

Example 7

A guitar string produces 4 beats per second when tuned with a 350 Hz tuning fork and 9 beats per second when tuned with a 355 Hz tuning fork. What is the actual frequency of the guitar?



Frequency is 346 Hz

Velocity of a String:

Example 8

A metal guitar string has a linear mass density of $(m/L) = 3.2 \times 10^{-2}$ g/cm. What is the velocity of a wave produced by this string when its tension is 90.0 N?

$$v = \sqrt{\frac{F_T}{m/L}}$$

$$m/L = 3.2 \times 10^{-3} \text{ kg/m}$$

$$F_T = 90.0 \text{ N}$$

$$v = \sqrt{\frac{90}{3.2 \times 10^{-3}}}$$

$v = 168 \text{ m/s}$

Example 9

When the tension in a particular cord is 75 N, the wave velocity is 130 m/s. If the length of the cord itself is approximately 26 inches (1 in = 25.4 mm), what is the mass of the cord?

$$v = \sqrt{\frac{F_T}{m/L}}$$

$$v = \sqrt{\frac{F_T \cdot L}{m}}$$

$$v^2 = \frac{F_T \cdot L}{m}$$

$$v^2 \cdot m = F_T \cdot L$$

$$m = \frac{F_T \cdot L}{v^2}$$

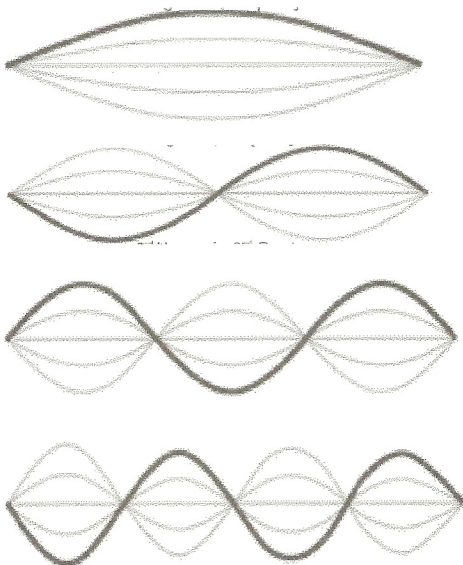
$$m = \frac{(75) \cdot (0.6604)}{(130)^2}$$

$m = 2.93 \times 10^{-3} \text{ kg}$

 $L = 26 \text{ in} = 0.6604 \text{ m}$

26 in	25.4 mm	1 m	= 0.6604 m
1 in	1000 mm		

Standing Waves: Strings



Fundamental (First harmonic) (lowest freq.)

Number of loops = 1
 f_1

Second Harmonic (First overtone)

Number of loops = 2
 $f_2 = 2 \cdot f_1$

Third Harmonic (Second overtone)

Number of loops = 3
 $f_3 = 3 \cdot f_1$

Fourth Harmonic (Third overtone)

Number of loops = 4
 $f_4 = 4 \cdot f_1$