Waves

* **A traveling disturbance that** carries energy through matter and space.
* **Waves transfer** energy without transferring matter.
* **Waves are produced** by something that vibrates.

Electromagnetic Wave

Waves propagating in form of oscillating electric and magnetic fields. Do not require medium for propagation.

Matter Wave

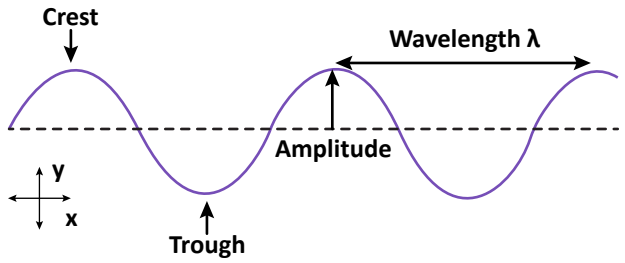
Waves associative with microscopic particles such as electrons, protons etc, in motion.

Mechanical Wave

Waves which require a material medium for their propagation are called mechanical waves.

Transverse Wave

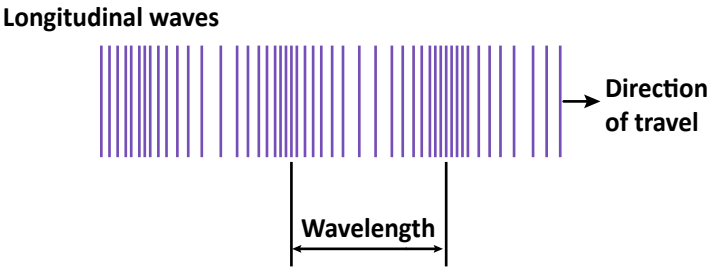
The individual particles of the medium oscillate perpendicular to the direction of wave propogation.



* In solids, $v = \sqrt{\frac{\eta}{\rho}}$
  where η is modulus of rigidity and ρ is density of solids.
* In stretched string, $v = \sqrt{\frac{T}{m}}$
  here, T is tension in string and m is mass per unit length of string.

Longitudinal Wave

The individual particles of the medium oscillate along the direction of wave propagation.



* In a solid of bulk modulus K, modulus of rigidity η and density ρ is

$$v = \sqrt{\frac{K + \frac{4}{3}\eta}{\rho}}$$

* In a fluid of bulk modulus K and density ρ is

$$v = \sqrt{\frac{K}{\rho}}$$

* Newton's formula for the velocity of sound in a gas is

$$v = \sqrt{\frac{K_{iso}}{\rho}} = \sqrt{\frac{P}{\rho}}$$ (P = pressure of the gas)

Progressive Wave

* Displacement, $y = A \sin(\omega t - kx + \phi_0)$

$$y = A \sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) = A \sin \frac{2\pi}{\lambda}(vt - x)$$

* Phase, $\phi = 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) + \phi_0$
  where ϕ_0 is the initial phase.
* Phase change: