

Answer on Question 76547, Physics, Other

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.

Solution:

The general equation describing a sinusoidal wave looks like:

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

here, A is the amplitude of the wave, ω is the angular frequency of the wave, k is the wave number.

a) As we can see from the equation above, the amplitude of the wave is $A = 0.03$ m.

b) The wave number is $k = 4.20 \frac{\text{rad}}{\text{cm}} = 420 \frac{\text{rad}}{\text{m}}$.

c) We can find the wavelength from the formula:

$$k = \frac{2\pi}{\lambda},$$

here, λ is the wavelength of the wave.

Then, we get:

$$\lambda = \frac{2\pi}{k} = \frac{2\pi}{420 \frac{\text{rad}}{\text{m}}} = 0.015 \text{ m}.$$

d) We can find frequency of the wave from the formula:

$$\omega = 2\pi f,$$

here, ω is the angular frequency of the wave, f is the frequency of the wave.

Then, we get:

$$f = \frac{\omega}{2\pi} = \frac{5.95 \frac{\text{rad}}{\text{s}}}{2\pi} = 0.95 \text{ Hz}.$$

e) We can find the velocity of the wave from the wave speed formula:

$$v = f\lambda = 0.95 \text{ Hz} \cdot 0.015 \text{ m} = 0.014 \frac{\text{m}}{\text{s}}$$

Answer:

a) $A = 0.03 \text{ m}$.

b) $k = 420 \frac{\text{rad}}{\text{m}}$.

c) $\lambda = 0.015 \text{ m}$.

d) $f = 0.95 \text{ Hz}$.

e) $v = 0.014 \frac{\text{m}}{\text{s}}$.

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