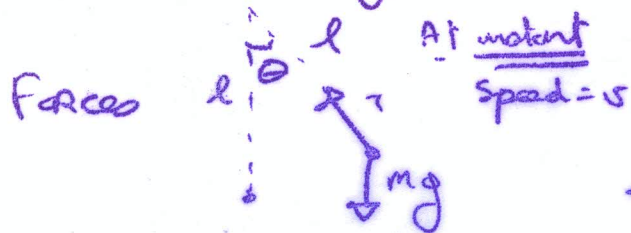


81 Mons

6a

$$T = 2\pi \sqrt{\frac{l}{g}}$$



in tangential dirⁿ.
NII $\Rightarrow -mg \sin \theta = m \text{ accel}$

$$\theta \text{ small} \Rightarrow -mg\theta = m \text{ accel}$$

$$\Rightarrow \text{accel} = -g\theta$$

$$\Rightarrow \text{accel} = -\frac{g}{l} x$$

$$\Rightarrow \ddot{x} = -\frac{g}{l} x$$

$$\text{SHM with } \omega = \sqrt{\frac{g}{l}}$$

$$\Rightarrow T \text{ periodic time} = \frac{2\pi}{\omega}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \text{ qed}$$

32 oscillations per minute (= 60 sec)

$$\Rightarrow \text{Periodic time} = \frac{60}{32} \text{ secs}$$

$$[\text{i.e. 1 oscillation} = \frac{60}{32} \text{ sec}]$$

$$\Rightarrow T_1 = \frac{60}{32} \text{ secs}$$

$$\text{But } T_1 = 2 \text{ secs}$$

% change in length

$$= \frac{l_2 - l_1}{l_1} \times \frac{100}{1} \%$$

$$= \left(\frac{l_2}{l_1} - 1 \right) \times \frac{100}{1} \%$$

$$\text{But } T = 2\pi \sqrt{\frac{l}{g}} \Rightarrow l = \left(\frac{T}{2\pi} \right)^2 g$$

$$\Rightarrow l_2 = \left(\frac{T_2}{2\pi} \right)^2 g \text{ and } l_1 = \left(\frac{T_1}{2\pi} \right)^2 g$$

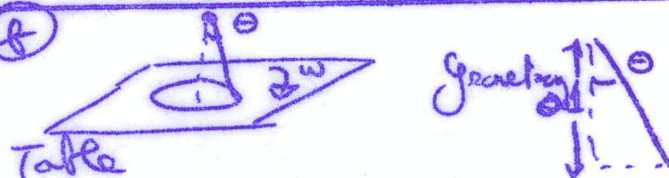
$$\Rightarrow \frac{l_2}{l_1} = \frac{T_2^2}{T_1^2} \text{ (rest cancel)}$$

$$\frac{l_2}{l_1} = \frac{\left(\frac{60}{32} \right)^2}{2^2} = \left(\frac{15}{16} \right)^2$$

$$\therefore \% \text{ change} = \left(\left(\frac{15}{16} \right)^2 - 1 \right) \times \frac{100}{1} \%$$

$$= 12.1 \%$$

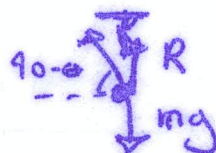
7



$$T \sin \theta = \frac{r}{l}$$

$$\Rightarrow r = \frac{1}{10} T \sin \theta$$

Force:



$$\vec{T} = T \sin \theta \hat{x} + T \cos \theta \hat{y}$$

$$\text{NII} \downarrow R + T \cos \theta - mg = 0$$

$$\text{Total } R = \frac{mg}{2}$$

$$\therefore \downarrow \Rightarrow \frac{mg}{2} + T \cos \theta - mg = 0$$

$$T \cos \theta = \frac{mg}{2} \quad (1)$$

$$\text{NII} \hookrightarrow T \sin \theta = m \omega^2 r$$

$$T \sin \theta = m \omega^2 \frac{T \sin \theta}{10} \quad (2)$$

Want to solve (1) and (2) for ω

$$\frac{(2)}{(1)} \Rightarrow \frac{T \sin \theta}{T \cos \theta} = \frac{m \omega^2 \left(\frac{T \sin \theta}{10} \right)}{\frac{mg}{2}}$$

$$\Rightarrow T \tan \theta = 2g \omega^2 \left(\frac{T \sin \theta}{10} \right)$$

$$\Rightarrow 1 = \frac{2}{5} \omega^2$$

$$\Rightarrow \frac{5}{2} = \omega^2$$

$$\Rightarrow \omega = \sqrt{\frac{5}{2}} \text{ Rad/sec}$$