

21.47. Model: The fundamental wavelength of an open-open tube is $2L$ and that of an open-closed tube is $4L$.
Solve: We are given that

$$\begin{aligned} f_{1 \text{ open-closed}} &= f_{3 \text{ open-open}} = 3f_{1 \text{ open-open}} \\ \Rightarrow \frac{v_{\text{air}}}{\lambda_{1 \text{ open-closed}}} &= 3 \frac{v_{\text{air}}}{\lambda_{1 \text{ open-open}}} \Rightarrow \frac{1}{4L_{\text{open-closed}}} = \frac{3}{2L_{\text{open-open}}} \\ \Rightarrow L_{\text{open-closed}} &= \frac{2L_{\text{open-open}}}{12} = \frac{2(78.0 \text{ cm})}{12} = 13.0 \text{ cm} \end{aligned}$$