36. (a) Using Eq. 17-53 with $n = 1$ (for the fundamental mode of vibration), we obtain

$$\frac{f'}{f} = \frac{(1)v/2L'}{(1)v/2L} = \frac{L}{L'}$$

so that $f' = rf$ (where r is a pure number) implies $L' = L/r$. Thus, the amount if must be shortened is $l = \Delta L = L - L' = L(1 - 1/r)$.

(b) With $L = 80$ cm and $r = 1.2$, this yields $l = 13$ cm.

(c) Since $v = f\lambda$, the ratio of wavelengths is the reciprocal of the ratio of frequencies: $\lambda'/\lambda = f/f' = 1/1.2 = 5/6$. This ratio applies to the wavelength ratio for the vibrating string and also for the wavelength ratio for the emitted sound waves (due to the fact that the frequency of a signal is generally not altered when transmitted from one medium to another).