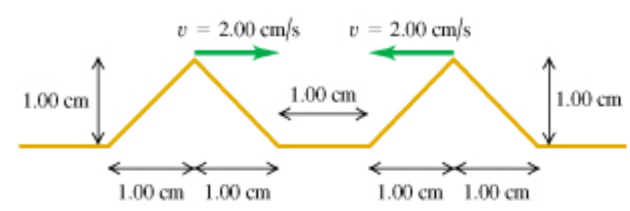
#41 Interference and Standing Waves Post-Class

Due: 11:00am on Friday, November 30, 2012

Note: You will receive no credit for late submissions. To learn more, read your instructor's Grading Policy

Exercise 15.32

Two triangular wave pulses are traveling toward each other on a stretched string as shown in the figure . Each pulse is identical to the other and travels at 2.00 $\mathrm{cm/s}$. The leading edges of the pulses are 1.00 cm apart at t = 0.



Part A

Sketch the shape of the string at t = 0.250s.

ANSWER:

Correct

Part B

Sketch the shape of the string at t = 0.500s.

ANSWER:

Correct

Part C

Sketch the shape of the string at t= 0.750s.

ANSWER:

Correct

Part D

Sketch the shape of the string at t = 1.000s.

ANSWER:

Correct

Part E

Sketch the shape of the string at t = 1.250s.

ANSWER:

Correct

Fundamental Wavelength and Frequency Ranking Task

A combination work of art/musical instrument is illustrated. Six pieces of identical piano wire (cut to different lengths) are hung from the same support, and masses are hung from the free end of each wire. Each wire is 1, 2, or 3 units long, and each supports 1, 2, or 4 units of mass. The mass of each wire is negligible compared to the total mass hanging from it. When a strong breeze blows, the wires vibrate and create an eerie sound.

Part A

Rank each wire-mass system on the basis of its fundamental wavelength.

Rank from largest to smallest. To rank items as equivalent, overlap them.

Hint 1. Identify the fundamental wavelength

For any wave on a wire of length L, the fundamental wavelength is the longest wave that "fits" on the wire, with a node at both fixed ends.

Recall that a node is a place where the wave has zero amplitude. (Although the bottom of each wire is not absolutely fixed, the inertia of the mass hanging from the end causes it to remain relatively fixed compared to the vibration of the wire.)

What is the longest wave that can fit on a wire of length L?

ANSWER:

- ○ $4L$
- ◉ $2L$
- ○ L
- ○ $L/2$
- ○ $L/4$

ANSWER:

Correct

Part B

Rank each wire-mass system on the basis of its wave speed.

Rank from largest to smallest. To rank items as equivalent, overlap them.

Hint 1. Factors that determine wave speed

The speed v of a wave on a wire depends on only two factors, the tension T in the wire and the linear mass density μ of the wire:

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

Basically, light wires under high tension carry very fast waves whereas heavy wires under low tension carry slower moving waves.

The piano wires in this question all have identical linear mass density.

Hint 2. Tension in the wires

Since the masses hanging from each wire are in equilibrium, the tension in each wire is equal to the total weight of the masses hanging from it.

ANSWER:

Correct

Part C

Rank each wire-mass system on the basis of its fundamental frequency.

Rank from largest to smallest. To rank items as equivalent, overlap them.

Hint 1. Find an equation for the fundamental frequency

Let L be the length of the wire, T the tension in the wire, and μ the linear mass density of the wire. Combine the result for the fundamental wavelength,

$$\lambda = 2L,$$

and the result for determining the wave speed,

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

with the relationship among these quantities and frequency f,

$$f = \frac{v}{\lambda},$$

to yield an equation for the fundamental frequency f_0.

Enter an expression for the fundamental frequency in terms of some or all of the variables L, T, and μ.

ANSWER:

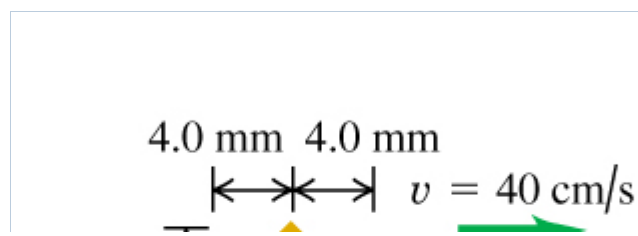
f_0 = $\frac{1}{2L}\sqrt{\frac{T}{\mu}}$

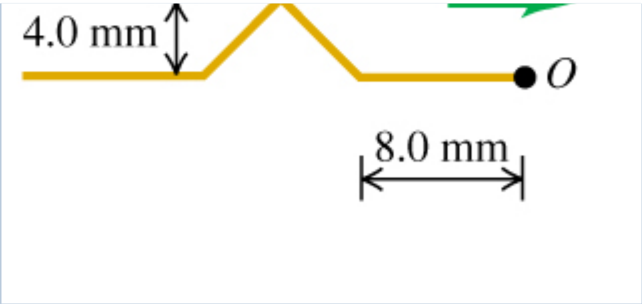
ANSWER:

Correct

Exercise 15.30

A wave pulse on a string has the dimensions shown in the figure at t = 0. The wave speed is 40 $\mathrm{cm/s}$.





Part A

If point O is a fixed end, draw the total wave on the string at t = 15ms.

ANSWER:

Correct

Part B

If point O is a fixed end, draw the total wave on the string at t = 20 ms.

ANSWER:

Correct

Part C

If point O is a fixed end, draw the total wave on the string at t = 25 ms.

ANSWER:

All attempts used; correct answer displayed

Part D

If point O is a fixed end, draw the total wave on the string at t = 30 ms.

ANSWER:

Correct

Part E

If point O is a fixed end, draw the total wave on the string at t = 35 ms.

ANSWER:

Correct

Part F

If point O is a fixed end, draw the total wave on the string at t = 40 ms.

ANSWER:

Correct

Part G

If point O is a fixed end, draw the total wave on the string at t = 45 ms.

ANSWER:

Correct

Part H

Repeat part A for the case in which point O is a free end for t=15 ms.

ANSWER:

Correct

Part I

Repeat part B for the case in which point O is a free end for t=20 ms.

ANSWER:

Correct

Part J

Repeat part C for the case in which point O is a free end for t=25 ms.

ANSWER:

Correct

Part K

Repeat part D for the case in which point O is a free end for t=30 ms.

ANSWER:

Answer Requested

Part L

Repeat part E for the case in which point O is a free end for t=35 ms.

ANSWER:

Correct

Part M

Repeat part F for the case in which point O is a free end for t=40 ms.

ANSWER:

Correct

Part N

Repeat part G for the case in which point O is a free end for t=45 ms.

ANSWER:

Correct

Score Summary:

Your score on this assignment is 94.2%.
You received 28.26 out of a possible total of 30 points.