

Answer on Question 73645, Physics / Mechanics | Relativity

Question

A sinusoidal wave is described by $y(x,t) = 3.0 \sin (5.95t - 4.20x)$ cm where x is the position along the wave propagation. Determine the amplitude, wave number, wavelength, frequency and velocity of the wave. (express in answer in meters not centimeter)

Solution. In the general case a sinusoidal wave is described by

$$y(x,t) = y_0 \sin(\omega t - kx)$$

where y_0 is the amplitude, ω is the angular frequency, k is the wave number

In this problem we have

$$y(x,t) = 3 \sin(5.95t - 4.20x)$$

Then we get:

the amplitude of the wave is $y_0 = 3.0$ cm = 0.03 m

the wave number of the wave is $k = 4.20 \text{ cm}^{-1} = 420 \text{ m}^{-1}$

the wavelength of the wave is $\lambda = \frac{2\pi}{k} = \frac{2\pi}{420 \text{ m}^{-1}} = 0.015 \text{ m}$

the angular frequency of the wave is $\omega = 5.95 \text{ s}^{-1}$

the frequency of the wave is $f = \frac{\omega}{2\pi} = \frac{5.95 \text{ s}^{-1}}{2\pi} = 0.95 \text{ Hz}$

the velocity of the wave is $v = \frac{\omega}{k} = \frac{5.95 \text{ s}^{-1}}{420 \text{ m}^{-1}} = 0.014 \text{ m/s}$

Answer: the amplitude, wave number, wavelength, frequency and velocity of the wave are

$$y_0 = 0.03 \text{ m}$$

$$k = 420 \text{ m}^{-1}$$

$$\lambda = 0.015 \text{ m}$$

$$f = 0.95 \text{ Hz}$$

$$v = 0.014 \text{ m/s}$$

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