# WAVES

a disturbance that transfers energy through a medium by means of a series of vibrations

characterized by

Phase: stage in a cycle
- two vibrating objects can have identical amp. & frequencies, yet be different b/c they are never @ same point in their cycles @ the same time

(T) Cycle Period: repeated pattern of motion
- time to complete 1 cycle

(f) Frequency: # of cycles in a unit of time (hertz = $s^{-1}$)

(A) Amplitude: max. distance from rest position (equilibrium)

$T = \frac{\Delta t}{N}$ & $F = \frac{N}{\Delta t}$

where $N$ = # of cycles

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

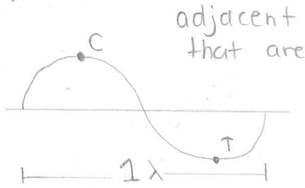
therefore

to find speed

$V = f\lambda$

$m/s = Hz \cdot m$

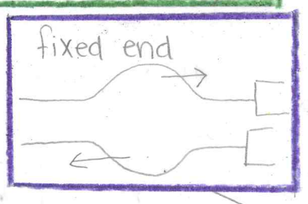
where wavelength ($\lambda$) is the distance between adjacent points in a wave that are vibrating in phase




C = Crest: region above rest position

T = Trough: region below rest position

varies with




wave behaviour

Interference: effect resulting from the passage of two like waves through each other

Principal of Superposition: whenever two or more waves pass through each other, the resultant wave @ each point is the sum of all the individual displacements occuring @ that point

types

Constructive Interference
- occurs when both waves push the medium in the same direction
- resultant waves called supercrest or supertroughs

Destructive Interference
- occurs when the waves push the medium in opposite directions, result in a smaller crest or trough

special case

Nodal Points: when crests & troughs of equal magnitude meet

Diffraction: spreading out of a wave

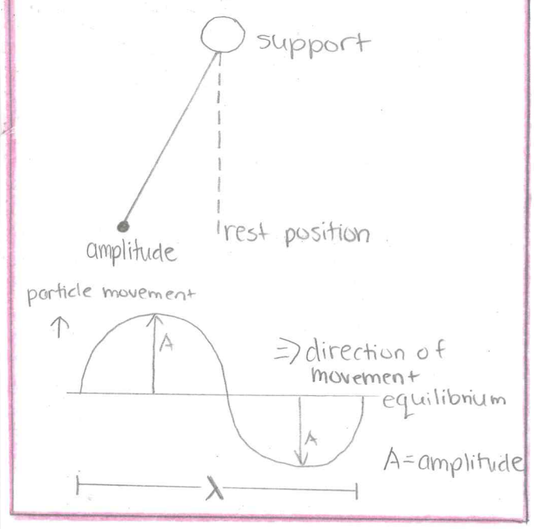
* if opening $< \lambda$ ∴ large amount of diffraction

* if opening $> \lambda$ ∴ little diffraction

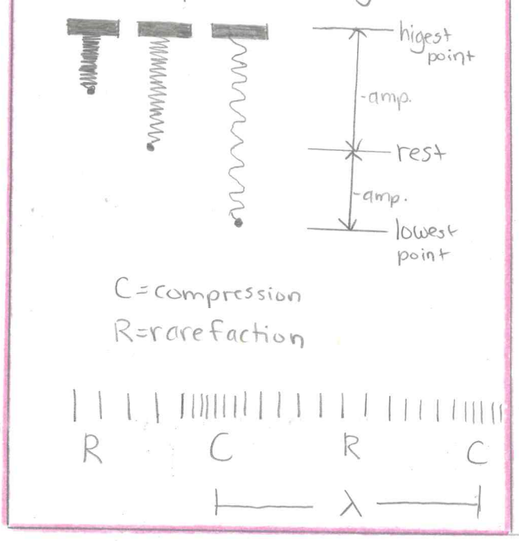
types of vibrations

* music - string
- air columns

Transverse
- motion is perpendicular to length

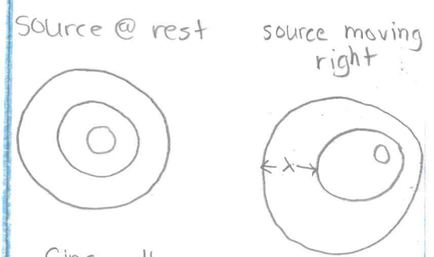



Longitudinal
- motion is parallel to length




Applications

Dopler Effect




Since the speed of waves is constant:
- as the $\lambda$ decreases, the frequency increases
- as the $\lambda$ increases, the frequency decreases

$V = f\lambda$

with

Radar
- Radio waves are bounced off a speeding car. Police compare original frequency to reflected frequency to get speed
⇒ car is considered source of vibration

with

Resonance: transfer of energy of vibration from one object to another having the same natural frequency

Tacoma Narrows
- bridge began an hour-long wild vibration due to resonance triggered by the wind, eventually tearing itself apart