"Compression waves in a fluid".

When waves are set up in a fluid the excess Pressure is given by -

$$p = -K \frac{dy}{dx} \longrightarrow (1)$$

where $K (= v^2 \rho)$ is the volume elasticity or bulk modulus of elasticity and $\frac{dy}{dx}$ denotes the volumetric strain for a for a stationary wave in an open end pipe. The equation is

$$y = -2a \sin \frac{2\pi x}{\lambda} \cos \frac{2\pi vt}{\lambda}$$

$$\therefore \frac{dy}{dx} = -\left\{\frac{4\pi a}{\lambda}\right\} \cos \frac{2\pi x}{\lambda} \cos \frac{2\pi vt}{\lambda}$$

$\therefore$ From equation (1) we have, $p = K\left(\frac{4\pi \lambda}{\lambda}\right) \cos \frac{2\pi x}{\lambda} \cos \frac{2\pi vt}{\lambda}$

$$\text{or } p = v^2 \rho \left(\frac{4\pi a}{\lambda}\right) \cos \frac{2\pi x}{\lambda} \cos \frac{2\pi vt}{\lambda}$$

$$= p_{max} \cos \frac{2\pi x}{\lambda} \cos \frac{2\pi vt}{\lambda}$$

$$\text{where } p_{max} = v^2 \rho \left(\frac{4\pi a}{\lambda}\right)$$

$$\therefore p = p_x \cos \frac{2\pi vt}{\lambda} \longrightarrow (2)$$

$$\text{where, } p_x \cos \frac{2\pi x}{\lambda} \longrightarrow (3)$$

It represents the amplitude of Pressure variation at a point distant x from the interface. This is the expression for the excess pressure which indicates that the pressure varies harmonical with time whose

$$\text{period} = \frac{2\pi x}{2\pi v/\lambda} = \frac{\lambda}{v}$$

the same as that of component waves.

Since, at antinodal points $\frac{dy}{dx} = 0$, $\cos \frac{2\pi x}{\lambda} = 0 \rightarrow$

P.T.O.