

### WAVES

A wave is a disturbance which travels through a medium and transfer energy from one point to another without causing any permanent displacement of the medium itself e.g. water waves, sound waves, waves formed when a string is plucked

#### CLASSIFICATION AND GENERAL PROPERTIES OF WAVES

A wave is a periodic disturbance which travels with finite velocity through a medium and remains unchanged in type as it travels. Or it is a disturbance which travels through a medium, and transfers energy from one location (point) to another without transferring matter.

Waves may be classified as mechanical or electromagnetic waves.

**Mechanical waves:** These are waves produced by a vibrating body. They are transmitted by particles of the medium vibrating to and fro.

They require a material medium for their propagation.

These include water waves, sound waves, waves on stretched strings and waves on vibrating springs., e.Lc.

**Electromagnetic waves:** These are waves produced by a disturbance in form of a varying electric or magnetic fields. These are waves that don't require a material medium for their propagation. Electromagnetic waves travel in a vacuum.

They include radio, infra red, light, Ultraviolet, X-rays, Gamma rays.

If the disturbance of the source of waves is simple harmonic, the displacement in a given time varies with distance from the source as shown below.

#### WAVE MOTION

When a wave is set up on the medium, the particles of the medium from about a mean position as the wave passes. The vibrations are passed from one particle to the next until the final destination is reached

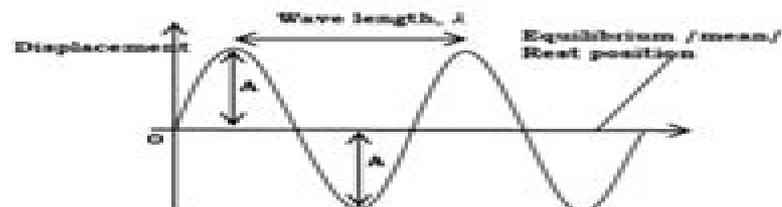
##### Generation and Propagation of mechanical waves.

Waves are generated when particles of a transmitting medium at any point are disturbed and start vibrating.

As they vibrate, they cause the neighboring particles to vibrate in turn, hence causing the vibrations to continue from the source to other regions in the transmitting medium.

The disturbance thus spreads the source outwards and it constitutes the wave.

##### Graphical representation of a wave.



#### Terms used in describing waves.

**Amplitude:** This is the greatest displacement of any wave particle from its equilibrium position.

**Wave length (λ):** Is the distance between two successive particles in a wave profile that are in phase.

It is the distance covered in a complete cycle of a wave.

It is the distance between two successive crests or troughs.

It is the distance between two successive compressions or rarefactions.

**Crest:** It is the maximum displaced point a above the line of O (zero) disturbance.

**Trough:** It is the maximum displaced point below line of zero disturbance.

**Wave front.** Is a line or surface that joins points of the same phase in a wave travelling through a medium.. OR: It is the imaginary line joining the set of particles that are in the same state of motion ( in phase).

Particles are in phase if they are in the same point in their path at the same time and are moving in the same direction.

The direction of travel of the wave is always at right angles to the wave front.

**Cycle or Oscillation:** is a complete to and fro motion of a wave. It is equivalent to moving from O to B.

**Period (T):** The time taken for any particle to undergo a complete oscillation.  $T = \frac{t}{n}$

**Frequency (f):** The number of oscillations per second.  
 $f = \frac{n}{t}$

**Velocity (v):** The distance covered by a wave particle per second in a given direction.

**Phase:** Is a fraction of a cycle which has elapsed after a particle passing a fixed point.

# O Level Physics Revision Waves Optics

**Mark Steyvers**



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