WAVES

TRANSVERSE AND LONGITUDINAL WAVES

WAVES

A wave is like a traveling disturbance that carries energy and a push without moving the stuff around. When there's a wave, it moves the particles in the medium back and forth around their usual spots, but those particles don't go with the wave. They stay in place. So, when the wave goes by, only the disturbance - the shaking or bumping - moves from one place to another.

Classification of waves based on the necessity of medium

1. Mechanical waves

Waves that require something to move through are called mechanical waves. They happen when stuff in the medium shakes back and forth, and this is how energy travels through that stuff.

Requirements for mechanical waves:

- Start with some energy to cause a disturbance.
- Have a material with different parts in it.
- These parts must have a way to affect each other.

Required characteristics of the medium:

- Elasticity means the material can bounce back, and this is important because it allows the particles to go back to their regular spots, which is needed for the disturbance to travel.
- Inertia means the material should be able to hold onto energy and carry the wave forward.

2. Non-mechanical waves

Waves that can move without a material are called non-mechanical waves.

Example: Electromagnetic (EM) waves

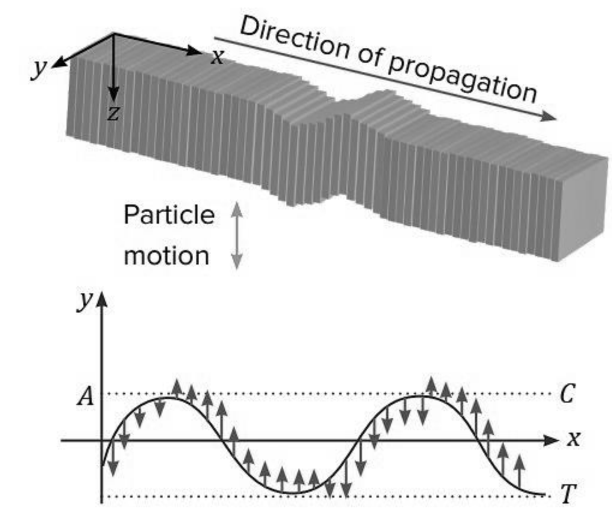
Electromagnetic waves are created when electric and magnetic fields shake or vibrate. EM waves travel through a vacuum at the speed of $v = 3 \times 108 ms^{-1}$.

Classification of waves based on the vibration of the particles

1. Transverse waves

When the medium's particles wiggle sideways, not in the same direction as the wave is moving, we call these waves "transverse waves."

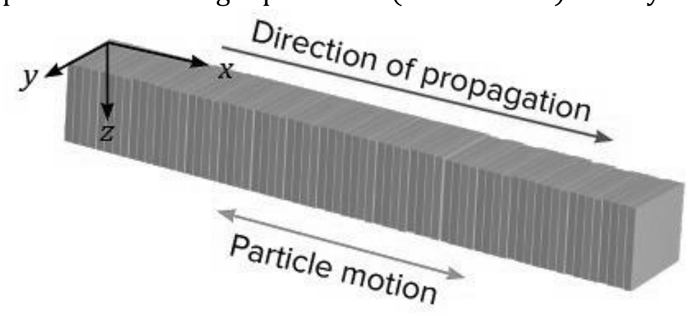
The transverse waves travel in the form of crests (C) and troughs (T).



Example: Waves on the surface of the water

2. Longitudinal waves

When the particles in the medium move in the same direction as the wave is going, we call those waves "longitudinal waves." These waves make areas where things get squished together (compressions) and spaces where things spread out (rarefactions) as they move.



Example: Sound waves travel in air

How can we explain the way a particle moves in a straight line?
The position of a particle moving along a straight line is given as y (t).

Example:
The particle of the medium executes a simple harmonic motion.
Equation of the particle performing SHM is given by, $y = A \sin(\omega t + \phi)$.