Important Definitions

1) **Amplitude**

The maximum displacement of any particle vibrating on either side of its equilibrium position is called the amplitude.

2) **Time period**

The time taken by a medium particle in completing one oscillation is called the time period. It is represented by T.

3) **Frequency**

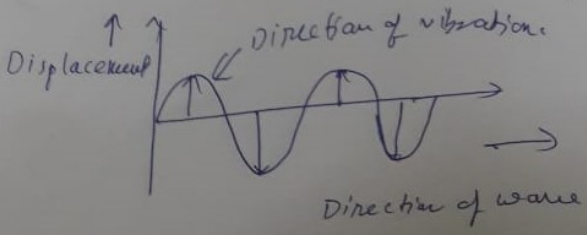
The number of oscillation per second is called frequency. It is denoted by ν

Now, $\nu = \frac{1}{T} = sec^{-1}$

4) **Wave speed**

The distance travelled by the wave per second is called wave speed. It is denoted by v

5) **Phase** The phase of ~~oscillation~~ oscillating particle ~~at~~ at any instant represents the position and direction of vibrating particle at that instant.



Wavelength

The distance moved by a wave in one time-period is called wavelength. It is denoted by λ.

Relation between v, υ and λ

The distance travel in one T is $= \lambda$

Distance travel in one sec $= \frac{\lambda}{T}$

Distance travel by wave in one sec $= v$

$$\frac{\lambda}{T} = v \quad \text{or} \quad \lambda = vT$$

Now, $T = \frac{1}{\upsilon}$, we have,

$$\lambda = v \times \frac{1}{\upsilon}$$

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

~~# The speed of wave in a medium is 500 m/s~~

~~If~~

Calculate the frequency of radio wave transmitted by a station if the wavelength of wave is $\lambda = 200$ m

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If $\psi(x,t)$ is a simple harmonic displacement of an oscillator at position x and time t, we would expect this function to be sine or cosine function.

The bracket $(vt-x)$ has the dimension of a length. Since the argument of a sine or cosine function must have the dimension of radians, the bracket $(vt-x)$ must be multiplied by $2\pi/\lambda$, where λ is a length. Thus we may write

$$\psi(x,t) = A \sin\left[\frac{2\pi}{\lambda}(vt - x)\right]$$

$$y = A \sin\omega\left(t - \frac{x}{v}\right)$$

$$y = A \sin\frac{2\pi}{T}\left(t - \frac{x}{v}\right)$$

$$= A \sin 2\pi\left(\frac{t}{T} - \frac{x}{vT}\right)$$

But $vT = \lambda$

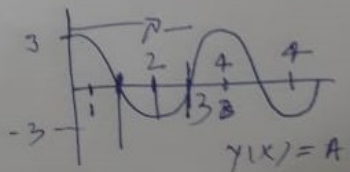
$$y = A \sin 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)$$

$$y = A \sin\frac{2\pi}{\lambda}(vt - x)$$

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

$$y = A \sin\frac{2\pi}{\lambda}(vt - x)$$

$$y = A \sin(\omega t - kx)$$



$$y(x) = A\cos\left(\frac{2\pi}{\lambda}x\right)$$

$$y(x) = 3m\cos\left(\frac{2\pi}{4m}\cdot 0\right) = 3m$$

$$y(2m) = 3m\cos\left(\frac{2\pi}{4m}\cdot 2\right) = 3m\cos(\pi) = -3$$