YAKEEN NEET 2.0

2026

Laws of Motion

Physics | Lecture - 14

By- Manish Raj (MR Sir)

Todays Goal

friction on Vertical surface

& Inclined Plane :—

Motion in a plane
ka summary lecture

→ Uploaded → 3hr

Question no → 6.

2 3 4 5 6 7 8 9 10

A block of mass m is placed inside a smooth hollow cylinder of radius R whose axis is kept horizontally. Initially system was at rest. Now cylinder is given constant acceleration $2\,g$ in the horizontal direction by external agent. The maximum angular displacement of the block with the vertical is:

(A) $2\tan^{-1} 2$

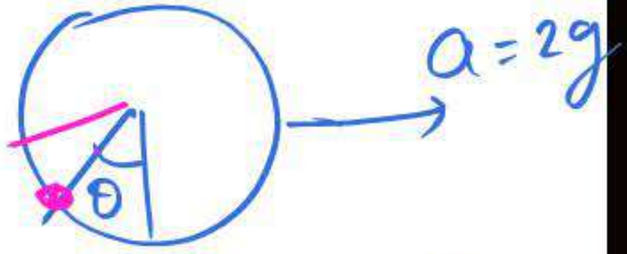
(B) $\tan^{-1} 2$

(C) $\tan^{-1} 1$

(D) $\tan^{-1}\left(\frac{1}{2}\right)$

Click here to zoom

work energy power



Angular dis^m for equlg

$\tan\theta = \frac{a}{g}$

$\tan\theta = \frac{2g}{g} = 2$

$\theta = \tan^{-1}(2)$

1	A	
2	B	
3	C	
4	D	

Play with Physics

↳ work energy & Power से

$\theta = 2\tan^{-1}(2)$

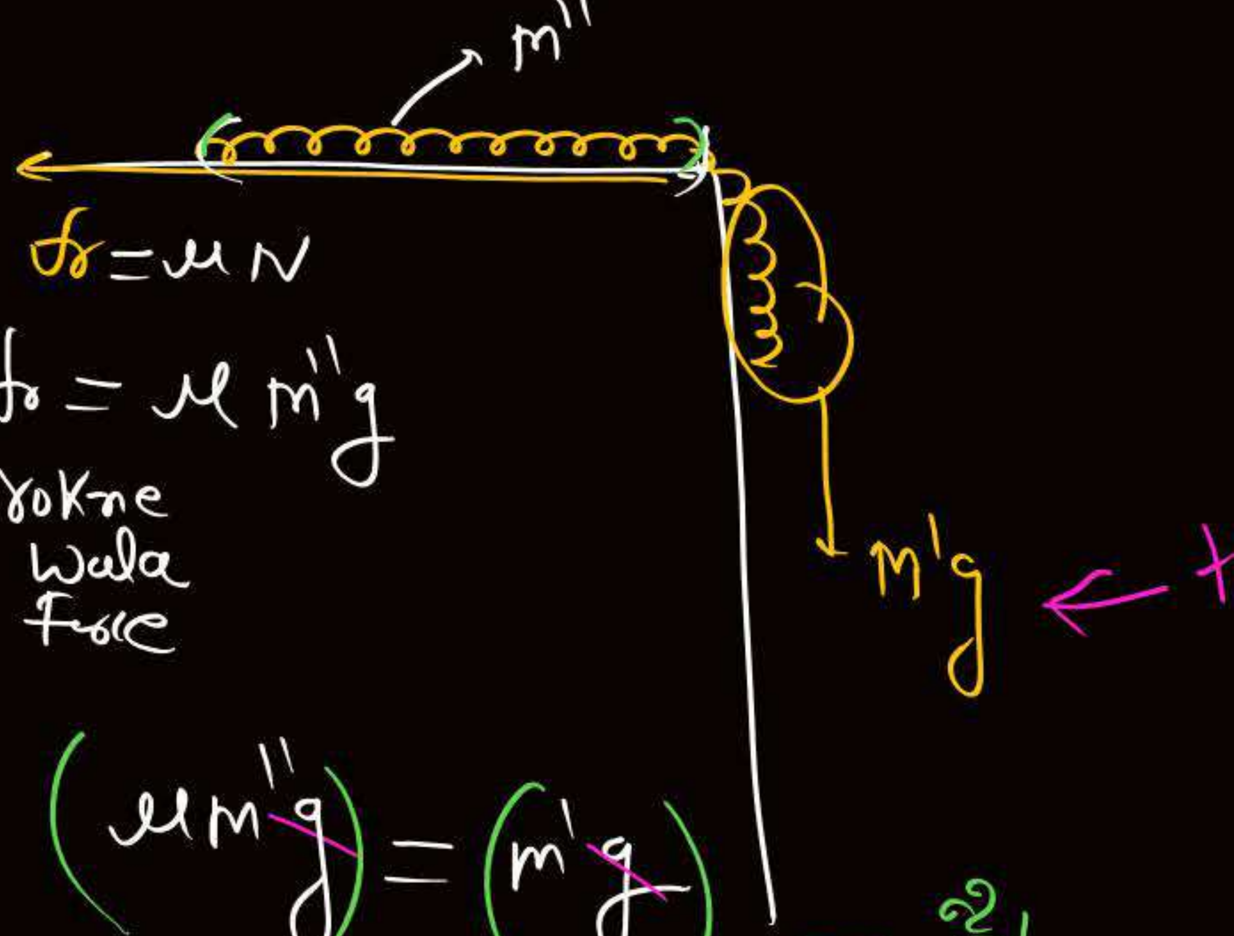
double

Notes में Chain Prob^m

A uniform chain of 6 m length is placed on a table such that a part of its length is hanging over the edge of the table. The system is at rest. The co-efficient of static friction between the chain and the surface of the table is 0.5, the maximum length of the chain hanging from the table is ________ m.

(माना) λ = Mass per unit length

(माना) $x \rightarrow$ hanging length



$f_r = \mu N$

$f_r = \mu m'' g$

rokne wala force

$(\mu m'' \cancel{g}) = (m' \cancel{g})$ लटका है।

table पर

$\mu m'' = m'$

$\cancel{\lambda}(6-x)\mu = \cancel{\lambda} x$

$(6-x)\frac{1}{2} = x$

$6-x = 2x$

$6 = 3x$

$x = \frac{6}{3} = 2m$

Question

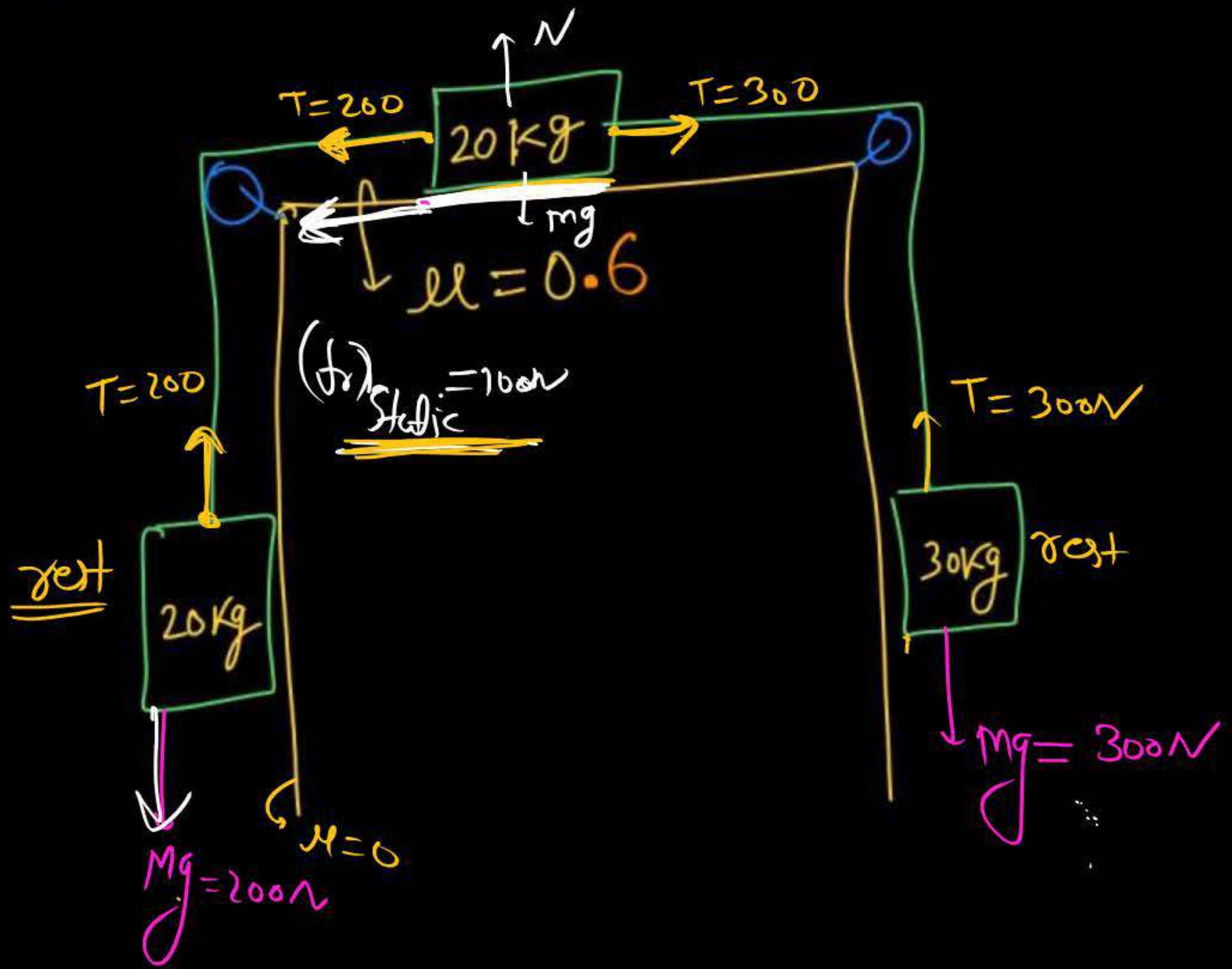
A block A of mass m_1 rests on a horizontal table. A light string connected to it passes over a frictionless pulley at the edge of table and from its other end another block B of mass m_2 is suspended. The coefficient of kinetic friction between the block and the table is μ_k. When the block A is sliding on the table, the tension in the string is

[AIMPT-2015]

H/W

1. $\dfrac{(m_2 + \mu_k m_1)g}{(m_1 + m_2)}$
2. $\dfrac{(m_2 - \mu_k m_1)g}{(m_1 + m_2)}$
3. $\dfrac{m_1 m_2(1 + \mu_k)g}{(m_1 + m_2)}$
4. $\dfrac{m_1 m_2(1 - \mu_k)g}{(m_1 + m_2)}$

H/W 1 find acc^n



Sol^n

$$f_{limit} = \mu N$$

$$= \frac{6}{10} \times 200$$

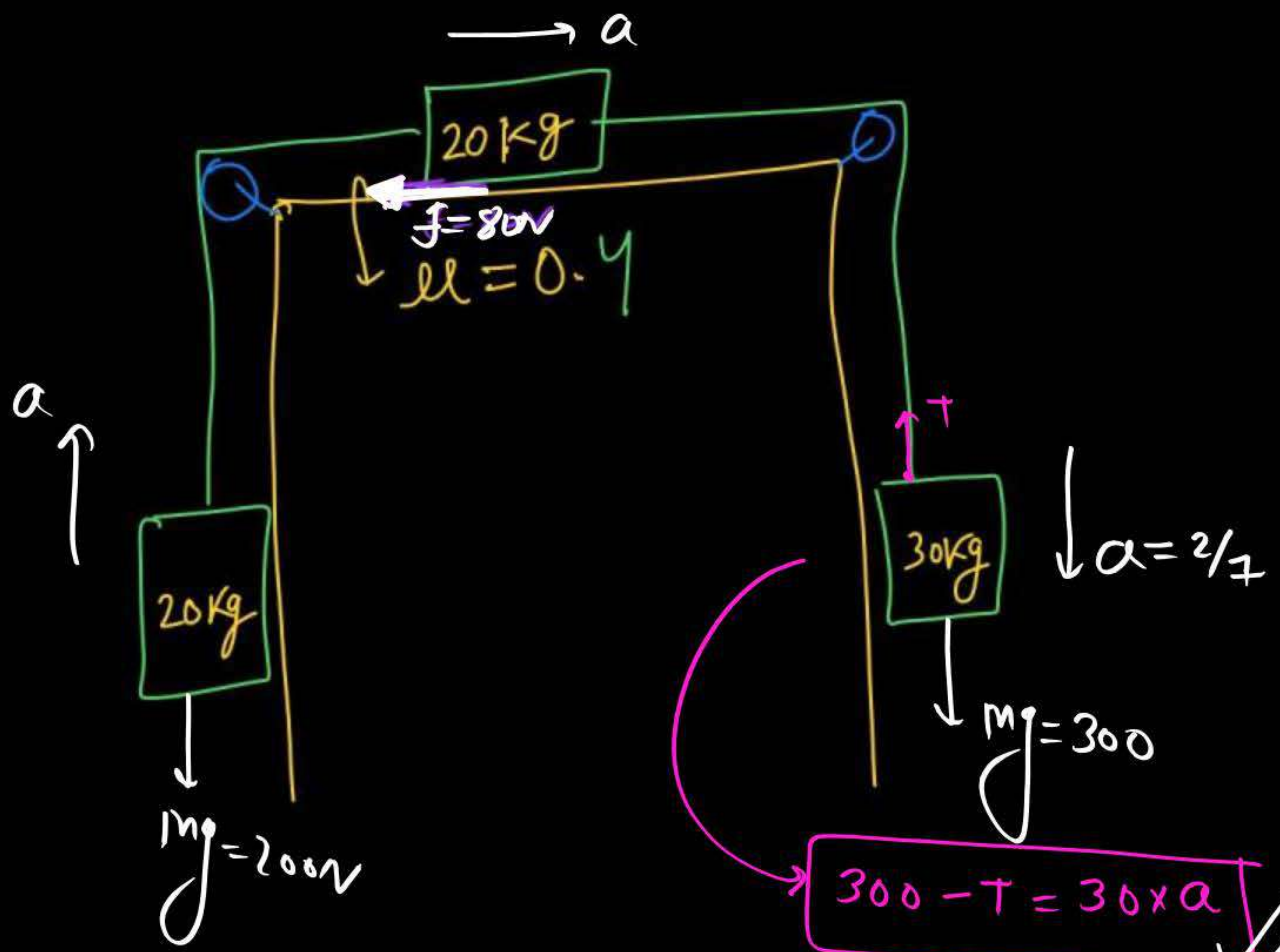
$$\boxed{f_{lim} = 120N}$$

$$\vec{F}_{Net\ unbal} = 300 - 200 = 100N$$

friction = 100 लगा के रोक लेगा

$$\boxed{a = 0}$$

② H/W find acⁿ ??



$$\boxed{300 - T = 30 \times a}$$

find T.

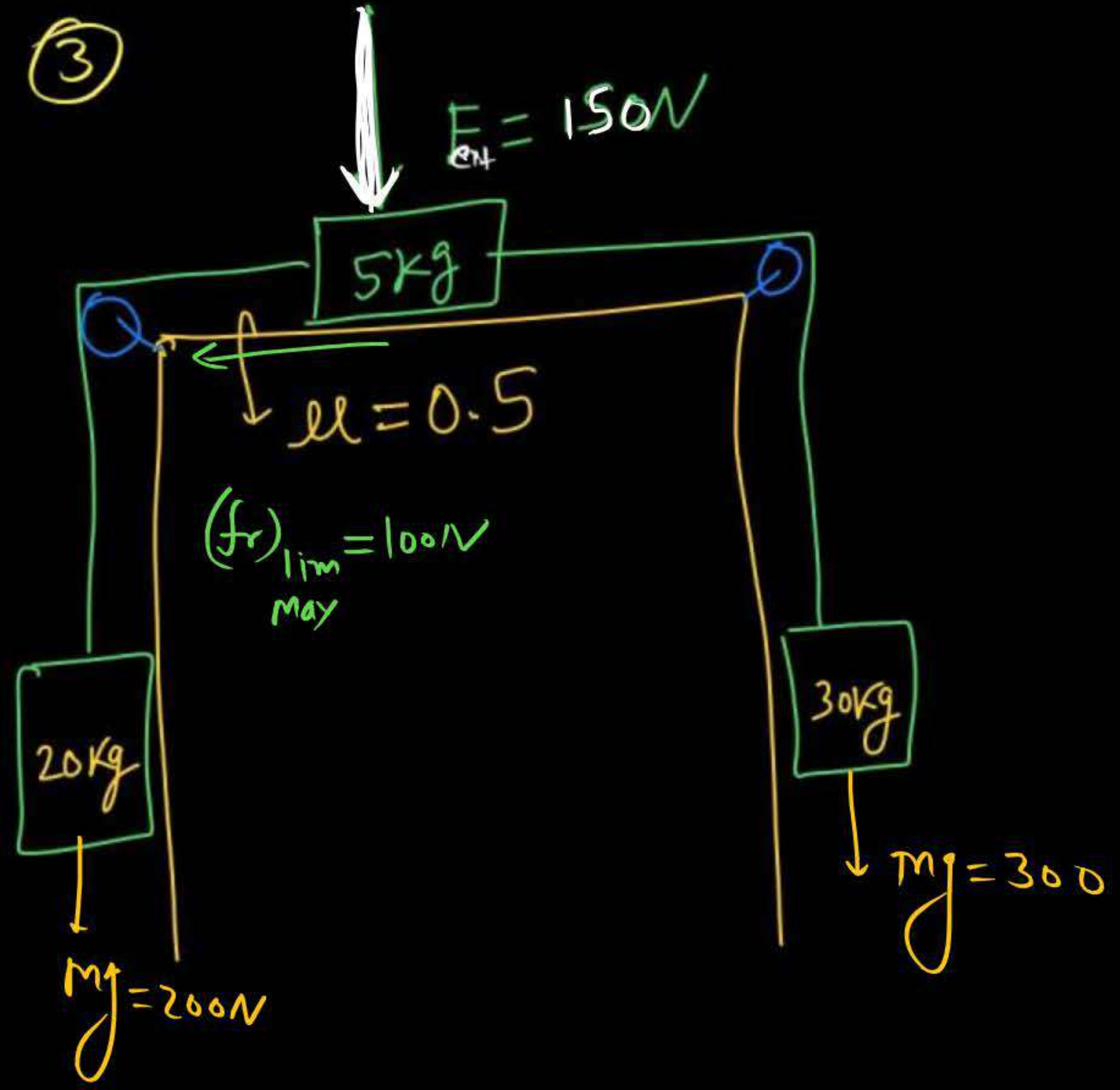
Solⁿ

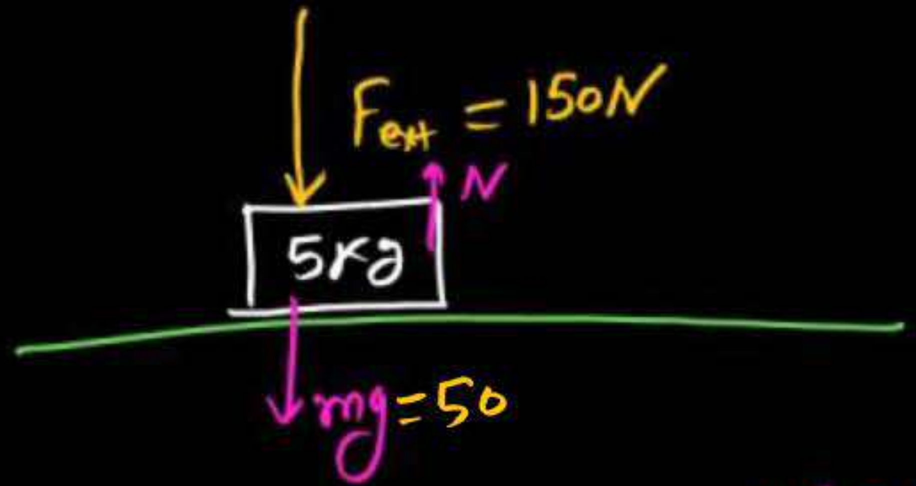
$$f_{limiting} = \mu N$$
$$= \frac{4}{\cancel{10}} \times 20\cancel{0}$$
$$= 80N$$

$$a = \frac{300 - 80 - 200}{70}$$

$$= \frac{2\cancel{0}}{7\cancel{0}} = \frac{2}{7}\ m/s^2$$

3





$$N = mg + F_{ext}$$

$$N = 150 + 50$$

$$\boxed{N = 200N}$$

$$f_{lim} = \mu N$$

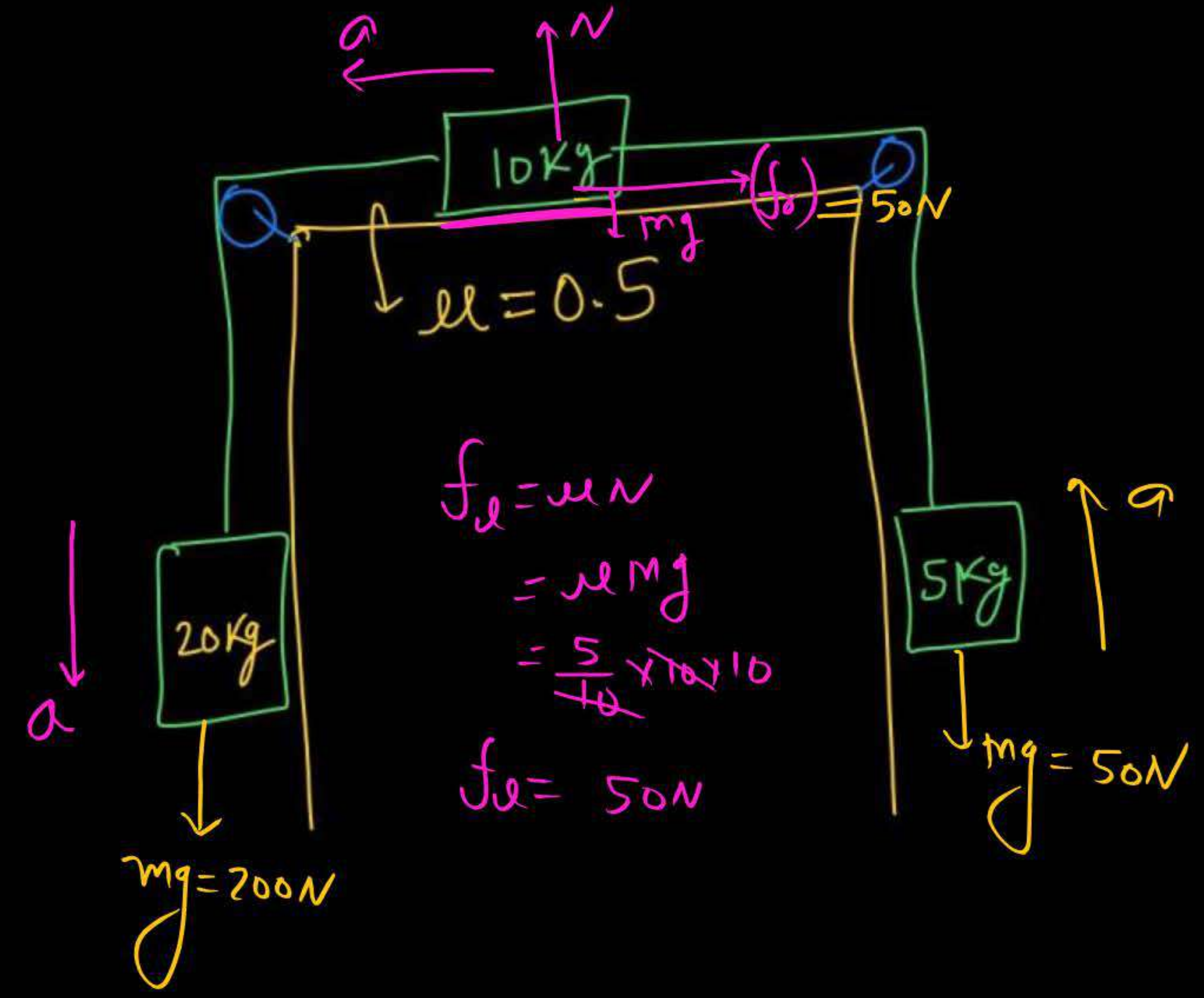
$$= \frac{5}{\cancel{10}} \times 20\cancel{0}$$

$$\boxed{f_{lim} = 100N}$$

$$\boxed{acc^n = 0}$$

Ag

⑤ H/W



$f_k = \mu N$

$= \mu mg$

$= \frac{5}{\cancel{10}} \times \cancel{10} \times 10$

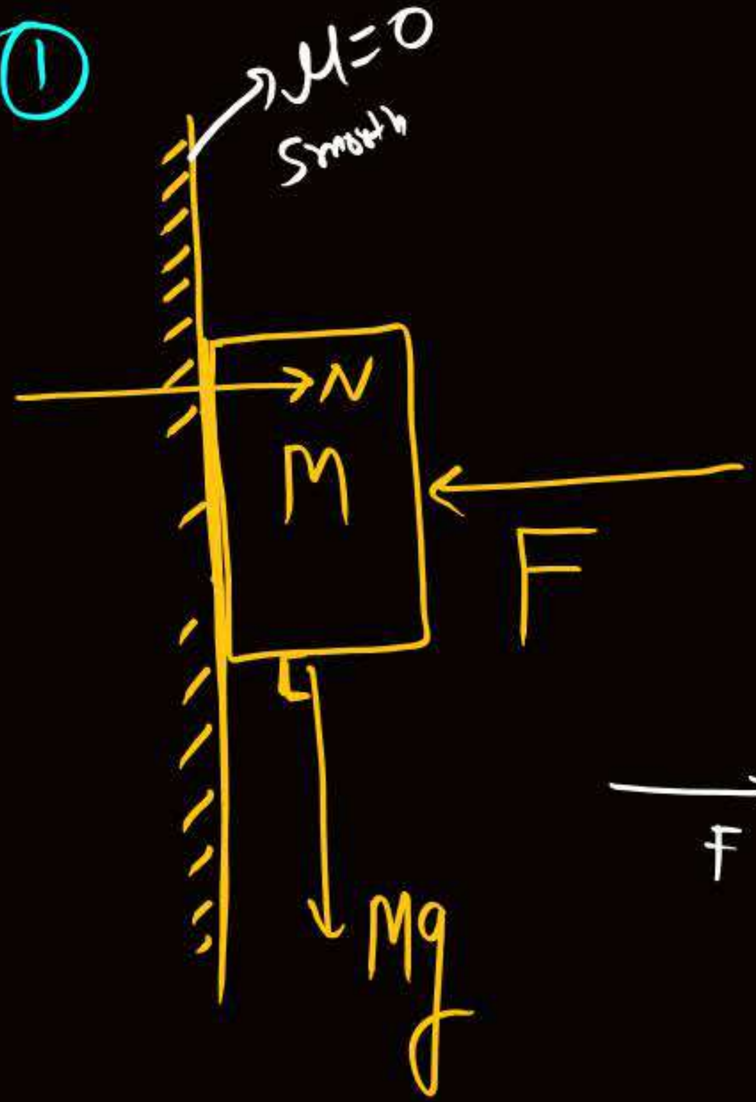
$f_k = 50N$

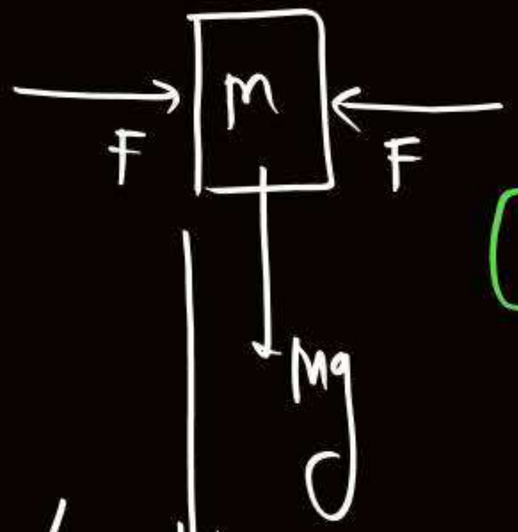
$$a = \frac{200 - 50 - 50}{35}$$

$$= \frac{100}{35} = \frac{20}{7}\,m/s^2$$

friction on vertical surface

①

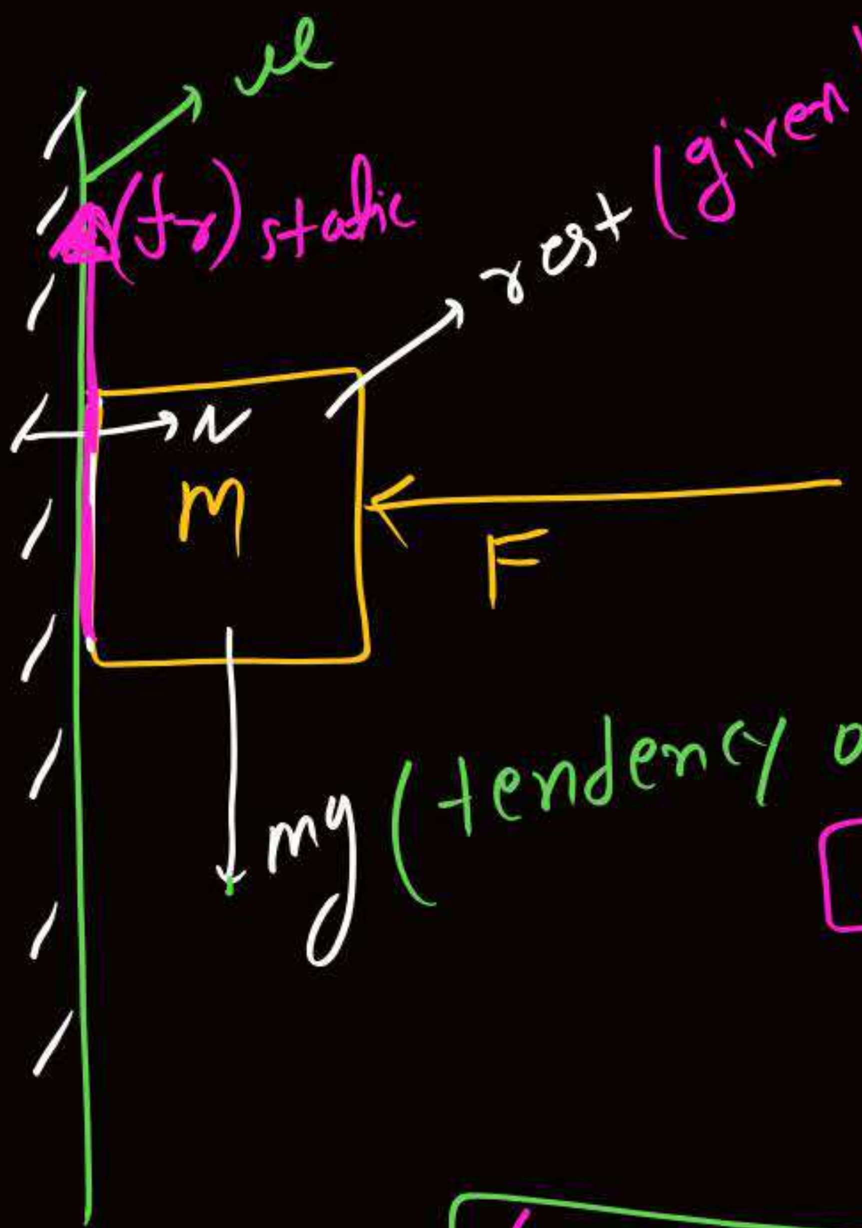




$\boxed{N = F}$

(Must fall)

②



rest (given hai)

(tendency of motⁿ)

$\boxed{N = F} \rightarrow$ alg(x)

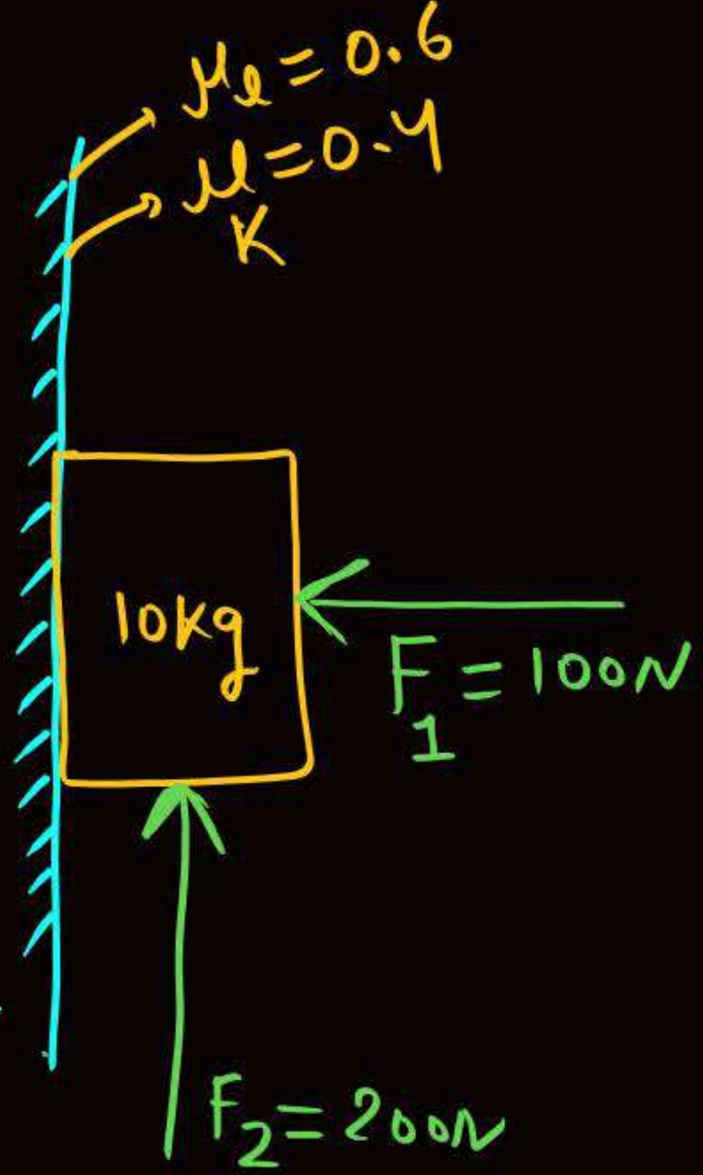
$$\boxed{(F_r)_{static} = mg}$$ Ans

$$(f_r)_{lim} = \mu N = (\mu F) \text{ औकात}$$

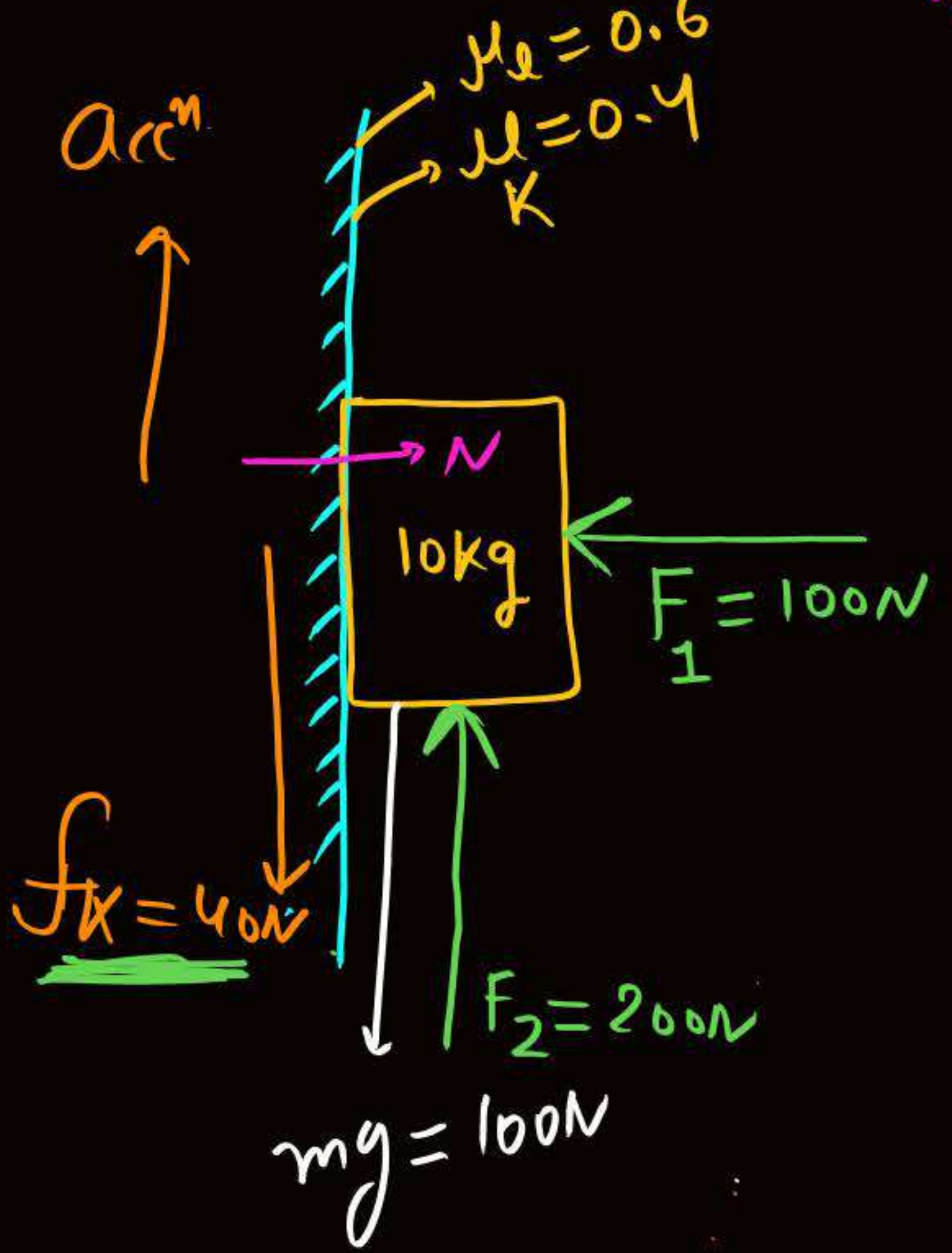
Maximum friction

find acc^n of this object :

(3)



Sol^n



$f_{limi} = \mu N$

$= \mu_s F_1$

$= \frac{6}{10} \times 100$

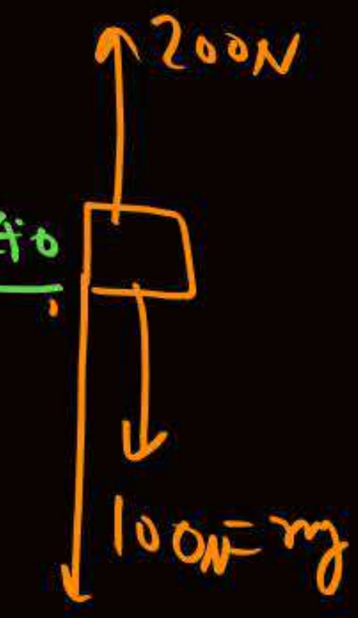
$= 60N$

$f_{kin} = \mu_K N$

$= \mu_K F_1$

$= \frac{4}{10} \times 100$

$= 40N$



$fr = 40N$

$a = \frac{200-100-40}{10}$

$= \frac{60}{10}$

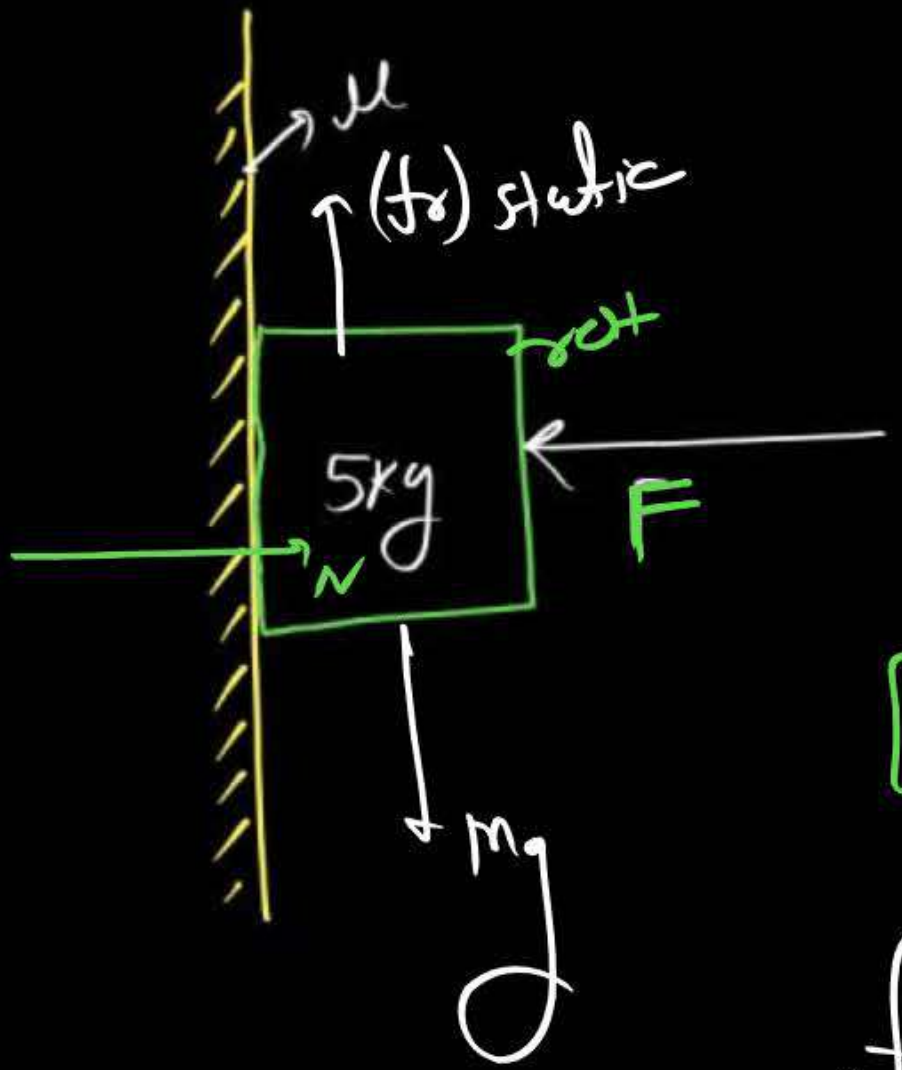
$\boxed{a = 6 m/s^2}$

upword

(4)

Object is at rest in given fig:—
then find (i) Normal by wall on object

(ii) friction force on 5kg.

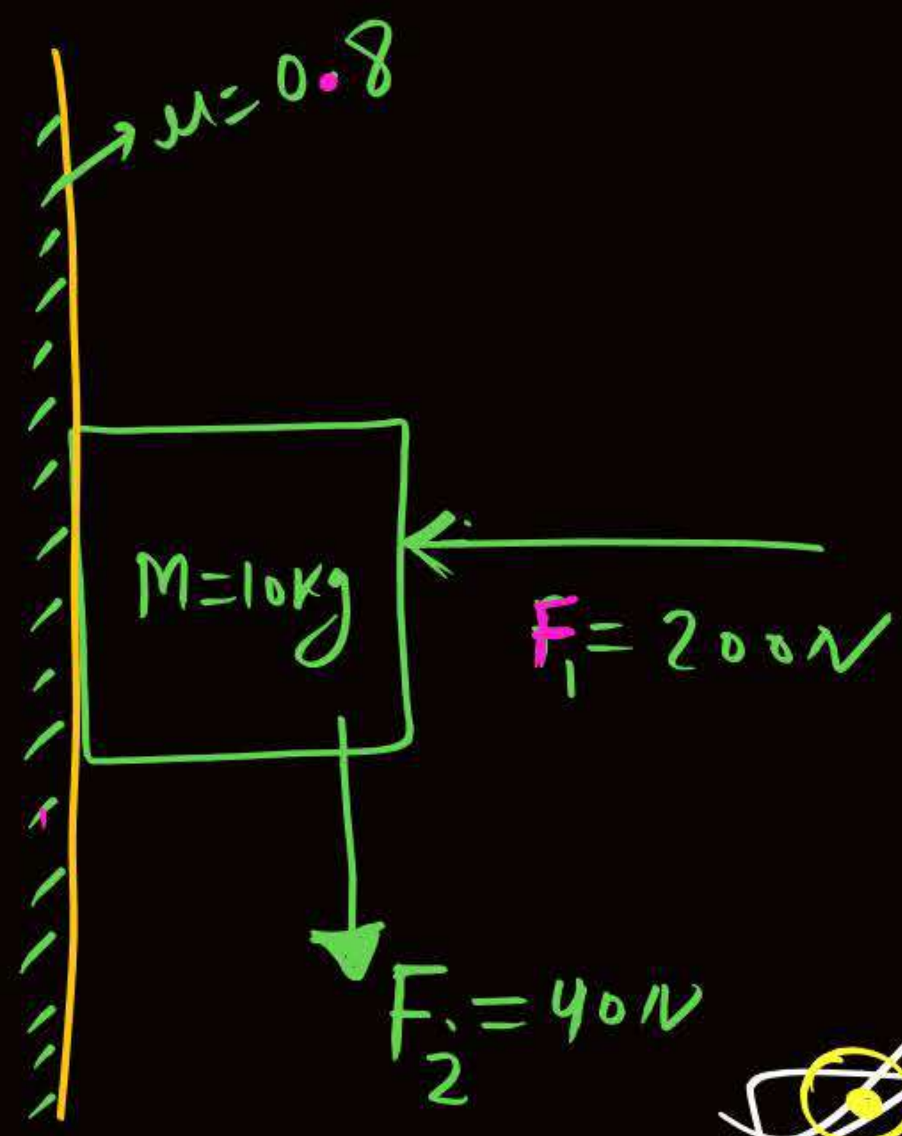


$\boxed{N = F}$ Ans

$f_{static} = mg = 50 \ \underline{\underline{N}}$

(5)

find friction & acc^n acting on object.



Sol^n

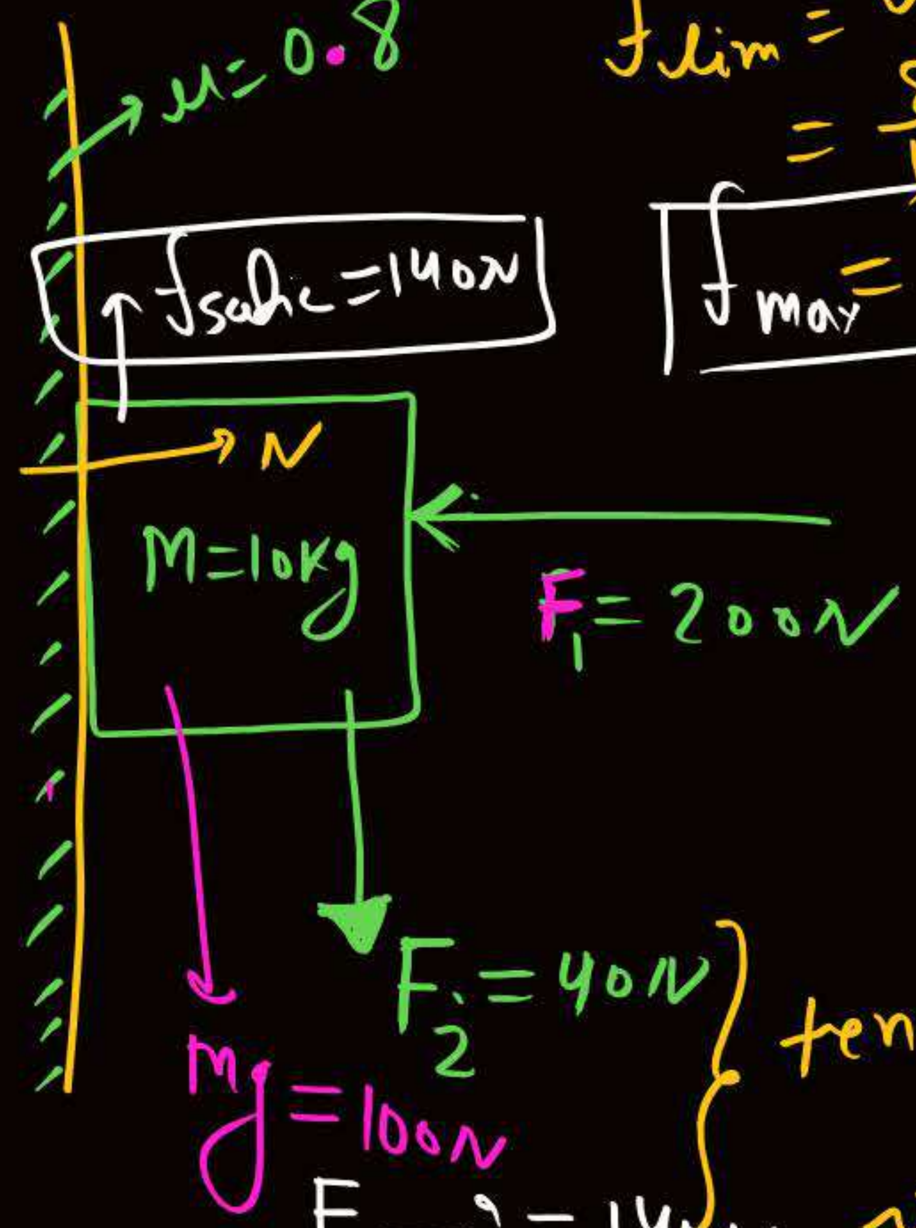
$acc^n = 0$

$(f)_{static} = 140N$

$f_{lim} = \mu N$

$= \frac{8}{10} \times 200$

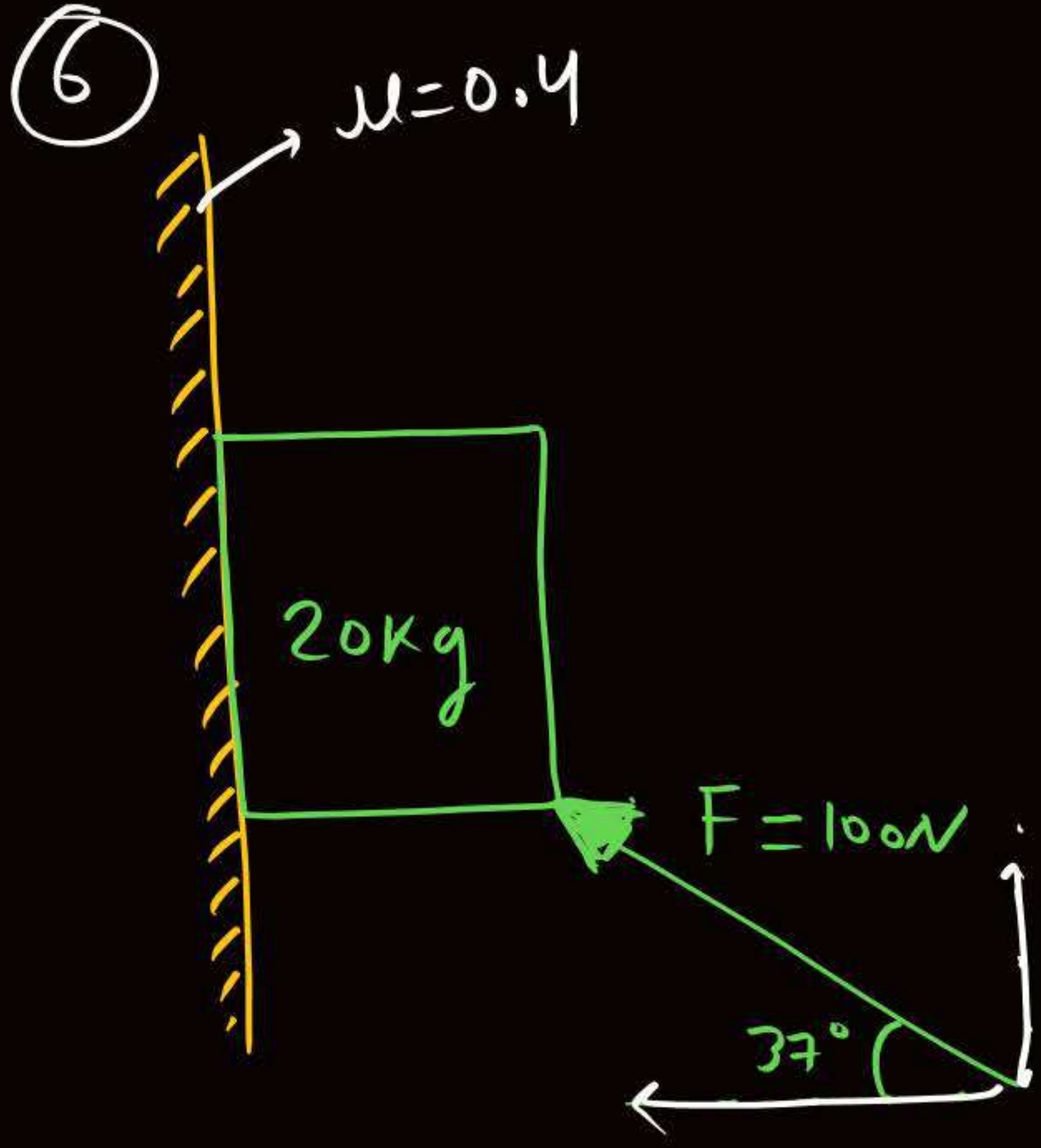
$\boxed{f_{max} = 160N}$



$F_{चलाने} = 140N$

tendency of mot^n चलाने wala force

find accⁿ & friction.



Solⁿ

$\boxed{N=80}$

$f_{lim} = \mu N$

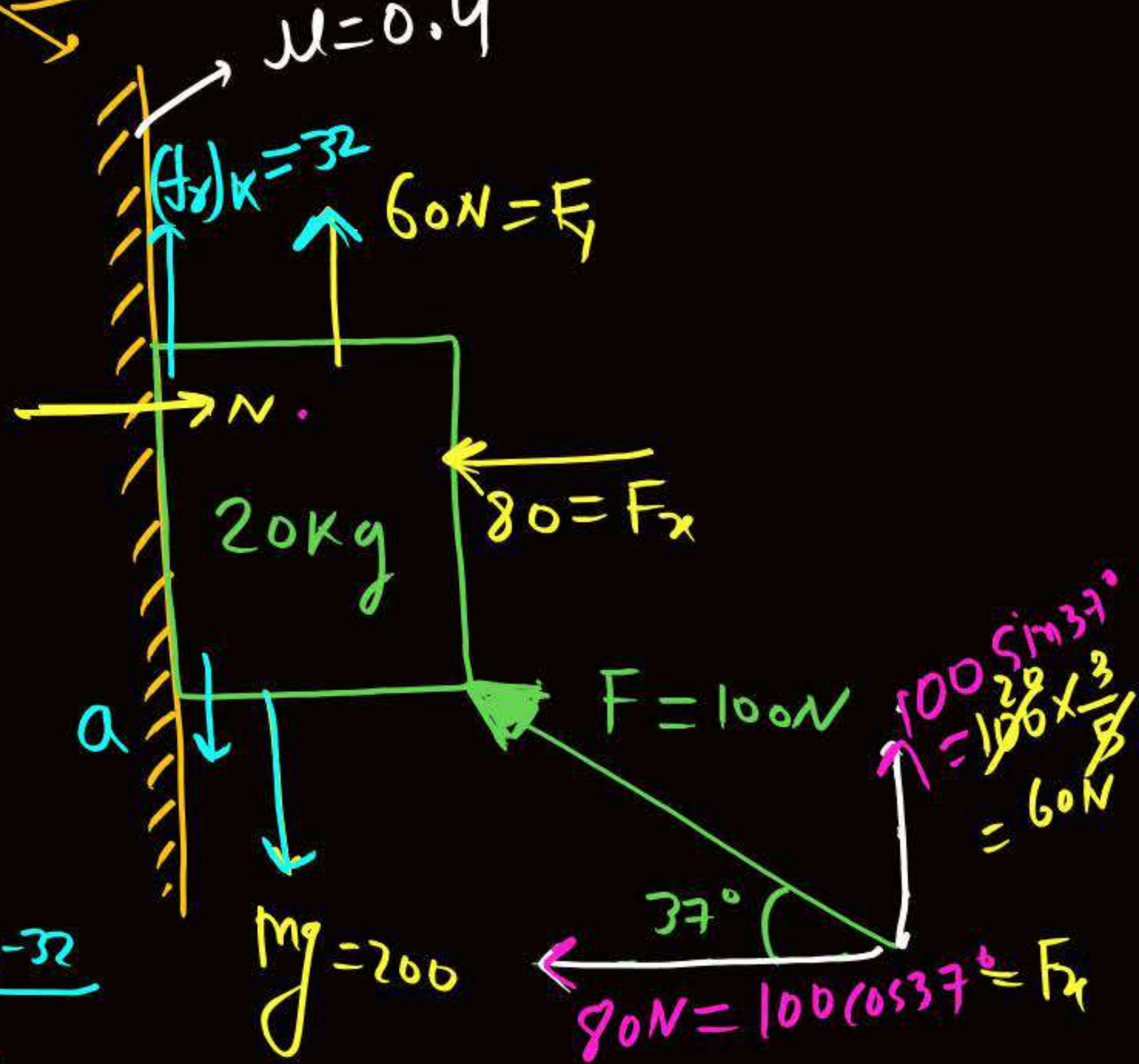
$= \frac{4}{10} \times 80$

$= 32\ N$

$a = \frac{200-60-32}{20}$

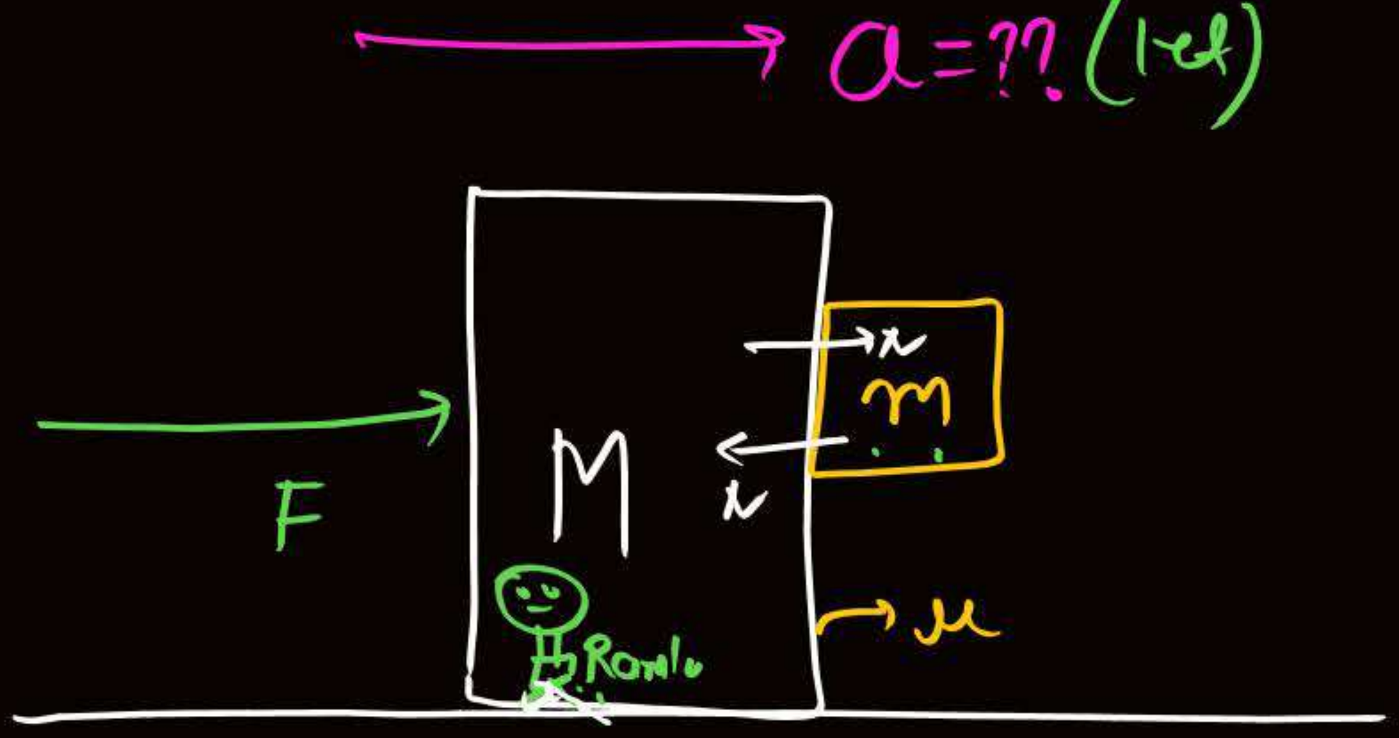
$= \frac{108}{20} = \frac{54}{10} = 5.4\ m/s^2$

Solⁿ



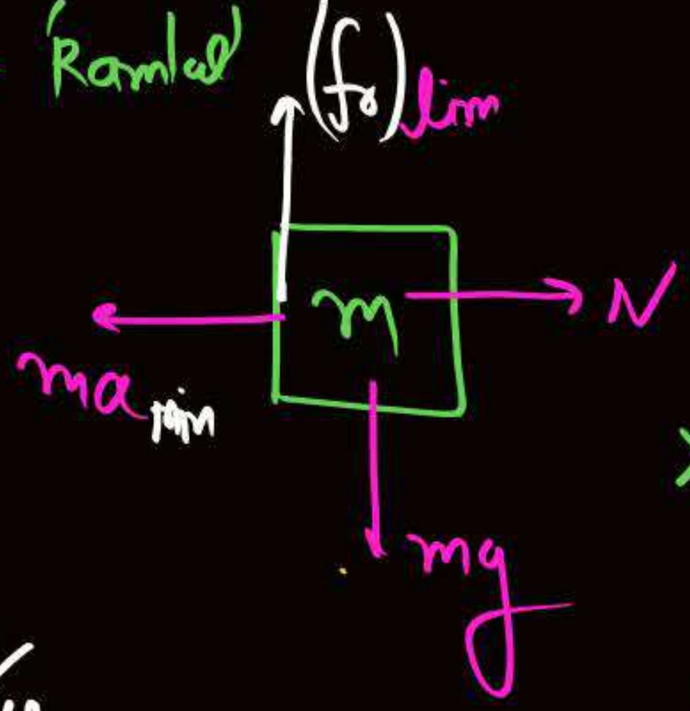
(NEET) 7

find $\underline{\text{minimum acc}^n}$ of this system so that block of $\boxed{m}$ mass does not slide on wedge.



$\underline{\text{Sol}^n}$

FBD of block w.r.t Ramlal



$$N = ma \quad \text{—— (1)}$$

$$(f_r)_{lim} = mg$$

$$\boxed{\begin{aligned} \mu N &= mg \\ \mu \cancel{m} a_{min} &= \cancel{m} g \end{aligned}}$$

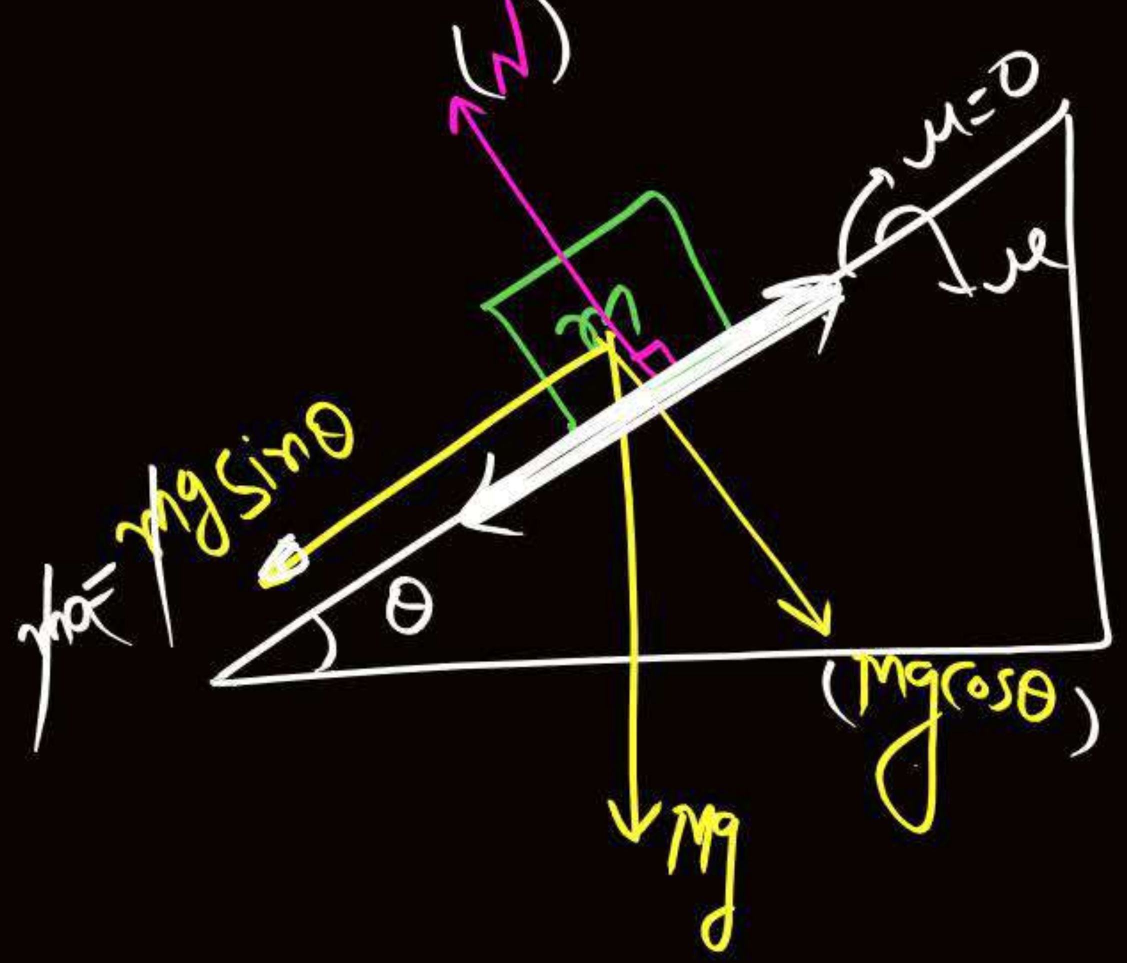
$$\boxed{a_{min} = \frac{g}{\mu}}$$

$$\boxed{acc^n \geq \frac{g}{\mu}}$$

$$\boxed{acc^n_{min} = g/\mu}$$

$$F_{min\,force} = (M+m)a_{min} = (M+m)\,g/\mu$$

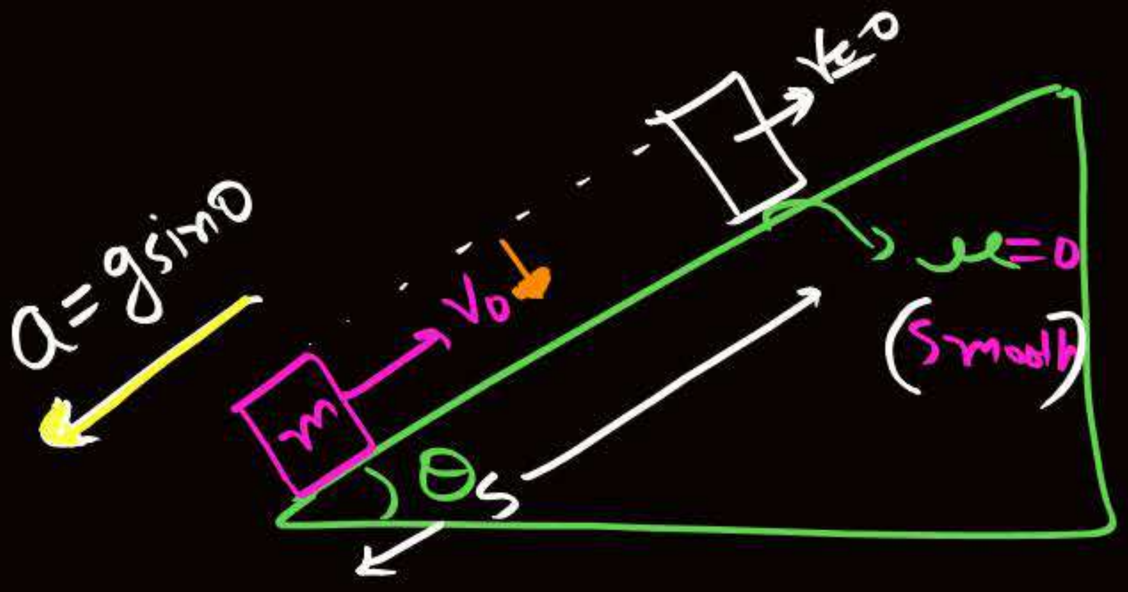
Friction on Inclined Plane (fixed)



$\perp_r$ to Inclined

$$\boxed{N = mg\cos\theta \quad \text{—— (1)}}$$

Case-1 (NEET)



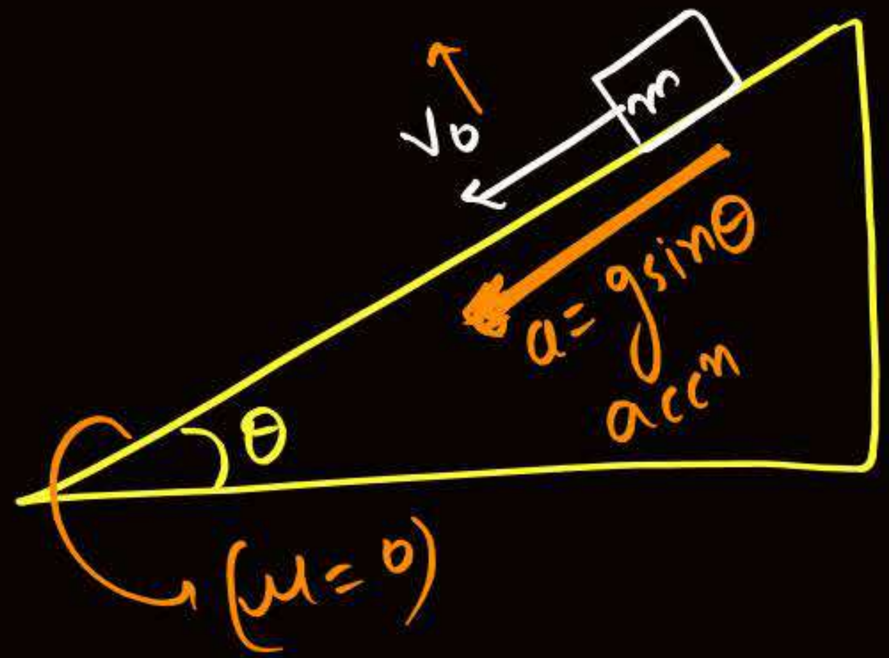
#) Stopping dist^n along Inclined plane $= \dfrac{V_0^2}{2(g\sin\theta)}$

$v - u = at$

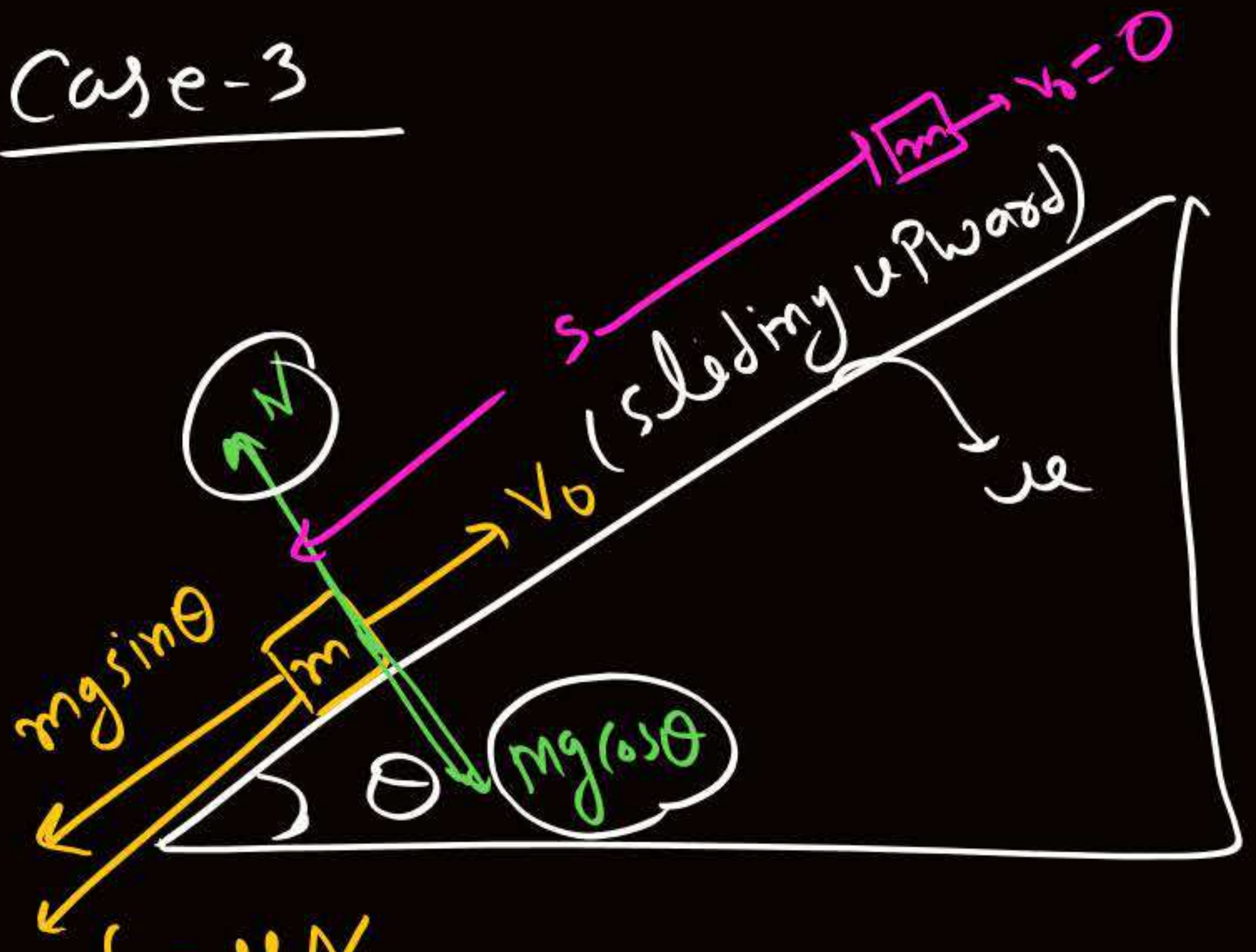
$-V_0 = -g\sin\theta\, t$

$\boxed{t = \dfrac{V_0}{g\sin\theta}}$ time after which object will stop.

Case-2



Case-3



$f_r = \mu N$

$(f_r)_{kind} = \mu\, Mg\cos\theta$

$\left\{ F_{net} = mg\sin\theta + \mu mg\cos\theta \right\}$ along Inclined Plane

$\cancel{m} a = \cancel{m}(g\sin\theta + \mu g\cos\theta)$

$a = g(\sin\theta + \mu\cos\theta)$

Incr down the

$$\boxed{s = \frac{v_0^2}{2g(\sin\theta + \mu\cos\theta)}}$$

① MR* 9f ($\mu = 0$)

$$\boxed{s = \frac{v_0^2}{2g\sin\theta}}$$

② MR* 9f $\theta = 90°$

$$\boxed{\left\{ s = \frac{v_0^2}{2g} \right\}}$$

Question

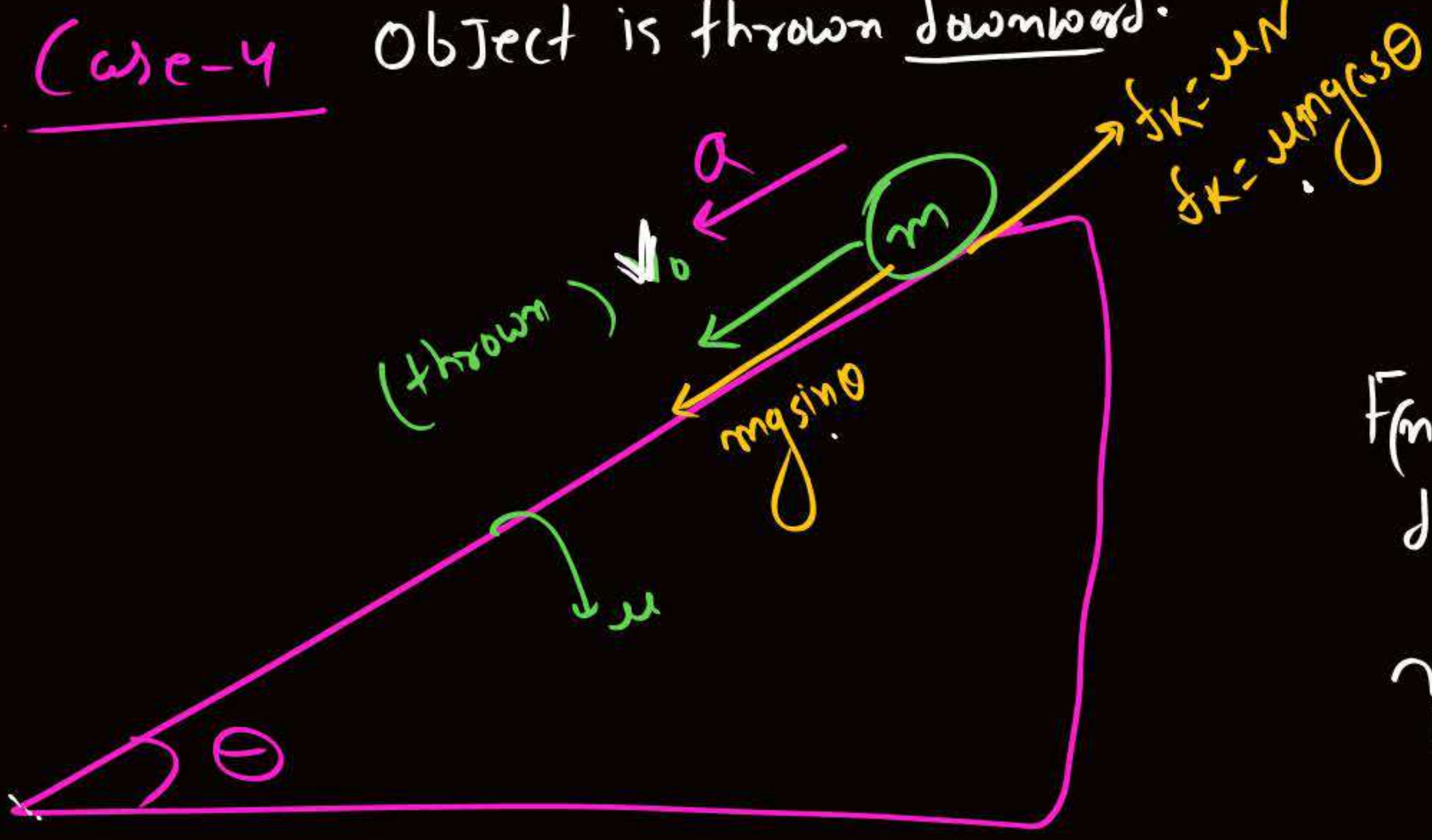
A block of mass 1 kg is projected from the lowest point up along the inclined plane. If $g = 10\ \text{ms}^{-2}$, the retardation experienced by the block is

1. $\boxed{\dfrac{15}{\sqrt{2}}\ \text{ms}^{-2}\ \text{(Ans)}}$
2. $\dfrac{5}{\sqrt{2}}\ \text{ms}^{-2}$
3. $\dfrac{10}{\sqrt{2}}\ \text{ms}^{-2}$
4. Zero

$$a = g(\sin\theta + \mu\cos\theta)$$

$$= 10\left[\sin 45^\circ + \frac{1}{2}\cos 45^\circ\right] = 10\left[\frac{1}{\sqrt{2}} + \frac{1}{2} \times \frac{1}{\sqrt{2}}\right] = \cancel{10}^{\,5}\,\frac{3}{\cancel{2}\sqrt{2}} = \frac{15}{\sqrt{2}}$$

Case-4 Object is thrown downward.



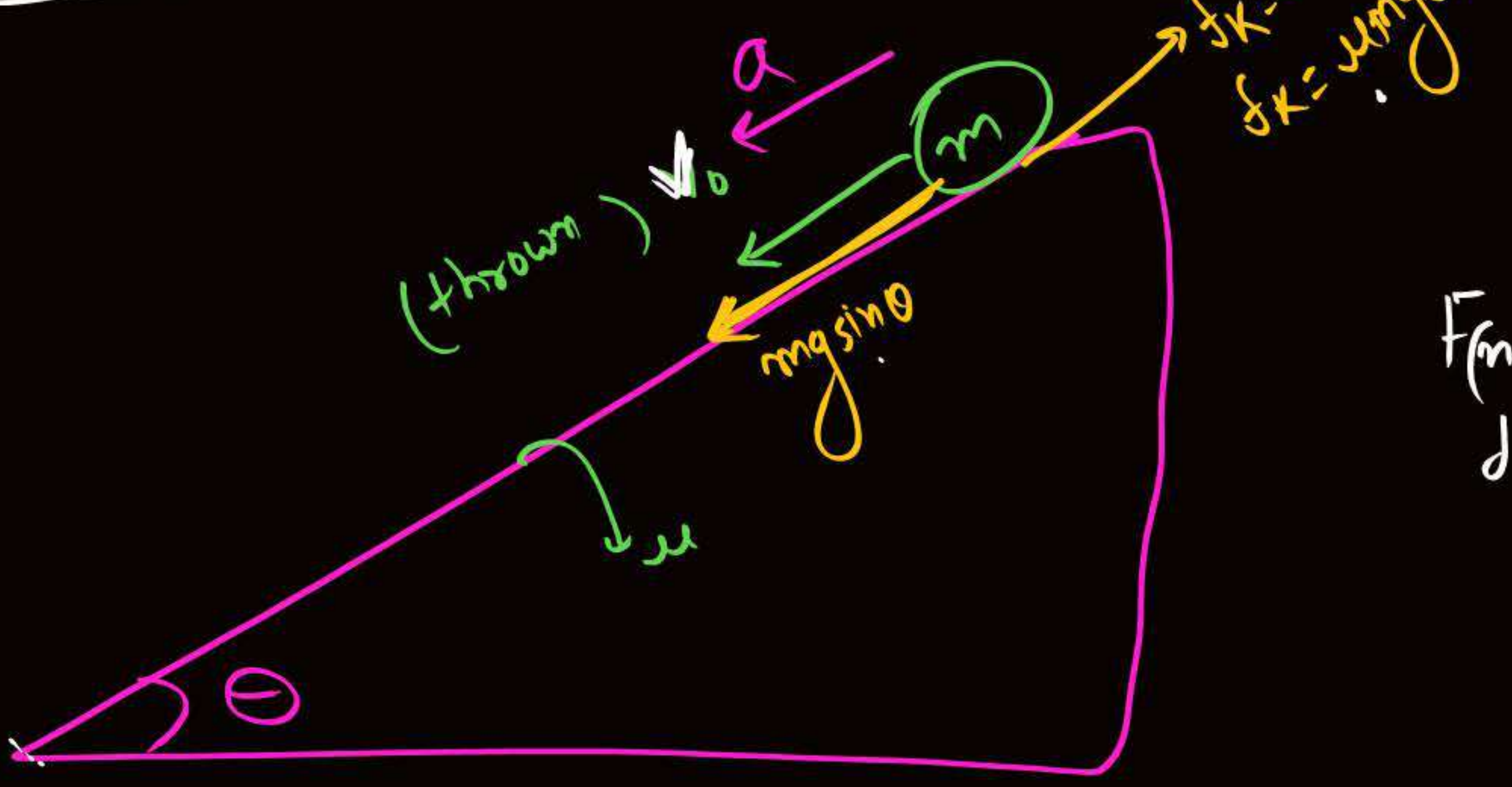
$$F_{(net)\,down} = mg\sin\theta - \mu mg\cos\theta$$

$$\cancel{m}a = \cancel{m}g(\sin\theta - \mu\cos\theta)$$

$\boxed{a = g(\sin\theta - \mu\cos\theta)}$

MR^x Box
Object Niche slide
kiya to kinetic
friction upar.

Case-5 Object is thrown downward.



$$F_{(net)\,down} = mg\sin\theta - \mu mg\cos\theta$$

$$\boxed{\text{If } mg\sin\theta = \mu mg\cos\theta}$$

$F_{net} = 0$

$a = 0$

$V = V_0$ const^n velocity se chalta rahega

MR^x Box

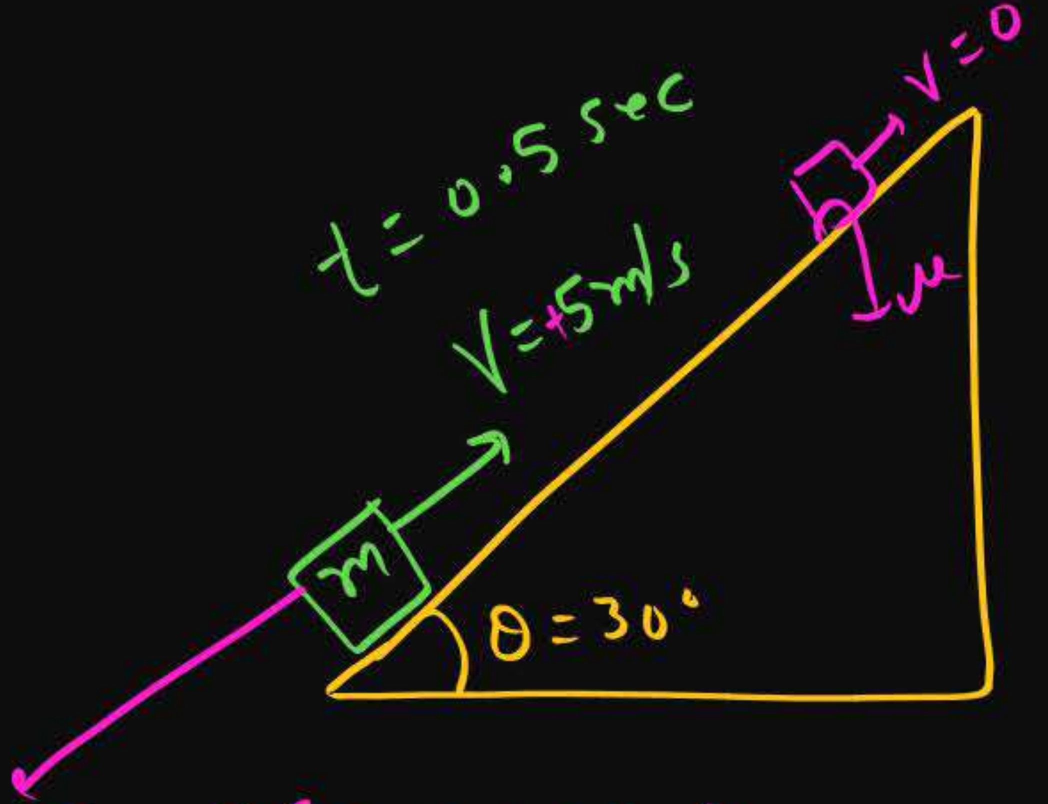
Object Niche slide kiya to Kinetic friction upar!!

Question

If a block moving up an inclined plane at 30° with a velocity of 5 m/s, stops after 0.5 s, then coefficient of friction will be nearly

1. 0.5
2. 0.6
3. 0.9
4. 1.1

$$\frac{1}{\sqrt{3}} = \frac{1}{1.71} = 0.584$$



$$a = g(\sin\theta + \mu\cos\theta)$$

$$v - u = at$$

$$0 - 5 = -g(\sin\theta + \mu\cos\theta)t$$

$$-\cancel{5} = -\cancel{10}\left[\sin 30 + \mu\cos 30\right]\frac{1}{\cancel{2}}$$

$$1 = \frac{1}{2} + \mu\frac{\sqrt{3}}{2}$$

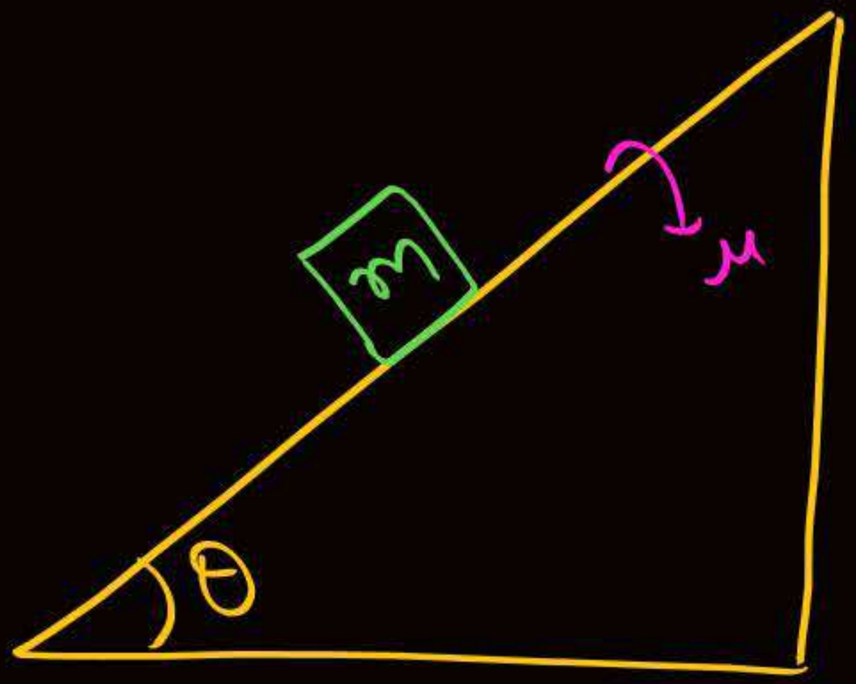
$$1 - \frac{1}{2} = \mu\frac{\sqrt{3}}{2}$$

$$\frac{1}{\cancel{2}} = \frac{\mu\sqrt{3}}{\cancel{2}}$$

$$\mu = \frac{1}{\sqrt{3}}$$

Now Object is released on Inclined Placed [Placed on Inclined]

Case-1



Case-1
Object place(release) Karne Ke bad Chala hi Nahi

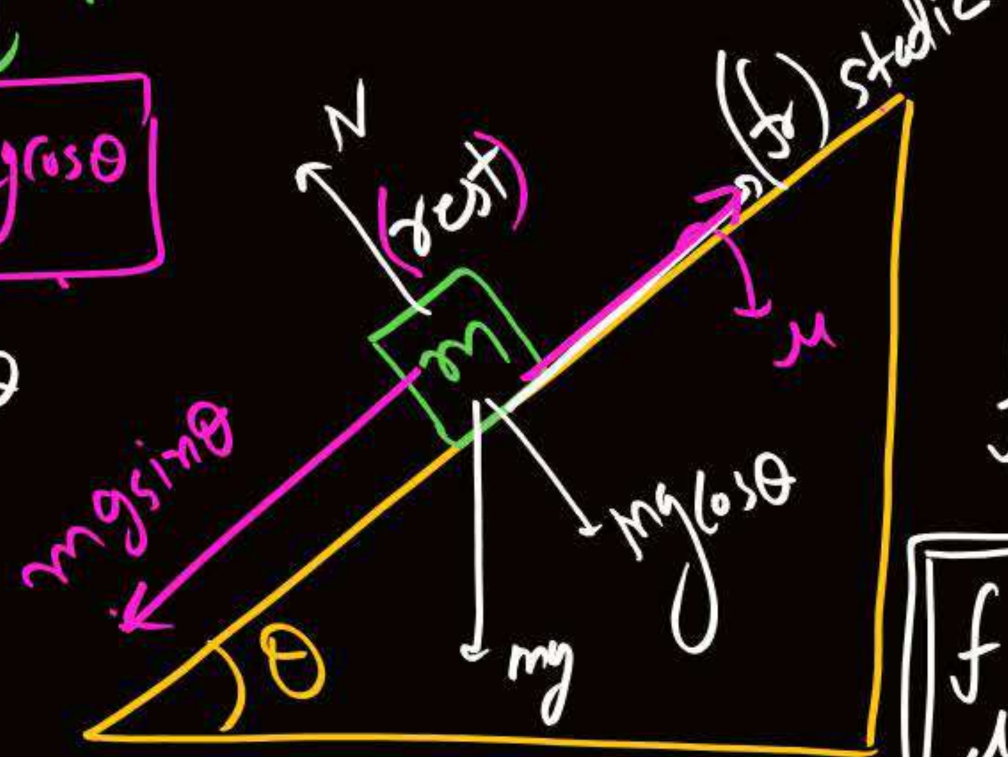
Chalane Ki Kosis | Rokne Ki Kosis

$$\boxed{mg\sin\theta < \mu mg\cos\theta}$$

$$\sin\theta < \mu\cos\theta$$

$$\boxed{\tan\theta < \mu}$$

(tendency of motion)



$N = mg\cos\theta$

$f_{limits} = \mu N$

$$\boxed{f_{lim} = \mu mg\cos\theta}$$

Ye Maximum friction Ki value hai
about to move Ki Condn me lagega.

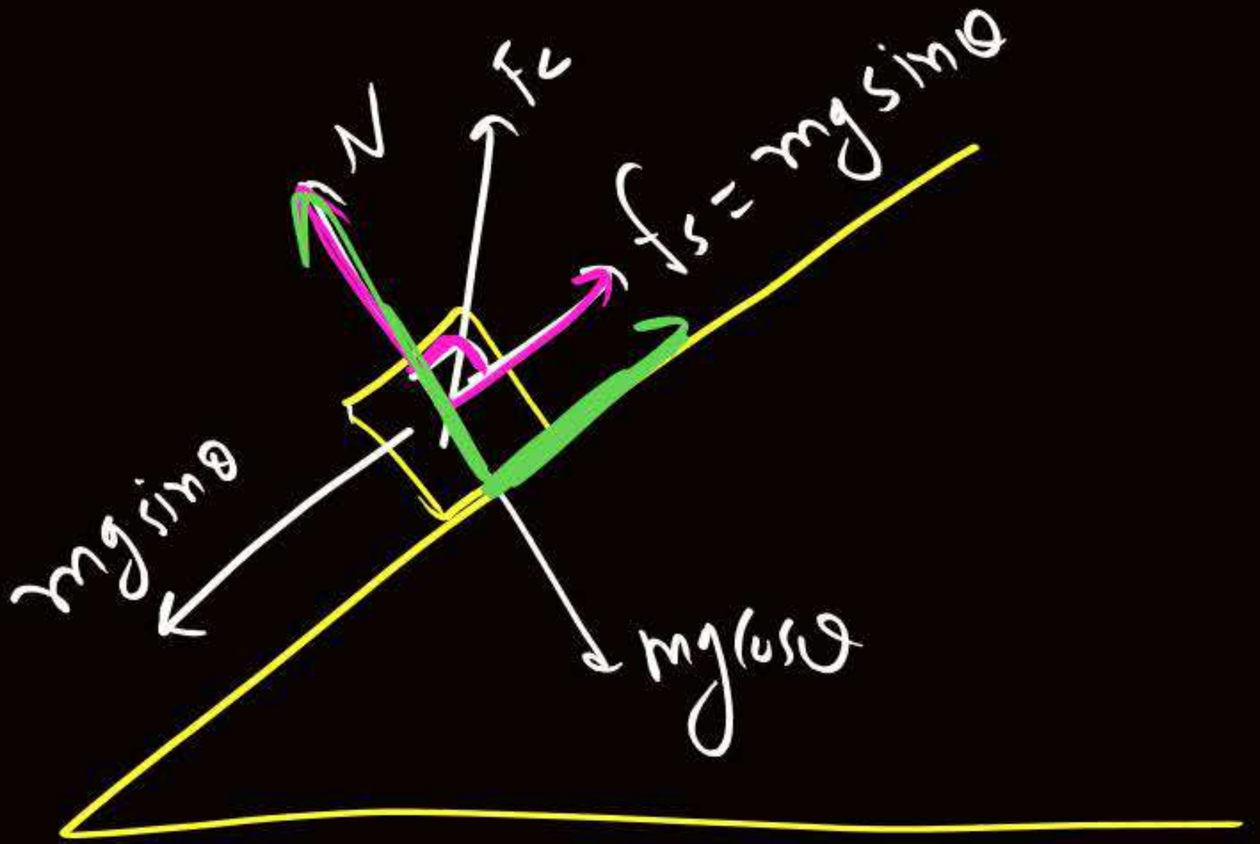
$f_{static} = F_{applied\ force}$

$$\boxed{f_{static} = mg\sin\theta}$$

यें friction लगेगा

$$\boxed{acc^n = 0}$$

Contact force applied by Inclind plane object will be :—

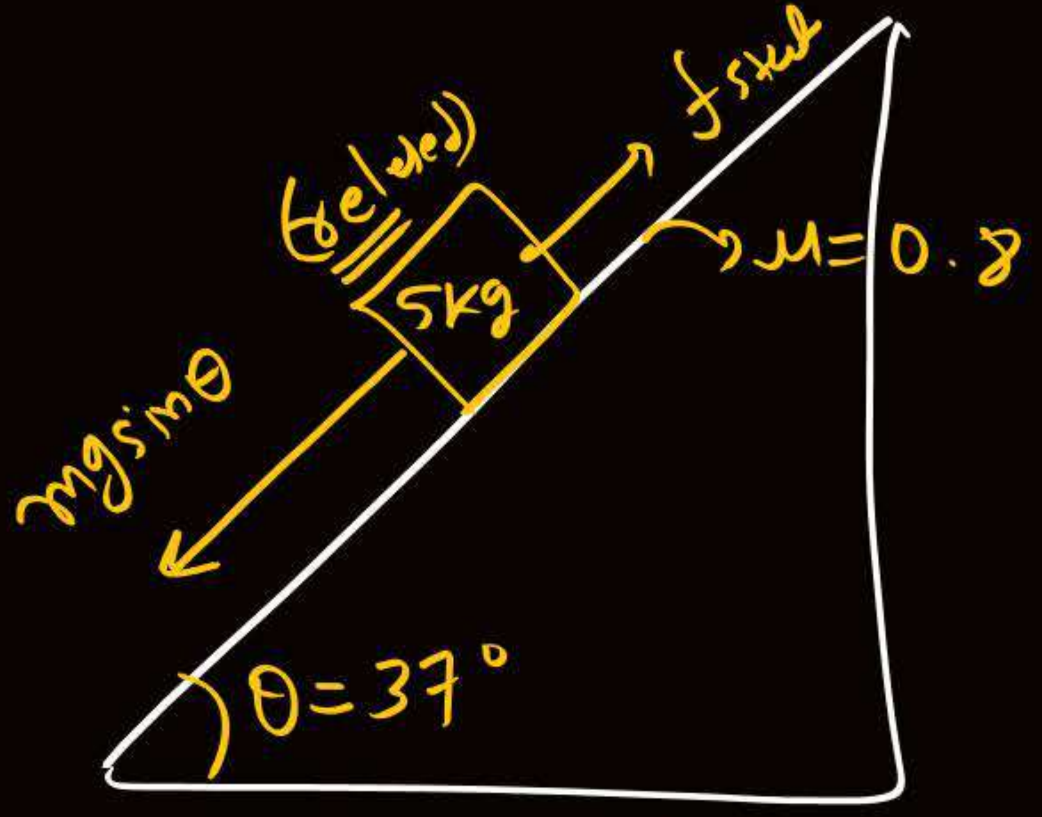


$$F_c = \sqrt{N^2 + f_s^2}$$

$$= \sqrt{(mg\cos\theta)^2 + (mg\sin\theta)^2}$$

$$= \sqrt{(mg)^2 (\sin^2\theta + \cos^2\theta)}$$

$$\boxed{F_c = \sqrt{(mg)^2 \times 1} = mg}$$



rest
$a = 0$

$$\boxed{f_{static} = mg\sin\theta = 30\,N}$$

मजदूरी

$Mg\sin\theta = 5\times10\times\sin37^\circ$

चलाने

$$= \cancel{50}^{10}\times\frac{3}{\cancel{5}}$$

$$= 30\,N$$

$f_{lim} = \mu mg\cos\theta = \frac{8}{10}\times5\times10\times\frac{4}{5} = 32\,N$

rokne

find accⁿ & fri ng force

MR*

$\mu = 0.8$

$\tan\theta = \tan37^\circ$

$= \frac{3}{4} = 0.75$

$$\boxed{\tan\theta < \mu}$$

नहीं चलेगा

$a = 0$

MR^x Box : when object is released on Inclined Plane

① $\boxed{\mu > \tan\theta}$

$a = 0$

$(f)_r = \text{static} = mg\sin\theta$

② $\mu = \tan\theta \longrightarrow \left[mg\sin\theta = \underbrace{\mu mg\cos\theta}_{}\right]$ (f_{lim})

about to move $(a = 0)$

$\tan\theta = \mu$

$\theta = \tan^{-1}(\mu)$ → $\boxed{\text{Angle of repose}}$

Angle of Inclination at which object Just about to slid.

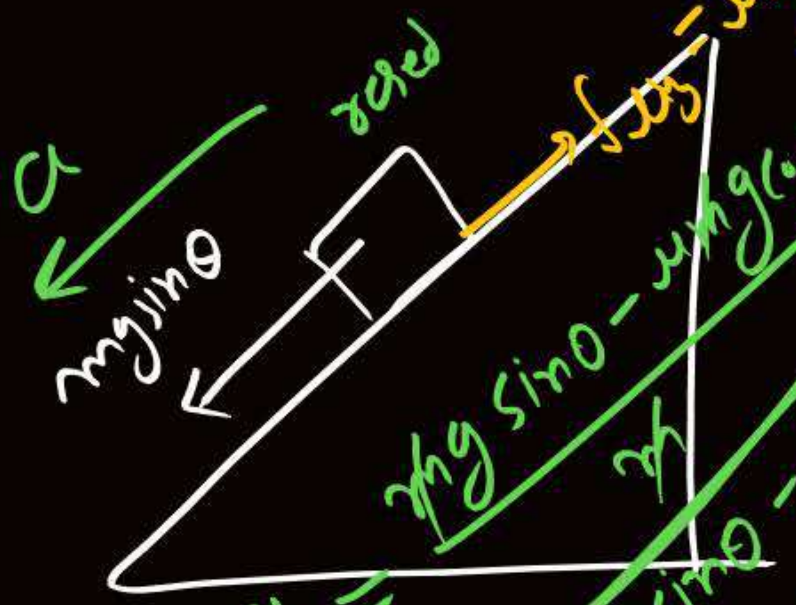
$\boxed{a = 0}$

$f_{\text{limit}} = \mu mg\cos\theta = mg\sin\theta$

Case-3

$\tan\theta > \mu$

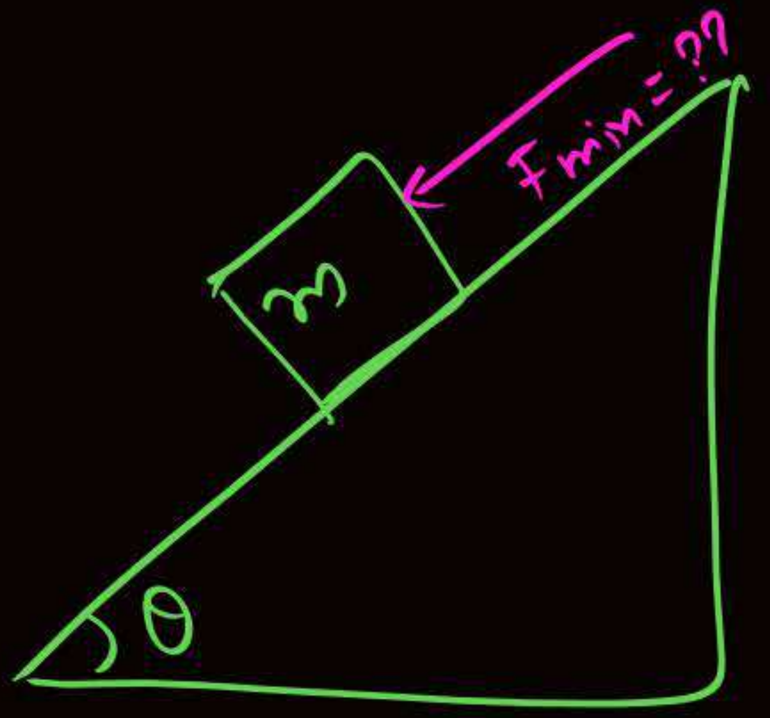
$mg\sin\theta > (\mu mg\cos\theta)$



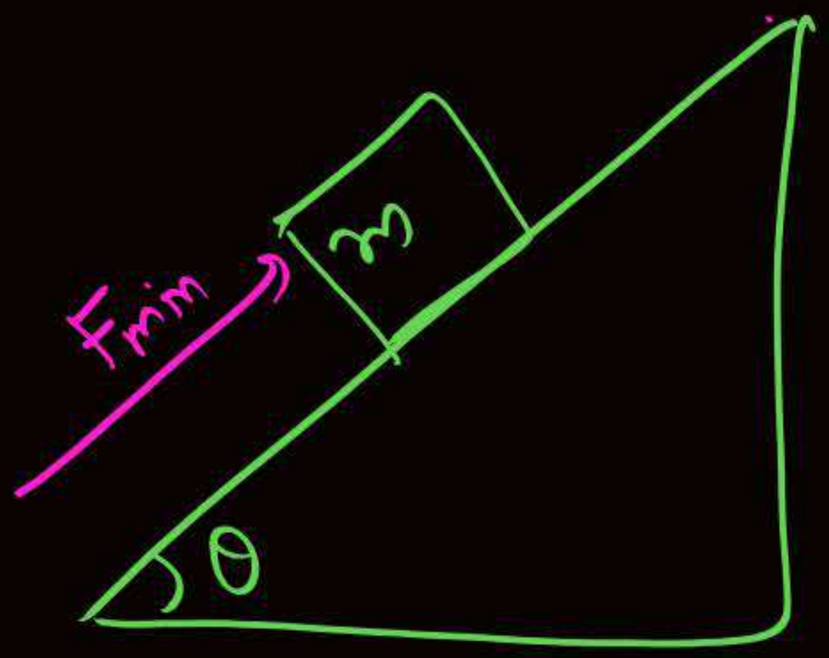
$\cancel{m}a = \cancel{m}g\sin\theta - \mu \cancel{m}g\cos\theta$

$\boxed{a = g\sin\theta - \mu g\cos\theta}$

(2) If ($\mu > \tan\theta$) ; then find minimum external force to move this object downward.



(2) If (μ_k tan θ) ; then find minimum external force to keep the object at rest



Question

(3)

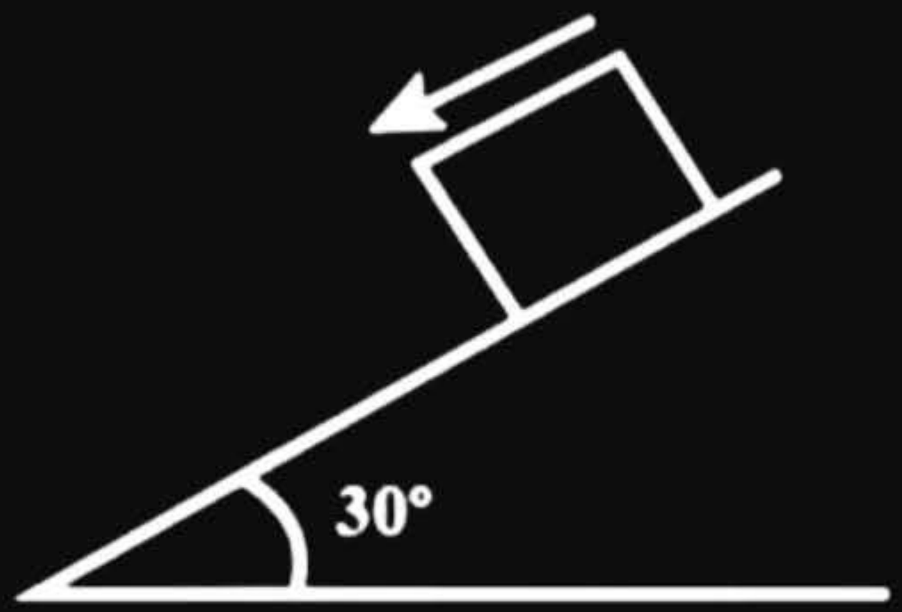
A cubical block rests on a plane of $\mu = \sqrt{3}$. The angle through which the plane be inclined to the horizontal so that the block just slides down will be

1. $30°$
2. $45°$
3. $60°$
4. $75°$

Question (4)

A block of mass 10 kg is released on rough incline plane. Block start descending with acceleration $2\ m/s^2$. Kinetic friction force acting on block is (take $g = 10\ m/s^2$)

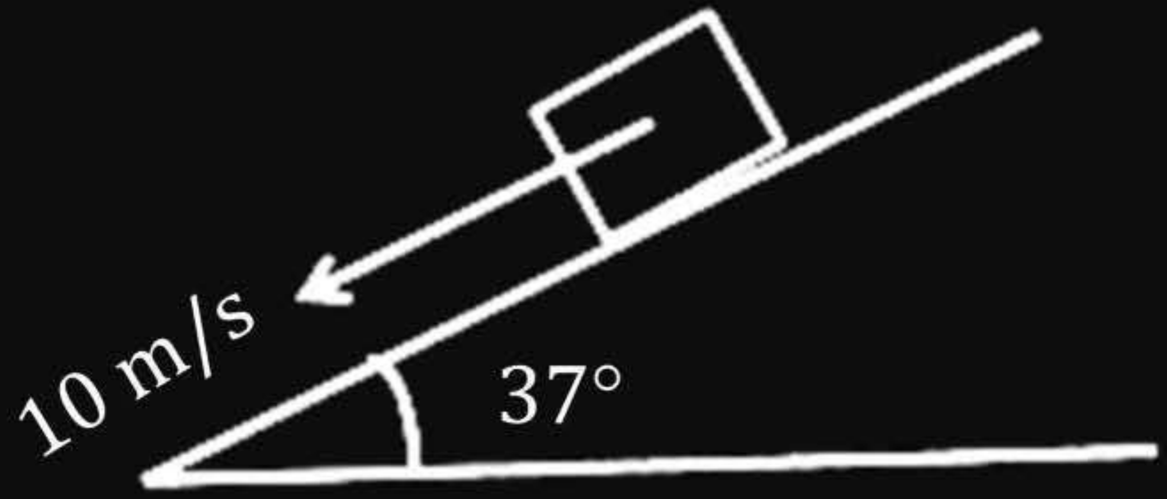
1. 10 N
2. 30 N
3. 50 N
4. $50\sqrt{3}$N



Question 5

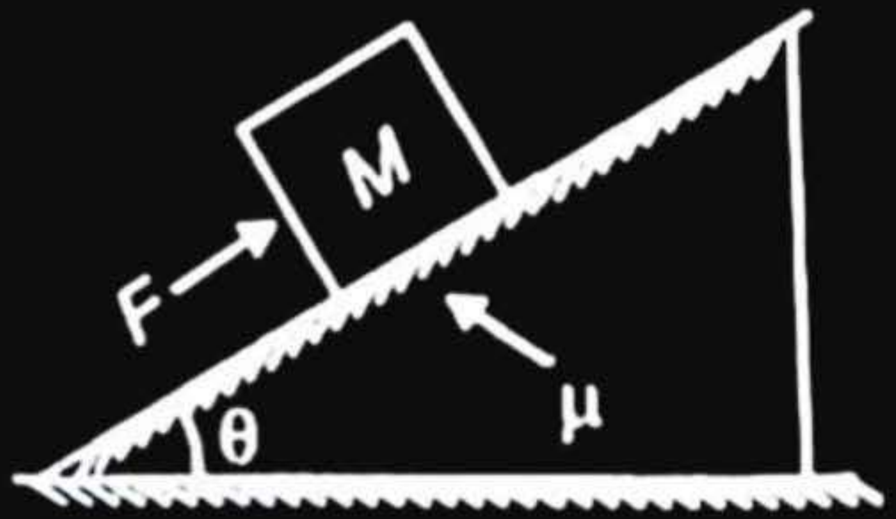
Block of mass 10 kg is moving on inclined plane with constant velocity 10 m/s. The coefficient of kinetic friction between incline plane and block is

1. 0.57
2. 0.75
3. 0.5
4. None of these



Question (5)

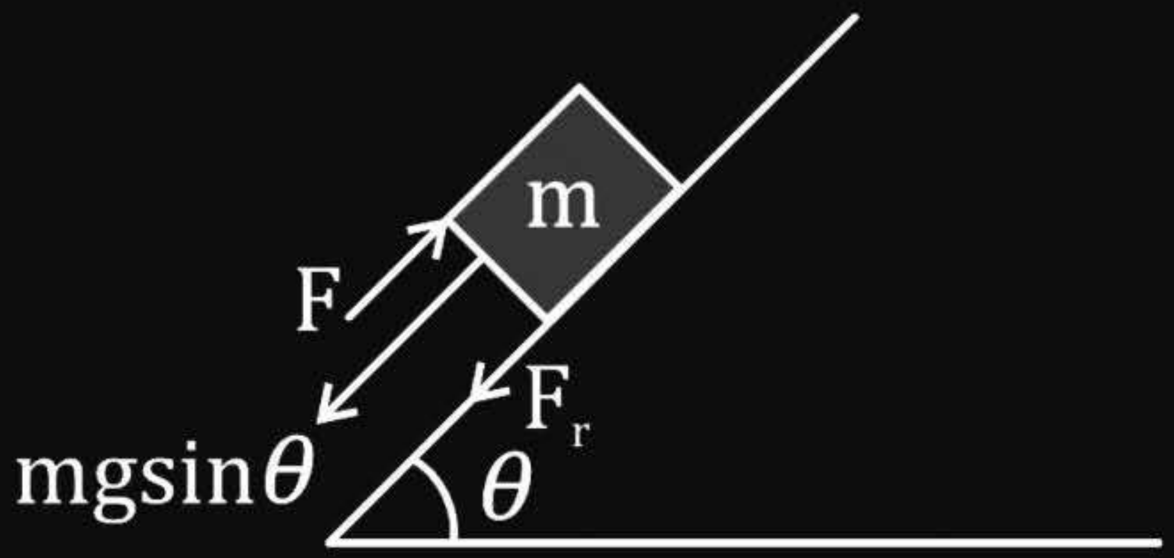
A block (mass = M kg) is placed on a rough inclined plane. A force F is applied parallel to the inclined (as shown in figure) such that it just starts moving upward. The value of F is



1. $Mg \sin\theta - \mu Mg \cos\mu$
2. $Mg \sin\theta + \mu Mg \cos\theta$
3. $Mg \sin\theta$
4. $\mu Mg \cos\theta$

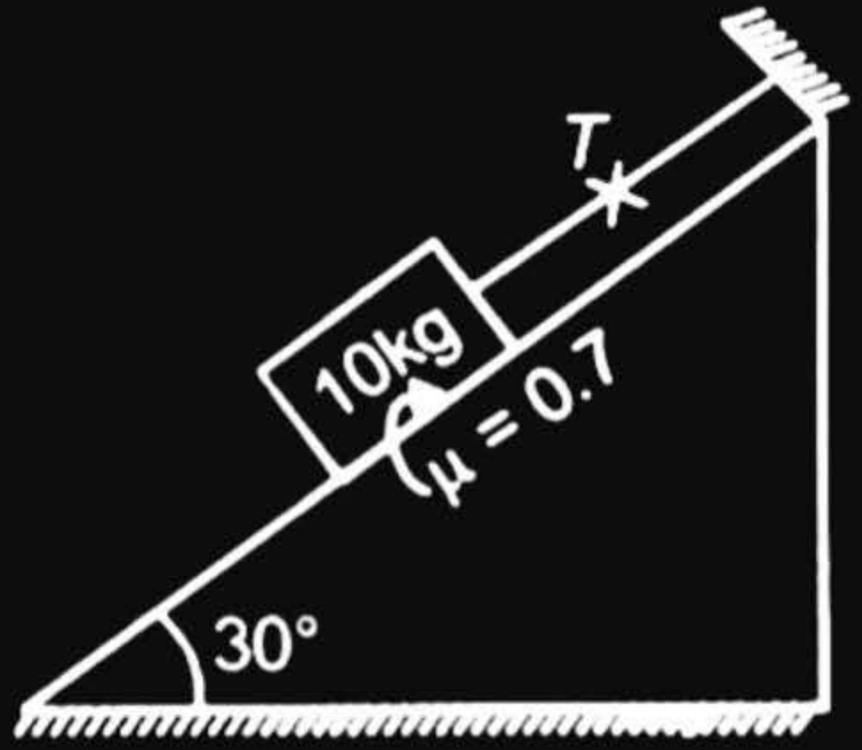
Question 6

If $\mu > \tan\theta$, then find minimum force required to move up to the inclined plane.



Question 7

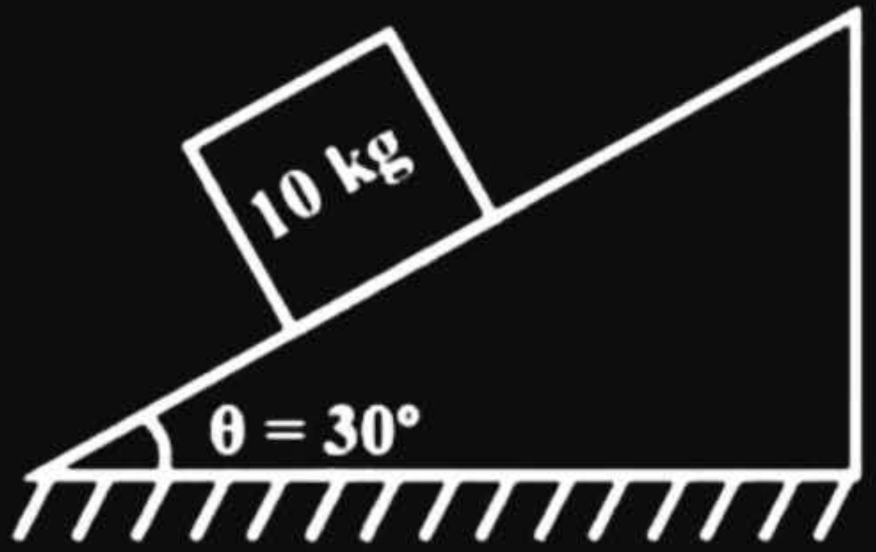
The tension T in the string shown in figure is



1. Zero
2. 50 N
3. 35V 3N
4. $(\sqrt{3}-1)50\text{N}$

Question

A block of mass 10 kg is kept on a fixed rough ($\mu = 0.8$) inclined plane of angle of indication 30°. The frictional force acting on the block is

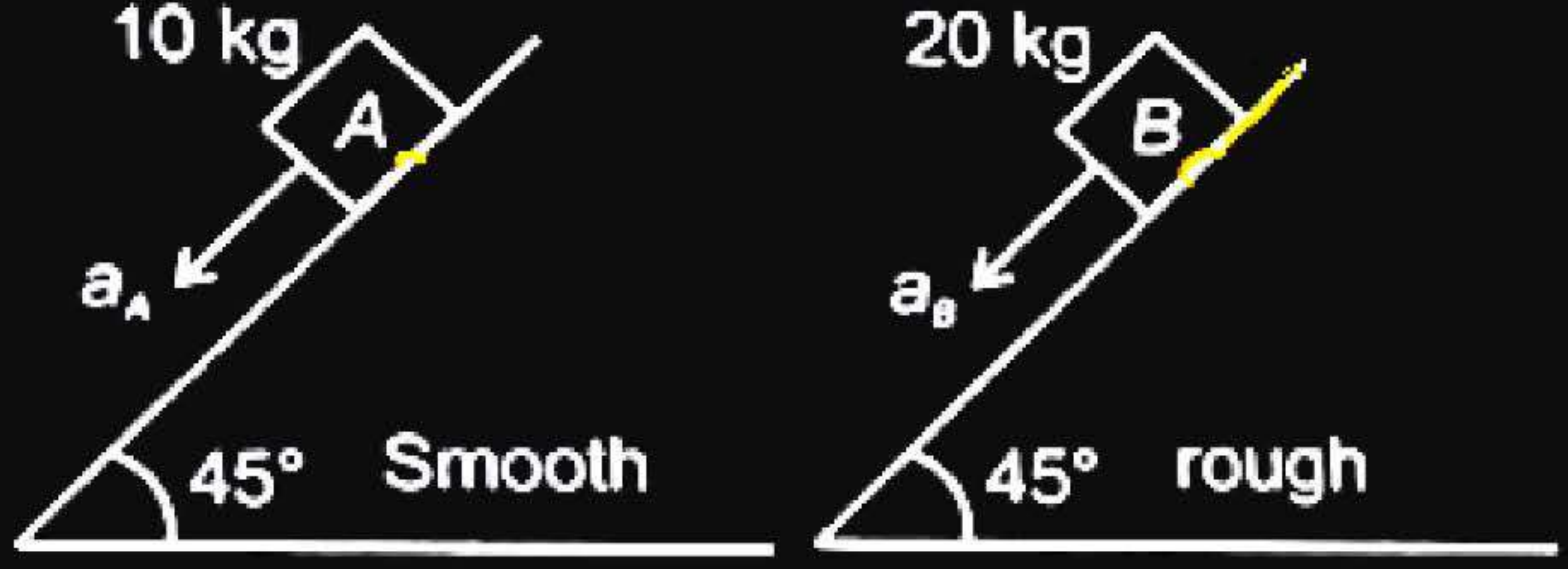


1. 50 N
2. $50\sqrt{3}$N
3. 52 N
4. 54 N

Question 9

The ratio of the acceleration of blocks A placed on smooth incline with block B placed on rough incline is 2 : 1. The coefficient of kinetic friction between block B and incline is

1. 0.5
2. 0.75
3. 0.57
4. None of these



Question (10)

A block rests on a rough inclined plane making an angle of $30°$ with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force the on the block is 10 N, the mass of the block (in kg) is (take $g = 10\ m/s^2$)

[AIEEE 2004]

1. 2.0
2. 4.0
3. 1.6
4. 2.5

Question 11

The force required just to move a body up an inclined plane is double the force required just to prevent the body sliding down. If the coefficient of friction is 0.25, the angle of inclination of the plane is:

1. 30°
2. 45°
3. $\tan^{-1}\left(\frac{1}{4}\right)$
4. $\tan^{-1}\left(\frac{3}{4}\right)$

Question

12

A body of mass 10 kg is lying on a rough inclined plane of inclination 37° and $\mu = 1/2$, the minimum force required to pull the body up the plane is

1. 80 N
2. 100 N
3. 120 N
4. 60 N

Question

13

A body is sliding down an inclined plane $\left(\mu = \frac{1}{2}\right)$. If the normal reaction is twice that of the resultant downward force along the incline, the inclination of plane is

1. 15°
2. 30°
3. 45°
4. 60°

Question 14

A given object takes n times as much time to slide down a $45°$ rough incline as it takes down a perfectly smooth $45°$ incline. The coefficient of kinetic friction between the object and the incline is given by:

1. $\left(1-\frac{1}{n^2}\right)$

2. $1-\frac{1}{n^2}$

3. $\sqrt{\left(1-\frac{1}{n^2}\right)}$

4. $\sqrt{1-\frac{1}{n^2}}$

Question 15

A block of mass m is placed on a surface with a vertical cross-section given by $y = \frac{x^3}{6}$. If the coefficient of friction is 0.5. The maximum height above the ground at which the block can be placed without slipping is:

1. $\frac{1}{6}$ m
2. $\frac{2}{3}$ m
3. $\frac{1}{3}$ m
4. $\frac{1}{2}$ m

H/w all 15 – Question in PPt

Sanghorsh assignment.

THANK YOU

MRV →