Speed of Sound

- Speed of a wave on a string:

$$v = \sqrt{\frac{T}{\mu}}$$

- T is tension sometimes listed as F for force on string.
- μ is the density of the string mass/length

$$v = \sqrt{\frac{T}{\mu}} \quad \text{and } f = v/\lambda$$

If wavelength is fixed, how does frequency change if v goes up?

a. Goes up
b. Goes down

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If the string is fatter - bigger μ, does the speed go up or down?

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b. Goes down

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b. Goes down

So, the frequency for a fatter string of the same length is?

a. Lower

b. higher

$$v = \sqrt{\frac{T}{\mu}} \text{ and } f = v/\lambda$$

If wavelength is fixed, how does frequency change if v **goes up**?

a. Goes up

b. Goes down

If you tighten a string, the speed

a. Goes up

b. Goes down

$$v = \sqrt{\frac{T}{\mu}} \quad \text{and } f = v/\lambda$$

If wavelength is fixed, how does frequency change if v **goes up**?

a. Goes up

b. Goes down

If you tighten a string, the speed

a. Goes up

b. Goes down

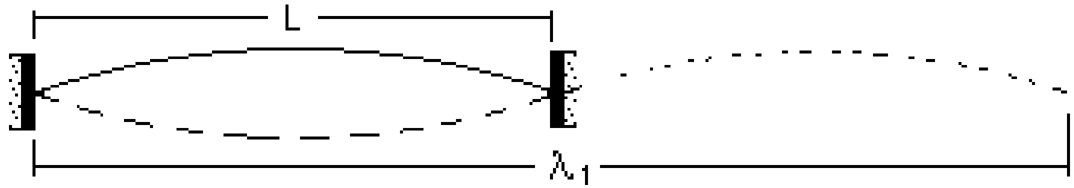
So, the frequency for a tighter string of the same length is?

a. Lower

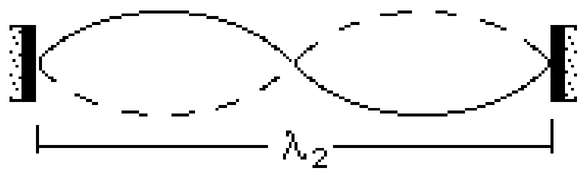
b. higher

$$f = v/\lambda$$

1st harmonic $\lambda_1 = 2L$

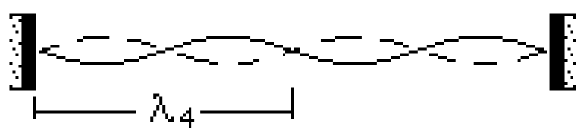


2nd harmonic $\lambda_2 = L$



3rd harmonic $\lambda_3 = 2/3L$

4th harmonic $\lambda_4 = 1/2L$



Nth harmonic $\lambda_n = 2L/n$ so $f = nv/(2L)$

In air

$$v = 331\, m/s \sqrt{1 + \frac{T}{273}}$$

If the air is hotter, is the speed of sound

a. Faster
b. slower

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Does hotter air have more collisions or less than colder air?

a. More

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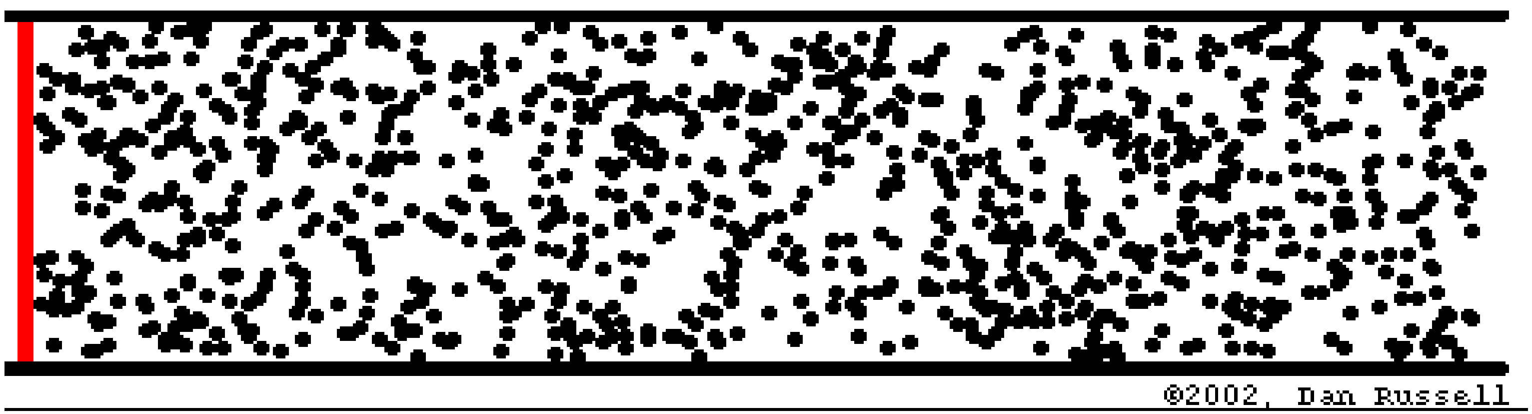

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a. More

b. less

$$V^2 = \frac{\text{rigidity}}{\text{Inertia}}$$

$$v = \sqrt{\frac{T}{\mu}}$$

Material	Speed of sound	
Air (0°C)	331 m/s	
Air (20°C)	343 m/s	
hydrogen	1290 m/s	
Water	1490 m/s	
Aluminum	5100 m/s	
Lead	1320 m/s	
Rubber	54 m/s	