MIC - Unit II

What is the newton laplace equation for the speed of sound.

$$U = \sqrt{(P/\rho)\,(C_p/C_v)}$$

Since $C_p/C_v = 1.42$ for air, but newton's calculation ~~has~~ has approx 20 percent short of the experimental value for the speed of ~~light~~ sound.

Speed of sound in air →

"The speed of sound depends on the compressibility and inertia of the medium through witch they are travelling."

We have a relation

$$V = \sqrt{\frac{E}{\rho}} \quad \text{--- (I)}$$

where ρ = density of the medium

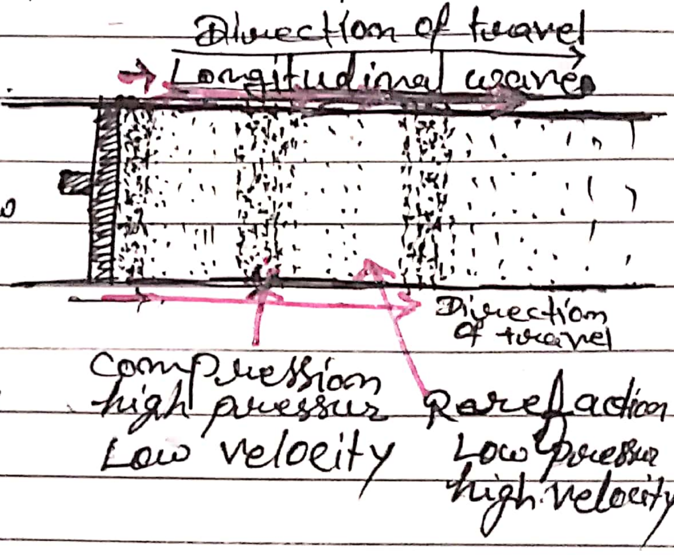
and E = Modulus of elasticity

$$E = \frac{\Delta P}{\Delta V / V} \quad \text{--- (II)}$$

Now Derivation of Newtons formula for speed of sounds

→

$$V = \sqrt{\frac{E}{\rho}} \quad \text{--- (I')}$$



For 'E' — We have boyle's law

$$PV = (P + \Delta P)(V - \Delta V)$$

$$PV = P(V - \Delta V) + \Delta P(V - \Delta V)$$

$$PV = PV - P\Delta V + \Delta PV - \Delta P \Delta V$$

Here $\Delta P \Delta V$ is small value, so neglecting it

$$PV = PV - P\Delta V + \Delta PV$$

or, $P\Delta V = \Delta PV$

then $P = \frac{\Delta P}{\Delta V / V}$ so eqn no (II) can be written as

$$\boxed{E = P}$$

Now eqn (I) becomes

$$\boxed{V = \sqrt{\frac{P}{\rho}}}$$

This formula for gives the value 281 m/s

But Experimental value in gas is 332 m/s