33. (a) When the string (fixed at both ends) is vibrating at its lowest resonant frequency, exactly one-half of a wavelength fits between the ends. Thus, $\lambda = 2L$. We obtain $v = f\lambda = 2Lf = 2(0.220\,\mathrm{m})(920\,\mathrm{Hz}) = 405\,\mathrm{m/s}$.

(b) The wave speed is given by $v = \sqrt{\tau/\mu}$, where τ is the tension in the string and μ is the linear mass density of the string. If M is the mass of the (uniform) string, then $\mu = M/L$. Thus $\tau = \mu v^2 = (M/L)v^2 = \left[(800 \times 10^{-6}\,\mathrm{kg})/(0.220\,\mathrm{m})\right](405\,\mathrm{m/s})^2 = 596\,\mathrm{N}$.

(c) The wavelength is $\lambda = 2L = 2(0.220\,\mathrm{m}) = 0.440\,\mathrm{m}$.

(d) The frequency of the sound wave in air is the same as the frequency of oscillation of the string. The wavelength is different because the wave speed is different. If v_a is the speed of sound in air the wavelength in air is $\lambda_a = v_a/f = (343\,\mathrm{m/s})/(920\,\mathrm{Hz}) = 0.373\,\mathrm{m}$.