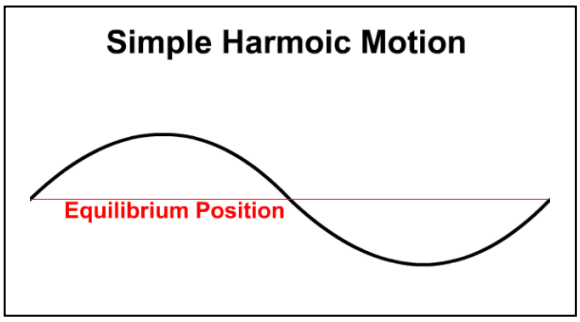
Name: _____ Period: _____ Date: _____

1. Intro to Waves: https://www.stickmanphysics.com/stickman-physics-home/unit-10-waves/intro-to-waves/

Waves: Are disturbances that propagate or **move energy** through an empty space or through medium (particles such as atoms and molecules)**.** Waves transfer energy **without transferring matter**



Waves move in **simple harmonic motion**. Simple harmonic motion is a back and forth motion around an equilibrium position.

Basic Electromagnetic and Mechanical Wave Differences

Two types of waves are mechanical and electromagnetic. Both have energy propagating or moving from one location to another.

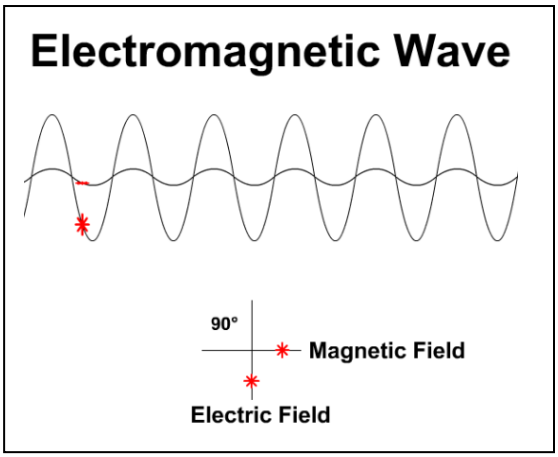
An **electromagnetic wave starts with a vibrating charged particle** which can be an electron shifting its energy level. **Electromagnetic waves do not need medium (particles) to transfer energy** and can move through the vacuum of space. Outer space is a vacuum because it does not have air particles like here on earth.

A **mechanical wave starts with a vibration of a particle**. Mechanical waves need particles, also called medium, to propagate. Without particles, they cannot move through a vacuum like in outer space.

Electromagnetic Waves

Remember from previous units, a static charge creates an electric field and a moving charge creates a magnetic field. The result of a vibrating charged particle is both a transverse electric field and magnetic field wave.

- The resulting **electric field** and a **magnetic field** in an electromagnetic wave **vibrate perpendicular (90°)** to each other.



Speed of Electromagnetic Waves:

Vacuum	**Least Elastic** to **Most Elastic**
Fastest: No Air	**Slower**: Gas → Liquid → Solid :**Slowest**

Wave Propagation

In order to start and transmit a wave, a source of disturbance (vibration) is required. Waves can propagate; transfer their energy, as a single vibration or **wave pulse**. They can also propagate if there is a continuous source of vibration called a **wave train**.

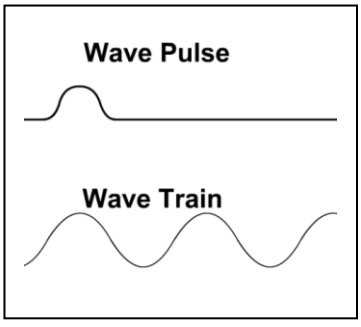
Questions

1. What do all waves transfer?

2. What do waves not transfer?

3. What is the do mechanical waves require that electromagnetic do not?

4. What is the difference between a wave train and pulse?



Mechanical Wave Types

The two types of mechanical waves that **require a medium** are transverse waves and longitudinal. A medium is matter particles like gas (ex. air), liquid (ex. Water), and solid (ex. earth). All mechanical waves start with a disturbance of medium. Mechanical Waves need a medium and travel fastest in the most elastic material.

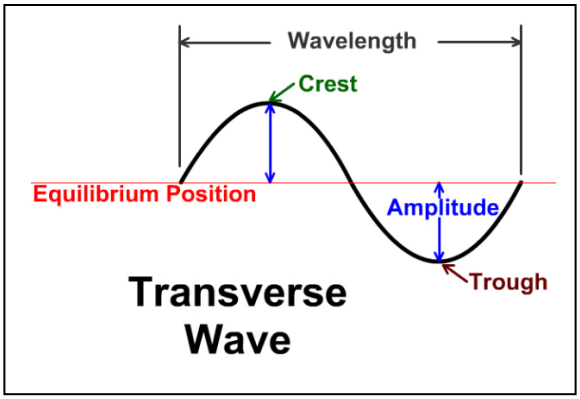
Speed of Mechanical Waves	**Vacuum**	**Least Elastic** to **Most Elastic**
	No Movement: No Air	**Slowest**: Gas → Liquid → Solid :**Fastest**

Transverse Waves

Transverse waves vibrate **perpendicular to wave energy movement**. In mechanical transverse waves, a medium is disturbed in an upward or downward direction. The particles vibrate up and down returning to their original position as the energy moves perpendicular to that vibration forward.

Parts of a Transverse Wave

- The **equilibrium position** of any wave is the middle point where vibrations occur around.
- A transverse wave has a top called a **crest** and a bottom called a **trough**.
- The distance from the equilibrium position to the crest, then to the trough, and back to the equilibrium position is a standard transverse **wavelength (λ)** measurement. Any crest to crest or trough to trough would also be a wavelength.
- **Amplitude** is the measurement from the equilibrium position to the top of the wave. Amplitude can also be measured from the equilibrium position to the trough. Both measurements will be the same.

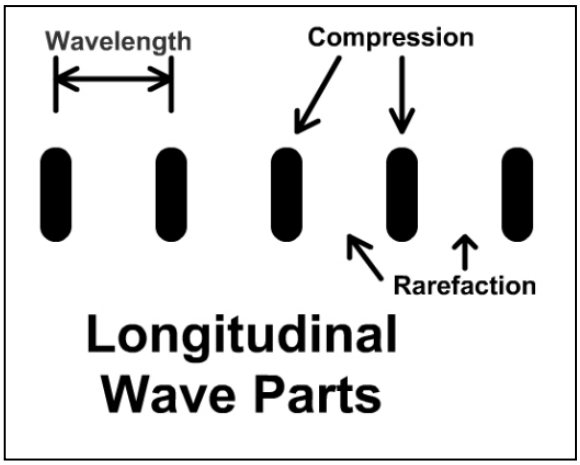


Longitudinal Waves

Longitudinal waves vibrate **parallel to the movement of energy** in a wave. The particles of a longitudinal mechanical wave will vibrate back and forth on the same plane as the motion of energy transfer.

Longitudinal Wave Parts

As longitudinal waves propagate they have areas of high density called compressions. Longitudinal waves have areas of less density called rarefactions. A wavelength can be measured from compression to compression.



Sound is a common longitudinal mechanical wave

Questions

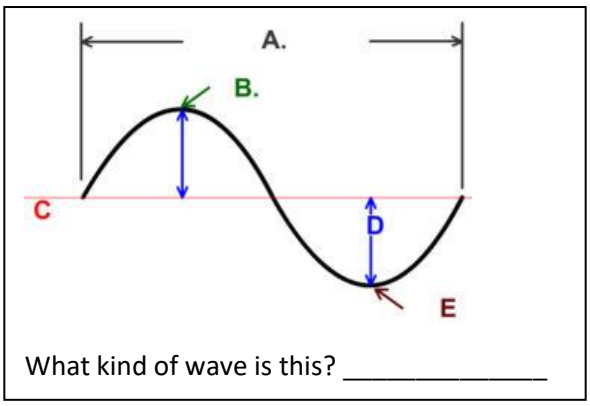
5. What kind of wave moves perpendicular to the direction of travel?

6. What kind of wave moves parallel to the direction of travel?

7. Label The Parts of a Transverse Wave.

A. B. C.

D. E.

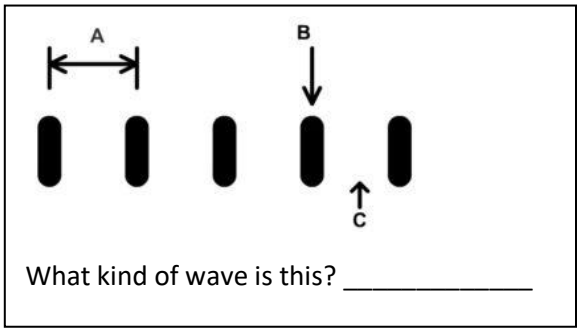


What kind of wave is this? _____

8. Label the parts of a longitudinal wave.

A. B.

C.



What kind of wave is this? _____

9. What kind of wave is a sound?

10. Compare and contrast the speed of an electromagnetic and mechanical wave: