SAT VOCABULARY

- ✓ Welcome to your first SAT vocabulary list!
- ✓ There will be twelve total. Hold onto these sheets.
- ✓ Periodically, I will collect them for 5 points apiece which will add some good points to your grade provided you have the sheets.
- ✓ You will get a new list each new topic. These four word words will be on the next test and we will try and use them periodically so that you can get used to them.

SAT VOCABULARY

- Confluence (n) a gathering together
- Atrophy (v) to wither away, decay
- Propagate (v) to multiply, spread out.
- Assess (v) to evaluate

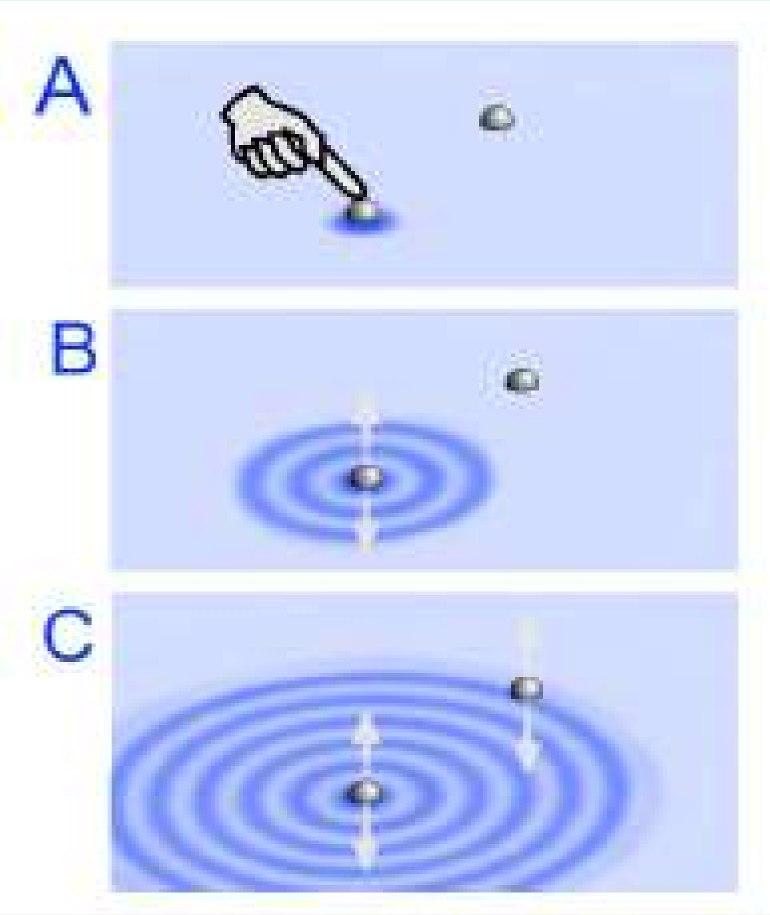
SAT VOCABULARY

- We are getting ready to study the topic of waves. At the end of this topic, you have a test to _________ how well you know the objectives taught. We will continue to go over these topics so that your knowledge of the content does not __________ before the end-of-course test. When we talk about waves, we will talk about interference which is the ____________ of two or more waves. When you drop a rock into a body of water, the waves ___________________ from the center where you dropped the rock.

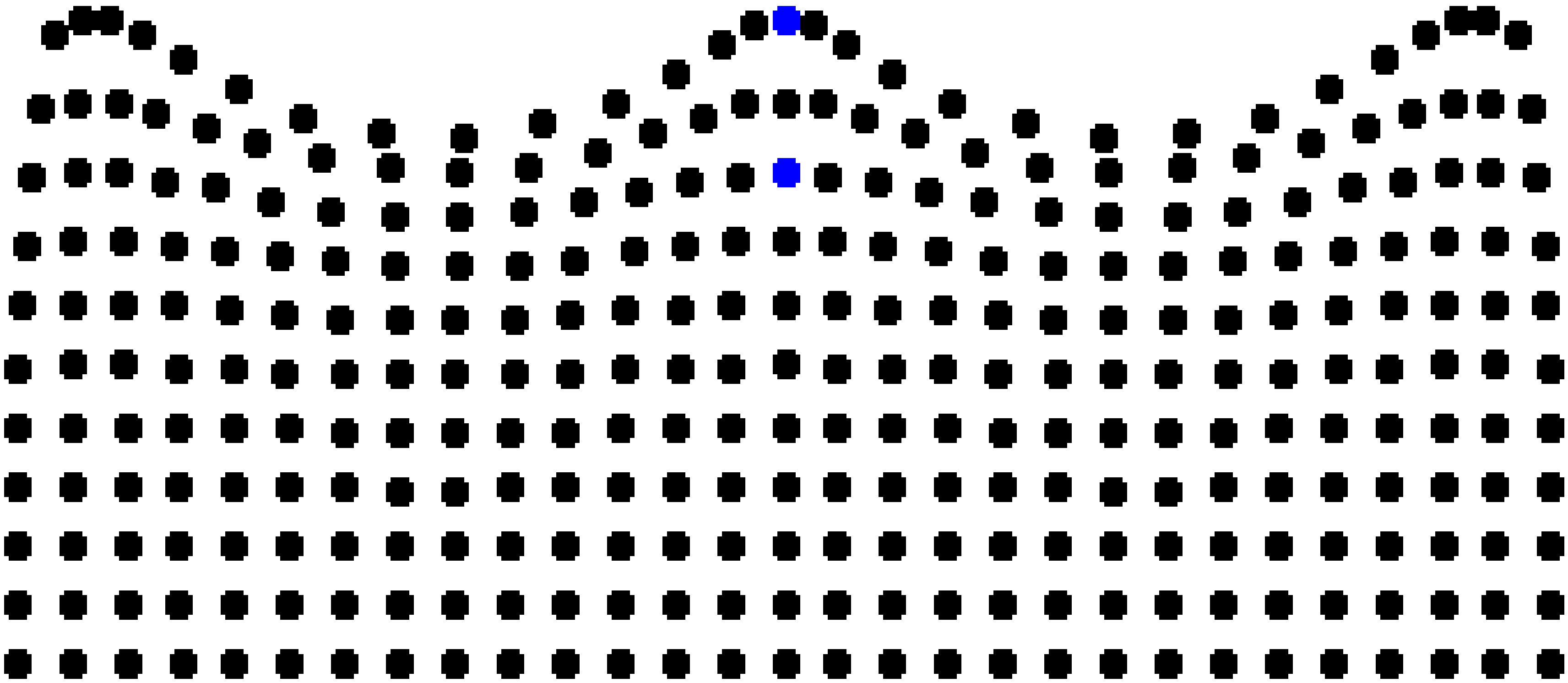

WAVES

WAVES

- A **WAVE** is a repeating disturbance or movement that transfers energy through matter or space.
- The energy is transferred to nearby particles and they move, causing other particles to move.
- Energy is transferred from one place to another.



WAVES



Energy is transferred;

NOT THE MATTER!

WAVES

- Waves carry useful information and energy.
- Waves are all around us:
  - light from the stoplight
  - ripples in a puddle of water
  - electricity flowing in wires
  - radio and television and cell phone transmissions

WAVES

- Anytime you see a vibration that moves...
- Anything that makes or responds to sound...
- Anything that makes or responds to light ...
- Anything that transmits information through the air (or space) without wires...
  - cell phones, radio, and television.
- Anything that allows you to “see through” objects...
  - ultrasound, CAT scans, MRI scans, and X rays

TYPES OF WAVES

Two types of waves:

- **Mechanical**
- **Non-Mechanical**

- **Mechanical: waves need a medium in order to travel.**
  - **Examples: Sound, water**
- **Non-mechanical: waves do not need a medium to travel.**
  - **Examples: light, gamma waves, microwaves, x-rays**

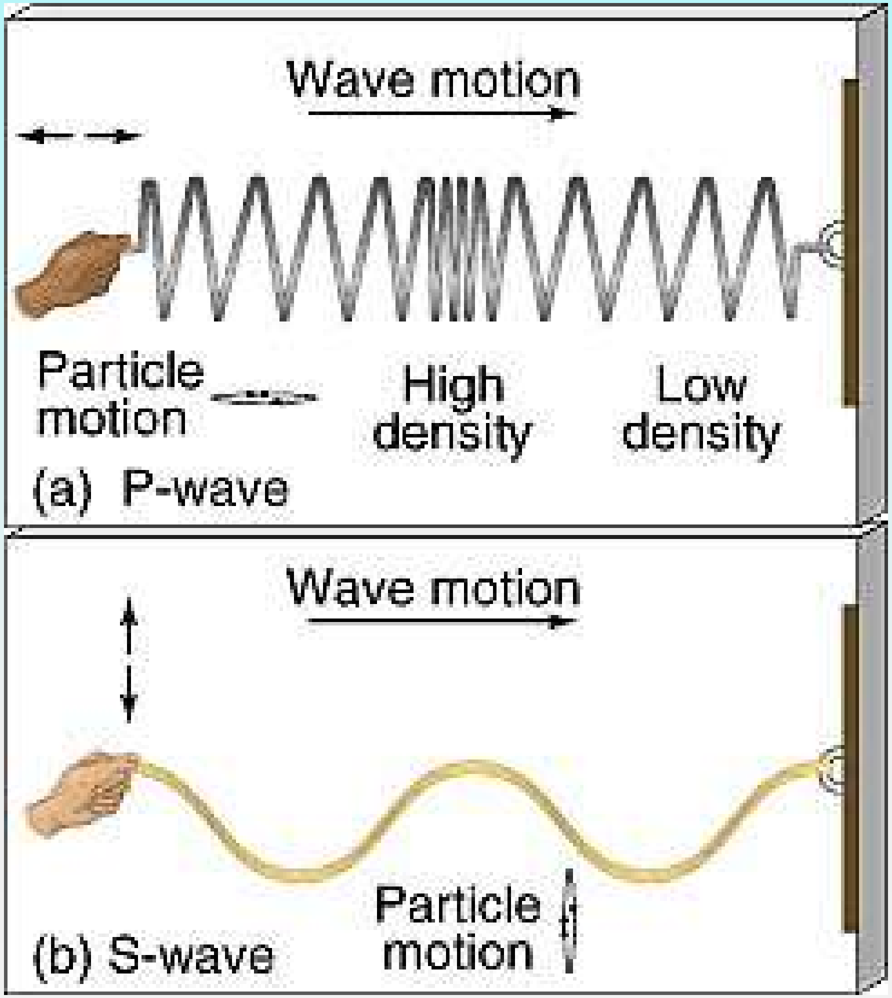
MECHANICAL WAVES

- **Waves that require a medium to travel.**
- **A medium is the material a wave travels through.**
- **Examples: Sound and water.**

Light waves are NOT Mechanical Waves.

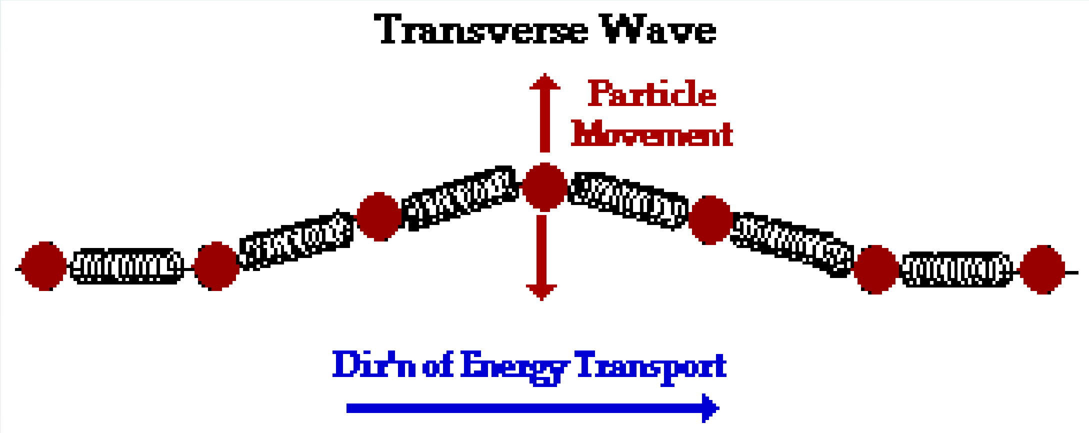
TYPES OF WAVES

- **Transverse Wave**
  oscillations are perpendicular to the direction of motion .
  Example: light, water
- **Longitudinal wave**
  oscillations are in the same direction of motion.
  (parallel to the motion)
  Example: sound



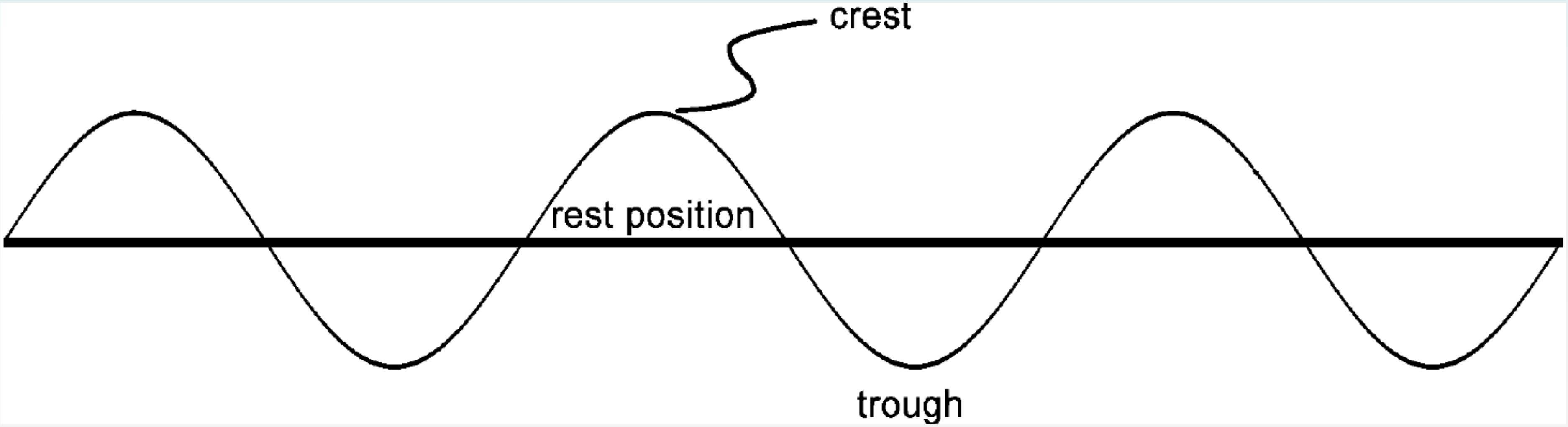
TRANSVERSE WAVE

- Transverse waves are UP & DOWN movements.
- The displacement of individual particles is perpendicular (at right angles) to the direction of the wave.
- Examples: water waves, radio waves (all EM waves)

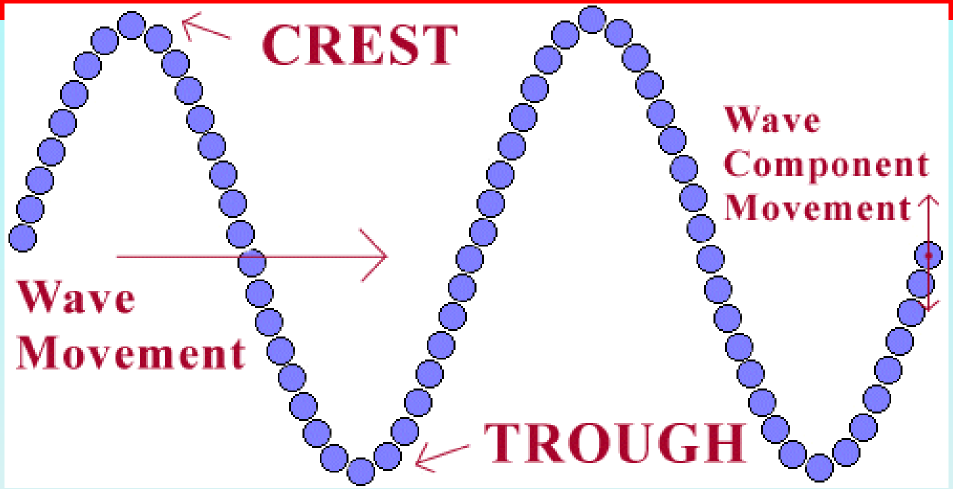


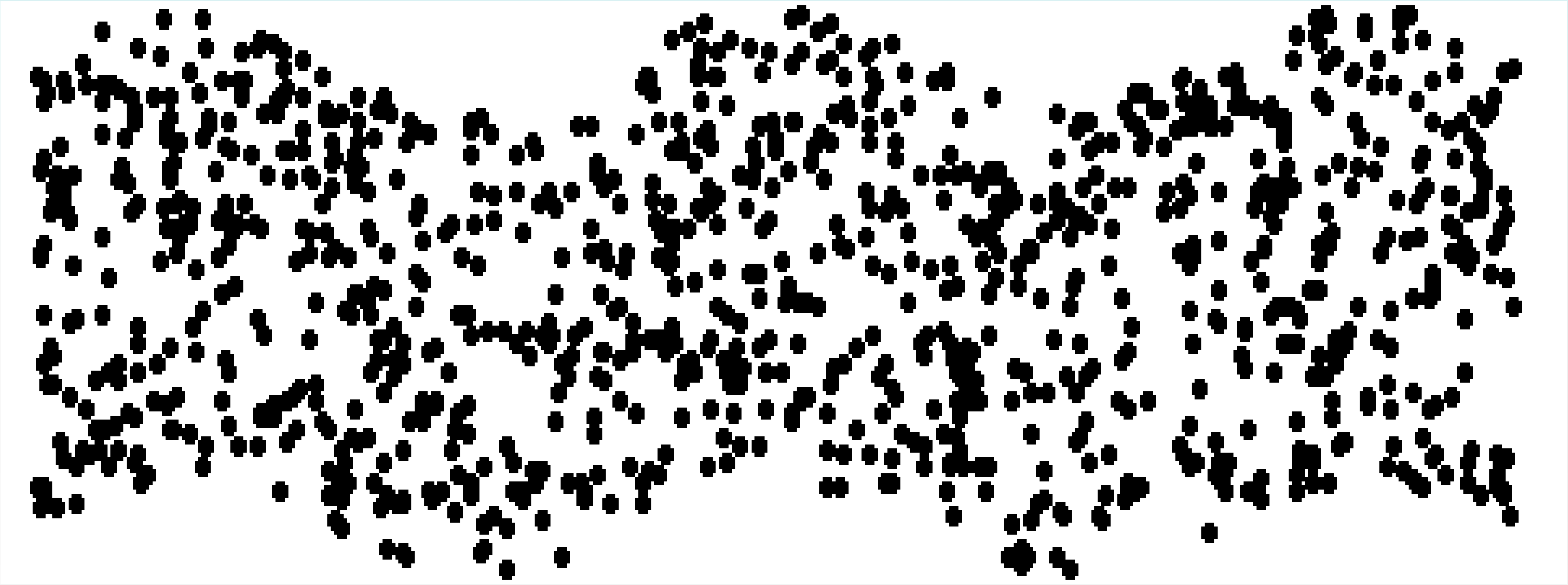
TRANSVERSE WAVES

- **Crest:** the highest point of a transverse wave.
- **Trough:** the lowest point of a transverse wave
- **Rest Position:** the position of the wave with no energy.



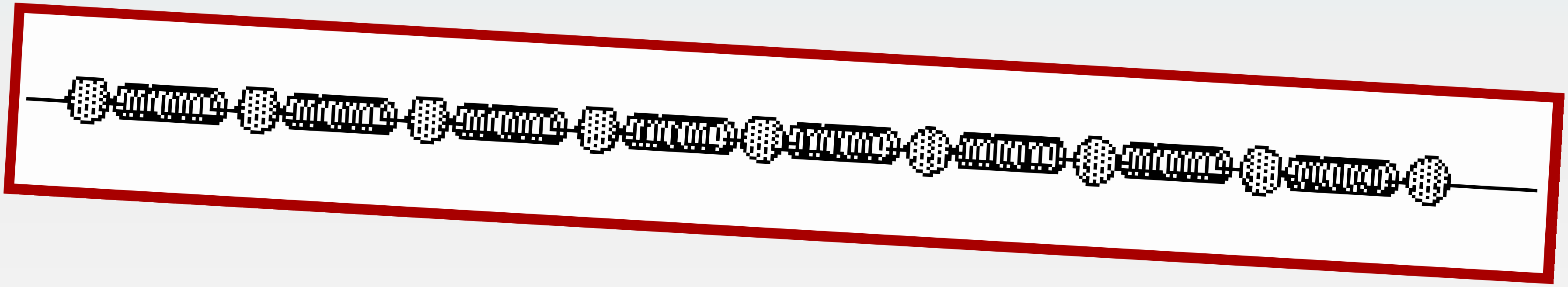
MOVEMENT OF A TRANSVERSE WAVE





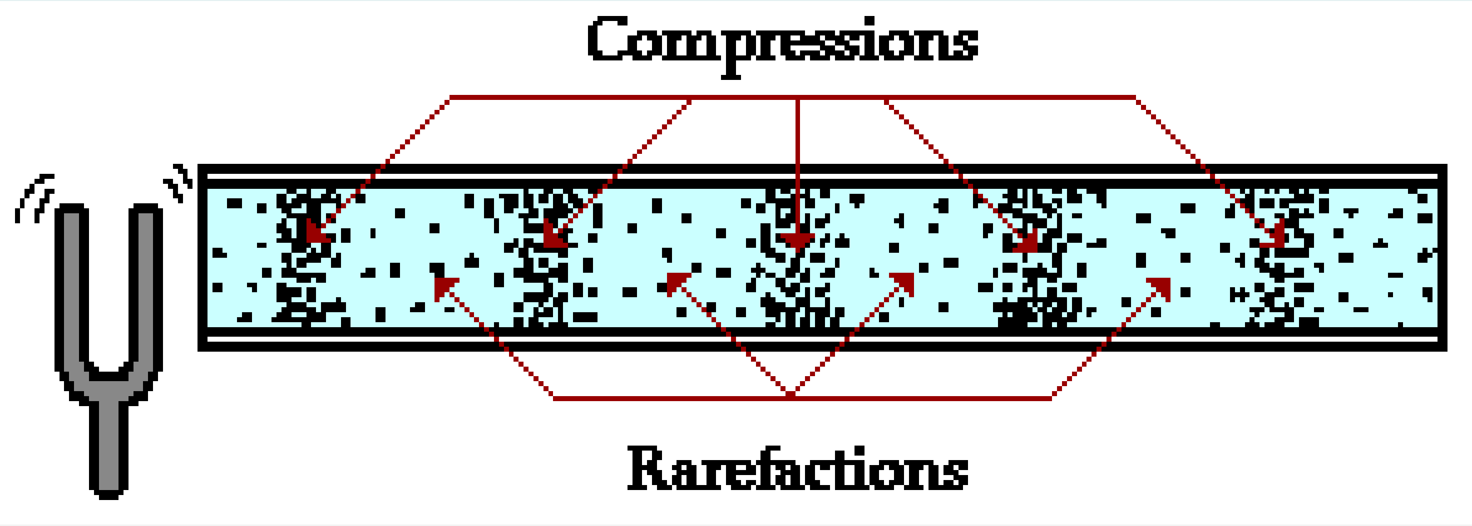
COMPRESSIONAL WAVE

- Compressional waves are a series of PUSHES & PULLS in which the motion of the medium is in the same direction that the wave travels.
- Example: sound



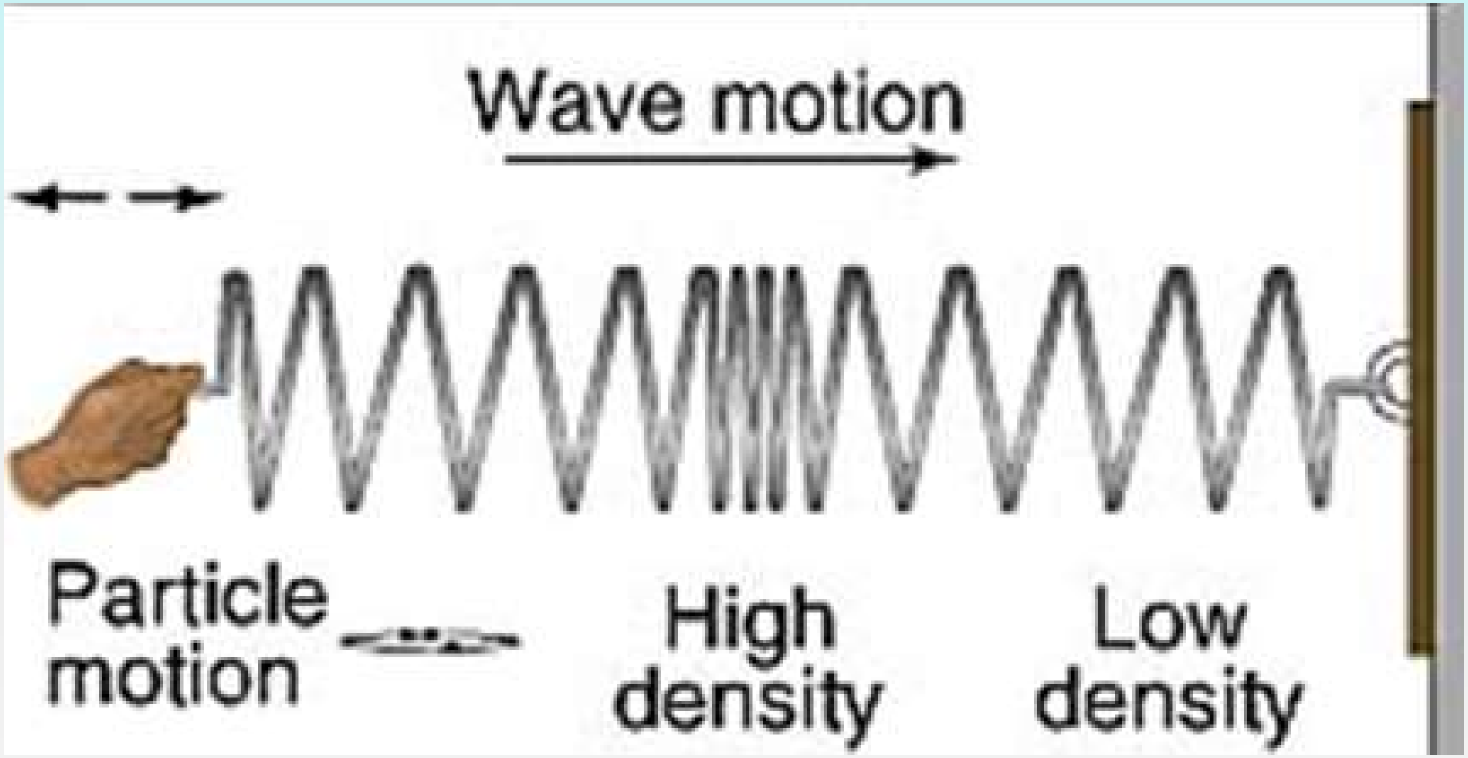
COMPRESSIONAL WAVE

- **Rarefaction** is a place where the material is the least dense (pressure is the lowest).
- **Compression** is where the material is the most dense (atmospheric pressure is the highest).

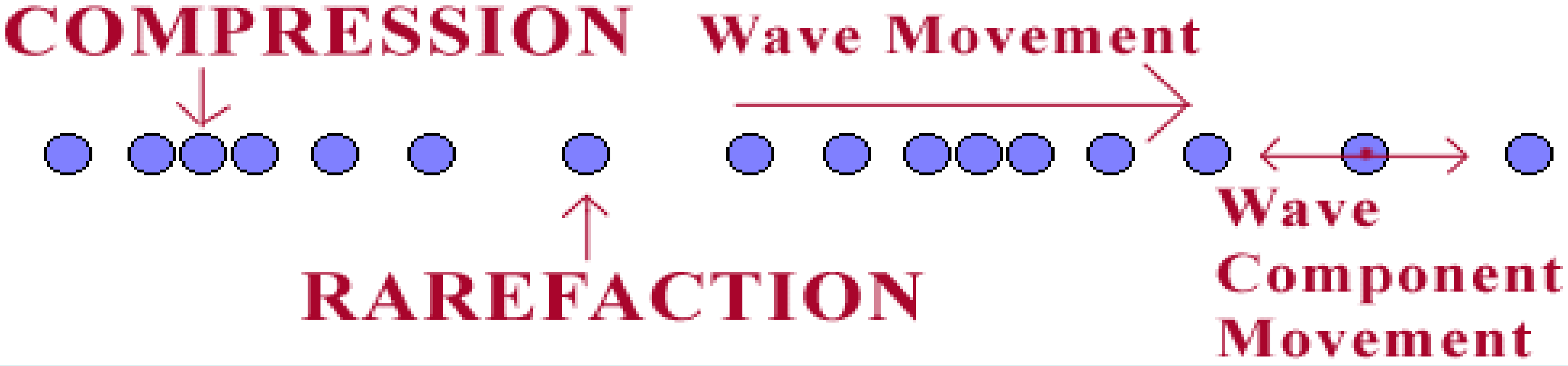


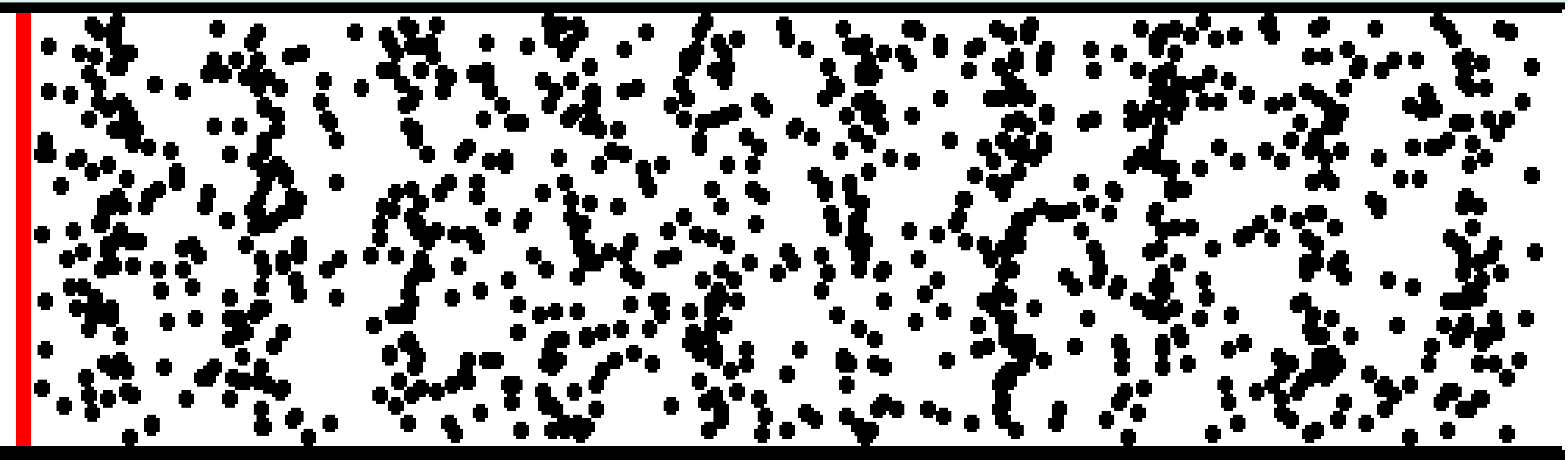
COMPRESSIONAL WAVE

- **Rarefaction**
- **Compression**



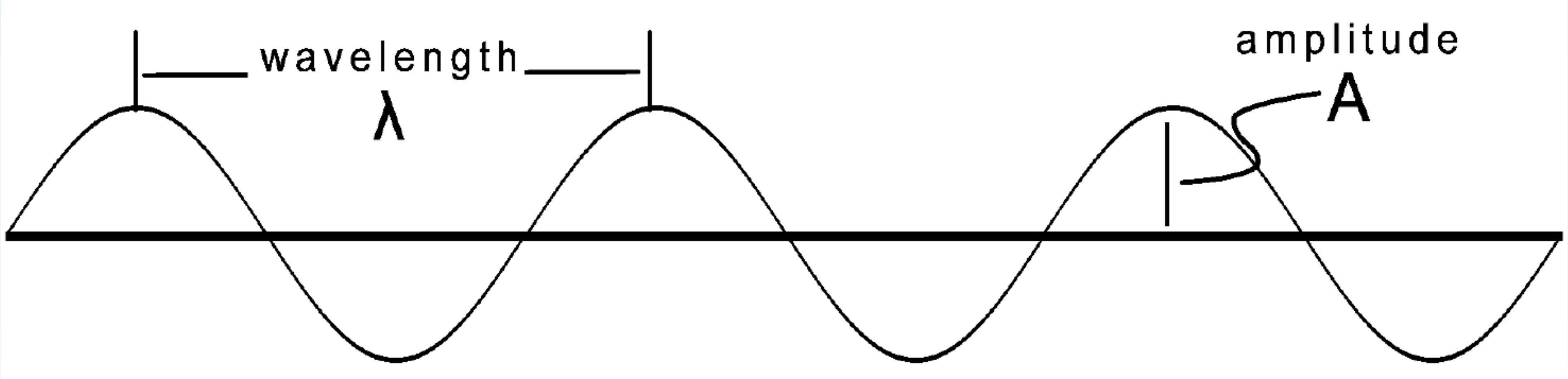
CHARACTERISTICS OF A COMPRESSIONAL WAVE



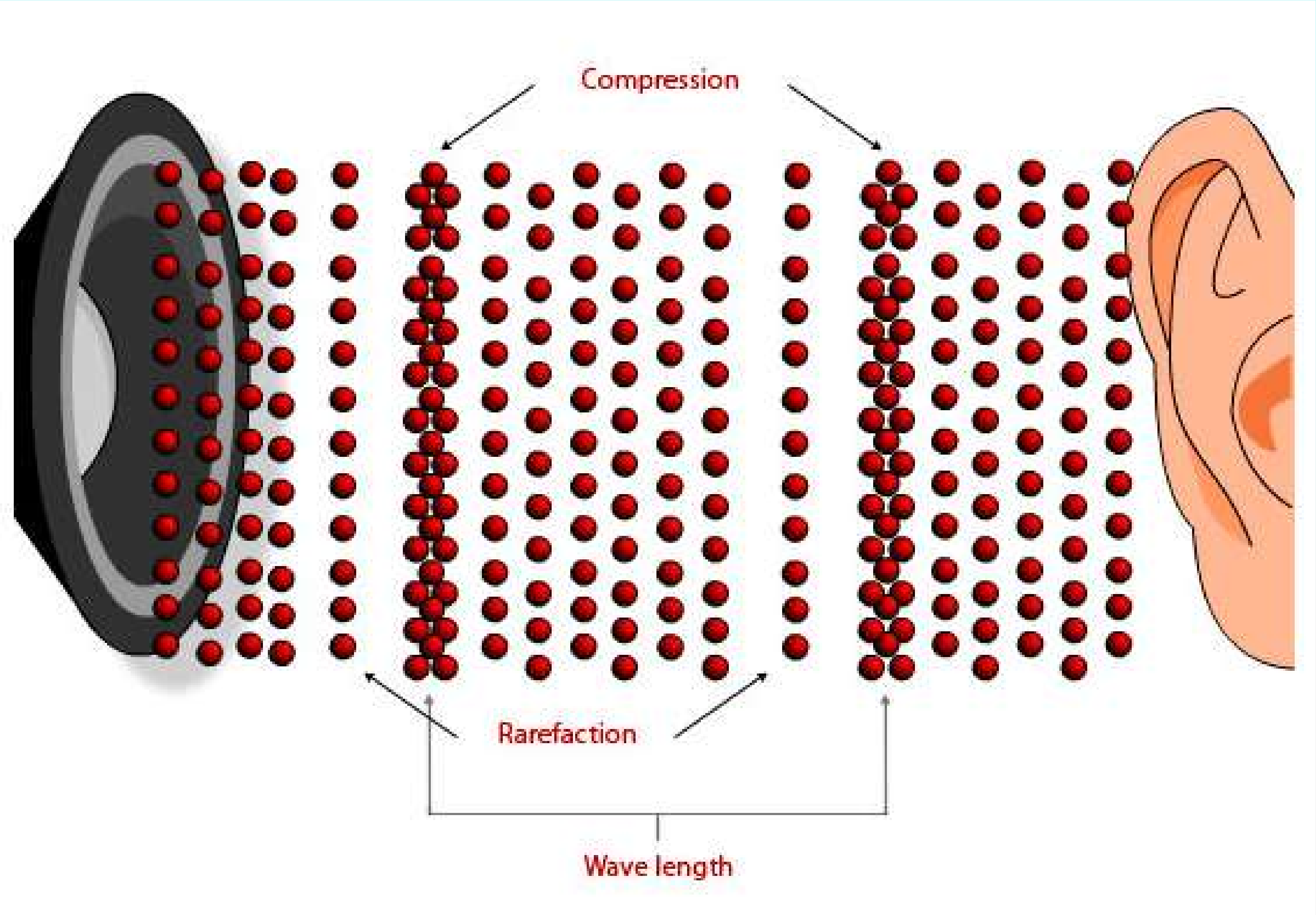


WAVE CHARACTERISTICS

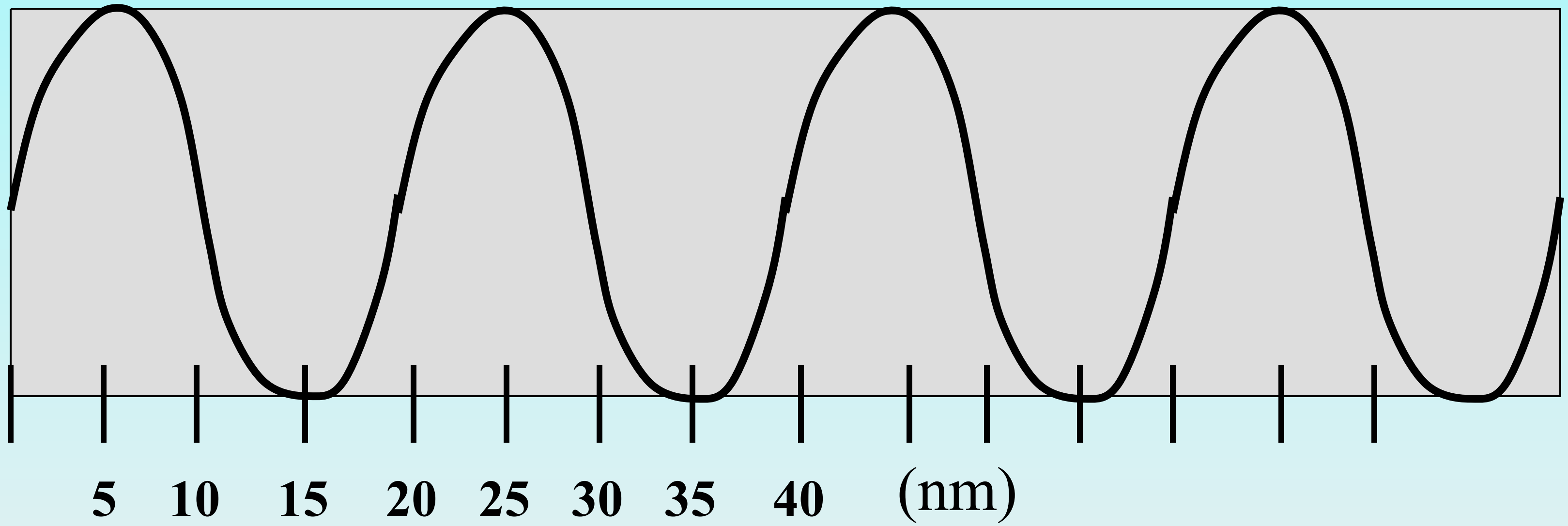
- **Wavelength, λ**
- Distance between two identical points on adjacent waves.
- Usually measured in meters



WAVE CHARACTERISTICS

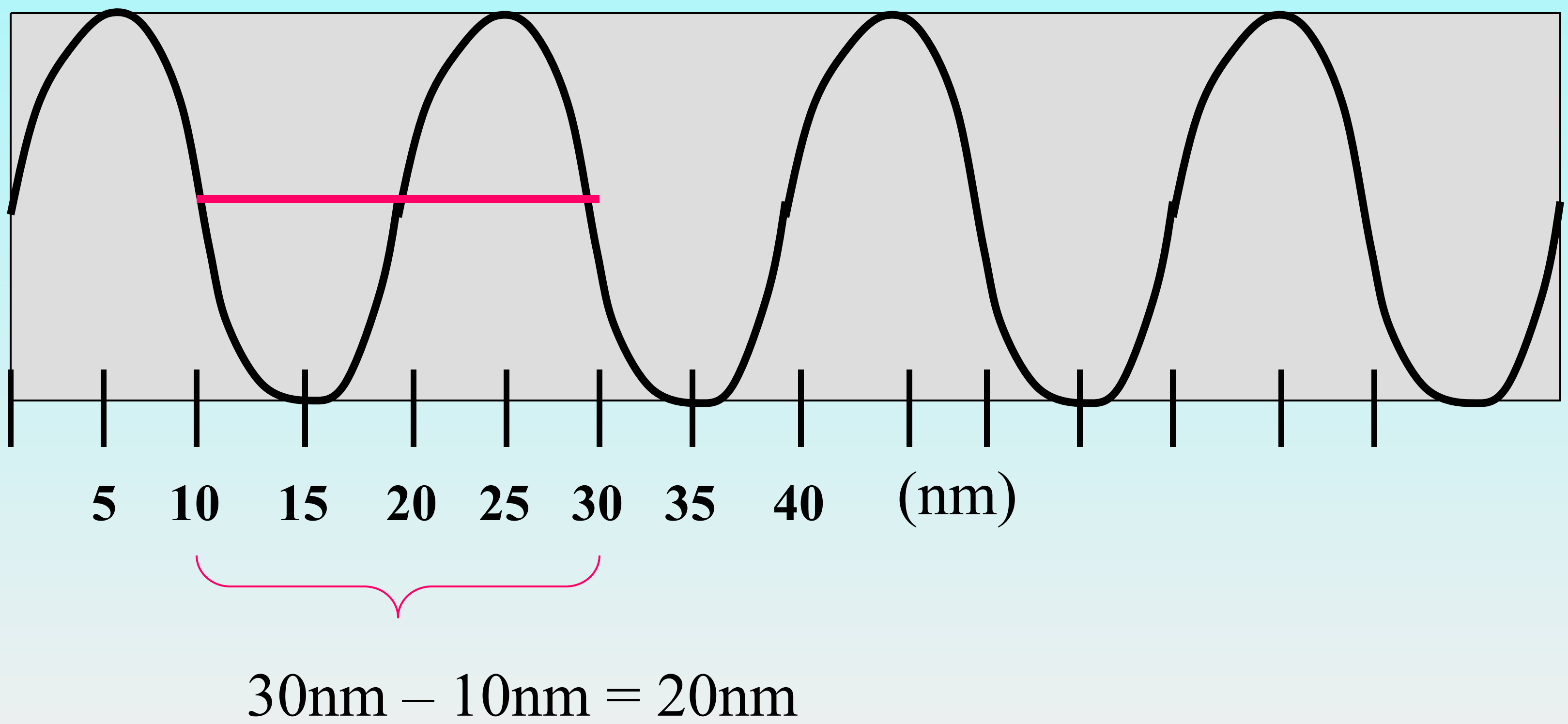


WAVE CHARACTERISTICS



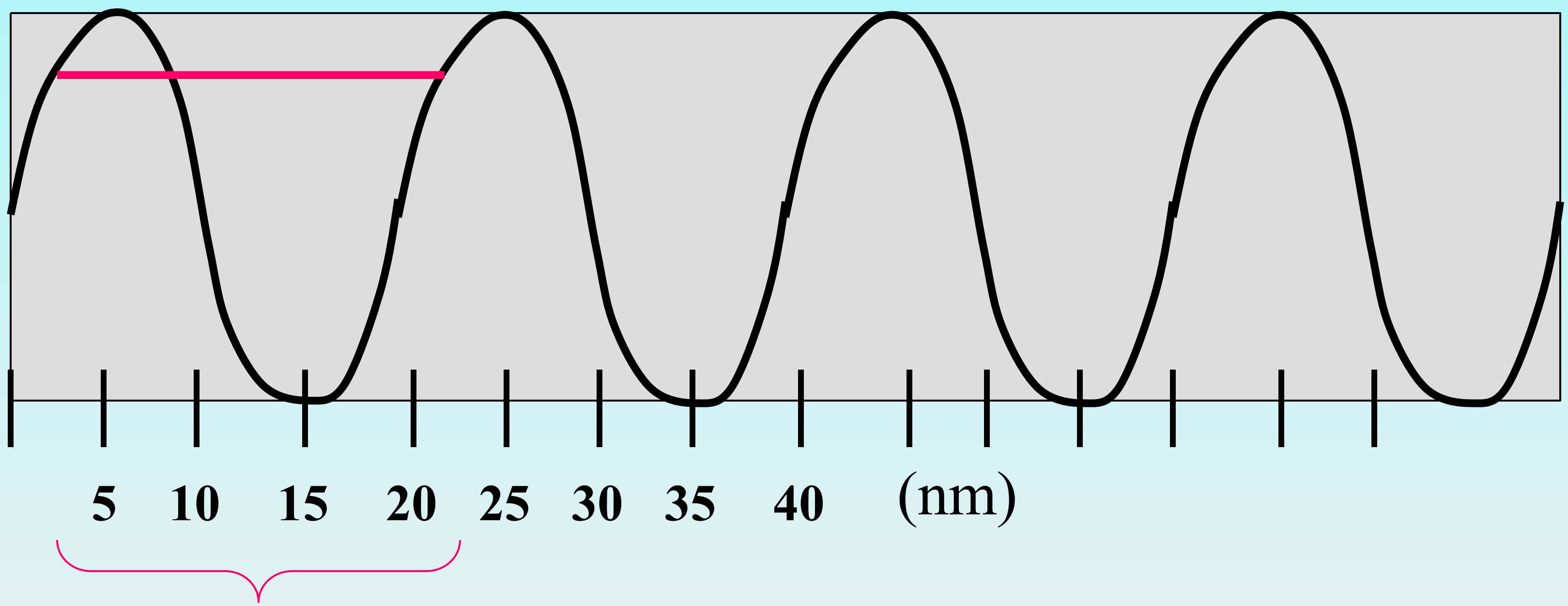
- Measure from any identical two successive points

WAVE CHARACTERISTICS



- Measure from any identical two successive points

WAVE CHARACTERISTICS

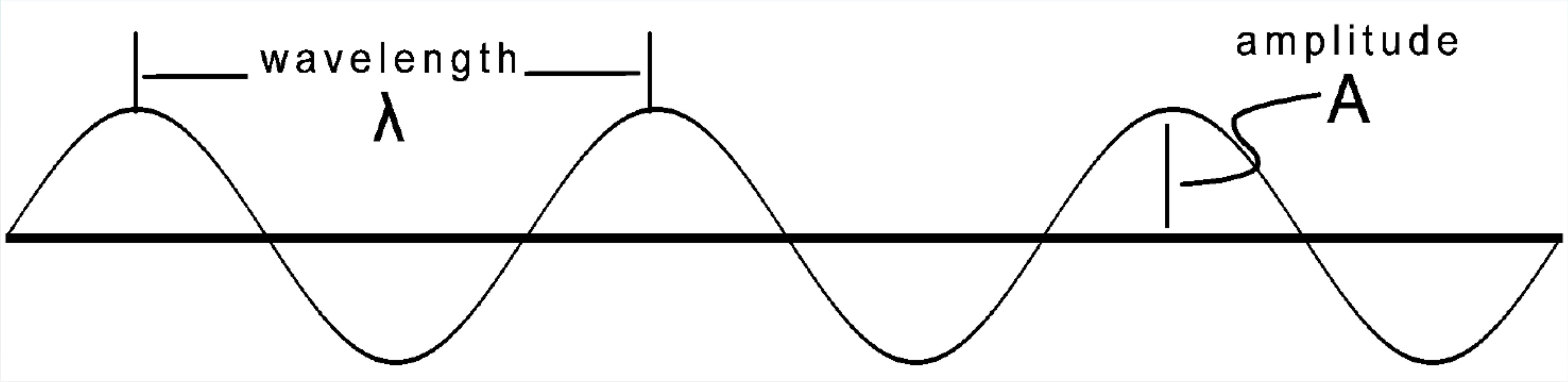


22.5nm - 2.5nm = 20nm

- Measure from any identical two successive points

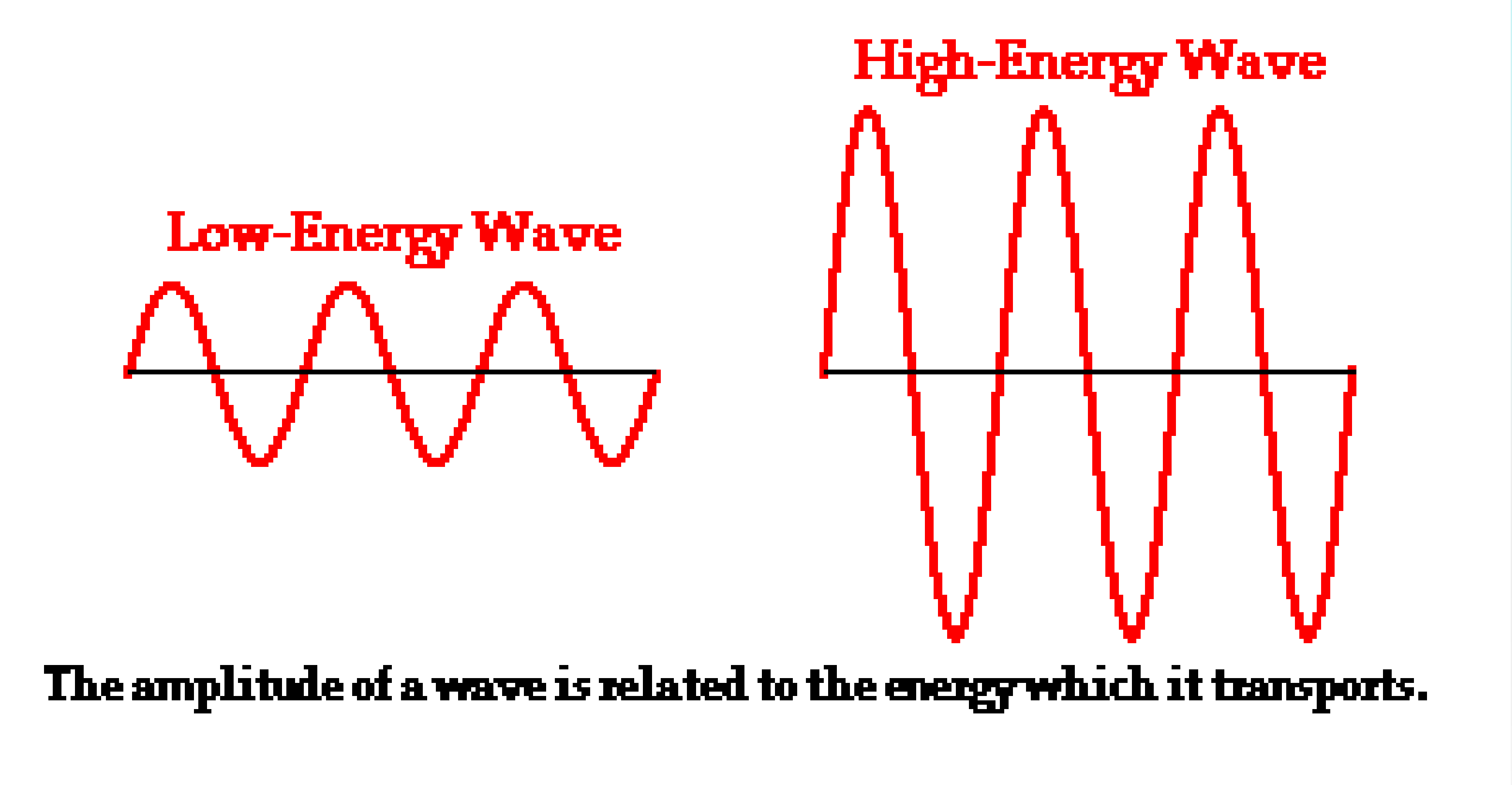
WAVE CHARACTERISTICS

- **Amplitude**: the amount of energy carried by the wave.
- The higher the amplitude, the more energy the wave is carrying.



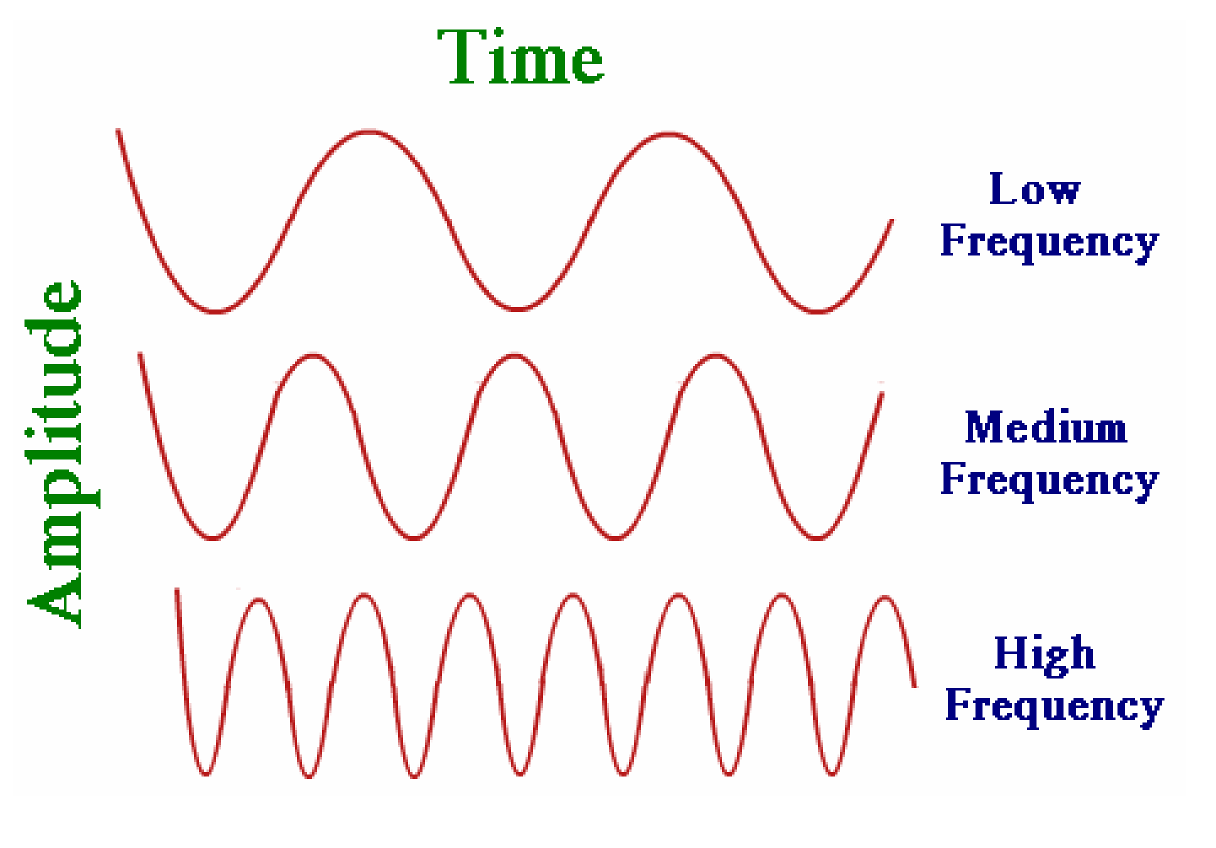
WAVE CHARACTERISTICS

Higher energy, higher amplitude; low energy, low amplitude



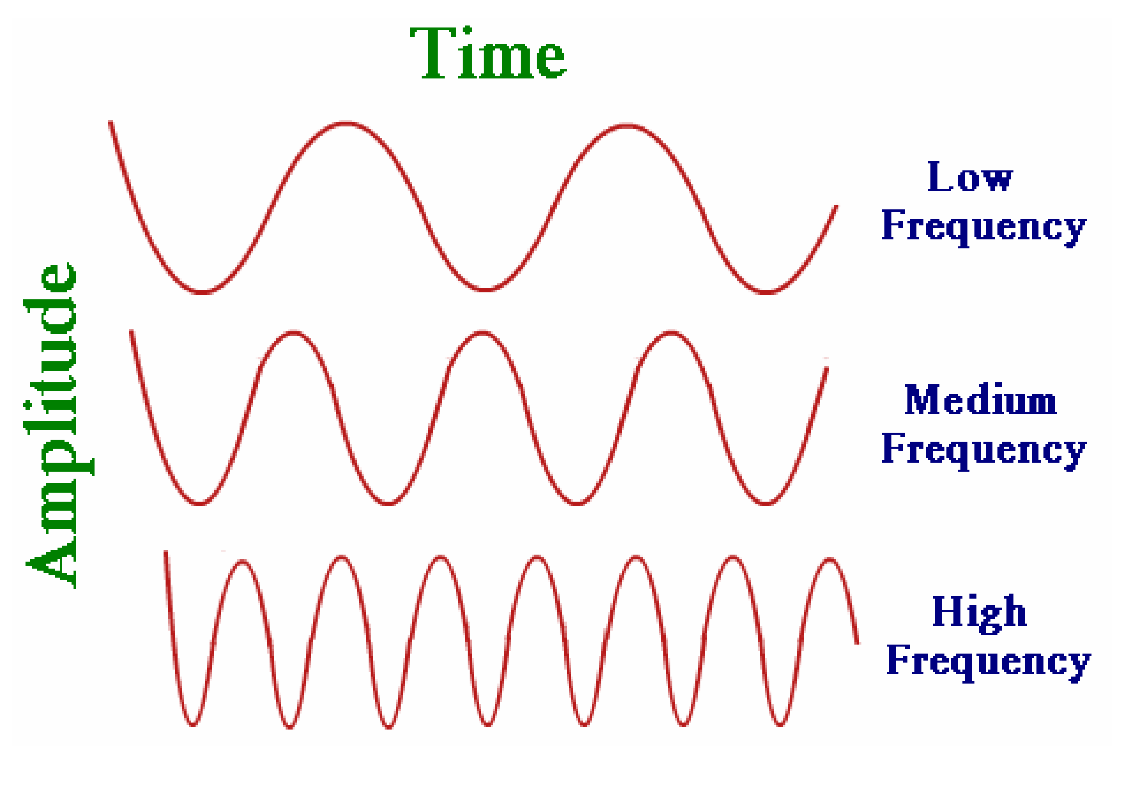
WAVE CHARACTERISTICS

- **Frequency:** number of WAVES passing a fixed point per second (Hertz).

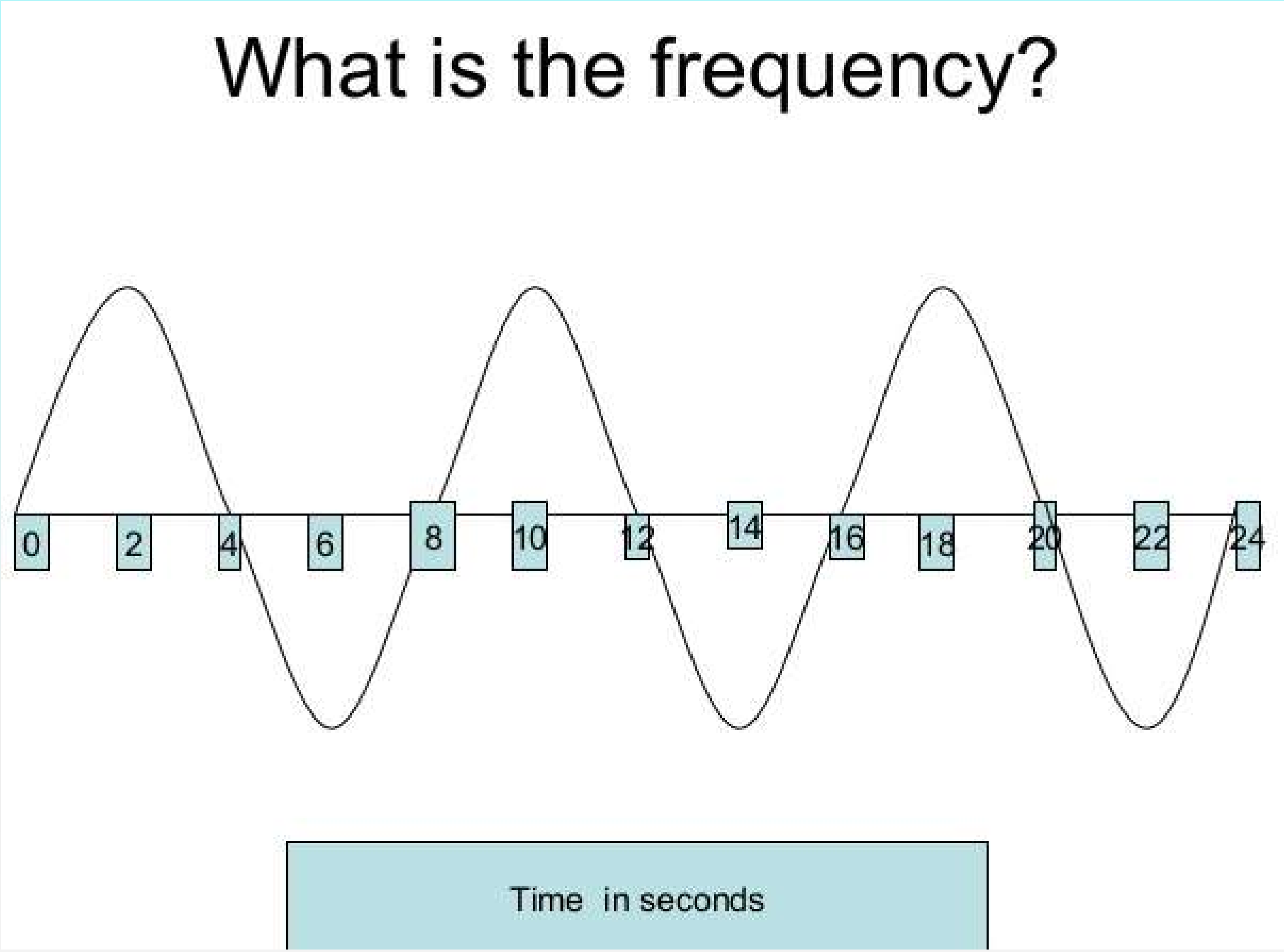


WAVE CHARACTERISTICS

- Wavelength and frequency are related.
- As the **wavelength** **decreases** the **frequency** **increases**.



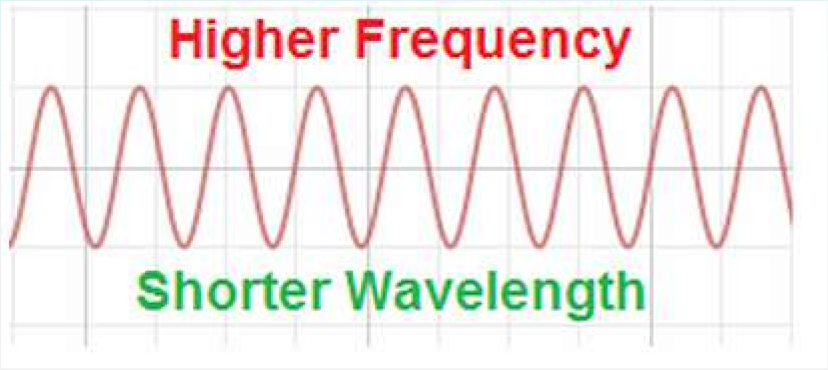
WAVE CHARACTERISTICS

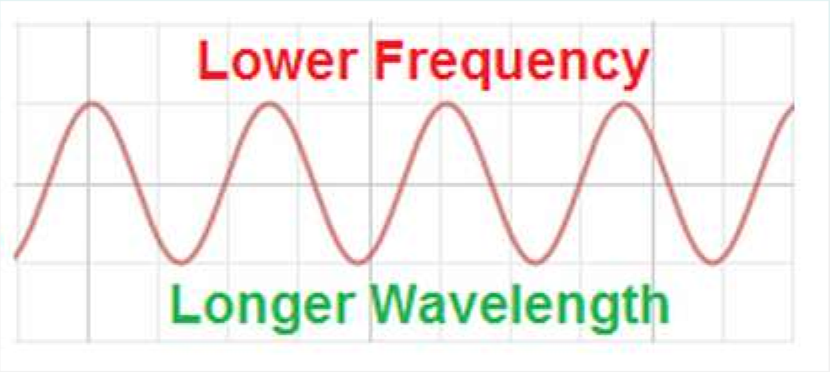


WAVE CHARACTERISTICS

- Frequency increases
- Energy increases
- Wavelength decreases

- Frequency decreases
- Energy decreases
- Wavelength increases





SPEED OF A WAVE

- Wave speed depends on the wavelength and frequency.

Speed = wavelength x frequency

$$v = (\lambda)(f)$$

  - ν is the velocity (m/s)
  - f is the frequency (hertz)
  - λ is the wavelength (m)

SPEED OF A WAVE

- The speed of a mechanical wave is **constant** for any given medium.
- The speed of a wave **changes** as it moves through **different** media (mediums).

PRACTICE

Calculate the speed of a wave whose wavelength is 1.5 meters and whose frequency is 280 hertz.

$\lambda = 1.5\text{m}$

$f = 280\text{Hz}$

$v = ?$

$v = \lambda f = (1.5\text{m})(280\text{Hz})$

$= 420\text{m/s}$

PRACTICE

A wave is traveling at a speed of 12m/s and its wavelength is 3m. Calculate the wave frequency.

$\lambda = 3m$

$f = ?$

$v = 12m/s$

$$v = \lambda f \qquad f = \frac{v}{\lambda}$$

$$F = \frac{12m/s}{3m} = 4Hz$$

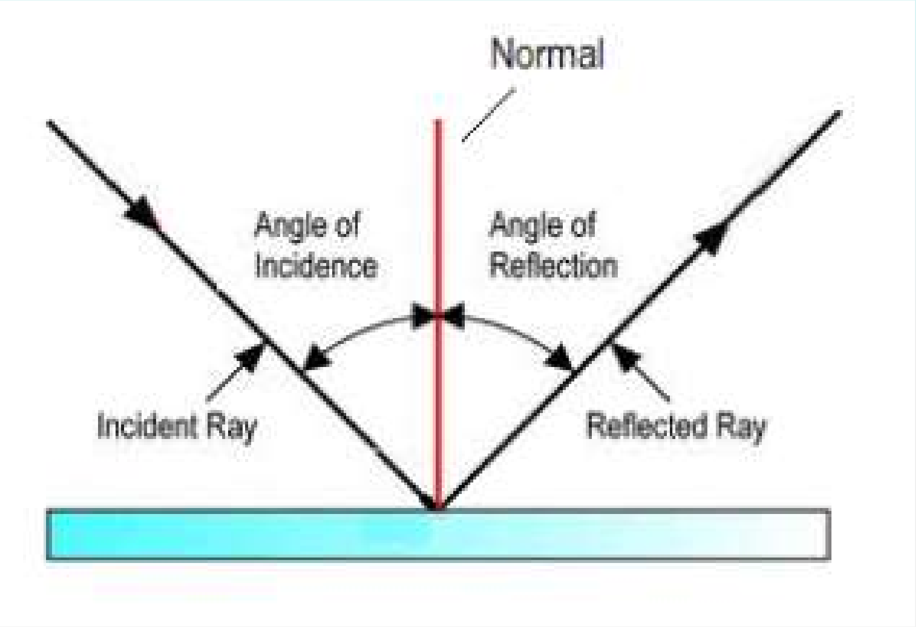
Wave interactions with matter

REFLECTION

- **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 at which it struck the surface. This is called the Law of Reflection.
- **Reflection** occurs when a wave hits another wave or object that it cannot pass through and bounces back.
- All types of waves can be reflected: light, sound, water.

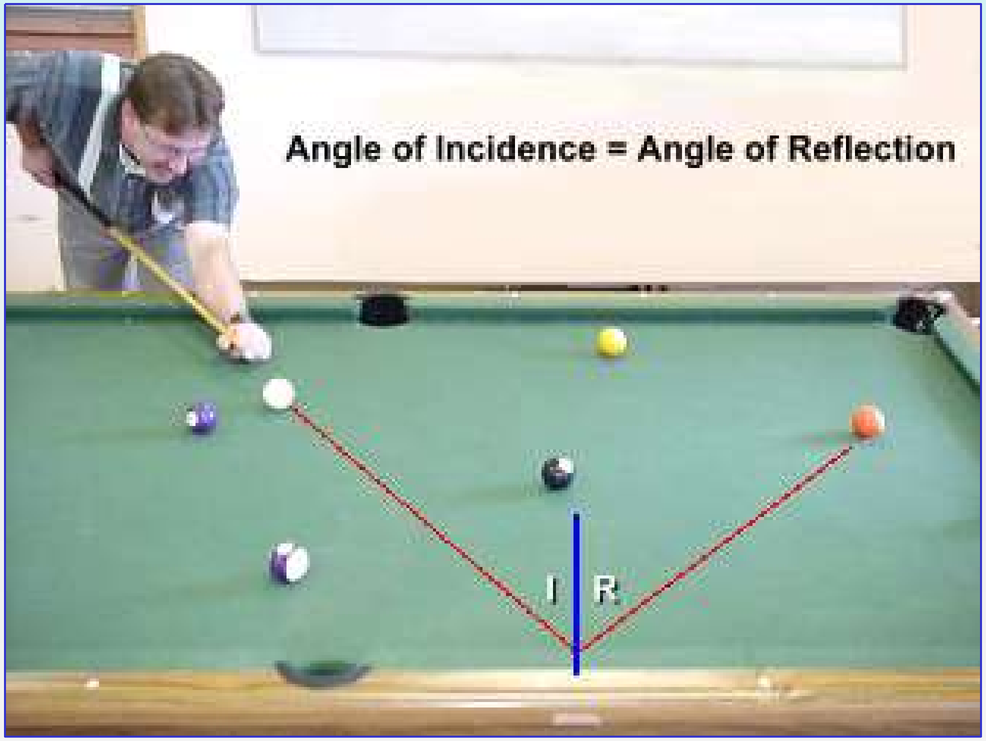
LAW OF REFLECTION

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



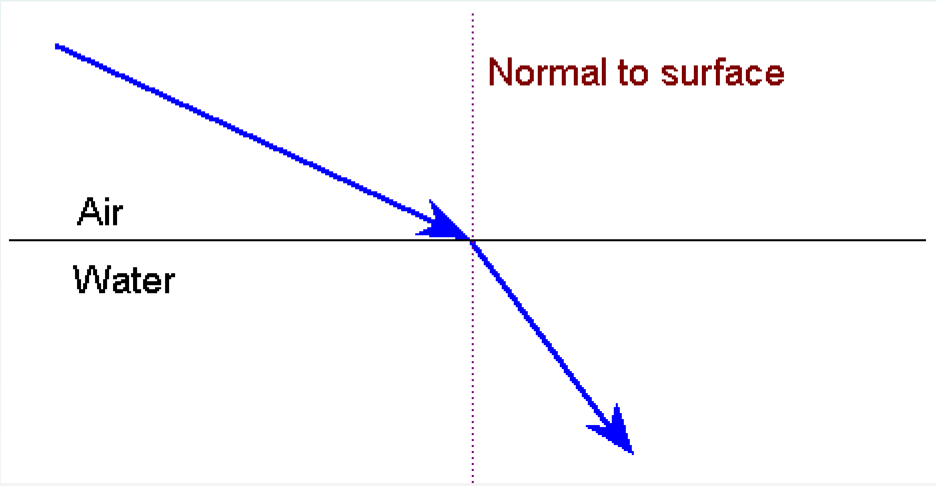
LAW OF REFLECTION

- The angle of incidence equals the angel of reflection.



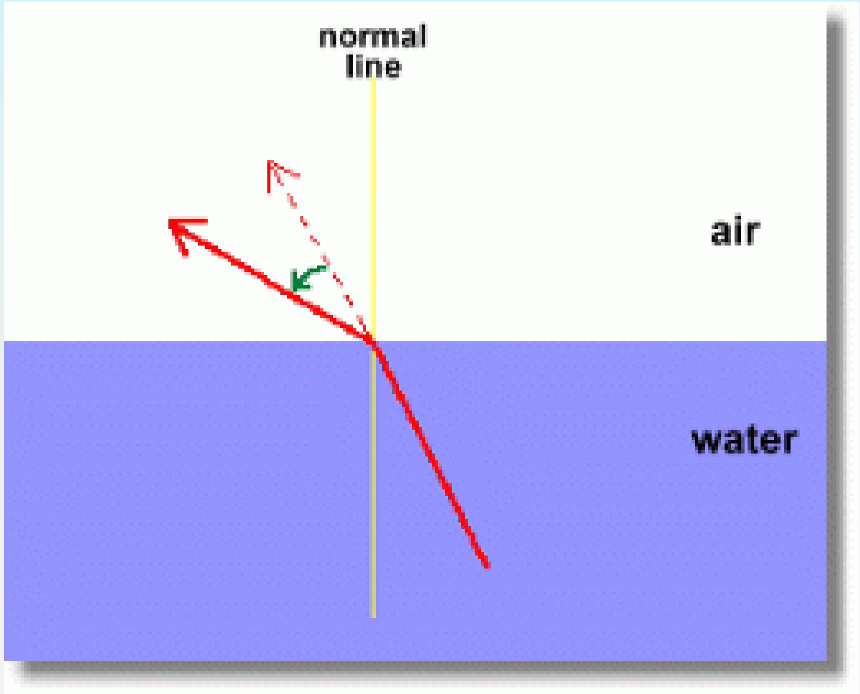
REFRACTION

- 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.

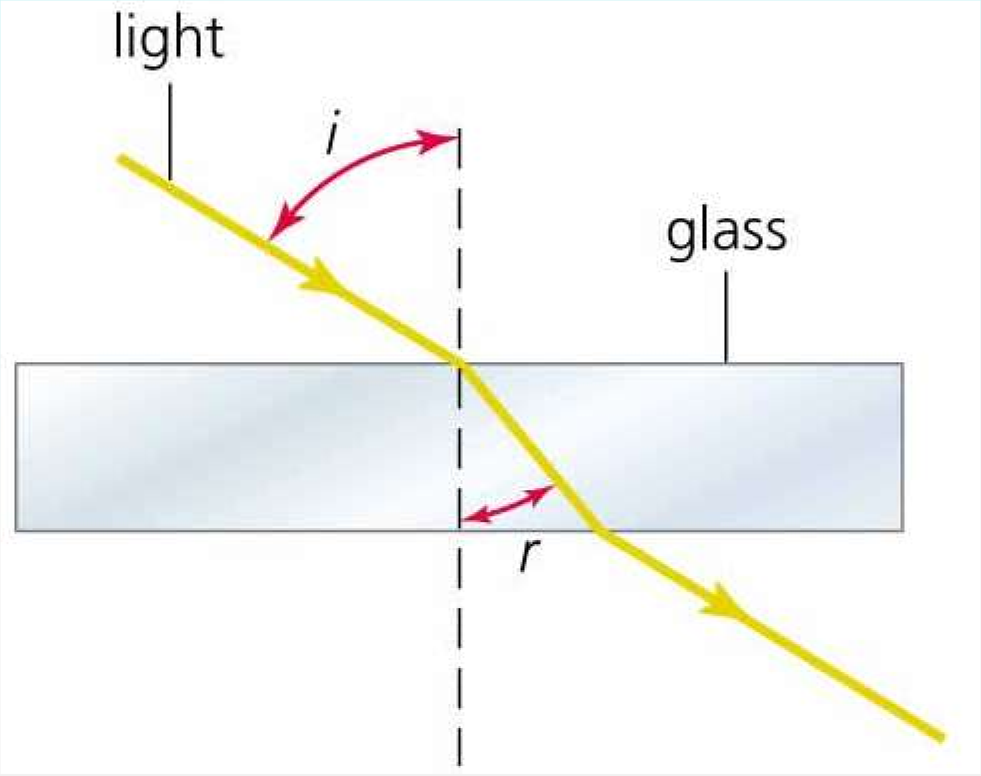


REFRACTION

- Refraction occurs when a wave passes from one medium to another at an angle and bends (changes direction) due to a change in speed.
- The amount of bending depends on the material, the wavelength, and the incident angle.

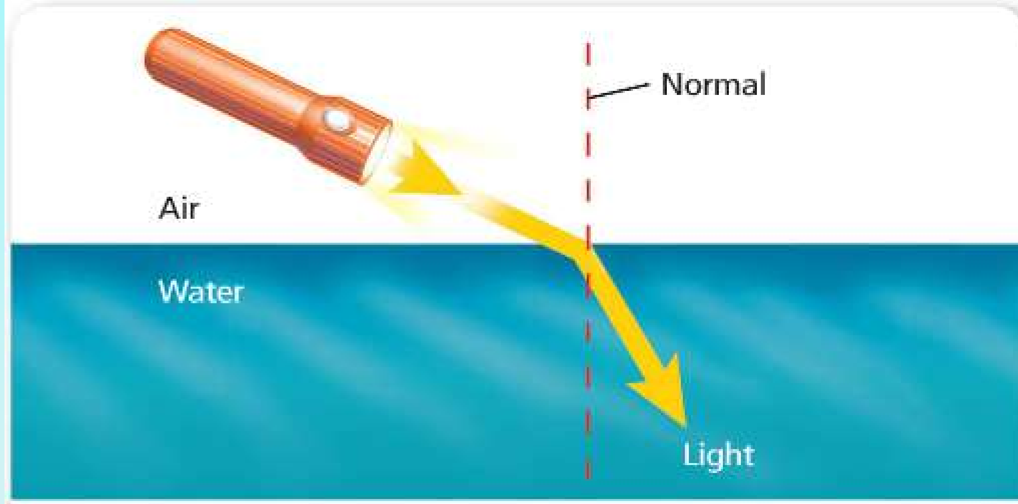


DIFFRACTION

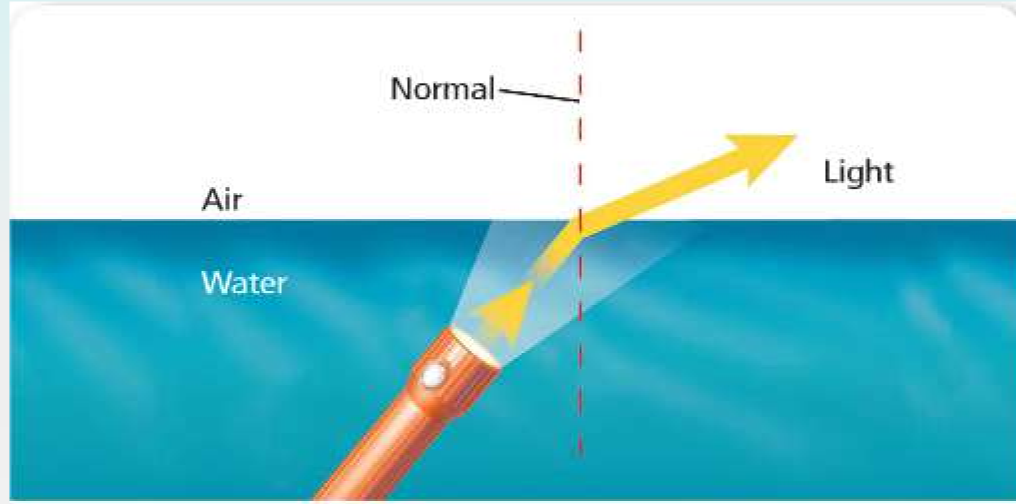


REFRACTION

Light waves travel more slowly in water than in air. This causes light waves to refract when they move from air to water or water to air

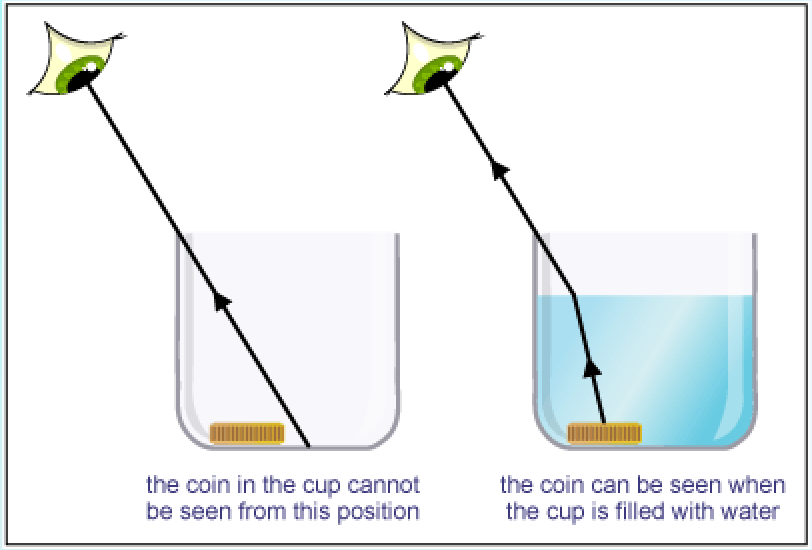


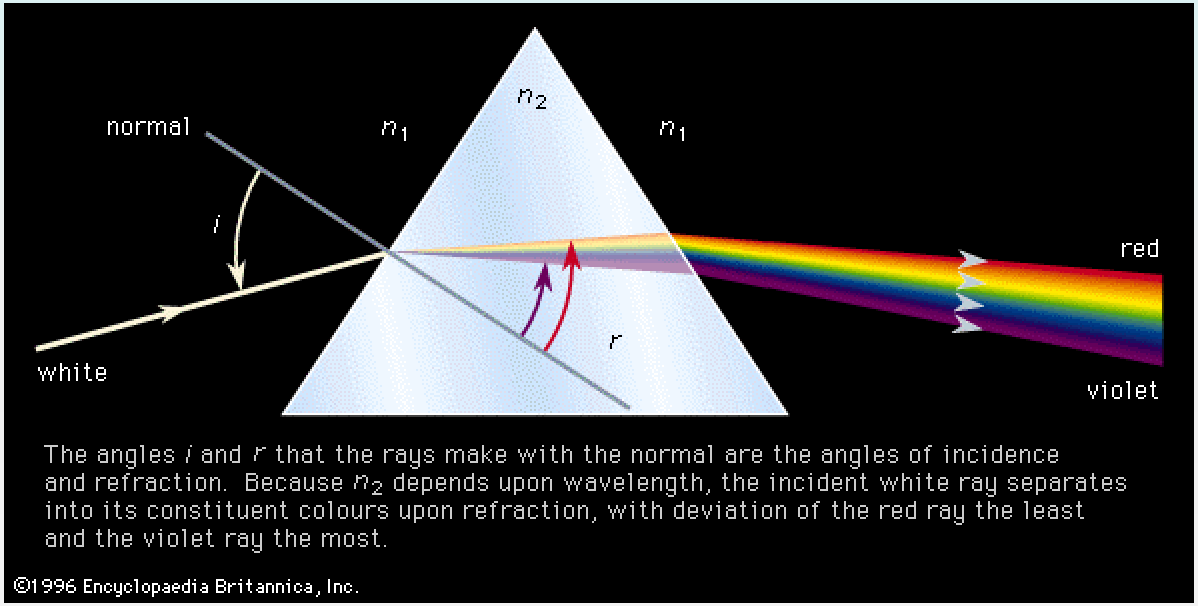
When light waves travel from air to water, they slow down and bend toward the normal.



When light waves travel from water to air, they speed up and bend away from the normal.

REFRACTION


the coin in the cup cannot
be seen from this position
the coin can be seen when
the cup is filled with water


normal
n_1
n_2
n_1
i
r
white
red
violet
The angles i and r that the rays make with the normal are the angles of incidence and refraction. Because n_2 depends upon wavelength, the incident white ray separates into its constituent colours upon refraction, with deviation of the red ray the least and the violet ray the most.
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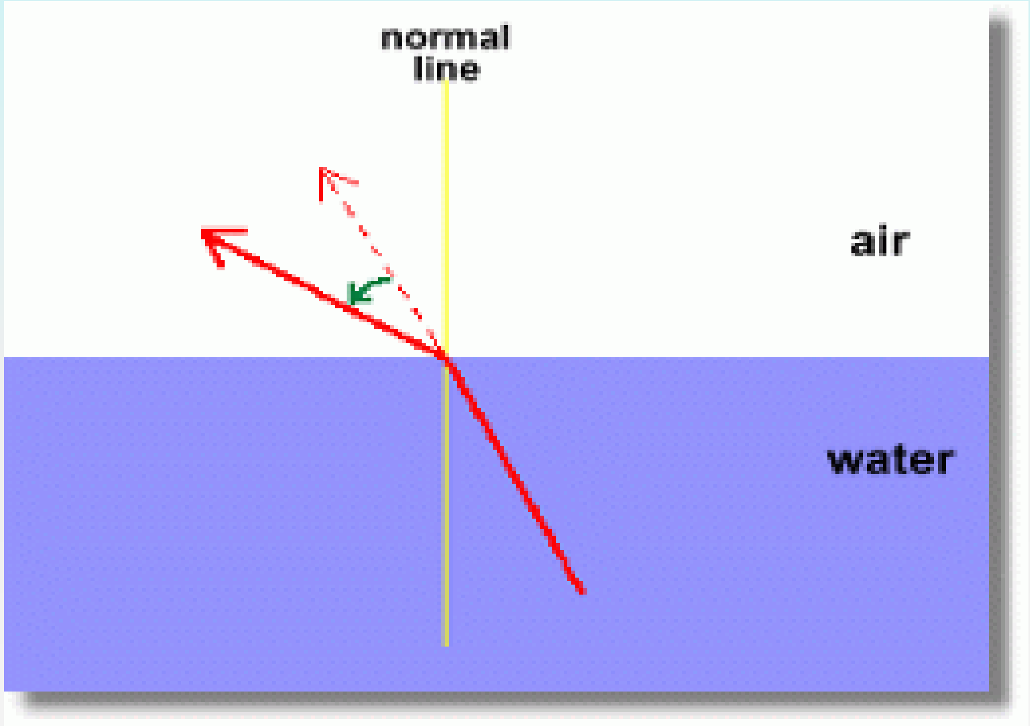
REFRACTION

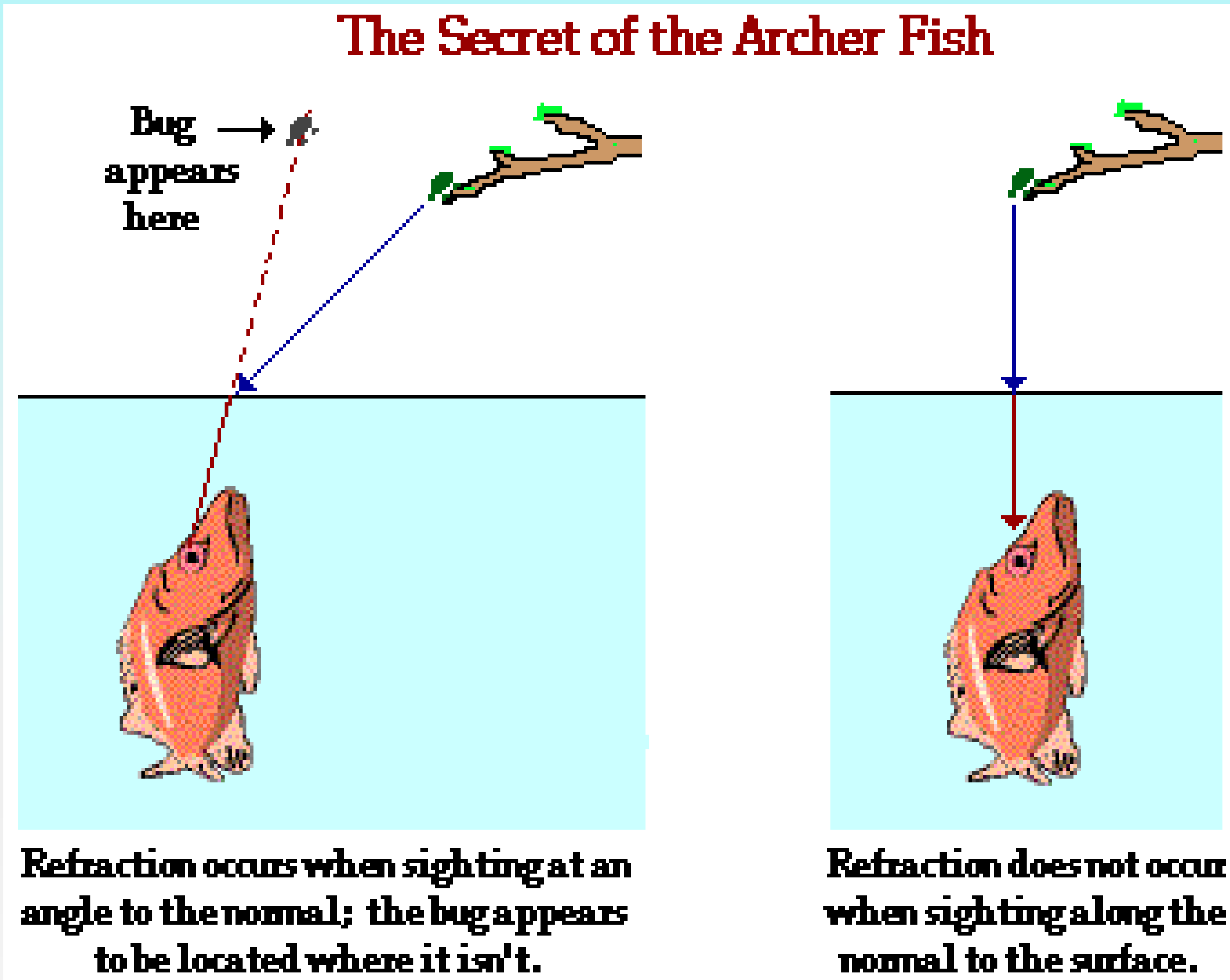
- Because of light refraction, a person bow fishing would not aim directly at the fish. Where should they aim?



REFRACTION

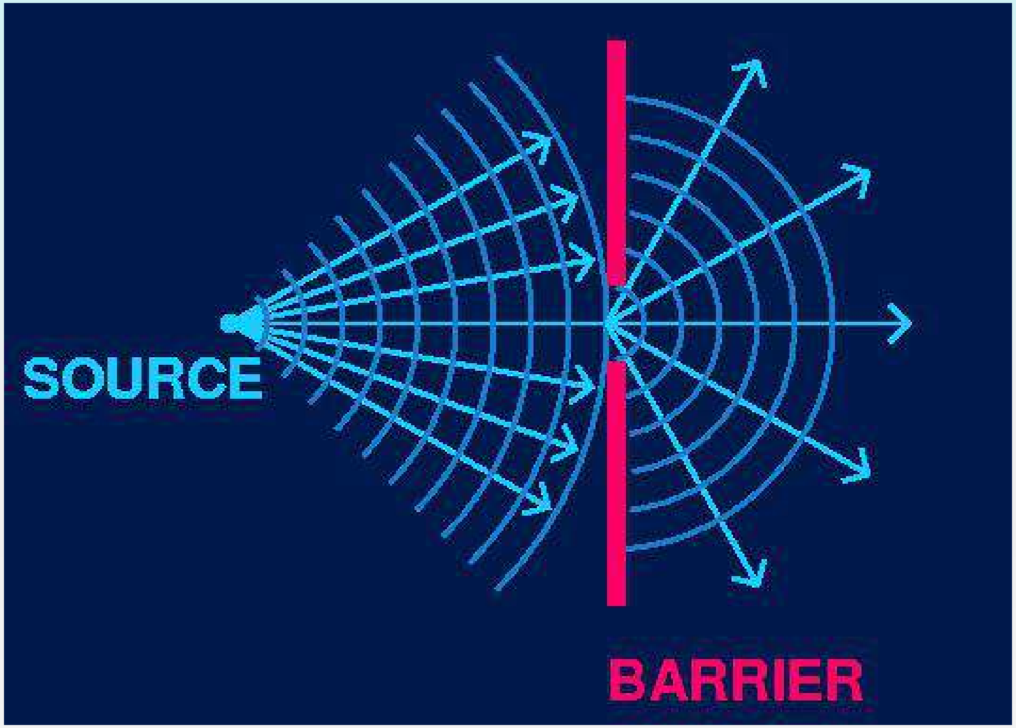
The South American archer fish shoots a stream of water which knocks unsuspecting prey down into the water where they are eaten. Would the fish in the picture need to aim higher or lower than where it perceives the bug to be?

REFRACTION


The Secret of the Archer Fish
Bug appears here
Refraction occurs when sighting at an angle to the normal; the bug appears to be located where it isn't.
Refraction does not occur when sighting along the normal to the surface.

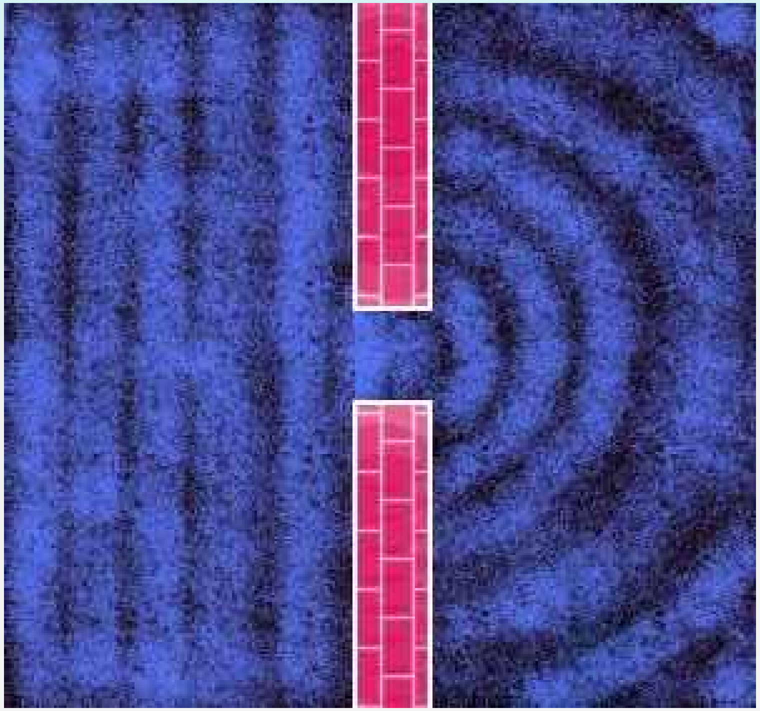
DIFFRACTION

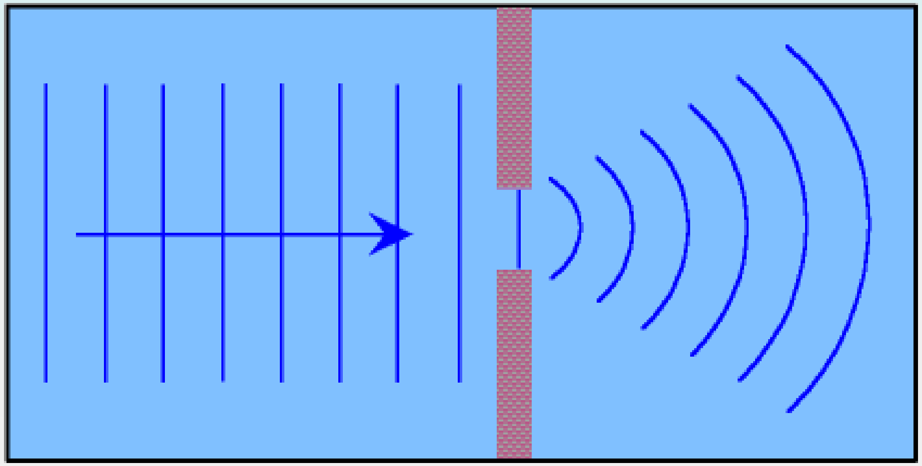
- **Diffraction** is the bending of a wave around a barrier.
- Diffraction is a wave phenomenon that is dependent on wavelength.



DIFFRACTION

- Diffraction occurs when a wave passes through an opening and spreads out.
- Light waves bend as they pass by the edge of a narrow aperture or slit.

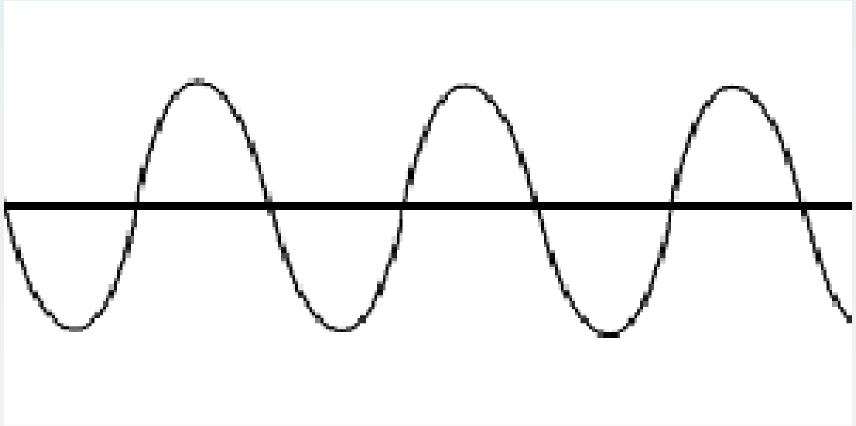




DIFFRACTION

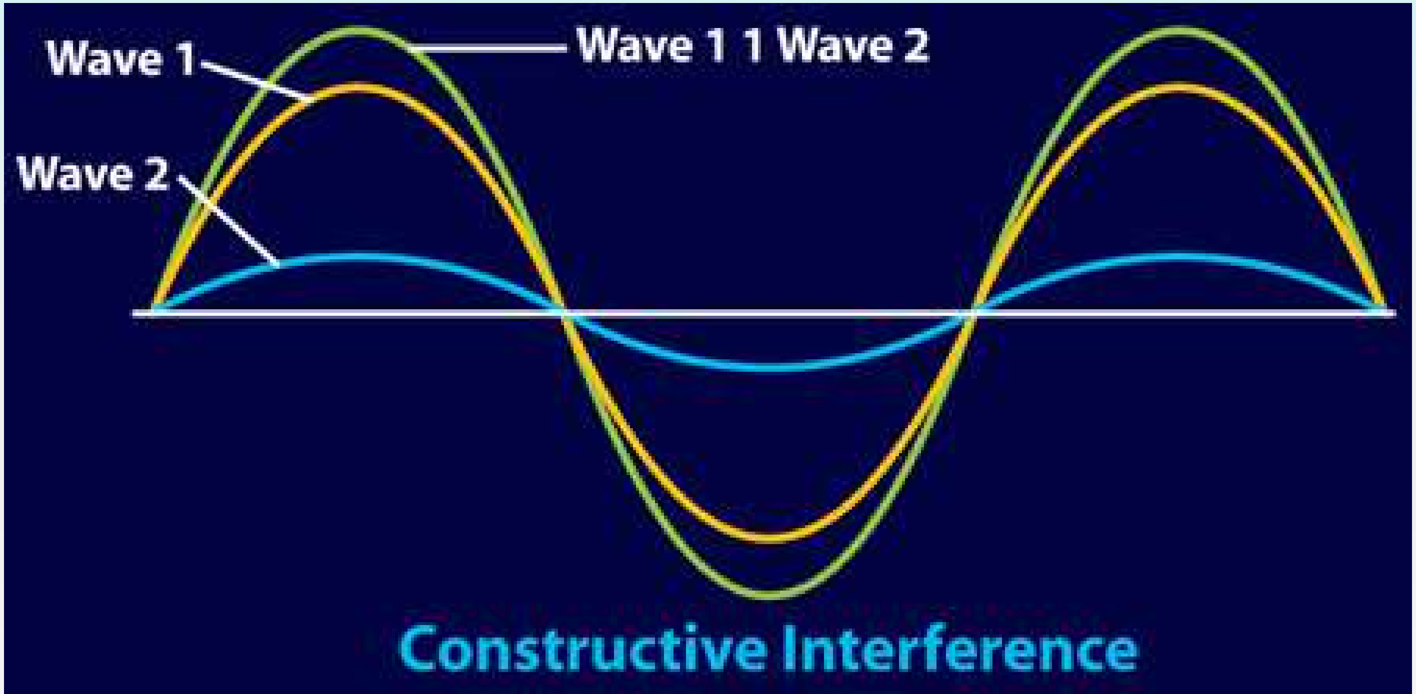
INTERFERENCE

- Sometimes two 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.



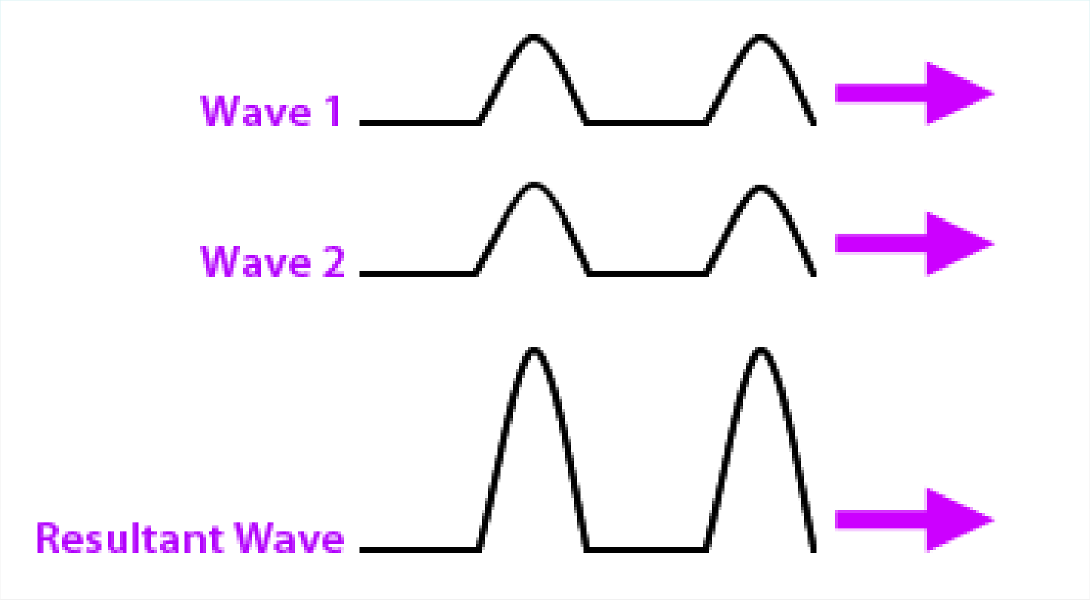
CONSTRUCTIVE

- **Constructive Interference** occurs when two or more waves hit the same point and combine to produce a larger single wave.

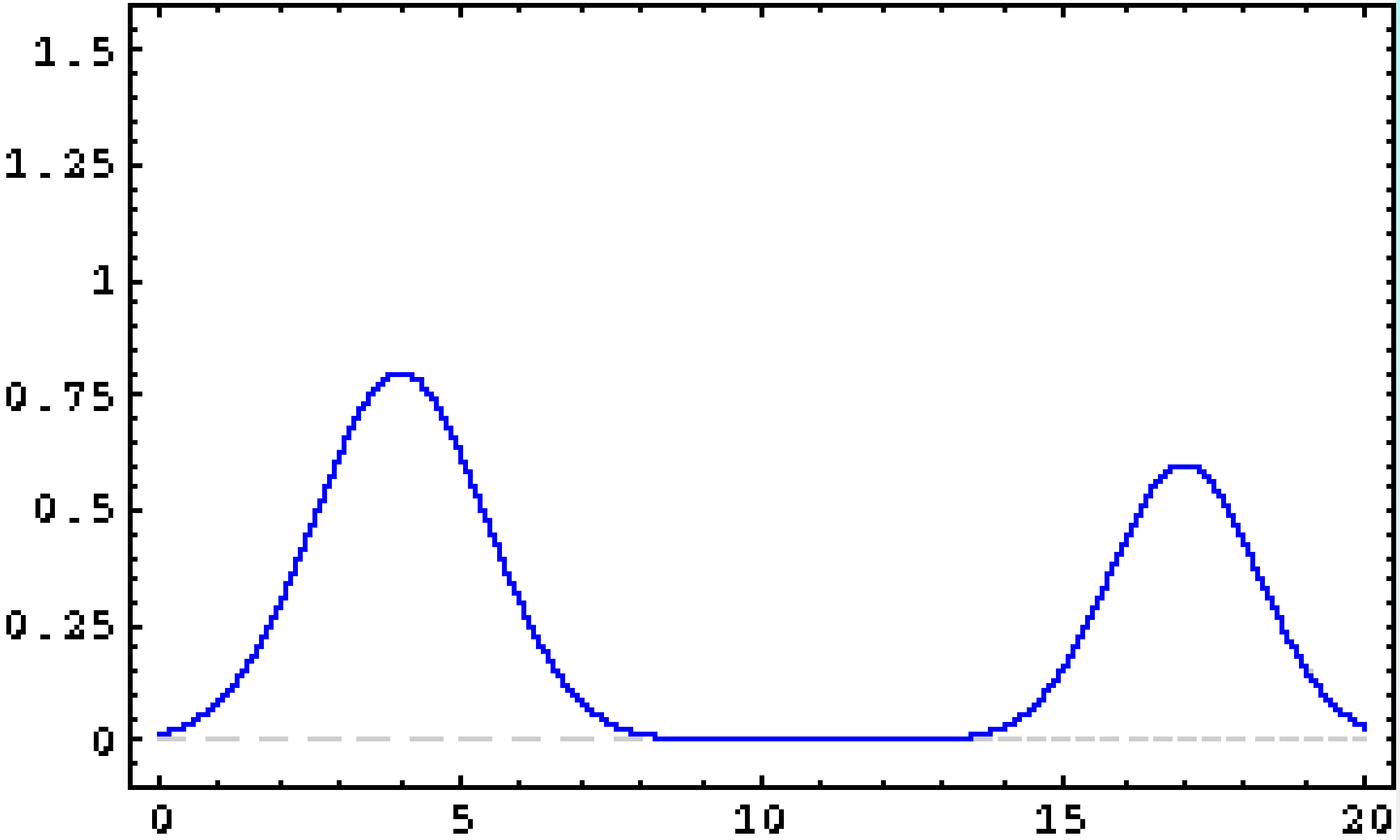


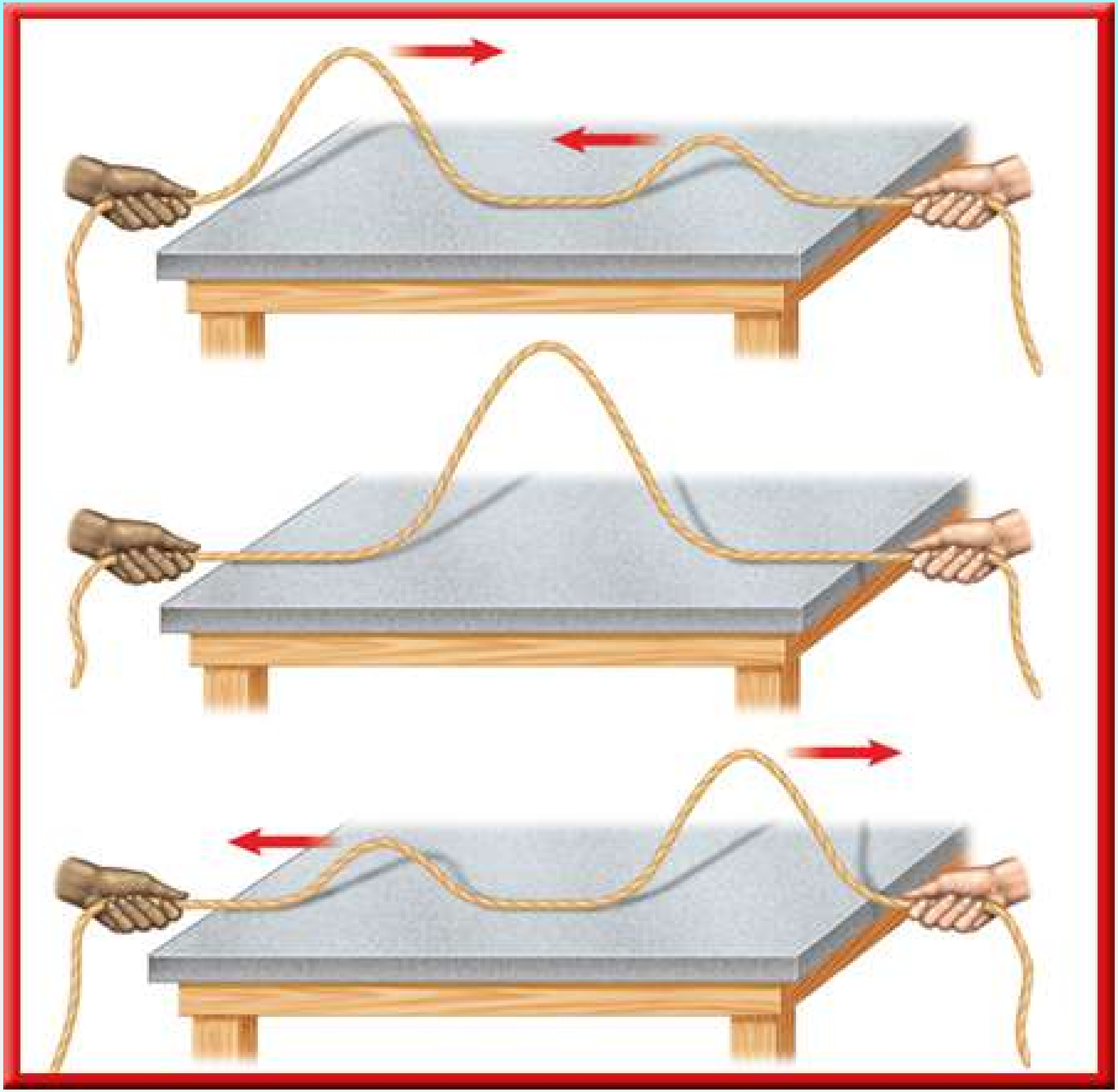
CONSTRUCTIVE

- **Constructive Interference** occurs when the crests and troughs coincide and produce a larger amplitude - greater overall combined energy.

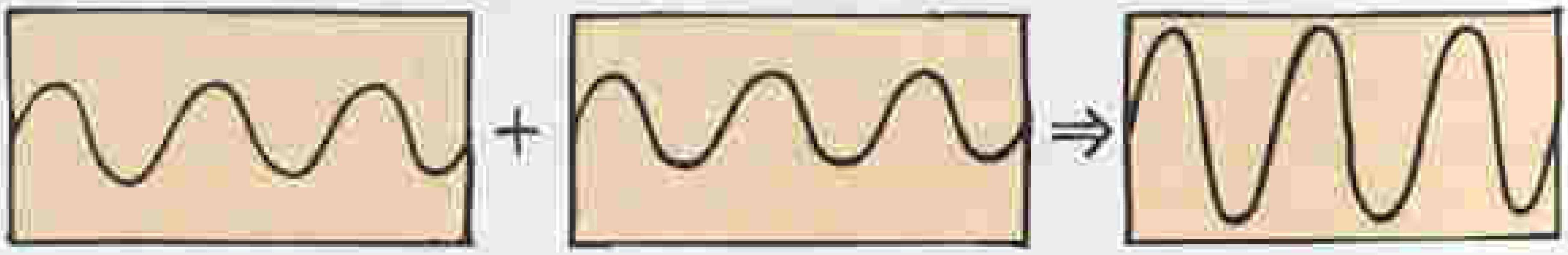


CONSTRUCTIVE

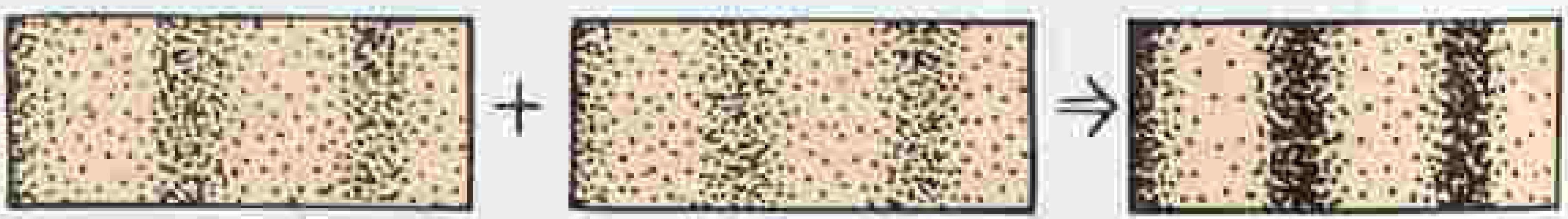




CONSTRUCTIVE



The superposition of two identical transverse waves in phase produces a wave of increased amplitude.



The superposition of two identical longitudinal waves in phase produces a wave of increased intensity.

CONSTRUCTIVE

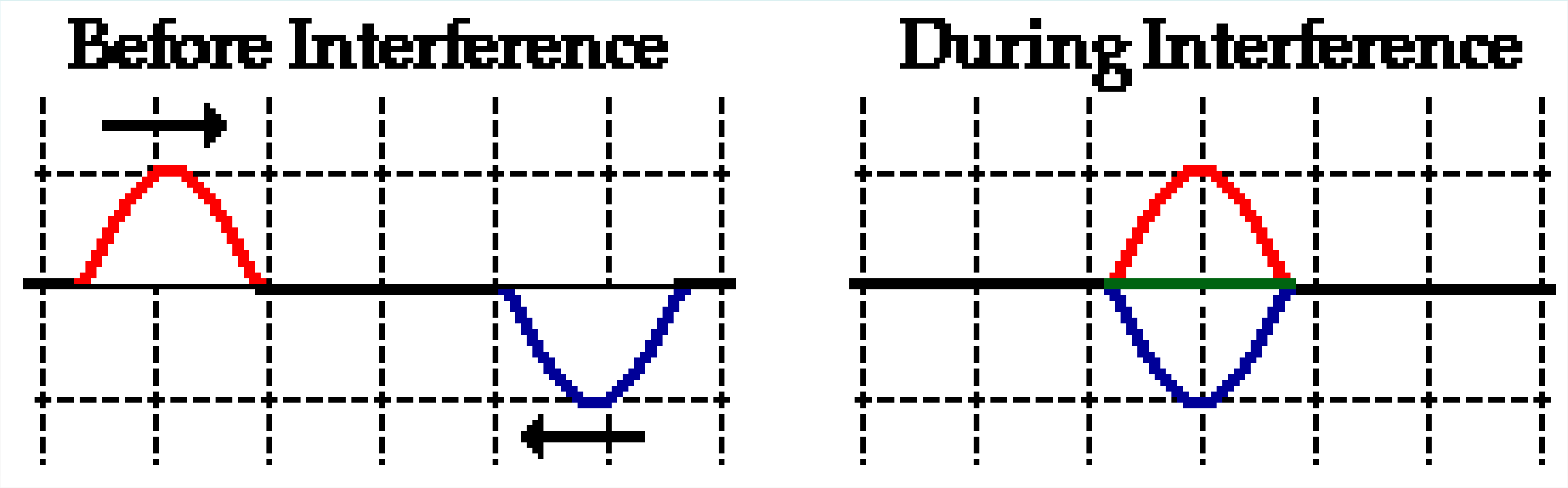
- Examples:
  - 2 people trampolining at the same time.
  - 2 or more people singing together (in sync).

CONSTRUCTIVE

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

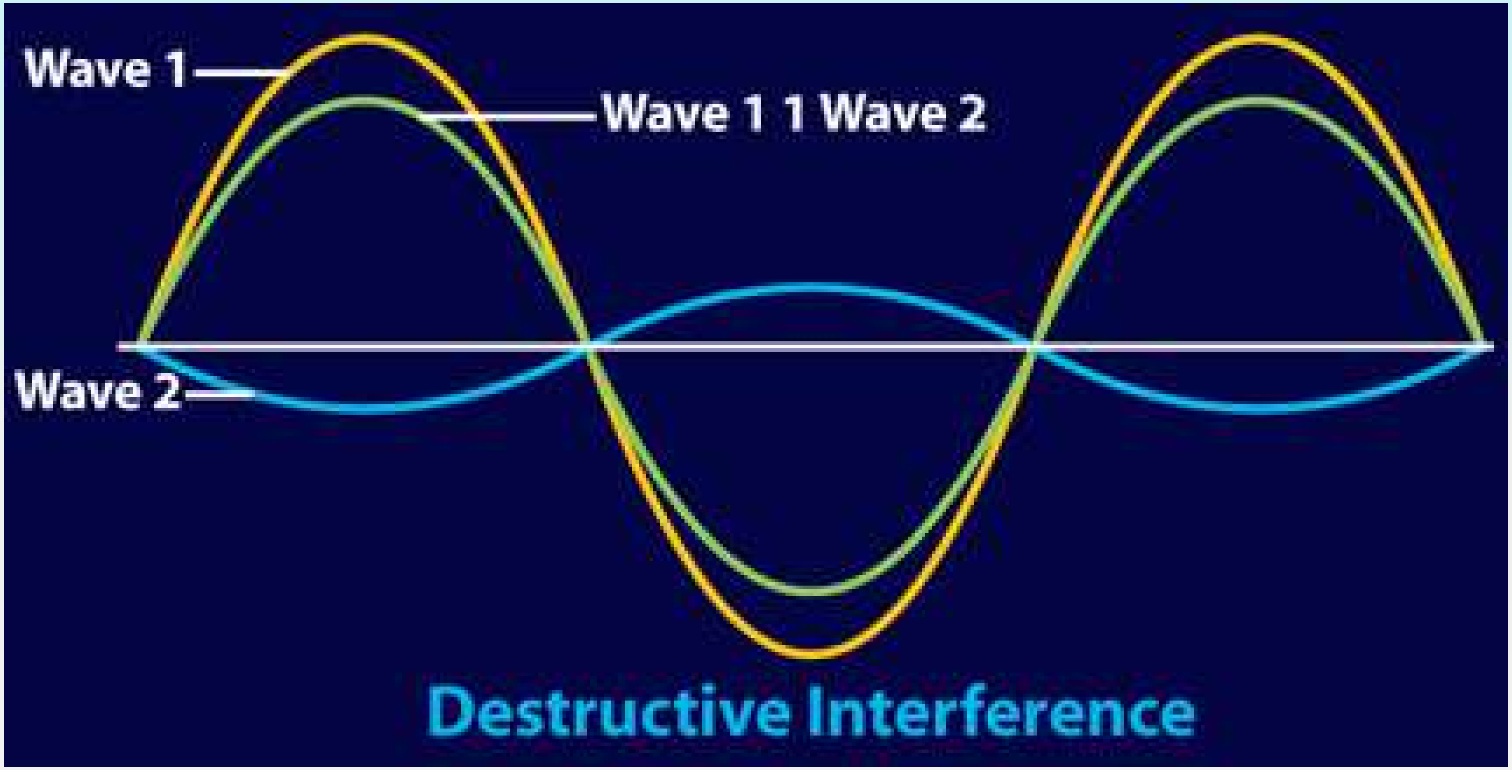
DESTRUCTIVE

- **Destructive Interference** occurs when two or more waves hit the same point and combine to produce a smaller single wave.

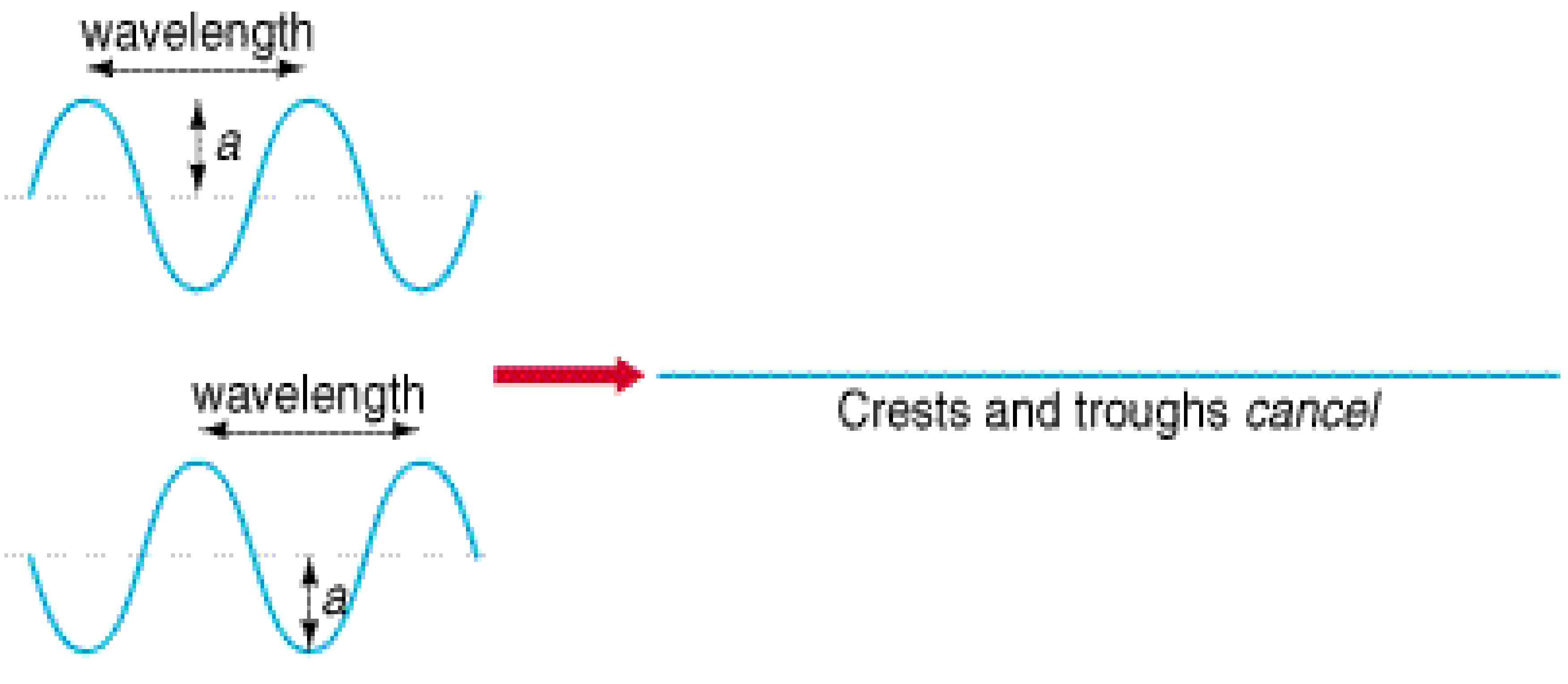


DESTRUCTIVE

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

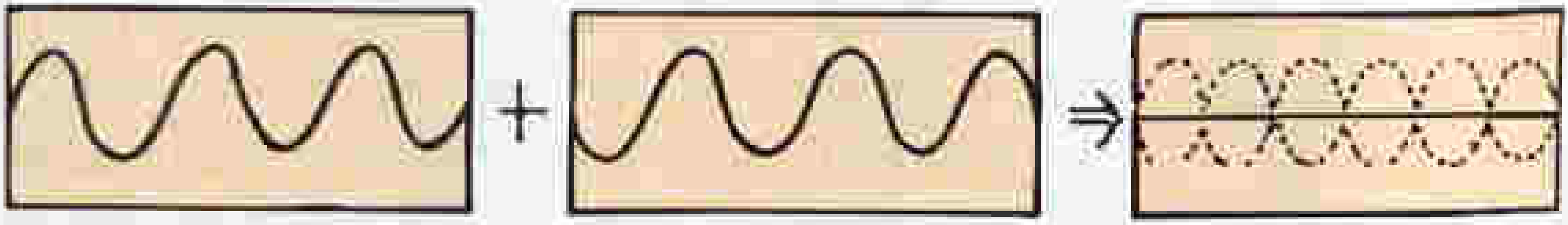


DESTRUCTIVE

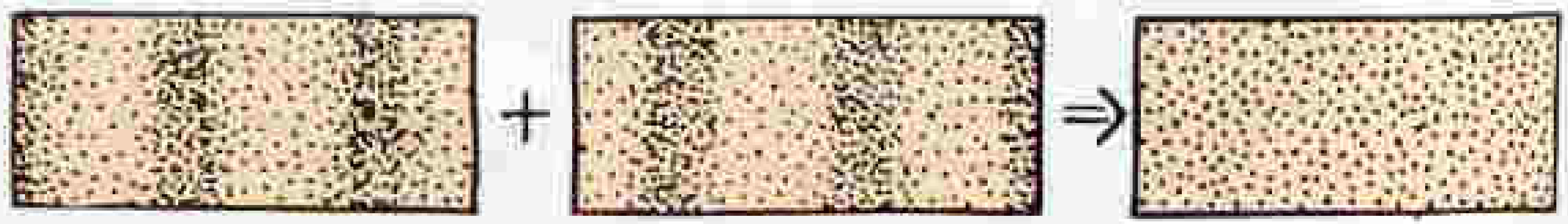


(b) Destructive interference

DESTRUCTIVE



Two identical transverse waves that are out of phase destroy each otherwhen they are superimposed.



Two identical longitudinal waves that are out of phase destroy each other when they are superimposed.

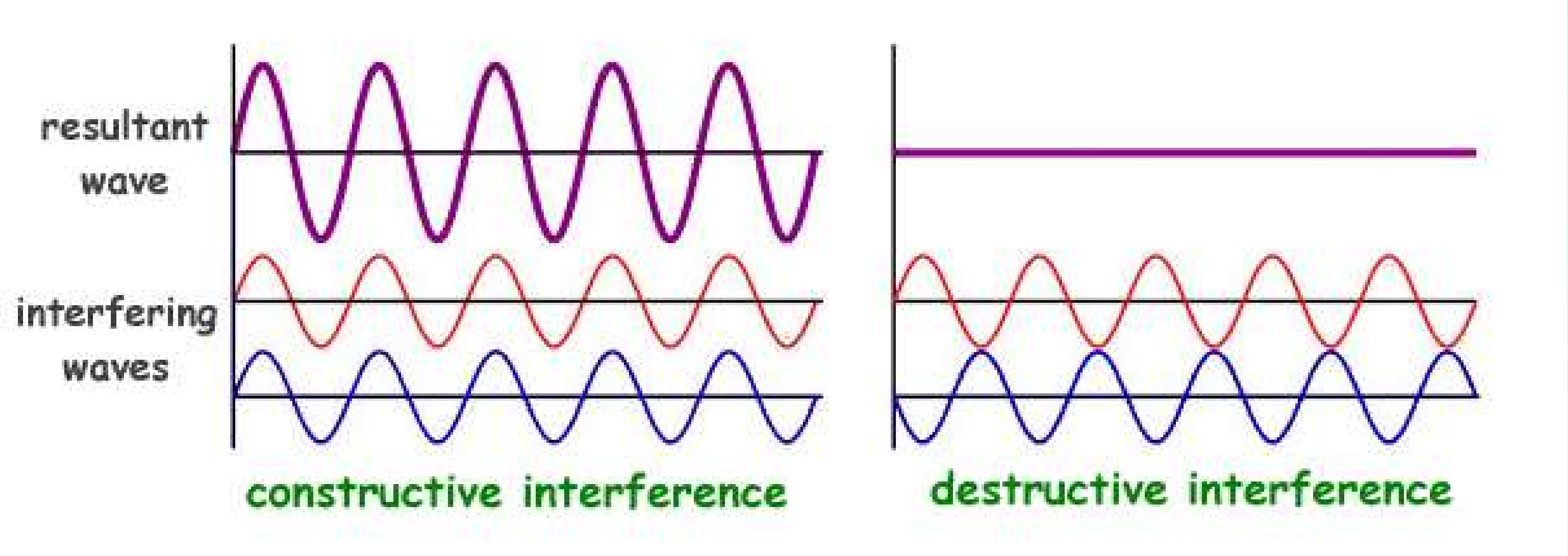
DESTRUCTIVE

- Examples:
  - excessive echoing in a stadium or arena, which distorts the P.A. system
  - 2 or more people singing together (out of sync)

DESTRUCTIVE

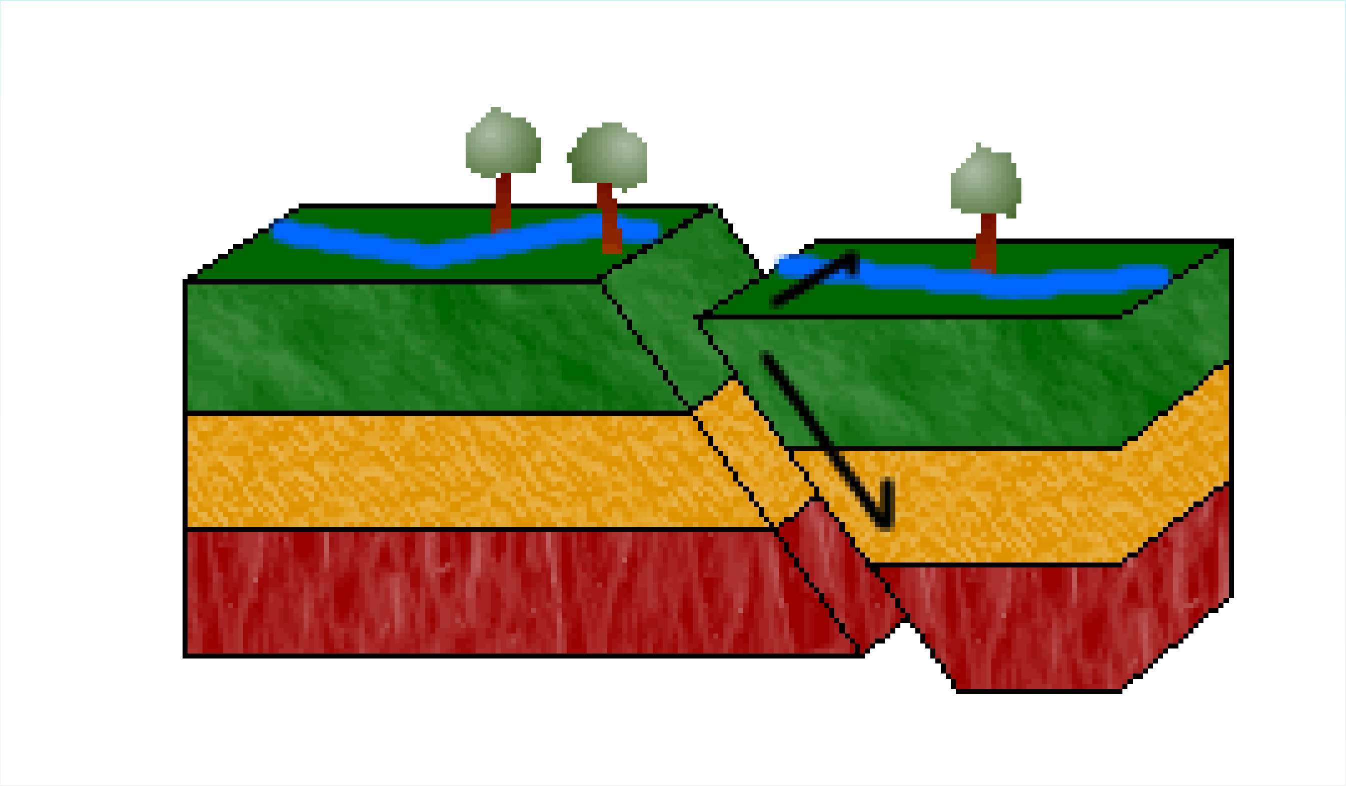
- Singers doing the National Anthem will often wear earplugs because the strong echo coming back through the stadium can interrupt their timing of the song.

INTERFERENCE



OTHER EXAMPLES

- Waves created through and along the crust of the earth by shifting or breaking tectonic plates are called seismic waves.



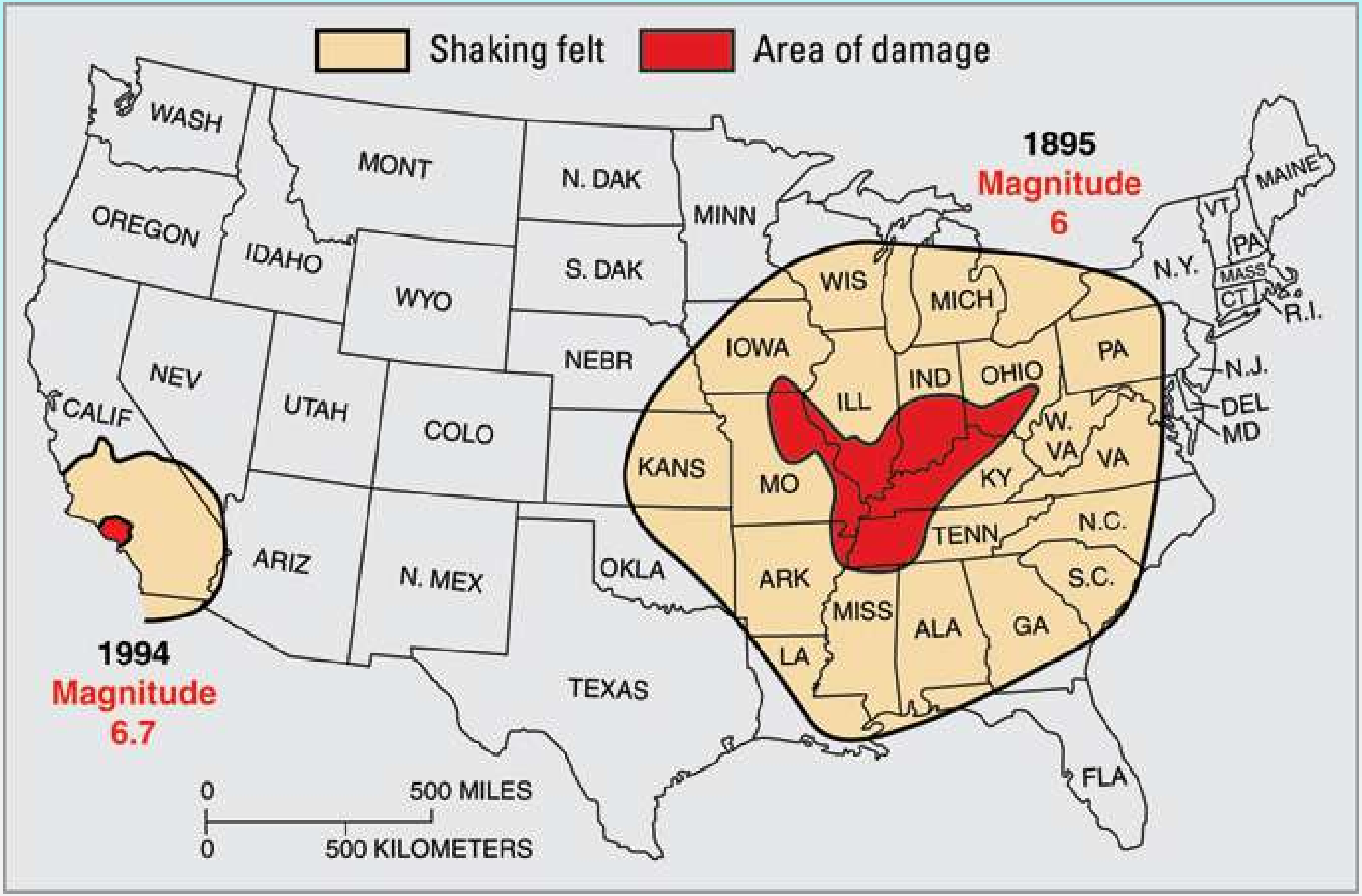
SEISMIC WAVES

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

SEISMIC WAVES

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

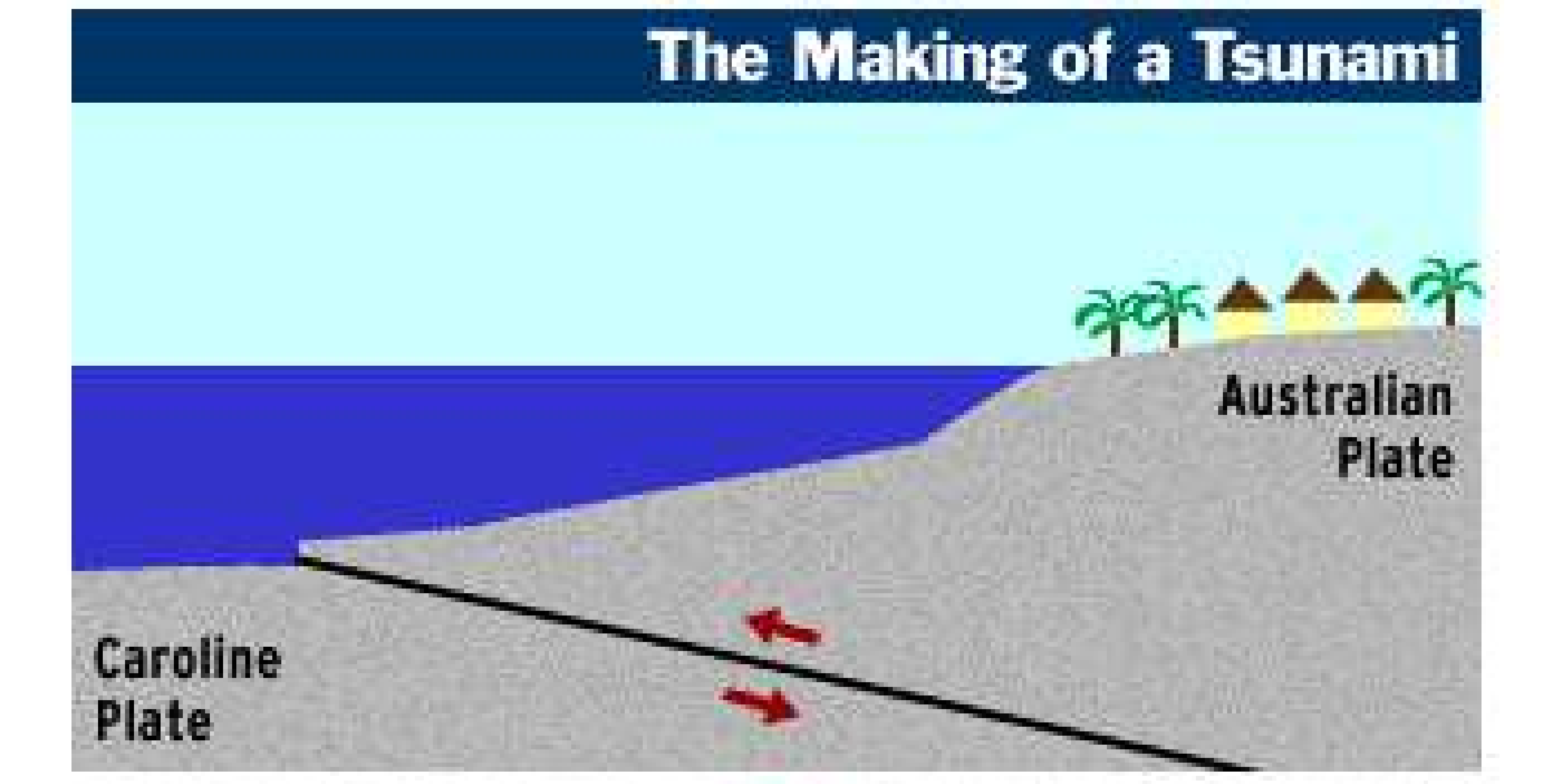
SEISMIC WAVES



TSUNAMI WAVES

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

STSUNAMI WAVES



JAPANESE TSUNAMI, 2011