Answer on Question #41995, Physics, Other

The third resonant length of a closed air column is 80 cm. Determine the length of column that will produce the second resonance?

Solution:

Given:

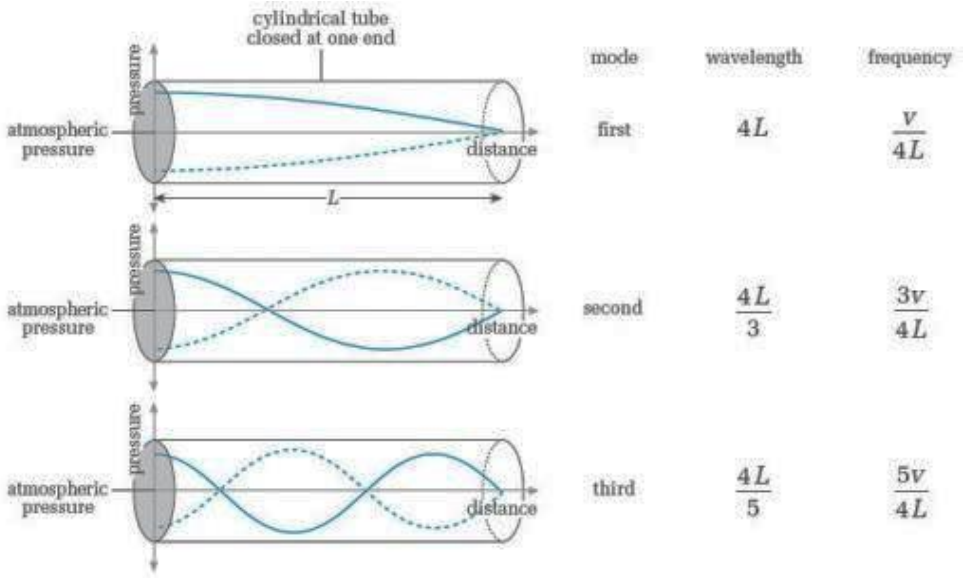
$L_3 = \frac{5}{4}\lambda = 80$ cm,

$L_2 = \frac{3}{4}\lambda = ?$

If an air column is closed at one end and open at the other, it is referred to as a closed air column.

The closed end is constrained to be a node of the wave and the open end is of course an antinode. This makes the fundamental mode such that the wavelength is four times the length of the air column.

When the resonance first occurs, the column is 1/4 λ in length, since a single loop and node are formed. The next possible lengths with a node at one end and a loop at the other are 3/4 λ, 5/4 λ , and so on. Thus, the resonant lengths in a closed air column occur at 1/4 λ , 3/4 λ , 5/4 λ, and so on.



From given data:

$$L_3 = \frac{5}{4}\lambda = 80 \text{ cm}$$

Thus, the second resonant length is

$$L_2 = \frac{3}{4}\lambda = \frac{80}{5} \cdot 3 = 48 \text{ cm}$$

Answer. 48 cm.