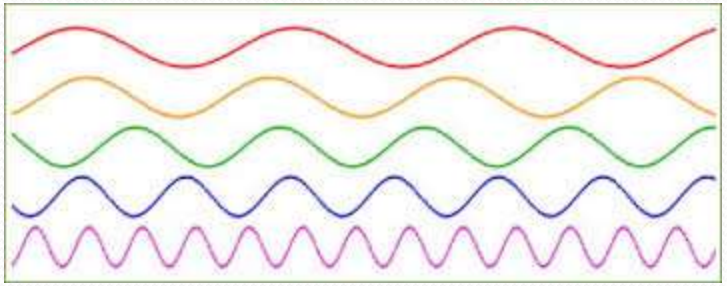
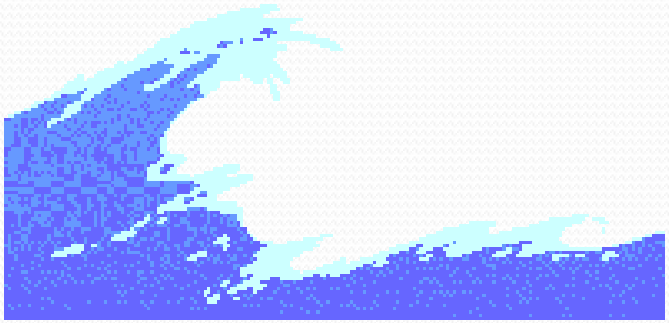
WAVES

EQ: Identify the Characteristics of Mechanical and Electromagnetic Waves.

What is a wave?

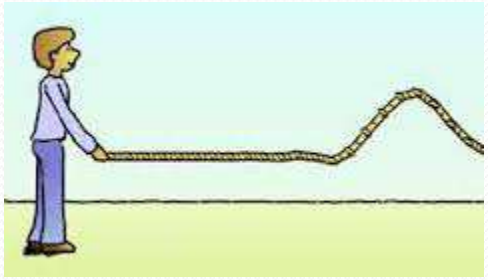
- **A wave is a disturbance that moves energy from one place to another.**
- **Waves are created by a force.**
- **A force can either be a push or a pull.**





Mechanical Wave

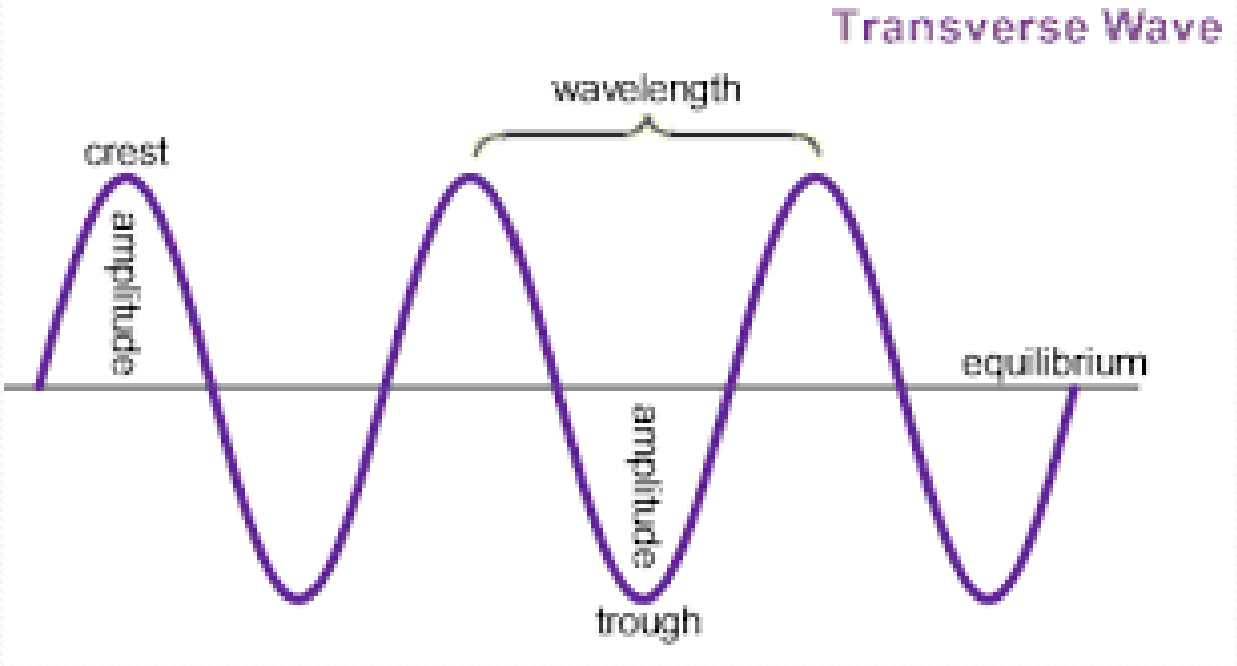
- A mechanical wave is a wave that requires a medium and transfers energy through matter
- A medium is any substance through which a wave can travel.
  - Examples: solid, liquid or gas



Transverse Wave

- **Waves in which the particles vibrate in an up and down motion**
- **Energy of the wave makes the medium move up and down or back and forth at right angles to the direction the wave moves**
- **Remember: T=90 degrees**

Transverse Wave



Transverse Wave Examples

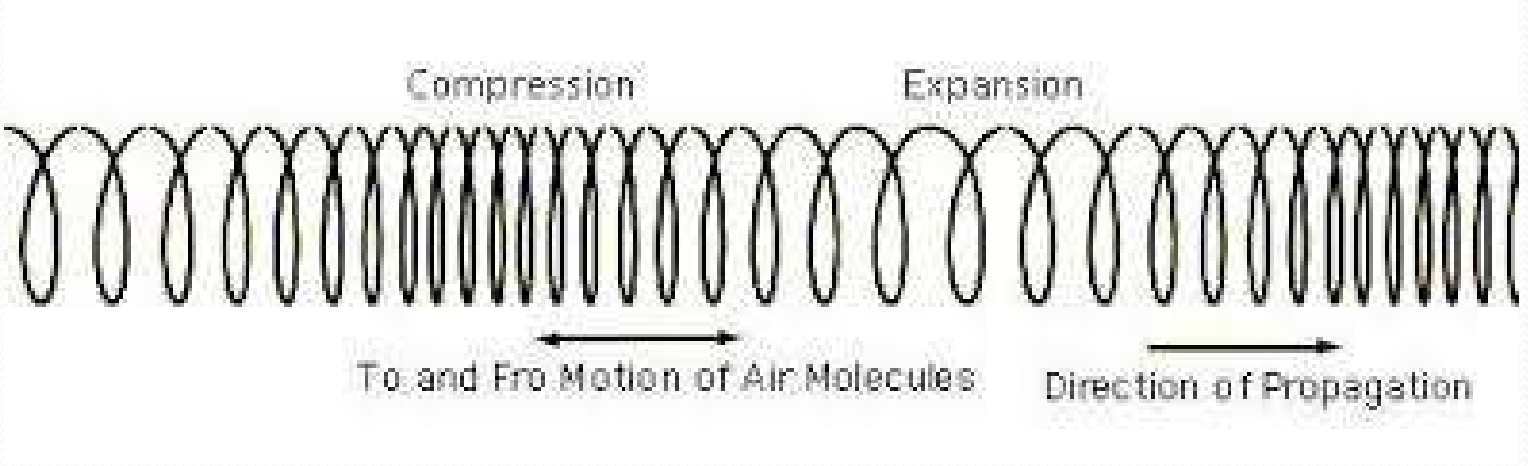
- **Ocean Waves**
- **Seismic Waves (earthquakes)**
- **Guitar string waves**

Longitudinal Wave

- **Waves in which the particles vibrate back and forth.**
- **Move the particles of the medium parallel to the direction in which the waves are traveling**
- **Remember: Parallel**

- **Examples: Sound Waves**

Longitudinal Wave



https://www.youtube.com/watch?v=j1Q5TFMqsFo

Parts of a Wave

- Amplitude: one half of the distance between a crest and trough
- Frequency: the number of wavelengths that pass a given point in one second
- Wavelength:
  - Transverse: 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
  - Longitudinal: the distance between the center of one compression to the center of the next compression

https://www.youtube.com/watch?v=pMIdzILycTY

Electromagnetic Waves

- Electromagnetic waves are waves that can travel through space and matter
- Do not require a medium
- All EM waves are transverse
- Travel at the speed of light
- 186,000 miles per second or 300,000,000 meters per second
- All EM waves give off radiation

Radio Waves

- Radio waves have the longest wavelengths of all the electromagnetic waves. They range from around a foot long to several miles long.
- Radio waves are often used to transmit data and have been used for all sorts of applications including radio, satellites, radar, and computer networks.

Microwaves

- Microwaves are shorter than radio waves with wavelengths measured in centimeters. We use microwaves to cook food, transmit information, and in radar that helps to predict the weather.
- Microwaves are useful in communication because they can penetrate clouds, smoke, and light rain.
- The universe is filled with cosmic microwave background radiation that scientists believe are clues to the origin of the universe they call the Big Bang.

Infrared

- Between microwaves and visible light are infrared waves. Infrared waves are sometimes classified as "near" infrared and "far" infrared.
- Near infrared waves are the waves that are closer to visible light in wavelength. These are the infrared waves that are used in your TV remote to change channels.
- Far infrared waves are further away from visible light in wavelength. Far infrared waves are thermal and give off heat.
- Anything that gives off heat radiates infrared waves. This includes the human body!

Visible light

- The visible light spectrum covers the wavelengths that can be seen by the human eye.
- This is the range of wavelengths from 390 to 700 nm which corresponds to the frequencies 430-790 THz.

Ultraviolet

- Ultraviolet waves have the next shortest wavelength after visible light. It is ultraviolet rays from the Sun that cause sunburns. We are protected from the Sun's ultraviolet rays by the ozone layer.
- Some insects, such as bumblebees, can see ultraviolet light. Ultraviolet light is used by powerful telescopes like the Hubble Space Telescope to see far away stars.

X-rays

- X-rays have even shorter wavelengths than ultraviolet rays. At this point in the electromagnetic spectrum, scientists begin to think of these rays more as particles than waves.
- X-rays were discovered by German scientist Wilhelm Roentgen. They can penetrate soft tissue like skin and muscle and are used to take X-ray pictures of bones in medicine.

Gamma rays

- As the wavelengths of electromagnetic waves get shorter, their energy increases. Gamma rays are the shortest waves in the spectrum and, as a result, have the most energy.
- Gamma rays are sometimes used in treating cancer and in taking detailed images for diagnostic medicine.
- Gamma rays are produced in high energy nuclear explosions and supernovas.

EM Drawing

- Consists of changing electric and magnetic fields