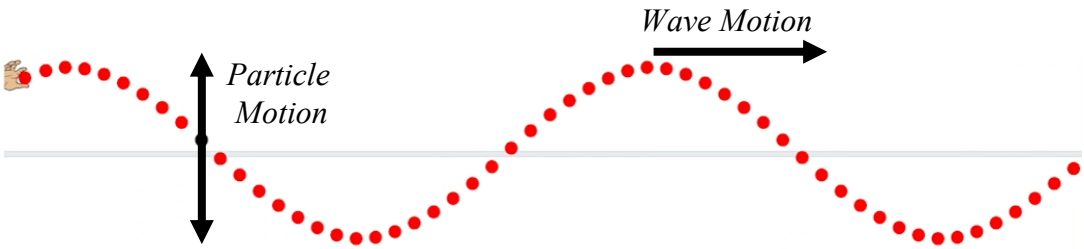
Categories of Waves
Lesson Notes

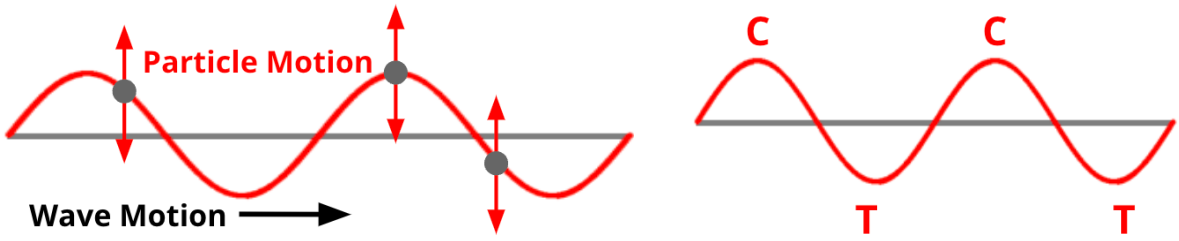
Learning Outcomes
- What are the various ways to categorize waves?

Particle Motion vs. Wave Motion
- Particles of the medium vibrate about a fixed position …
- … to form a pattern that moves from one location to another.

One way to categorize waves is by comparing the direction of particle motion to the direction of wave motion.



Transverse Waves
- A wave is categorized as a transverse wave if the particle motion is **perpendicular** to wave motion.
- Transverse waves have **crests (C)** and **troughs (T)** - high points and low points.



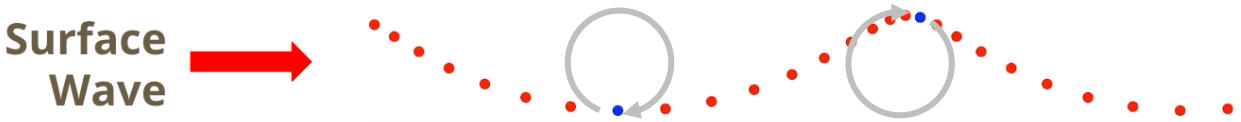
Longitudinal Waves
- A wave is categorized as a longitudinal wave if the particle motion is **parallel** and **anti-parallel** to the wave motion.
- Longitudinal waves have **compressions (C)** and **rarefactions (R)** - high density and low density regions.

Surface Waves, Torsional Waves, Etc.

Besides longitudinal and transverse waves, there are other types - surface waves, torsional waves and more ...

Surface Waves:

- In a surface wave, particles on the surface of the medium (and to a lessening degree, below the surface) move in a circular fashion while the wave moves along the surface.
- A water wave is an example of a surface wave.



Torsional Waves:

- Many Physics Labs are equipped with wave machines consisting of rigid steel rods attached to one another and resting upon a horizontal platform.
- As one end of the steel rod moves downward, the other end moves upward as the wave pattern moves perpendicular to the motion of the steel rods.

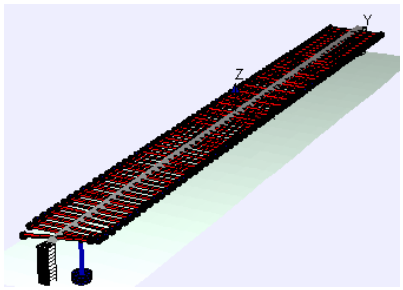


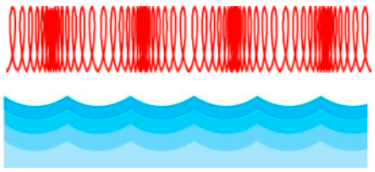
Image Source: https://commons.wikimedia.org/wiki/File:Wavemachine.gif

Mechanical vs. Electromagnetic Waves

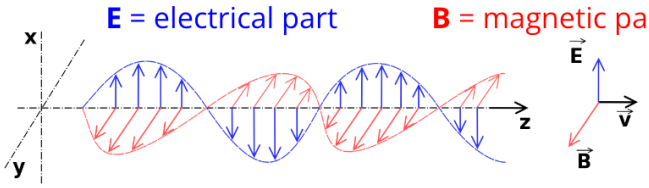
These two categories of waves are not based upon a comparison of particle motion direction to wave motion direction. Rather, they are based on the ability (or lack of ability) to propagate through the void of empty space.

Mechanical waves: waves that are only able to travel through a medium (material object).

Examples: Water waves, Slinky waves, stadium waves, waves in a rope, sound waves, etc.



Electromagnetic waves: waves that are able to travel through a vacuum (empty space); they can also travel through a physical medium.



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