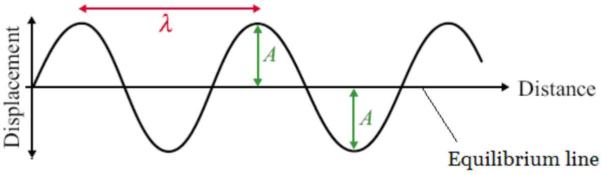
Progressive Waves

To be know the basic measurements of a wave
To be able to calculate the speed of any wave
To know what phase and path difference are and be able to calculate them.

Waves

All waves are caused by oscillations and all transfer energy without transferring matter. This means that a water wave can transfer energy to you sitting on the shore without the water particles far out to sea moving to the beach.

Here is a diagram of a wave; it is one type of wave called a transverse wave. A wave consists of something (usually particles) oscillating from an equilibrium point. The wave can be described as progressive; this means it is moving outwards from the source.



We will now look at some basic measurements and characteristics or waves.

Amplitude, A
Amplitude is measured in metres, m

The amplitude of a wave is the maximum displacement of the particles from the equilibrium position.

Wavelength, λ
Wavelength is measured in metres, m

The wavelength of a wave is the length of one whole cycle. It can be measured between two adjacent peaks, troughs or any point on a wave and the same point one wave later.

Time Period, T
Time Period is measured in seconds, s

This is simply the time is takes for one complete wave to happen. Like wavelength it can be measured as the time it takes between two adjacent peaks, troughs or to get back to the same point on the wave.

Frequency, f
Frequency is measured in Hertz, Hz

Frequency is a measure of how often something happens, in this case how many complete waves occur in every second. It is linked to time period of the wave by the following equations: $T = \frac{1}{f}$ and $\boxed{f = \frac{1}{T}}$

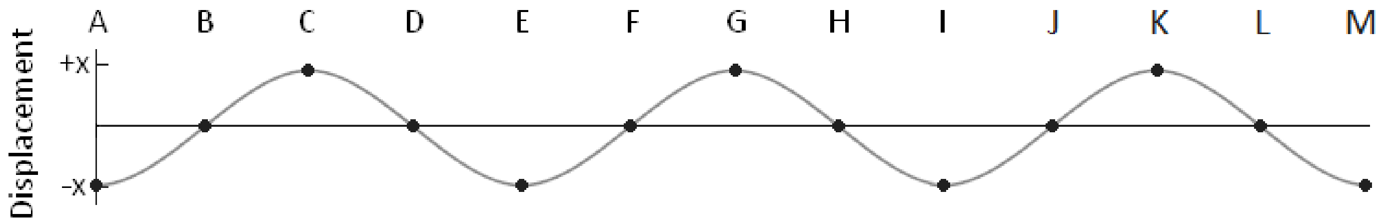
Wave Speed, c
Wave Speed is measured in metres per second, m s^{-1}

The speed of a wave can be calculated using the following equations: $\boxed{c = f\lambda}$

Here c represents the speed of the wave, f the frequency and λ the wavelength.

Phase Difference
Phase Difference is measured in radians, rad

If we look at two particles a wavelength apart (such as C and G) we would see that they are oscillating in time with each other. We say that they are *completely in phase*. Two points half a wavelength apart (such as I and K) we would see that they are always moving in opposite directions. We say that they are *completely out of phase*. The phase difference between two points depends on what fraction of a wavelength lies between them



	B	C	D	E	F	G	H	I	J	K	L	M
Phase Difference from A (radians)	½π	1π	1½π	2π	2½π	3π	3½π	4π	4½π	5π	5½π	6π
Phase Difference from A (degrees)	90	180	270	360	450	540	630	720	810	900	990	1080

Path Difference
Path Difference is measured in wavelengths, λ

If two light waves leave a bulb and hit a screen the difference in how far the waves have travelled is called the path difference. Path difference is measured in terms of wavelengths.

	B	C	D	E	F	G	H	I	J	K	L	M
Path Difference from A	¼λ	½λ	¾λ	1λ	1¼λ	1½λ	1¾λ	2λ	2¼λ	2½λ	2¾λ	3λ

So two waves leaving A with one making it to F and the other to J will have a path difference of 1 wavelength (1λ).