Answer on Question #65642, Physics / Mechanics | Relativity |

Consider two cylindrical pipes of equal length. One of these acts as a closed organ pipe and the other as open organ pipe. The frequency of the third harmonic in the closed pipe is 200 Hz higher than the first harmonic of the open pipe. Calculate the fundamental frequency of the closed pipe.

Solution

$L_i = L_{ii} = L$

$v_3{}^i = 200 + v_1{}^{ii}$

$v_1{}^i - ?$

For the closed pipe:

$$L = \frac{n\lambda}{4} = \frac{nc}{4v_n^i}, \qquad v_n^i = \frac{nc}{4L},$$

where, $c = 340$ m/s, for $n = 1$ we have first harmonic, $n = 2$ second harmonic, $n = 3$ third harmonic, etc.

For the open pipe:

$$L = \frac{n\lambda}{2} = \frac{nc}{2v_n^{ii}}, \qquad v_n^{ii} = \frac{nc}{2L}.$$

$$\frac{3 \cdot 340}{4L} = 200 + \frac{340}{2L}, \Longrightarrow L = 0.425 \text{ (m)}.$$

$v_1{}^i = 340/4L = 200$ (Hz)

Answer: 200 Hz