

#42 Normal Modes Post-Class

Due: 11:00am on Monday, December 3, 2012

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

Exercise 15.37

Standing waves on a wire are described by $y(x, t) = (A_{\text{SW}} \sin kx) \sin \omega t$, with $A_{\text{SW}} = 2.10 \text{ mm}$, $\omega = 989 \text{ rad/s}$, and $k = 0.800\pi \text{ rad/m}$. The left end of the wire is at $x = 0$.

Part A

At what distances from the left end are the nodes of the standing wave.

ANSWER:

- ☐ $x_{\text{node}} = 0.625 + (1.25 \text{ m})n$, $n = 0, 1, 2, \dots$
- ☒ $x_{\text{node}} = (1.25 \text{ m})n$, $n = 0, 1, 2, \dots$
- ☐ $x_{\text{node}} = (0.625 \text{ m})n$, $n = 0, 1, 2, \dots$
- ☐ $x_{\text{node}} = (1.25 \text{ cm})n$, $n = 0, 1, 2, \dots$

Correct

Part B

At what distances from the left end are the antinodes of the standing wave?

ANSWER:

- ☐ $x_{\text{antinode}} = 1.25 \text{ m} + (1.25 \text{ m})n, n = 0, 1, 2, \dots$
- ☐ $x_{\text{antinode}} = 0.625 \text{ cm} + (1.25 \text{ cm})n, n = 0, 1, 2, \dots$
- ☒ $x_{\text{antinode}} = 0.625 \text{ m} + (1.25 \text{ m})n, n = 0, 1, 2, \dots$
- ☐ $x_{\text{antinode}} = 0.625 \text{ m} + (0.625 \text{ m})n, n = 0, 1, 2, \dots$

Correct

Exercise 15.40

A rope of length 1.41 m is stretched between two supports with a tension that makes the transverse waves have a speed of 47.7 m/s .

Part A

What is the wavelength of the fundamental harmonic?

ANSWER:

$$\lambda = 2.82 \text{ m}$$

Correct

Part B

What is the frequency of the fundamental harmonic?

ANSWER:

$$f = 16.9 \text{ Hz}$$

Correct

Part C

What is the wavelength of the second overtone?

ANSWER:

$$\lambda = 0.940 \text{ m}$$

Correct

Part D

What is the frequency of the second overtone?

ANSWER:

$$f = 50.7 \text{ Hz}$$

Correct

Part E

What is the wavelength of the fourth harmonic?

ANSWER:

$$\lambda = 0.705 \text{ m}$$

Correct

Part F

What is the frequency of the fourth harmonic?

ANSWER:

$$f = 67.7 \text{ Hz}$$

Correct

Exercise 15.50: Waves on a Stick

A flexible stick 5.0 m long is not fixed in any way and is free to vibrate.

Part A

Find the wavelengths of the first harmonic. (*Hint:* Should the ends be nodes or antinodes?)

Express your answer using two significant figures.

ANSWER:

$$\lambda_1 = 10 \text{ m}$$

Correct

Part B

Find the wavelengths of the second harmonic. (*Hint:* Should the ends be nodes or antinodes?)

Express your answer using two significant figures.

ANSWER:

$$\lambda_2 = 5.0 \text{ m}$$

Correct

Part C

Find the wavelengths of the third harmonic. (*Hint:* Should the ends be nodes or antinodes?)

Express your answer using two significant figures.

ANSWER:

$$\lambda_3 = 3.3 \text{ m}$$

Correct

Score Summary:

Your score on this assignment is 100%.

You received 30 out of a possible total of 30 points.