Physics 102-Rec
Quiz#1-Sect.23
Chapter 16

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Name: Key Id:

1. A sinusoidal wave is traveling in the negative x-direction with a speed of 20 m/s on a stretched string. The particles in the string have maximum transverse accelecration of 30 m/s^2.
   (a) Find the amplitude of this wave if the wavelength is 0.1 m.

$v = 20$ m/s $\quad a_{max} = 30$ m/s^2

$a_{max} = \omega^2 y_m \qquad y_m = \dfrac{a_{max}}{\omega^2}$

$\omega = 2\pi f = 2\pi\left(\dfrac{v}{\lambda}\right) = 2\pi\left(\dfrac{20}{0.1}\right) = 400\pi$ rad/s

$y_m = \dfrac{30}{(400\pi)^2} = 1.89 \times 10^{-5}$ m

   (b) Find the displacement of the particle in the string at x = 0.125 m and t = 0, knowing that $y(0,0) = y_m$.

$y(x,t) = y_m \sin(kx + \omega t + \phi)$

$y(0,0) = y_m = y_m \sin\phi \Rightarrow \phi = \dfrac{\pi}{2}$

$k = \dfrac{2\pi}{\lambda} = \dfrac{2\pi}{0.1} = 20\pi$ m^{-1}

$\omega = 400\pi$ rad/s

$y(x,t) = 1.9 \times 10^{-5} \sin\left(20\pi x + 400\pi t + \dfrac{\pi}{2}\right)$

$y(0.125, t) = 1.9 \times 10^{-5} \sin\left(20\pi \times 0.125 + \dfrac{\pi}{2}\right)$

$= 0$ (the particle at this time has zero displacement)