ARJUNA NEET BATCH

LAWS OF MOTION

LECTURE - 02

Todays goal

Force

Type and Nature

Free body diagram. ✓

Newtons 1st Law s ✓

Equlibrium.

questions on equlibrium

fundamental forces in nature

Gravitational force

Electro-magnetic force

Strong Nuclear force

Weak - Nuclear force

tension, Normal reaction, friction Spring force all are derived force
they all are derived from electromagnetic force

fundamental P.C

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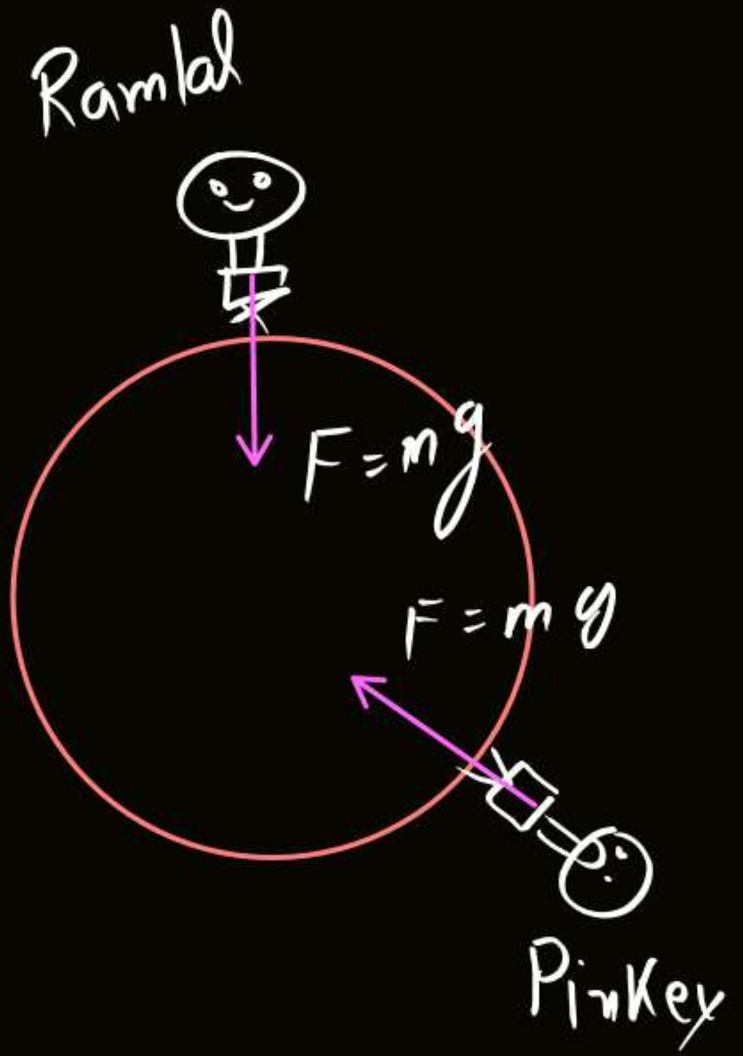
fundamental Particle

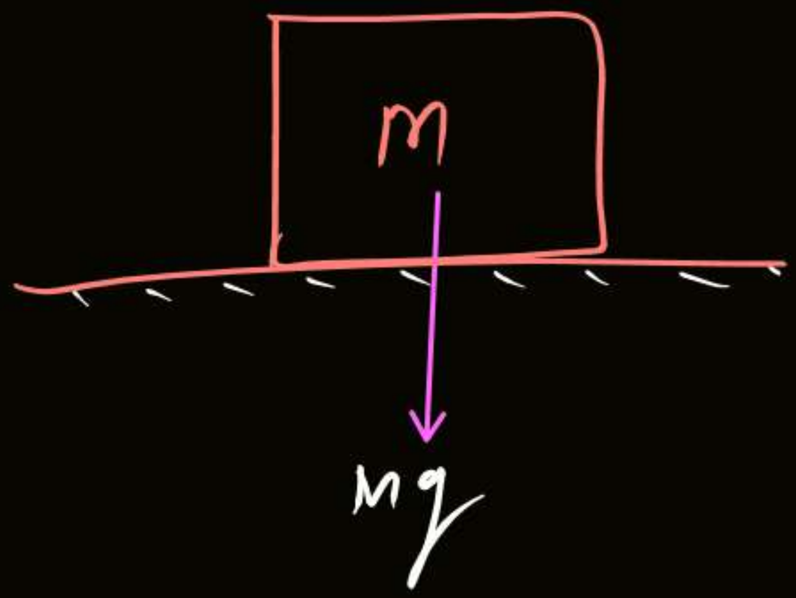
electron, quarks, Photon

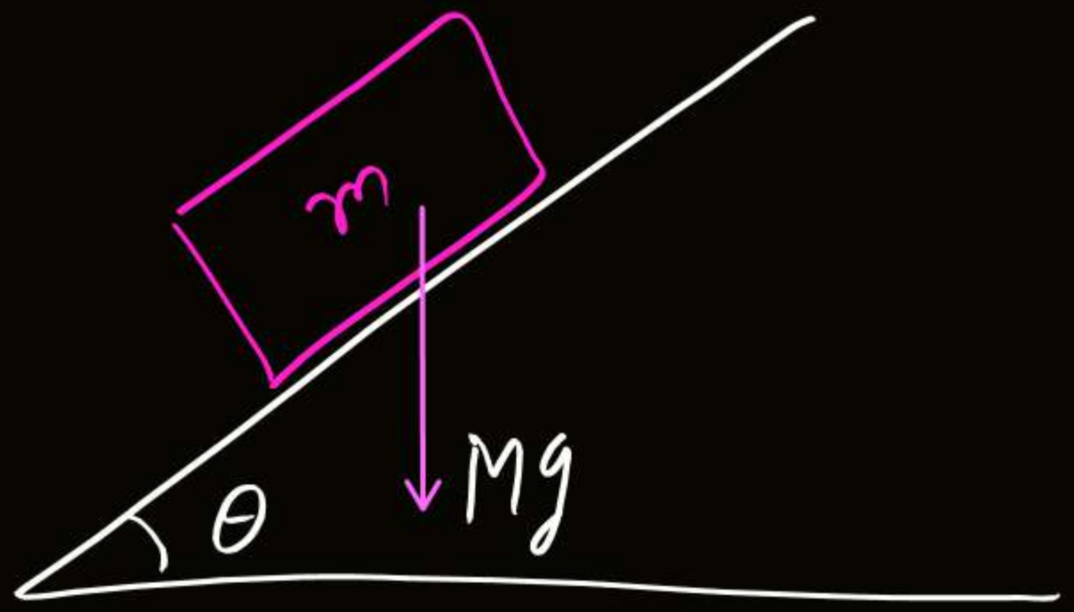
Proton and neutron is not a fundamental.

Weight $\rightarrow$ gravitational force (N)

$$\boxed{W = mg}$$







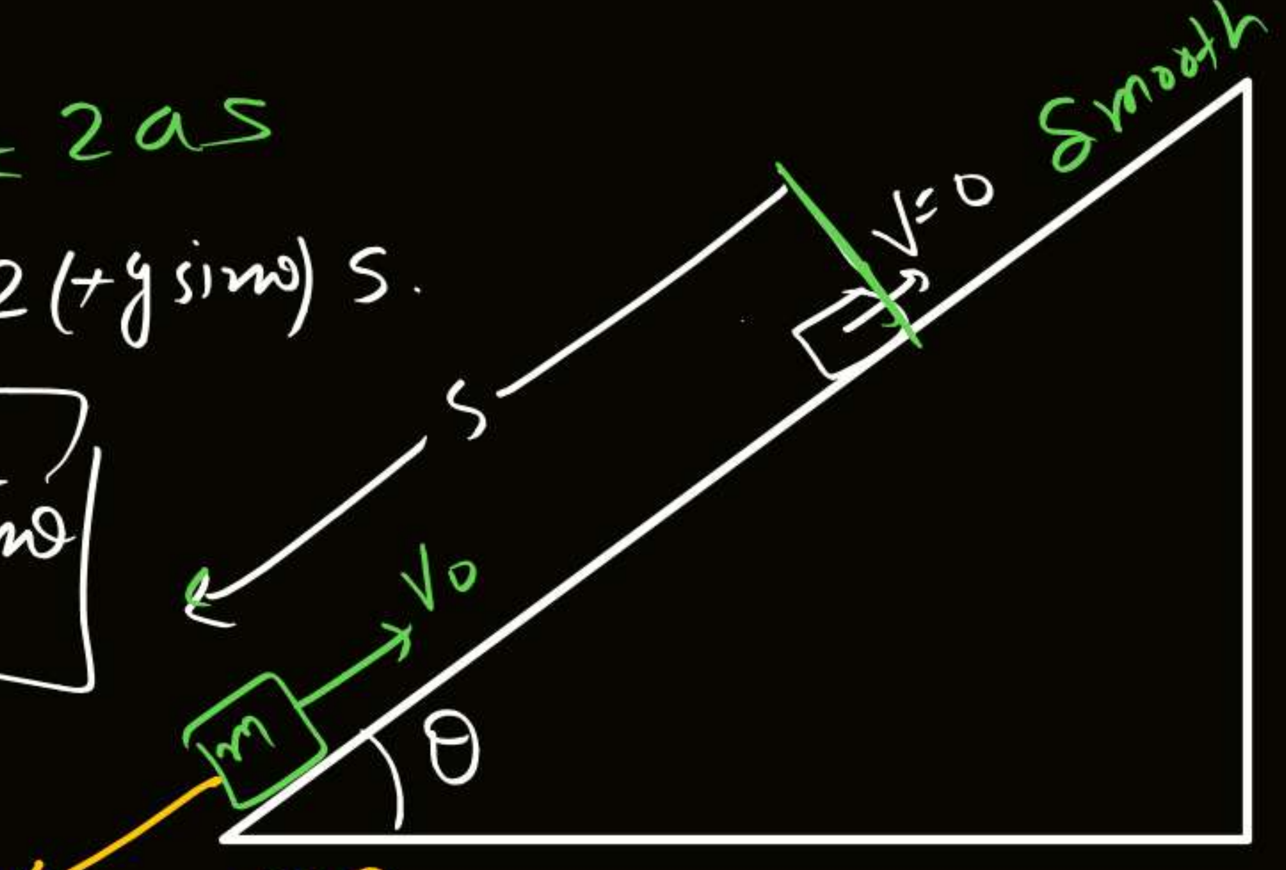
NEET-2019

1-D

$\cancel{v^2} - u^2 = 2as$

$+ v_0^2 = 2(+g\sin\theta)\,s.$

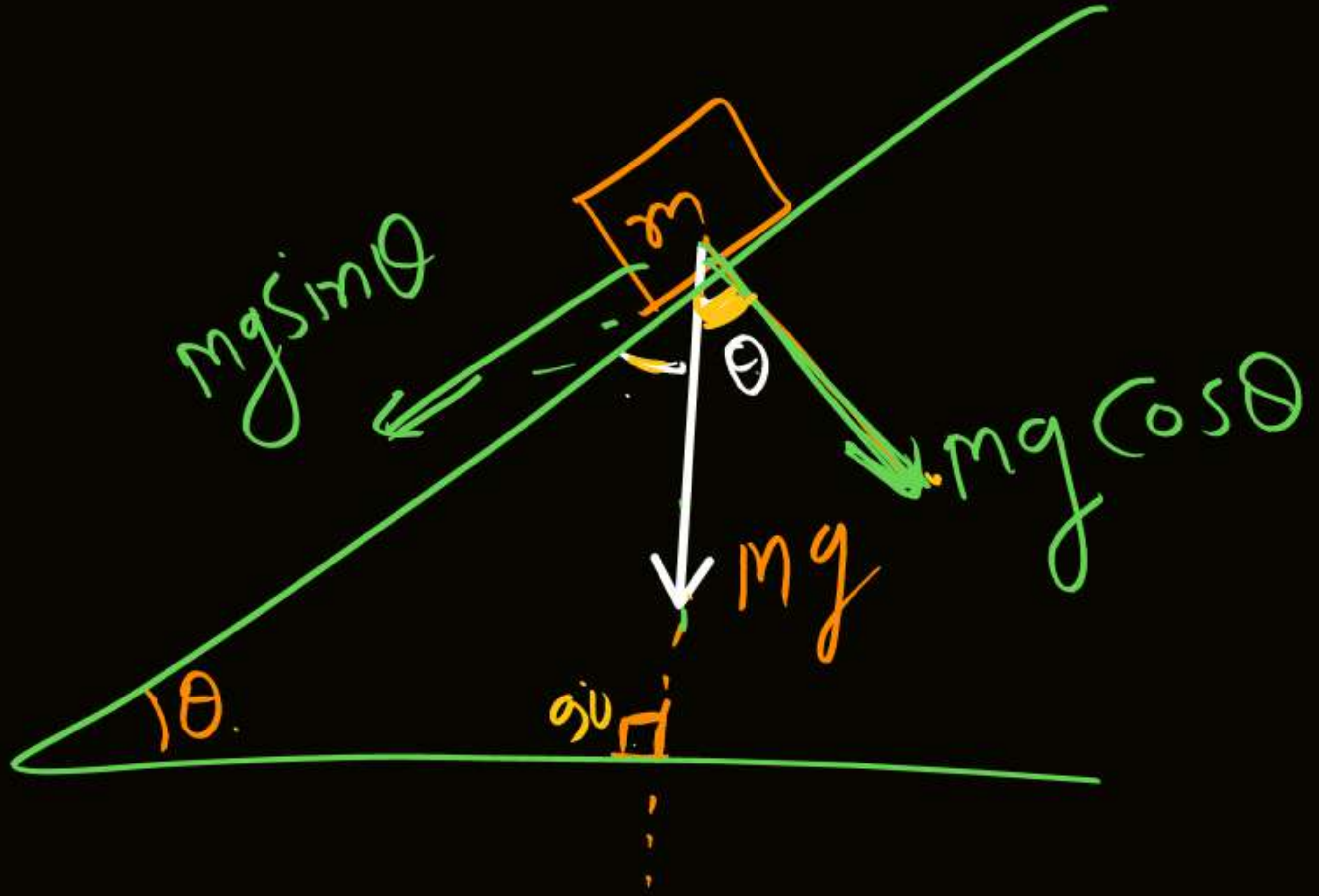
$\boxed{S = \dfrac{v_0^2}{2g\sin\theta}}$



$F = mg\sin\theta$

$\cancel{m}a = \cancel{m}g\sin\theta$

(ret^n) $a = g\sin\theta$



m
mgsinθ
θ
mgcosθ
mg
θ
giu

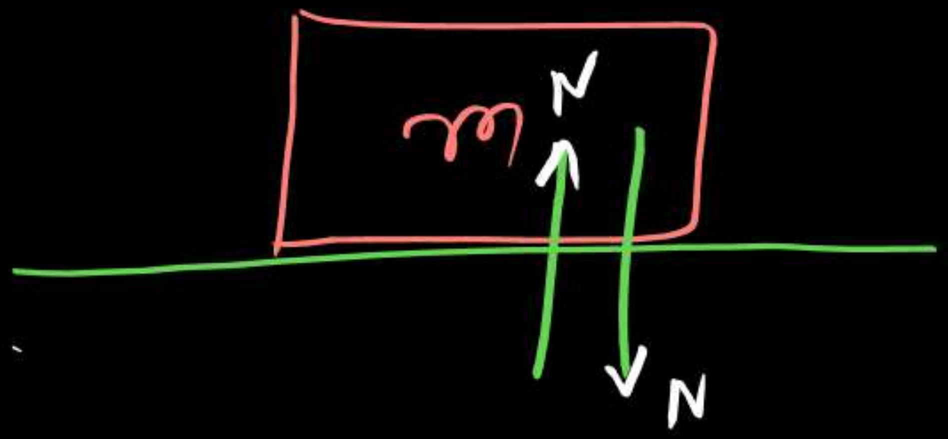
NORMAL REACTION

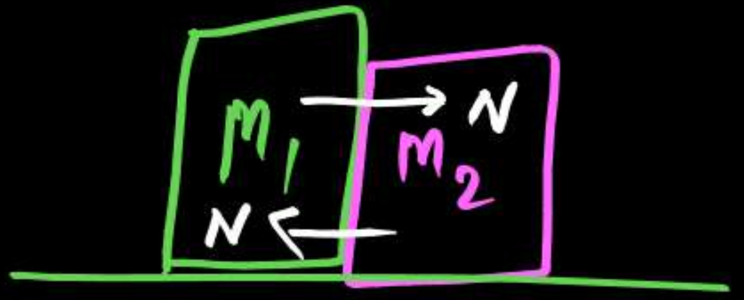
- Contact force
- Always in pair ✓
- Perpendicular to contact surface

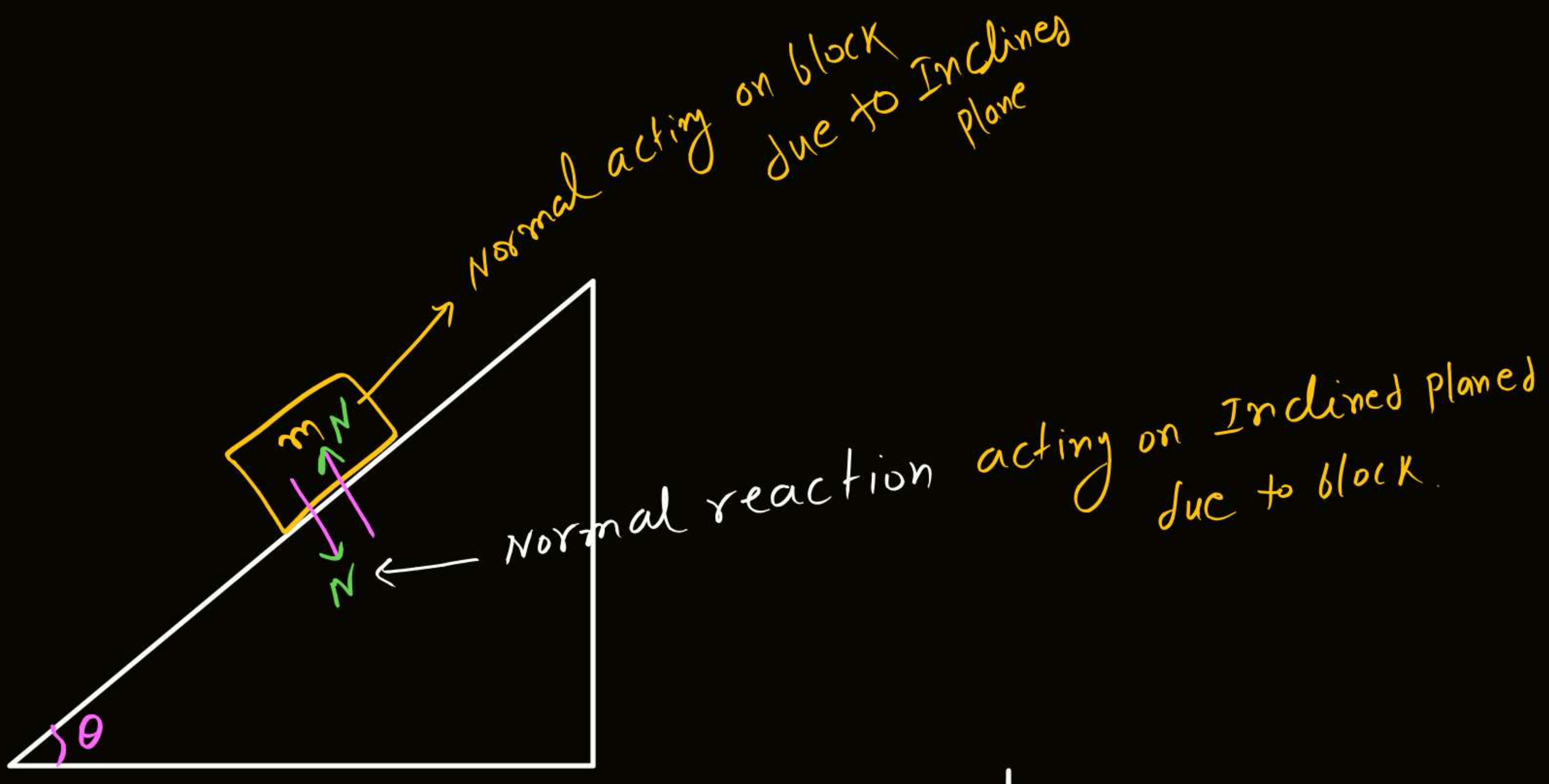
$N \rightarrow$ High $\rightarrow$ Strong contact.

$N \rightarrow$ Low $\rightarrow$ Weak contact

$N = 0$ (No Contact)



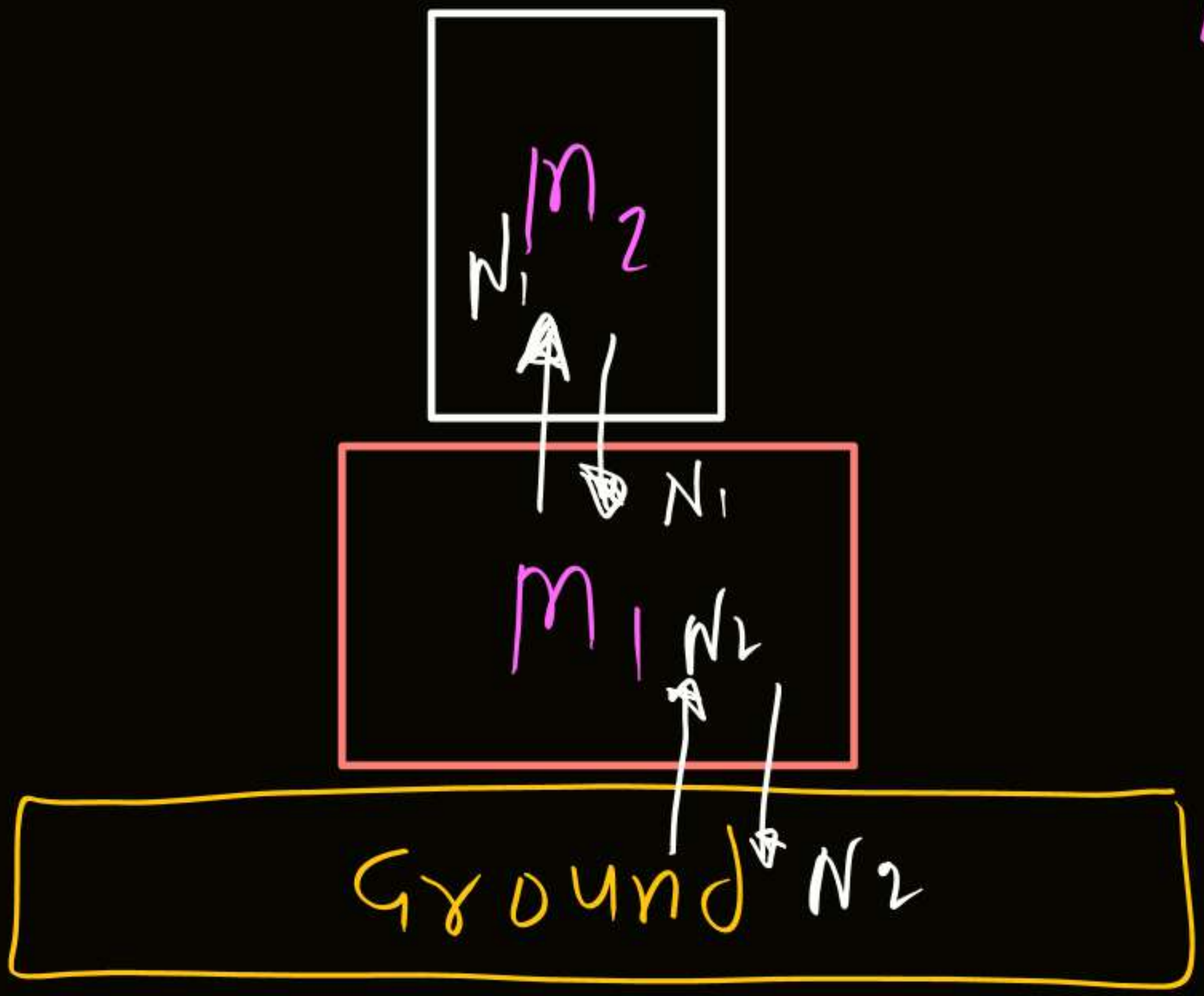




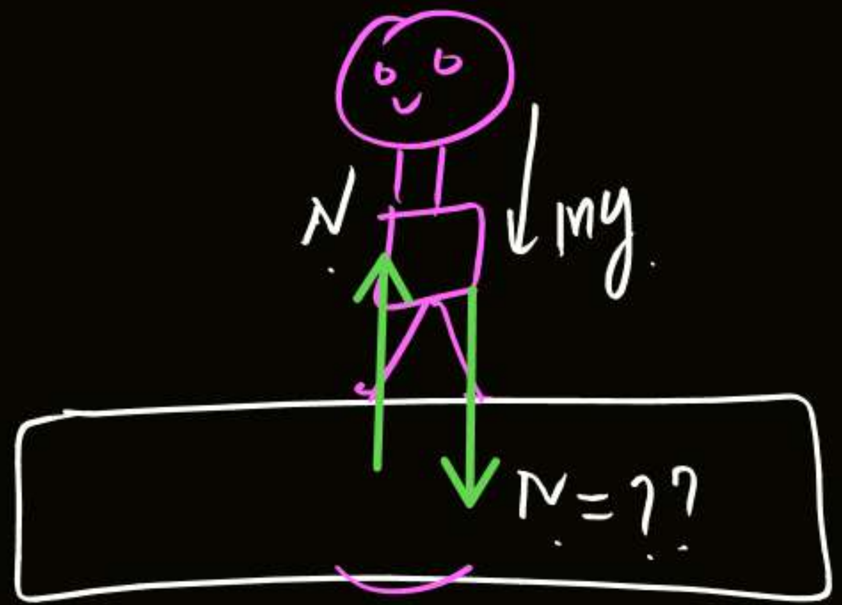
Normal acting on block due to Inclined plane
m
N
N
Normal reaction acting on Inclined planed due to block
θ

No. of contact force ??

Ans =



on man $\boxed{mg = N}$ ✓



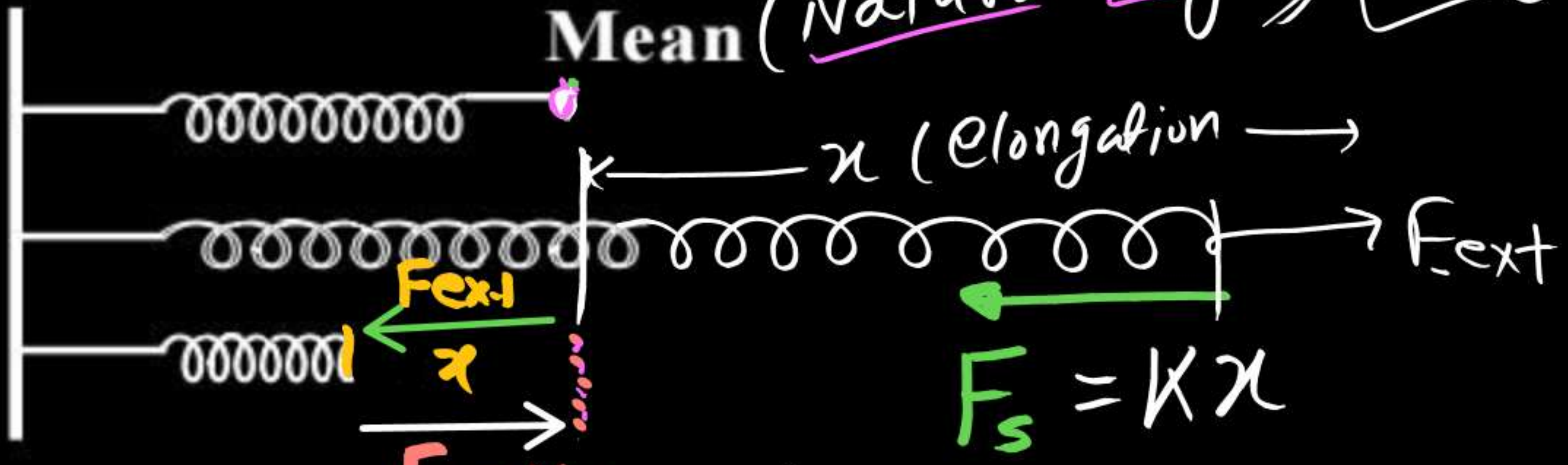
① Weight
② mass
③ Normal reaction

Spring Form

l (elongation = 0)

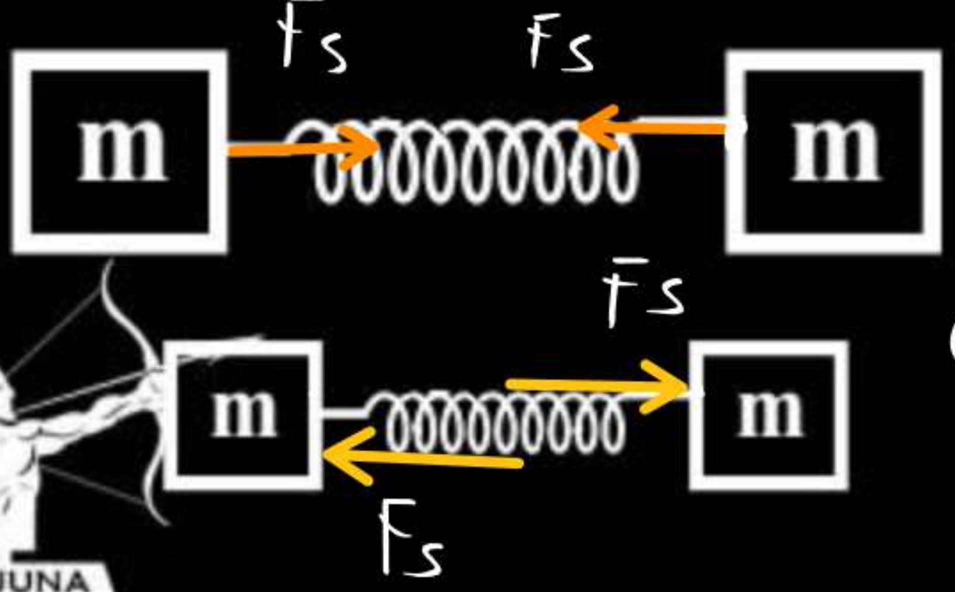
Mean (Natural length) $\boxed{F_{sping} = 0}$

Spring const^n = K



$F_s = Kx$ (compression)

> # Spring force
> always acts towards the mean position



elongated spring

compresed spring

NEWTON'S 1ST LAW OF MOTION

- Law of Inertia/Law of equilibrium
- Qualitative definition of Motion

If $\sum F_{\text{net}} = 0$ then $\sum a_{\text{sys}} = 0$ hen $\vec{u} = \text{Cost}^n \rightarrow$ body will continue its state

"If net force acting on body is zero then it will continuous its state"

If $\vec{F}_{ext} \neq 0$ then body will change it state.

$\sum \vec{F_x} = 0$ then $\sum \vec{a_x}$ = must be zero.

$\sum \vec{F_y} = 0$ then $\vec{a_y}$ = must be zero

Free body diagram (F.B.D]

Seperate the body from system, & reprsent it with Point

Identfy all the forces acting on it.

Draw all forces in vector form ✓

take component in x-axis and y-axis

Apply newton's Laws of motion.

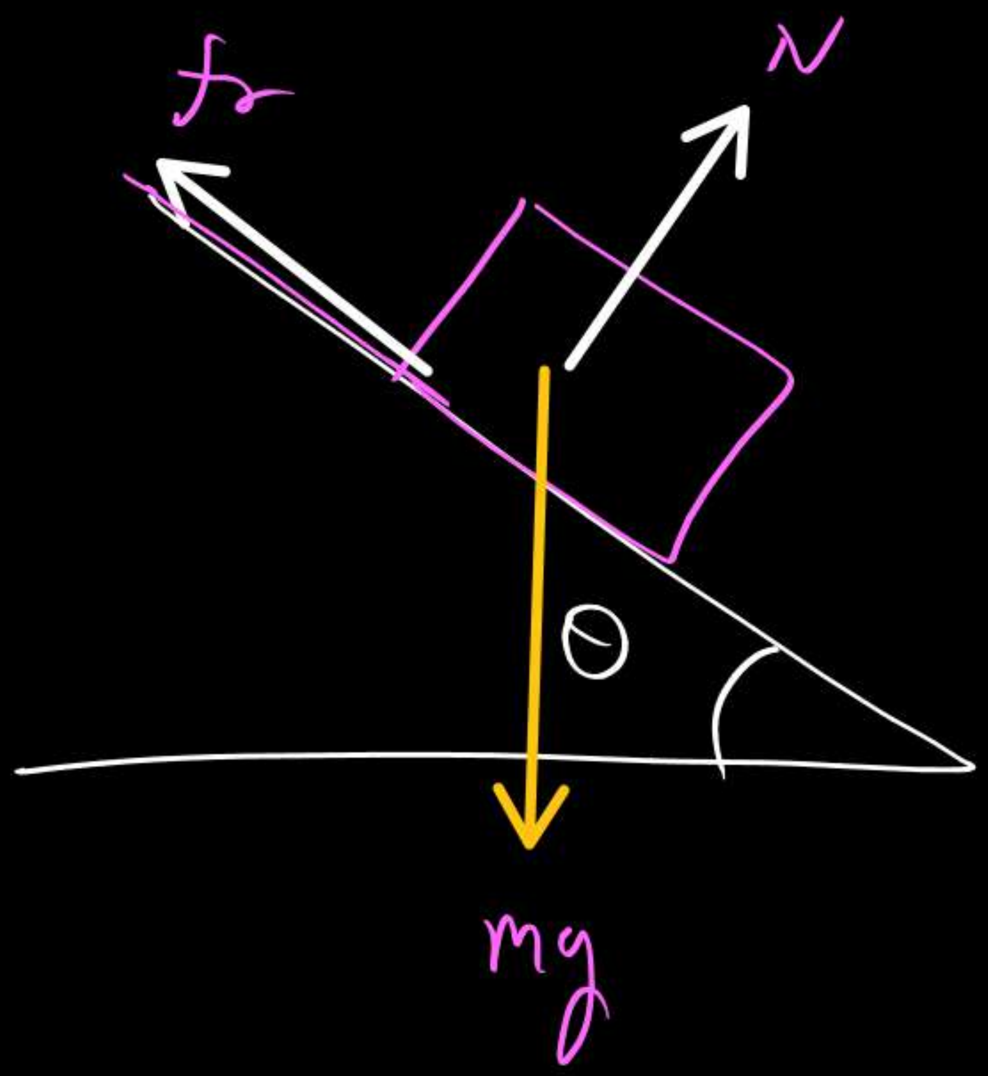
A block is stationary on a rough inclined plane. How many forces are acting on the block ?

(a) 2

(b) 3

(c) 4

(d) 5

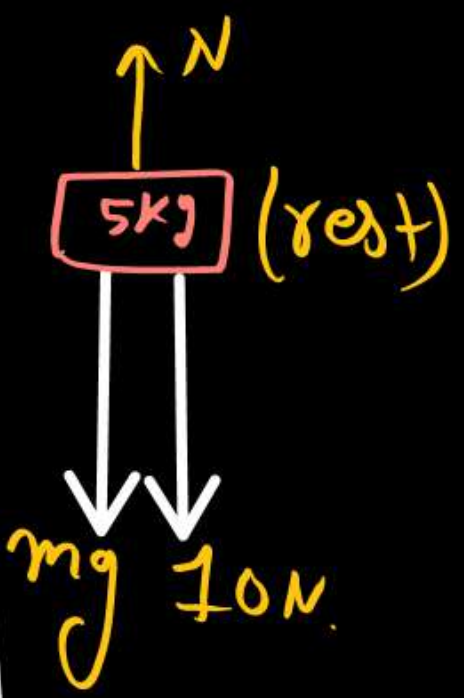


A book of mass 5 kg is placed on a table and it is pressed by 10 N force then normal force exerted by the table on the book is

(a) 10 N (b) 70 N

(c) 59 N (d) 50 N

F.B.D OF BOOK

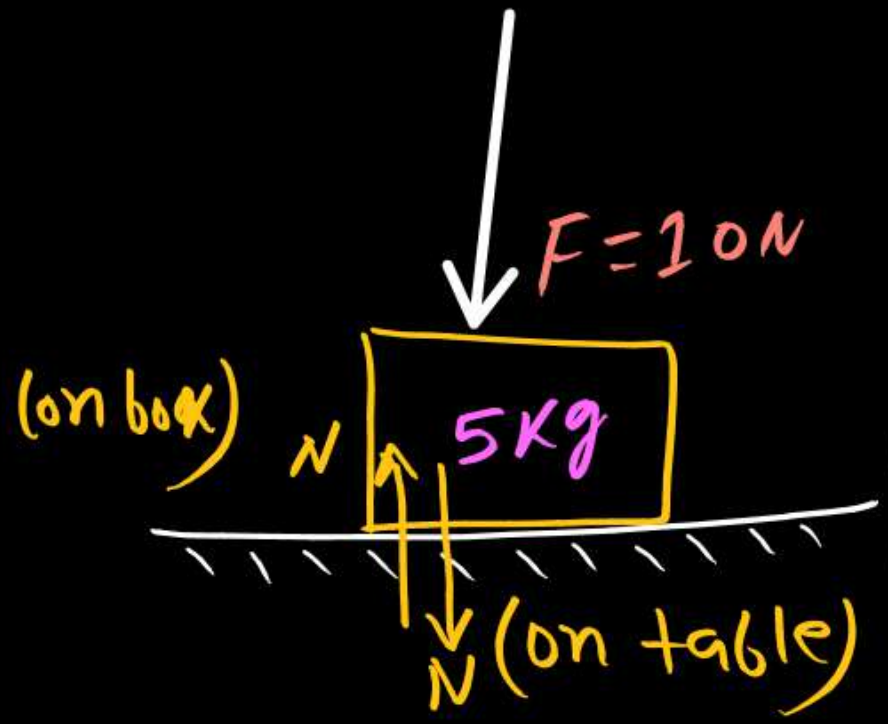


"$N = mg + 10$"

$= 5 \times 9.8 + 10$

$= 49 + 10$

$\boxed{N = 59 \text{ Newt}}$



$F_{net} = N - 10 - mg = 0$

$\boxed{N = 10 + mg}$

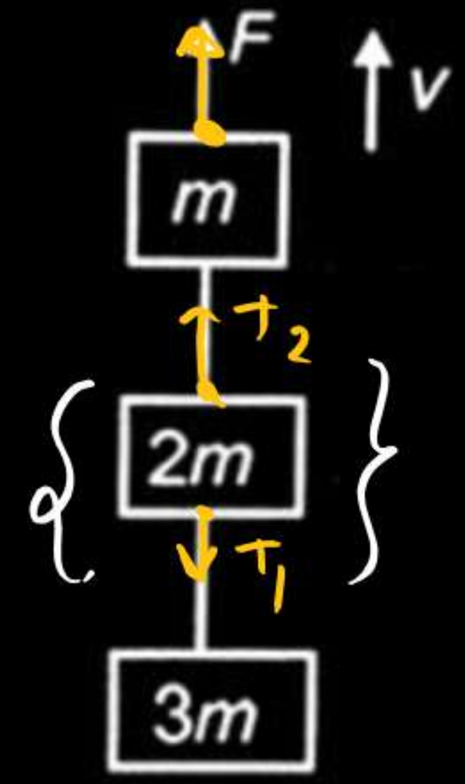
Three blocks with masses m, $2m$ and $3m$ are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass $2m$? (g is the acceleration due to gravity) [NEET-2013]

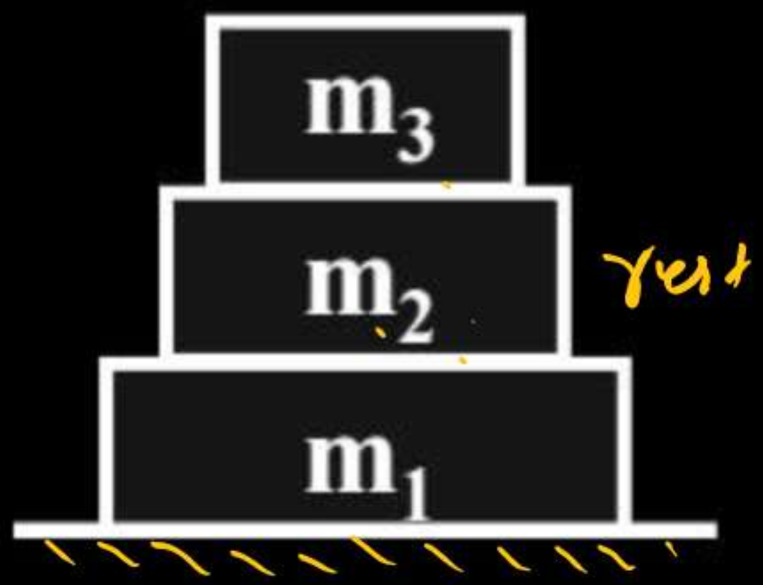
(a) $2\,mg$
(b) $3\,mg$
(c) $6\,mg$
(d) Zero

$\vec{V} = \text{const}^n$

$\rightarrow a = 0$

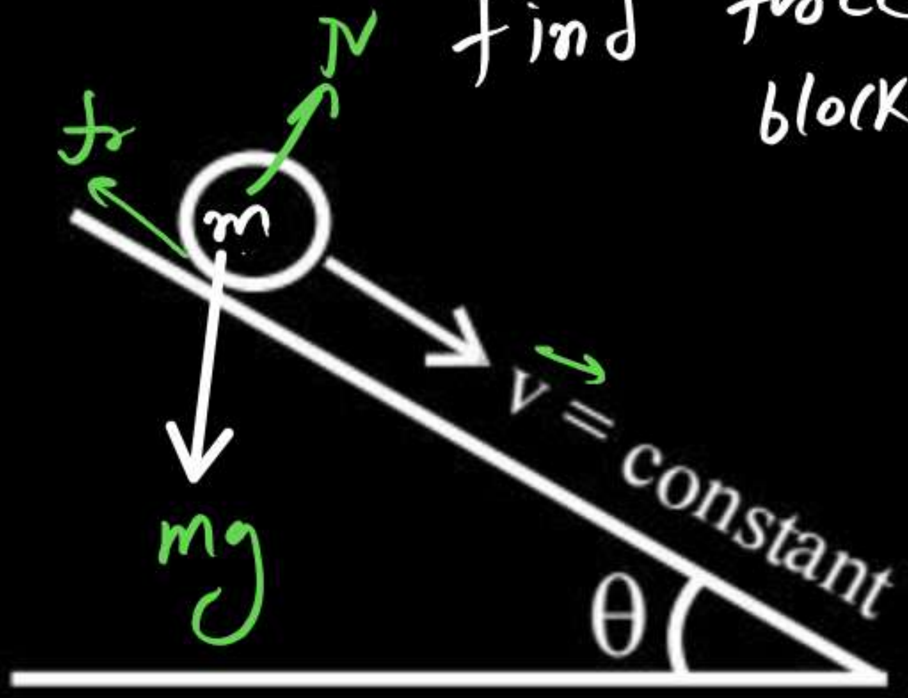
$F_{net} = 0$





find net force on m_2

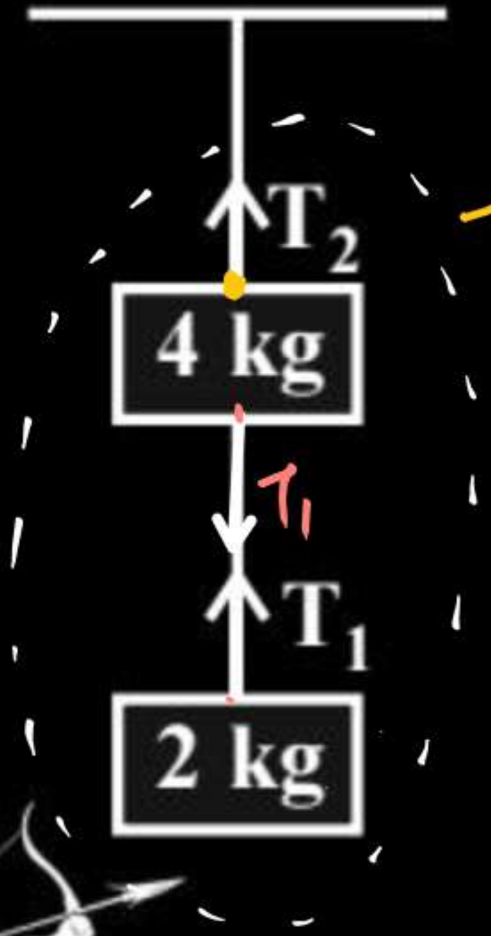
$$\boxed{(F_{net})_{on\ m_2} = 0}$$



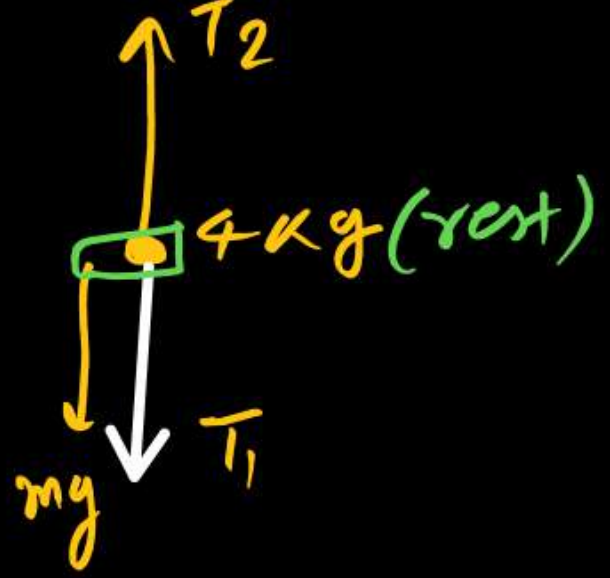
find force on block of mass 'm'.

$$(F_{net})_{on\ mass\ m} = 0$$

find T_1 & T_2 ??



F.B.D (4kg)



$$T_2 = T_1 + mg$$
$$= \underbrace{20} + \underbrace{4\times10}$$
$$= 60N$$

F.B.D OF (2kg)

$$T_1 = mg = 2\times10 = 20N$$

mr*

$$mg = \boxed{6\times10\,N = T_2}$$

The value of T_3/T_1 is

(a) 1 (b) 2

(c) 3 (d) 3/2

MR*

T_3

A+B+C

$mg = 150\,N$

$\boxed{T_3 = 150\,N}$

$\frac{T_3}{T_1} = \frac{15\cancel{0}}{5\cancel{0}} = \frac{3}{1}$

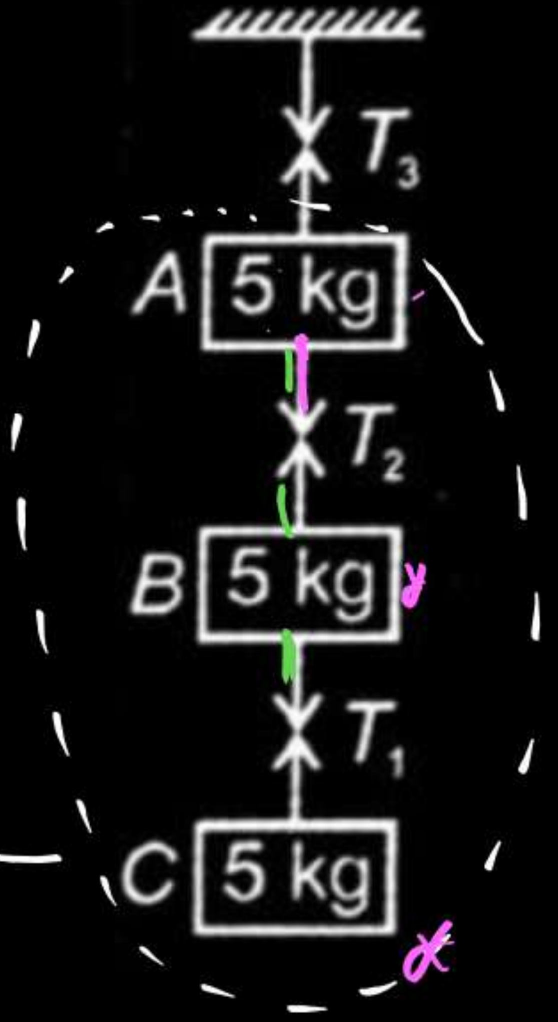
T_1

C

mg

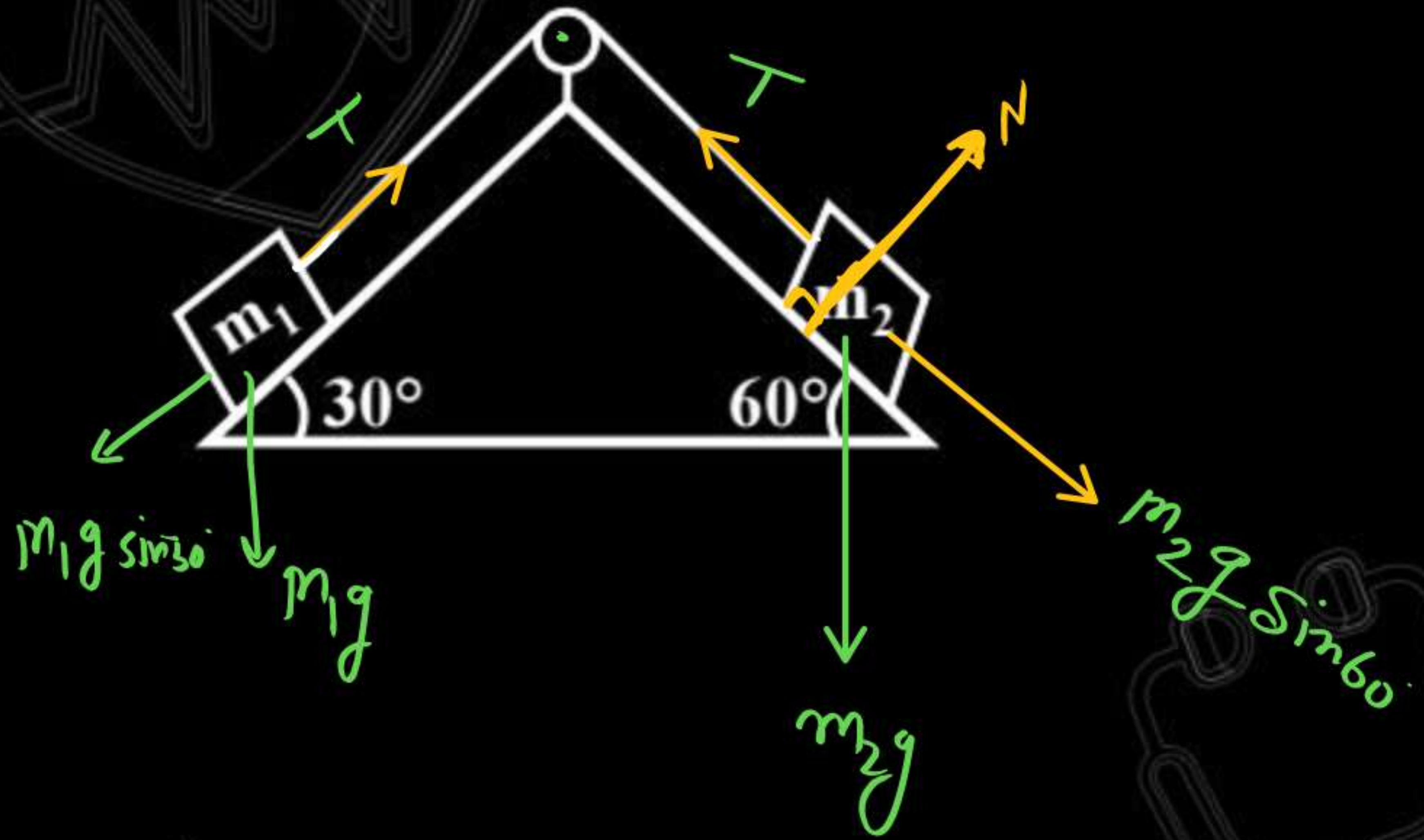
F.B.D

$T_1 = mg$
$= 50\,N$



find m_1 & m_2 is at rest then

find $\frac{m_1}{m_2} = ??$



along the Inclined plane

$$T = m_2 \cancel{g} \sin 60° = m_1 \cancel{g} \sin 30°$$

$$\frac{\sqrt{3}}{\cancel{2}} = \frac{1}{\cancel{2}} \frac{m_1}{m_2}$$

$$\boxed{\frac{m_1}{m_2} = \sqrt{3}}$$

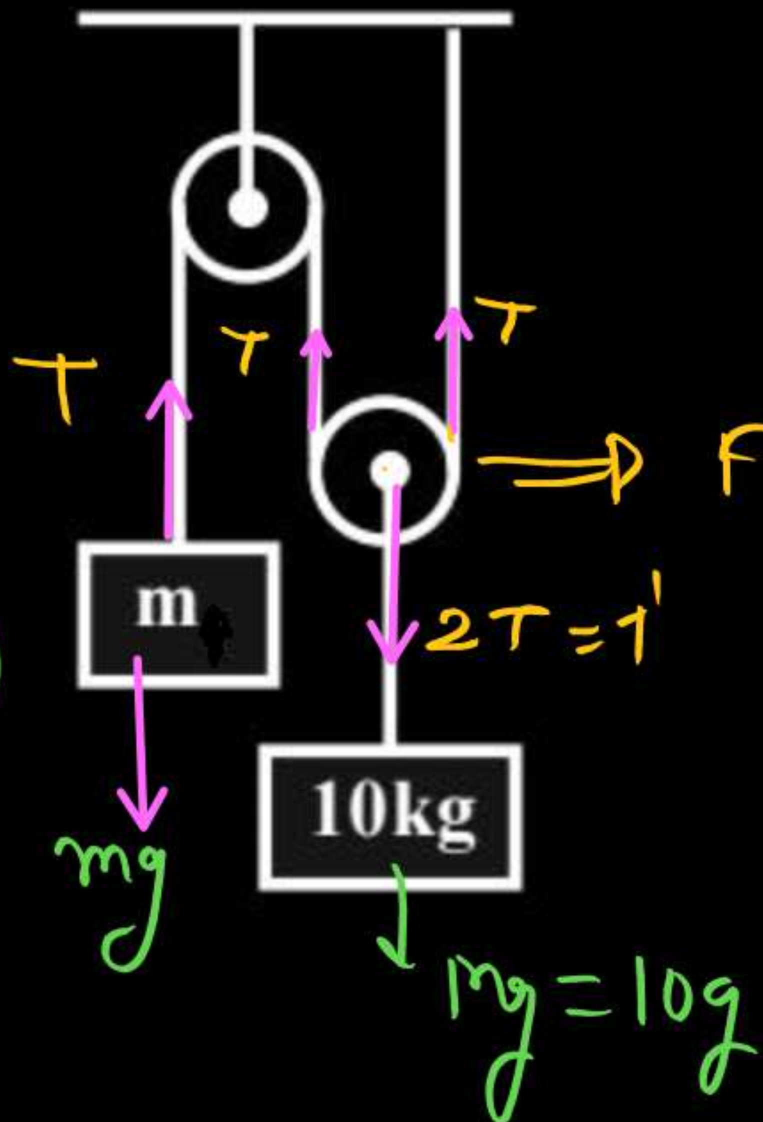
Find m so that

system is in equilibrium ??

$$\cancel{T} = mg \quad \text{— (i)}$$

$$2\cancel{T} = 10\cancel{g} \quad \text{— (ii)}$$

$$m = \frac{10}{2} = 5\,\text{Kg}$$



$\Longrightarrow$ F.B.D OF Pulley

$\uparrow 2T$

$\downarrow T'$

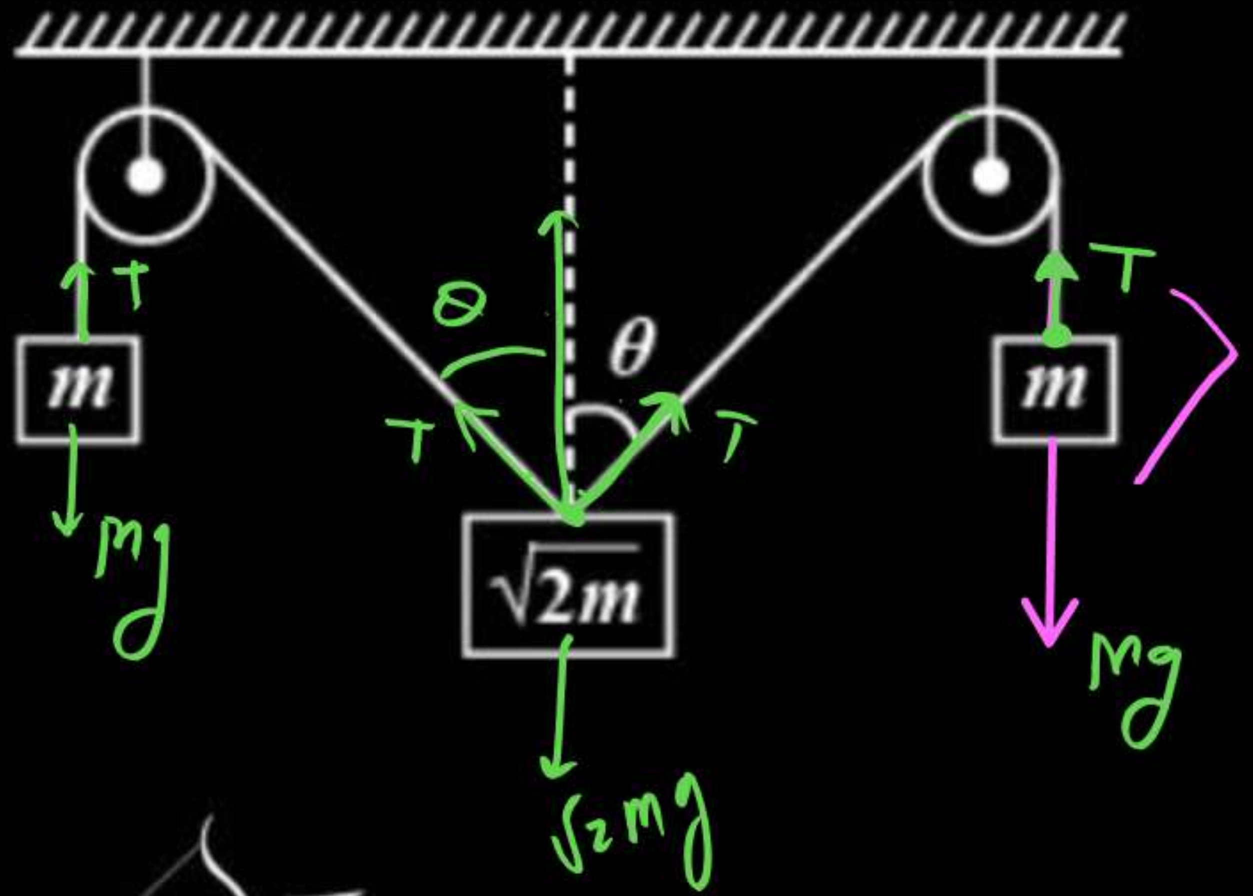
The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be

(2001, 2M)

IIT

(a) 0° (b) 30°

(c) 45° (d) 60°



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

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

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

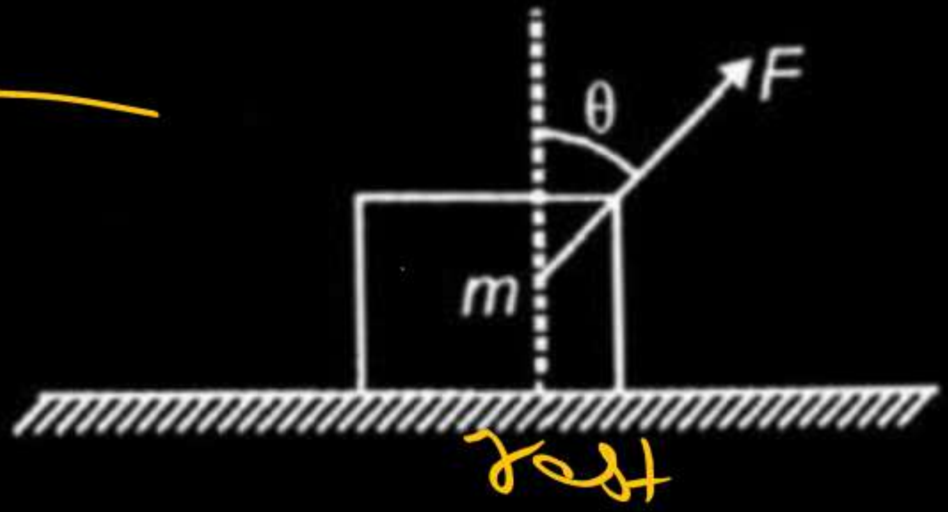
$$\cos\theta = \frac{1}{\sqrt{2}}$$

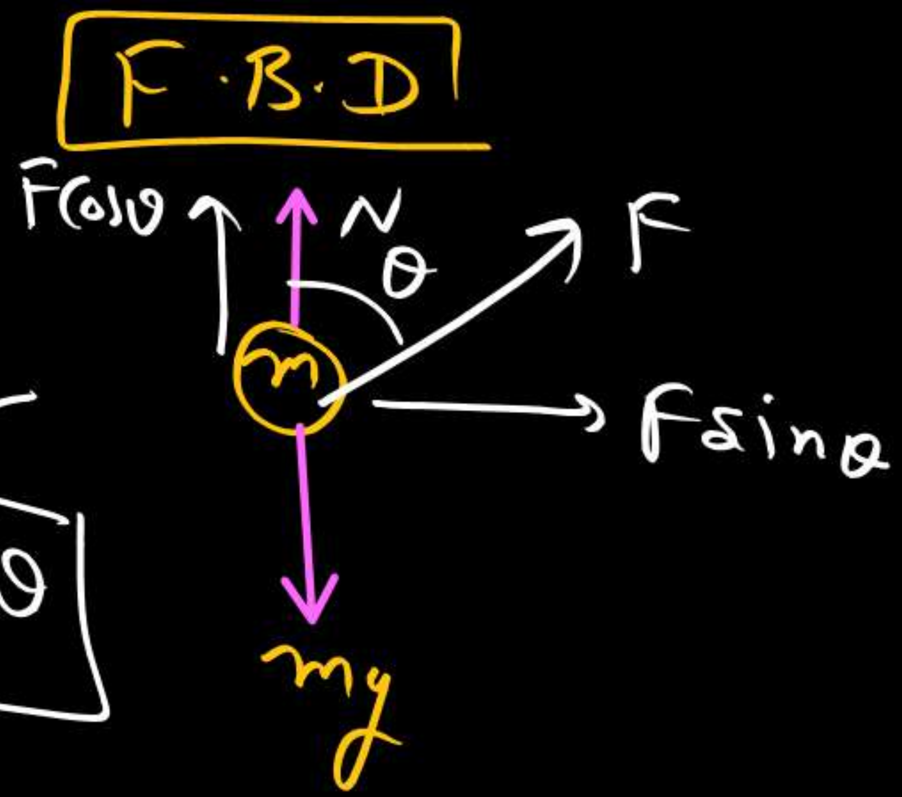
$$\theta = 45^\circ$$

In the given arrangement, the normal force applied by block on the ground is

(a) mg (b) $mg - F\cos\theta$

(c) $mg + F\cos\theta$ (d) $F\cos\theta$





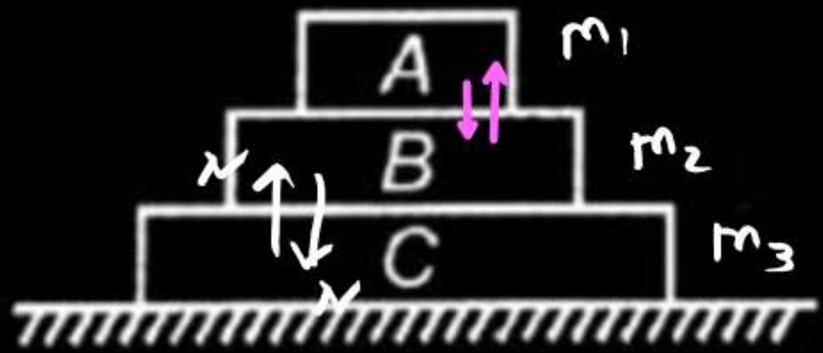
$N + F\cos\theta = mg$

$$\boxed{N = mg - F\cos\theta}$$

Three blocks are placed as shown in figure. Mass of A, B and C are m_1, m_2 and m_3 respectively. The force exerted by block 'C' on 'B' is

(a) $m_1 g$ ~~(b)~~ $(m_1 + m_2)\,g$

(c) $m_2 g$ (d) $(m_1 + m_2 + m_3)\,g$



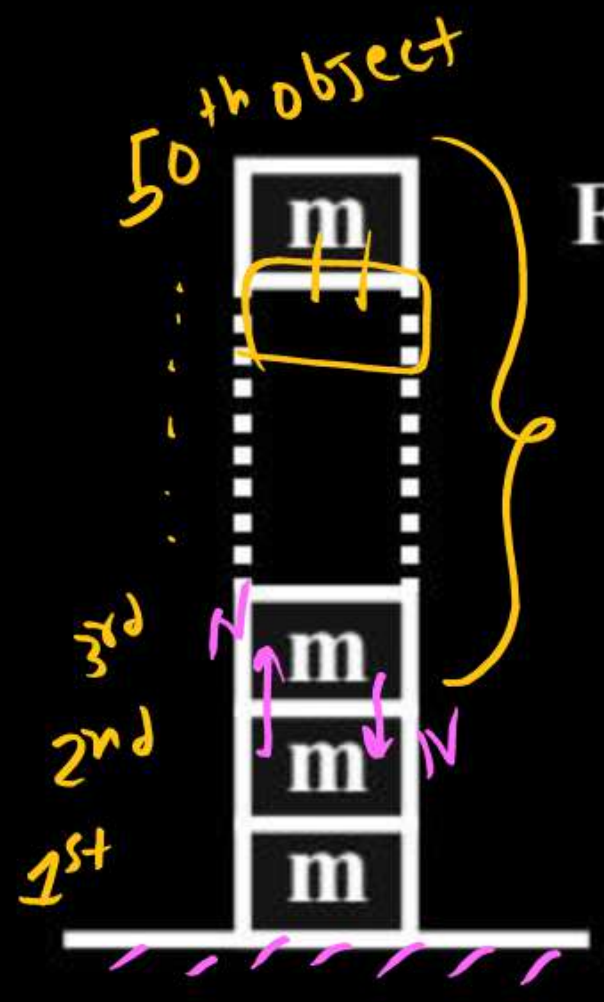
MR*

F.B.D of A+B

N

A+B

$N = (m_1+m_2)g \quad (m_1+m_2)g$



Force between 2nd and 3rd block; if all blocks is identic

F.B.D of (3rd to 50th block)

$\uparrow N$

$\boxed{48}$ $\quad F_{net} = 0$ $\quad \boxed{N = 48mg}$

$\downarrow 48mg$

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 I from the rigid support is

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

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

(c) Mg

(d) $\frac{I}{L}Mg$

H.W

THANK YOU ☺