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 $\dfrac{N}{m^2} = \dfrac{kgm}{s^2m^2} = \dfrac{kg}{s^2m}$, what means that

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

The answer:

$$v = \sqrt{\dfrac{E}{\rho}}$$

The speed of sound in a medium , where ρ is the density.