

Answer on Question #81287, Physics / Mechanics | Relativity

Question:

The speed of sound in a medium depends on its wavelength, the young modulus, and the density, of the medium. Use the method of dimensional analysis to derive a formula for the speed of sound in a medium. (Unit for Young Modulus :)

Solution:

The dimensional of Young Modulus E is $\frac{N}{m^2} = \frac{kgm}{s^2m^2} = \frac{kg}{s^2m}$, what means that

$\left(\frac{kg}{s^2m}\right)^\alpha \left(\frac{kg}{m^3}\right)^\beta (m)^\gamma = \frac{m}{s}$ i.e. $\alpha = 0.5 = -\beta$ and $\gamma = 0$, therefore $v = \sqrt{\frac{E}{\rho}}$, where ρ is the density.

The answer:

The speed of sound in a medium $v = \sqrt{\frac{E}{\rho}}$, where ρ is the density.

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