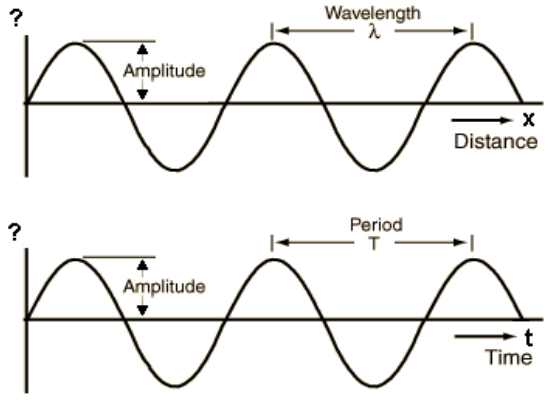
11 Wave Motion

Progressive Waves

A **progressive wave** is a waveform that advances and transfers energy from one point to another, whereas the wave particles undergo SHM (Chapter 10).

Terms	Description
	
Wave speed (v/ms^{-1}) $v = \frac{distance}{time} = \frac{\lambda}{T} = f\lambda$, where frequency $f = \frac{1}{T}$	Speed of propagation of energy of wave
Phase difference (ϕ/rad) $\Phi = 2\pi\frac{\Delta x}{\lambda}$, where Δx is the displacement between two particles.	Phase indicates state of vibration of particles in terms of angles. **Phase difference** between two particles along a wave is the difference in their phase angles. Wave particles vibrating in the same/opposite direction are said to be **in phase/π out of phase.**

Transverse and Longitudinal Waves

In a transverse/longitudinal wave, the direction of vibrations is **perpendicular/parallel** to the direction of wave propagation.

Transverse and Longitudinal Waves

Important Graphs

1. Displacement-distance graph
2. Displacement-time graph
3. Pressure-distance graph (longitudinal only)

Energy of a Wave

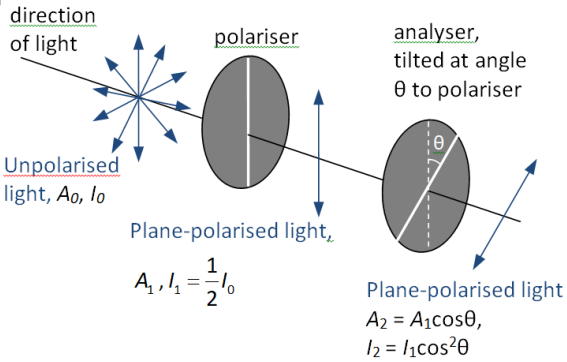
Energy carried by a wave $E \propto f^2A^2$

Intensity of a wave $I = \frac{Power\ P}{Area\ A}$ where area is perpendicular to wave propagation. If wave propagates uniformly in all directions without losses, then $I \propto \frac{1}{r^2}$. Since $I \propto A^2$, $A \propto \frac{1}{r}$.

Power received by a receiver is given by $P_{received}$ = Intensity x $A_{receiver}$

Polarisation

Polarisation is a phenomenon associated **only** with transverse waves.



For polarization of unpolarised waves:
Amplitude unchanged, intensity halved.

For polarization of plane-polarised waves:
$A = A_0\cos\theta$, Malus' Law gives $I = I_0\cos^2\theta$.

Finding frequency and wavelength of sound

Frequency and wavelength of sound can be determined with a calibrated cathode ray oscilloscope C.R.O, but to find wavelength, the sound must be reflected.