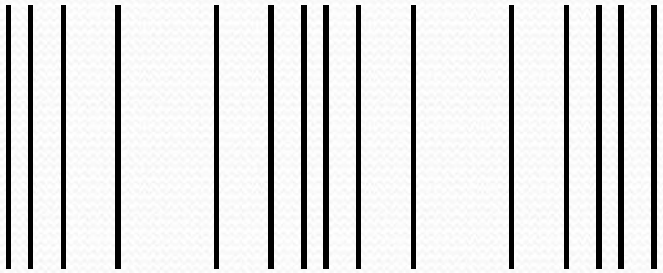
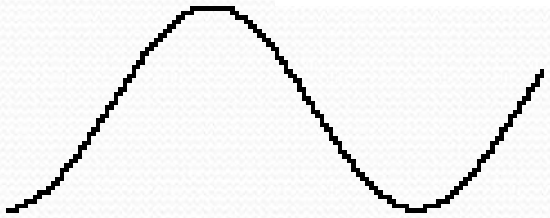
Introduction to Waves

Essential Question:
What are the characteristics of mechanical and electromagnetic waves? (S8P4a,d,f)

What are Waves?

Rhythmic disturbances that carry energy without carrying matter





Types of Waves

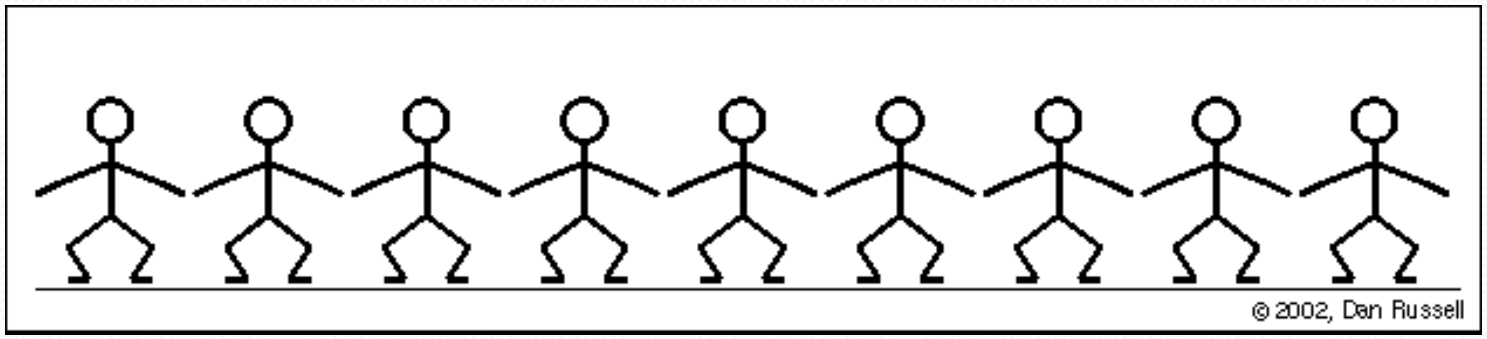
- Mechanical Waves – need matter (or medium) to transfer energy
  - A medium is the substance through which a wave can travel. Ex. Air; water; particles; strings; solids; liquids; gases
- Electromagnetic Waves – DO NOT NEED matter (or medium) to transfer energy
  - They do not need a medium, but they can go through matter (medium), such as air, water, and glass

Mechanical Waves

Waves that need matter (medium) to transfer energy:

Examples: Sound waves, ocean waves, ripples in water, earthquakes, wave of people at a sporting event

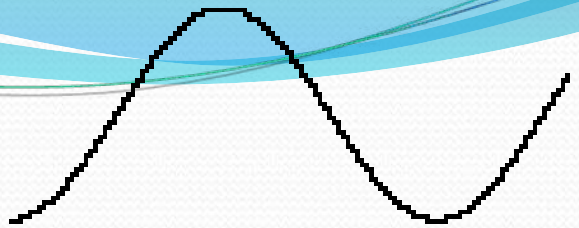
Some examples of Mechanical Waves



Distributed Summarizing

Answer the following question with an elbow partner:

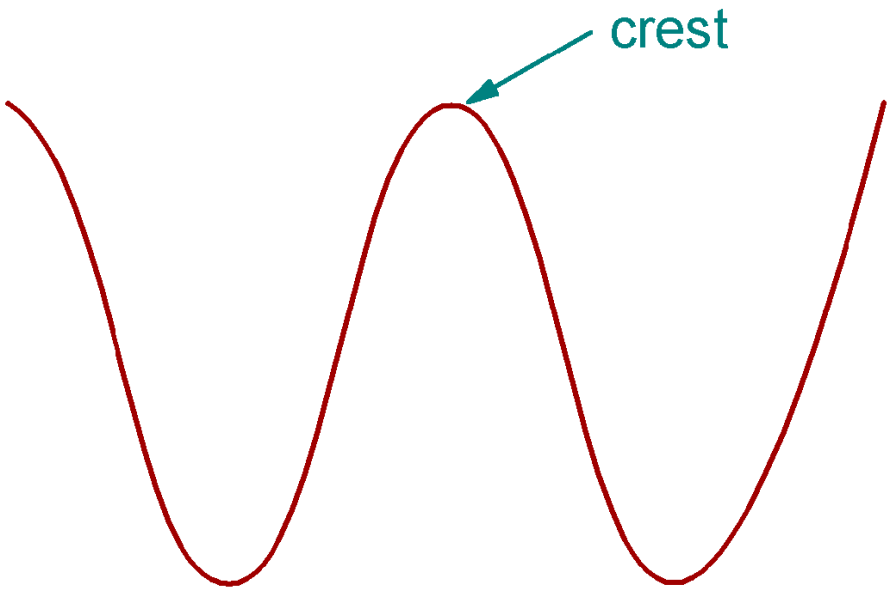
Look back at the examples of mechanical waves. If waves transfer energy, which type of mechanical wave do you think transferred the most energy? Why?



Transverse (Mechanical) Waves

- Waves in which the particles vibrate in an up-and-down motion.
- The direction in which the wave travels is perpendicular to the direction of the disturbance
  - **Remember: t=90 degrees
- Examples:
  - waves in water
  - Seismic waves

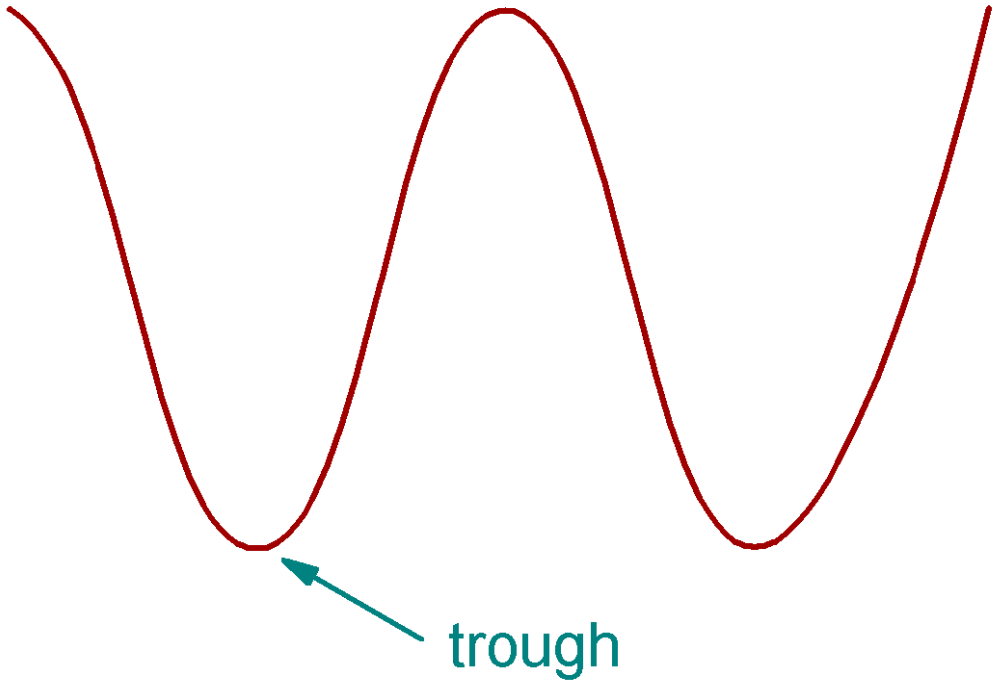
Parts of a Transverse Wave



The **crest** is the highest point on a wave.

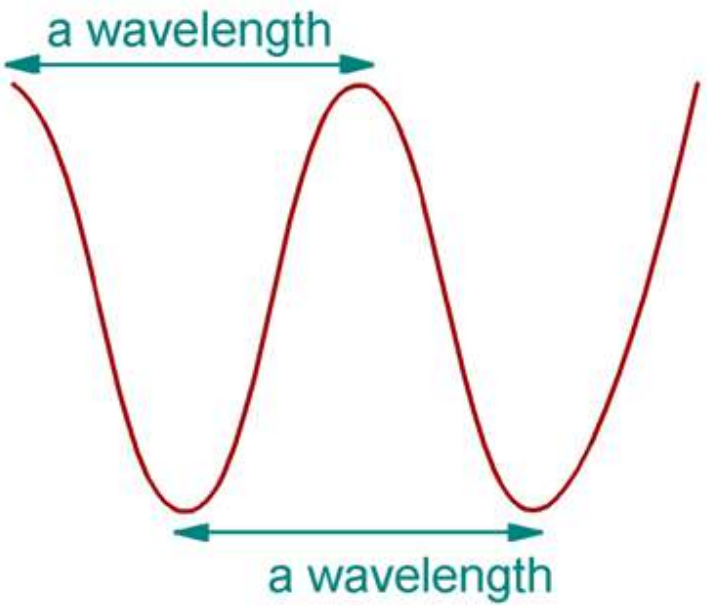
Parts of a Transverse Wave

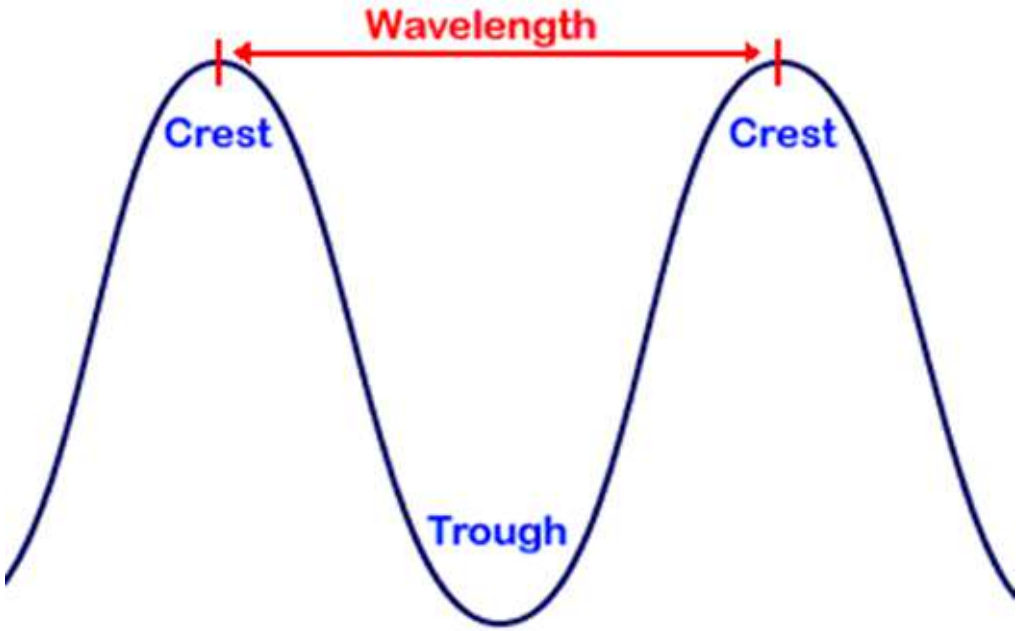
The **trough** is the valley between two waves, is the lowest point.



Parts of a Transverse Wave

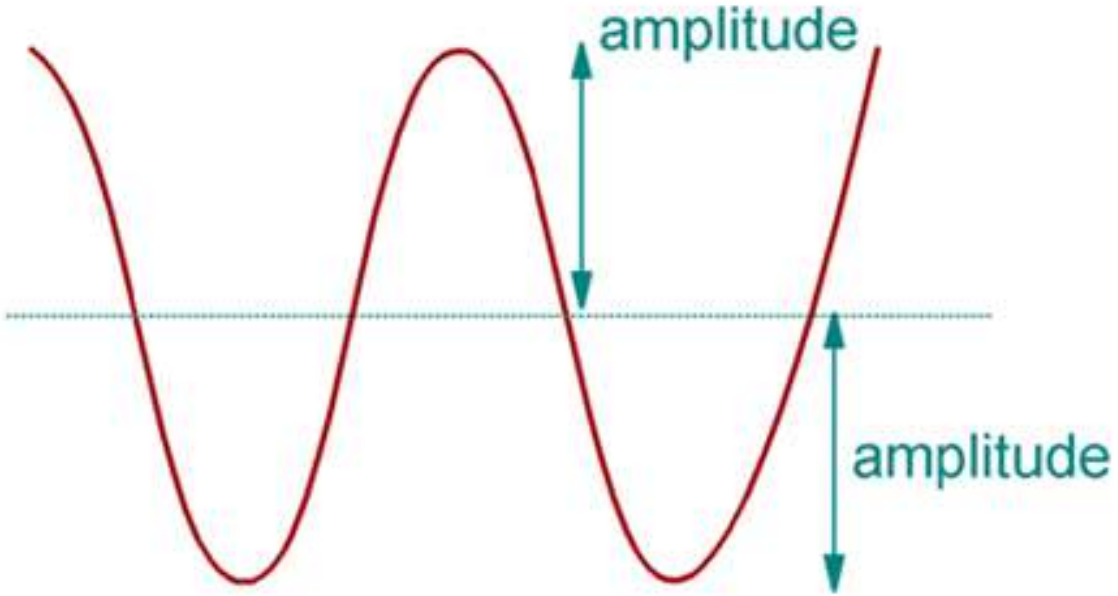
The **wavelength** is the horizontal distance, either between the crests or troughs of two consecutive waves.



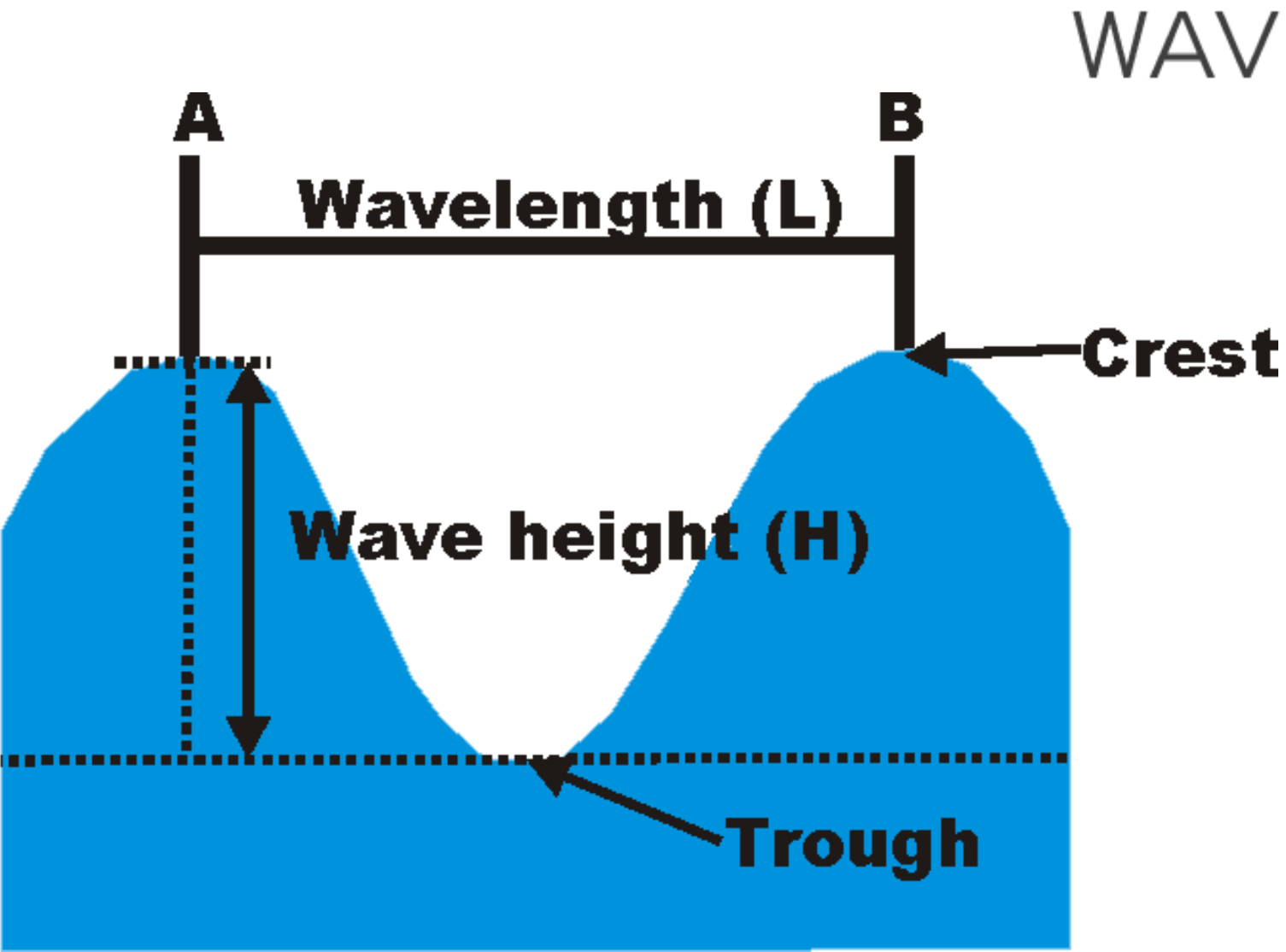


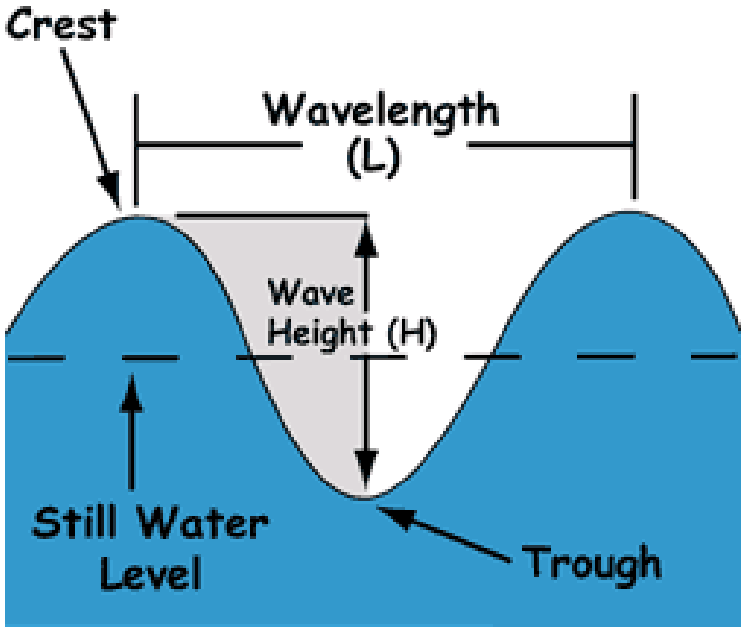
Parts of a Transverse Wave

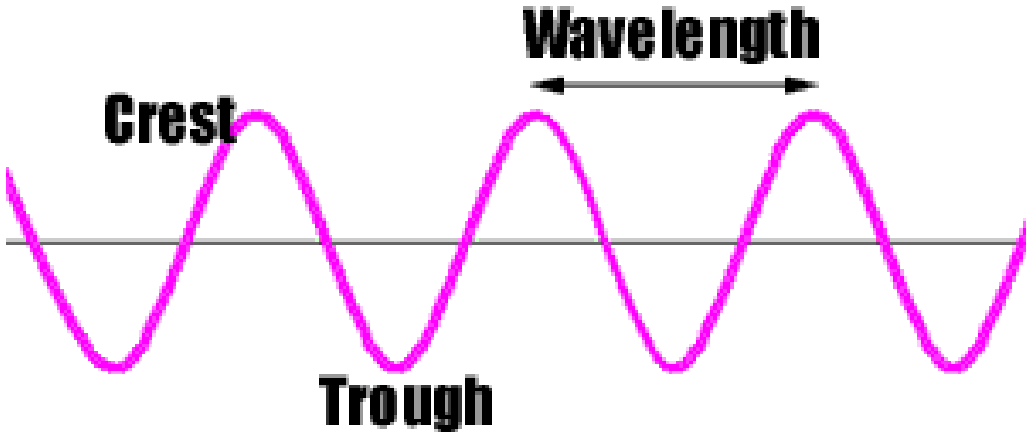
The **amplitude** is the peak (greatest) value (either positive or negative) of a wave. The distance from the undisturbed level to the trough or crest.

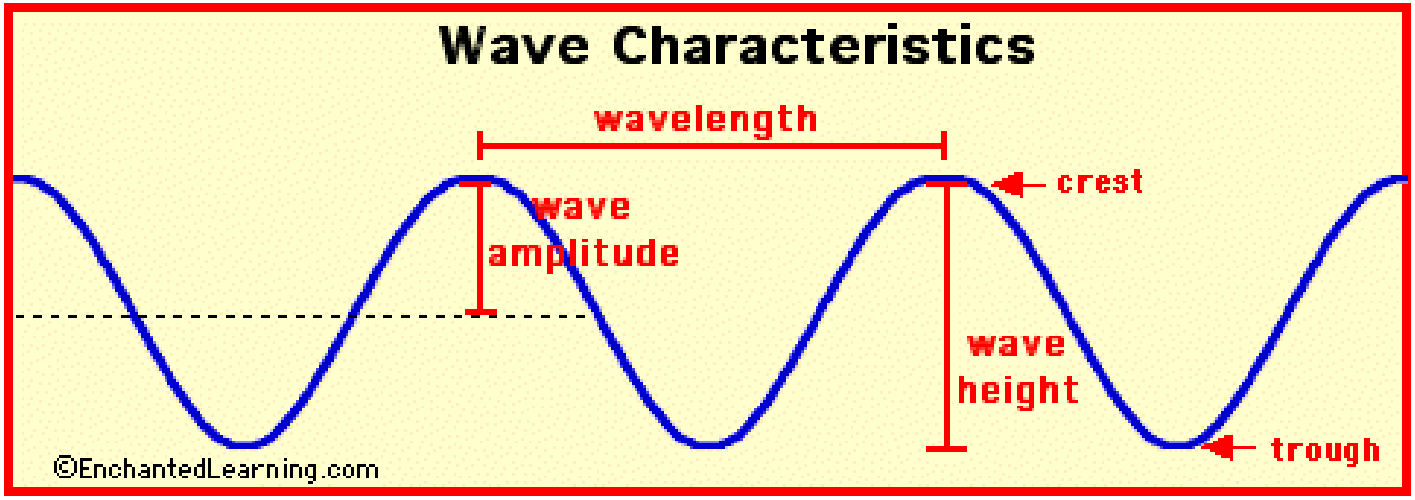


An ocean wave is an example of a mechanical transverse wave




Crest
Wavelength
(L)
Wave
Height (H)
Still Water
Level
Trough


Wavelength
Crest
Trough


Wave Characteristics
wavelength
wave
amplitude
crest
wave
height
trough
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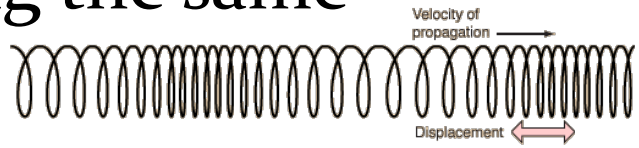
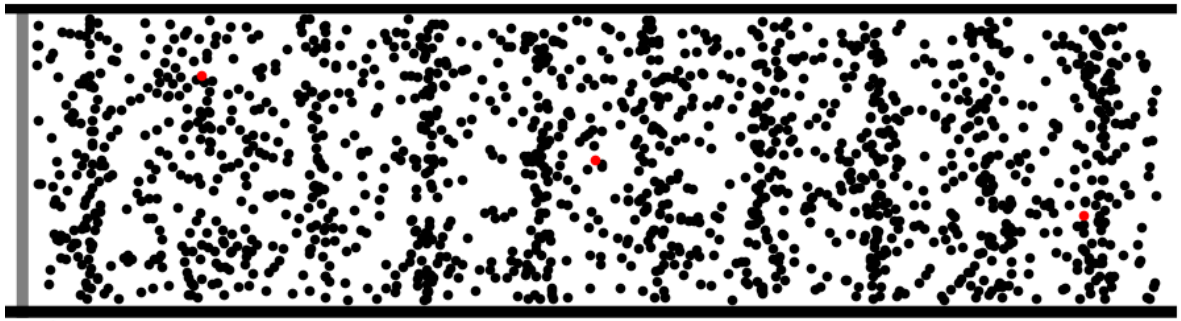
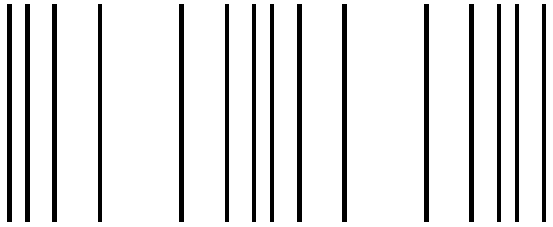
Compressional Wave (longitudinal)

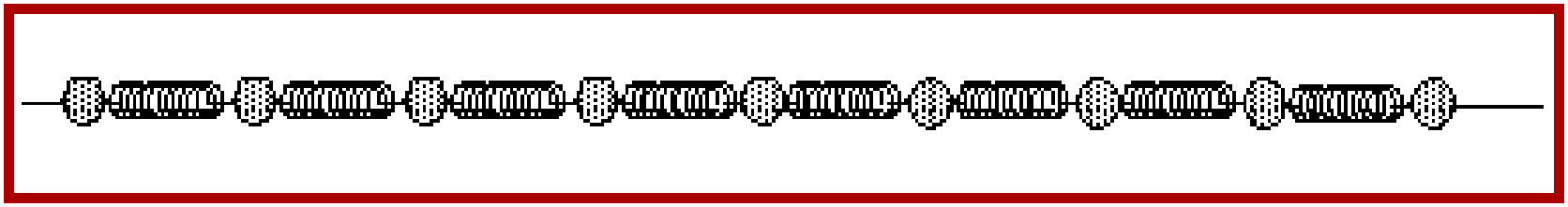
- A mechanical wave in which matter in the medium moves forward and backward along the same direction that the wave travels.
- Ex. Sound waves



A slinky is a good illustration of how a compressional wave moves



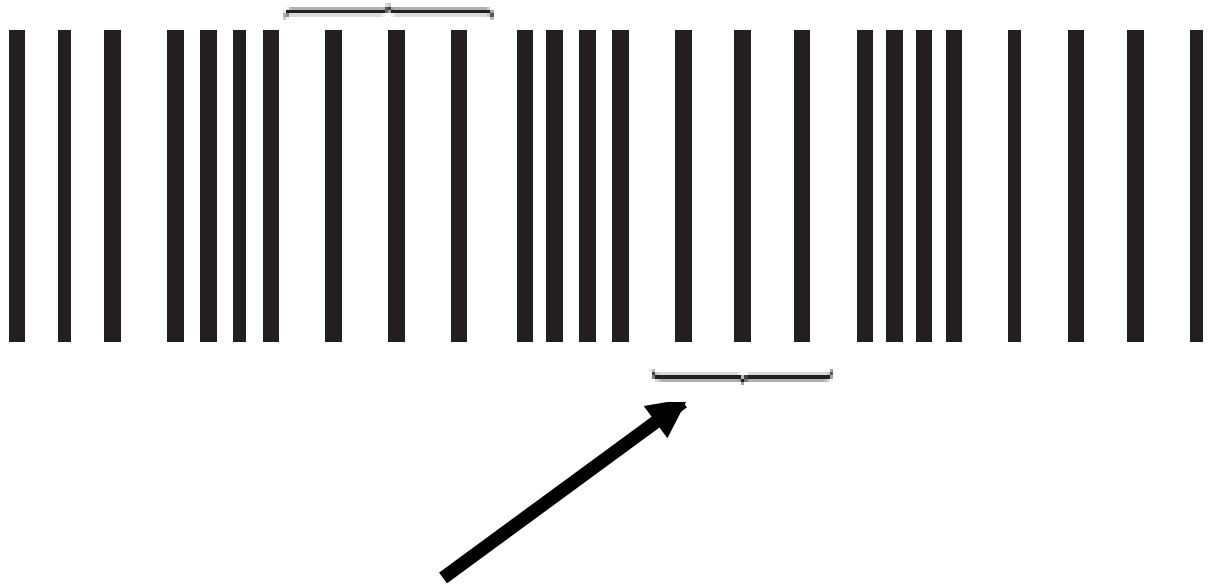




Parts of a Compressional Wave (Longitudinal)

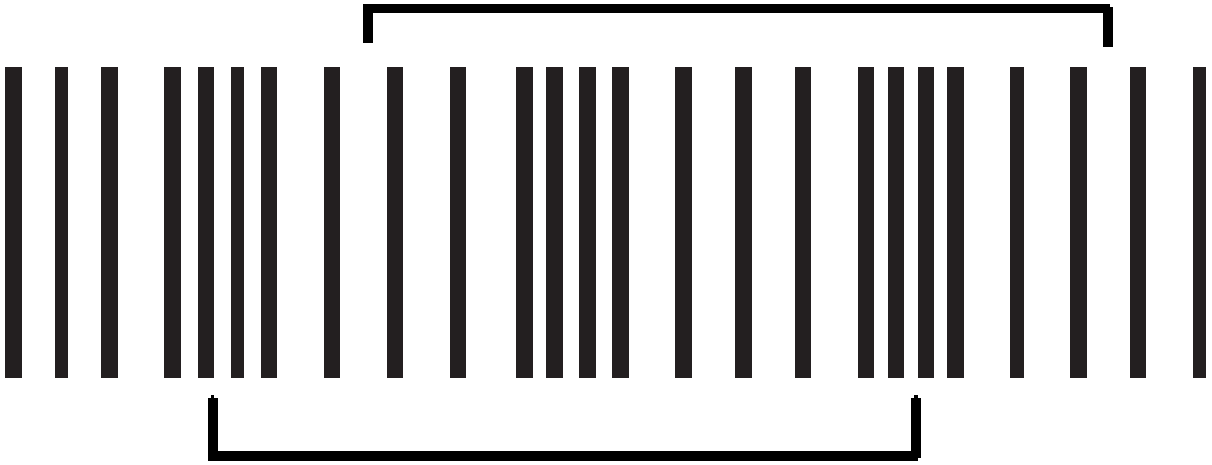
The **compression** is the part of the compressional wave where the particles are crowded together.

Parts of a Compressional Wave (Longitudinal)

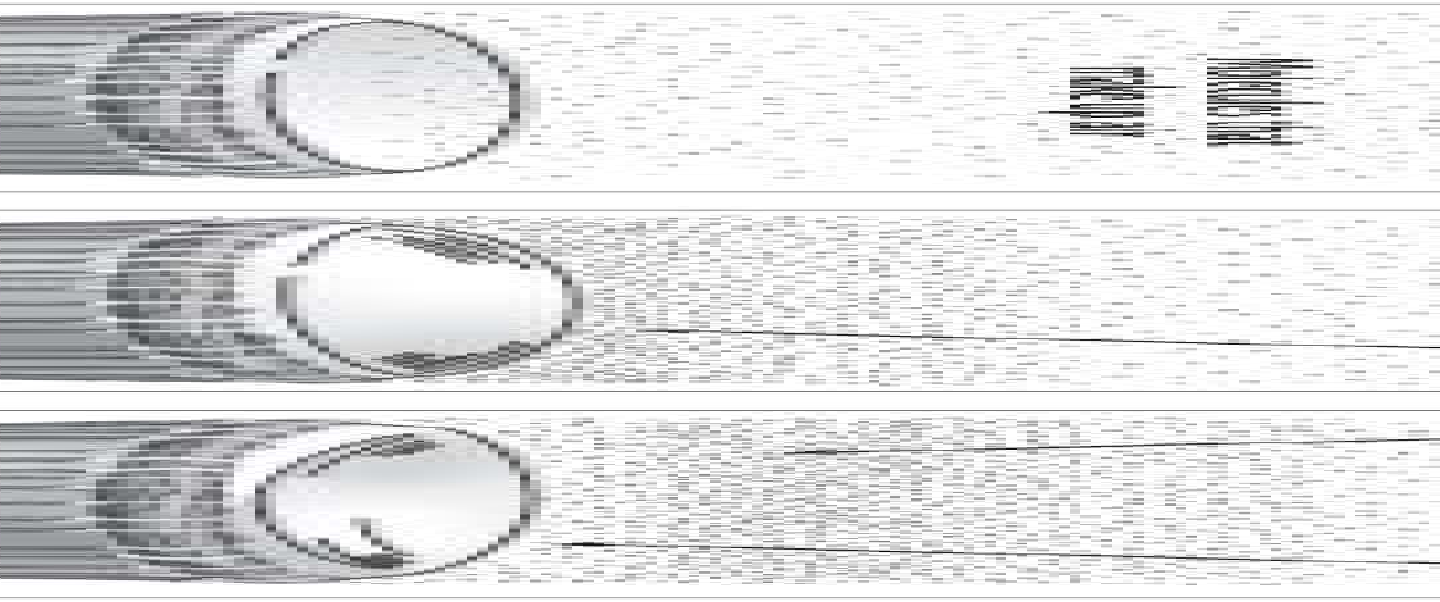


The **rarefaction** is the part of the compressional wave where the particles are spread apart.

Parts of a Compressional Wave (Longitudinal)



The **wavelength** is the distance from compression to compression or rarefaction to rarefaction in a compressional wave.



Animation of Transverse and Longitudinal (Compression) Waves:

http://www.stmary.ws/highschool/physics/home/animations3/waves/wavemotion.html

Electromagnetic Waves

- Waves that that can travel through space and matter
  - **DO NOT NEED matter (medium) to transfer energy

- Electromagnetic waves are considered transverse waves because they have similar characteristics; therefore, they have the same parts.

EM Waves

- Consists of changing electric and magnetic fields.

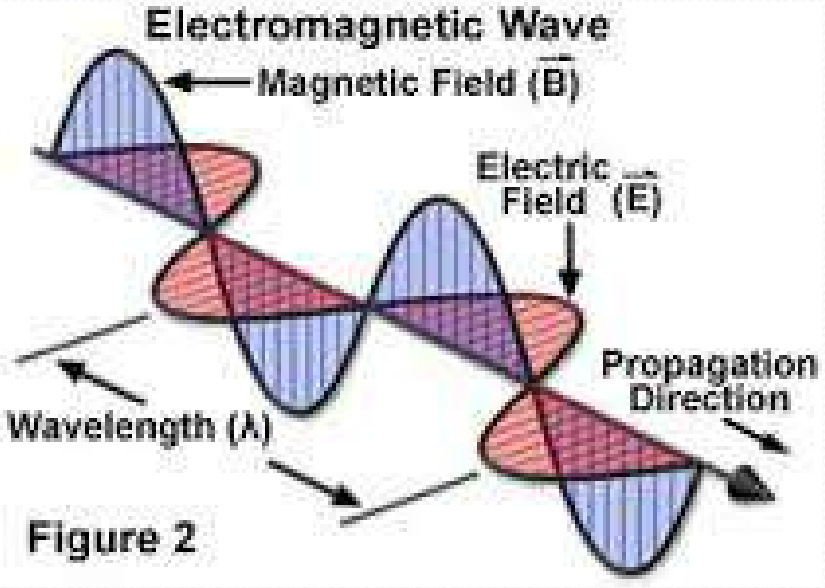


Figure 2

EM Waves

Examples: All EM waves give off radiation

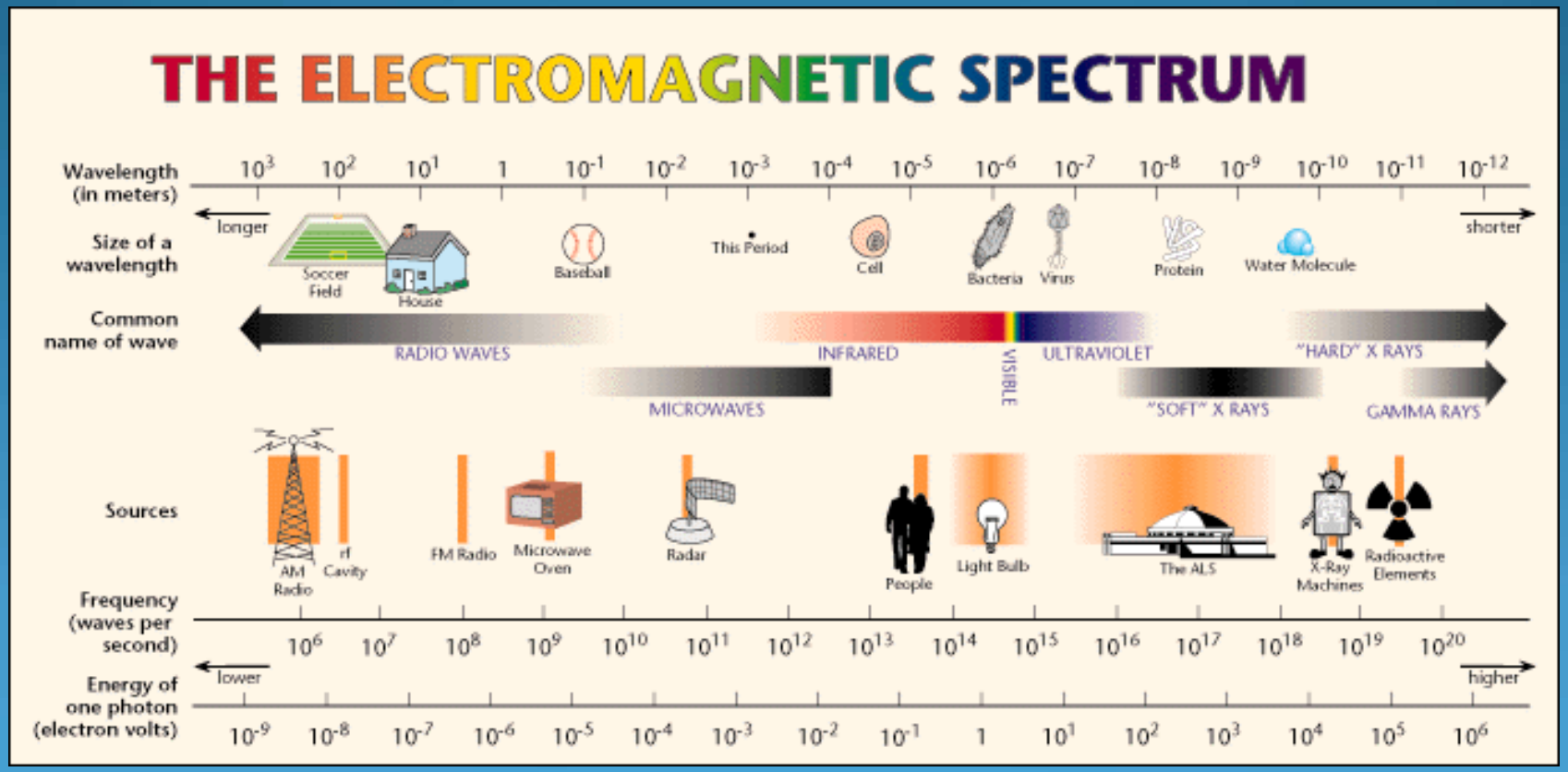
:TV & radio waves,
X-rays, microwaves, lasers, energy from the sun, visible light, infrared, UV rays, Gamma rays

Travel at the speed of light

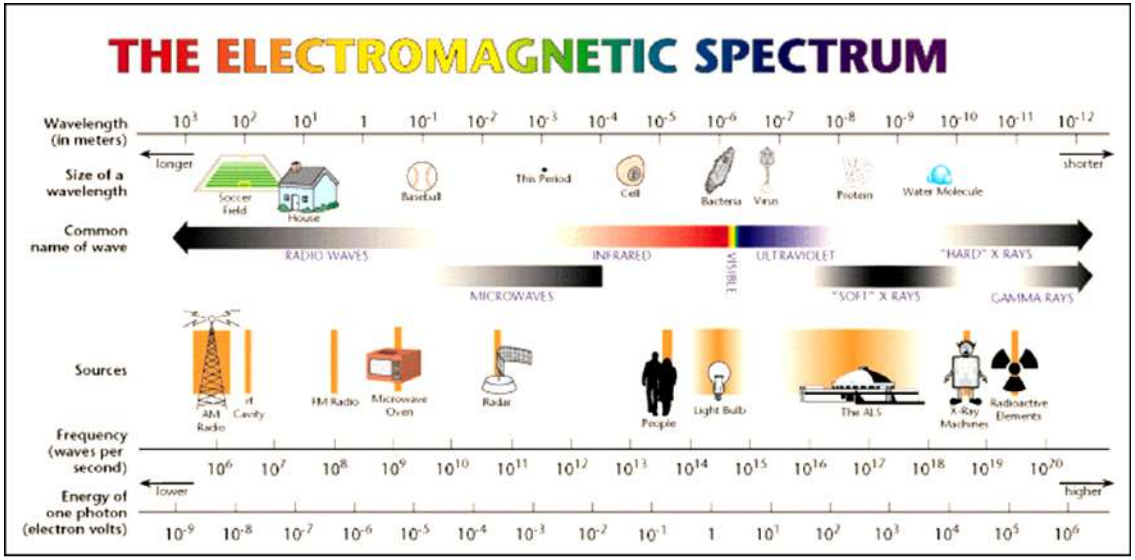
- **186,000 miles per second or 300,000,000 meters per second**

Electromagnetic Spectrum

The electromagnetic spectrum illustrates the range of wavelengths and frequencies of electromagnetic waves.



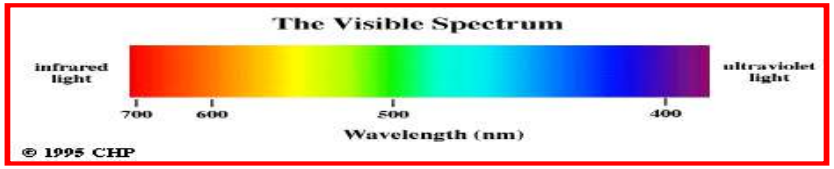
Electromagnetic Spectrum Sheet



1. Which of the following has the longest wavelength? Microwave Gamma Ray Radio Wave Ultraviolet Light

2. Which of the following has the highest frequency? Microwave Gamma Ray Radio Wave Ultraviolet Light

3. Compare the wavelength and frequency of a radio wave to the wavelength and frequency of a gamma ray.



4. Compare the wavelength of infrared light to the wavelength of ultraviolet light.