

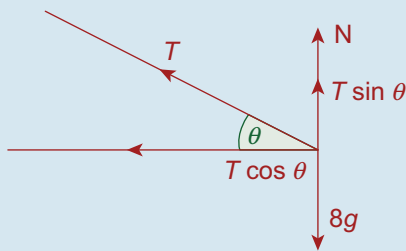
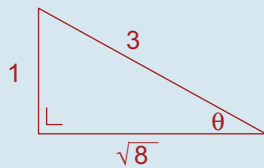
(iii) Equating the two values of  $T$  gives:

$$\begin{aligned}\frac{Mgl}{h} &= M\omega^2 l \\ \Rightarrow \frac{g}{h} &= \omega^2 \\ \Rightarrow h &= \frac{g}{\omega^2}\end{aligned}$$

(iv)  $h \geq 0.25$

$$\begin{aligned}\Rightarrow \frac{g}{\omega^2} &\geq 0.25 \\ \Rightarrow \omega^2 &\leq \frac{g}{0.25} \\ \Rightarrow \omega &\leq 6.3 \text{ rads/sec}\end{aligned}$$

Q. 11.



$$\begin{aligned}\uparrow &= \downarrow \\ N + \frac{T}{3} &= 8g \quad \dots \textcircled{1}\end{aligned}$$

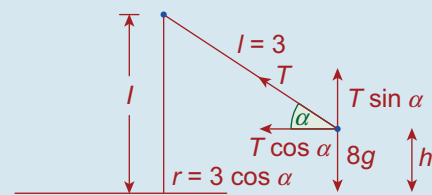
$$\begin{aligned}\text{(i) NZL: } \leftarrow \frac{T\sqrt{8}}{3} &= \frac{mv^2}{r} \\ \Rightarrow \frac{T\sqrt{8}}{3} &= \frac{8v^2}{\sqrt{8}} \\ \Rightarrow T &= 3v^2\end{aligned}$$

(ii) From  $\textcircled{1}$

For contact with table  $N > 0$

$$\begin{aligned}N &= 8g - T \sin \theta \\ \Rightarrow 8g &> 3v^2 \frac{1}{3} \\ \Rightarrow v &< \sqrt{8g}\end{aligned}$$

(iii)



$$v = \sqrt{9.1g}$$

$$\uparrow = \downarrow$$

$$\begin{aligned}T \sin \alpha &= 8g \\ \Rightarrow T &= \frac{8g}{\sin \alpha} \quad \dots \textcircled{1}\end{aligned}$$

$\textcircled{2}$  NZL:  $\Sigma F = ma$

$$\leftarrow T \cos \alpha = \frac{mv^2}{r}$$

$$\text{From } \textcircled{1} \quad \frac{8g}{\sin \alpha} \cos \alpha = \frac{8(9.1g)}{3 \cos \alpha}$$

$$\Rightarrow 3 \cos^2 \alpha = 9.1 \sin \alpha$$

$$\Rightarrow 3(1 - \sin^2 \alpha) = 9.1 \sin \alpha$$

$$\Rightarrow 3 \sin^2 \alpha + 9.1 \sin \alpha - 3 = 0$$

$$\Rightarrow (3 \sin \alpha + 10)(10 \sin \alpha - 3) = 0$$

$$\Rightarrow \sin \alpha = \frac{3}{10}$$

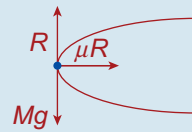
From diagram,  $h = 1 - l \sin \alpha$

$$= 1 - 3\left(\frac{3}{10}\right)$$

$$\Rightarrow h = \frac{1}{10} \text{ m}$$

## Exercise 11C

Q. 1.



$$1: R = mg$$

$$\begin{aligned}2: \mu R &= \frac{mv^2}{r} \\ \Rightarrow \mu mg &= \frac{m(21)^2}{50} \\ \Rightarrow \mu &= 0.9\end{aligned}$$

Q. 2.

$$\text{(i) } 1: R = mg$$

$$\begin{aligned}2: \mu R &= \frac{mv^2}{r} \\ \Rightarrow \frac{2}{3}(mg) &= \frac{mv^2}{24} \\ \Rightarrow v^2 &= 16g\end{aligned}$$

$$\Rightarrow v = 4\sqrt{g} = 12.52 \text{ m/s}$$

$$\text{(ii) } 1: R = mg$$

$$\begin{aligned}2: \mu R &= \frac{mv^2}{r} \\ \Rightarrow \mu(mg) &= \frac{m(7)^2}{24} \\ \Rightarrow \mu &= \frac{5}{24}\end{aligned}$$