

84. Let ℓ be the length of the rod. Then the time of travel for sound in air (speed v_s) will be $t_s = \ell/v_s$. And the time of travel for compressional waves in the rod (speed v_r) will be $t_r = \ell/v_r$. In these terms, the problem tells us that

$$t_s - t_r = 0.12 \text{ s} = \ell \left(\frac{1}{v_s} - \frac{1}{v_r} \right) .$$

Thus, with $v_s = 343 \text{ m/s}$ and $v_r = 15v_s = 5145 \text{ m/s}$, we find $\ell = 44 \text{ m}$.