Chapter 17

Problem 98

$L = 24.00\,cm \qquad m = 0.860\,g$

$f_1 = 1.00\,kHz$

a) What is the speed of the wave?

With the fundamental

$$\lambda_1 = \frac{2L}{n} = \frac{2L}{1} = 2(0.24m) = 0.48m$$

from the wave velocity

$$v = \lambda \cdot f = (0.48_m)(1.00\times10^3\,Hz) = 480\,\frac{m}{s}$$

$$\boxed{v = 480\ m/s}$$

b) What is the tension of the string?

$$\mu = \frac{m}{L} = \frac{0.860\times10^{-3}\,kg}{0.24\,m} = 3.58\times10^{-3}\,\frac{kg}{m}$$

The velocity of the wave on the string is

$$v = \sqrt{\frac{F_T}{\mu}} \rightarrow v^2 = \frac{F_T}{\mu}$$

$$F_T = \mu v^2 = \left(3.58\times10^{-3}\,\frac{kg}{m}\right)\left(480\,m/s\right)^2$$

$$F_T = 825\,N$$

$$\boxed{F_T = 825\ N}$$