Homework Solutions to HW Set #13 due VOLUNTARY Sec 14.8 NO CREDIT

By [illegible]
On 12/3/03

HW#13: Sec 14.8 Problems 34, 35, 36. (No Credit)

#34. (a) $v = f \cdot \lambda$. Given $f_1 = 261.6\ Hz$, find tension F, for $L = 0.700\ m$, $M = 4.3 \times 10^{-3}\ kg$

FOR FUNDAMENTAL, $L = \lambda_1/2$ (b)

ALSO (c) $v = \sqrt{F/\mu}$ from Eq. (13.17).

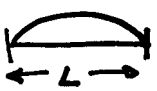
and mass/unit length $= \mu = M/L$. (d)

[Note "fundamental" is same as first harmonic & has $n=1$ half wavelengths in L.]

Find expression for F = tension in string: Substituting from (a)(b)&(d) into (c):

$$F = v^2\mu = v^2\frac{M}{L} = f_1^2\lambda_1^2\frac{M}{L} = f_1^2 \cdot (4L^2)\cdot\frac{M}{L} = 4f_1^2 LM$$

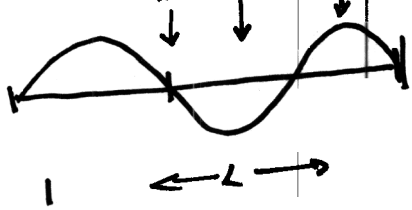
& check dimension $[F] = ML/T^2$ (ok)



Then $F = (4)(261.6)^2 \cdot (0.700)(4.3\times10^{-3})\ kg\,m/sec^2$

$= 82.39 \times 10^{4-3} =$ **824 N = F = Tension**

#35 Third harmonic has $n = 3$ half wavelengths within string length L



so that $L = 3\lambda_3/2$, $\lambda_3 = 2L/3$

(a) Then nodes (zeroes of vibn) are at $x = 0$, $x = L/3$, $x = 2L/3$, $x = L$

for L = 8.00 m Nodes are at **0.00, 2.667 m, 5.333 m & 8.00 m.**

Maxima (or Antinodes) are half way between nodes: $x = L/6, L/2, 5L/6 =$

1.33 m, 4.00 m, 6.67 m.

$$f_3 = v/\lambda_3 = \sqrt{\frac{F}{\mu}}\cdot\frac{3}{2L}$$

$$= \sqrt{\frac{FL}{M}}\cdot\frac{3}{2L} = \frac{3}{2}\sqrt{\frac{F}{LM}}$$

& insert F = 49.0 N, L = 8.0 m, M = 40.0 gm = 0.04 kg

$$f_3 = (1.5)\left[\frac{(49)}{(8)(0.04)}\right]^{1/2} = 18.6\ Hz = f_3$$

Homework Solutions to HW Set # 14 (Ch 14.8) : Voluntary Sec 14.8, ~~due~~ NO CREDIT

By [illegible]
On 12/3/03

#36 $L = 0.70\,m$; $M = 0.300g = 3\times10^{-4}\,kg$.; $F = 600N$

[Q] find f_1, f_2, f_3. [A] From $v = f\cdot\lambda$, we have

$f_i = v/\lambda_i$. Also $\lambda_1/2 = L$, $\lambda_2 = L$; $\lambda_3 = \frac{2L}{3}$

and $v = \sqrt{F/\mu} = \sqrt{FL/M}$

$L = \frac{\lambda_1}{2}, \lambda_2, \frac{3}{2}\lambda_3$.

Then $f_1 = v/\lambda_1 = \sqrt{\frac{FL}{M}}\cdot\frac{1}{2L} = \sqrt{\frac{F}{ML}}\cdot\frac{1}{2}$

$= \frac{1690}{2} = \boxed{845\,Hz = f_1}$

& $f_2 = \sqrt{\frac{FL}{M}}\cdot\frac{1}{1} = 2f_1 = \boxed{1690\,Hz = f_2}$

$f_3 = \sqrt{\quad}\cdot\frac{3}{2} = 3f_1 = \boxed{2535\,Hz = f_3}$