(from Page-1) Continued. For MJC + MIC: Physics'

Waves in a Liquid. Date - 08.02.2015

∴ From equation (3) we have,

$$p_x = p_{max} \cos \frac{2\pi x}{\lambda} = 0 \text{ and hence,}$$

$$p = p_x \times \cos \frac{2\pi v t}{\lambda} = 0$$

which indicates that there are no changes of Pressure and hence of density, at these points. This shows that at antinodes pressure and density remain normal.

At nodes, however, $\frac{dy}{dx}$ is maximum and therefore

$$\cos \frac{2\pi x}{\lambda} = \pm 1 \text{ where as } p_x = p_{max} \cos \frac{2\pi x}{\lambda} = p_{max}$$

$$\therefore p = \pm p_{max} \cos \frac{2\pi v t}{\lambda} \longrightarrow (4)$$

Therefore Pressure and hence density may be greater or less than the normal value.

At all other points Pressure variation is given by

$$p = p_{max} \cos \frac{2\pi x}{\lambda} \cos \frac{2\pi v t}{\lambda} \longrightarrow (5)$$

and so $p_x = p_{max} \cos \frac{2\pi x}{\lambda}$ ~~cos~~ ~~$\frac{2\pi v t}{\lambda}$~~ is always less than p_{max} i.e the Pressure and density variation at times are always less than at the nodal points.

Thus we see that antinodes of displacement undergoes no variation of Pressure and the nodes of displacement undergo a maximum variation of Pressure. Hence the antinodes of displacement are the nodes of Pressure and vice-versa. As the time elapses the position of antinodes and nodes of displacement remain unchanged and so do the position of an antinodes and nodes of Pressure.

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