

Progressive wave = An oscillation that travels through matter or a vacuum and transfers energy

Transverse wave = Progressive wave where oscillations are perpendicular to direction of energy transfer

Longitudinal wave = A progressive wave where oscillations are parallel to the direction of energy transfer

Displacement = Distance from the equilibrium position

Amplitude = Maximum displacement from the equilibrium position

Wavelength = Minimum distance between two points, in phase on adjacent waves

Period = Time taken for one oscillation or wave to travel  $1\lambda$  past a given point

Frequency = Number of wavelengths passing a point per unit time

Wave speed = Distance travelled by the wave per unit time

Phase difference = Difference between displacements of particles along a wave

Path difference = Difference in the distance travelled

Reflection = When a wave changes direction at a boundary between 2 different media, remaining in the original medium

Wavefront = A line joining points of the wave which are in phase

Refraction = When wave changes direction as it changes speed when passes from one medium to another

Diffraction = When waves pass through a gap or travel around an obstacle and spread

Polarisation = Particles only oscillating in one direction, the wave being confined to a single plane

Partially polarised = When transverse waves reflect off a surface (so more waves are oscillating in one particular plane)

Intensity = Radiant power passing through a surface per unit area

EM Waves = Electric and magnetic fields oscillating at right angles to each other

Refractive index = Angle at which light is bent depending on relative speed of light

Total internal reflection = All light reflecting back into the medium

Principle of superposition = When 2 waves meet at a point, resultant displacement there is equal to the sum of the displacements of the individual waves

Interference = When 2 waves (progressive) continuously pass through each other, superpose, and produce a resultant wave

Coherence = Waves from 2 sources having a constant phase difference

Stationary wave = When 2 waves with the same frequency and ideally amplitude superpose, travelling in opposite directions

Node = A point on stationary wave where displacement is permanently 0

Antinode = The point of greatest amplitude on stationary wave

Fundamental frequency = The minimum frequency of a stationary wave (string)

**Harmonics**

n	$\Delta x$	$\Delta \phi$
Central max:	0	0
1st min:	$\frac{1}{2}\lambda$	$\pi$
1st max:	$\lambda$	$2\pi$
2nd min:	$\frac{3}{2}\lambda$	$3\pi$
2nd max:	$2\lambda$	$4\pi$

**Constructive**  
 $\Delta \phi = 2n\pi$   
 $\Delta x = n\lambda$

**Destructive**  
 $\Delta \phi = (2n+1)\pi$   
 $\Delta x = (n + \frac{1}{2})\lambda$

**Equations:**

- $v = f\lambda$
- $\lambda = \frac{ax}{D}$  (where  $a \ll D$ )
- $n\lambda = d \sin \theta$
- $f = \frac{1}{T}$
- $n_1 \sin \theta_1 = n_2 \sin \theta_2$
- $n = \frac{c}{v}$
- Intensity  $\propto$  Amplitude<sup>2</sup>
- $I = \frac{P}{4\pi r^2} = \frac{P}{A}$
- $\theta_i = \theta_r$  (Law of reflection)
- $\phi = \frac{x}{\lambda} \times 360^\circ$

**Radio wave**  $1m - 10^5 m$

**Microwave**  $10^{-3} - 1m$

**Infrared**  $700nm - 10^{-3}$

**Visible light**  $400nm - 700nm$

**Ultraviolet**  $10^{-8} - 400nm$

**X-rays**  $10^{-11} - 10^{-8}$

**Gamma rays**  $10^{-14} - 10^{-11}$