Physics 102
Quiz # 1
Chapter 17

Name : Solution Id : Sec. # :

The linear density of a string is 1.6×10^{-3} g/cm. A transverse wave is propagating on the string and is described by the following equation:

$$y(x,t) = (0.02\,\text{m})\sin\left[(2.0\,\text{m}^{-1})x + (30\,\text{s}^{-1})t\right].$$

a) Write an expression for the transverse speed of the particles of the string.

$$u = \frac{\partial y}{\partial t}$$

$$= (0.02\ \text{m})(30\ \text{s}^{-1})\cos\left[2x + 30t\right]$$

$$= \left(0.6\ \frac{\text{m}}{\text{s}}\right)\cos\left[(2.0\ \text{m}^{-1})x + (30\ \text{s}^{-1})t\right]$$

b) What is the tension on the string?

$$v = \sqrt{\frac{\tau}{\mu}} \quad \Rightarrow \quad \tau = v^2\mu$$

$$\mu = 1.6 \times 10^{-3}\ \frac{\text{g}}{\text{cm}} = 1.6 \times 10^{-4}\ \frac{\text{kg}}{\text{m}}$$

$$v = \frac{\omega}{k} = -\frac{30}{2} = -15\ \frac{\text{m}}{\text{s}}$$

$$\Rightarrow \tau = (-15)^2 \times (1.6 \times 10^{-4})$$

$$\boxed{\tau = 0.036\ \text{N}}$$