Waves and Sound

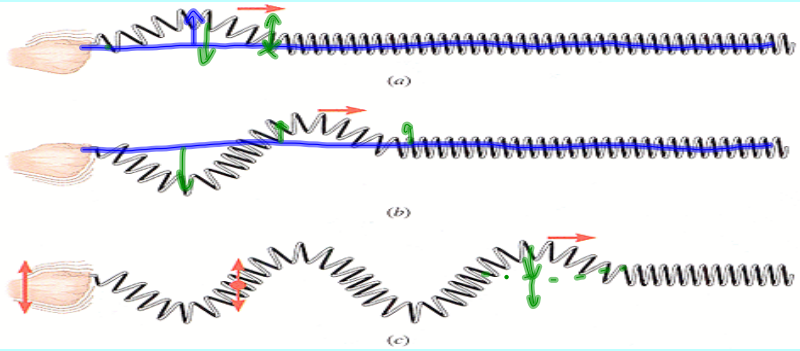
1. Waves
2. Sound
3. Music

What is a wave?

All waves... -transfer energy from one point to another
-result from oscillations at its source
↳ repetative, periodic

Most waves... -travel through a medium → substance in which something travels

Along a wave, there is always a periodic oscillation of particles (or energy in the case of light). The particles move back and forth around its equilibrium point (much like a pendulum).



There are many examples of waves...

Waves are often divided into 2 categories:

vibration

Transverse wave: The oscillation of the particles is perpendicular to the direction of motion of the wave.

http://www.acs.psu.edu/drussell/Demos/waves-intro/waves-intro.html

- light
- water

Longitudinal wave: The oscillation of the particles is parallel to the direction of motion of the wave

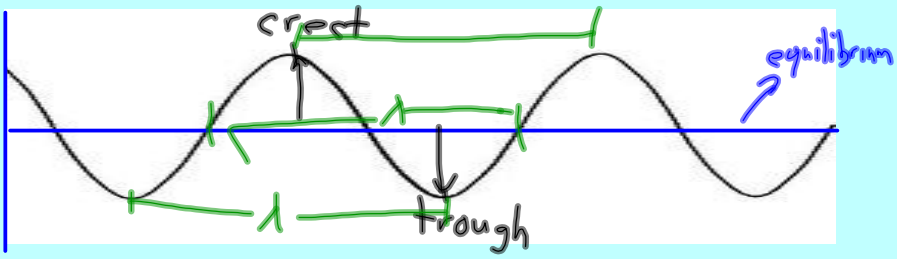
- sound
- siesmic

Wave Characteristics and Terms

frequency → f → # of cycles per unit of time (cycles/s = Hz)

period → T → time for 1 cycle (s)

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



wavelength → λ → distance between 2 consecutive identical points in a wave (m)

The Wave Equation

We know that $v = \frac{d}{t}$

For 1 cycle of a wave, the wave travels a distance, $d = \lambda$

in a time of $t = T$

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

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

So $v = \lambda \times \frac{1}{T} = \lambda f$

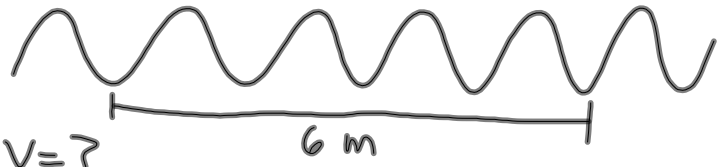
$$\boxed{v = \lambda f}$$

$[m][Hz] = [m]\left[\frac{1}{s}\right] = \left[\frac{m}{s}\right]$

This is known as the wave equation.

Example:

A wave has 5 troughs spread out over 6.0 m. It takes 16 s for a point on the wave to go up and down 4 times. Determine the speed of the wave.



$v = ?$

$\lambda = ?$

$f = ?$

cycles = 4

$t = 16\,s$

$f = \frac{\text{cycles}}{t}$

$= \frac{4}{16}$

$= 0.25\ Hz$

$\lambda = \frac{d}{\text{cycle}}$

$= \frac{6}{4}$

$= 1.5\ m$

$v = f\lambda$

$= (0.25)(1.5)$

$= 0.375\ \frac{m}{s}$