Name _____

Physics 121, Section 1 .....Quiz #6

1. Suppose, in an experiment similar to the one you did on transverse waves, we oscillate the end of a stretched string at a frequency of 150 Hz and see the standing wave pattern pictured at the right. The string has a length of 1.20 m and is under a tension of 17.0 N.

$L = 1.20\ m$

a) Find the wavelength of these waves.

The standing wave pattern contains 5 (count 'em, 5) half-wavelengths.

Therefore $L = 5 \cdot \frac{\lambda}{2} \Rightarrow \lambda = \frac{2}{5} L = \frac{2}{5}(1.20\ m) = \boxed{0.48\ m}$

b) Find the speed of these waves on the string.

If the associated frequency is 150 Hz, then

$v = \lambda f = (0.48\ m)(150\ s^{-1}) = \boxed{72\ m/s}$

(Kinda slow, but just play along...)

c) Find the mass density, $\frac{m}{L}$, of the string.

Since $v = \sqrt{\frac{F}{(\frac{m}{L})}}$, we get: $v^2 = \frac{F}{(\frac{m}{L})}$, or:

$$\left(\frac{m}{L}\right) = \frac{F}{v^2} = \frac{17.0\ N}{(72\ m/s)^2} = \boxed{3.28 \times 10^{-3}\ kg/m}$$

d) What is the *fundamental* (lowest) frequency for this string?

The lowest frequency has $L = \frac{\lambda}{2}$,

so

$$f_0 = \frac{v}{\lambda_0} = \frac{72\ m/s}{2L} = \frac{72\ m/s}{2(1.2\ m)}$$

$$= \boxed{30\ Hz}$$

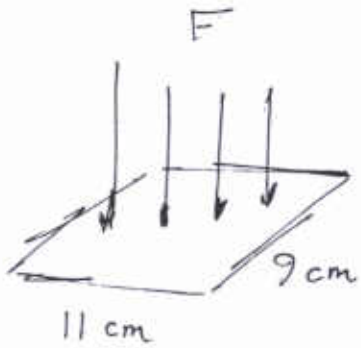
2. A sound wave has an intensity of $5.0\times10^{-3}\ \frac{W}{m^2}$. Find its *intensity level* (in decibels).

$$\beta = 10\log_{10}\left(\frac{I}{I_0}\right) = 10\log_{10}\left(\frac{5.0\times10^{-3}\ W/m^2}{10^{-12}\ W/m^2}\right) = 10\log_{10}(5\times10^{9})$$

$$= \boxed{97 \text{ (deci bels)}}$$

3. A net force of 15.0 N is exerted (perpendicularly) on a rectangle of dimensions 11.0 cm × 9.0 cm.

a) Find the (average) pressure on the rectangle. Express the answer in Pa and in $\frac{lb}{in^2}$



$$A = (0.11\ m)\cdot(0.09\ m) = 9.9\times10^{-3}\ m^2$$

$$P = \frac{F}{A} = \frac{15\ N}{9.9\times10^{-3}\ m^2} = \boxed{1.52\times10^{3}\ Pa}$$

$$= (1.52\times10^{3}\ N/m^2)\left(\frac{14.7\ lb/in^2}{1.013\times10^{5}\ N/m^2}\right) = \boxed{0.22\ \frac{lb}{in^2}}$$

$\lambda f = v$ $\quad v = \sqrt{\frac{F}{(\frac{m}{L})}}$ $\quad \beta = 10\log_{10}\left(\frac{I}{I_0}\right)$ $\quad I_0 = 10^{-12}\ \frac{W}{m^2}$

$F = \frac{P}{A}$ $\quad 1\text{Pa} = 1\ \frac{N}{m^2}$ $\quad 1\text{atm} = 1.013\times10^{5}\ \frac{N}{m^2} = 14.7\ \frac{lb}{in^2}$

REMEMBER TO <u>SHOW YOUR WORK</u>!