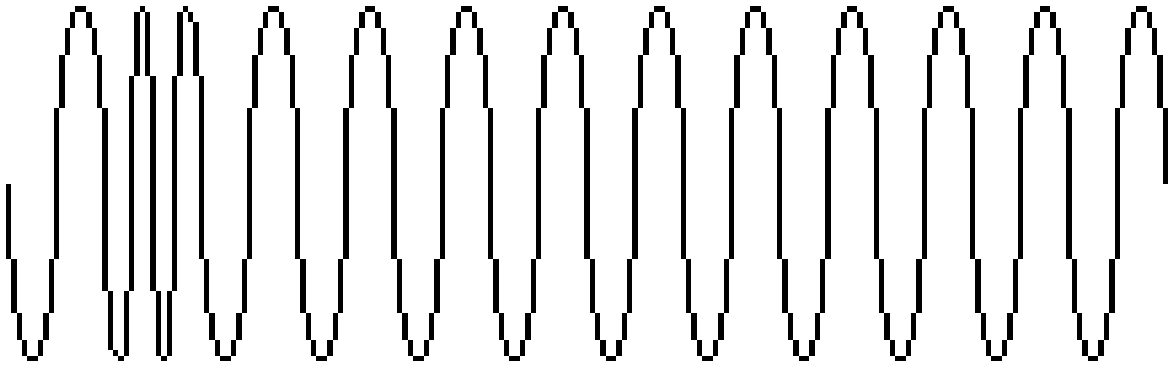



Crest
Amplitude
Amplitude
Rest position
Trough

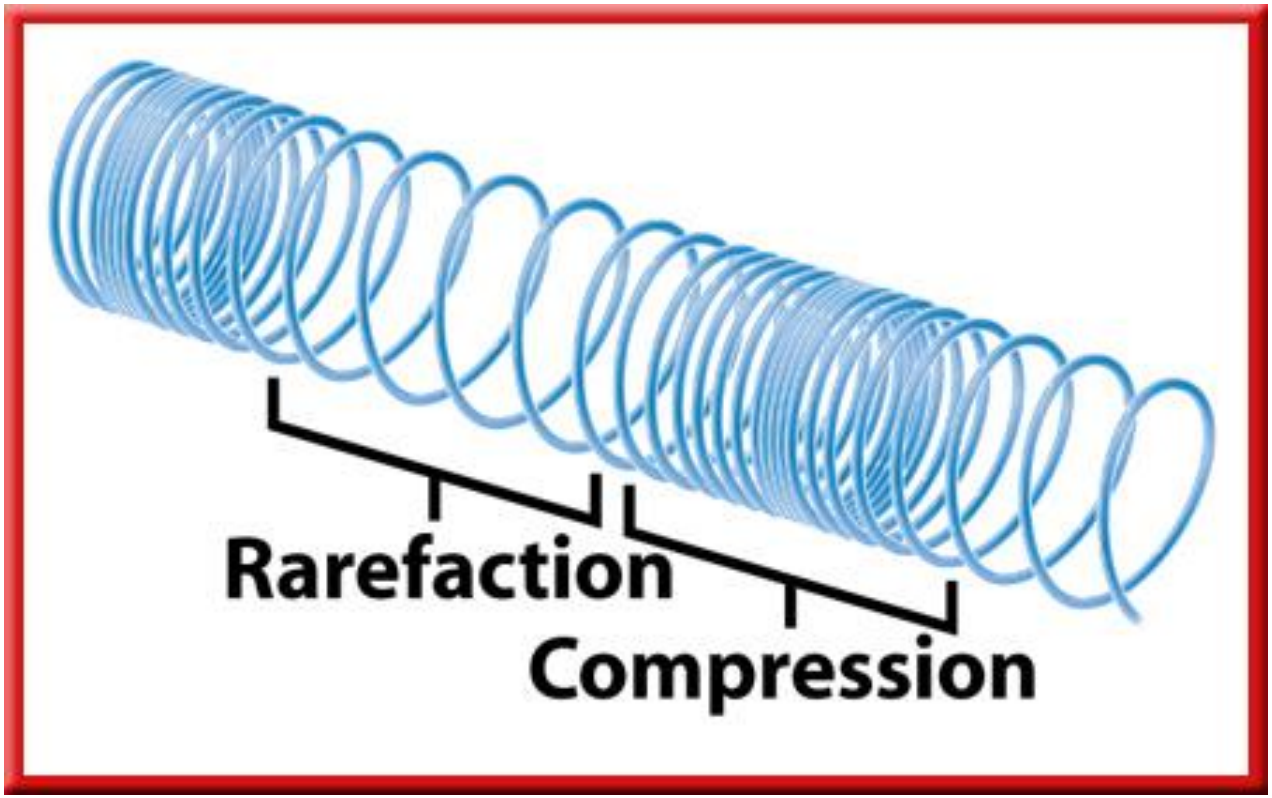
Compressional Waves

- A compressional wave vibrates in the direction that the wave is travelling. These waves are also known as longitudinal waves.

Examples: slinky, sound waves



- The 2 main parts of a compressional wave are:
  - A. Compression- area of higher density within the wave
  - B. Rarefaction- area of lower density within the wave pg. 296



Wave Frequency

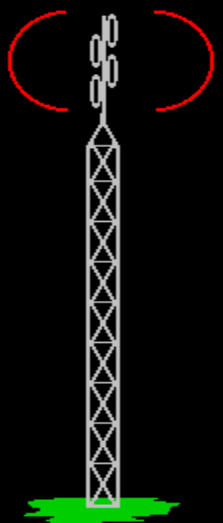
- Frequency is a property of a wave, not a part of one.
- Frequency is the number of waves which pass a given point in 1 second.
- Hertz (Hz) is the SI unit for frequency.

  1 Hz = 1 wave passing a given point in 1 second

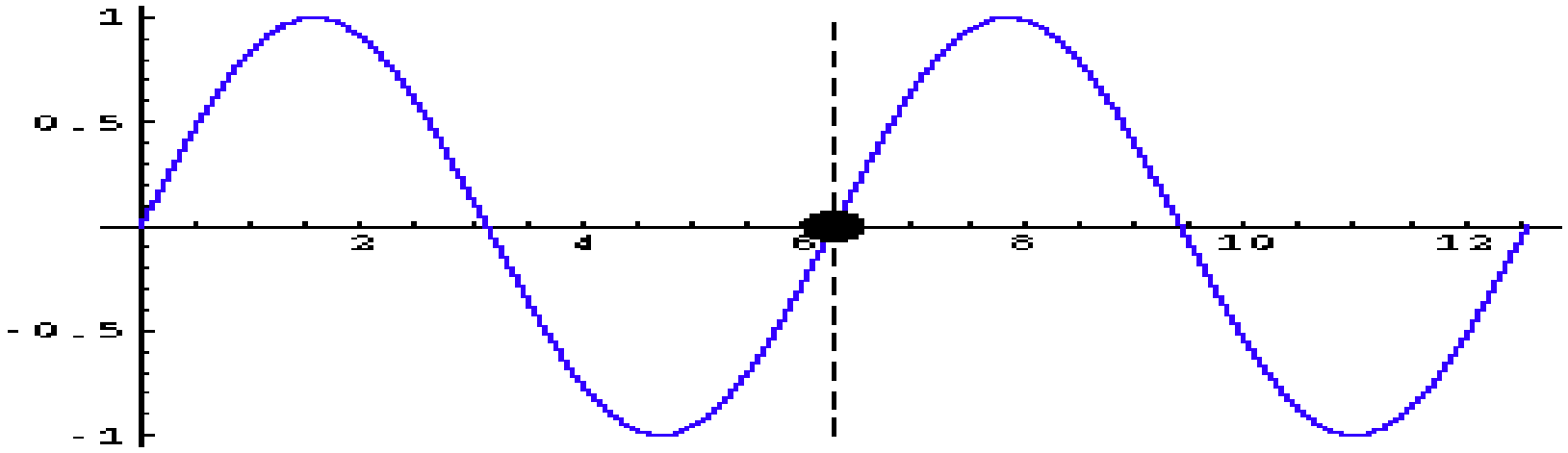
- When you tune in to a radio station, the numbers on the dial represent the frequency that a particular station is sending their signal out at.

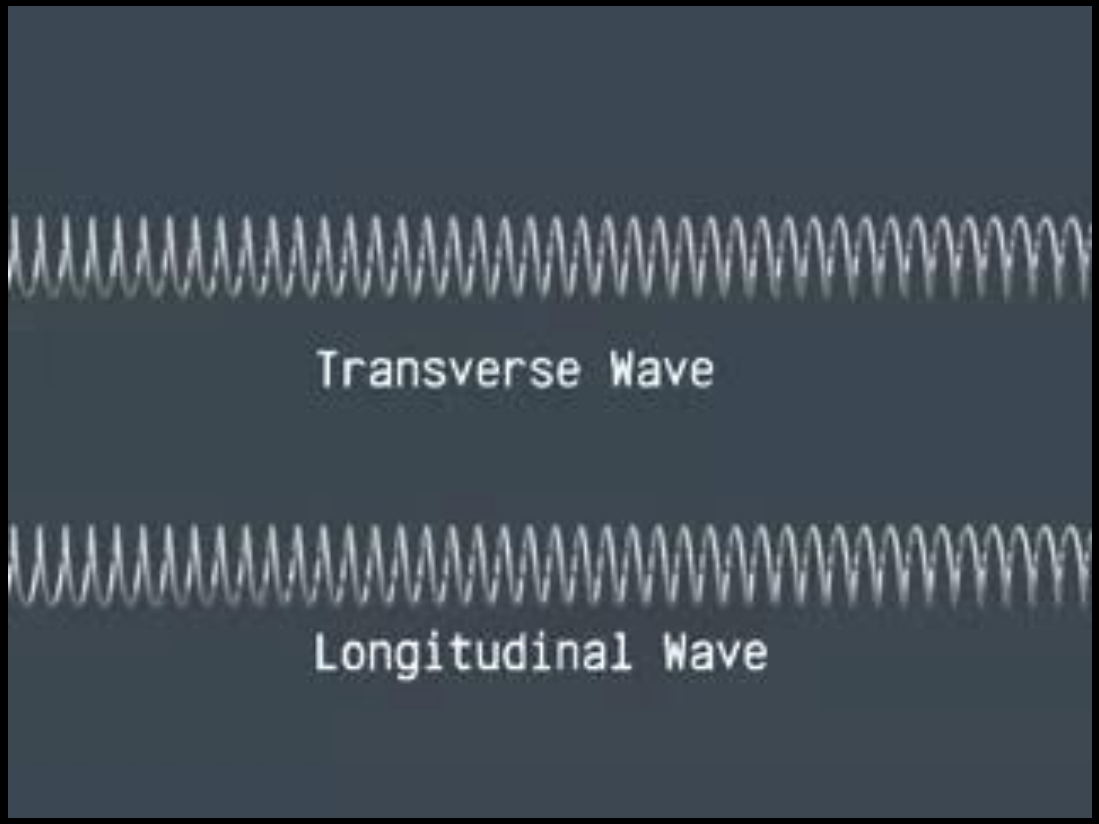
FM – MHz (megahertz), 98.9 = 98,900,000 Hz

AM – KHz (kilohertz), 610 = 610,000 Hz



- The period of a wave is the amount of time it takes one wavelength to pass a stationary point. The wave below has a period of about 2 s.




Transverse Wave
Longitudinal Wave

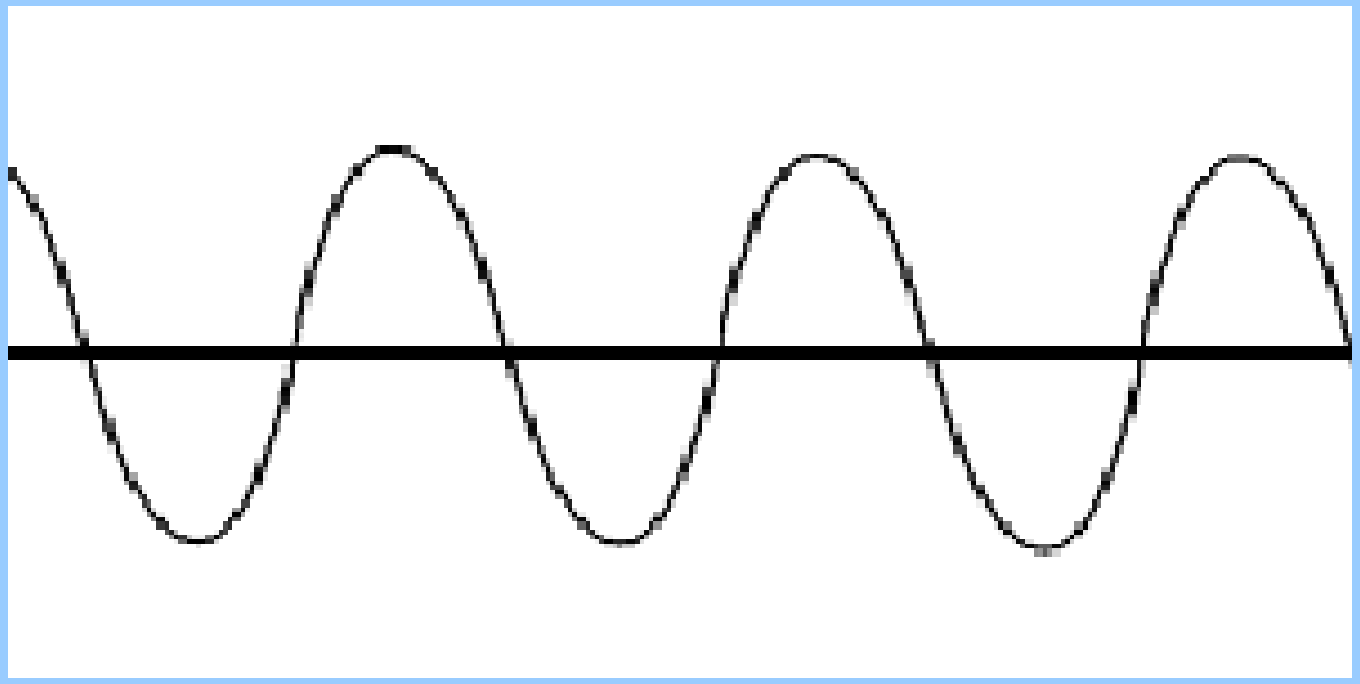
Sound Waves

- Sound waves are a type of compressional wave which require a medium to travel.
- Sound waves travel at about 750 mi/hr. This speed is effected slightly by the type of medium, temperature of medium, and elevation.

- When an object such as a jet travels at a speed greater than 750 mi/hr it is said to be supersonic.
- What happens when an object travels at supersonic speeds?

- Wave speed is the rate at which a wave is traveling, and is measured in m/s.
- The formula for wave speed is:

frequency (Hz) x wavelength (m)

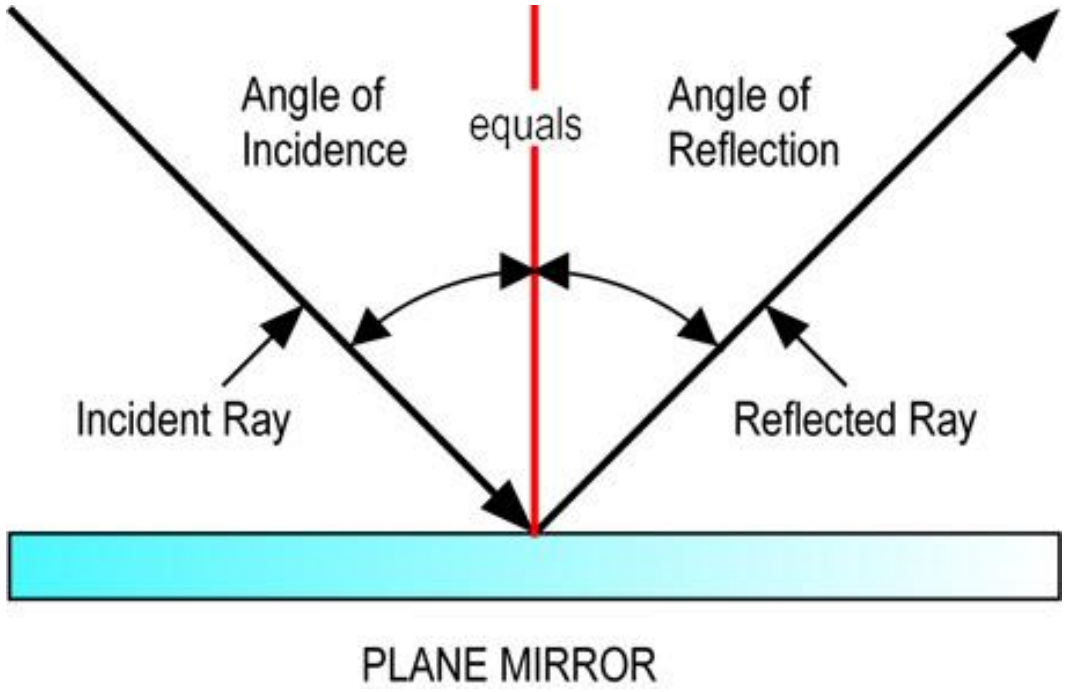


Reflection and Refraction

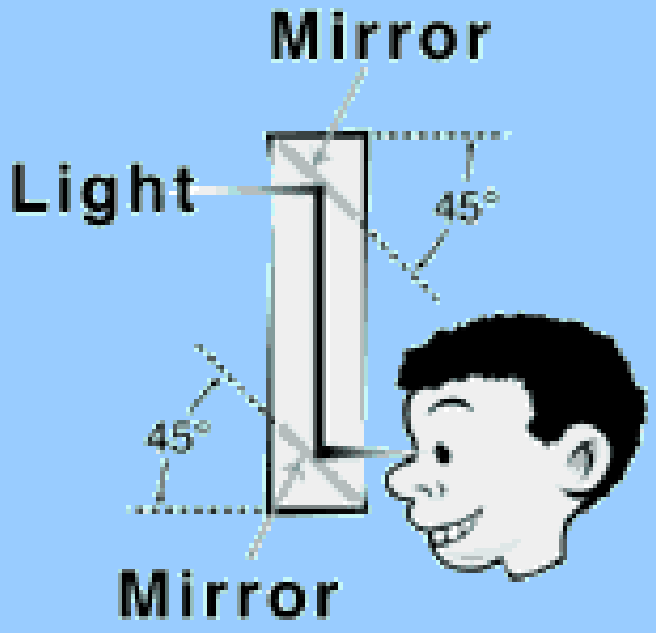
- Reflection is where a wave strikes an object and bounces off.
- When a wave strikes a flat reflective surface it will reflect back at the same angle that it struck the surface at. This is called…….

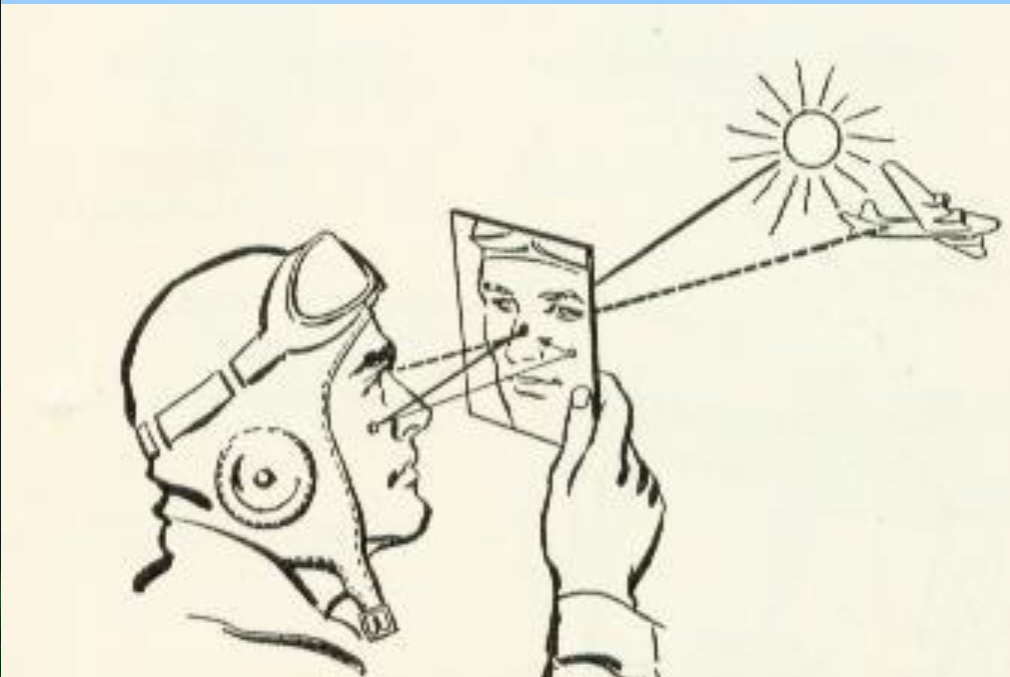
The Law of Reflection

- The law of reflection states that the angle of incidence is equal to the angle of reflection on a flat reflective surface.



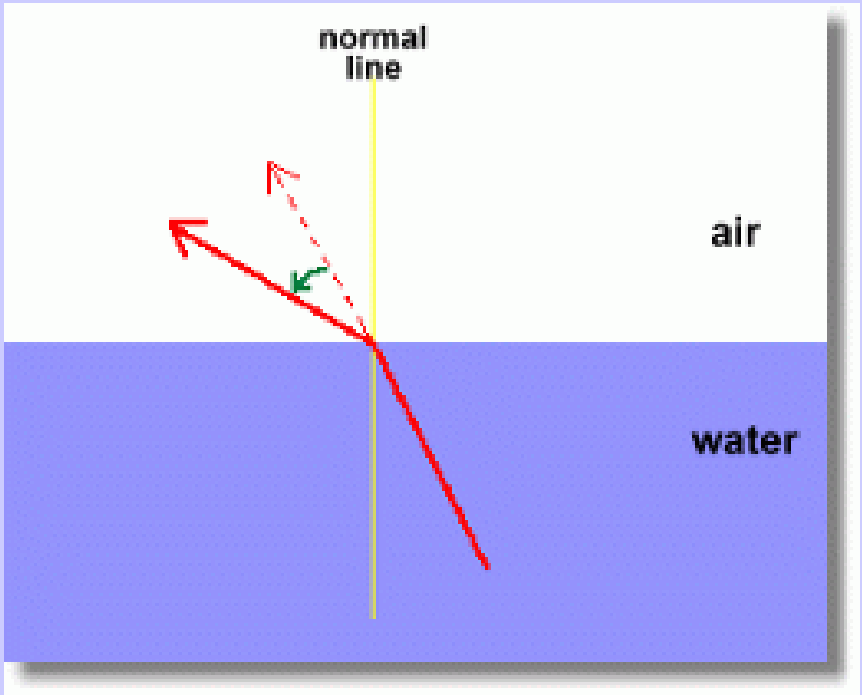
Examples of the Law of Reflection:





- In addition to reflection a wave can experience refraction.

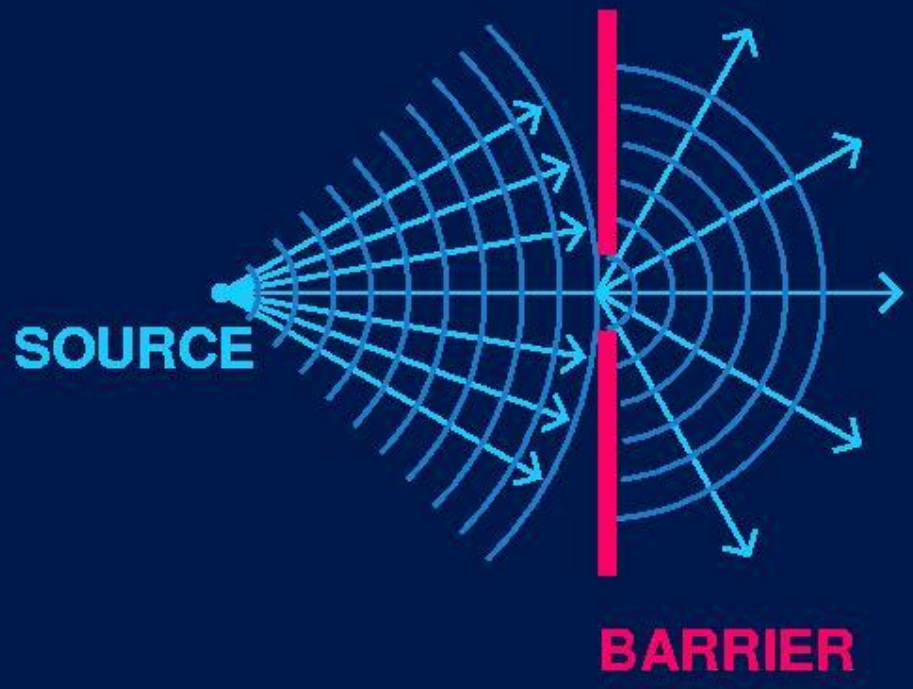
Refraction is the bending of a wave as it enters a different medium, due to a change in speed.



Diffraction

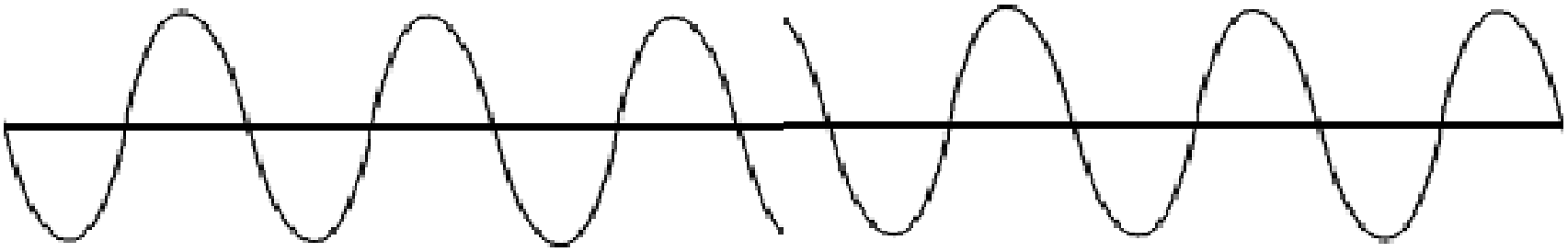
- Diffraction is the bending of a wave, around a barrier.

Ex.: Light in the storage room partially illuminating the classroom.

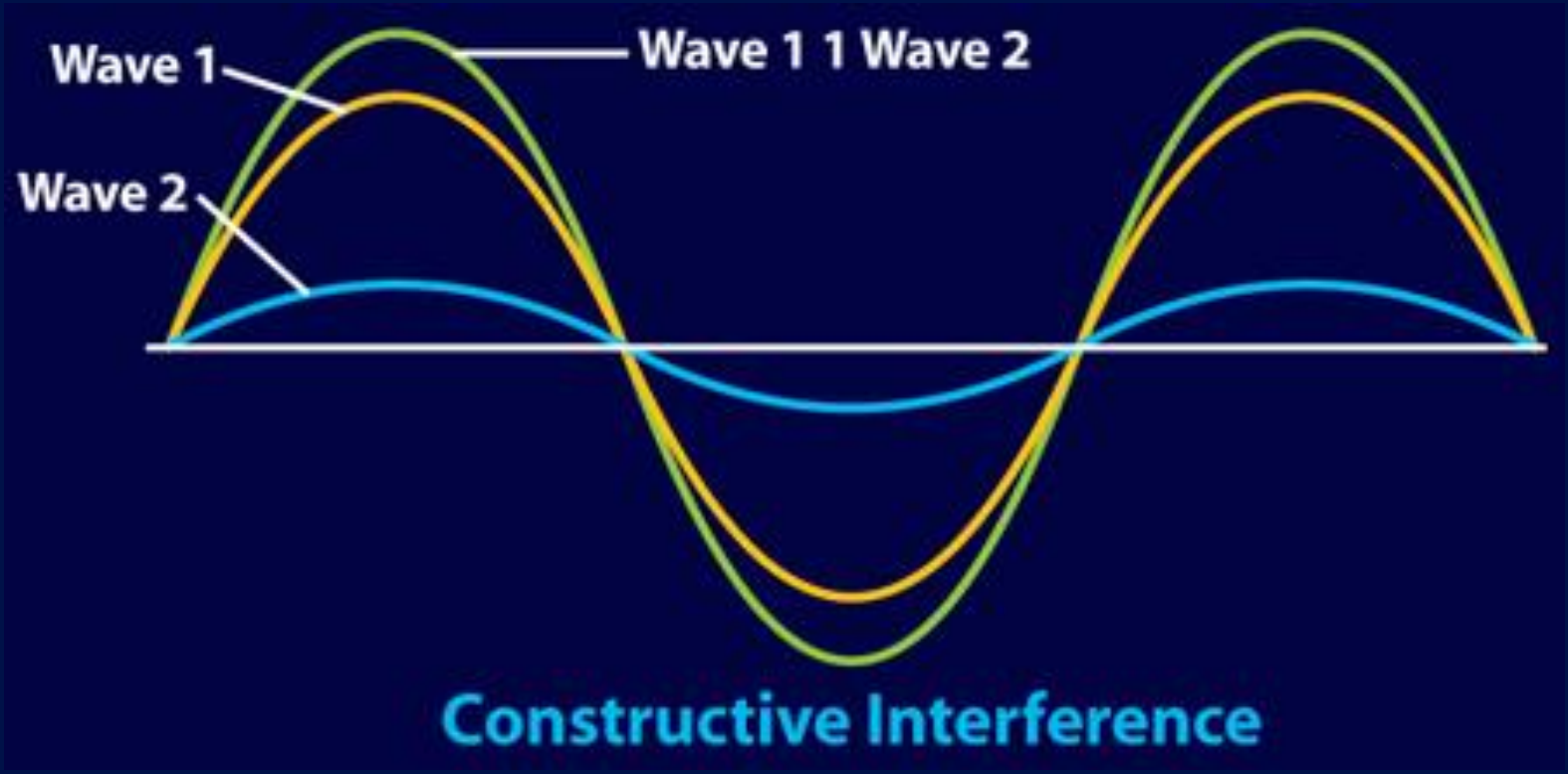


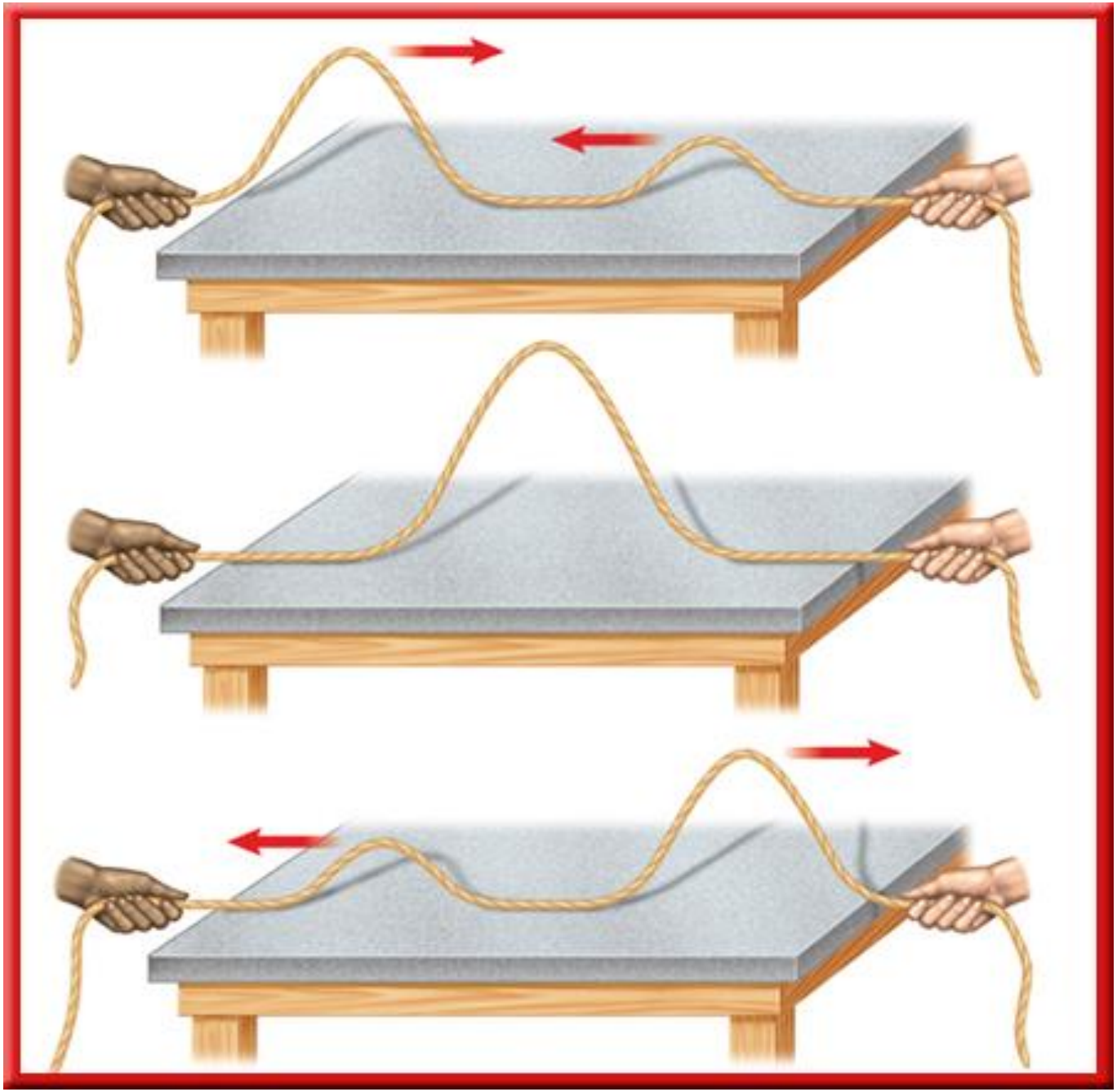
- Sometimes 2 or more waves may come in contact with each other and overlap to form a new wave. This is called interference

- As these waves overlap, they can either multiply and enhance each other, or cancel each other out.



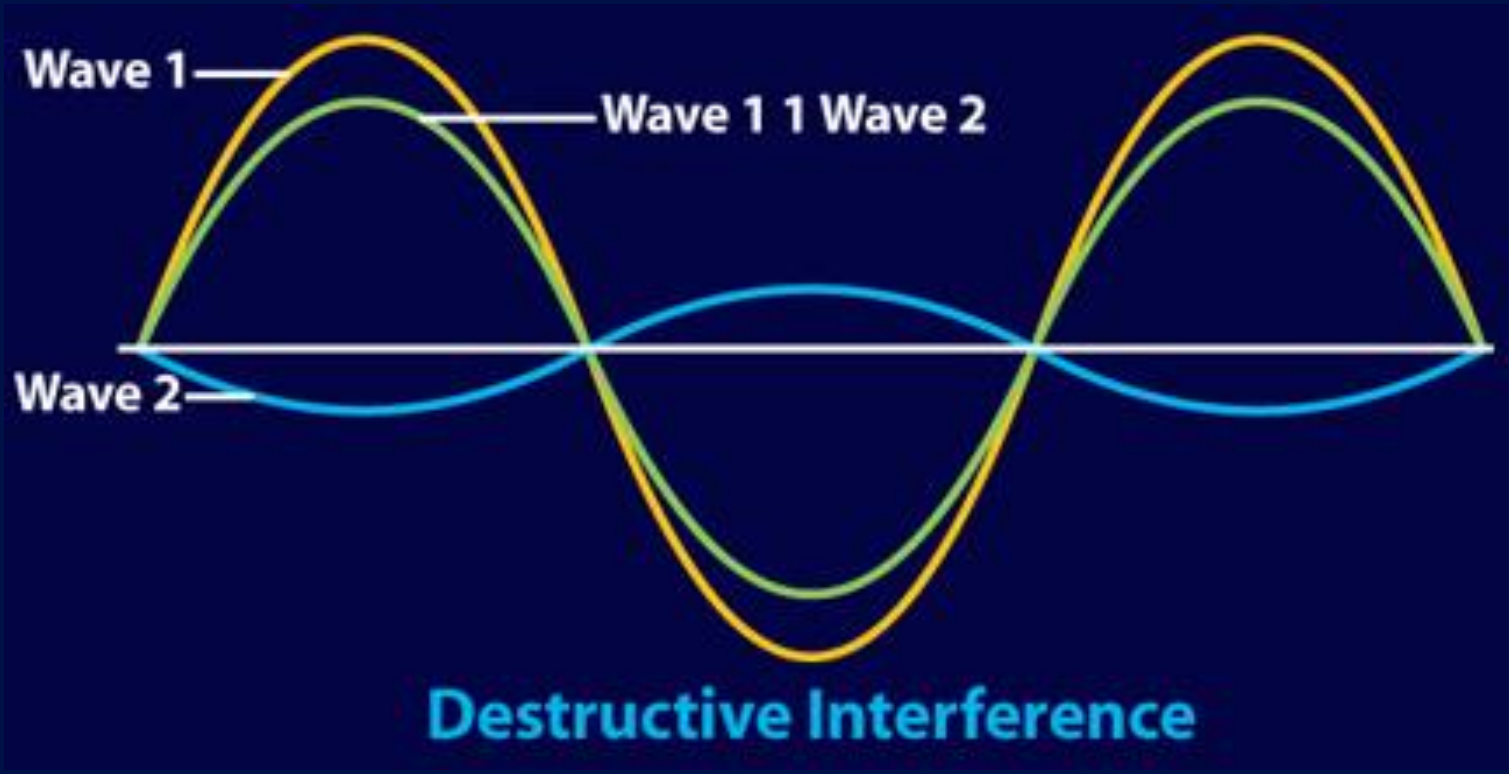
- Constructive interference occurs when the crests and troughs coincide and produce a larger amplitude (greater overall combined energy)



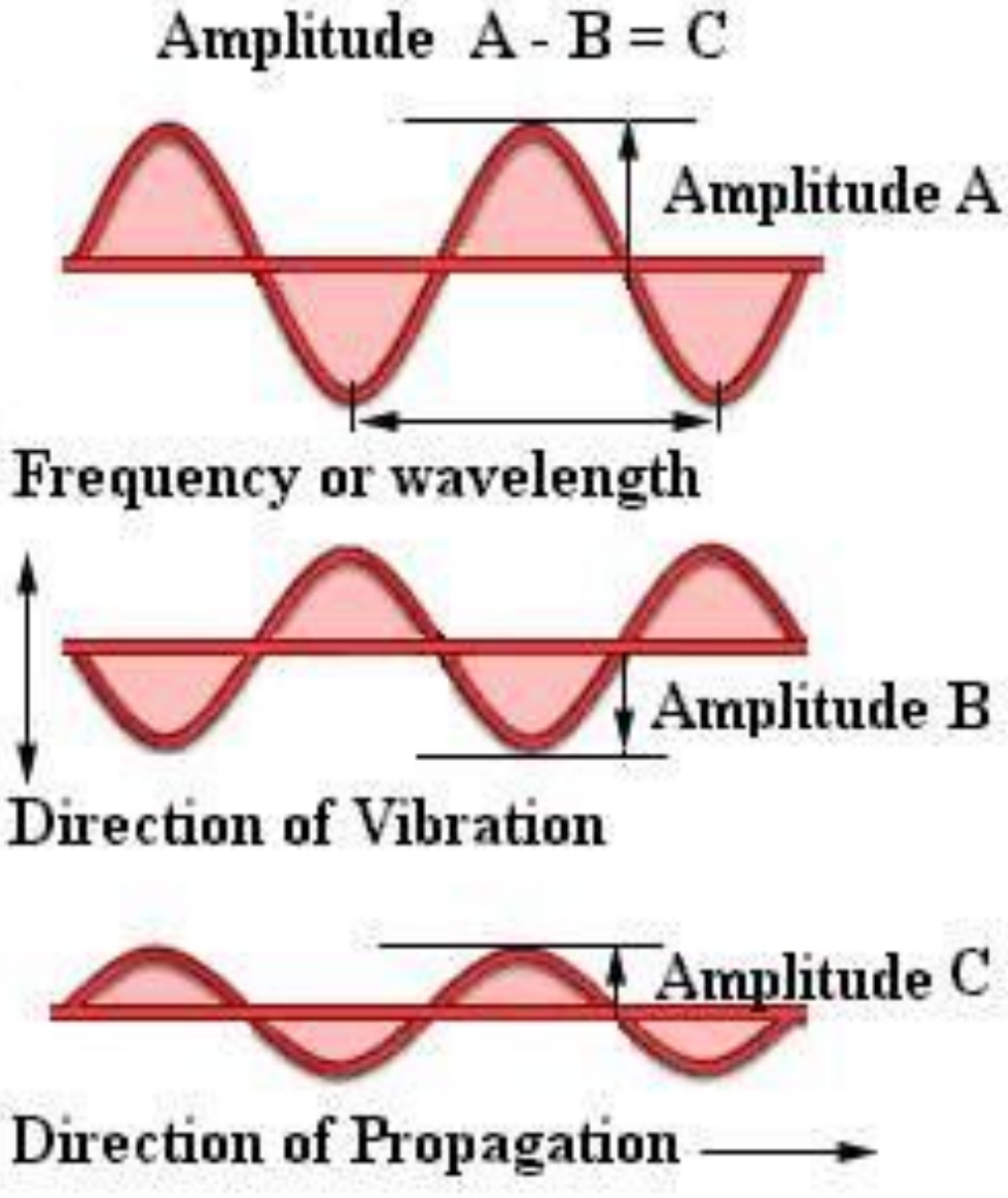


- Examples of constructive interference:
  - 2 people trampolining at the same time
  - 2 or more people singing together (in sync)

- Destructive interference occurs when the crests of one wave coincide with the troughs of another, creating a smaller amplitude.

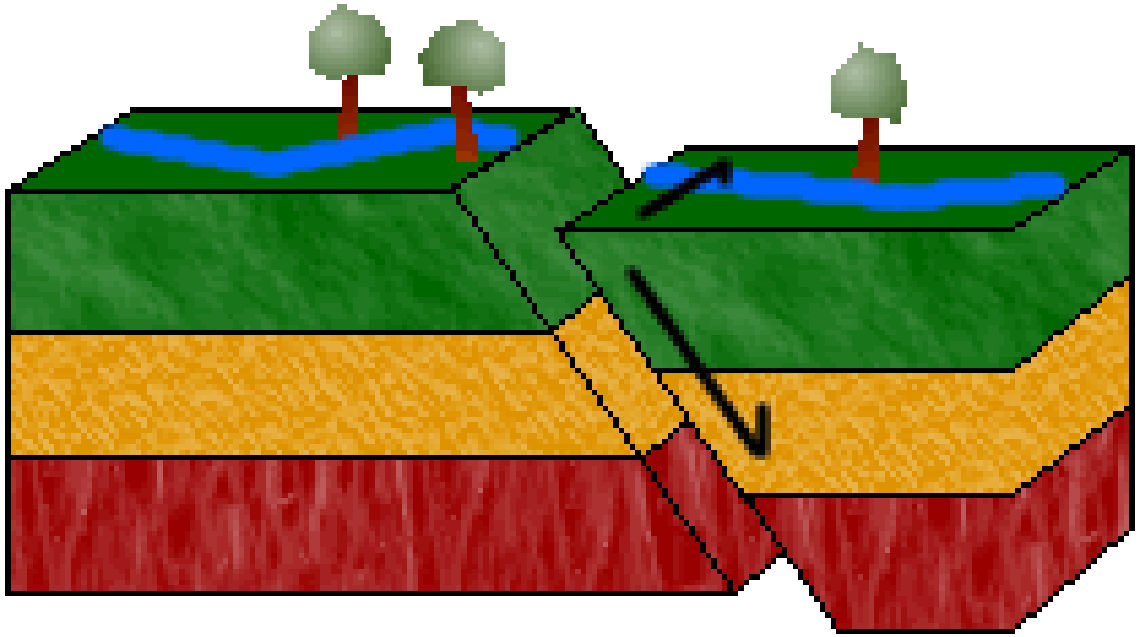


Destructive Interference

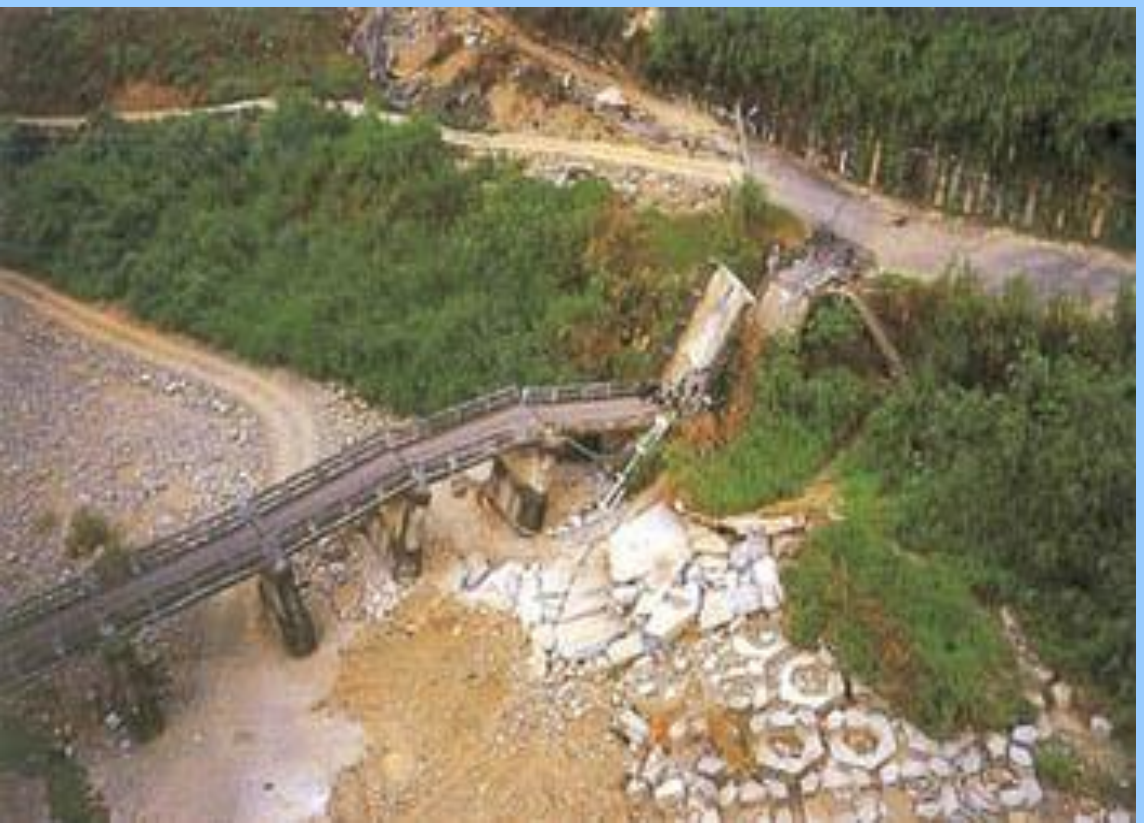


- Many locations, such as auditoriums and modern stadiums are specifically designed to produce constructive interference.

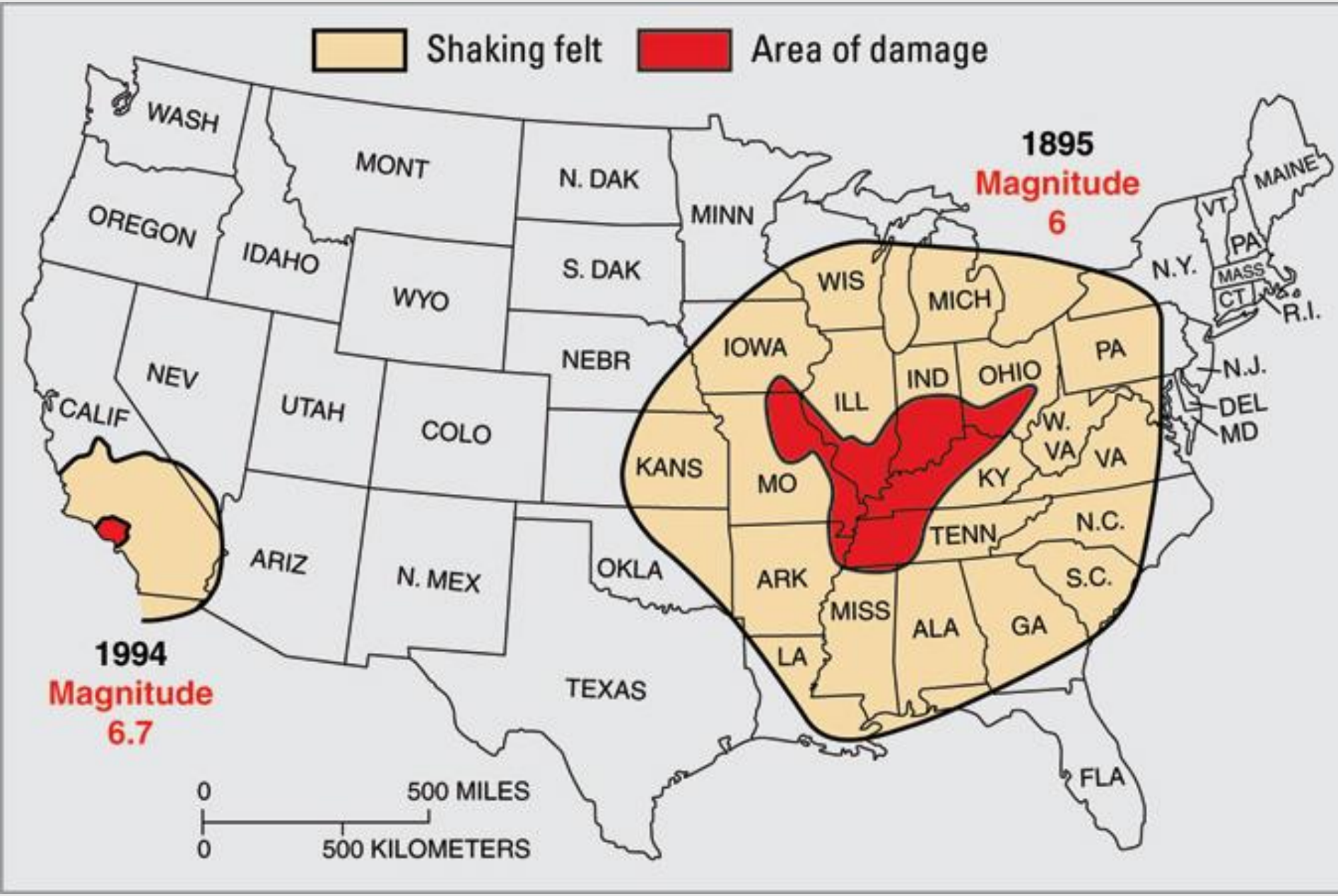
- Waves created through and along the crust of the earth by shifting or breaking tectonic plates are called seismic waves.
- These waves are a special type of **Surface** waves



- These waves are comprised of both transverse and compressional waves, and can create very damaging earthquakes.



- The San Andreas Fault line in California and the New Madrid Fault in SE Missouri are 2 locations where plates come together, and are therefore more likely to slide or break.


Shaking felt
Area of damage
WASH
OREGON
CALIF
NEV
IDAHO
MONT
WYO
UTAH
ARIZ
COLO
N. MEX
N. DAK
S. DAK
NEBR
KANS
OKLA
TEXAS
MINN
IOWA
MO
ARK
LA
WIS
ILL
MICH
IND
OHIO
KY
TENN
MISS
ALA
GA
FLA
S.C.
N.C.
W. VA
VA
PA
N.Y.
MAINE
VT
PA
MASS
CT
R.I.
N.J.
DEL
MD
1895
Magnitude
6
1994
Magnitude
6.7
0
500 MILES
0
500 KILOMETERS

- Underwater earthquakes can often produce tsunamis, giant ocean waves.

The Making of a Tsunami