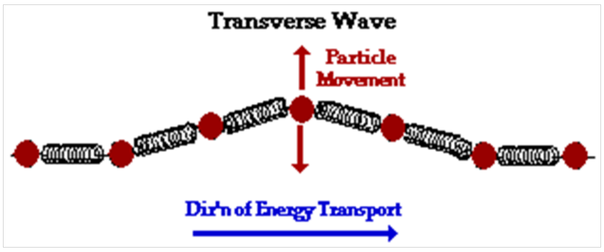
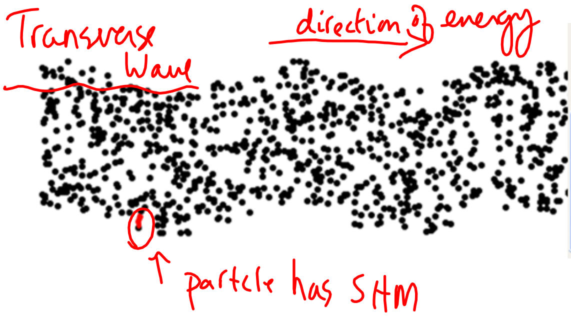
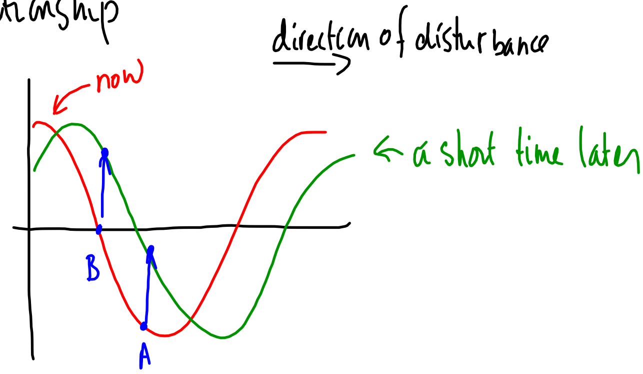
Particles undergo SHM.





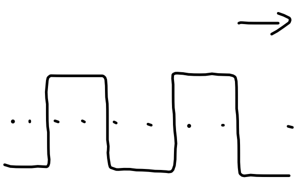
Phase relationship

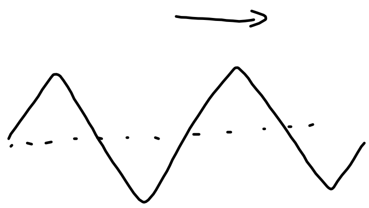


↑ this particle is behind in phase to the one preceding it (i.e. B)

- A wave is a Simple Harmonic wave if it is sinusoidal.
- There are other waves that are not harmonic:

Square Wave





Triangular wave.

Saw tooth wave.

Progressive (travelling) waves transfer energy.

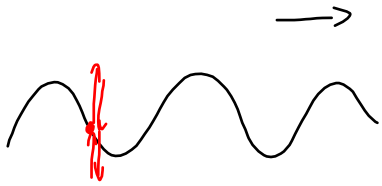
* It is the energy (or disturbance) that is transferred by a wave through a given medium.

Examples of waves:

- ocean waves
- sound waves
- earthquake waves
- light waves (electromagnetic waves)

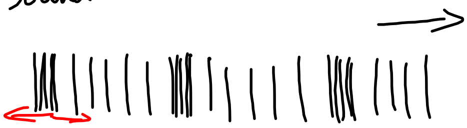
Transverse Waves

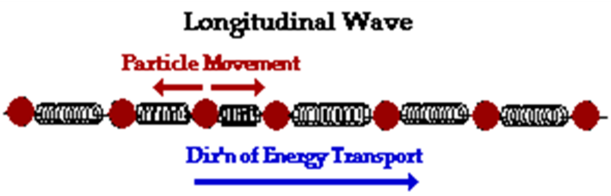
- light
- water ripples

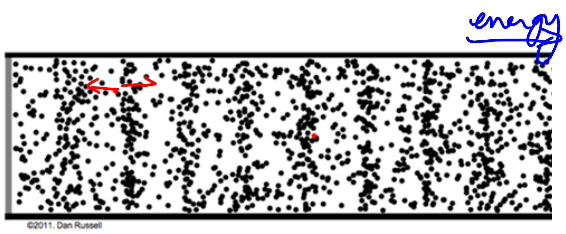


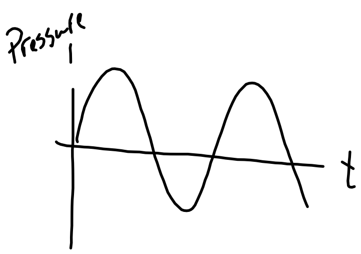
Longitudinal waves

- sound waves





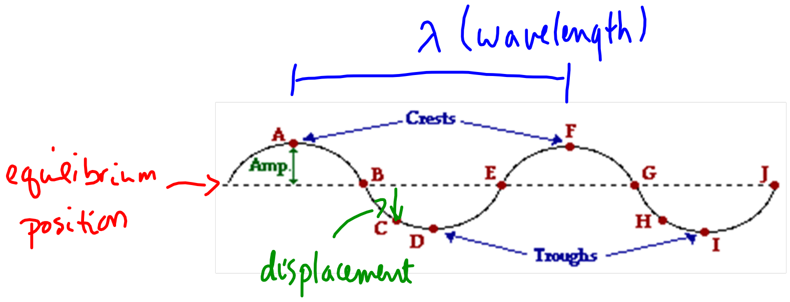


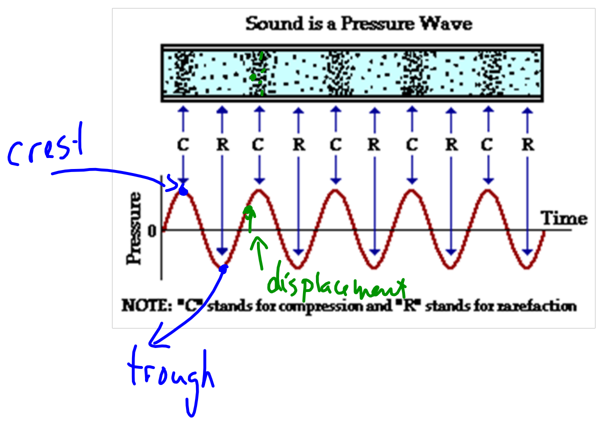


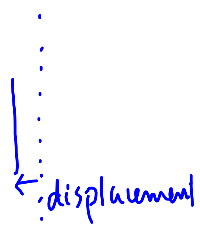
Propagation of Sound energy

- sound is propagated via a longitudinal wave.
- areas of high pressure (compressions) and low pressure (rarefactions)
- areas of pressure fluctuations travel to your ear from the sound source → causes ear drum to vibrate at the same frequency as the sound source. → sending electrical impulses to your brain. → we perceive this as sound.

Transverse Waves cannot be propagated in gases
- no mechanism in gases for driving the motion of the particles perpendicular to the propagation of the wave.

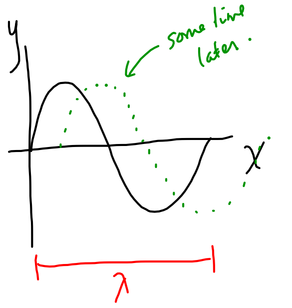




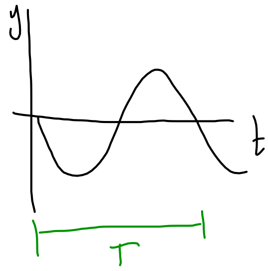


Displacement-time graphs and displacement-position graphs for Transverse Waves

Displacement-position graph is like taking a picture of a wave at a given instant in time. At a later time, the waveform will have moved to the left (or right)



Displacement vs time graph is the graph of the displacement of point (or particle) on the wave versus time.



* Take note of the horizontal axis!!

Wave Equation

wave speed: $v = \frac{d}{t}$

for a wave to travel a special distance (λ) it would take 1 full period to travel

$v = \frac{\lambda}{T}$

$v = \lambda\left(\frac{1}{T}\right)$

$v = \lambda f$ ← universal wave equation.

Example:

FM radio station: $f = 103.9\ MHz$

The speed of radio waves: $3.00 \times 10^{8}\ ms^{-1}$

Find the wavelength and the period!

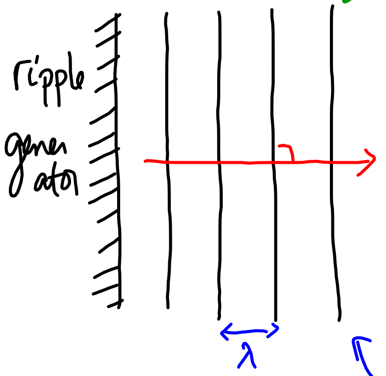
$\lambda = 2.89\ m$

$T = 9.62 \times 10^{-9}\ s$

Two-dimensional Waves (4.4.4)

- surface waves on water ⇒ study using a ripple tank.

plane waves



← wavefronts

← ray (always ⊥ to the wavefronts.)

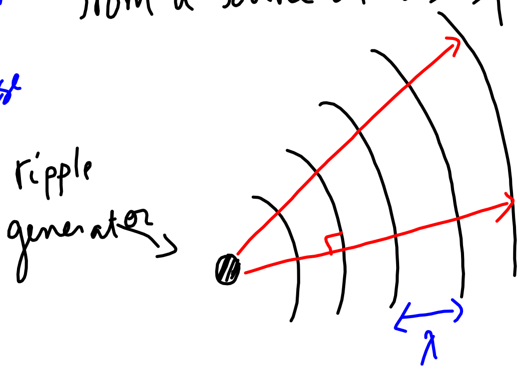
(shows the direction of travel of the energy)

↑ all points on the wave front are in the same phase

Waves move out in a straight line in 2D space.

Circular Waves

Waves move out radially from a source in 2D space.



From yesterday: 103.9 MHz →

$$v = \lambda f$$

$$\lambda = \frac{v}{f}$$

$$\lambda = \frac{3.00 \times 10^{8}\, m\, s^{-1}}{103.9 \times 10^{6}\, s^{-1}}$$

$$\lambda = 2.89\, m$$

$$T = \frac{1}{f}$$

$$T = \frac{1}{103.9 \times 10^{6}\, s^{-1}}$$

$$T = 9.62 \times 10^{-9}\, s$$