Waves

S8P4. Students will explore the wave nature of sound and electromagnetic radiation.

a. Identify the characteristics of electromagnetic and mechanical waves.

What are waves?

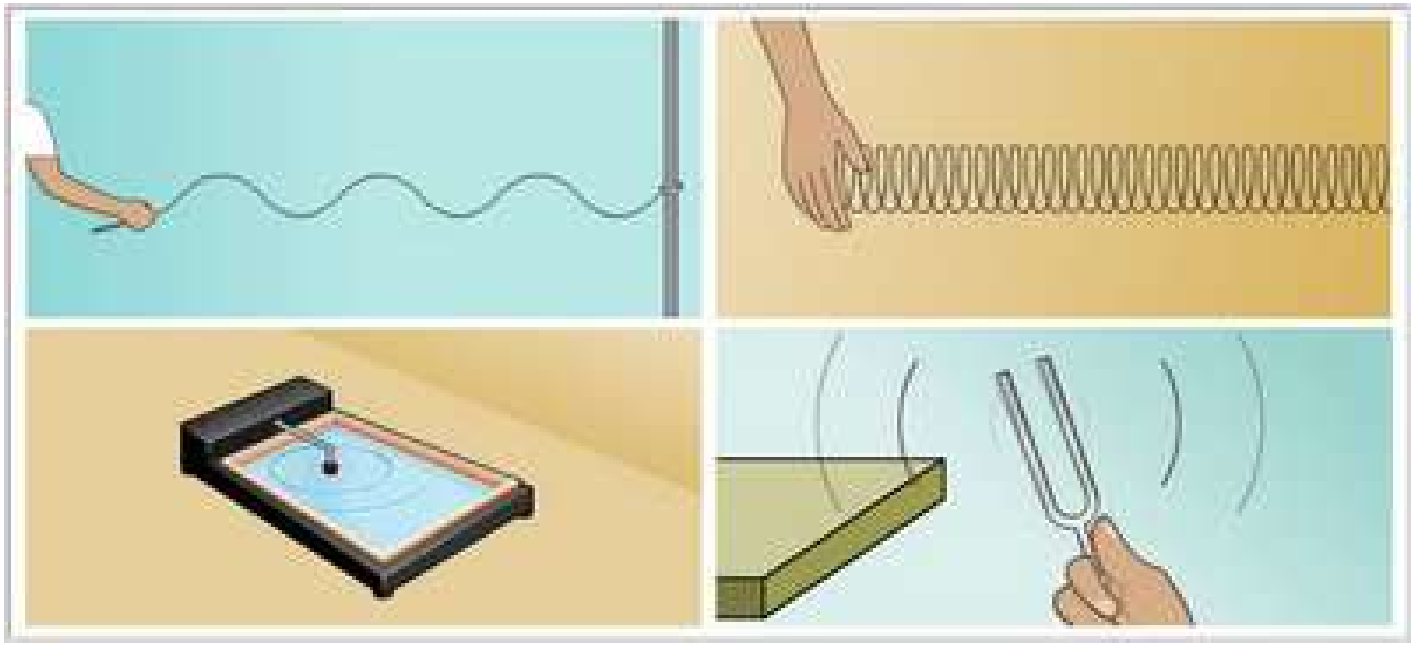
- Waves carry energy
  - Rhythmic disturbances that carry energy without carrying matter are called waves.

Models of Waves

- How does a wave carry energy without transporting matter?

Waves

- Waves transfer energy, but do not transfer matter.

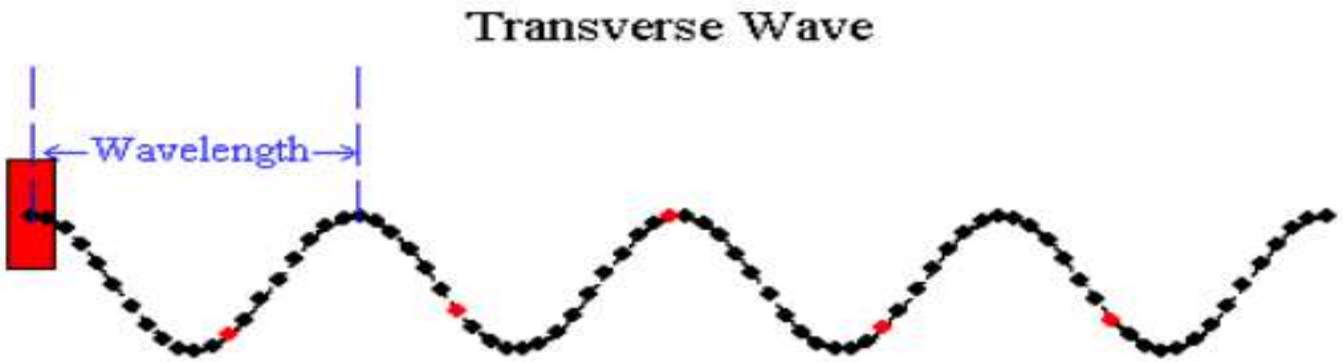


Mechanical Waves

- Waves that require matter to transfer energy are mechanical waves.
- The matter through which a mechanical wave travels is called a medium.
- A mechanical wave travels as energy is transferred from particle to particle in the medium.
- There are two kinds of mechanical waves.

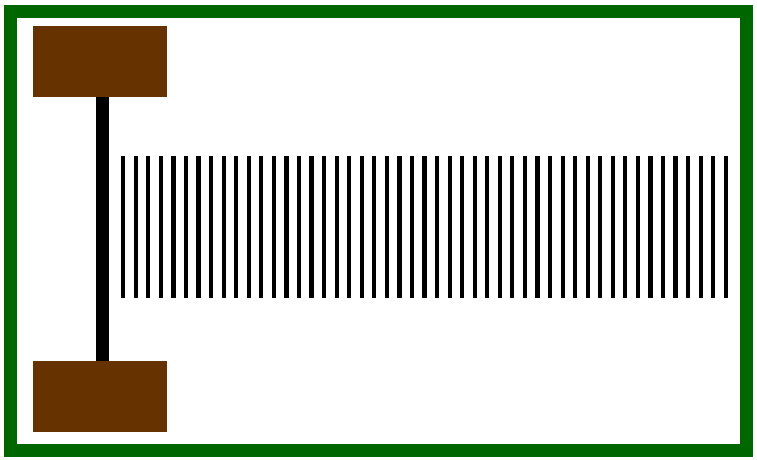
Transverse Waves

- A type of mechanical wave.
- The wave energy causes the matter in the medium to move up and down or back and forth at right angles to the direction the wave travels.



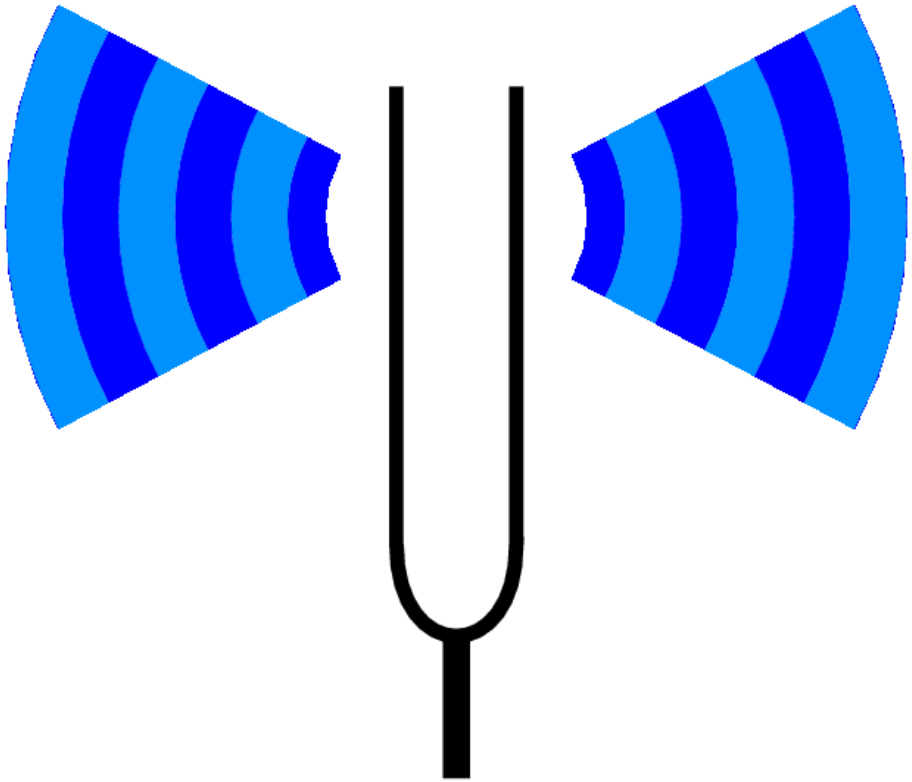
Compressional Waves

- A type of mechanical wave.
- In a compressional wave, matter in the medium moves forward and backward along the same direction that the wave travels.



Sound Waves

- Sound waves are compressional waves.



Electromagnetic Waves

- Waves that can travel through space where there is no matter are electromagnetic waves.
- There are different types of electromagnetic waves, including radio waves, X rays, and gamma rays.
- These waves can travel in matter or in space.

Radiant Energy

- The sun emits electromagnetic waves that travel through space and reach Earth.
- The energy carried by electromagnetic waves is called radiant energy.
- Most of the radiant energy that reaches Earth from the sun is carried by infrared and visible light waves.

Summary

- What is a wave?
  - Waves transfer energy, but do not transfer matter.
- Mechanical Waves
  - Mechanical waves require a medium in which to travel.
  - When a transverse wave travels, particle of the medium move at right angles to the direction the wave is traveling.

Summary (continued)

- Mechanical Waves (continued)
  - When a compressional wave travels, particles of the medium move back and forth along the same direction the wave is traveling.
  - Sound is a compressional wave.
- Electromagnetic Waves
  - Electromagnetic waves can travel through empty space.
  - The sum emits different types of electromagnetic waves, including infrared, visible light, and ultraviolet waves.

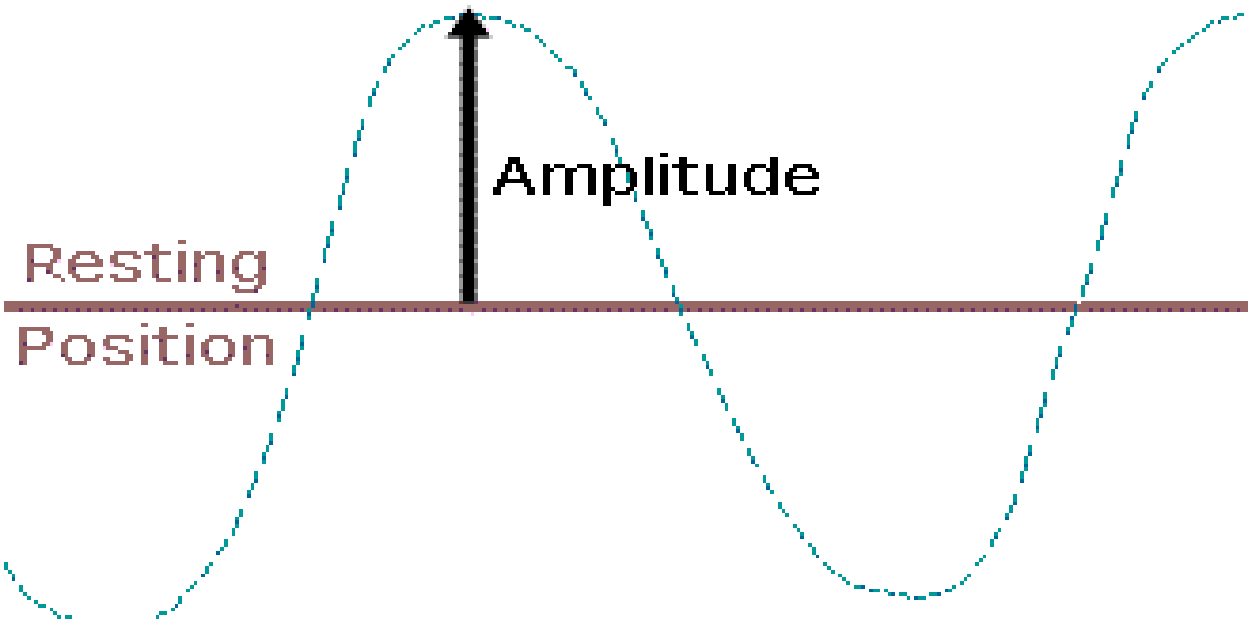
Wave Properties

S8P4

f. Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

Amplitude

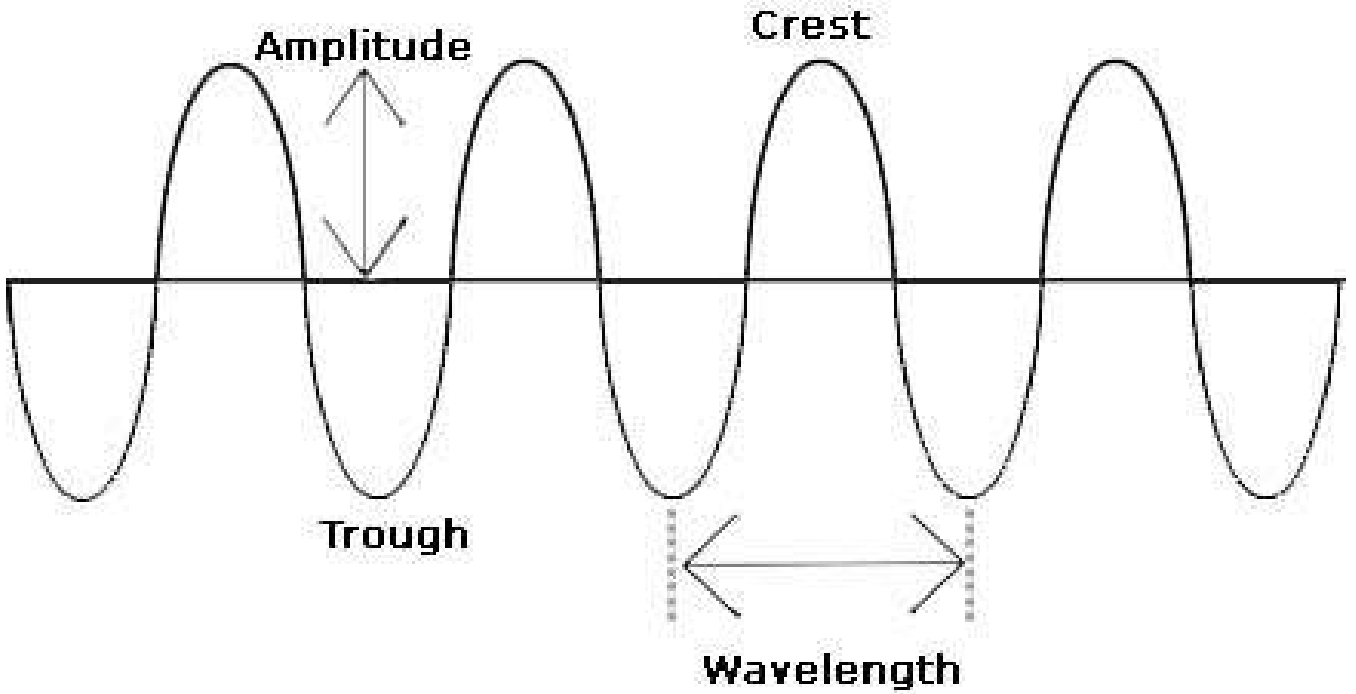
- The distance above or below the resting position of a wave is the amplitude.



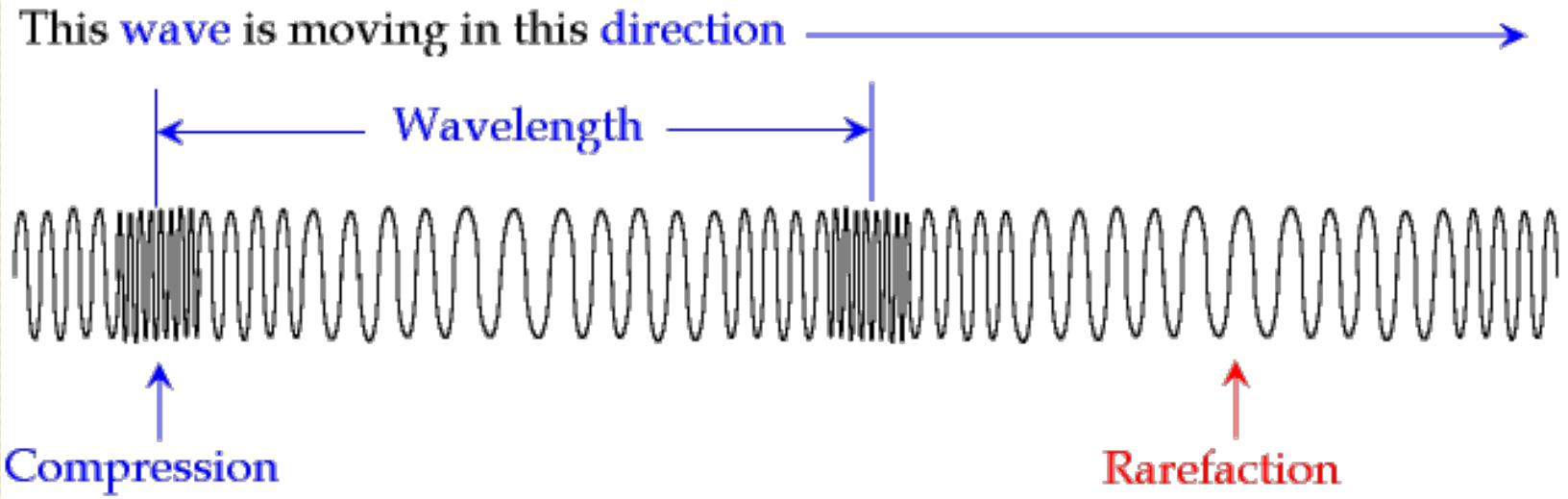
Amplitude and Energy

- A wave's amplitude is related to the energy that the wave carries.
- The brighter the light the greater the amplitude the dimmer the light the lower the amplitude.
- The louder the sound the greater the amplitude the quieter the sound the lower the amplitude.

Transverse wave diagram

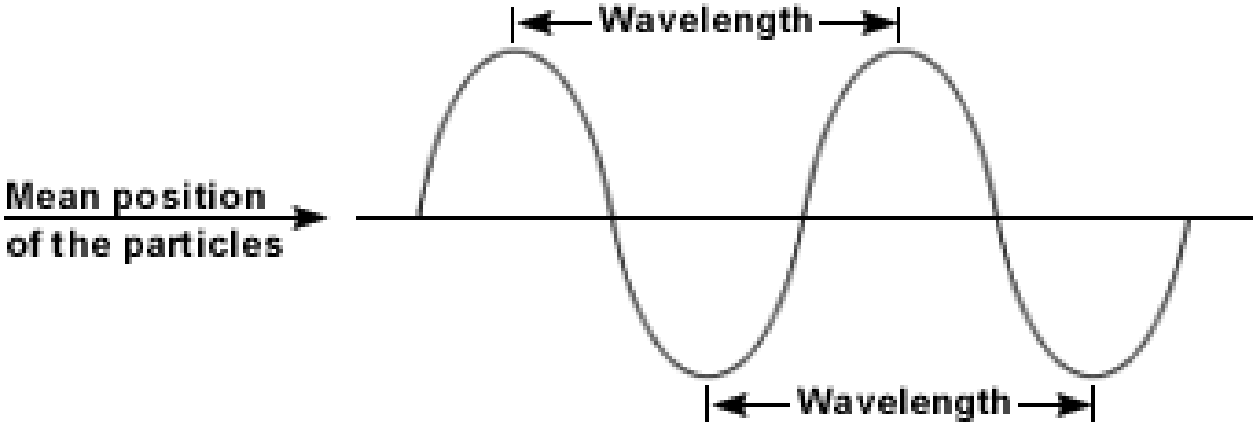


Compressional wave diagram



Wavelength

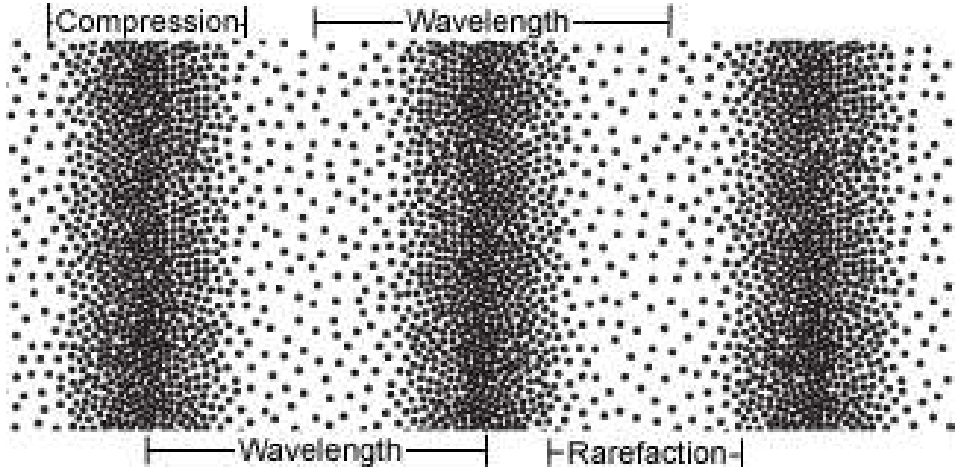
- For a transverse wave, wavelength is the distance from the top of one crest to the top of the next crest, or from the bottom of one trough to the bottom of the next trough.



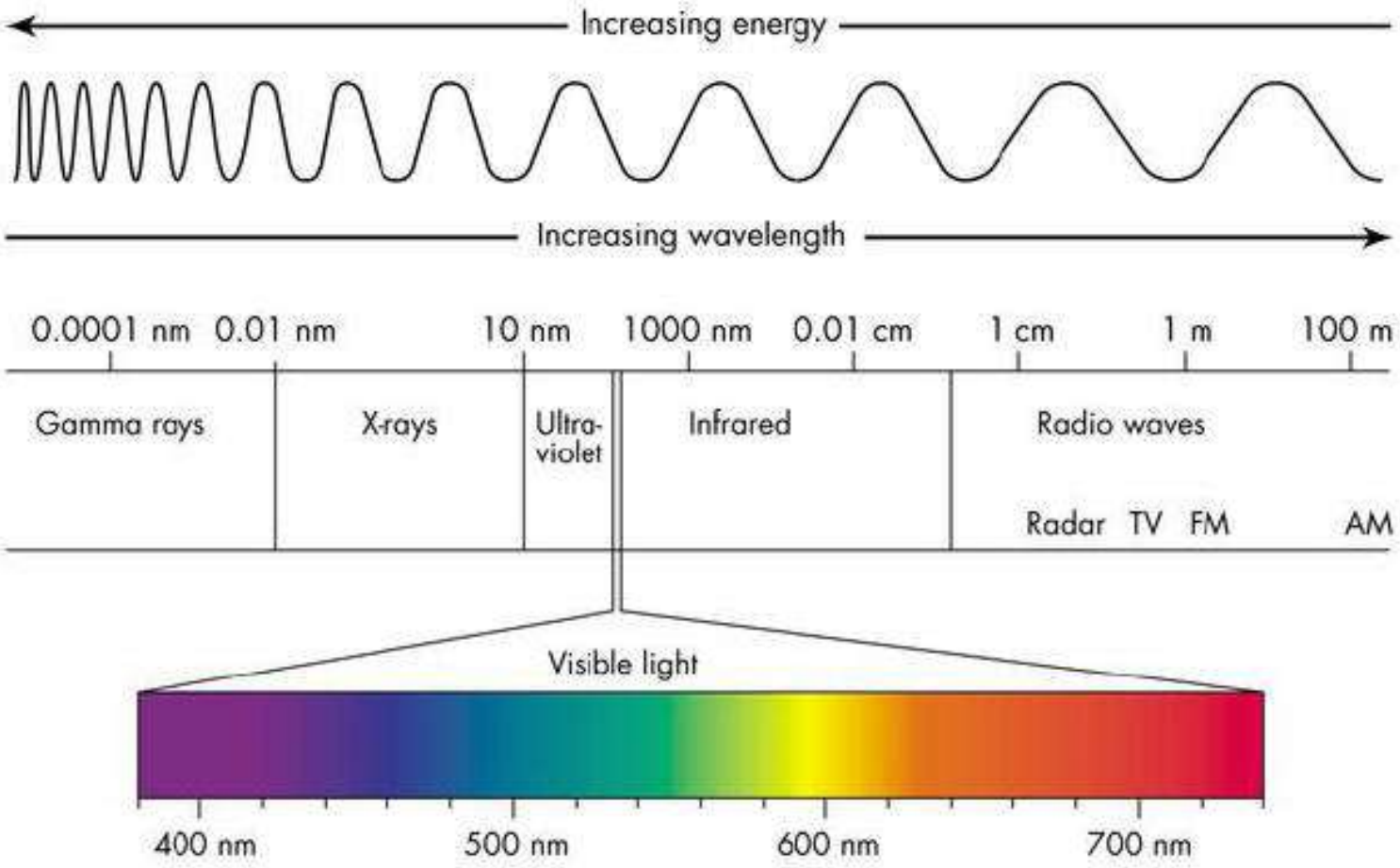
Wavelength of Transverse Waves

Wavelength

- For a compressional wave, the wavelength is the distance between the center of one compression and the center of the next compression, or from the center of one rarefaction to the center of the next rarefaction.



Electromagnetic waves

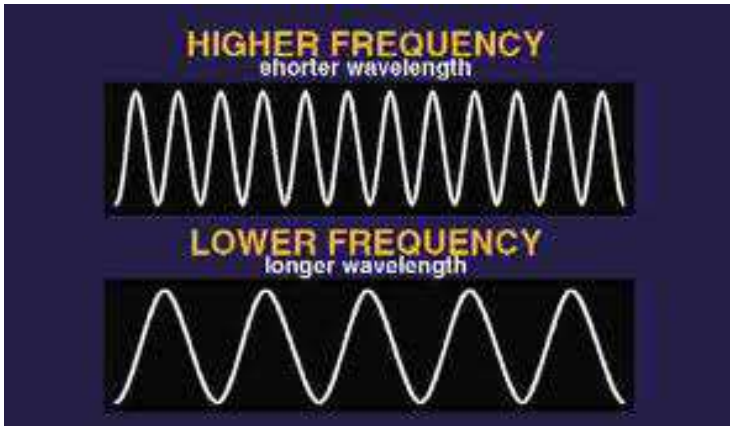


Frequency

- The frequency of a wave is the number of wavelengths that pass a given point in one second.
- The unit of frequency is the number of wavelengths per second, or hertz (Hz).

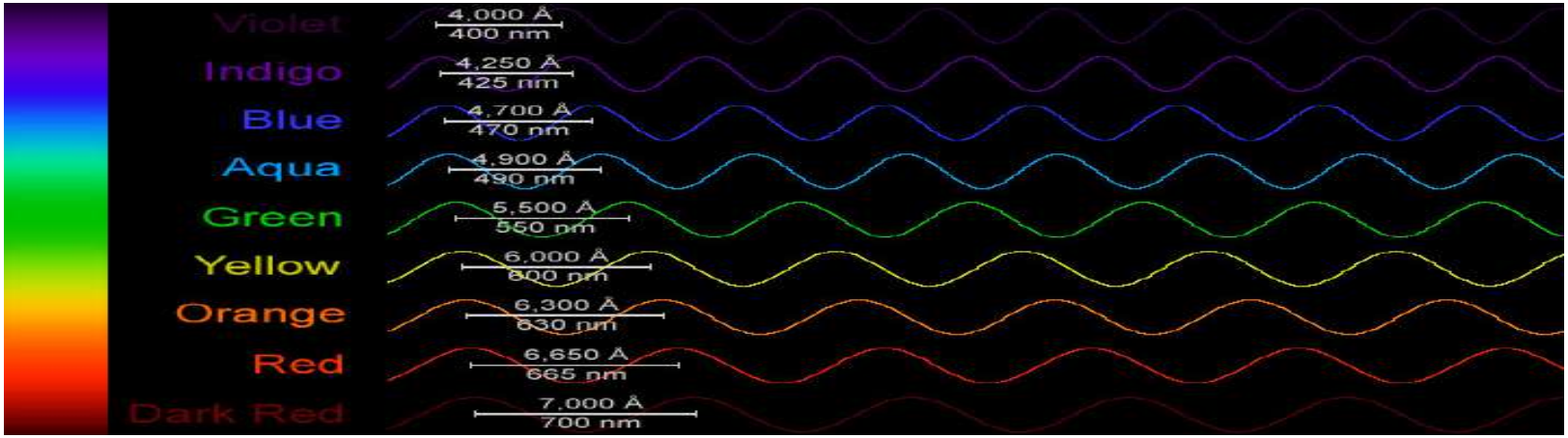
Frequency and Wavelength

- High frequencies result in shorter wavelength.
- Shorter frequencies result in longer wavelengths.



Color

- Because frequency and wavelength are related, either the wavelength or frequency of a light wave determines the color of the light.
- For example, blue light has a larger frequency and shorter wavelength than red light.



Pitch

- Either the wavelength or frequency determines the pitch of a sound wave.
- Pitch is how high or low a sound seems to be.
- The frequency of the notes on a musical scale increases as the notes get higher in pitch, but the wavelength of the notes decreases.

Summary

- Amplitude
  - In a transverse wave, the amplitude is one-half the distance between a crest and a trough.
  - The larger the amplitude, the greater the energy carried by the wave.
- Wavelength
  - For a transverse wave, wavelength is the distance from crest to crest, or from trough to trough.

Summary (continued)

- Wavelength (continued)
  - For a compressional wave, wavelength is the distance from compression to compression, or rarefaction to rarefaction.
- Frequency
  - The frequency of a wave is the number of wavelengths that pass a given point in one second (1 s).
  - For waves the travel at the same speed, as the frequency of the wave increases, its wavelength decreases.