

38. (a) Using Eq. 18-39 with  $n = 1$  (for the fundamental mode of vibration) and 343 m/s for the speed of sound, we obtain

$$f = \frac{(1)v_{\text{sound}}}{4L_{\text{tube}}} = \frac{343 \text{ m/s}}{4(1.20 \text{ m})} = 71.5 \text{ Hz} .$$

- (b) For the wire (using Eq. 17-53) we have

$$f' = \frac{nv_{\text{wire}}}{2L_{\text{wire}}} = \frac{1}{2L_{\text{wire}}} \sqrt{\frac{\tau}{\mu}}$$

where  $\mu = m_{\text{wire}}/L_{\text{wire}}$ . Recognizing that  $f = f'$  (both the wire and the air in the tube vibrate at the same frequency), we solve this for the tension  $\tau$ :

$$\tau = (2L_{\text{wire}}f)^2 \left( \frac{m_{\text{wire}}}{L_{\text{wire}}} \right) = 4f^2 m_{\text{wire}} L_{\text{wire}} = 4(71.5 \text{ Hz})^2 (9.60 \times 10^{-3} \text{ kg}) (0.33 \text{ m}) = 64.8 \text{ N} .$$