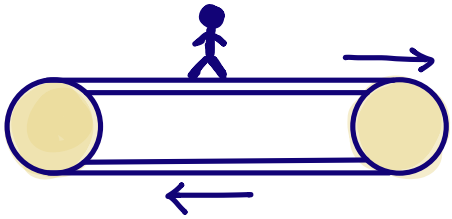
Q. belt has acceleration $1 ms^{-2}$.



a) Net force on Man = ?

b) If $\mu_{Static} = 0.2$, upto what acceleration of belt, can man continue to be stationary.

a) $f_{Man} = ma = 65 \times 1 = 65 N$

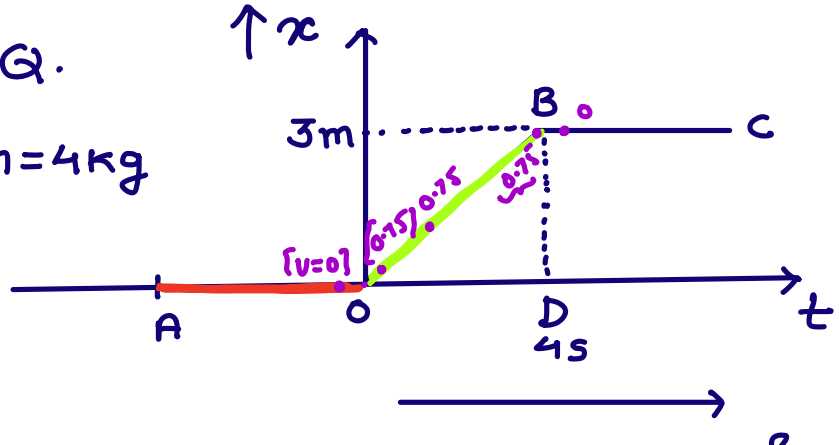
b) frictional force $= \mu R = \mu (mg)$
$= 0.2 \times 65 \times 10$
$= 130 N$

$ma' = 130$

$a' = \frac{130}{65} = 2 ms^{-2}$

Q.

$m = 4kg$



① What is the force acting on particle for

a) $t < 0$

b) $0 < t < 4s$

c) $t > 4s$.

Motion may be considered to be 1 dimensional.

(II) find Impulse at $t = 0s$ & $t = 4s$.

Solution (I)

a) $t < 0$, $x = 0 \Rightarrow v = 0 \Rightarrow a = 0$
$\Rightarrow f = 0$

b) $0 < t < 4s$

$$v = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-0}{4-0} = \frac{3}{4}\ ms^{-1}$$

$0.75\ ms^{-1}$

$\Rightarrow a = 0$
$\Rightarrow f = 0$

c) $t > 4sec$,

$x = 3m$

$\frac{dx}{dt} = v = 0$ $\quad v = 0 \Rightarrow a = 0$
$f = 0$

(II) Impulse at $t = 0sec$.

I = change in momentum.

$= m(v - u)$

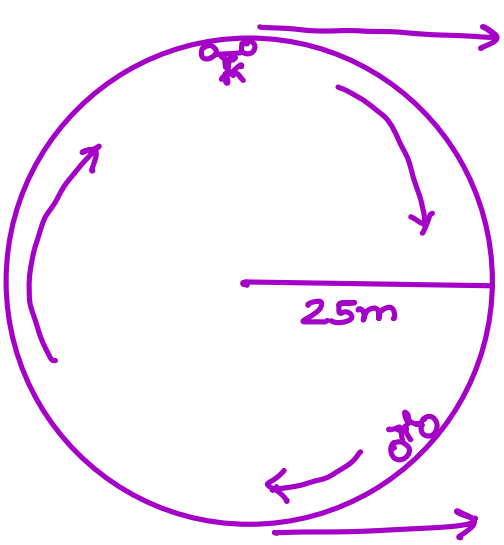
↳ | 0sec के just बाद में velocity
↳ " " " पहले "

$$I = 4(0.75-0) = 3\ kg\,ms^{-1}$$

Impulse at $t = 4s$,

$$m(v-u) = 4(0-0.75)$$
$$I = -3\ kg\,ms^{-1}$$

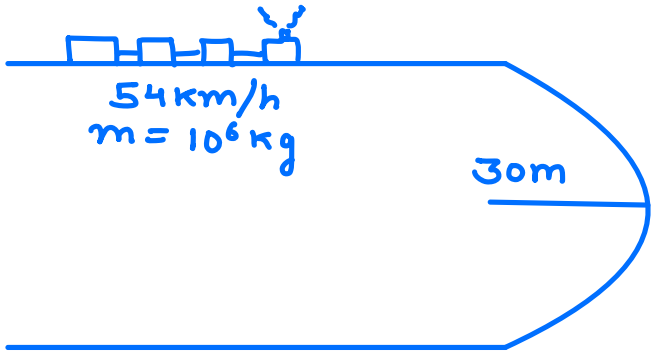
Q



$v_{min} = \sqrt{gr}$

$v_{min} = \sqrt{5gr}$

Q.



Angle of banking reqd to protect wearing out of rails.

$v = \sqrt{rg\tan\theta}$

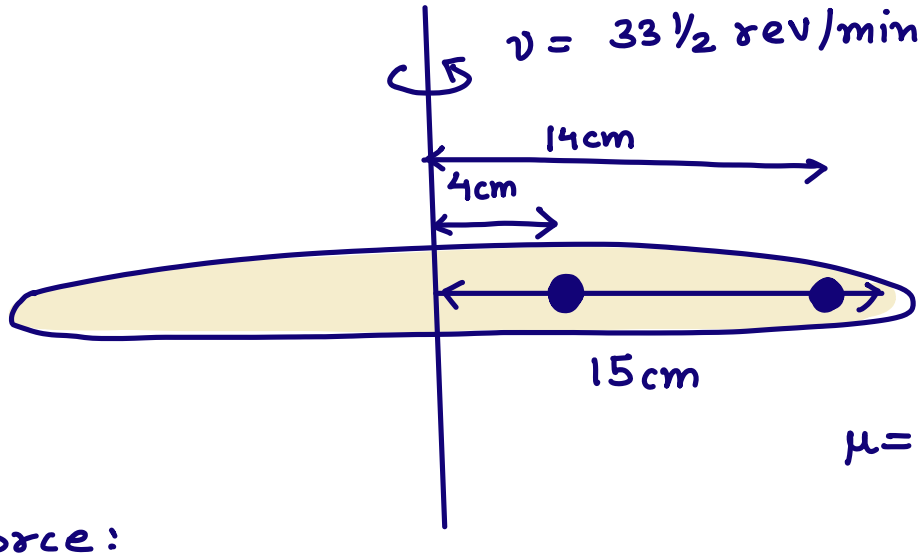
$$\tan\theta = \frac{v^2}{rg}$$

$$\theta = \tan^{-1}(3/4) = 37$$

Q. A disc revolves with speed of $33\frac{1}{3}$ rev/min & has a radius of 15cm.

Two coins are placed 4cm & 14cm away from centre of record (disc)

If coeff of friction b/w coins & record is 0.15, which of two coins will revolve with record (disc).



$\mu = 0.15$

2 force:

1) centrifugal force
2) frictional force

frictional force $\geq$ centrifugal force

$$f \geq f_c$$

$$\mu R \geq \frac{mv^2}{r} \Rightarrow \mu mg \geq \frac{mv^2}{r}$$

$$\Rightarrow \mu g \geq \frac{v^2}{r}$$

$\Rightarrow \boxed{\mu g \geq \omega^2 r}$ $\quad (\because v = \omega r)$

If this condition is satisfied then coin will rotate along with disc.

coin 1: $r = 4\,cm$ $\quad \nu = \frac{100}{3}\,rev/min = \frac{100}{180}\,rev/s$

$\downarrow$

$$\omega^2 r = (2\pi\nu)^2 r = 4\pi^2\nu^2 r$$

$$= 4 \times 3.14 \times 3.14 \times \frac{100}{180} \times \frac{100}{180} \times 4 \times 10^{-2}$$

$$= .49\ ms^{-2}$$

$$\mu g = 0.15 \times 10 = 1.5\ ms^{-2}$$

$$\Rightarrow \mu g > \omega^2 r$$

$\Rightarrow$ coin ① will rotate along with disc.

coin ② $\quad \omega^2 r = 4\pi^2\nu^2 r$

$$= 4 \times 3.14 \times 3.14 \times \frac{100}{180} \times \frac{100}{180} \times 14 \times 10^{-2}$$

$$= 1.705\ ms^{-2}$$

$$\mu g = 0.15 \times 10 = 1.5\ ms^{-2}.$$

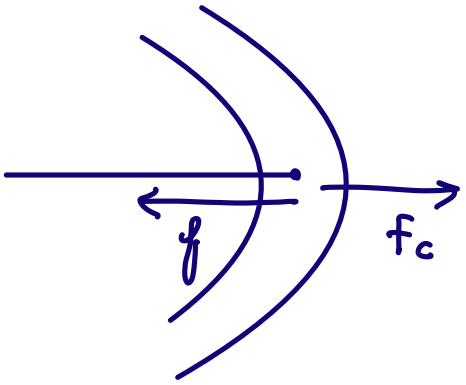
$\Rightarrow \omega^2 r > \mu g \Rightarrow$ coin ② will not rotate along with disc.

Q. Motorcycle curved track radius = 500 m

given, coeff of friction = 0.5.

$g = 10$

What should be maximum speed to avoid skidding.

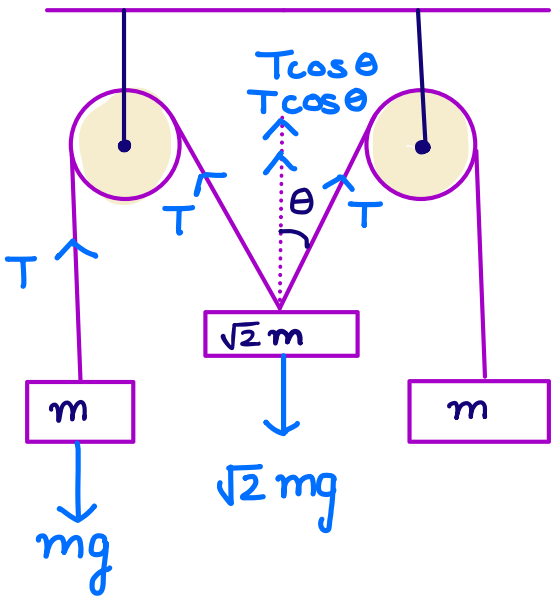


$f = f_c$

$\mu \cancel{m} g = \frac{\cancel{m} v^2}{r}$

$v = \sqrt{\mu r g}$ $\qquad v = 50\ ms^{-1}$

Q.



The pulleys & strings shown in figure are smooth and of negligible mass.

for system to remain in equilibrium, angle θ is _____

$2T\cos\theta = \sqrt{2}mg$

$2mg\cos\theta = \sqrt{2}mg$

$\cos\theta = 1/\sqrt{2} \Rightarrow \theta = 45°$