YAKEEN NEET 2.0

2026

Laws of Motion

Physics | Lecture - 04

By- Manish Raj (MR Sir)

Todays goal

→ Momentum & newtons 2nd Law

(1) Maha-manthan of Motion in a Plane

(2) Sanghash assignment

N.L.M.- 1

on equilibrium

→ 30%-40% kar liya → SamjhTOP-500

Top-500 Run

60 numb पर हैं

Question

A man of mass m stands on a frame of mass M. He pulls a light rope, which passes over a pulley. The other end of the rope is attached to the frame. For the system to be rest [redacted] what force must the man exert on the rope?

1. $\frac{(M + m)g}{2}$
2. $(M + m)\,g$
3. $(M - m)\,g$
4. $(M + 2m)\,g$

FBD of man

$T + N = mg$ — (i)

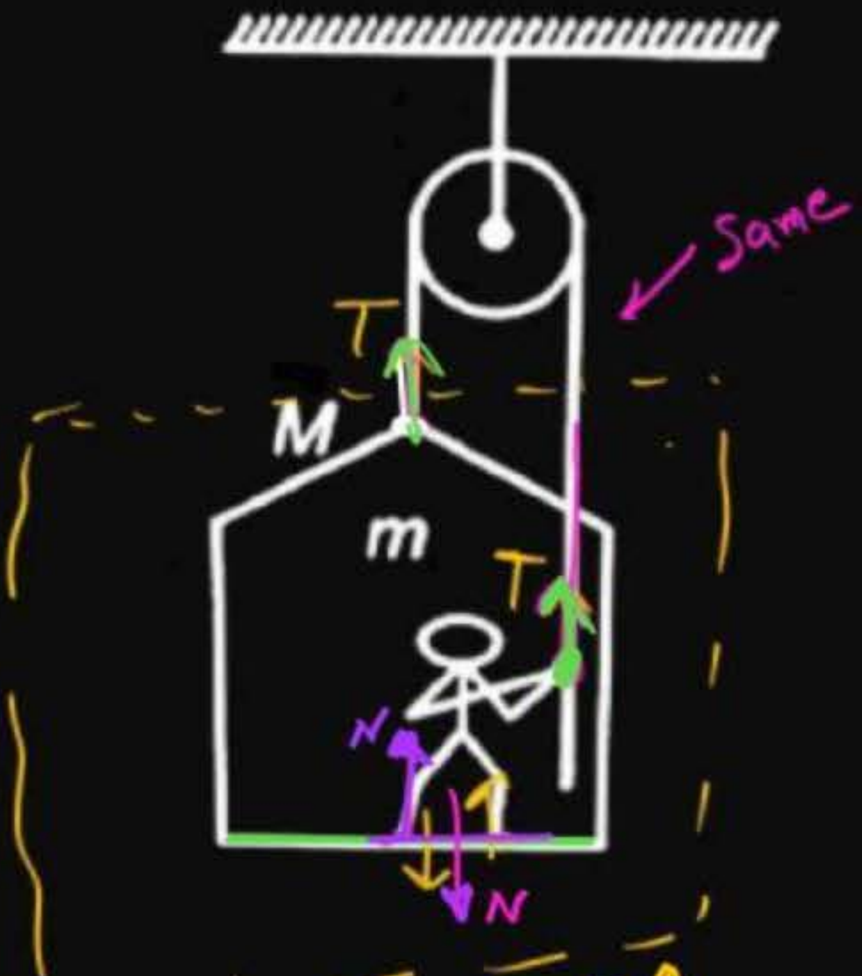
$N = mg - T$ — (i)

Fram Ka FBD

rest {

$T = N + Mg$ — (ii)

$N = T - Mg$ — (ii)



$mg - T = T - Mg$

$T = \frac{(m+M)g}{2}$

Question

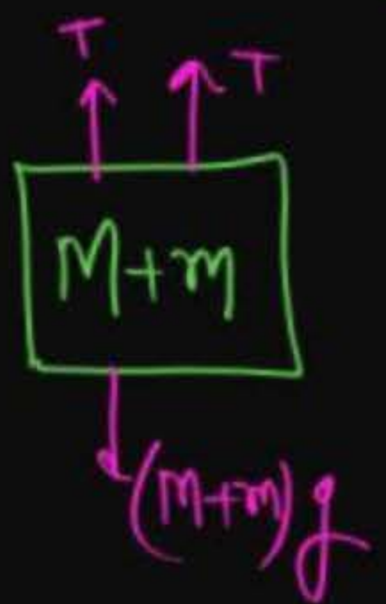
A man of mass m stands on a frame of mass M. He pulls a light rope, which passes over a pulley. The other end of the rope is attached to the frame. For the system to be rest [redacted] what force must the man exert on the rope?

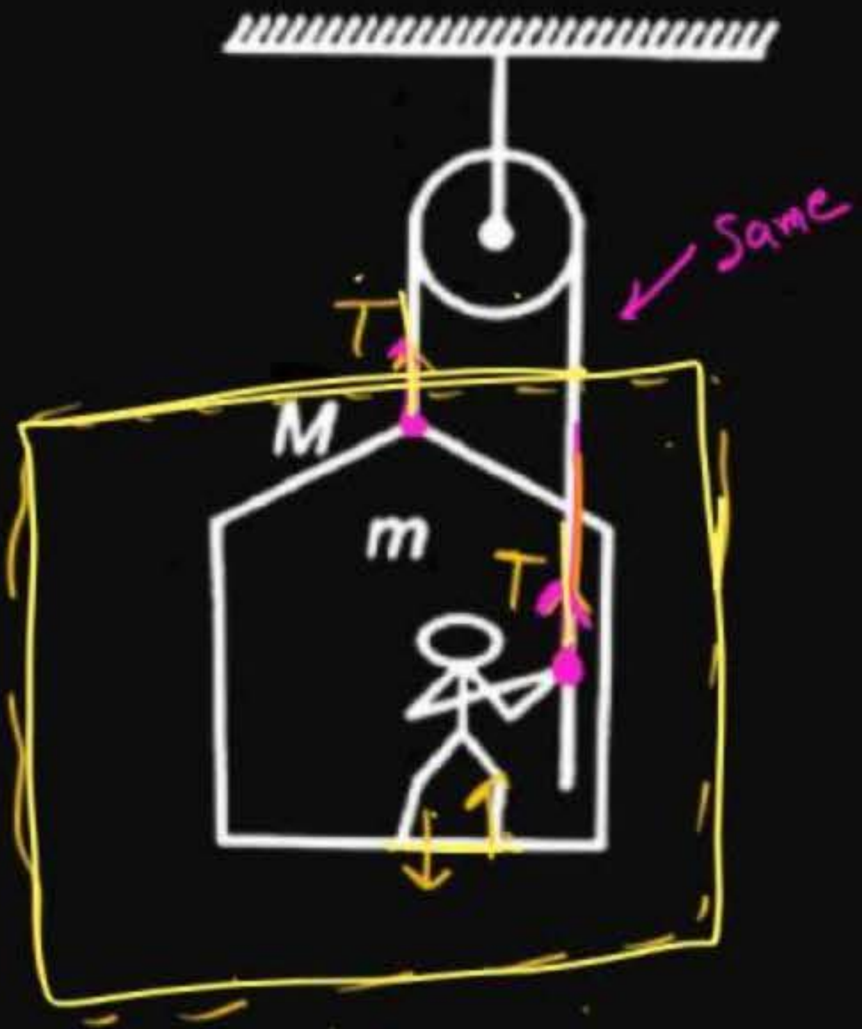
1. $\dfrac{(M+m)g}{2}$
2. $(M+m)\,g$
3. $(M-m)\,g$
4. $(M+2m)\,g$

$$2T = (m+M)g$$

$$\boxed{T = \left(\frac{M+m}{2}\right)g}$$

Man + fram ka combine FBD





Question

A man (mass m) hold himself and plank (mass M) in equilibrium with the help of 3 pulley + string system. The force exerted by man upon rope is

JEE

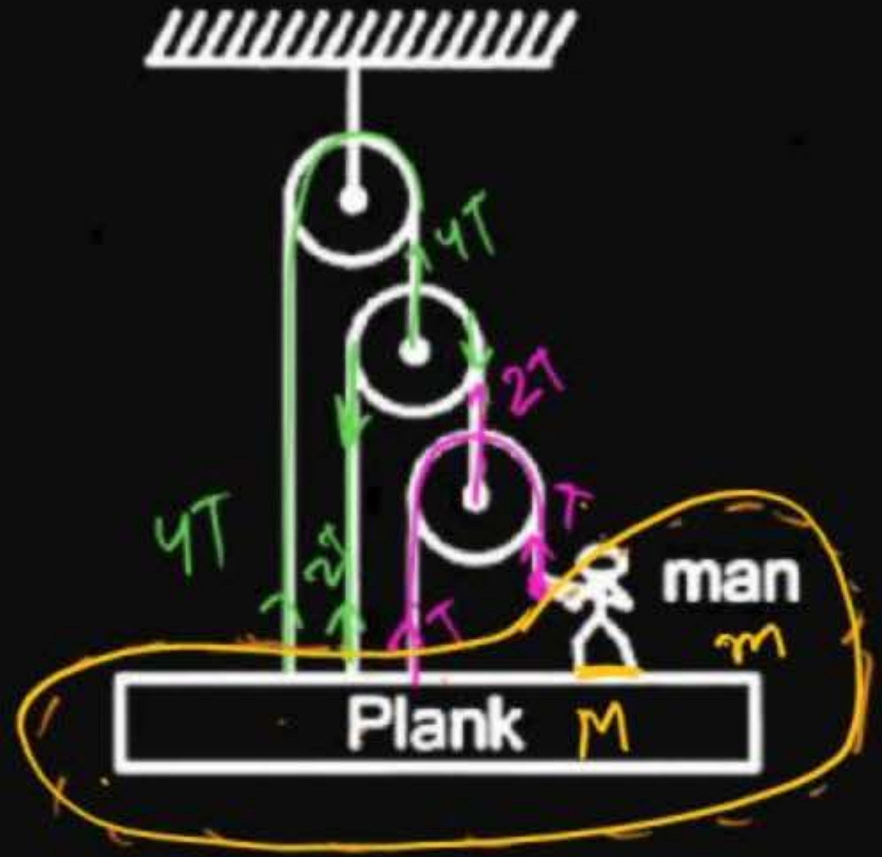
1. $\dfrac{(M+m)g}{7}$

2. $\dfrac{(M+m)g}{8}$

3. $\dfrac{(M+m)g}{6}$

4. $\dfrac{(M+m)g}{5}$

$T = \dfrac{(M+m)g}{8}$



Question

(H/W) लिखना नहीं है

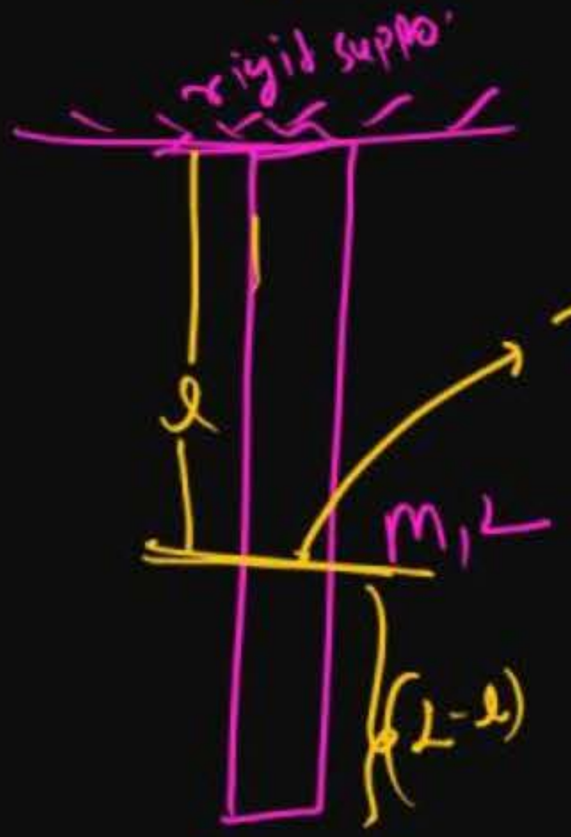
A uniform rope of mass M and length L is fixed at its upper end vertically from a rigid support. Then the tension in the rope at the distance l from the rigid support is

(1) $Mg\frac{L}{L+I}$

(2) $\frac{Mg}{L}(L-I)$

(3) Mg

(4) $\frac{L}{L}Mg$



$L \longrightarrow m$

$1 \longrightarrow \frac{m}{L}$

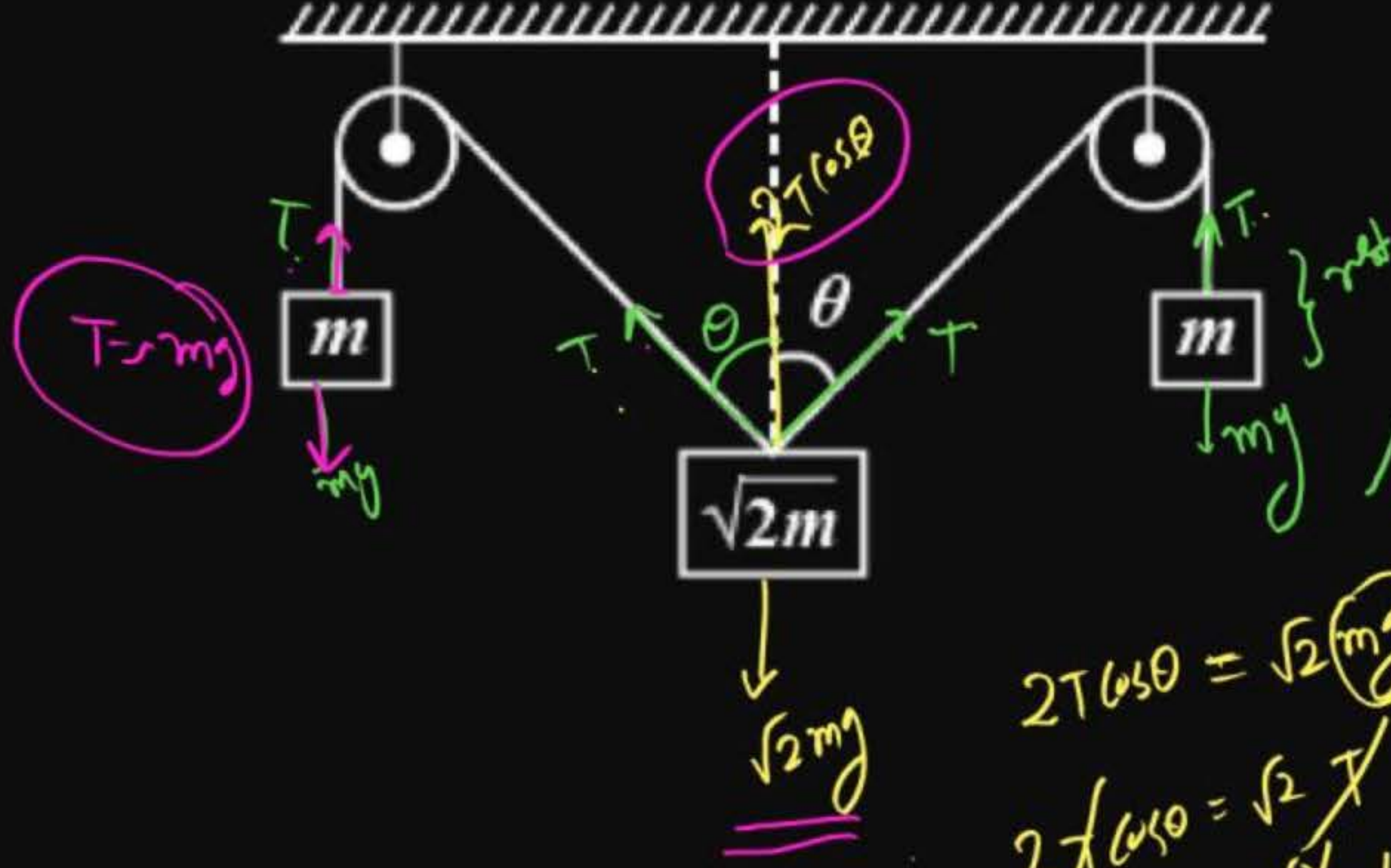
$T = gm' = \frac{m}{L}(L-l)g$

Question

H/w लिखना नहीं है।

The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be **(2001, 2M)**

1. 0°
2. 30°
3. 45° ✓
4. 60°



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

$2\cancel{T}\cos\theta = \sqrt{2}\,\cancel{T}$

$\cos\theta = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$

Question

H/ω लिखना नहीं है

A mass of 10 kg is suspended vertically by a rope from the roof. When a horizontal force is applied on the mass, the rope deviated at an angle of 45° at the roof point. If the suspended mass is at equilibrium, the magnitude of the force applied is
(Take, $g = 10 \text{ ms}^{-2}$) **(2019 Main, 9 Jan II)**

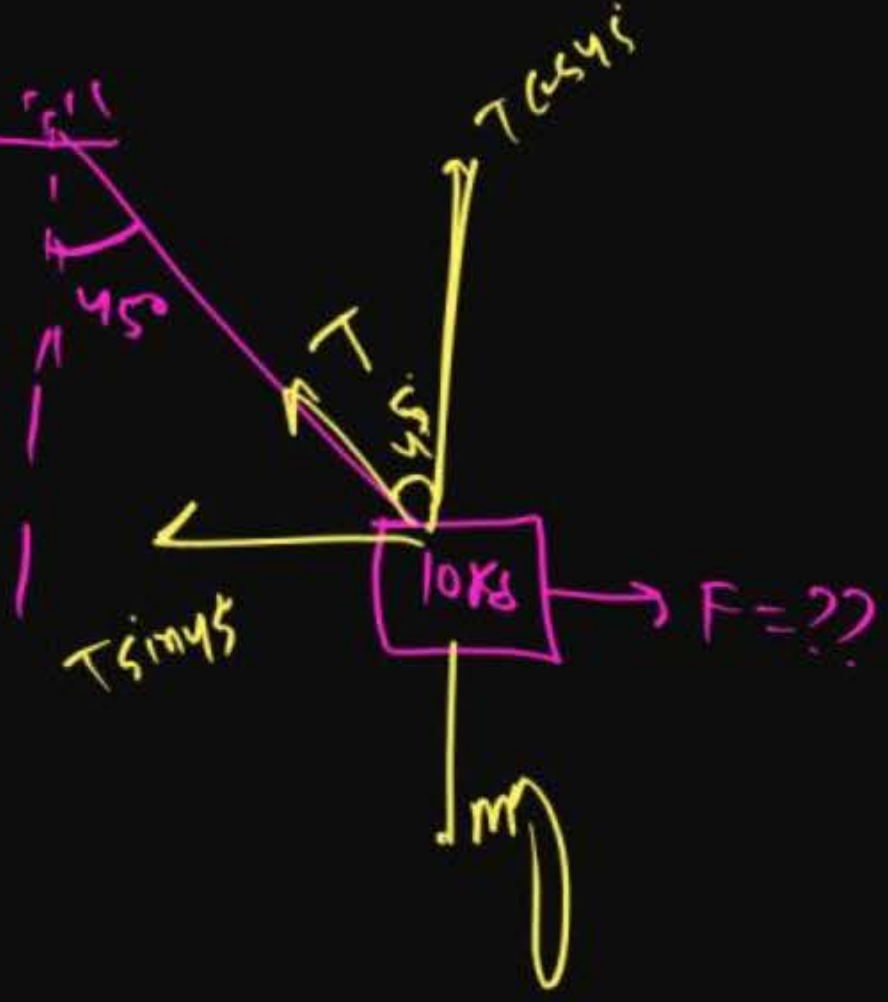
(1) 70 N

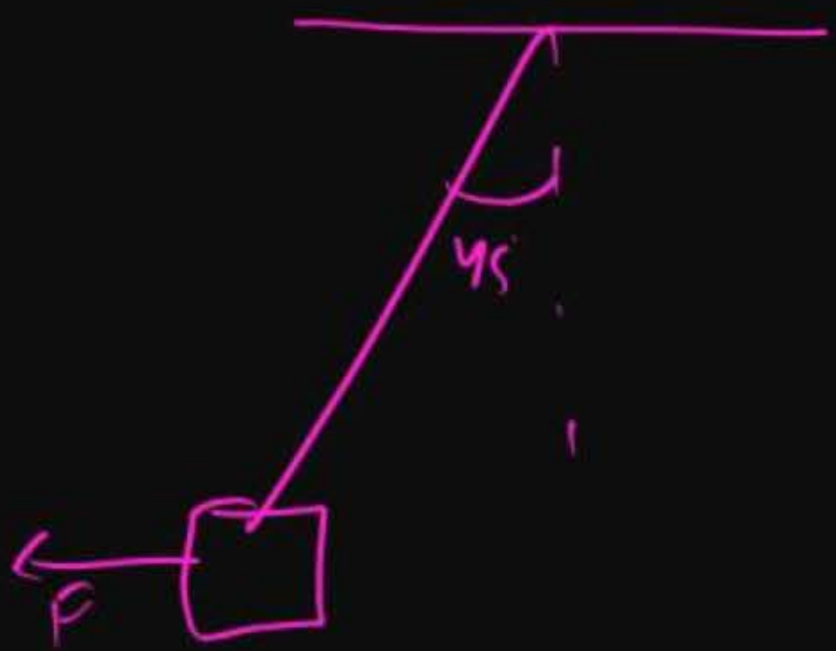
(2) 200 N

(3) 100 N

(4) 140 N

done





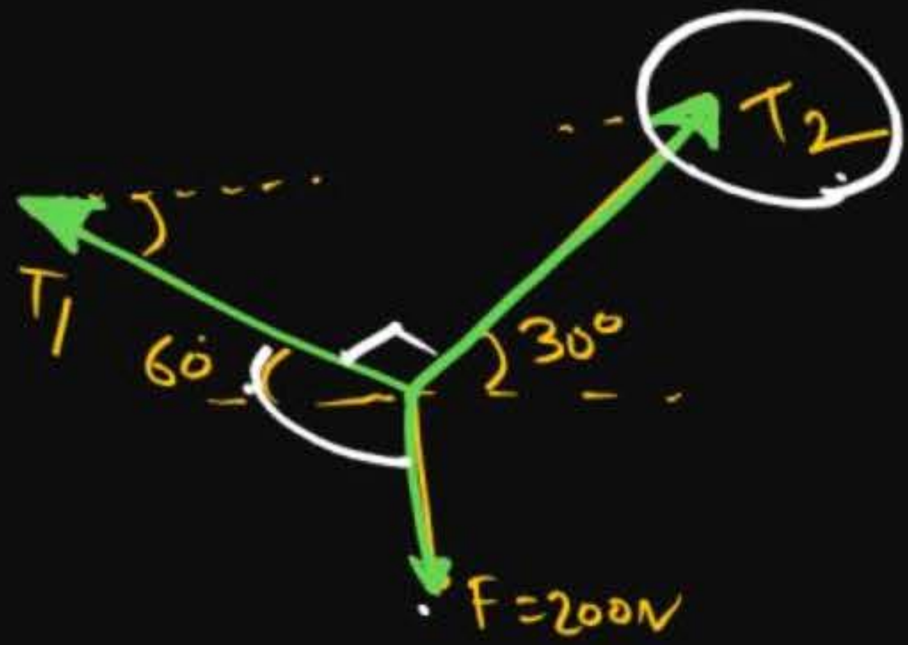
Question

H/w लिखना नहीं है

easy

In the arrangement as shown, tension T_2 is $(g = 10\ \mathrm{m/s^2})$

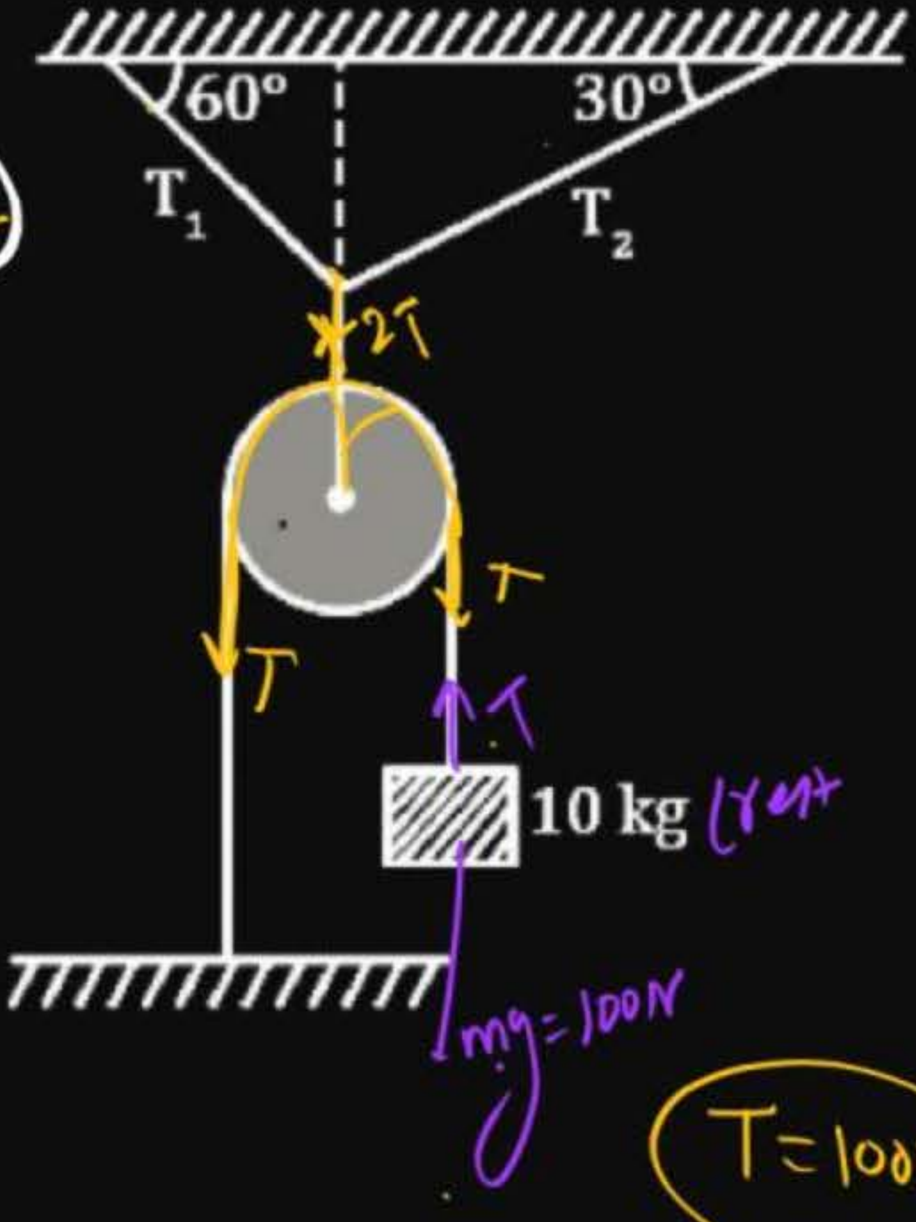
1. 50 N
2. 100 N
3. $50\sqrt{3}$ N
4. $100\sqrt{3}$ N



LT

$$\frac{T_2}{\sin 150} = \frac{200}{\sin 90}$$

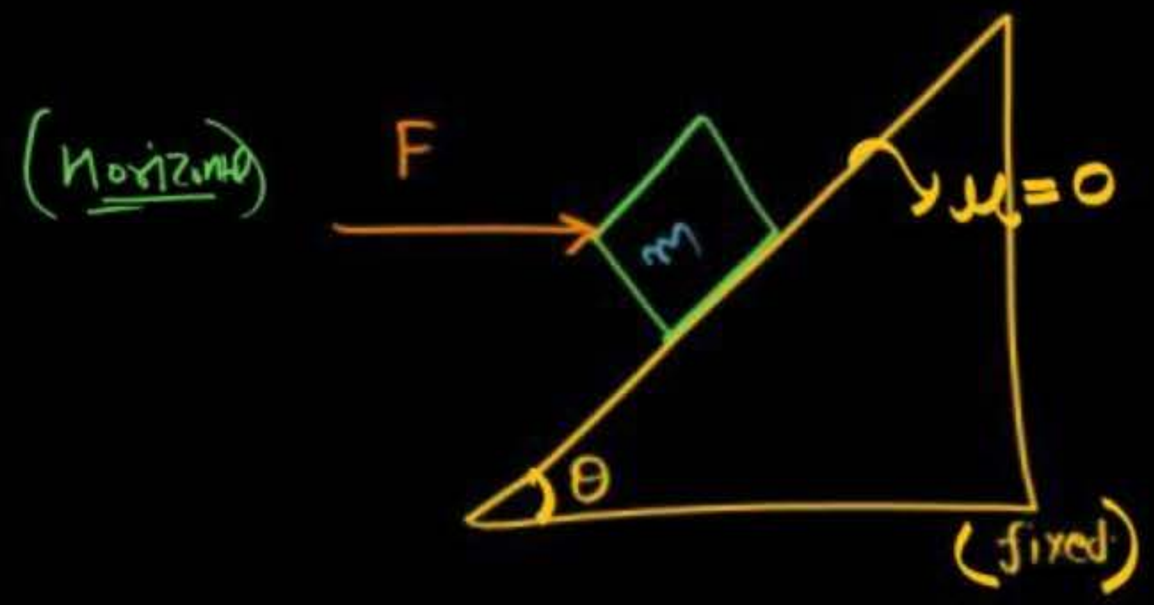
$$T_2 = \frac{200}{1} \times \frac{1}{2} = 100\ \mathrm{N}$$

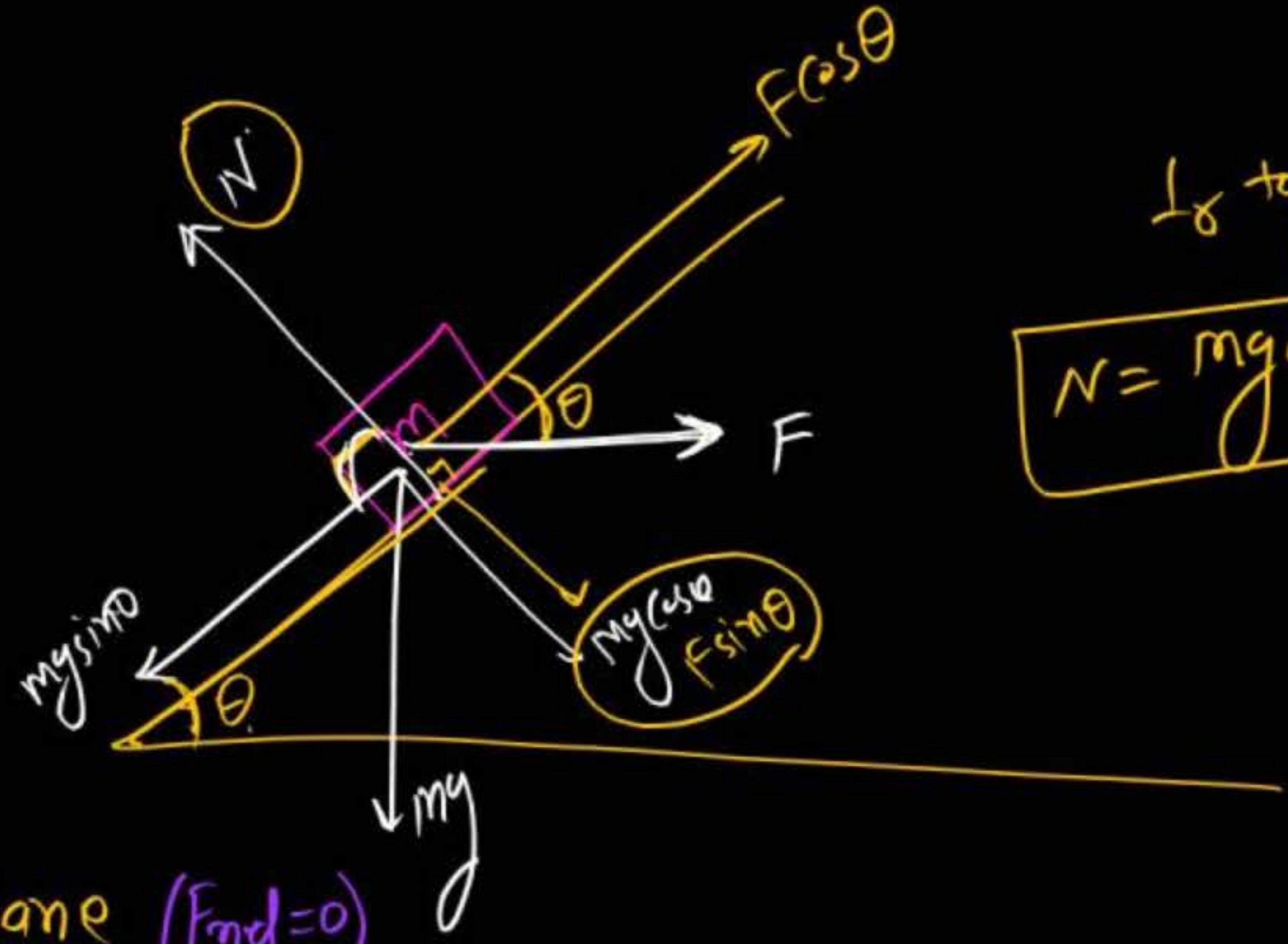


T = 100 N

(H/W) लिखना है

find F so that block will be in equilibrium.





⊥r to Inclined (F_{net}=0)

$$\boxed{N = mg\cos\theta + F\sin\theta}$$

along Inclined plane ($F_{net}=0$)

$$F\cos\theta = mg\sin\theta$$

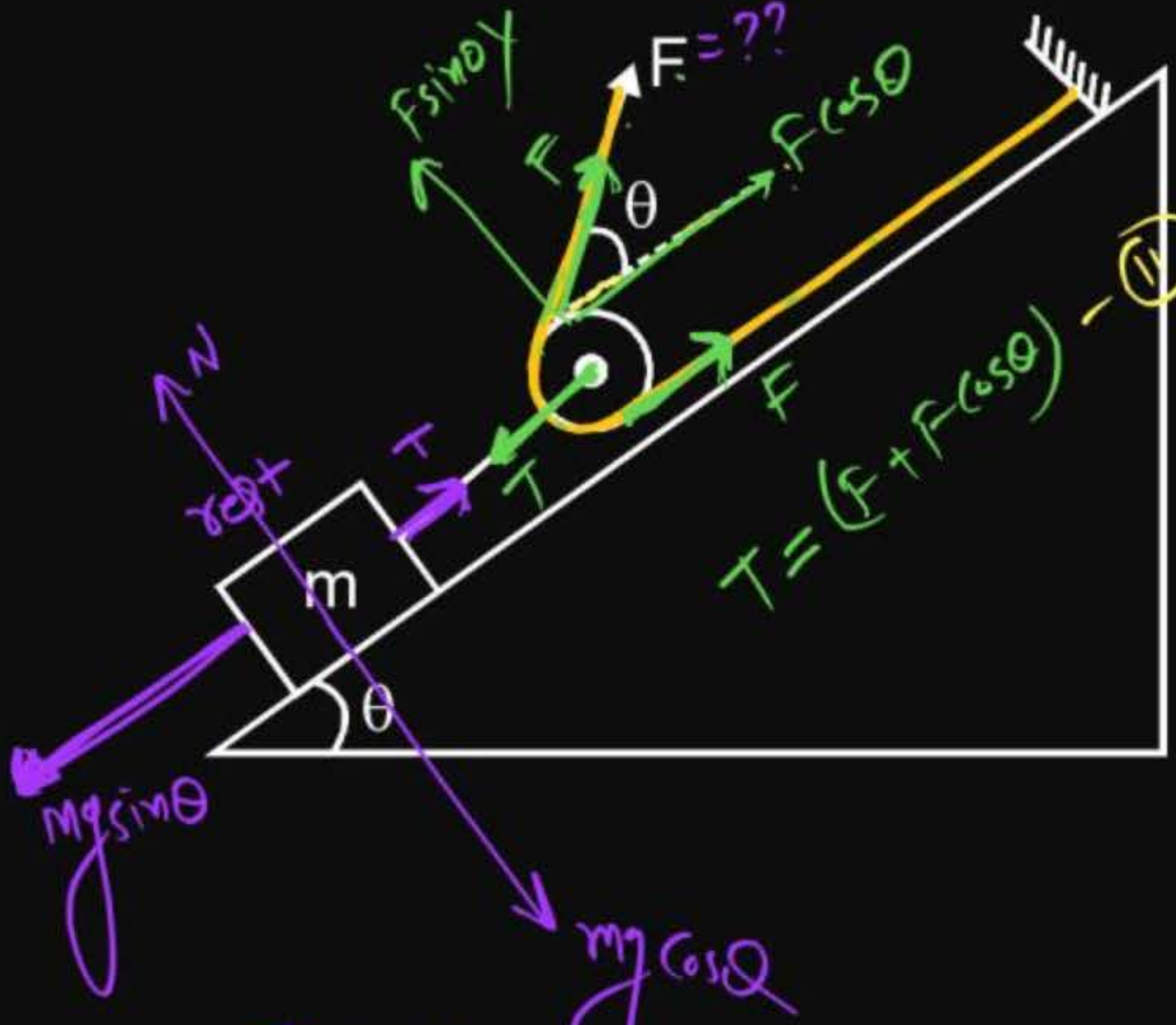
$$F = \frac{mg\sin\theta}{\cos\theta} = mg\tan\theta \checkmark$$

Question

Find F so that object of mass m will be at rest.

(Level up)

Notes में लिखना है।



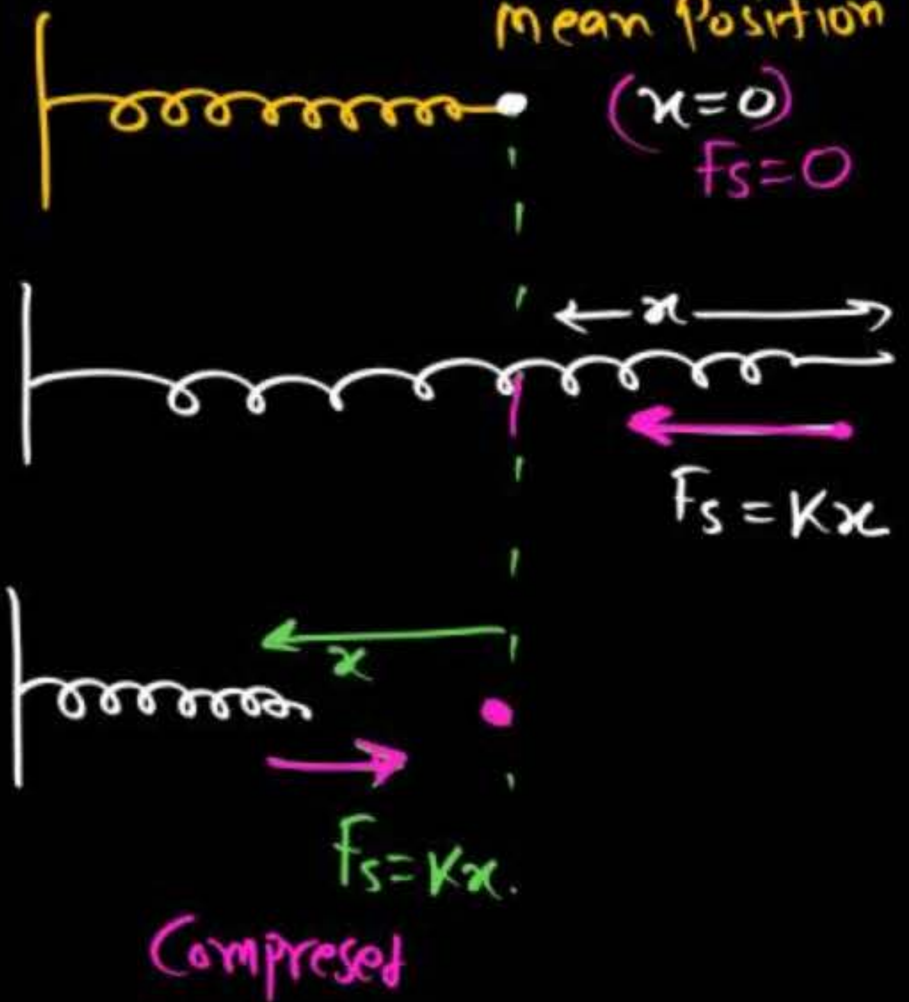
$T = mg\sin\theta$ — (1)

$$mg\sin\theta = F + F\cos\theta$$

$$mg\sin\theta = F(1+\cos\theta)$$

$$F = \frac{mg\sin\theta}{(1+\cos\theta)} \checkmark$$

Diretion of spring force (massless spring)



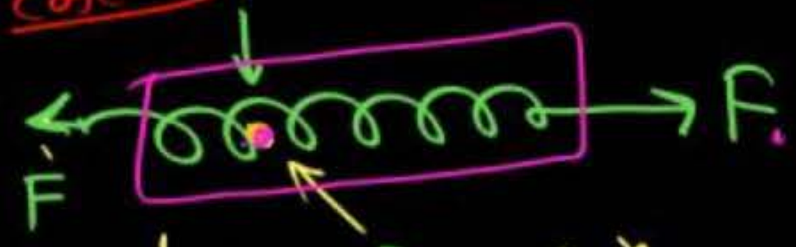
Case-1

$f_{spring}=0$
elongated

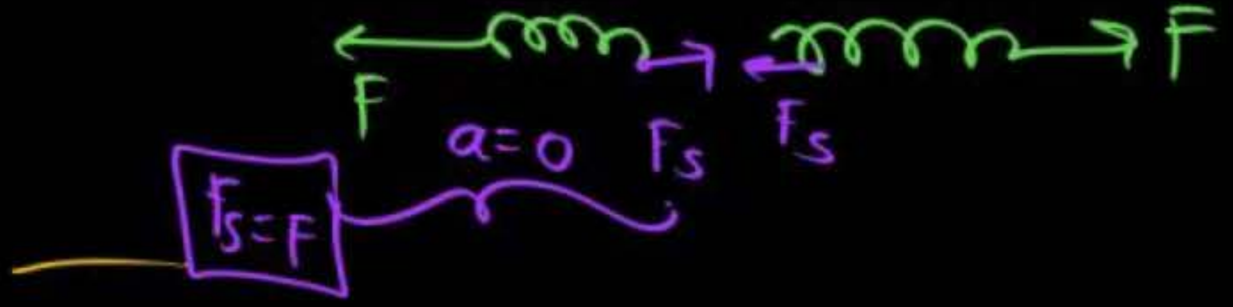
~~Spring force spring ke length ke traf lagta hai~~

~~MR SRAN~~

Case-2

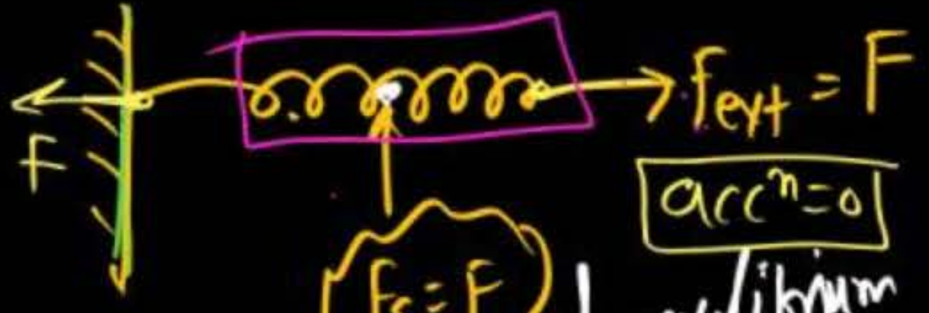


$F_s = 2)$ $acc^n = 0$



Spring force mean Position ki Traf lagta hai

Case-3

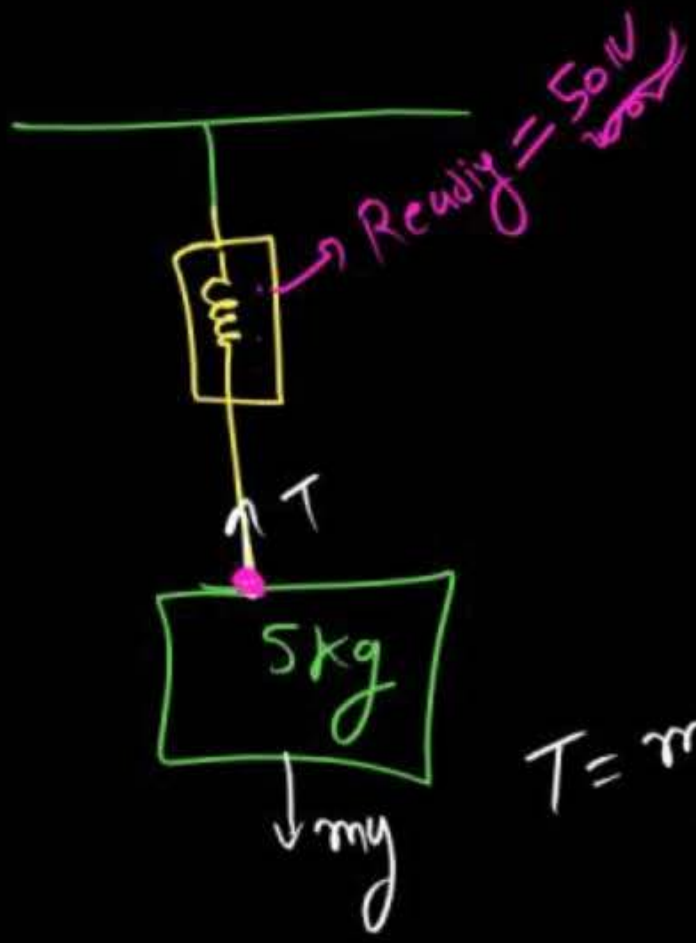


$\boxed{acc^n=0}$

$F_s=F$ at equilibrium

MR* BOX

String ke bich me kahi bhi spring lga ho, usko hata ke complete string lo, & string ka Tension hi, spring force & uski reading dega.



$T = mg = 5 \times 10 = 50N$

MR* Box

(I) Tension force in a string at contact always along length of string

(II) spring force, length ke along, & length ke opossite lag sakta hai

Question

$F_s = Kx$

Figure shows two cases. In first case a spring (spring constant K) is pulled by two equal and opposite force F at both ends and in second case is pulled by a force F at one end. Extensions (x) in the spring will be

(1) In both cases $x = \frac{2F}{K}$

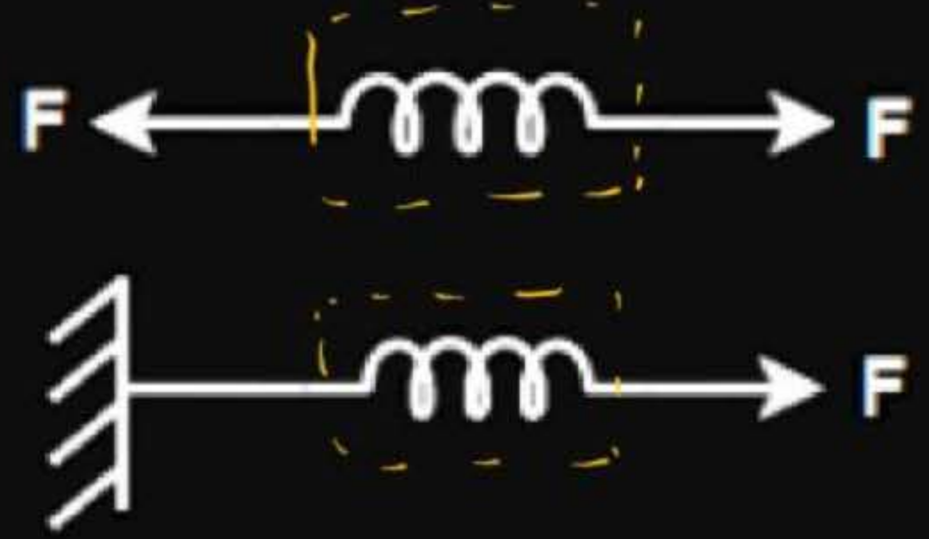
$F_s = Kx = F$

$x = F/K$

(2) In both cases $x = \frac{F}{K}$

(3) In first case $x = \frac{2F}{K}$, in second case $x = \frac{F}{K}$

(4) In first case $x = \frac{F}{K}$, in second case $x = \frac{2F}{K}$

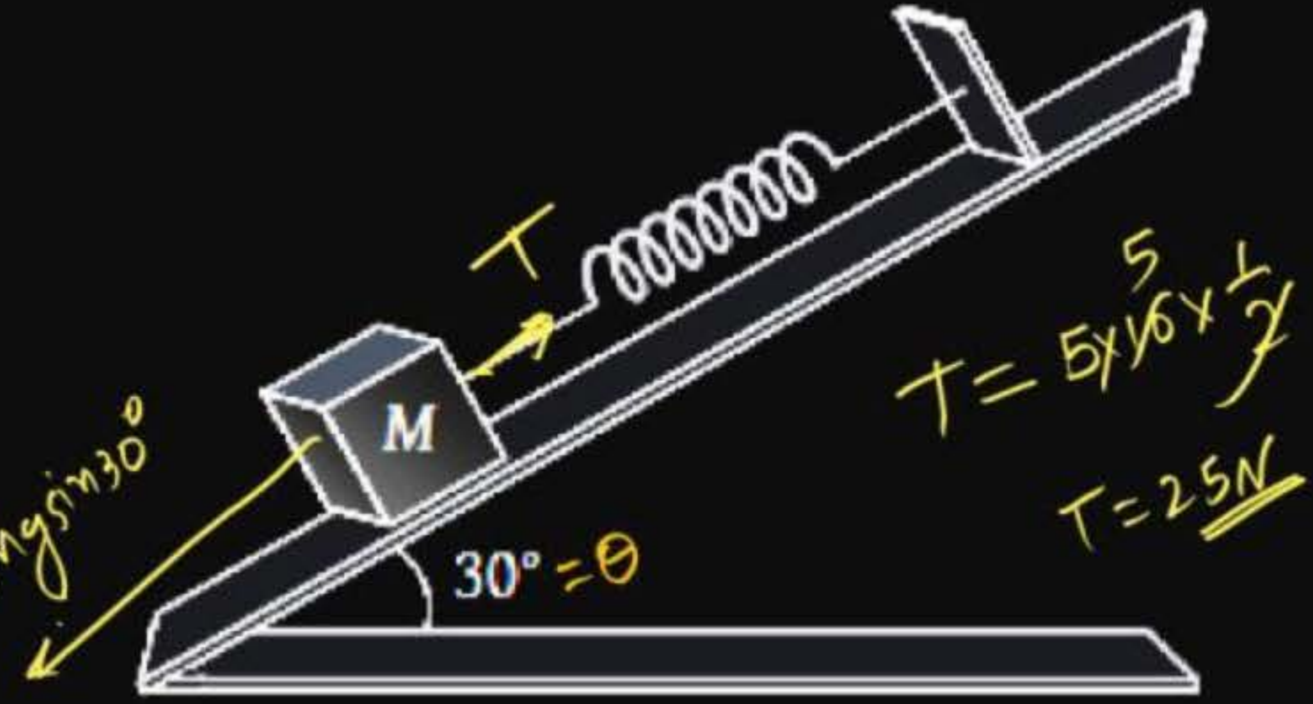


elongation in both case $x = F/K$

Question

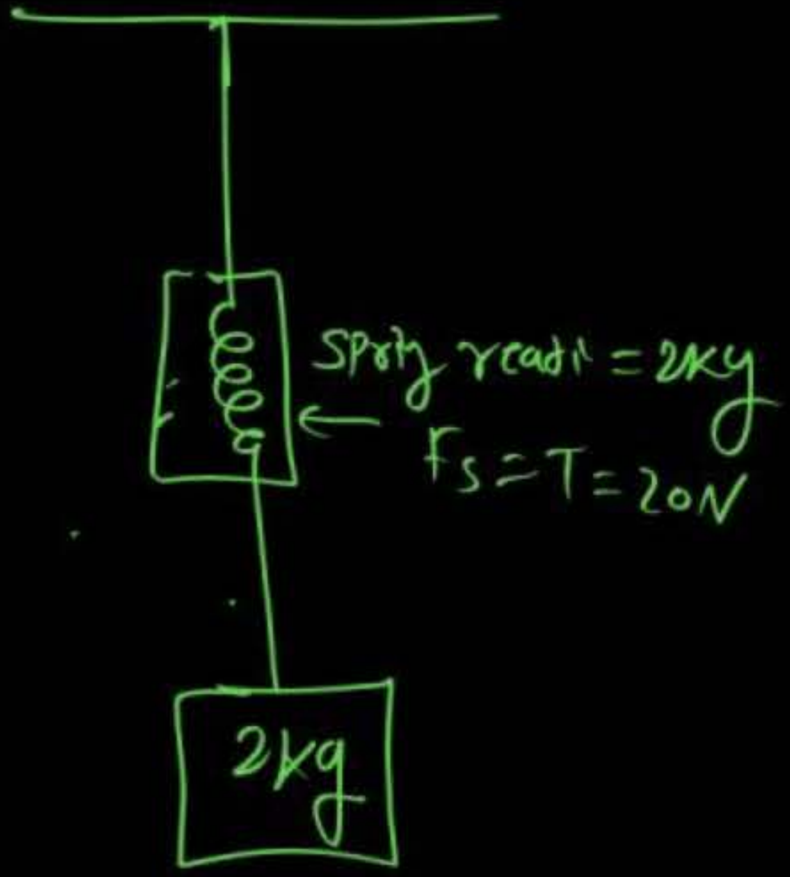
A body of mass 5 kg is suspended by a spring balance on an inclined plane as shown in figure. The spring balance measure:

1. 50 N
2. 25 N Ans
3. 500 N
4. 10 N

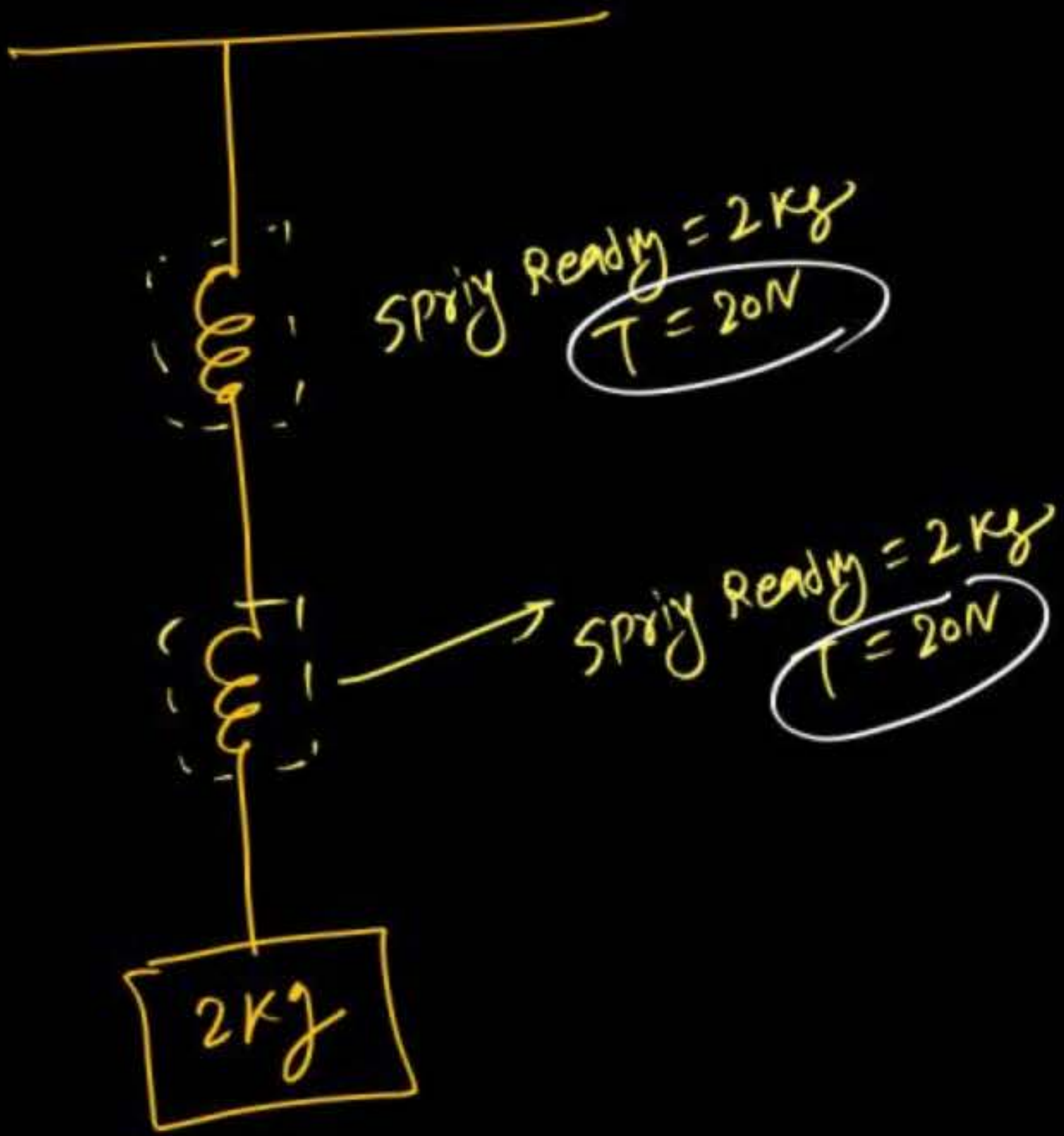


hence Reading of Tension is 25N

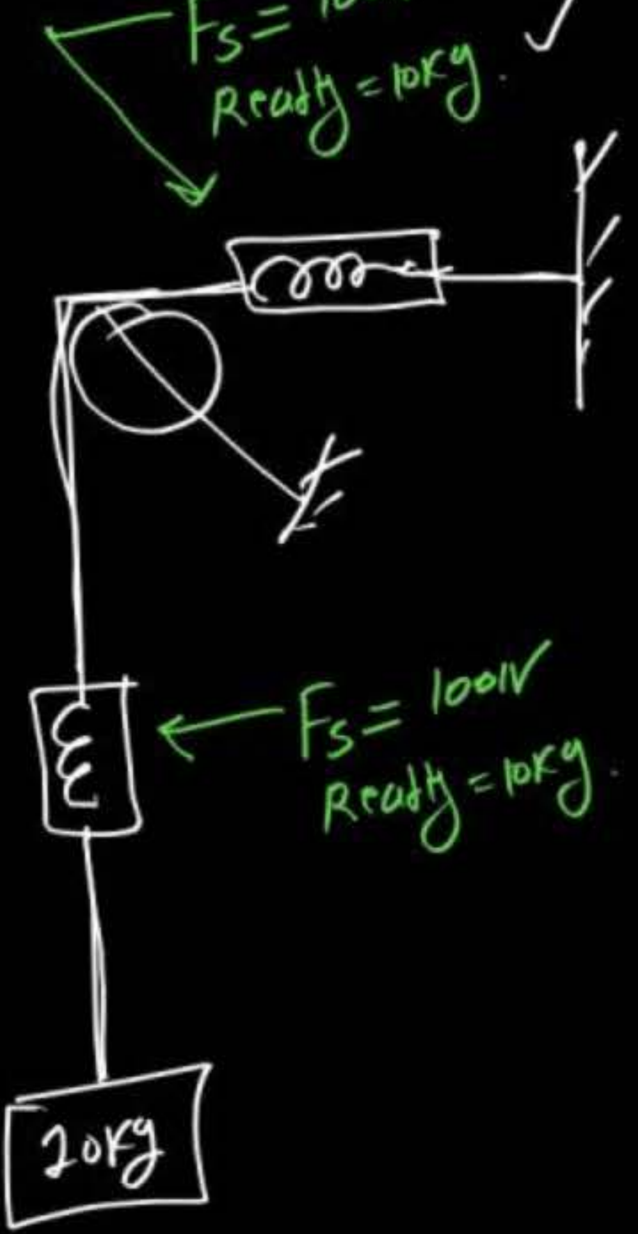
Case-1



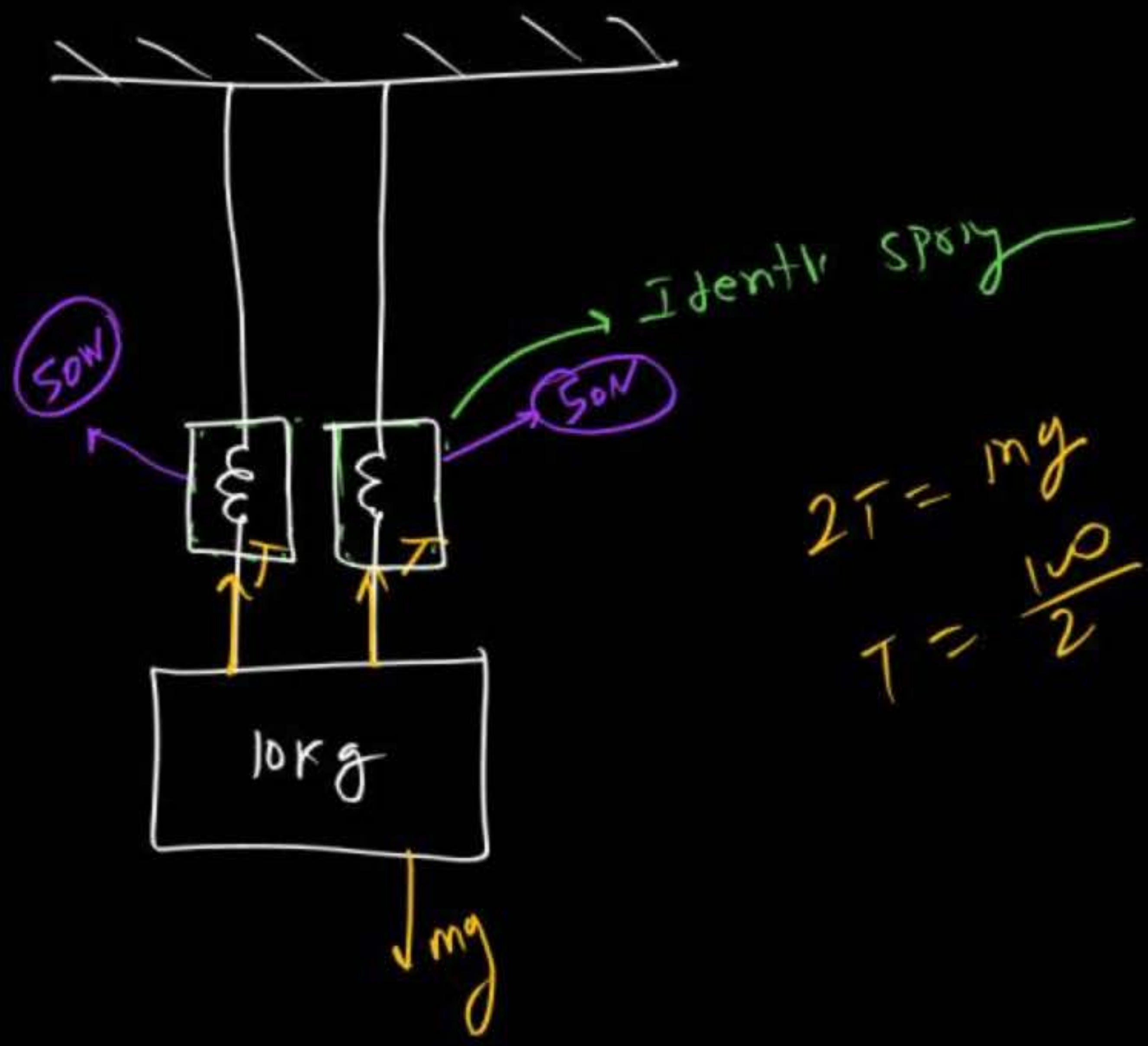
Case-2



Case-3



Case-4



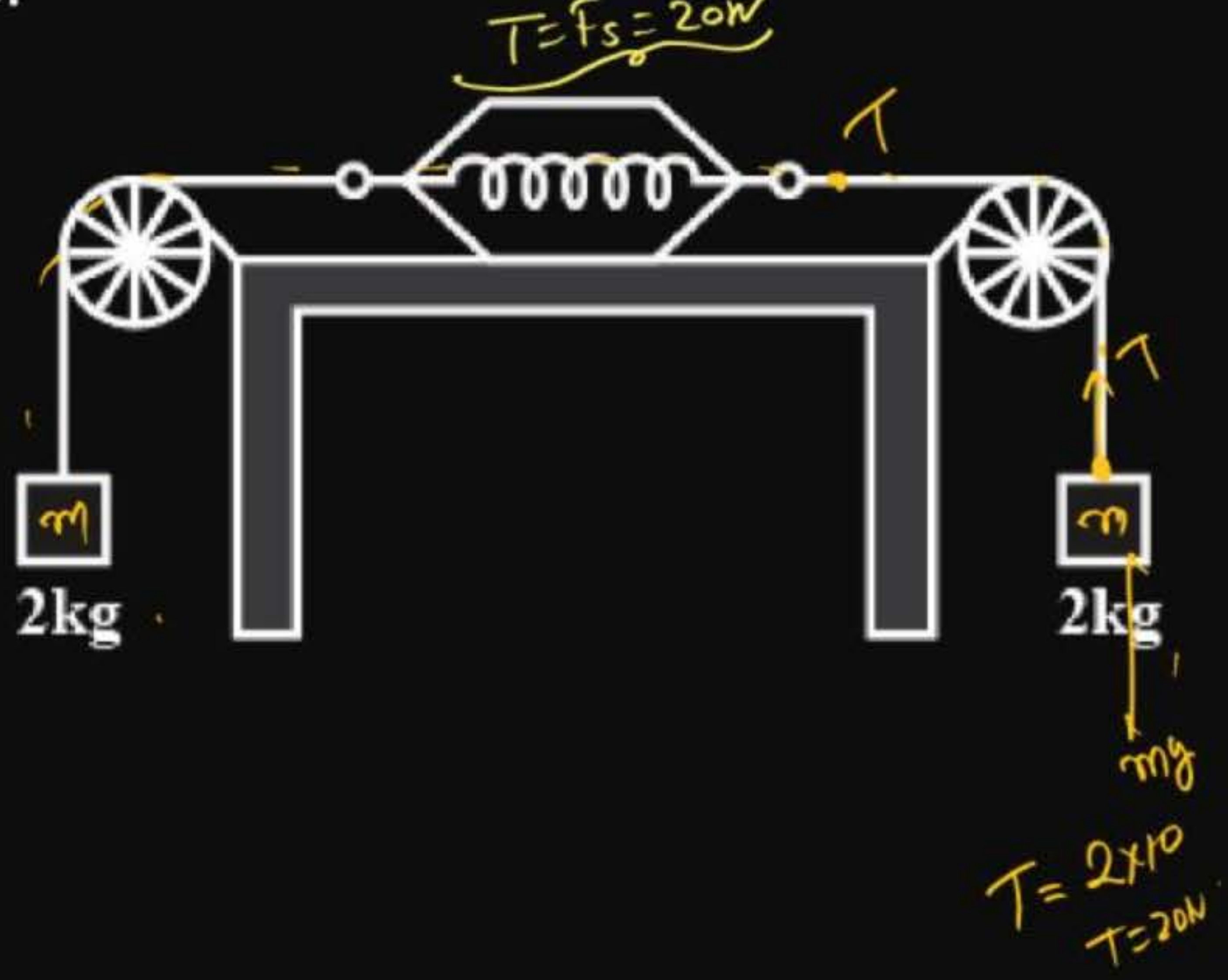
$$2T = mg$$

$$T = \frac{100}{2} = 50N$$

Question

Case-5

As shown in figure, two equal masses each of 2 kg are suspended from a spring balance. The reading of the spring balance will be:



1. Zero
2. 2 kg
3. 4 kg
4. Between zero and 2 kg

MR* BOY

$$\boxed{1\,kg\,wt = 10\,N}$$

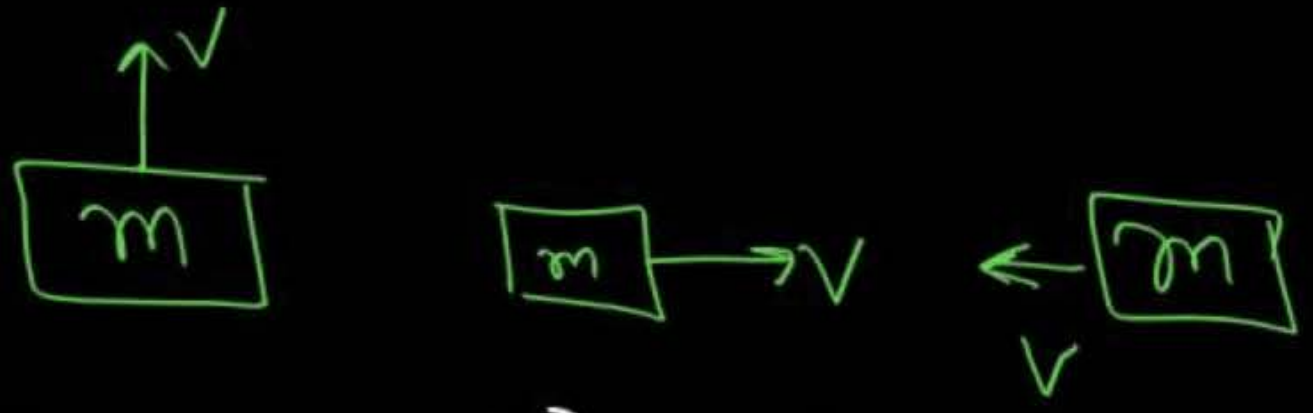
Momentum → Motion contained in a body is called momentum.

$$\vec{P} = m\vec{v}$$

↳ direction along velocity

↳ unit kg m/s

↳ vector



$\vec{P}_1 = mv\hat{j}$ $\quad$ $\vec{P}_2 = mv\hat{i}$ $\quad$ $\vec{P}_3 = -mv\hat{i}$

↳ but magnitude of momentum is same for all.

$\boxed{50\,kg} \longrightarrow v_1 = 1\,m/s$

$\boxed{1\,kg} \longrightarrow v_2 = 50\,m/s$

$\vec{P}$ = same.

$$\boxed{\begin{aligned} K.E &= \frac{1}{2}mv^2 \times \frac{m}{m} \\ K.E &= \frac{p^2}{2m} \end{aligned}}$$

Change in momentum :— (Imp for NEET)

Case-1

$$\vec{\Delta P} = \vec{P_f} - \vec{P_i}$$

$$= 0 - (-mu\hat{i})$$

$$\vec{\Delta P} = mu\hat{i}$$

Case-2 rebound with same speed

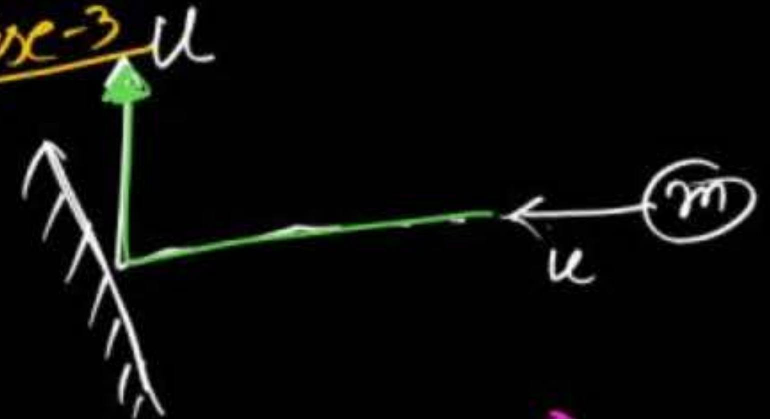
$$\vec{\Delta P} = \vec{P_f} - \vec{P_i}$$

$$= mu\hat{i} - (-mu\hat{i})$$

$$\vec{\Delta P} = 2mu\hat{i}$$

$$|\vec{\Delta P}| \quad 2mu$$

Case-3



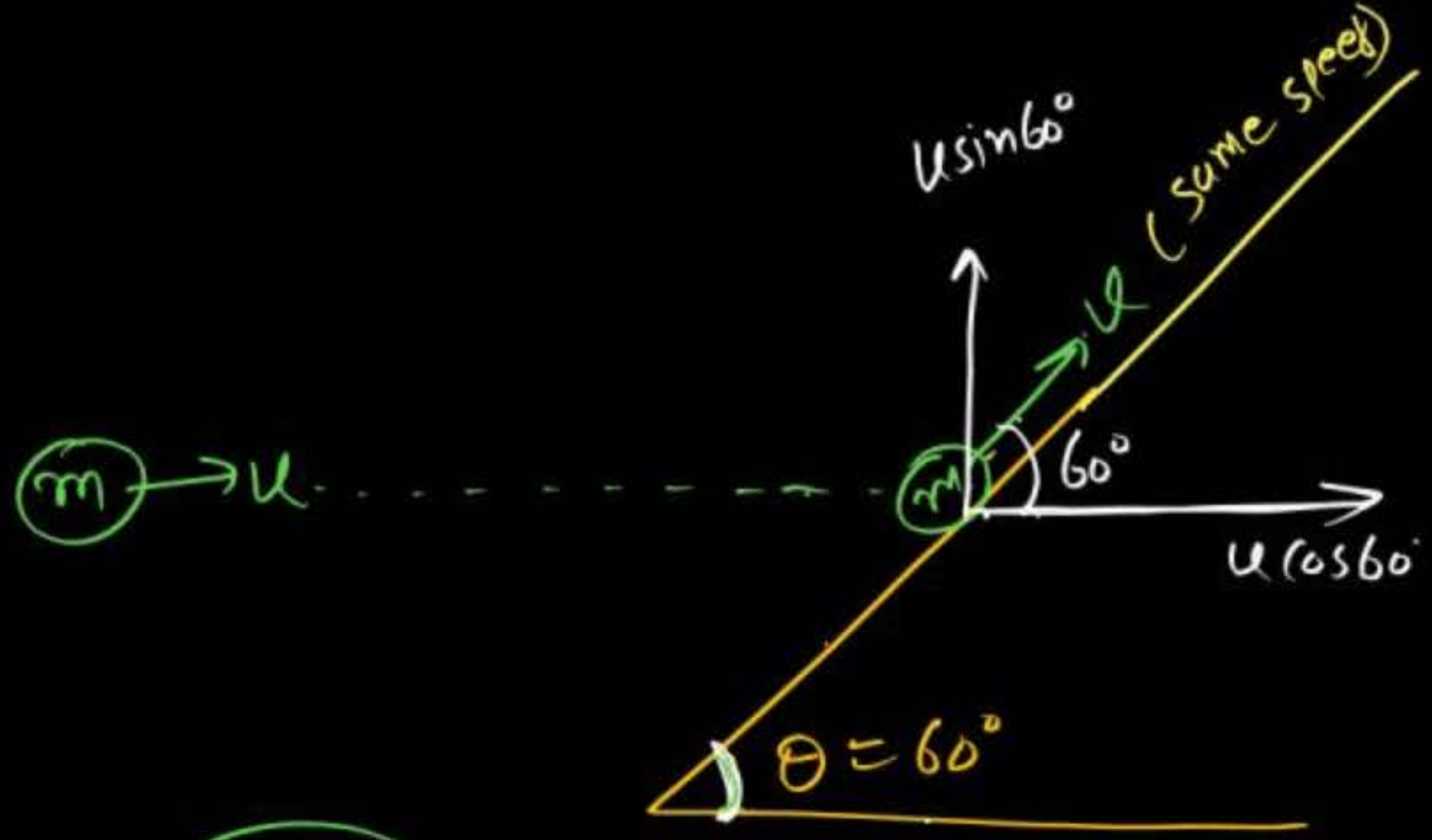
$$\vec{\Delta P} = \vec{P_f} - \vec{P_i}$$

$$\vec{\Delta P} = mu\hat{j} - (-mu\hat{i})$$

$$= mu\hat{j} + mu\hat{i}$$

$$|\vec{\Delta P}| = \sqrt{2}mu$$

Case-4



$$\vec{\Delta P} = \vec{P_f} - \vec{P_i}$$

Sol^n ghos likh

$$\vec{P_i} = mu\hat{i}$$

$$\vec{P_f} = mu\cos 60°\,\hat{i} + mu\sin 60°\,\hat{j}$$

$$\vec{P_f} = \frac{mu}{2}\hat{i} + \frac{\sqrt{3}}{2}mu\hat{j}$$

$$\vec{\Delta P} = \vec{P_f} - \vec{P_i}$$

$$= \frac{mu\hat{i}}{2} + \frac{\sqrt{3}}{2}mu\hat{j} - mu\hat{i}$$

$$\vec{\Delta P} = -\frac{mu}{2}\hat{i} + \frac{\sqrt{3}}{2}mu\hat{j}$$

MR* Box

$$\vec{\Delta P} = 2mu\sin(\theta/2)$$

$$= 2(mu)\sin\left(\frac{60}{2}\right)^{30°}$$

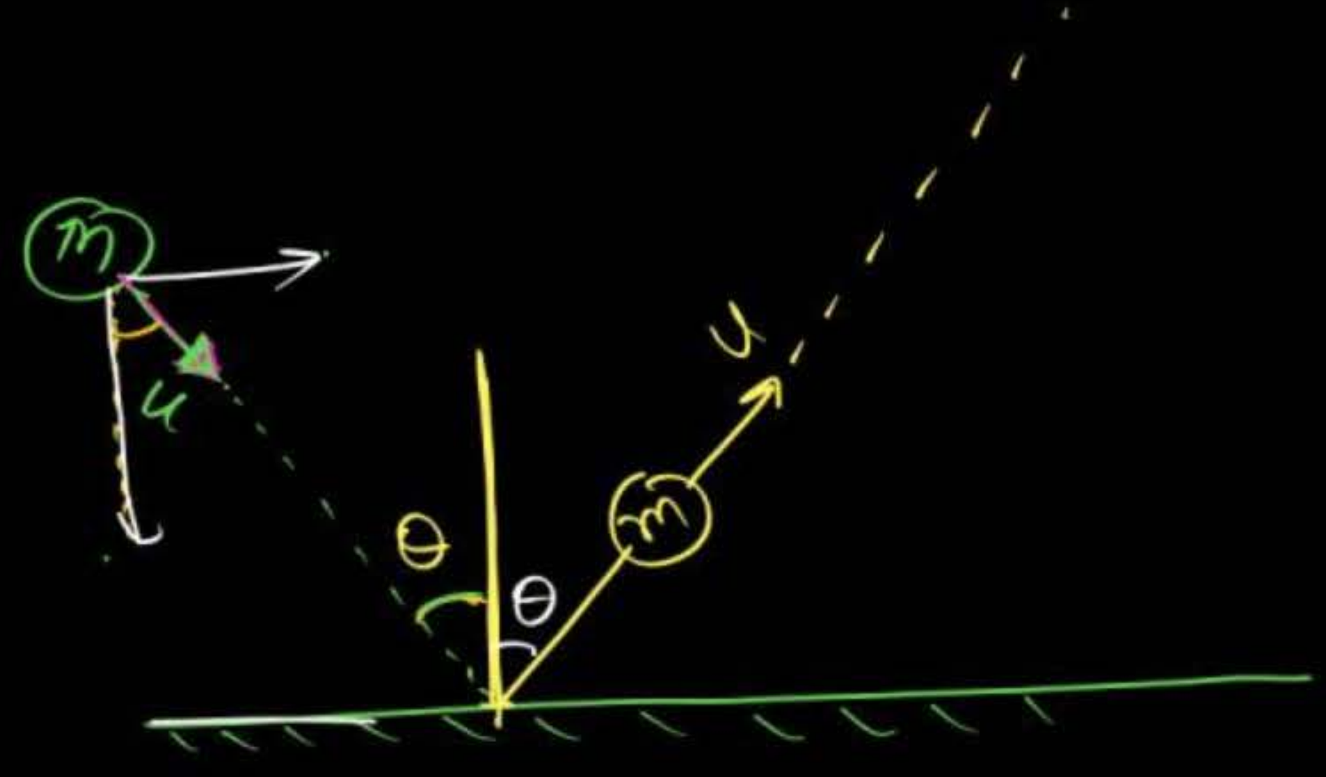
$$= \cancel{2}mu \times \frac{1}{\cancel{2}} = \underline{mu}$$

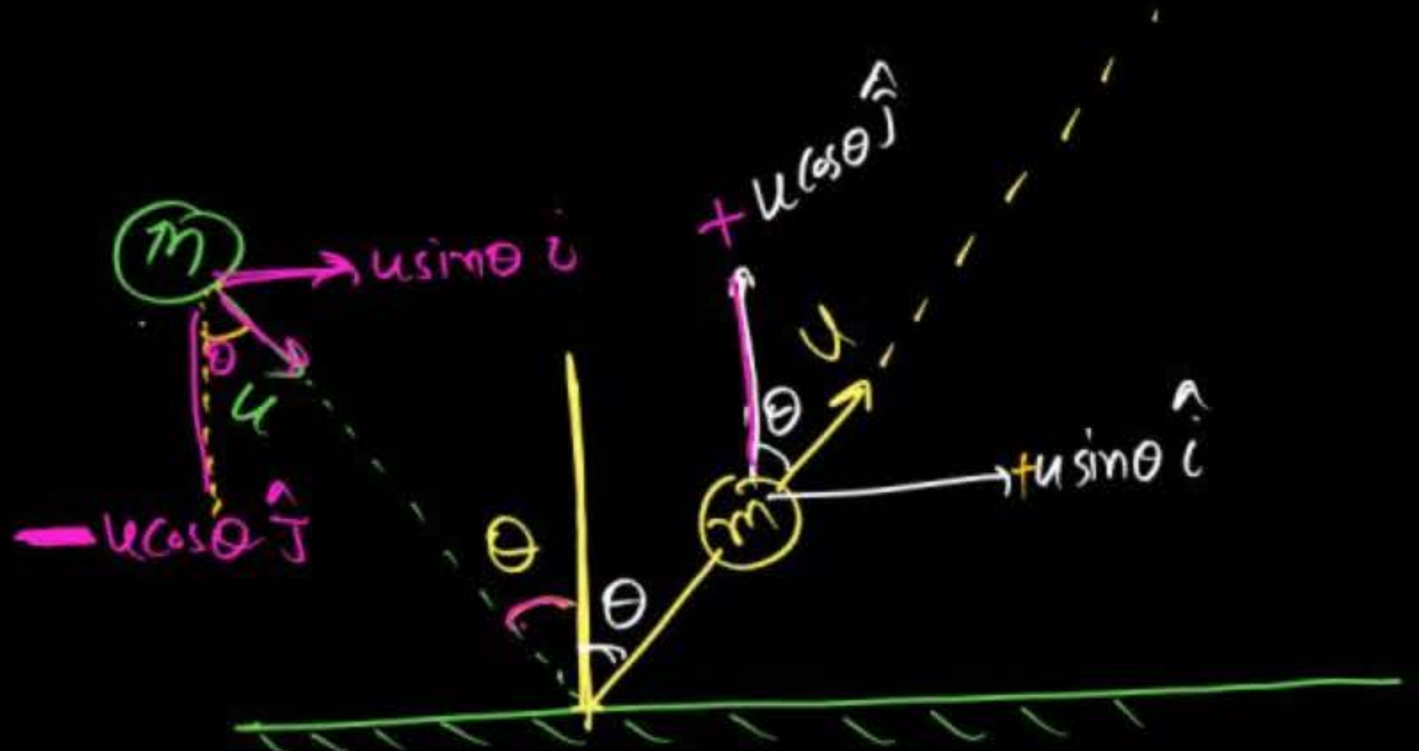
$$|\vec{\Delta P}| = mu\sqrt{\left(\frac{1}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2}$$

$$= mu\sqrt{\frac{1}{4} + \frac{3}{4}} = \sqrt{\frac{4}{4}} = 1\,mu$$

Case-5

$\vec{\Delta P} = ??$





#

$$\Delta P = 2mu\cos\theta$$

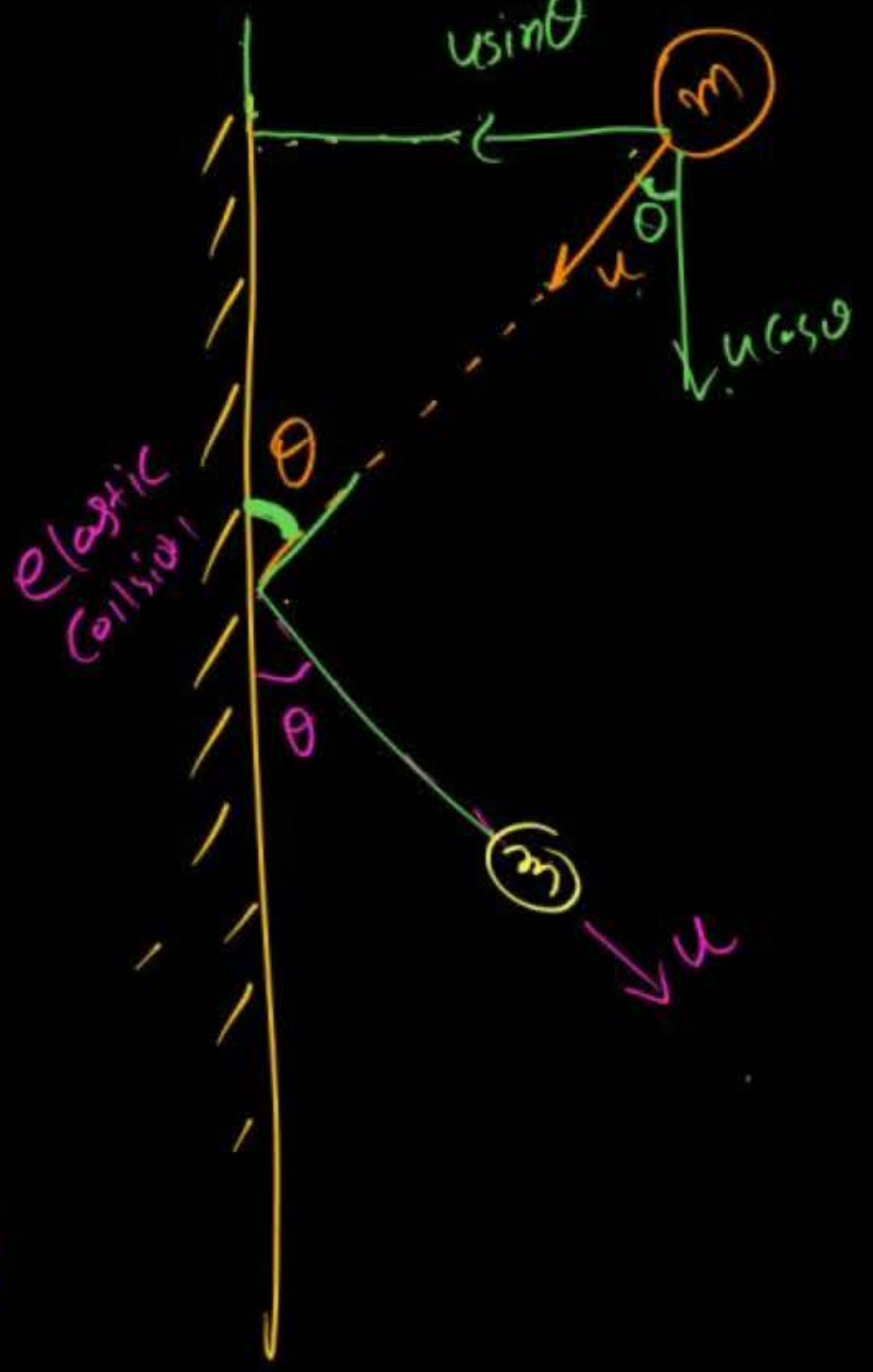
$$\vec{P}_i = mu\sin\theta\,\hat{i} - mu\cos\theta\,\hat{j}$$

$$\vec{P}_f = mu\sin\theta\,\hat{i} + mu\cos\theta\,\hat{j} \leftarrow \text{final}$$

$$\vec{\Delta P} = \vec{P}_f - \vec{P}_i = 0\hat{i} + 2mu\cos\theta\,\hat{j}$$

NEET 2012, 14, 2016

Cq-6



$|\vec{\Delta p}| = ??$

$|\vec{\Delta p}| = (2u\sin\theta)\, m$ ✓

MR* BOX.
Change in momentum
surface ke ⊥r hota hai

\# Surface ke along $F = 0$
$\Delta P = 0$

Newtons 2^{nd} Law

$F_{Avg} \propto \Delta P$

$F_{Avg} \propto \frac{1}{\Delta t}$

$$\boxed{\# \ \vec{F}_{Avg} = \frac{\Delta P}{\Delta t}}$$

In time interval

$\vec{F}_{inst} = \frac{d\vec{P}}{dt}$ = Rate of change in momentum is called force.

= slope of P|t graph is force

= vector

= unit Newton.

$\cancel{F = ma}$

~~this is newton 2^{nd} law~~

$\vec{F}_{inst} = \frac{d(mv)}{dt} = m\frac{d\vec{v}}{dt} + v\frac{dm}{dt}$

$$\# \ \boxed{\vec{F}_{inst} = m\vec{a} + v\frac{dm}{dt}}$$

$\to m = \text{const}^n$

$$\# \ \boxed{\vec{F} = m\vec{a}}$$

$u = \text{const}^n \to \# \ \vec{F} = v\frac{dm}{dt}$

IMR scam

Object is moving with constant velocity then Net force on object must be zero →

(a) True

(b) false ✓

force may be actly if mass is varible

- # Rocket Probm
- # Balloon Probm

Q) Object of mass m moving with constant velocity then Net force on it must be zero → True ✓

In newton 1st law

$$\vec{F} = \frac{dP}{dt}$$

$P = mv$

$$F = \frac{d(mv)}{dt}$$

$$\boxed{\vec{F} = m\frac{dv}{dt}^{0} + v\frac{dm}{dt}}$$

$\underline{\underline{m = \text{const}^n}}$

$$\vec{F} = m\left(\frac{dv}{dt}\right) = ma$$

$v = \text{const}^n$ (m = varible)

$$\boxed{F = v\left(\frac{dm}{dt}\right)} \ast$$

MR Box

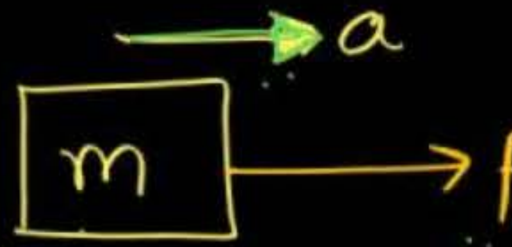
acc^n zero hone par bhi force lag sakta hai if mass is varible

$$\boxed{\begin{array}{c} a = 0, m = \text{const} \\ F_{net} = 0 \end{array}}$$

$\vec{F} = m\vec{a}$ (for const^n mass)

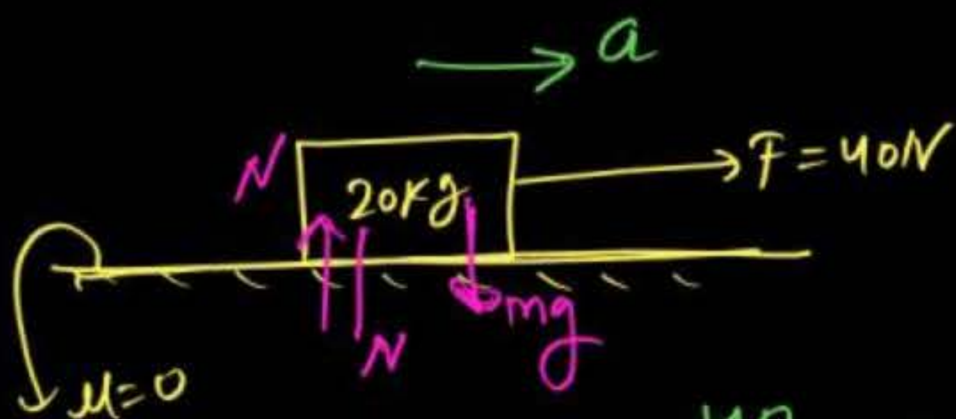
$$\vec{F}_{net} = \underbrace{m\vec{a}}$$

→ requirment of force.



$$\vec{a} = \frac{\vec{F}}{m} \checkmark$$

(1)



$$a = \frac{40}{20} = 2\,m/s^2$$

Normal & mg kyu nahi liya

→ becus N, mg vertical hai

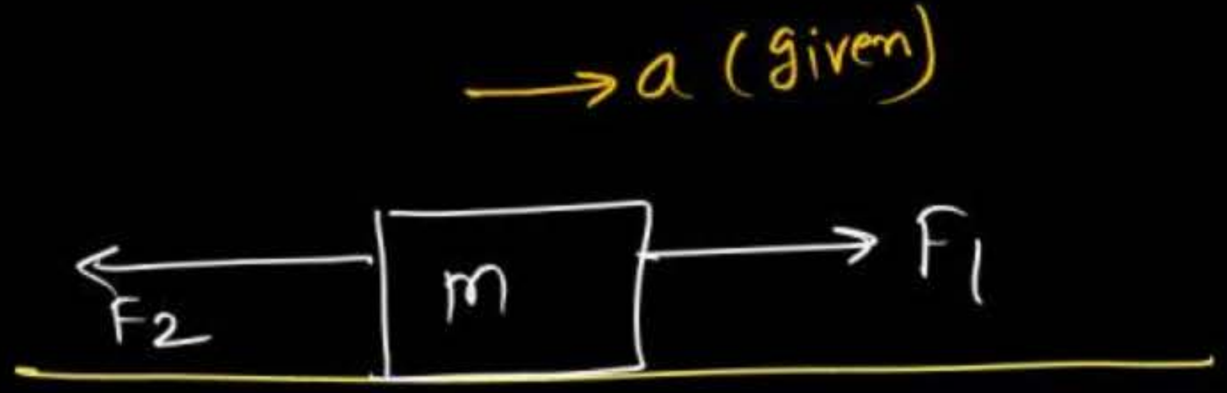
ac^n x me ho raha hai

MR* Box
X & Y मे
Force अलग
अलग देखेंगे

$N = mg$ $[F_y = 0]$

$N = 200$ New

(2)



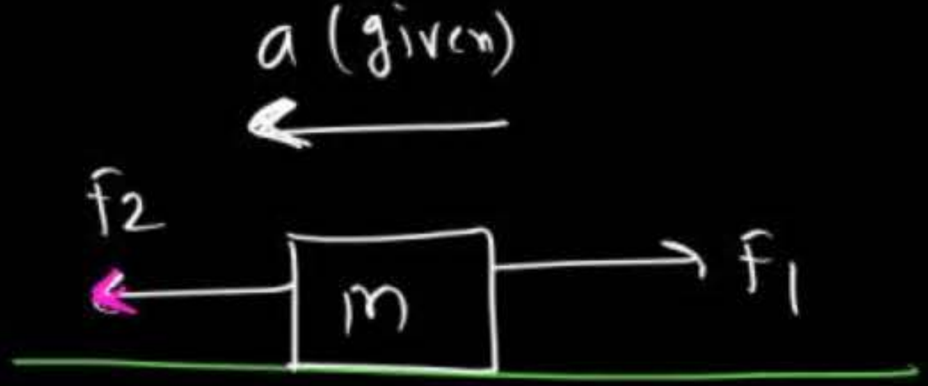
$$F_{net} = (F_1 - F_2) = ma$$

MR* Box:

(1) Jis side acc^n hai object ka, usi side net force ka diretion hoga.

(2) acc^n ki diretion me Jo force hai wo large hoga.

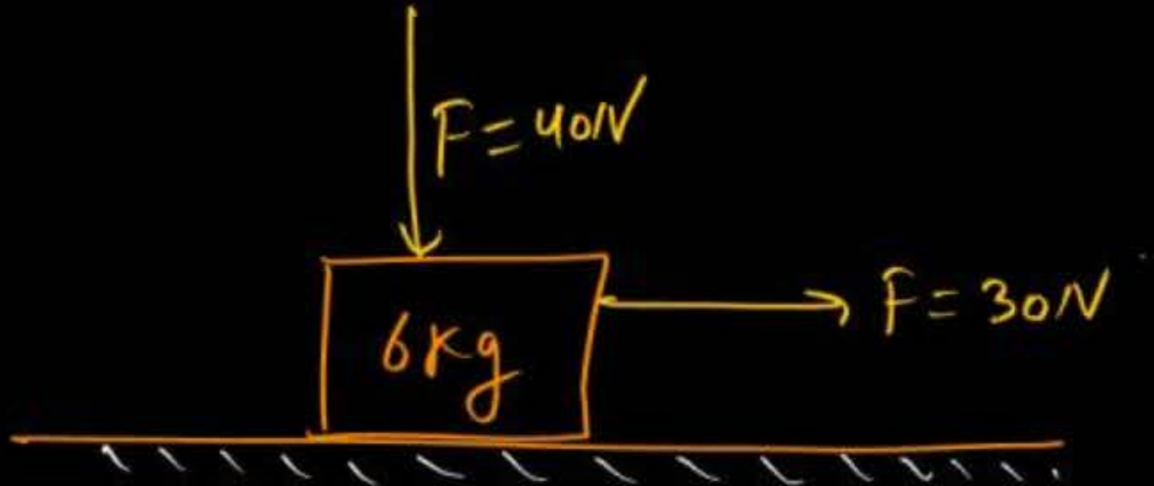
(3)



$$F_{net} = F_2 - F_1 = ma$$

$$\# \quad a = \left(\frac{F_2 - F_1}{m}\right)$$

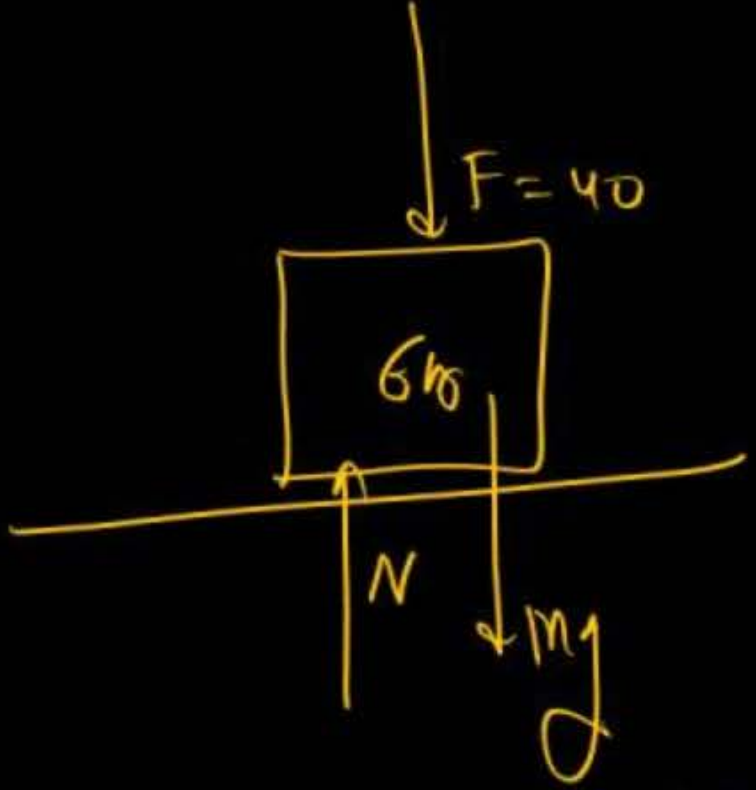
4



$$\Sigma F_x = 30 = ma$$

$$30 = 6 \times a$$

$$a = 5\,m/s^2$$

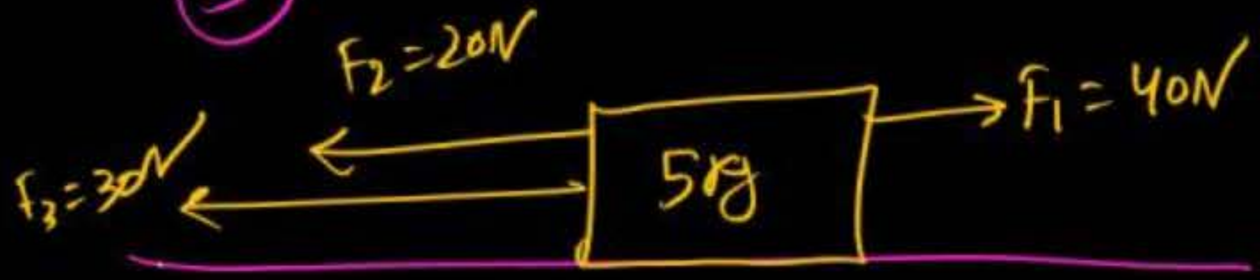


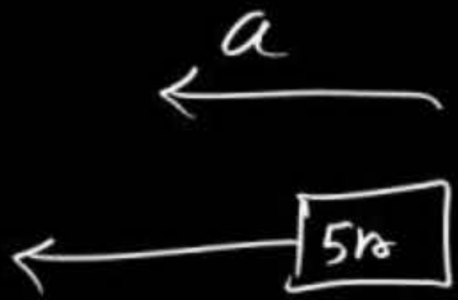
$$\Sigma F_y = 0$$

$$F + mg = N$$

$$N = 40 + 60 = 100N$$

5



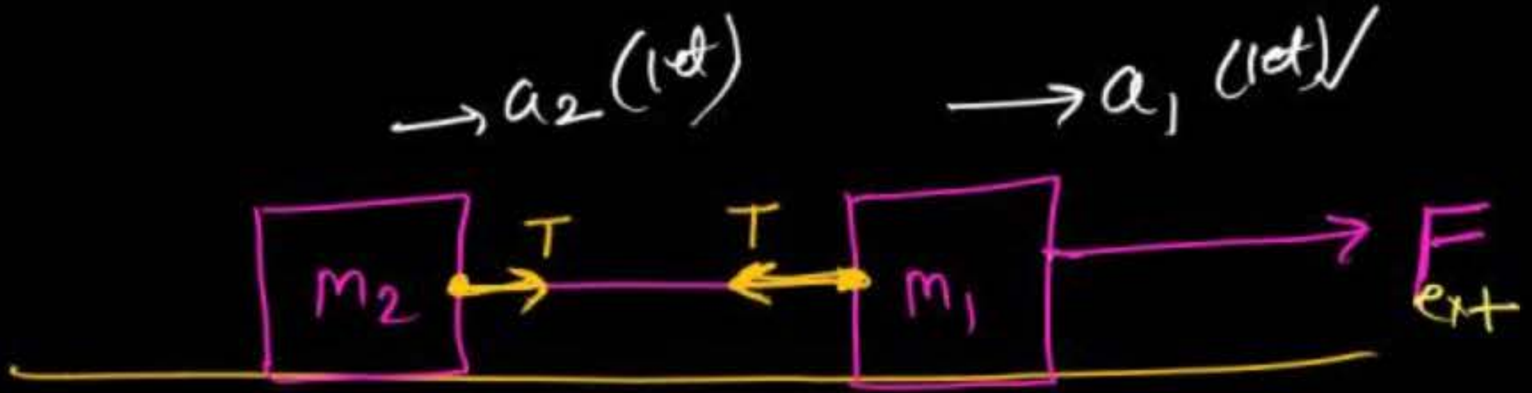


$$F_{net} = (50-40) = 10N$$

$$a = \frac{10}{5} = 2\,m/s^2$$

(Backwr)

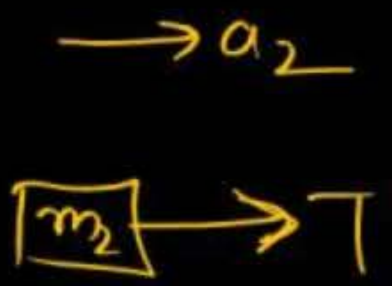
(6)

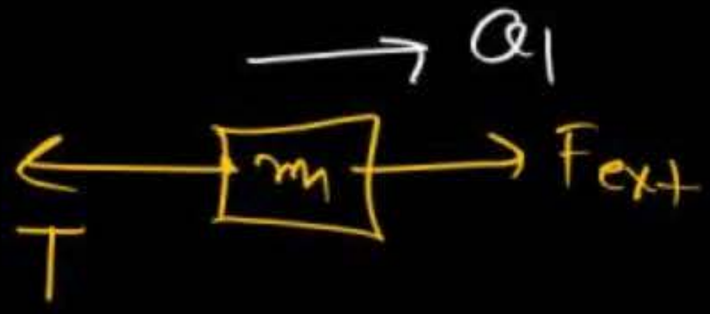


$$\boxed{\vec{F}_{ext} = m_1\vec{a}_1 + m_2\vec{a}_2}$$

(if $a_1 = a_2 = a$)

find acc^n of system:-





$$T = m_2 a_2 \text{ — (I)}$$

$$F_{ext} - T = m_1 a_1 \text{ — (II)}$$

$$T = m_2 a_2 \text{ — (I)}$$

$$+ \qquad +$$

$$F_{ext} = m_1\vec{a}_1 + m_2\vec{a}_2$$

$$f_{ex} = m_1\vec{a} + m_2\vec{a}$$

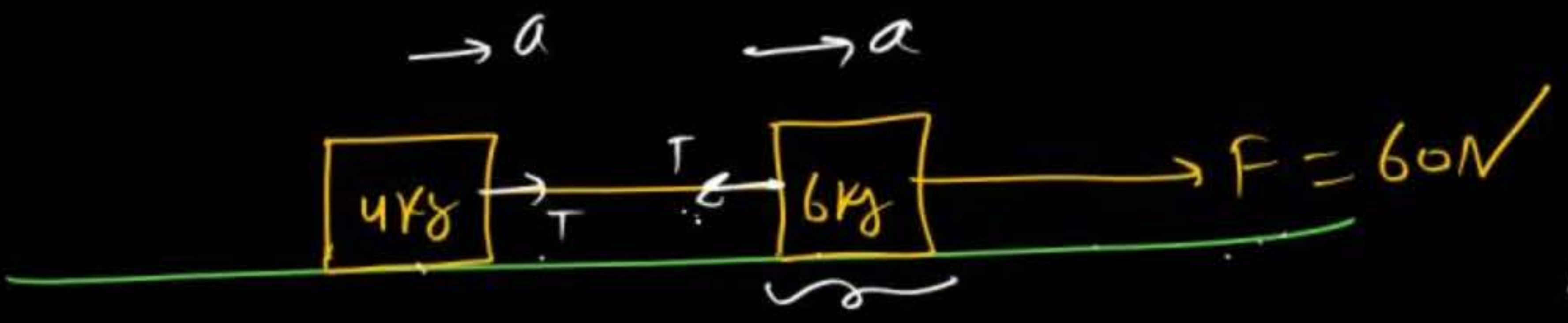
$$\vec{a}(m_1+m_1) = \vec{F}_{ex}$$

$$\boxed{a = \frac{\vec{F}_{ext}}{m_1+m_2}}$$

#

$$a = \frac{\text{Fnet force}}{m_{net}}$$

(7)



$\boxed{F_{net} \text{ force on } 4kg = 24N}$

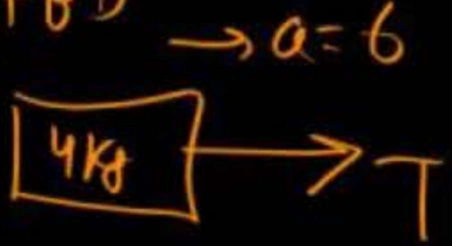
$\hookrightarrow F_{net} = m\,a_{net}$

$\boxed{F_{net} \text{ force on } 6kg = 36N \quad F_{net} = F - T}$

$= 60 - 24 = \underline{\underline{36}}$

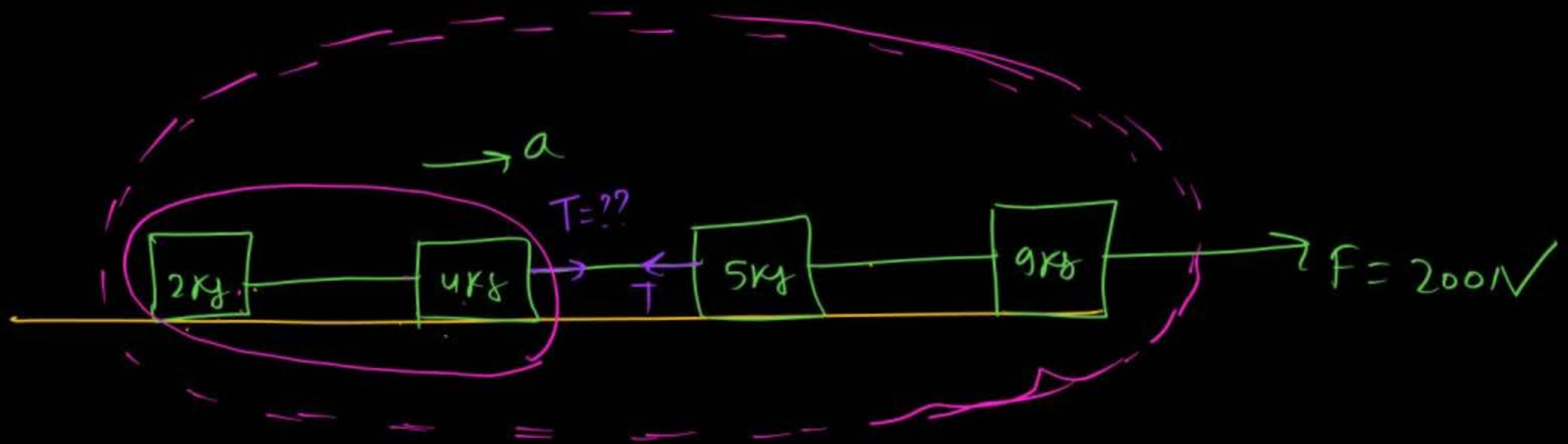
$a = \frac{6\cancel{0}}{1\cancel{0}} = 6\,m/s^2$ Ans

4kg ka FBD



$T = ma = 4 \times 6 = 24\,N$ Ans

(8)



Sol^n

$$a = \frac{20\cancel{0}}{2\cancel{0}} = 10\,m/s^2$$

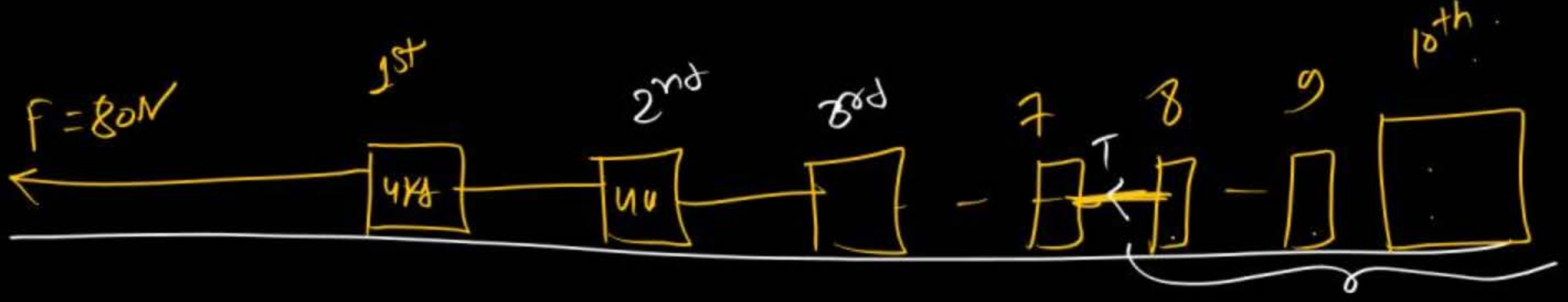
(for Tension)

MR*

FBD of 2kg & 4kg

$$\boxed{6kg} \rightarrow T = m \times a$$
$$= 6 \times 10 = 60N$$

(9) JEE 10 object of mass 4 kg.



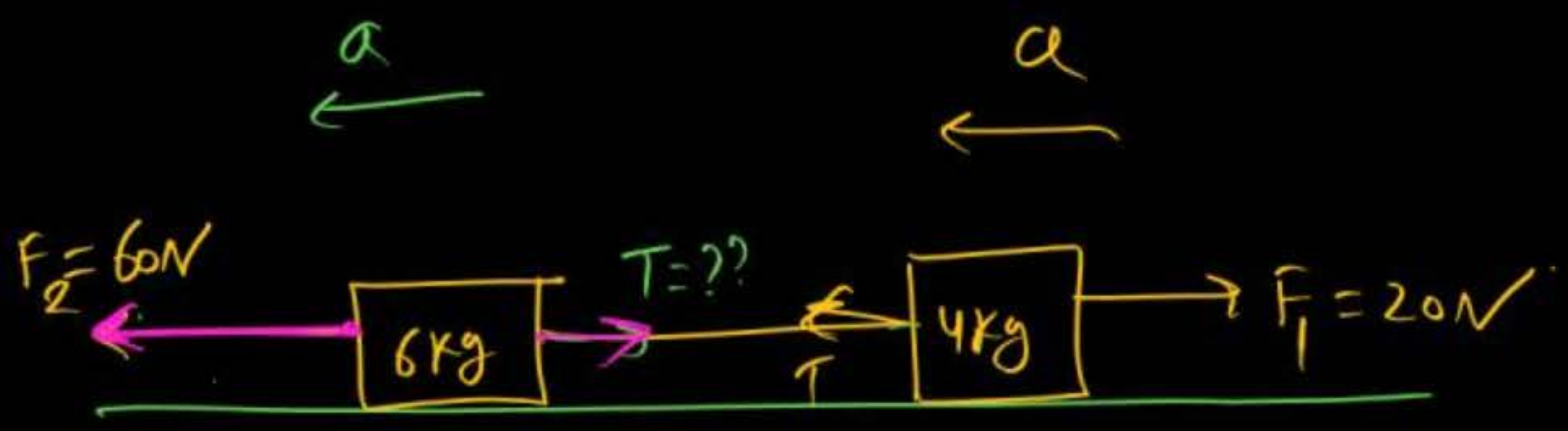
Tension B/w 7^{th} & 8^{th} Block

$$a = \frac{80}{10 \times 4} = \frac{80}{40} = 2\,m/s^2$$

last 3 obje (8^{th}, 9^{th}, 10^{th}) ka FBD

$$T = (4+4+4) \times a$$
$$= 12 \times 2 = 24 \text{ Newton}$$

(10)



$a = 4 m/s^2$

$F_2 - T = ma$

$60 - T = 6 \times 4$

$T = 60 - 24 = 36N$

$T - f_1 = ma$

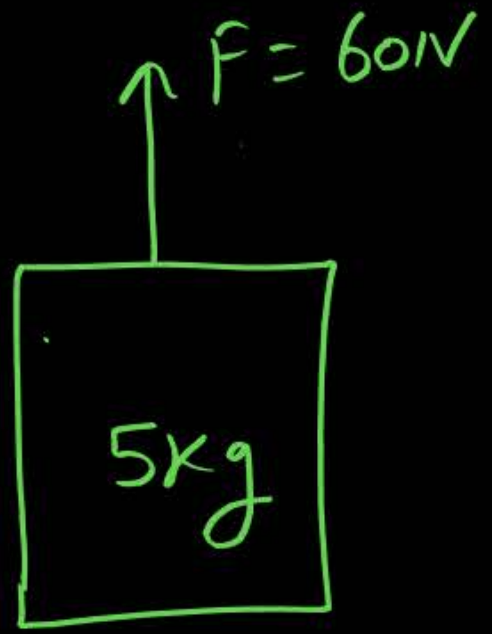
$T = f_1 + ma$

$= 20 + 4 \times 4$

$= 20 + 16 = 36N$

11

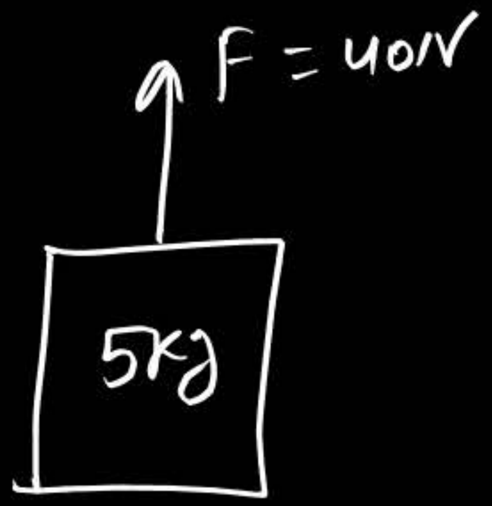
12



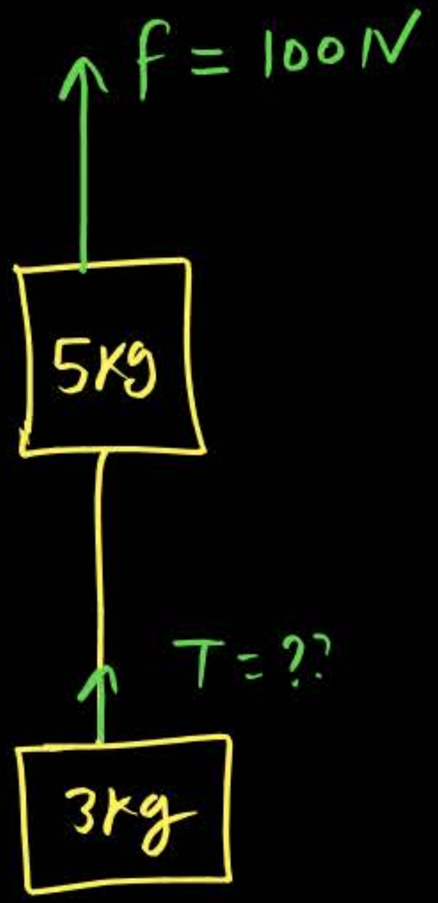
find acc^n.

(consider mg)

13

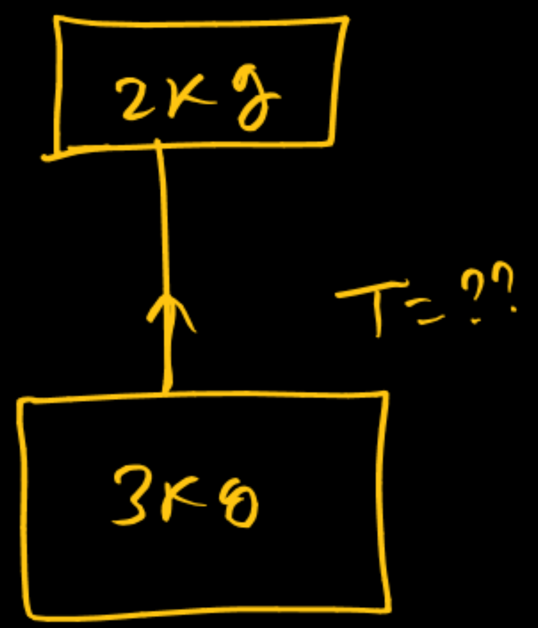


(14)



Consider mg on both.

15



drop

H/W 11 to 15

@MRPHYSICSS

← Join.

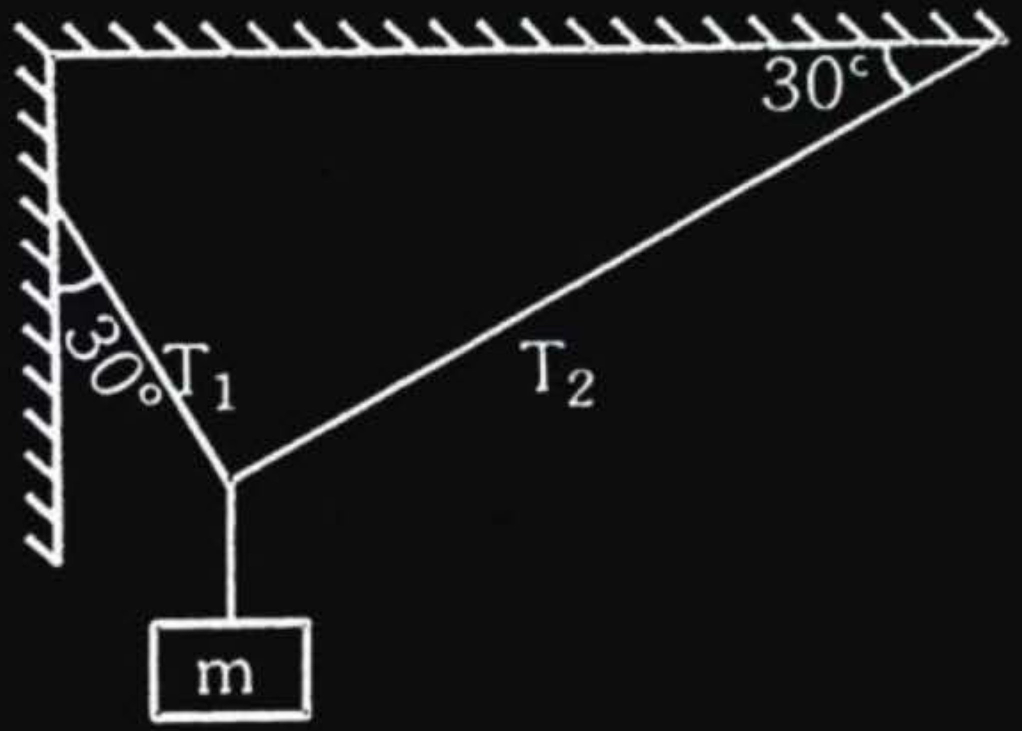
Today rapid Test
every 7 pm

Sangharsh Assignment - 1

Newtons laws of motion

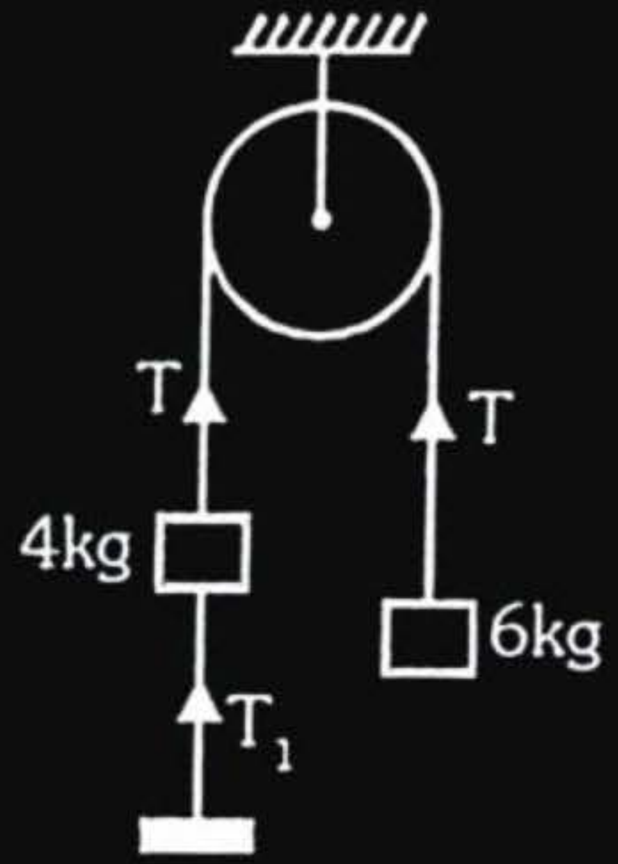
Question

Calculate T_1 & T_2.



Question

Two bodies of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley. The 4 kg mass is attached to the table top by other string. The tension in this string T_1 is equal to



(1) 10 N

(2) 10.6 N

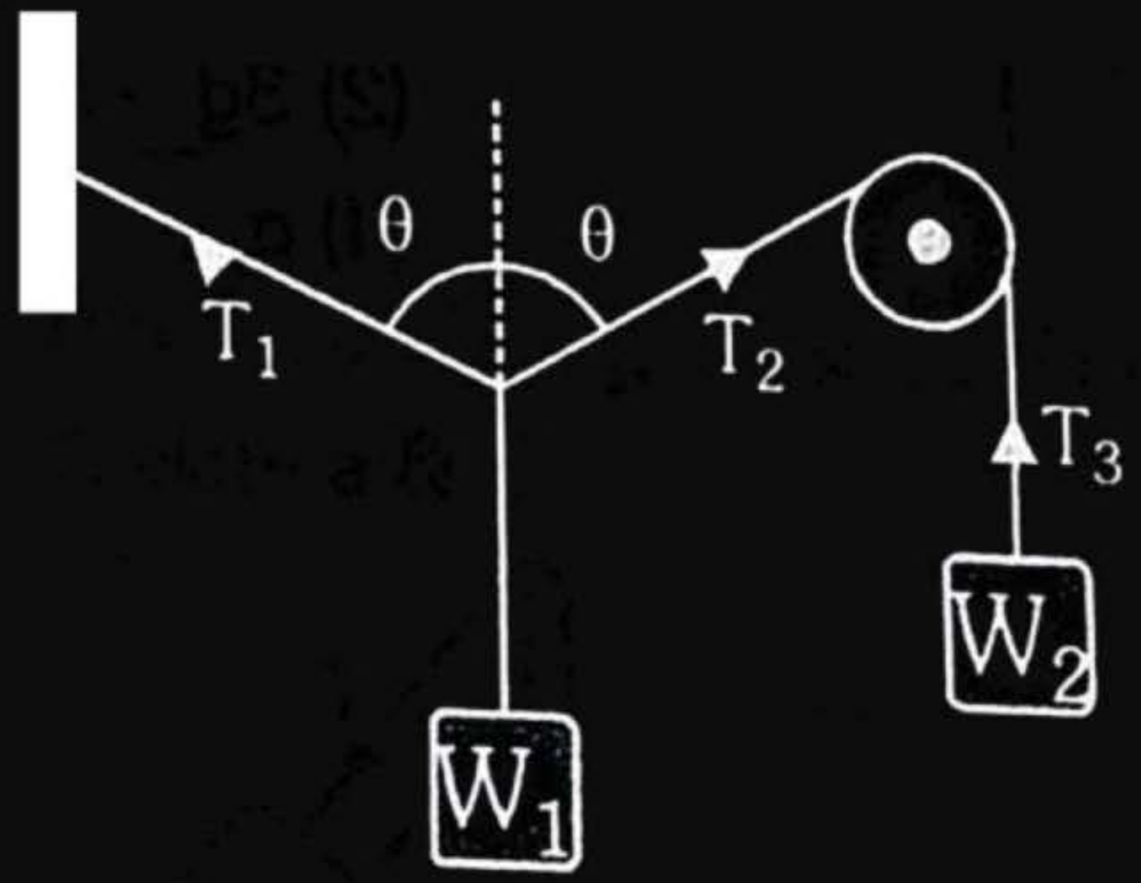
(3) 25 N

(4) 20 N

Question

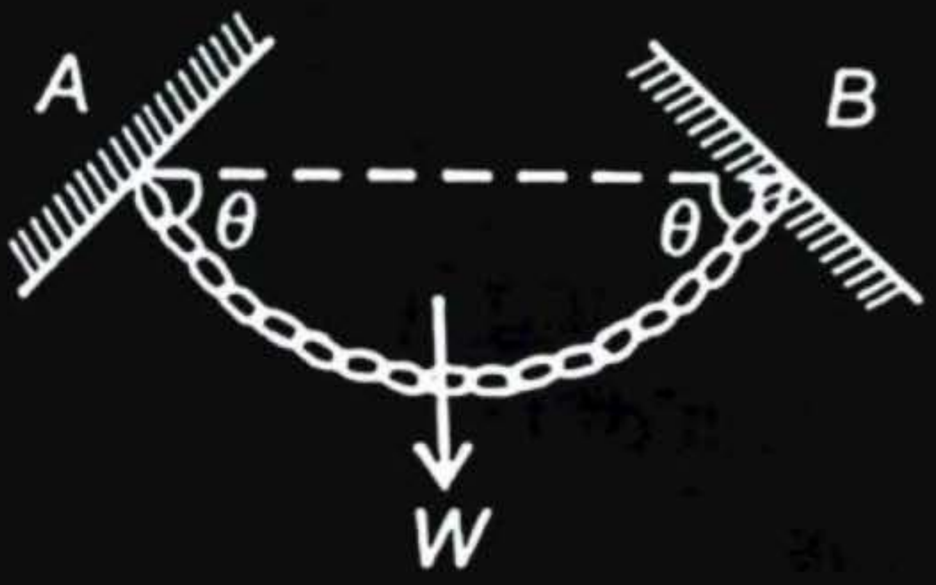
In the following figure, the pulley is massless and frictionless. The relation between T_1, T_2 and T_3 will be:

1. $T_1 = T_2 \neq T_3$
2. $T_1 \neq T_2 = T_3$
3. $T_1 \neq T_2 \neq T_3$
4. $T_1 = T_2 = T_3$



Question

A flexible chain of weight W hangs between two fixed points A and B at the same level. The inclination of the chain with the horizontal at the two points of support is θ. What is the tension of the chain at the endpoint?



(1) $\frac{W}{2}\operatorname{cosec}\theta$

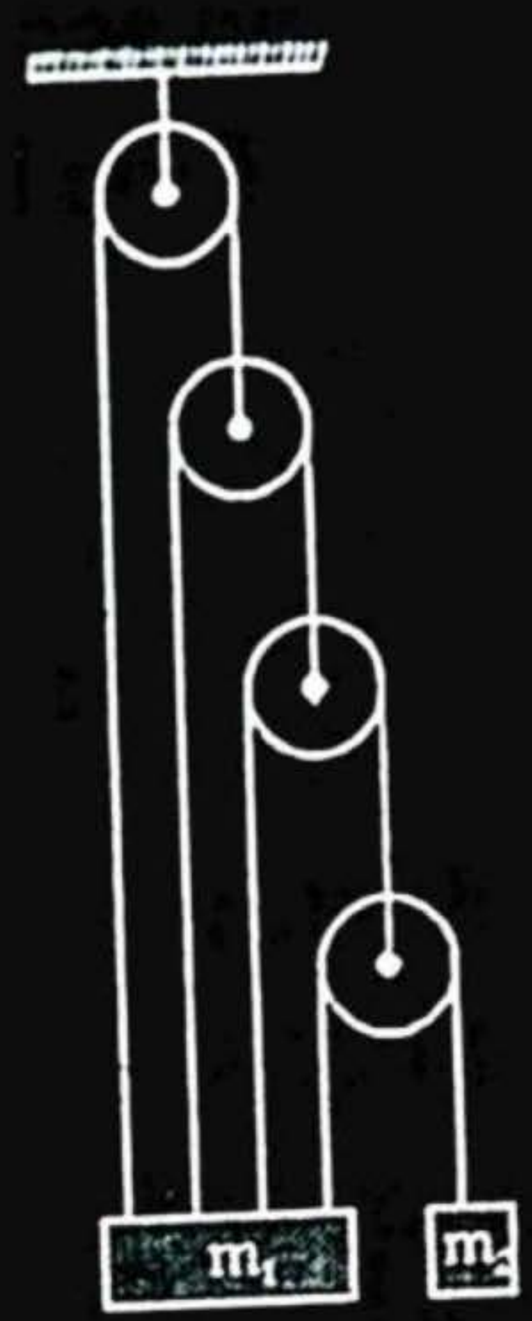
(2) $\frac{W}{2}\sec\theta$

(3) $W\cos\theta$

(4) $\frac{W}{2}\sin\theta$

Question

If system is in equilibrium, then find relation between m_1 and m_2.



1. $\frac{m_1}{m_2} = \frac{1}{2}$

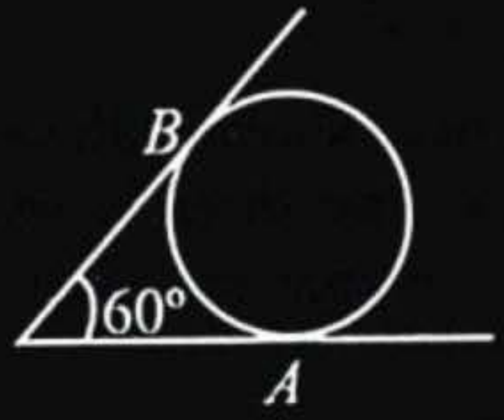
2. $\frac{m_1}{m_2} = \frac{1}{15}$

3. $\frac{m_1}{m_2} = \frac{1}{10}$

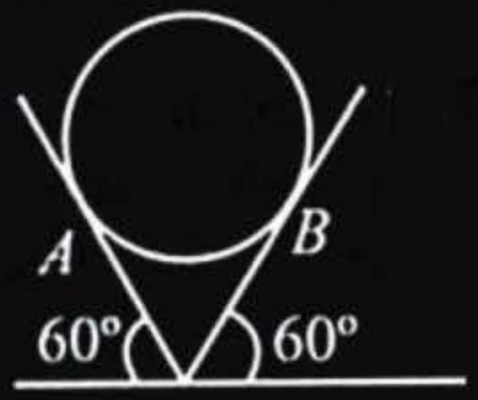
4. $\frac{m_1}{m_2} = 1$

Question

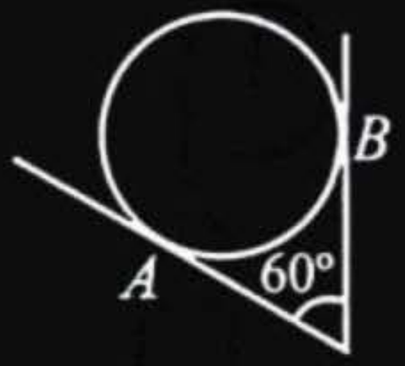
An iron sphere weighing 10 N rests in a V shaped smooth trough whose sides form an angle of 60° as shown in the figure. Then the reaction forces are:
($g = 10\ \mathrm{m/s^2}$)



(i)



(ii)



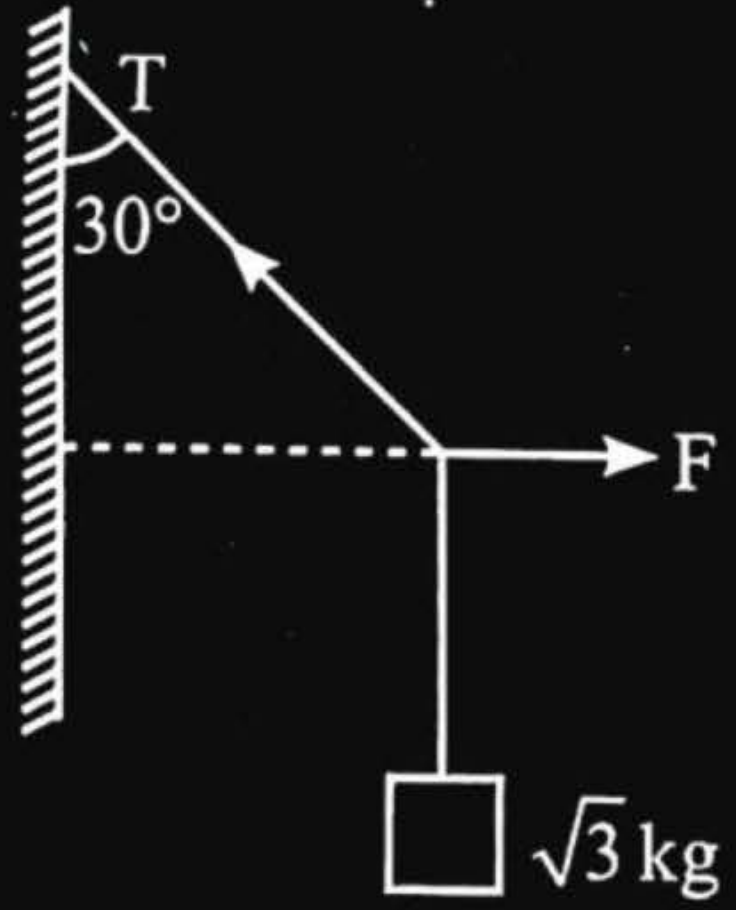
(iii)

1. $R_A = 10\ \mathrm{N}$ and $R_B = 0$ in case (i)
2. $R_A = 10\ \mathrm{N}$ and $R_B = 0$ in case (ii)
3. $R_A = \frac{20}{\sqrt{3}}\ \mathrm{N}$ and $R_B = \frac{10}{\sqrt{3}}$ in case (iii)
4. $R_A = 10\ \mathrm{N}$ and $R_B = 10\ \mathrm{N}$ in all the three cases

Question

A block of $\sqrt{3}$ kg is attached to a string whose other end is attached to the wall. An unknown force F is applied so that the string makes an angle of $30°$ with the wall. The tension Tin the string is:

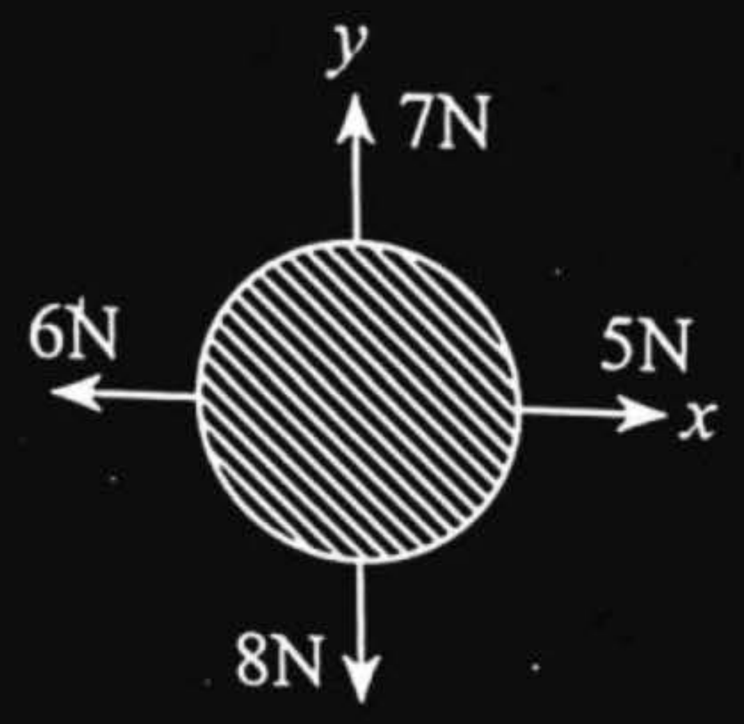
(Given $g = 10\ \text{ms}^2$) **[JEE Main 2023]**



1. 20 N
2. 25 N
3. 10 N
4. 15 N

Question

For a free body diagram shown in the figure, the four forces are applied in the 'x' and 'y' directions. What additional force must be applied and at what angle with positive x-axis so that the net acceleration of body is zero? **[JEE Main 2022]**

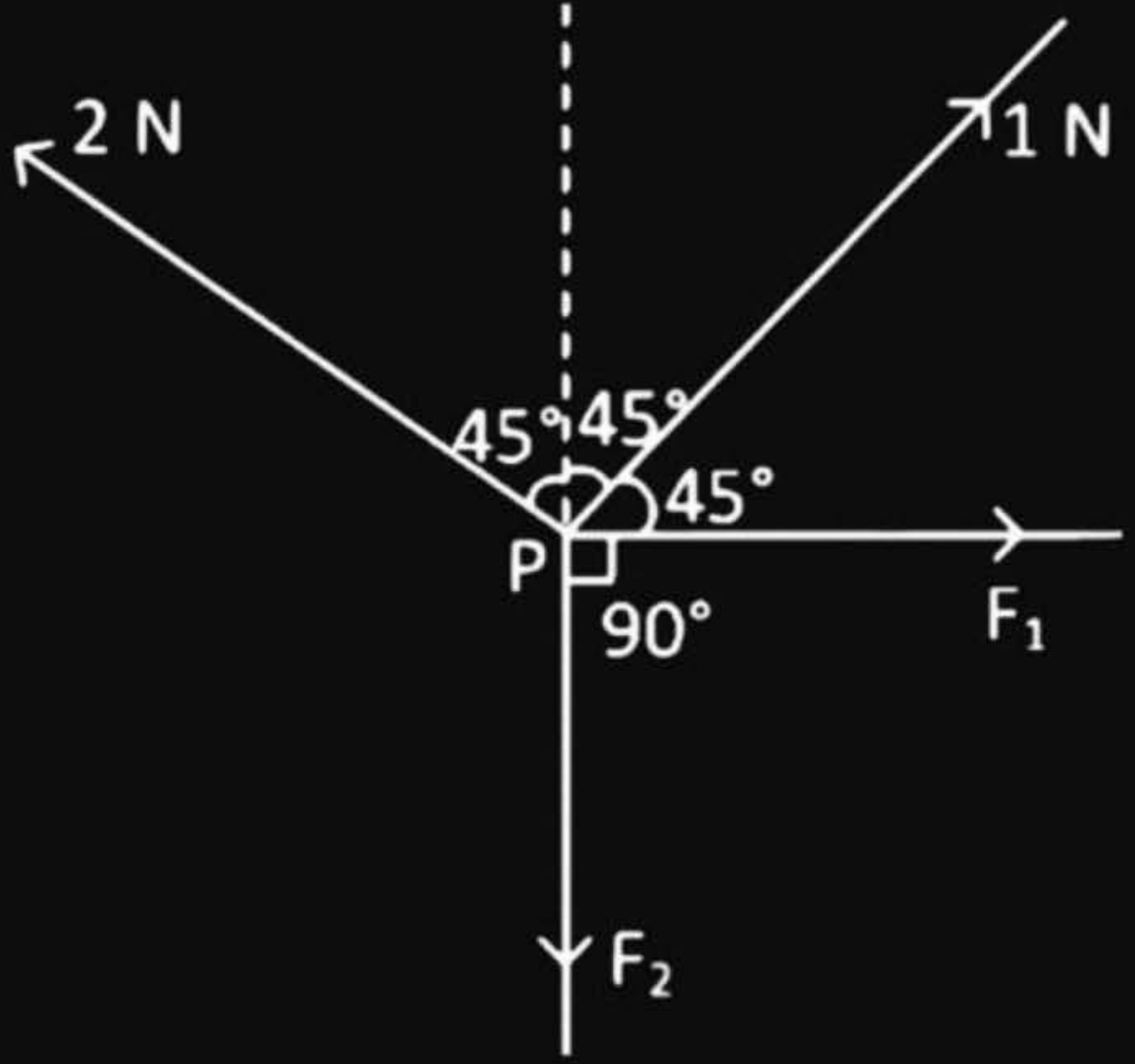


1. $\sqrt{2}$ N, 45°
2. $\sqrt{2}$ N, 135°
3. $\frac{2}{\sqrt{3}}$ N, 30°
4. 2 N, 45°

Question

Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force F_1 to F_2 is $1 : x$ where, $x =$ ________.

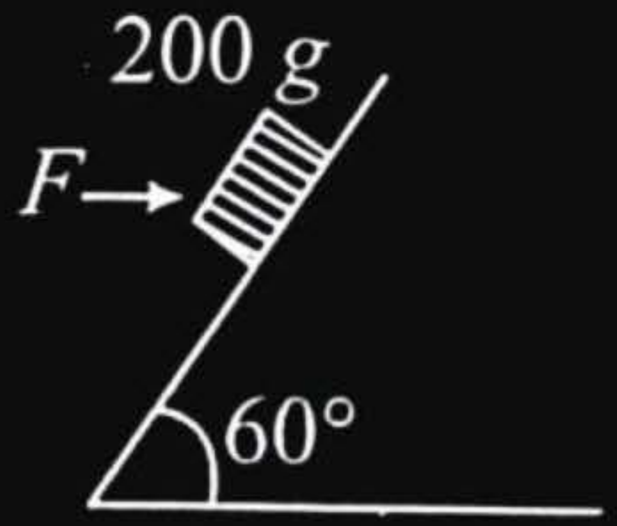
[JEE Main 2022]



Question

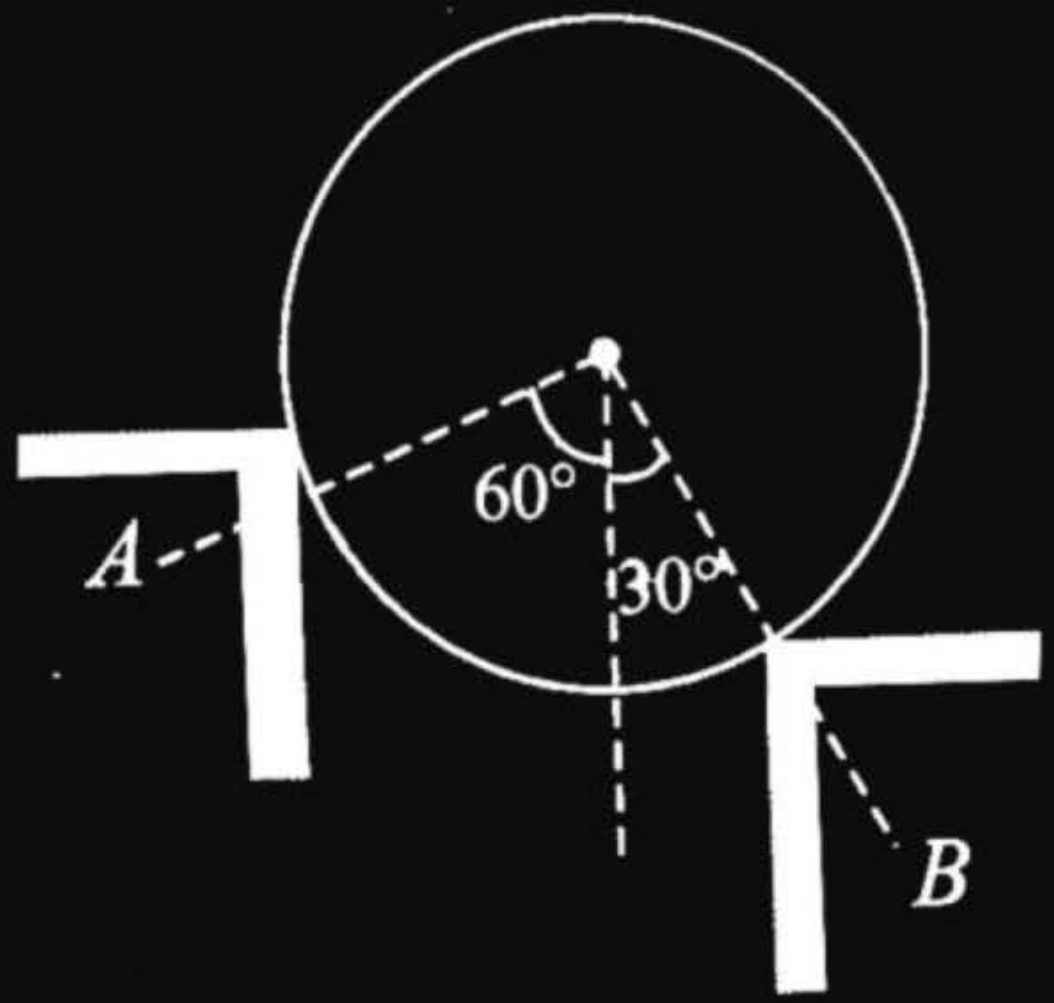
A block of mass 200 g is kept stationary on a smooth inclined plane by applying a minimum horizontal force $F = \sqrt{x}$ N as shown in figure. The value of x = ______.

[JEE Main 2022]



Question

A cylinder of mass M and radius R is resting on two corner edges A and B as shown in figure. The normal reaction at the edges A and B are: (Neglect friction):

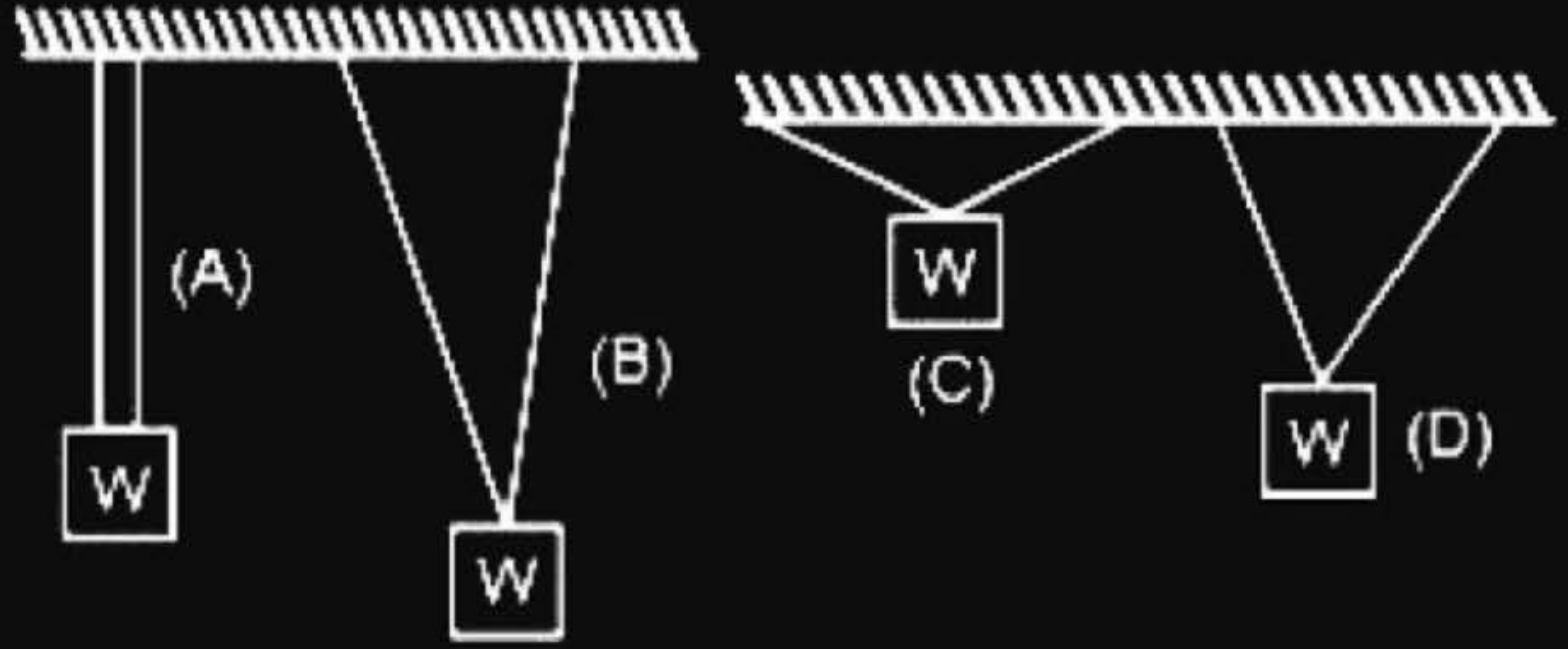


1. $N_A = \sqrt{2} N_B$
2. $N_B = \sqrt{3} N_A$
3. $N_A = \frac{Mg}{2}$
4. $N_B = \frac{2\sqrt{3}Mg}{5}$

Question

A weight can be hung in any of following four ways by using same string. In which case is the string more likely is break

1. A
2. B
3. C
4. D



Question

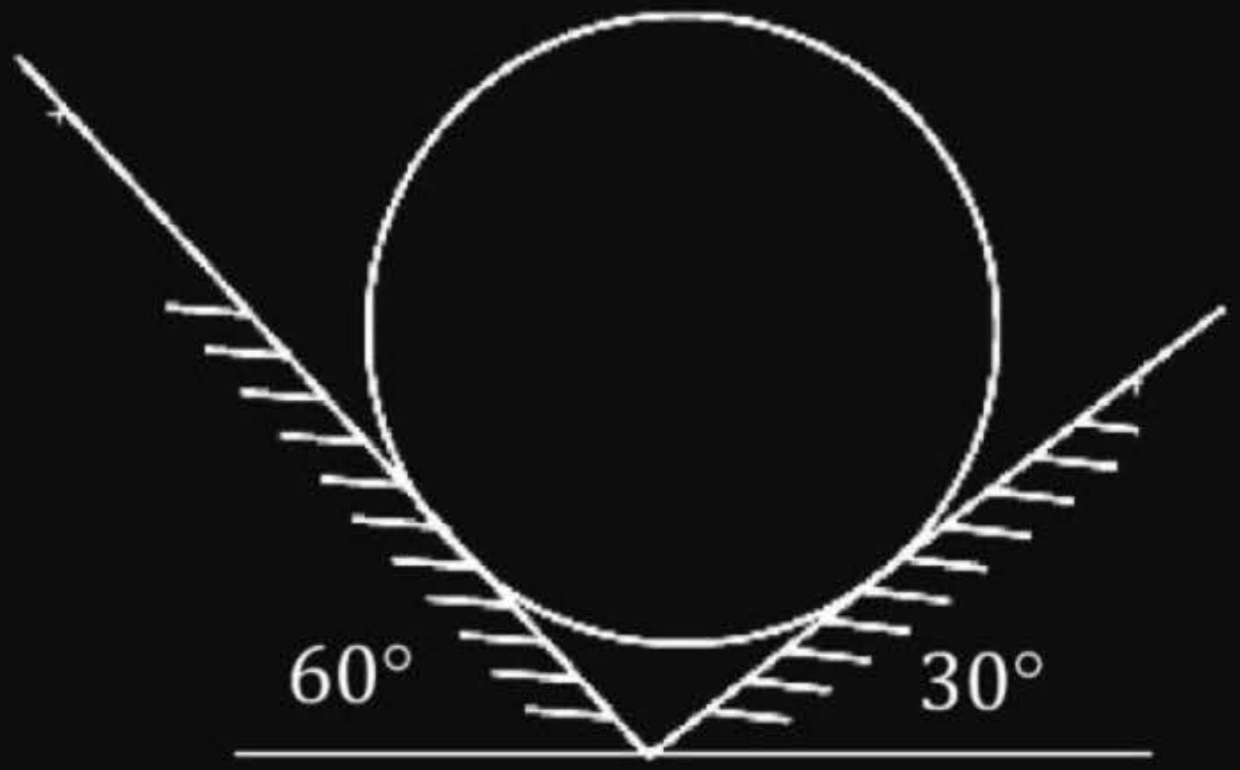
A cylinder of mass $1/\sqrt{3}$ kg is placed on the corner of two inclined planes as shown in the figure. Find the normal reaction at contact point of cylinder with the slope of inclination 30°.

(1) 15 N

(2) 10 N

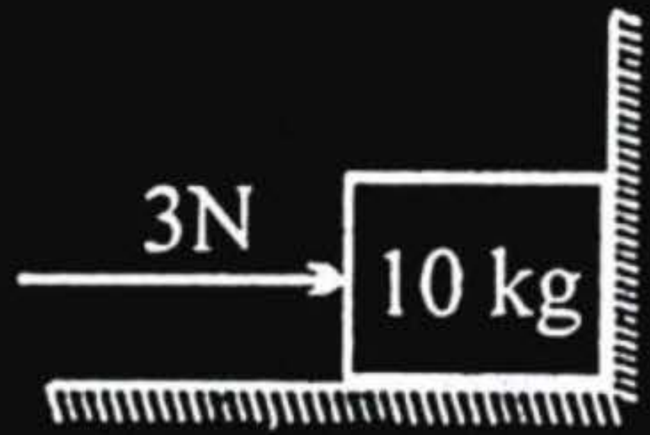
(3) 7 N

(4) 5 N



Question

A block is kept at the corner of two walls and force 3N is applied on block. If $\mu = 0.1$, between block and walls then frictional force acting on block equal to:



1. 3 N
2. 10 N
3. 0
4. cannot be determined

Question

Four forces act on a particle as shown in the figure such that net force is zero. Then consider following statements:

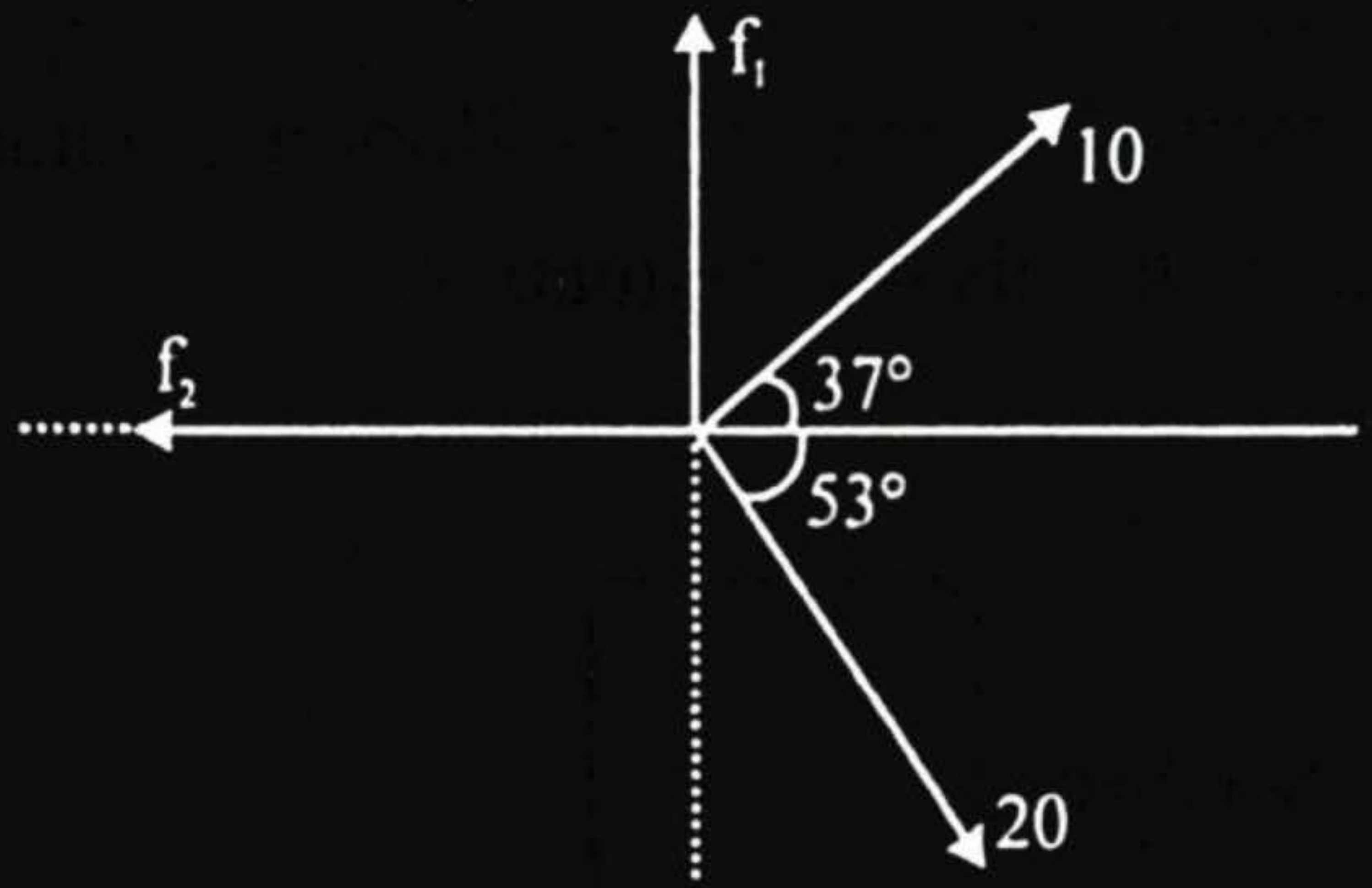
(A) Magnitude of $\vec{f}_1$ is 10 N

(B) Magnitude of $\vec{f}_1$ is 20 N

(C) Magnitude of $\vec{f}_2$ is 10 N

(D) Magnitude of $\vec{f}_2$ is 20 N

Select correct alternative

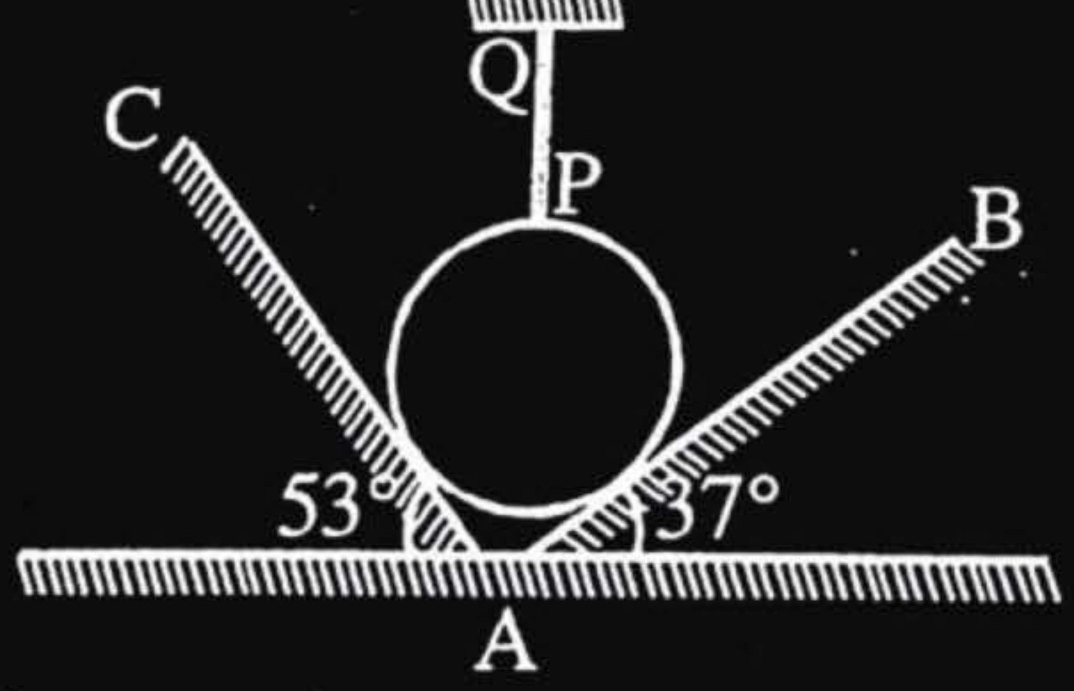


1. Only A
2. Only C
3. Only D
4. Only A and D

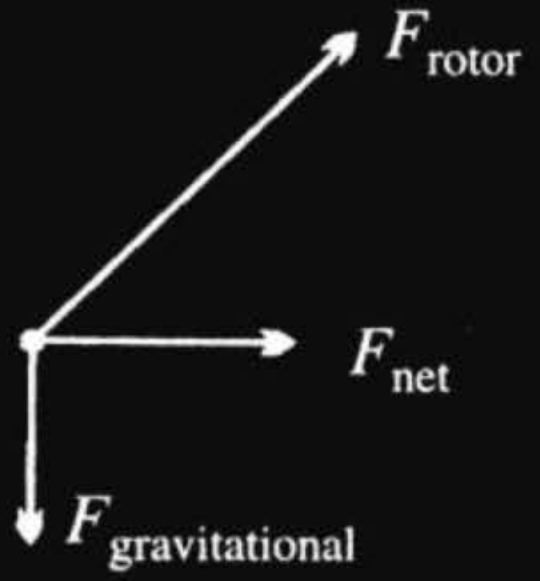
Question

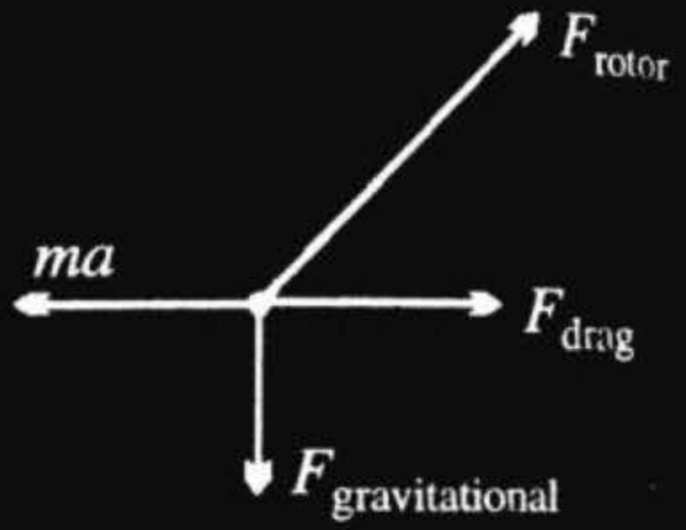
A cylinder of mass 10 kg is resting between two frictionless inclined surfaces AB and AC, and it is attached to a vertical string PQ whose other end Q is fixed to the ceiling, as shown in the figure. If the forces applied by cylinder to surfaces AC and AB are 30 N and 40 N, respectively, the tension in the string is (in N) [$g = 10\ m/s^2$]

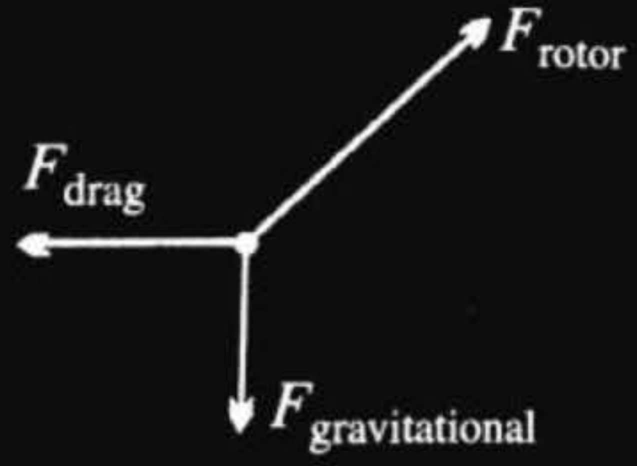
1. 20
2. 50
3. 30
4. 40

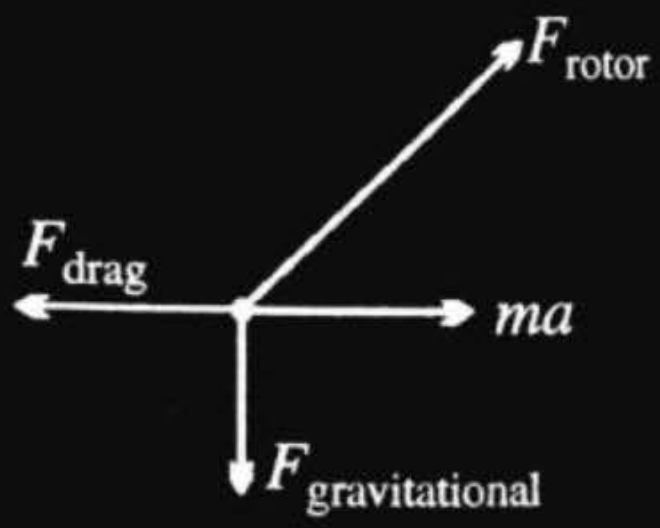


A helicopter is moving to the right in horizontal plane. It experiences three forces $\vec{F}_{\text{gravitational}}$, $\vec{F}_{\text{drag}}$ and upthurst force on it caused by rotor $\vec{F}_{\text{rotor}}$ and its net acceleration being 'a'. Which of the following diagrams can be correct free body diagram w.r.t. to a stationary observer on ground?

1 

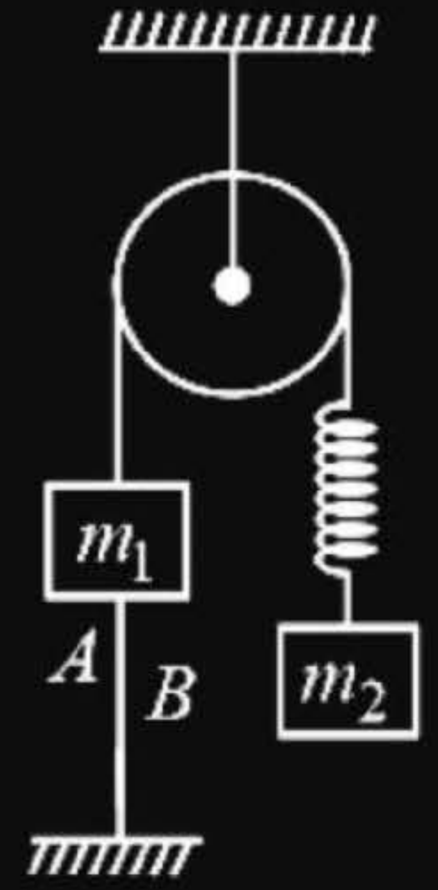
2 

3 

4 

Question

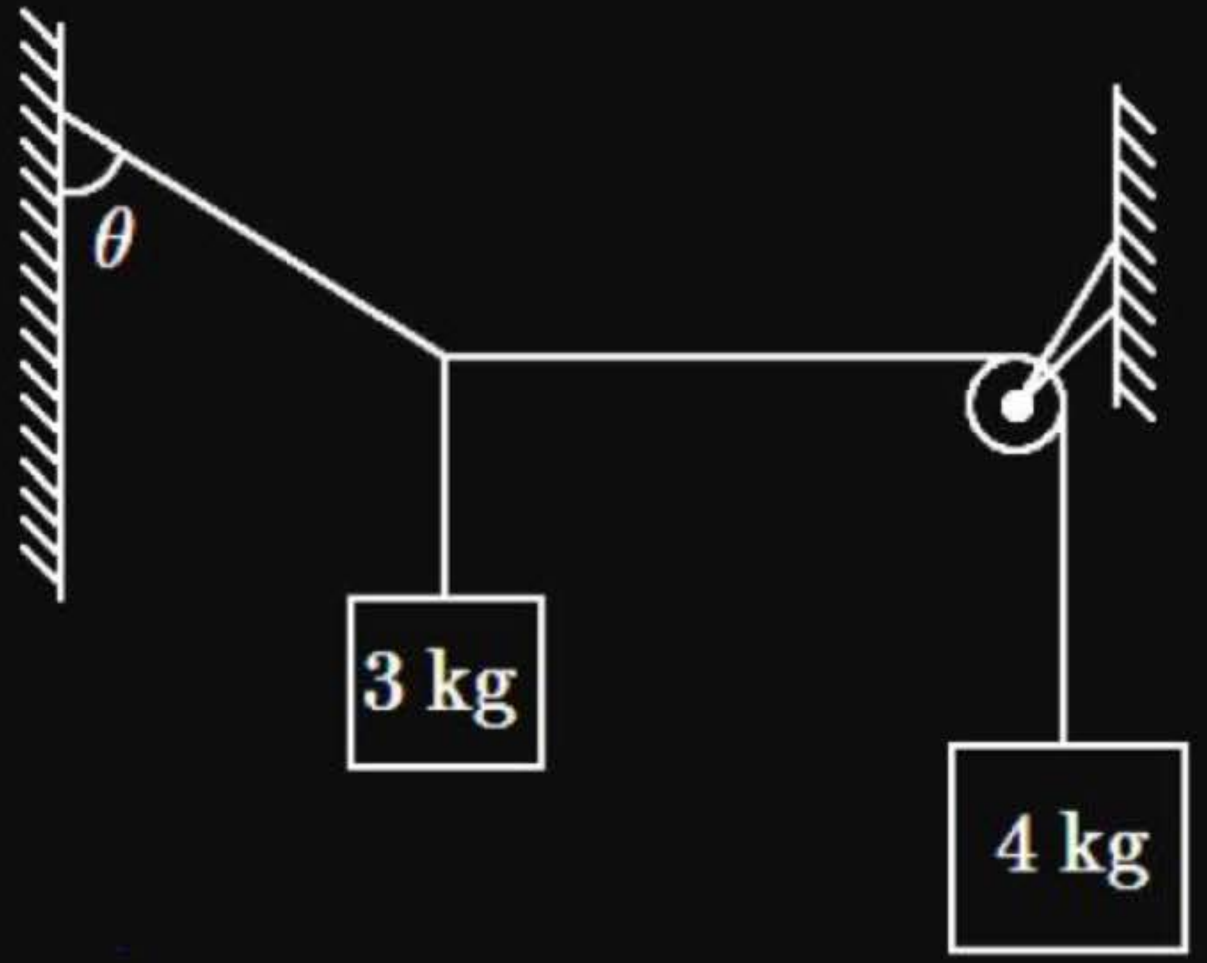
In a given figure, two masses m_1 and m_2 $(m_2 > m_1)$ are at rest in equilibrium position. Find the tension in string AB



1. $m_1 g$
2. $m_2 g$
3. $(m_1 + m_2)g$
4. $(m_2 - m_1)g$

Question

In shown system, each of the block is at rest. The value of θ is



1. $\tan^{-1}(1)$
2. $\tan^{-1}\left(\frac{3}{4}\right)$
3. $\tan^{-1}\left(\frac{4}{3}\right)$
4. $\tan^{-1}\left(\frac{3}{5}\right)$

THANK
YOU