Answer on Question #69409 -Physics / Other

A transverse wave of amplitude $A = 2$ cm is generated at $x = 0$ and $t = 0$ in a long string by a tuning fork of frequency $f = 500$ Hz. At a particular time, the displacement of the particles at $x = 20$ cm and $x = 40$ cm are -1.0 cm and 1.0 cm respectively Calculate the wavelength and velocity of the wave. express the displacement in terms of wave velocity, if the wave travels along the positive x direction and $x = 0$ signifies the equilibrium position.

Solution

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

$$\omega = 2\pi f$$

$$y_1(x_1,t) = A\sin(\omega t - kx_1) = -1 \text{ cm}.$$

$$y_2(x_2,t) = A\sin(\omega t - kx_2) = 1 \text{ cm}.$$

$$\omega t - kx_1 = \omega t - kx_2 + \pi$$

$$k(x_2 - x_1) = \pi$$

$$\frac{2\pi}{\lambda}(x_2 - x_1) = \pi$$

$$\lambda = 2(x_2 - x_1) = 2(40 - 20) = 40 \text{ cm}.$$

The speed of the wave

$$v = \lambda \cdot f = 0.4{\times}500 = 200\ \frac{\text{m}}{\text{s}}.$$

Answers: $\lambda = 0.4$ m, $v = 200\ \frac{\text{m}}{\text{s}}$.

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