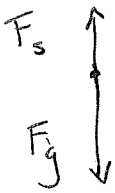
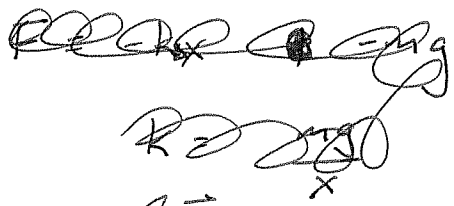
Practice Exam #4

1) $\Delta x = 9.6\,cm$

$m = 1.3\,kg$





a) $a = \frac{\sum \vec{F}}{m} = -mg + kx = 0$

$x = \frac{mg}{k} = \frac{1.3\,kg \times 9.8\,m/s^2}{0.096\,m}$

$= 133\,\frac{kg}{s^2}$

b) $\omega = \sqrt{\frac{k}{m}} = 10.1\,\frac{rad}{s}$

$\Rightarrow f = 1.6\,Hz$ c

$\Rightarrow T = \frac{1}{f} = 0.62\,s$ b

d) amplitude is 5 cm

e) $x = A\cos\omega t$

$\frac{dx}{dt} = -A\omega \sin\omega t$

(max speed)

$= 0.05\,m \times 10.1\,\frac{rad}{s} = 0.505\,m/s$

2) $V = \frac{\omega}{k} = \frac{30\,rad/s}{2\,rad/m} = 15\,m/s$

$v = \sqrt{\frac{T}{\mu}} \Rightarrow T = \mu v^2 = 0.036\,N$

3 for string A $\frac{n_A \lambda}{2} = L \Rightarrow \lambda = \frac{2L}{n_A}$

so $v = \lambda f \Rightarrow f = \frac{v}{\lambda}$

$$f_A = \frac{n_A v}{2L}$$

like wise

$$f_B = \frac{n_B v}{2(4L)} = \frac{n_B v}{8L}$$

so looking for equal frequencies

$f_A = f_B$

$$\frac{n_A v}{2L} = \frac{n_B v}{8L}$$

$$n_A = \frac{n_B}{4}$$

so for $n_A = 1$ $n_B = 4$

$n_A = 2$ $n_B = 8$

4/ $I = \frac{1}{2} \rho v \omega^2 s^2$ $\Delta P = v \rho \omega s$

$$s = \frac{\Delta P}{v \rho \omega}$$

so

$$I = \frac{1}{2} \rho v \omega^2 \frac{\Delta P^2}{v^2 \rho^2 \omega^2} = \frac{1}{2} \frac{\Delta P^2}{v \rho}$$

a) for equal intensity

$I_{air} = I_{water}$

$$\frac{1}{2} \frac{\Delta P_{air}^2}{v_{air} \rho_{air}} = \frac{1}{2} \frac{\Delta P_{water}^2}{v_{water} \rho_{water}}$$

$$\frac{(\Delta P_{water})^2}{(\Delta P_{air})^2} = \frac{v_{water} \rho_{water}}{v_{air} \rho_{air}}$$

$$\frac{\Delta p_{water}}{\Delta p_{air}} = \sqrt{\frac{V_{water}\,\rho_{water}}{V_{air}\,\rho_{air}}} = \sqrt{\frac{1482}{343}\,\frac{990}{1.21}}$$

$$= 59$$

b) for equal pressures

$$\frac{I_{water}}{I_{air}} = \frac{\frac{1}{2}\frac{\Delta p^2}{V_{water}\rho_{water}}}{\frac{1}{2}\frac{\Delta p^2}{V_{air}\rho_{air}}} = \frac{V_{air}\,\rho_{air}}{V_{water}\,\rho_{water}}$$

$$= 2.8 \times 10^{-4}$$

5) If the string is too tightly stretched the frequency will be higher than 440

$$f_{beat} = f_1 - f_2$$

$$4Hz = f - 440Hz$$

$$f = 444Hz$$