#61985 (SHM.)

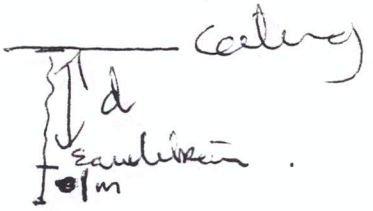
Before SHM (Notes)

$m = .25$

$T = 2\text{sec}$

Initially

$x =$  m



(i) Find w and A. first

$T = \frac{2\pi}{\omega} \Rightarrow 2 = \frac{2\pi}{\omega} \Rightarrow \boxed{\omega = \pi \text{ secs}}$

$v = 0$ when $x =$ $\Rightarrow$ $\boxed{A = \pm .1\,m}$

Find v when at equilibrium position $(x = 0)$

$x = 0 \Rightarrow v^2 = \omega^2(A^2 - x^2)$

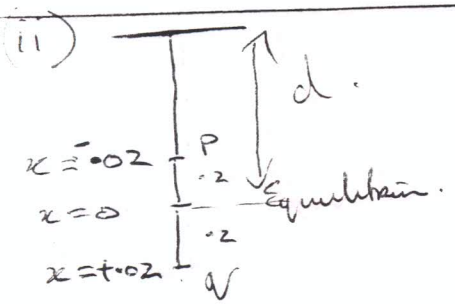
$\Rightarrow v^2 = \pi^2((.1)^2 - 0^2)$

$\Rightarrow v^2 = \pi^2(.1)^2$

$\Rightarrow v = \pm .1\pi \Rightarrow \boxed{v = \frac{\pi}{10}}$ $\pm$ at Equilibrium

---

(ii)



Time to travel q to p = 2[time (q to Equilibrium)]

$= 2(t_*)$

Find t_* $\quad x = A\sin\omega t$.

$-.02 = -.1\sin\pi t_*$

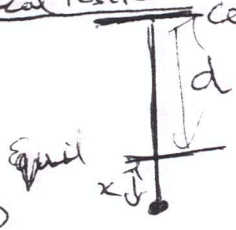
$.2 = \sin\pi t_*$

$.2013 = \pi t_*$

$.064 = t_*$

$\Rightarrow$ Time to travel [q p] = .128 secs

(iii) Examine forces at typical Position



Hooke $F = k(l - l_0)$

Hooks forces: $|S| = k(d + x - l_0)$; $w = .25g = \frac{g}{4}$.

$\Sigma F = ma$

$\Rightarrow -|S| + w = ma.$

$\Rightarrow -k(d + x - l_0) + \frac{g}{4} = -\frac{1}{4}[\pi^2 x]$

$\Rightarrow -k(d - l_0) - kx + \frac{g}{4} = -\frac{\pi^2}{4}x$

$-kx = -\frac{\pi^2}{4}x \Rightarrow \boxed{k = \frac{\pi^2}{4}}$

At Equilibrium Position

$\Sigma F = 0$

$|S| = w$

$(d - l_0) = \frac{g}{4}$.

(iv) Examine forces at Equil $\quad |S| = w$ $\quad$ String will shorten by $d - l_0$.

$\Rightarrow k(d - l_0) = \frac{1}{4}g$

$\Rightarrow \frac{\pi^2}{4}(d - l_0) = \frac{1}{4}g$

$\Rightarrow (d - l_0) = \frac{g}{\pi^2}$ $\Rightarrow$ String shortens by $\frac{g}{\pi^2}$.