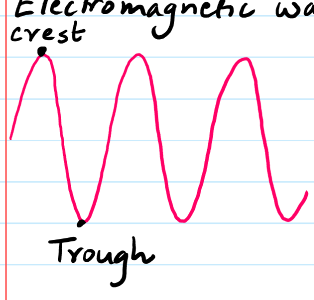
Waves

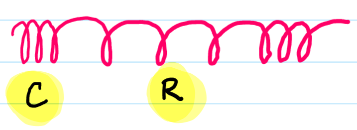
Progressive Wave
* waves which travel or move & as they move they transfer energy from one pt to another pt.

Stationary Wave
not done in O-level but it is a part of AS Level.

Transverse
- direction of vibration is perpendicular to the direction in which wave travels.
- eg Water waves, waves on ropes, Electromagnetic waves



Longitudinal
- direction of vibration is parallel to the direction in which wave travels
- eg waves on Springs, Sound waves.

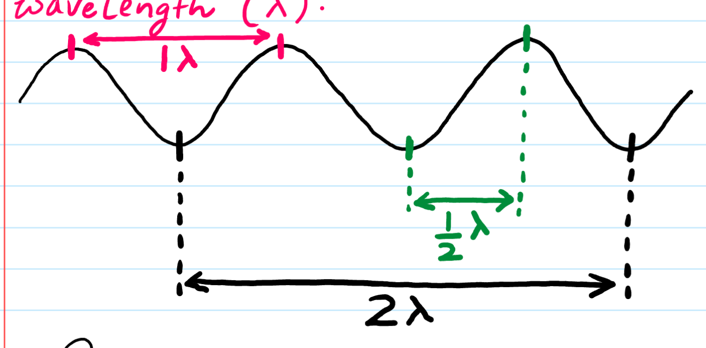


C = Compression
R = Rarefaction.

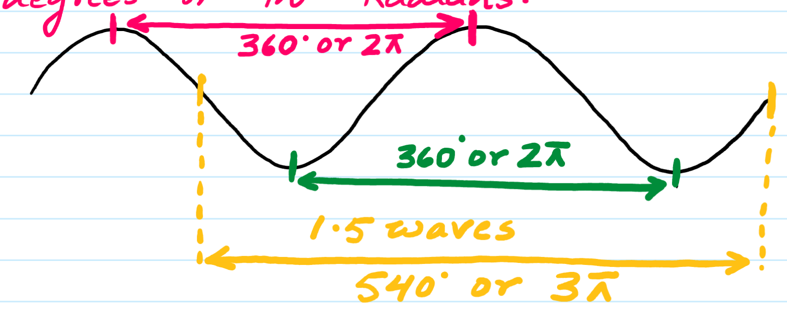
- Properties of Waves

1. Reflection } O-level
2. Refraction }
3. Superposition } AS-level.
4. Interference }
5. Diffraction }

- PATH DIFFERENCE :: refers to distance b/w any two points on a wave measured in terms of wavelength (λ).

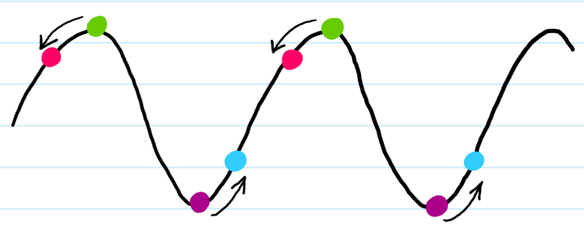


- PHASE DIFFERENCE :: refers to distance b/w any two points on a wave measured either in degrees or in Radians.



- A path diff of 1λ corresponds to a phase diff of $360°$ / 2π rad.

- What are In-phase pts :: Two pts if upon comparision exhibit identical / similar behaviour than they are said to be in phase with each other

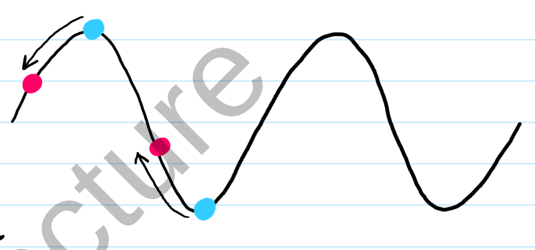


examples could be a Crest if compared with another Crest or a Trough if compared with another trough.

1. For In-phase pts, they must have a path difference of 1λ, 2λ, 3λ, 4λ, 5λ, 6λ, 7λ .... and they must have a corresponding phase difference of 2π, 4π, 6π, 8π, 10π ....

$1\lambda, 2\lambda, 3\lambda, 4\lambda, 5\lambda, 6\lambda, 7\lambda, 8\lambda$ } → In phase
$2\pi, 4\pi, 6\pi, 8\pi, 10\pi$ }

- What are Out-of phase pts :: Two pts if upon comparision exhibit exactly opposite behaviour than they are said to be out-of phase with each other



example could be a Crest if compared with a trough.

2. For Out-of phase pts, they must have a path difference of $\frac{1}{2}\lambda$, $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, $\frac{7}{2}\lambda$, $\frac{9}{2}\lambda$, $\frac{11}{2}\lambda$ ... and $\frac{1}{2}\lambda$, 1·5, 2·5, 3·5, 4·5, $\frac{11}{2}\lambda$
they must have a corresponding phase difference of π, 3π, 5π, 7π, 9π, 11π. $\pi, 3\pi, 5\pi, 7\pi, 9\pi, 11\pi$

Example Question

$v = 640\,ms^{-1}$
$f = 800\,Hz$

Cal. the PHASE DIFF b/w 2 pts on this wave which are seperated by a distance of 0·4 m.

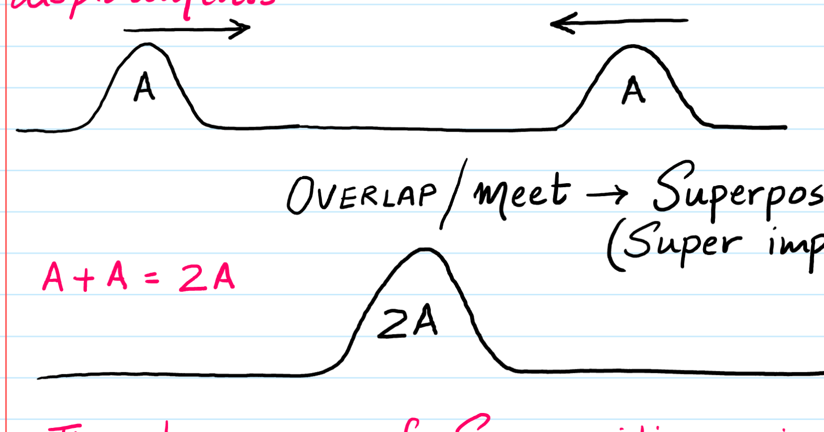
$v = f\lambda$
$\frac{640}{800} = \lambda$ ($\lambda = \frac{v}{f}$)
$\lambda = 0{\cdot}8\,m$

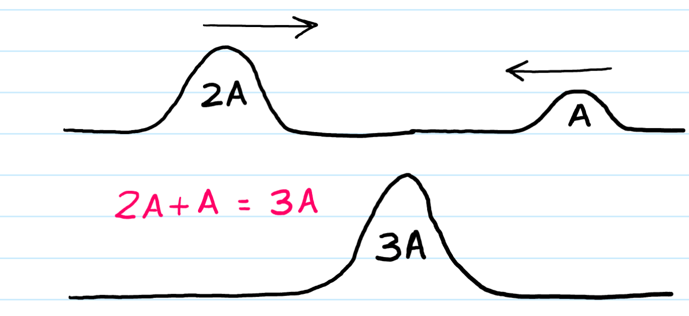
1 wavelength 1λ (0·8m) ⟶ $360°/2\pi$
0·4m ⟶ $180°/\pi$ ANS.

1. Superposition :: Super impose → Two waves → Overlap. / meet / mapping on top of each other

Principle of Superposition :-

According to the principle of Superposition, if two or more waves overlap / meet at a common pt, than the Total displacement due to these waves will be the sum of their individual displacements.





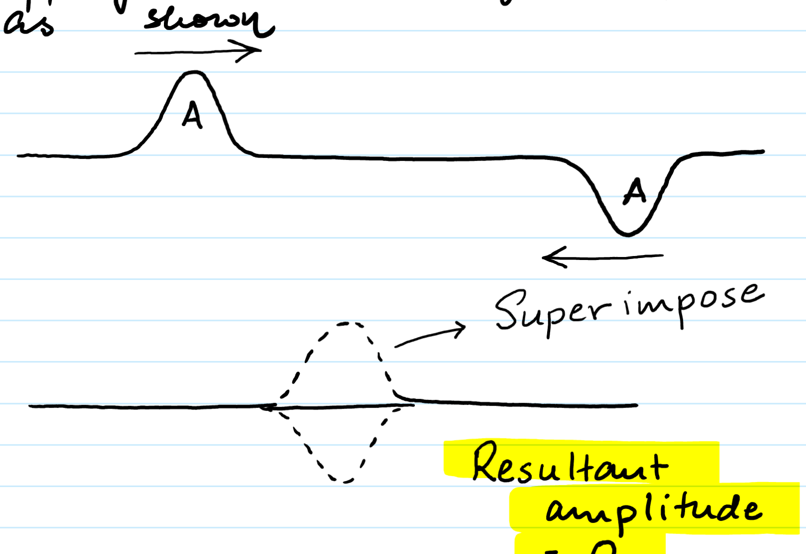
- The phenomena of Superposition gives rise to "INTERFERENCE". The above case can be classified by the term "CONSTRUCTIVE" interference

- Constructive Interference occurs when IN PHASE pts superimpose each other.

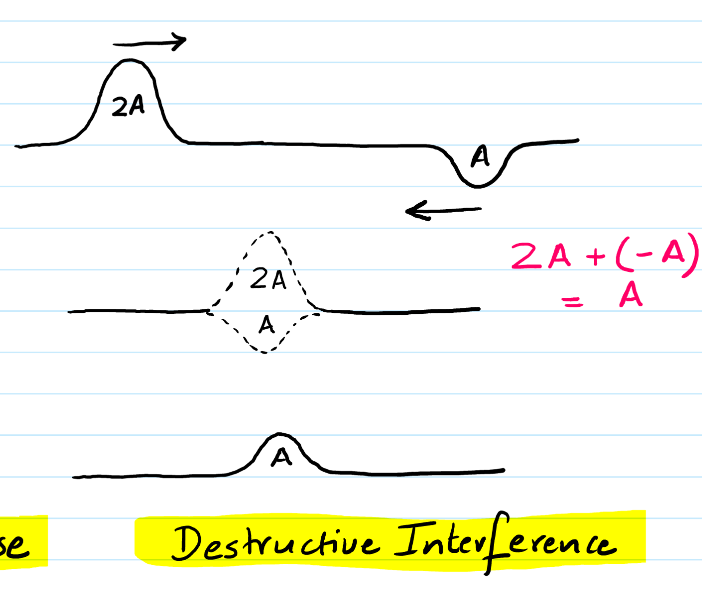
- for Constructive Interference to occur we can say that path diff will be $1\lambda, 2\lambda, 3\lambda, 4\lambda, 5\lambda; 6\lambda$ & phase diff will be $2\pi, 4\pi, 6\pi, 8\pi$....

What about Destructive Interference

Think of a crest amplitude (A) over-Lapping with a Trough amplitude (A). as shown



hence Destructive Interference.



Destructive Interference
Resultant Amp = (A) (decreases)

- for Destructive Interference to occur, out of phase pts must superimpose each other

- for Destructive Interference, the path difference Corresponds to $\frac{1}{2}\lambda$, $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, $\frac{7}{2}\lambda$, $\frac{9\lambda}{2}$ .... and the phase difference Corresponds to π, 3π, 5π, 7π, 9π -