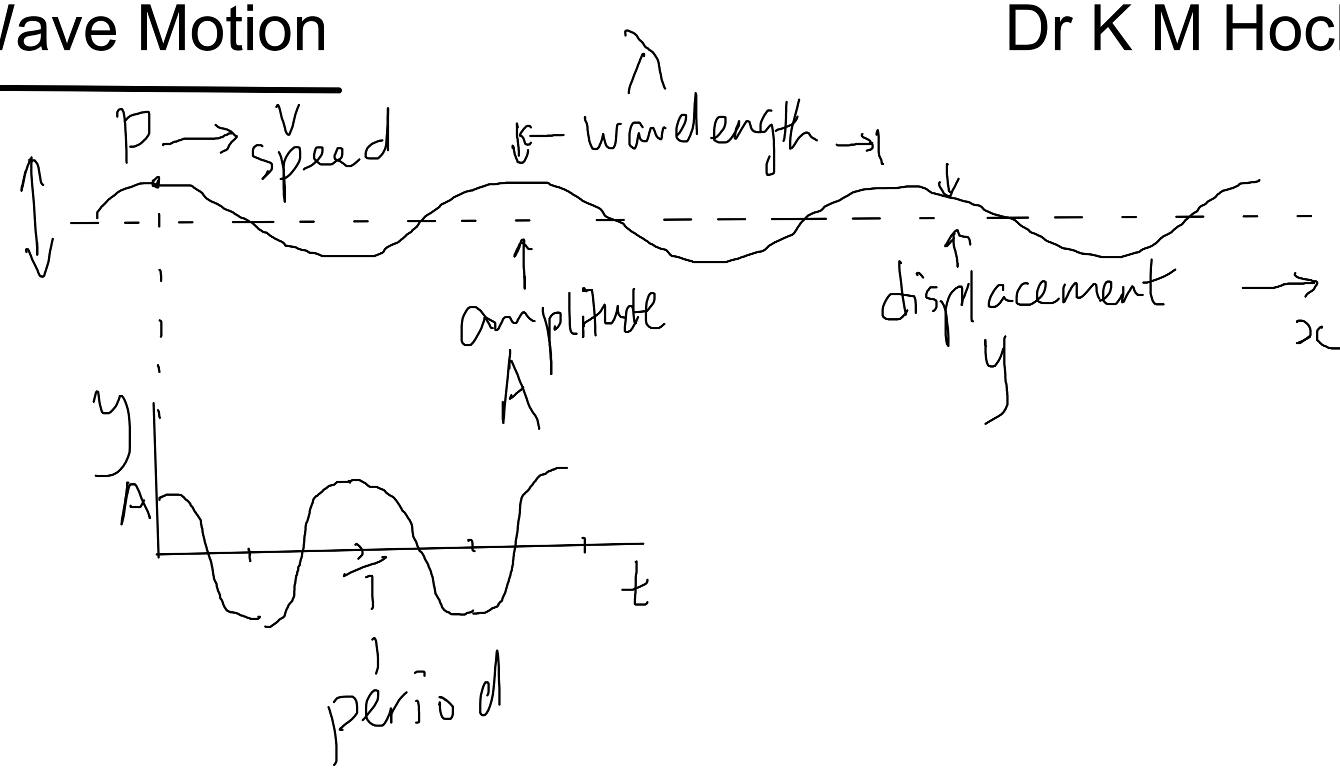
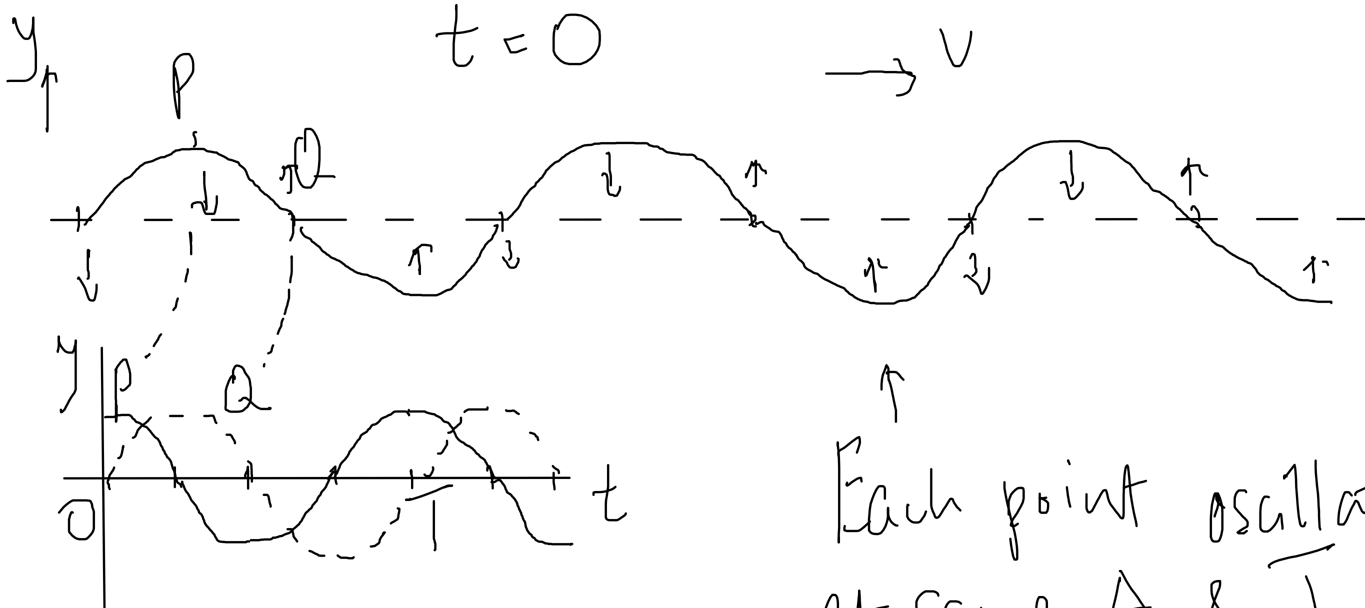
show an understanding and use the terms displacement, amplitude, phase difference, period, frequency, wavelength and speed

Wave Motion

Dr K M Hock





Each point oscillate at same A & T.

but can be out of phase

e.g. P, Q timing out by $t = T/4$

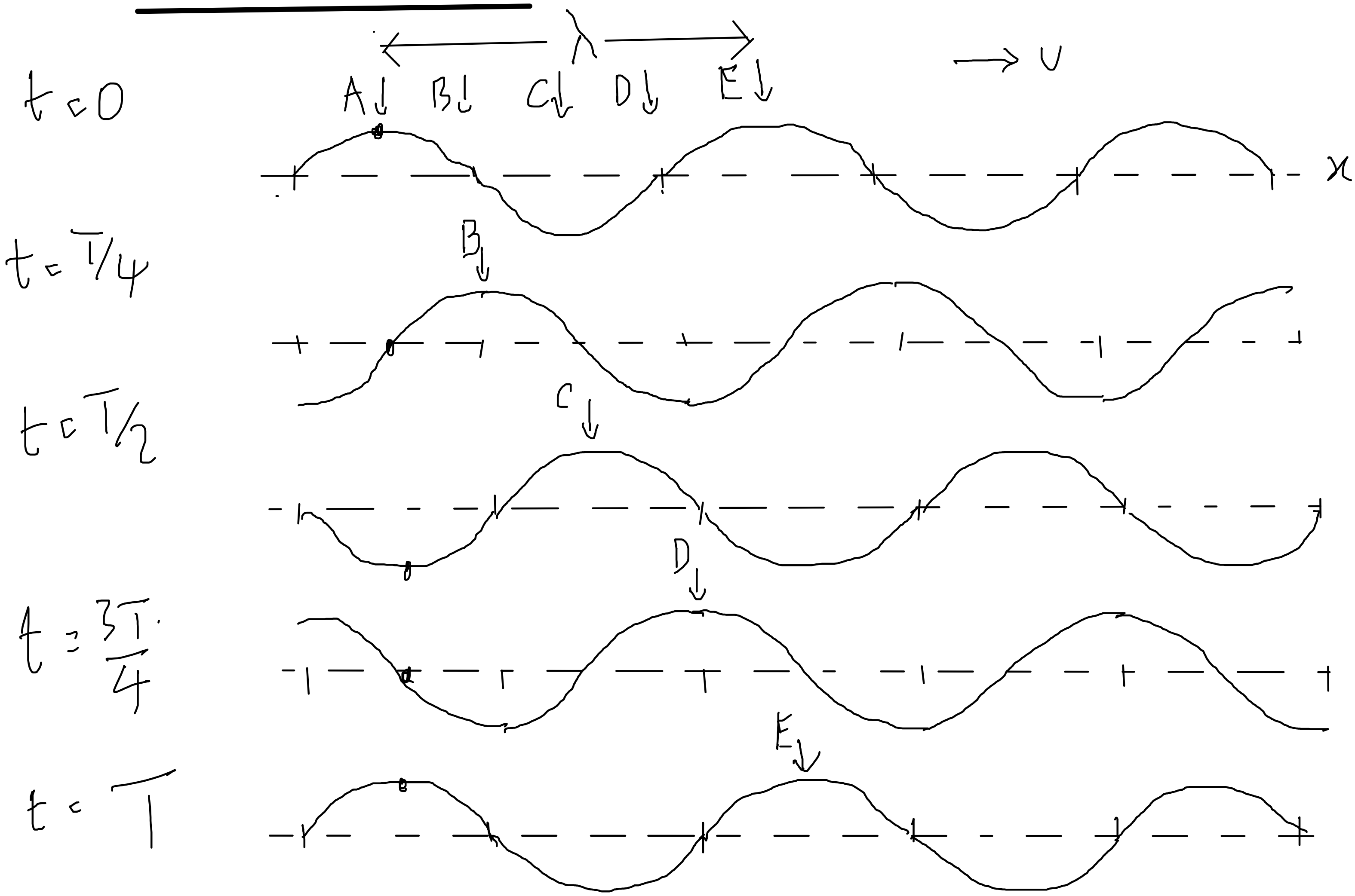
In radians, phase difference $\phi = \frac{t}{T} \times 2\pi$

$= \pi/2$ rad.

deduce, from the definitions of speed, frequency and wavelength, the equation v = f λ

Speed of wave

Dr K M Hock



When peak at A moves to the right by distance λ,
string at A goes up & down 1 cycle.
So time taken is T.

∴ Speed of wave (crest) $= \frac{\lambda}{T}$

frequency $f = \frac{1 \text{ cycle}}{T}$

$$v = f\lambda$$

Speed of Wave 2

Dr K M Hock

e.g.

Find the frequency of oscillation of the water surface.

$v = f\lambda$ $f = \frac{v}{\lambda} = \frac{1}{0.1} = 10\,s$

---

e.g.

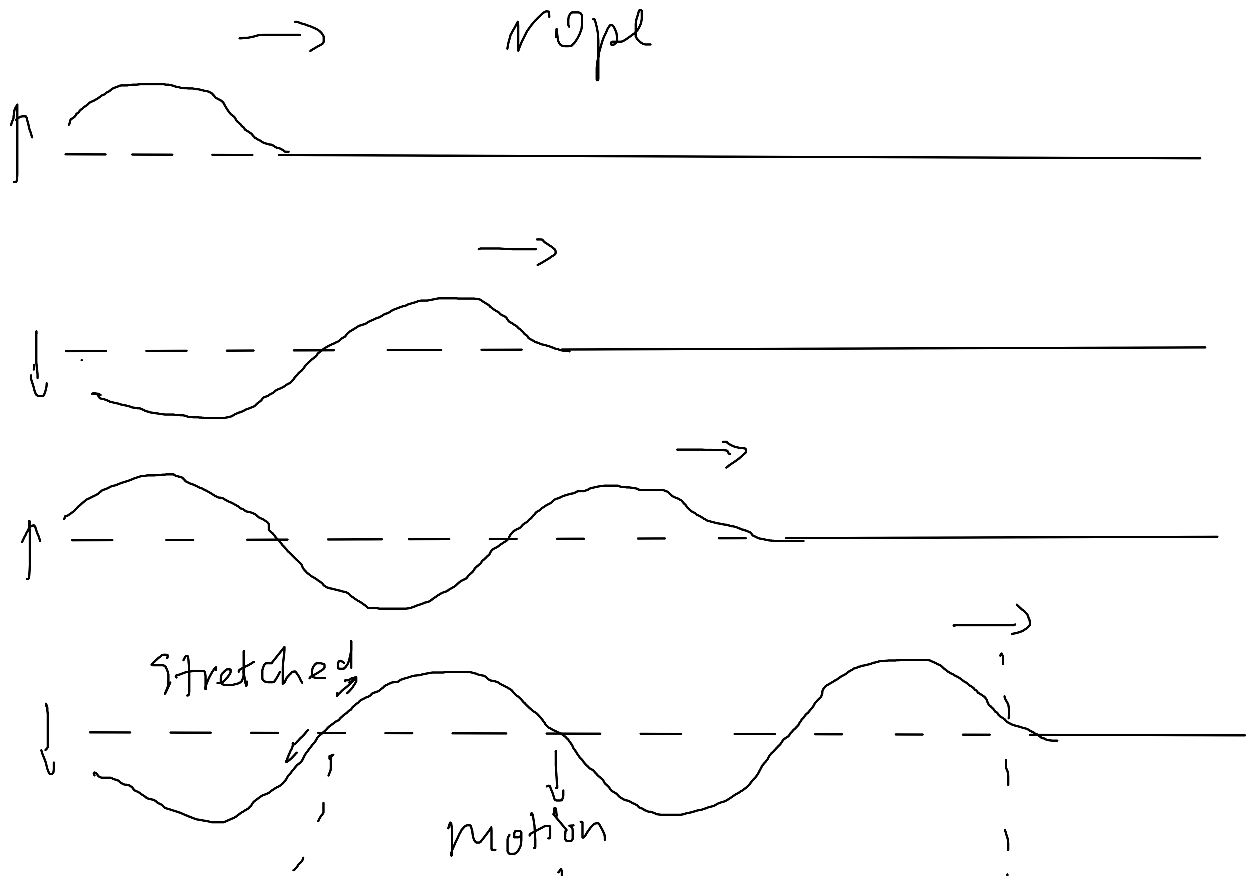
Find the velocity of the wave.

$v = f\lambda = 2 \times 1 = 2\ m/s$

show an understanding that energy is transferred due to a progressive wave

Progressive Wave

Dr K M Hock



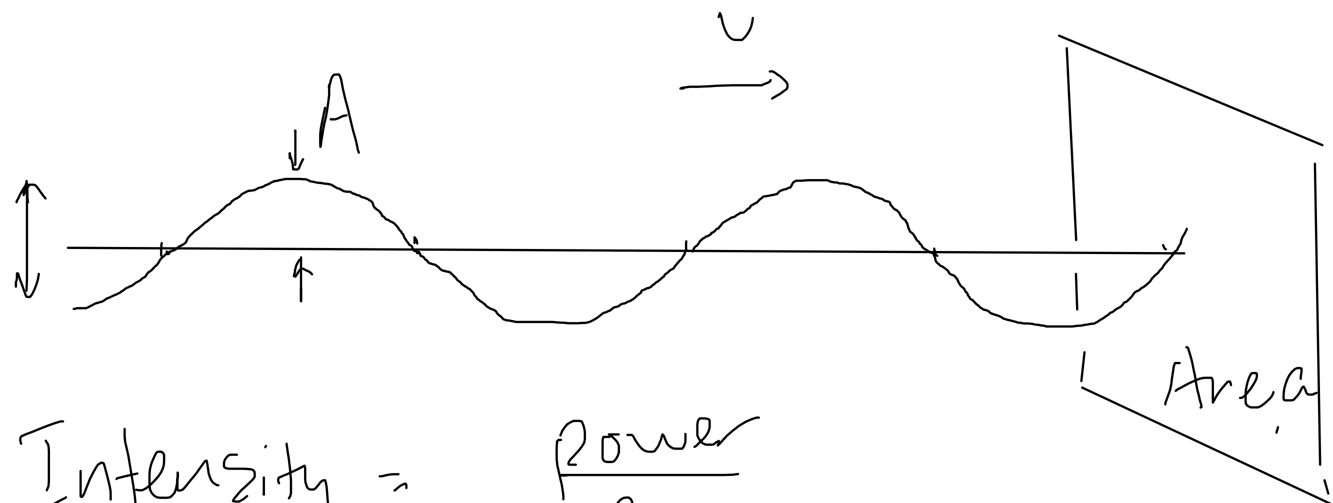
PE & KE — travelling

∴ energy is transferred to the right

Progressive Wave

Intensity and Amplitude

Dr K M Hock



Intensity = $\frac{\text{Power}}{\text{Area}}$

(e.g. 1 m^2)

- energy going thru' unit area in unit time (e.g. 1 s)

Recall Hooke's law:

elastic potential energy = $\frac{1}{2}Fe$ or $\frac{1}{2}ke^2$

- proportional to extension^2

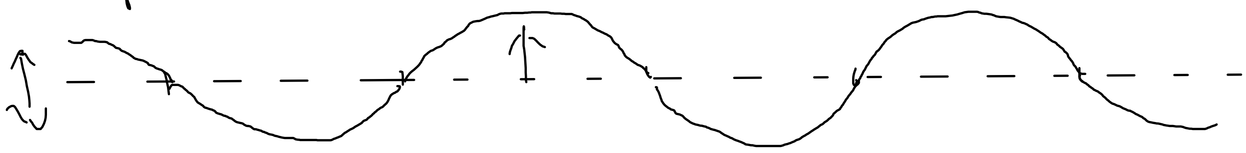
For rope wave, extension ~ amplitude

$\therefore$ intensity $\propto$ amplitude^2

Transverse, Longitudinal Waves

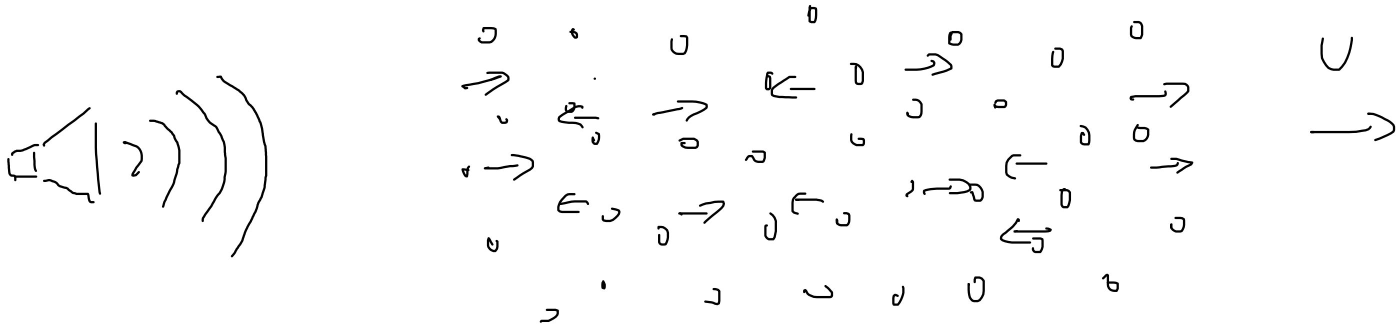
Dr K M Hock

Rope wave → v



Displacement ⊥ v.

Sound wave



Displacement // v.

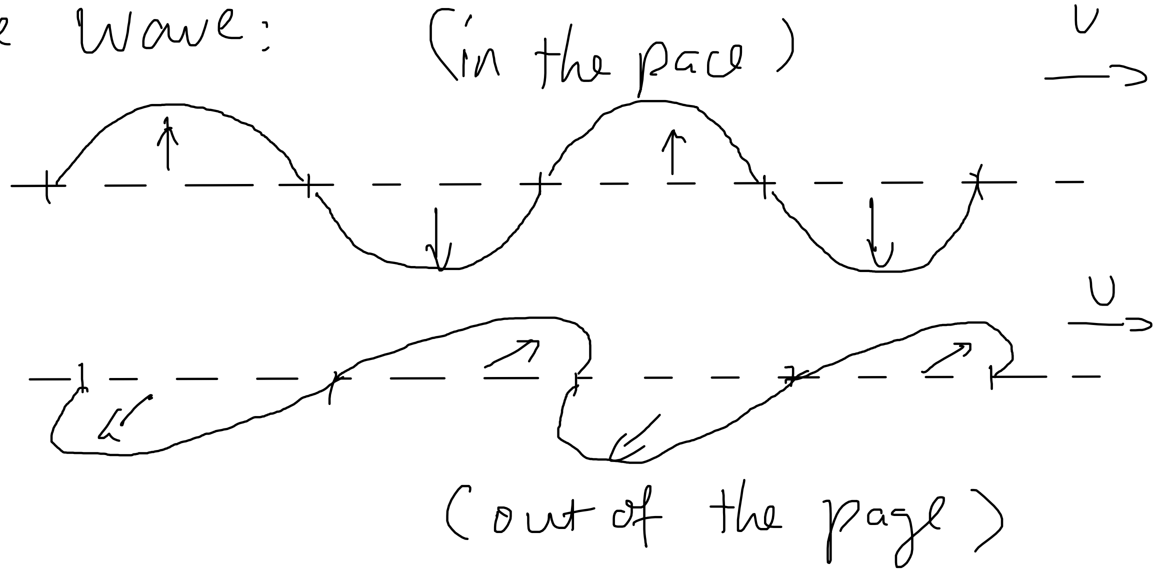
Transverse wave – displacement perpendicular to direction of travel.

Longitudinal wave – displacement parallel to direction of travel.

Polarisation

Dr K M Hock

Rope wave:

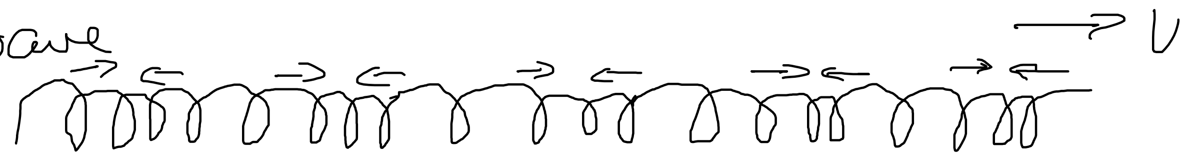


Displacement can go in different directions.

└ Polarisation.

Transverse waves can have difference polarisations (for the same direction of travel).

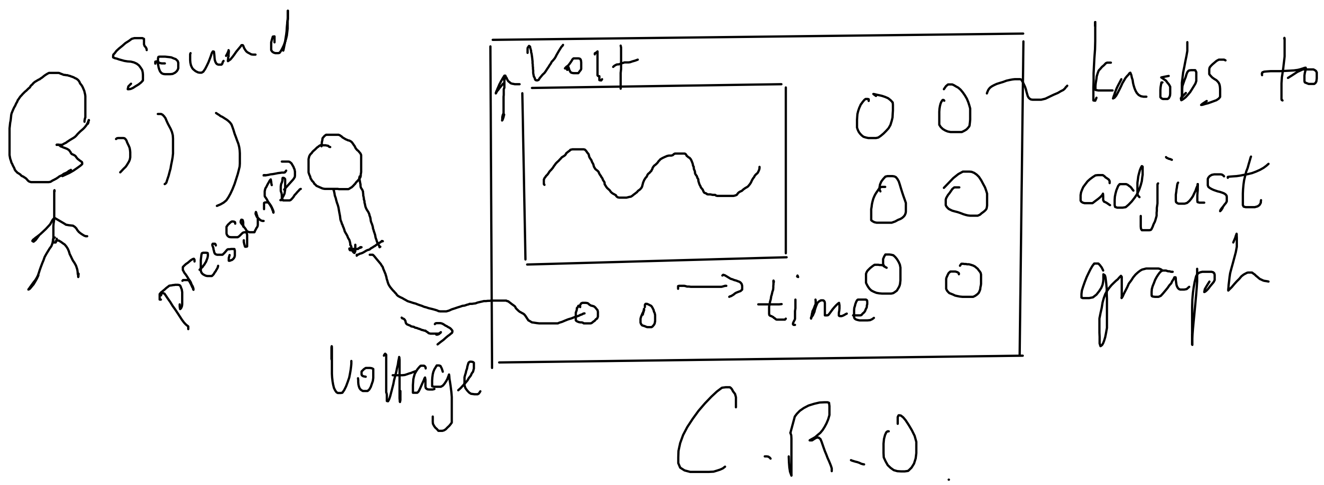
Spring wave



Longitudinal wave – only 1 polarisation.

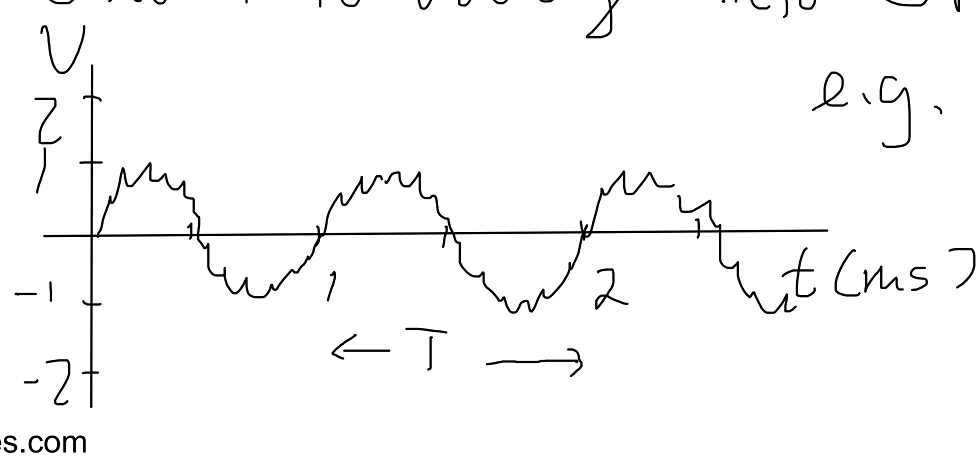
Measure Sound Frequency

Dr K M Hock



C.R.O - Cathode Ray Oscilloscope
- to plot graph of voltage against time.

Sound wave produces changes in pressure in air.
Microphone senses pressure and convert to voltage into C.R.O.



e.g. T = 1ms

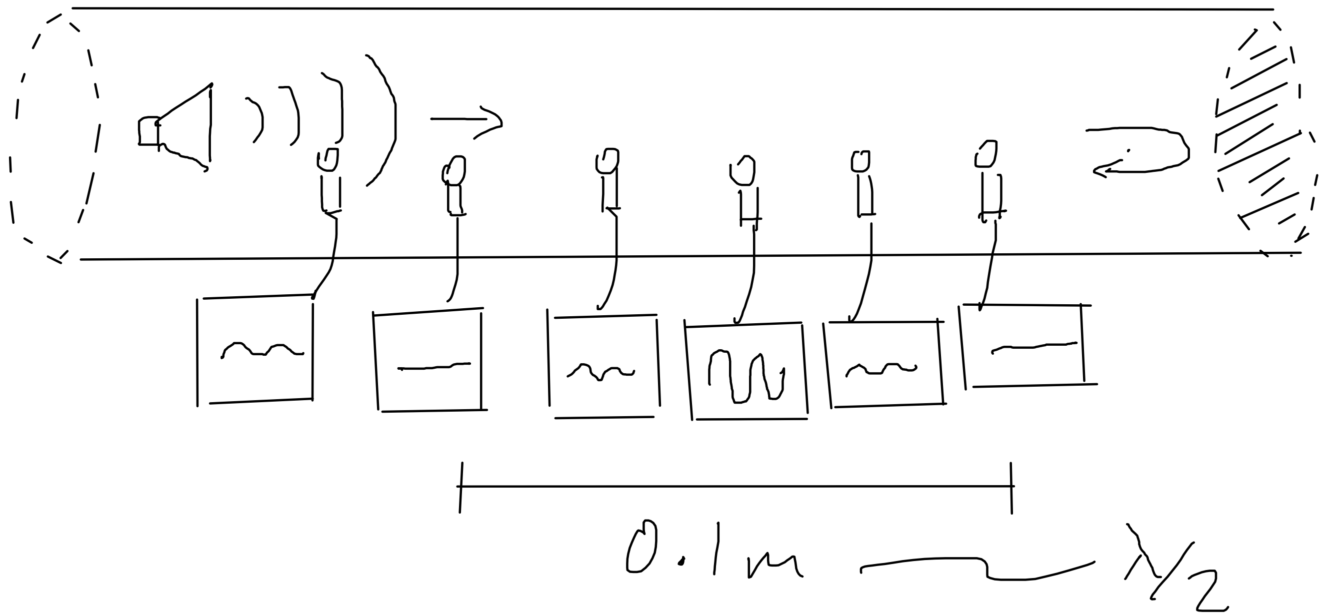
$f = \frac{1}{T}$

$= 1000\ Hz$

determine the wavelength of sound using stationary waves.

Measure Sound Wavelength

Dr K M Hock



Setup: - get a tube
- loudspeaker one end
- block other end
- move microphone through tube
- look at CRO graph.

Observe: - amplitude up - down - up - down ..
- distance between minima = half wavelength.

e.g. $\frac{\lambda}{2} = 0.1\,m \rightarrow \lambda = 0.2\,m$.

Reason - Stationary wave.