Answer to Question #67616, Physics / Mechanics | Relativity

Question: A guitar string has a linear density of 7.16 gm/ m and is under tension of 152N.The fixed supports of the string are 89.3 cm apart. If it vibrates in three segments, calculate the speed,wavelength and frequency of the standing wave.

Solution:

Tension $T = 152$ N

Length of the string $L = 89.3\ cm = 0.893\ m$

The linear density of the string $\rho = 7.16\frac{g}{m} = 0.00716\frac{kg}{m}$

In general the wave propagates the string with the speed

$$\boldsymbol{\vartheta = \sqrt{\frac{T}{\rho}} = 145.702\frac{m}{s}}$$

If the string has two ends fixed and vibrates in three segments then

$$\boldsymbol{f = 3f_{fundamental} = \frac{3\vartheta}{2L} = 244.74\ s^{-1}}$$

and the wavelength is then calculated as

$$\boldsymbol{\lambda = \frac{\vartheta}{f} = \frac{2L}{3} = 0.595\ m}$$