

Answer on Question 73453, Physics, Other

Question:

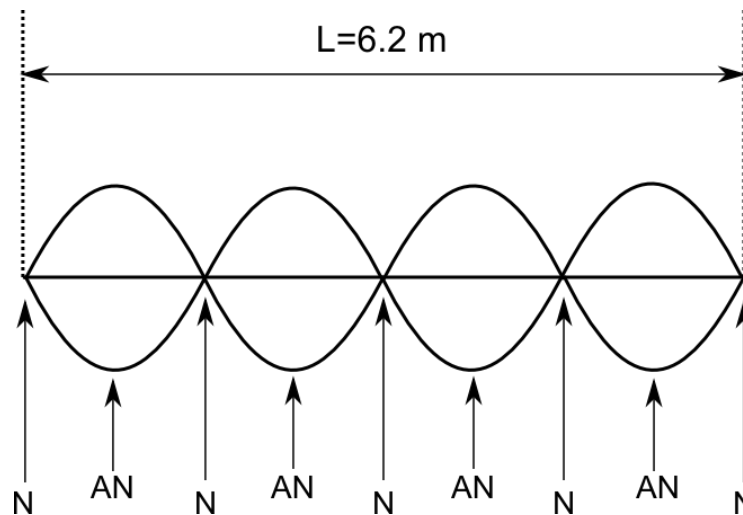
In a physics demonstration, Mr. H establishes a standing wave pattern in a snakey (long spring) by vibrating it up and down with 32 vibrations in 10 seconds. Gerald is holding the opposite end of the snakey and it's standing 6.2 m from Mr.H's end. There are 4 equal length sections in the snakey, each occupied by an antinode. Determine the frequency, wavelength, and speed of the wave.

Solution:

a) The frequency can be found as follows:

$$f = \frac{32 \text{ vibrations}}{10 \text{ seconds}} = 3.2 \text{ Hz.}$$

b) In the picture below we can see the standing wave pattern in the long string:



As we can see from the picture there are 5 nodes (depicted as N) and 4 antinodes (depicted as AN) in a distance of 6.2 m. Also, we can see from the picture that there are four loops. One complete wave in a standing wave pattern consists of two loops. Therefore, the length of the string is equal to two wavelengths of the wave:

$$L = \frac{1}{2}n\lambda = \frac{4}{2}\lambda = 2\lambda,$$

here, $L = 6.2 \text{ m}$ is the length of the string, $n = 4$ is the number of the loops, λ is the wavelength.

Then, from this formula we can find the wavelength of the wave:

$$\lambda = \frac{L}{2} = \frac{6.2 \text{ m}}{2} = 3.1 \text{ m.}$$

c) We can find the speed of the wave from the wave speed formula:

$$v = f\lambda,$$

here, v is the speed of the wave, $f = 3.2 \text{ Hz}$ is the frequency and $\lambda = 3.1 \text{ m}$ is the wavelength.

Let's substitute the numbers:

$$v = f\lambda = 3.2 \text{ Hz} \cdot 3.1 \text{ m} = 9.92 \text{ ms}^{-1}.$$

Answer:

a) $f = 3.2 \text{ Hz}$.

b) $\lambda = 3.1 \text{ m}$.

c) $v = 9.92 \text{ ms}^{-1}$.

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