

Answer on Question #54955-Physics-Mechanics-Kinematics-Dynamics

Two identical guitar strings are prepared such that they have the same length (1.91 m) and are under the same amount of tension. The first string is plucked at one location, primarily exciting the 3rd harmonic. The other string is plucked in a different location, primarily exciting the 5th harmonic. The resulting sounds give rise to a beat frequency of 333 Hz. What is the wave propagation speed on the guitar strings? Please answer in m/s.

Solution

The frequencies of third and fifth harmonic are

$$f_5 = 5f \text{ and } f_3 = 3f,$$

where f is fundamental frequency.

Thus,

$$5f - 3f = 2f = 333 \text{ Hz.}$$

The fundamental frequency is

$$f = \frac{333 \text{ Hz}}{2}.$$

We know that

$$f = \frac{v}{2L}.$$

The wave propagation speed on the guitar strings is

$$v = 2fL = 2 \frac{333 \text{ Hz}}{2} 1.91 \text{ m} = 636 \frac{\text{m}}{\text{s}}.$$

Answer: $636 \frac{\text{m}}{\text{s}}$.