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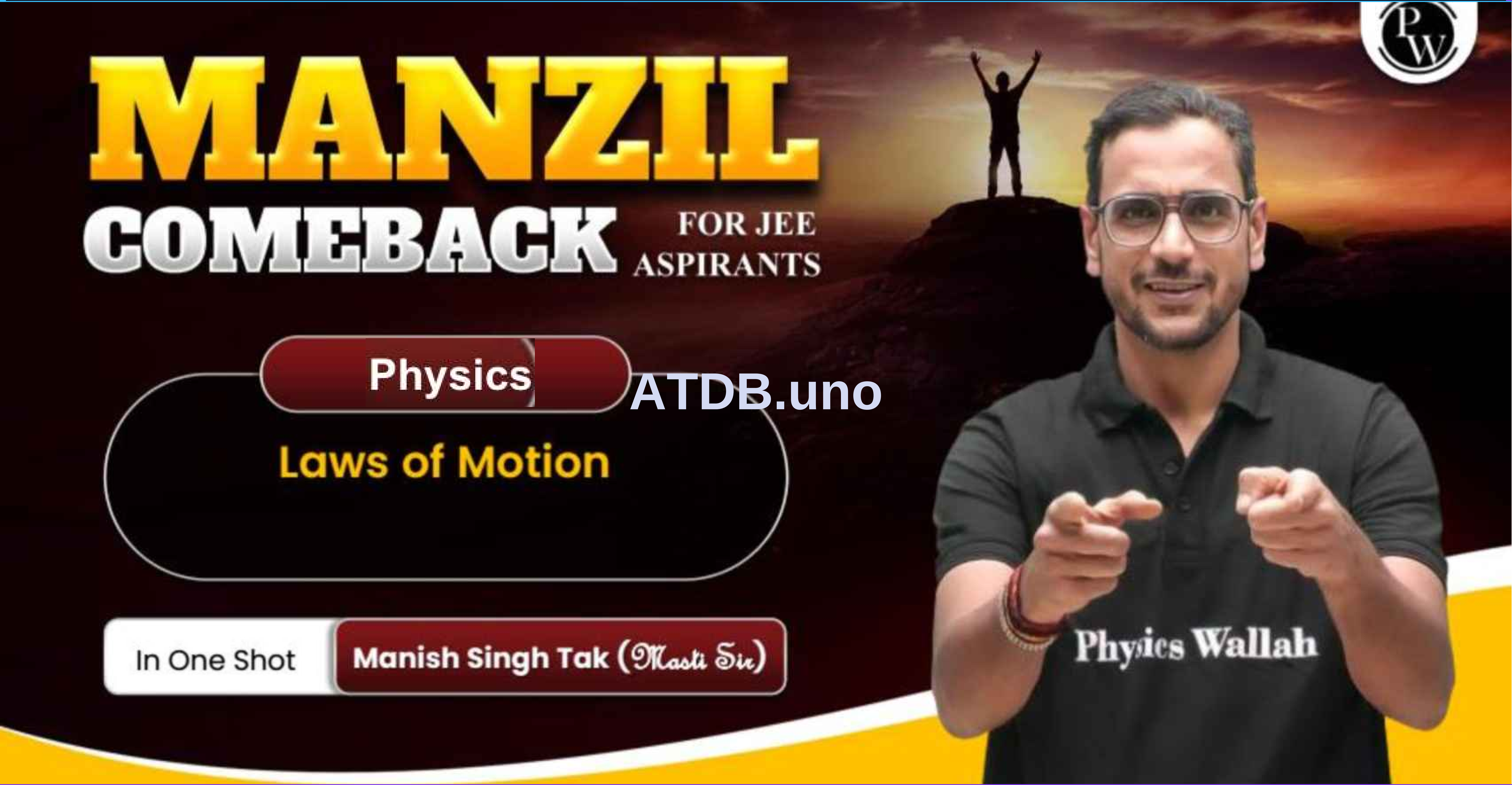

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Topics *to be covered*

1. # Newton Laws of Motion
2. # Constrain Motion
3. # Pseudo Force
4. # Friction
5. #

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Topic	22-01-2025		23-01-2025		24-01-2025		28-01-2025		29-01-2025	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Laws of Motion	0	0	0	1	0	0	0	1	0	0

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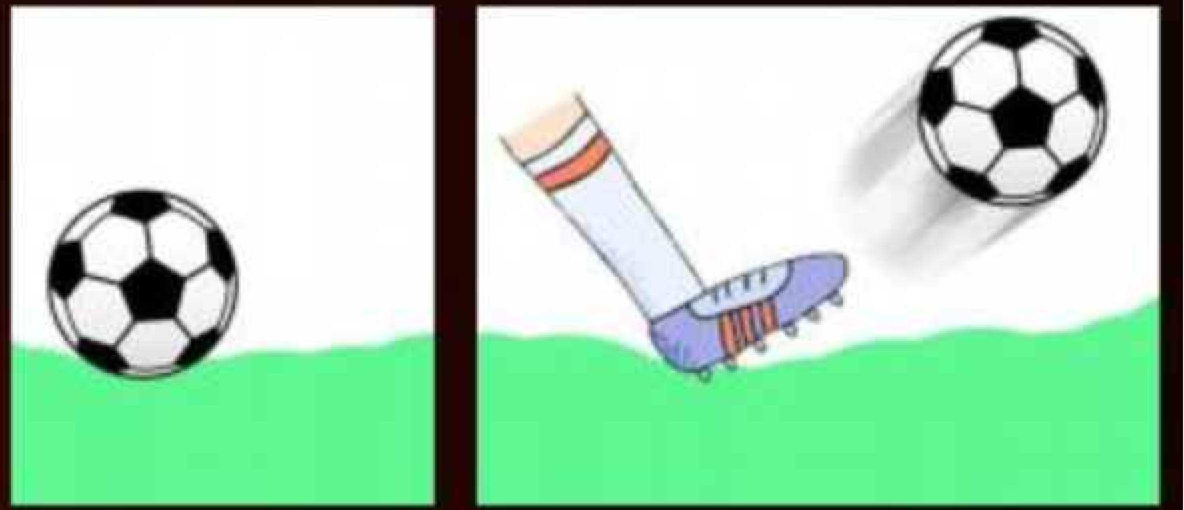
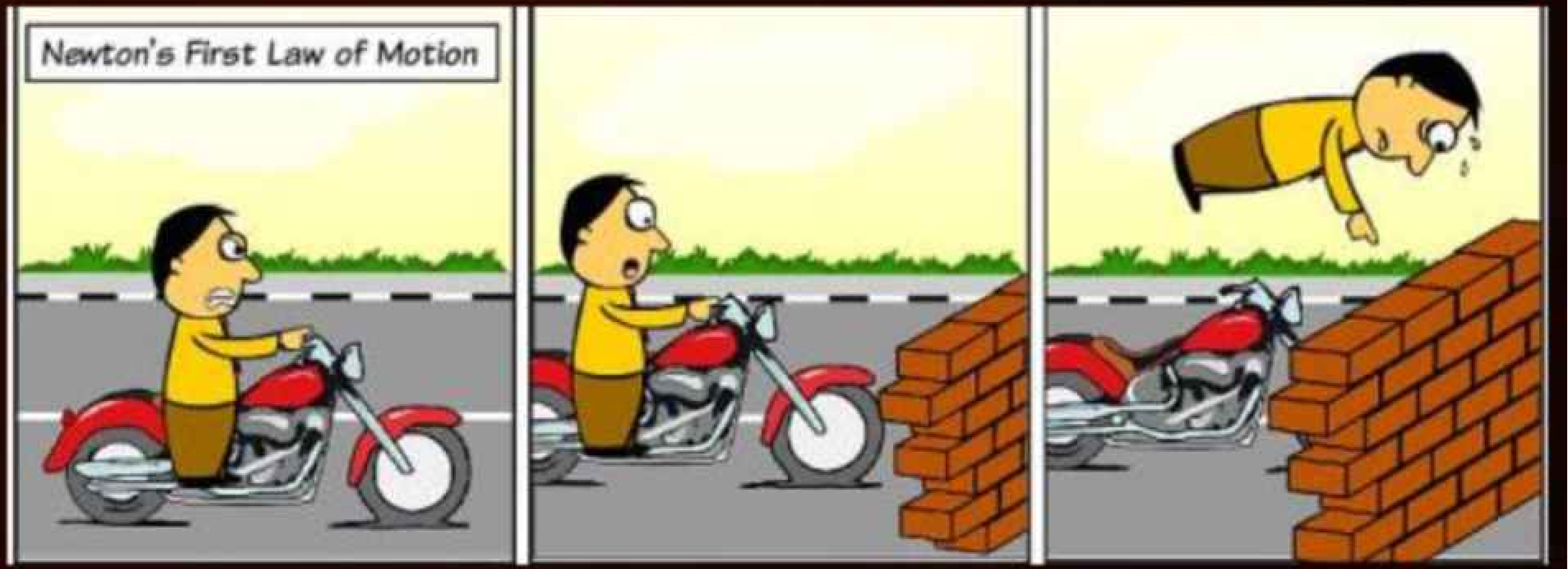
Newton's Laws of Motion

Newton's First Law (law of inertia)





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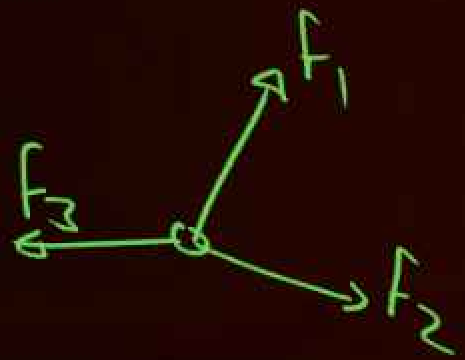
Newton's Second Law

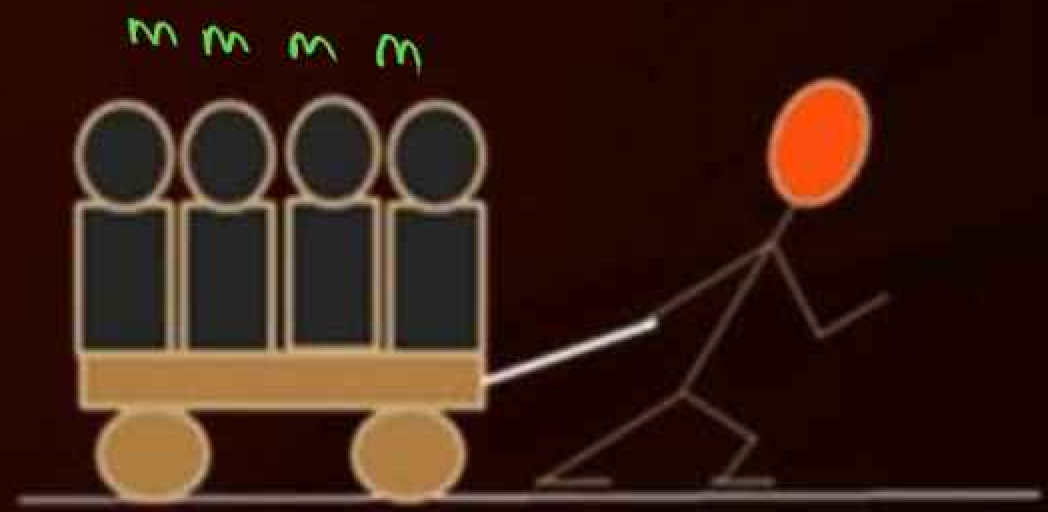
Rate of change of momentum of particle is directly proportional to net force acting on the particle

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

** $\boxed{\vec{F} = \frac{d\vec{P}}{dt}}$

$\vec{F}$, $\vec{P}$ → vector





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→ net Force $\vec{F} = \frac{d\vec{P}}{dt} = \frac{d}{dt}(m\vec{v})$

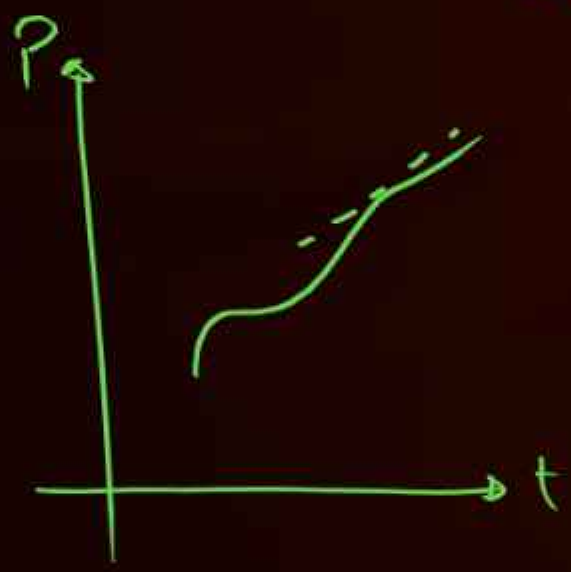
if mass = Constant

** $\vec{F} = m\frac{d\vec{v}}{dt} \Rightarrow \boxed{\vec{F} = m\vec{a}}$

$\downarrow$ net

→ $F = \frac{dP}{dt}$ in 1-D

→ Slope in P-t Graph



$\int d\vec{P} = \int \vec{F}\,dt$

$\vec{P}_2 - \vec{P}_1 = \int \vec{F}\,dt$

Impulse $\vec{J}$

** $\boxed{\vec{J} = \vec{P}_2 - \vec{P}_1 = \int \vec{F}\,dt}$

↑ Area under Curve $\vec{F}$-t Graph

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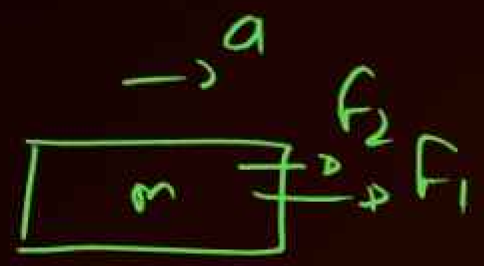
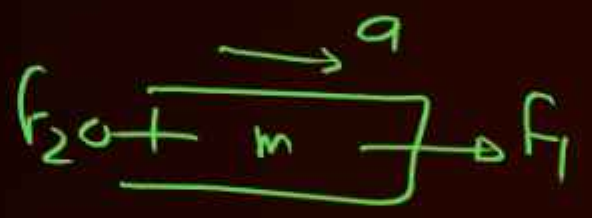


$$f_1 + f_2 = ma$$



$$f_1 - f_2 = ma$$

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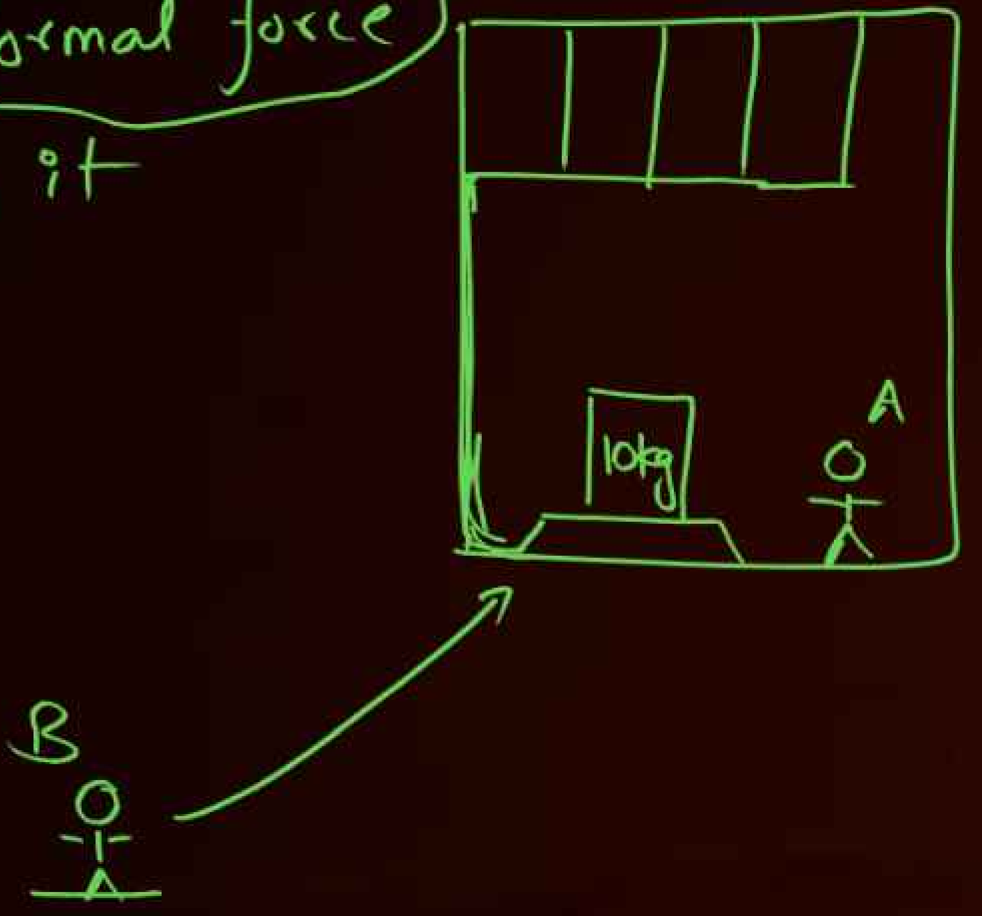
Weight machine always read Normal force on it



→ lift at rest → acc. = 0

10kg

10g

$N = 10g$

$N = 100N$

| 1 | 0 | 0 | N

→ if lift is moving up with acc. = $2m/s^2$

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w.r.t B

N

$a = 2$

10kg

100

$N - 100 = 10 \times 2$

$N = 120$

| 1 | 2 | 0 |

w.r.t A

N

10g

rest (acc. = 0)

$N = 10g = 100N$

| 1 | 0 | 0 |

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inertial frame $\rightarrow$ $\vec{F} = \dfrac{d\vec{P}}{dt}$ valid ($\vec{F} = m\vec{a}$)

assumption $\rightarrow$ Let Ground frame is inertial

then any frame having zero acc. w.r.t Ground is inertial

non-inertial $\rightarrow$ any frame having acc. w.r.t inertial frame (Ground)

$\vec{F} = \dfrac{d\vec{P}}{dt}$ is not valid without Correction term

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if observer have acc. $\vec{a}$

then use a Correction term pseudo force $(\vec{f}_{ps})$

Given as ** $\boxed{\vec{f}_{ps} = -m\vec{a}}$ m → mass of object

object

→ observer → dir^n is opposite to acc. of observer

** $\boxed{\vec{F}_{Real} + \underline{\underline{\vec{f}_{ps}}} = m\vec{a}_{object/observer}}$

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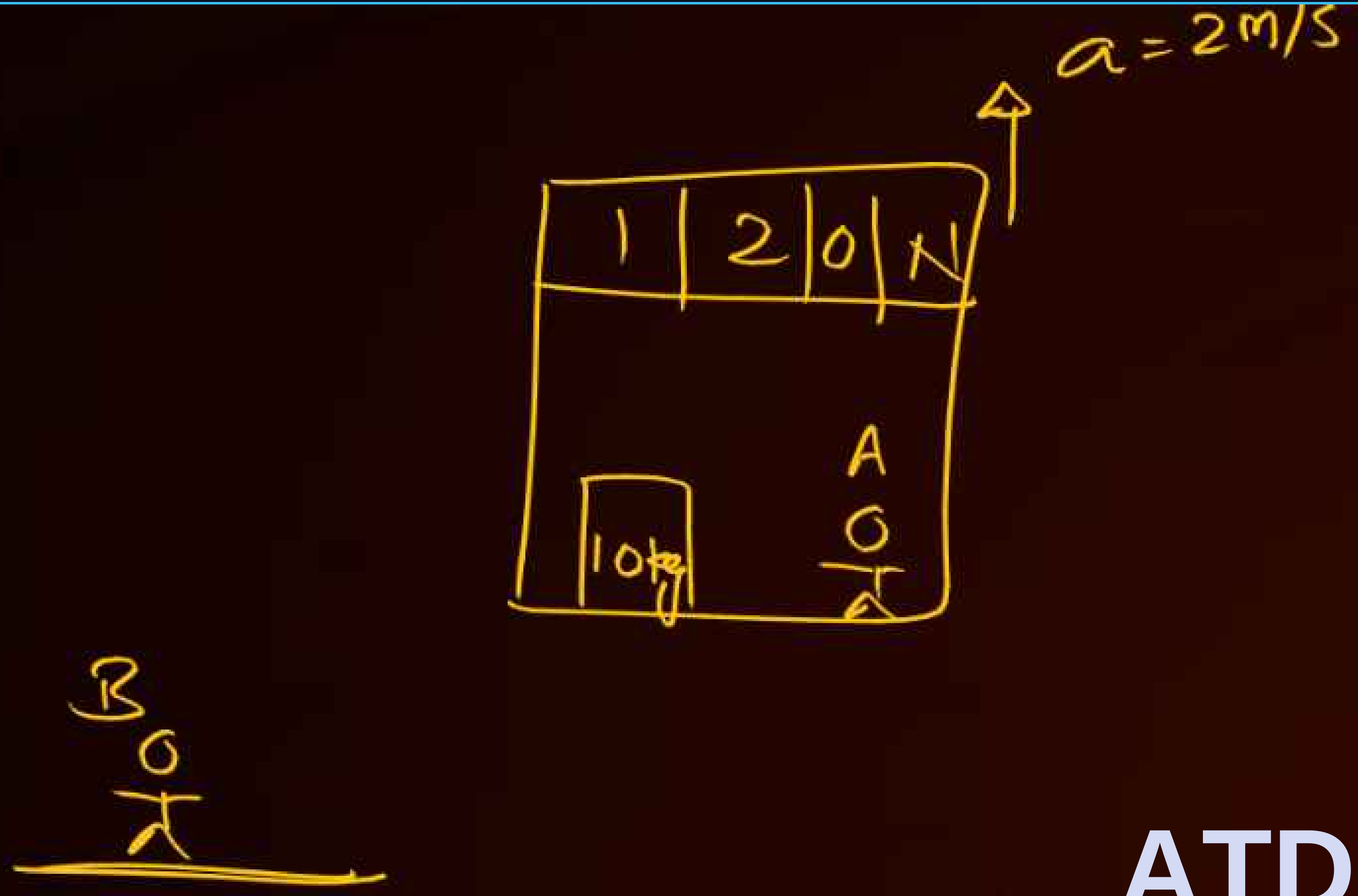
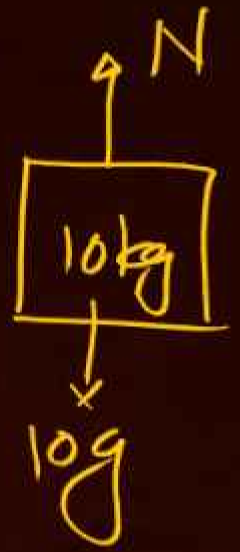


B —>

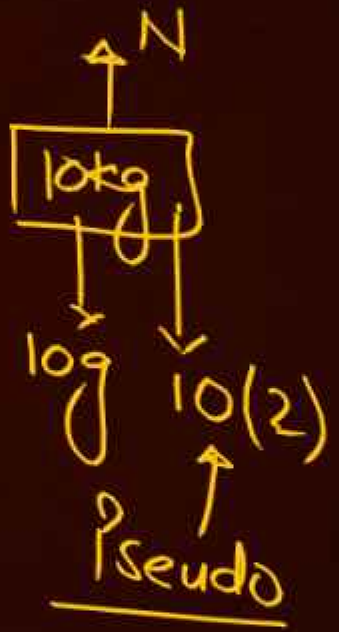


$a = 2\,m/s^2$

$N - 100 = 10 \times 2$

$N = 120N$

A —>



acc. = 0

$N = 10g + 10 \times 2 = \underline{120N}$

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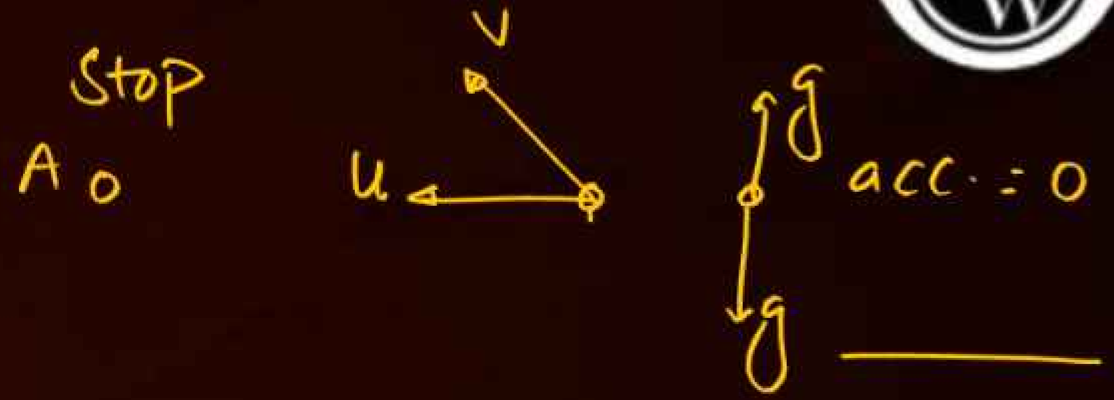
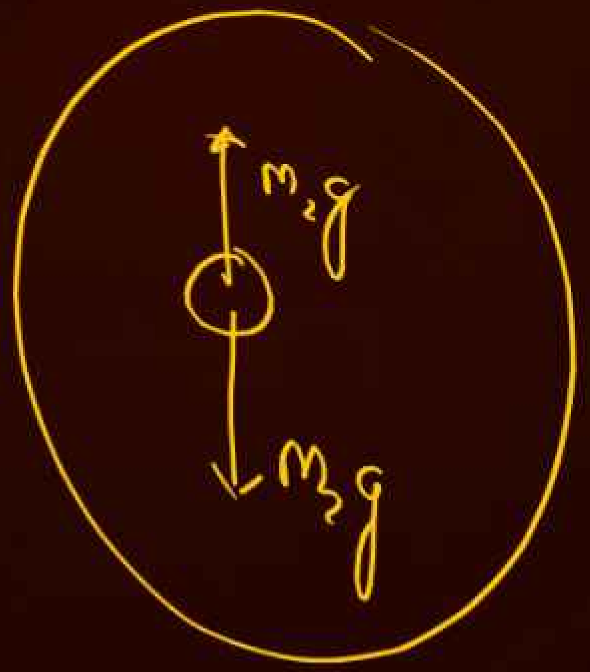
$\Rightarrow$ w.r.t A



Pseudo क्यों नहीं लगाया

क्या मैंने F = ma use किया??

FBD बनाया



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Newton's Third Law

→ $a_1 = \frac{F}{m_1}$ ←

m_1 $\quad$ m_2

$A \xrightarrow{F}$ $\quad$ $\xleftarrow{F} B$

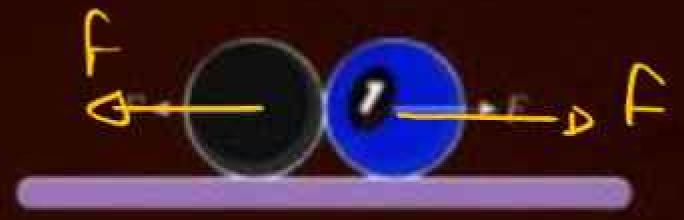
$\vec{F}_{1/2}$ $\quad$ $\vec{F}_{2/1}$

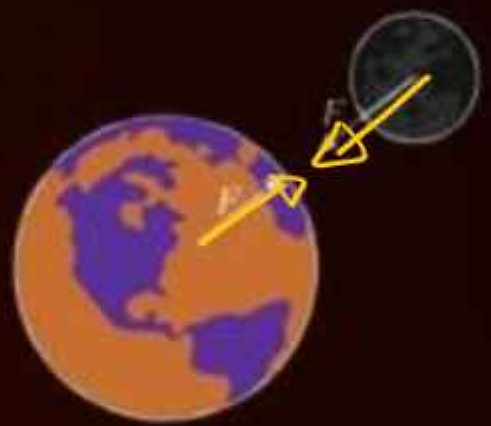
q_1 $\quad$ q_2

→ $\vec{F}_{1/2} = -\vec{F}_{2/1}$

→ nature Same

→ Impact may diff.





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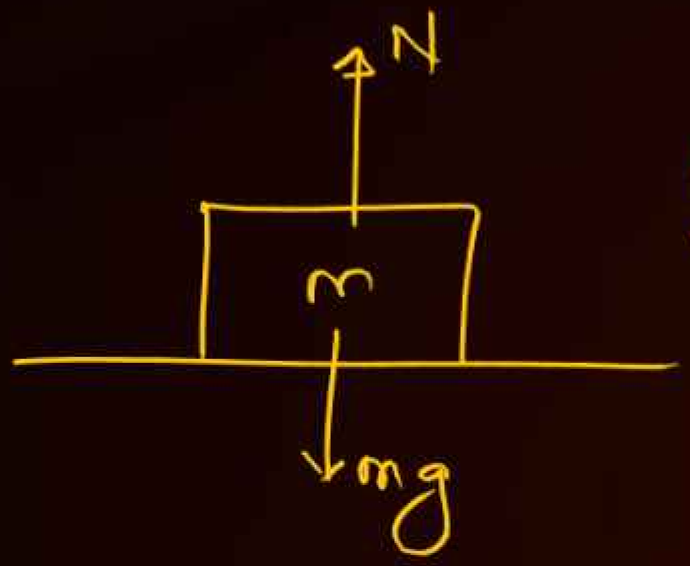
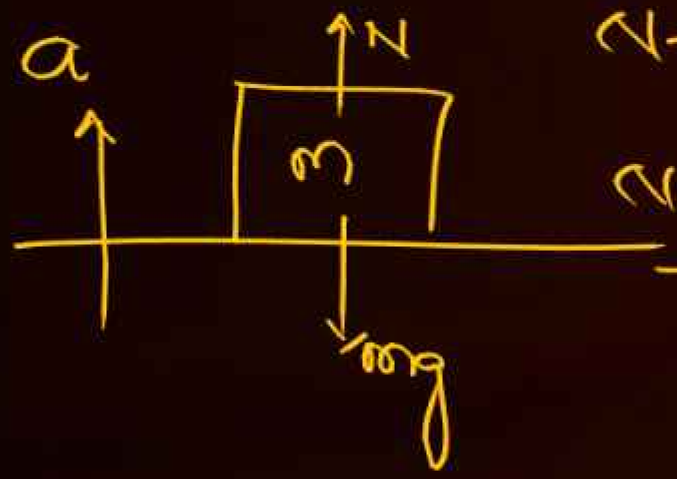
Newton's Third Law



$N = mg$

action Reaction



$N - mg = ma$

$N = mg + ma$

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Newton's Third Law

1. Force always exist in pair

2. If particle A exert force $\vec{F}$ on particle B then particle B exert force $-\vec{F}$ on particle A

$$\vec{F}_{B/A} = -\vec{F}_{A/B}$$

3. Force $\vec{F}_{B/A}$ and $\vec{F}_{A/B}$ are should be of same nature like both are electric or gravitation etc.

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4. Force $\vec{F}_{B/A}$ and $-\vec{F}_{A/B}$ are also known as action and reaction and acted simultaneously

5. Action and reaction are always acting on different particles

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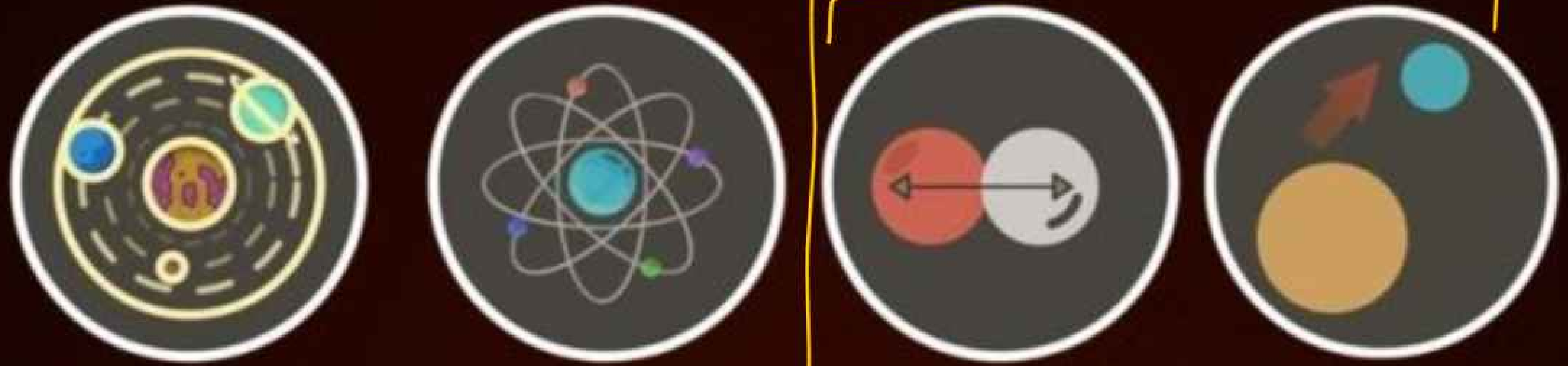
Four Fundamental forces



Gravitation

Elecctro-magnetism

Friction

Normal

Tension

Spring

Strong Force

nuclear

Weak Force

Nuclear

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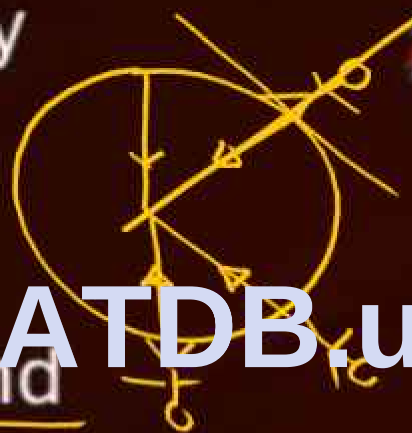
Gravitational force

- Gravitational force on object is acting directly towards center of earth

- Gravitational force per unit mass is known as acceleration due to gravity $\left(g = \frac{F}{m} = \frac{mg}{m}\right)$

- Value of force change with height and depth

Gravition Chapter



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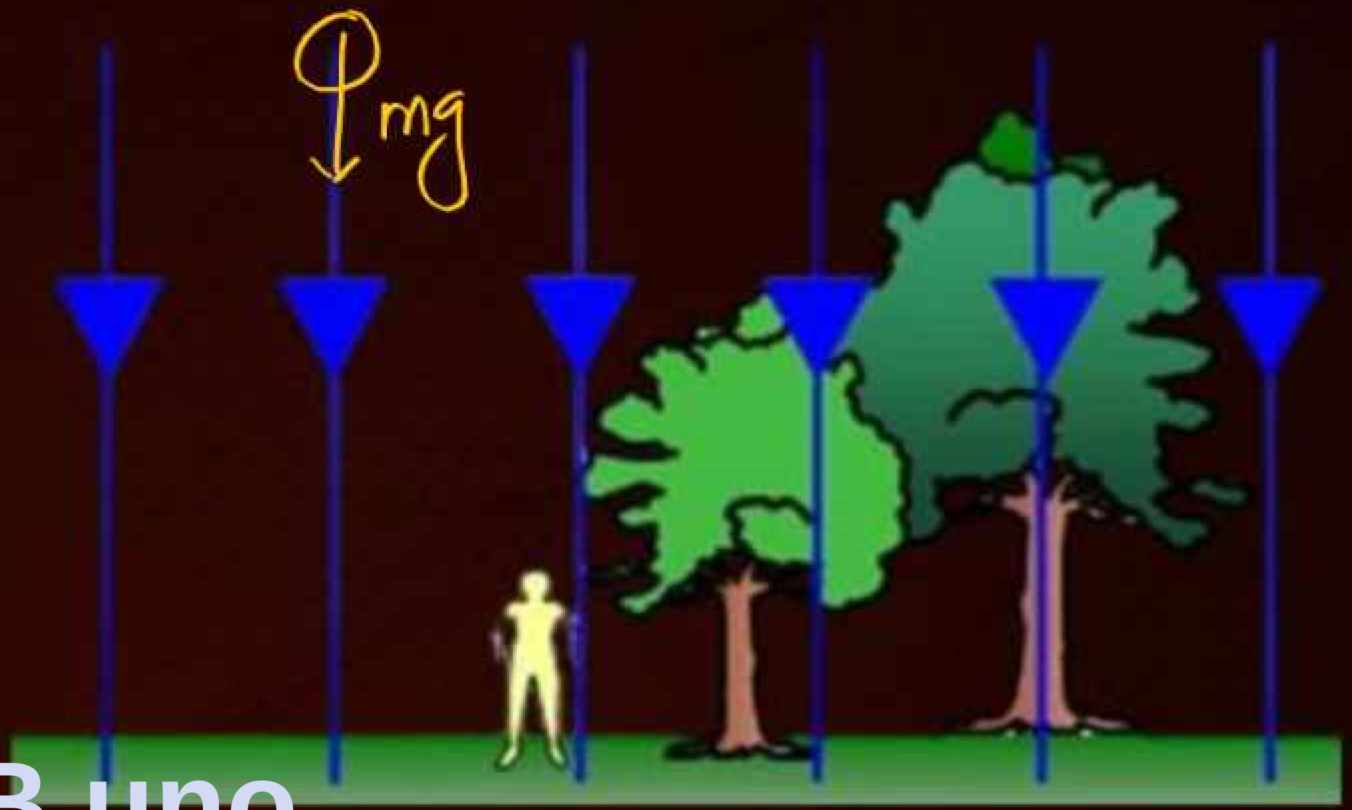

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mg downward

uniform

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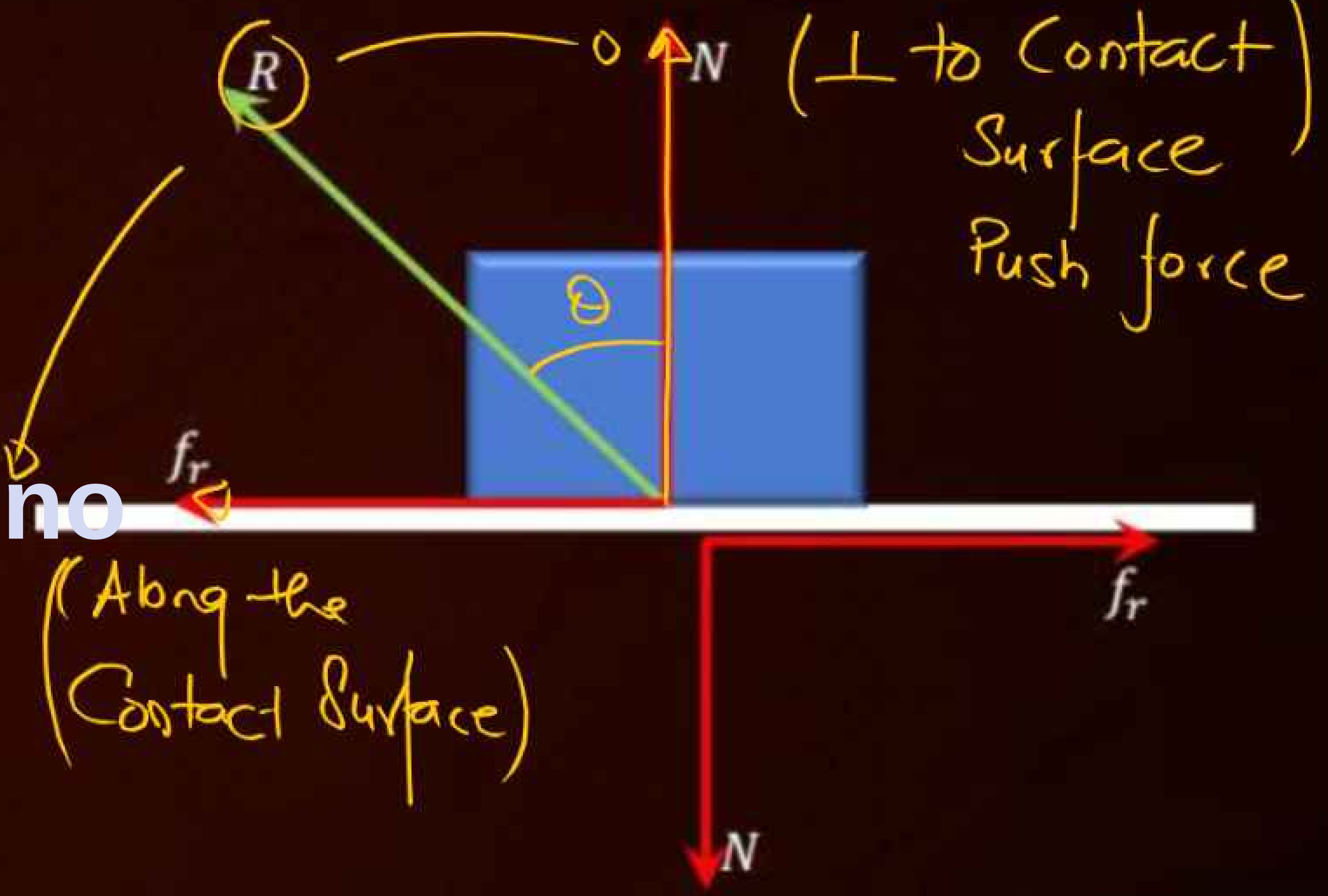
Contact Force (R) solid-solid

$$R = \sqrt{N^2 + f_r^2}$$

$$\tan\theta = \frac{f_r}{N}$$



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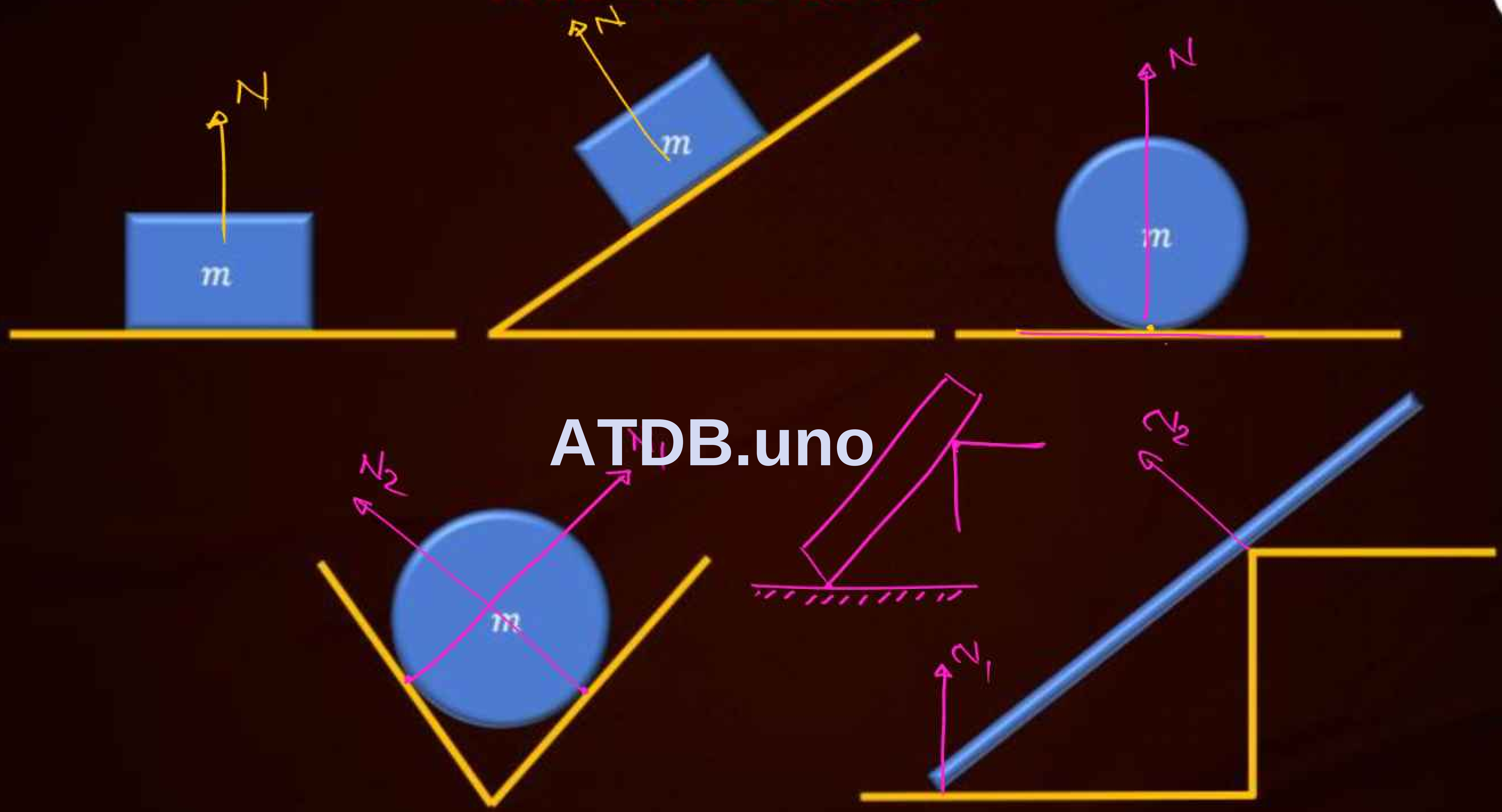
Normal Force



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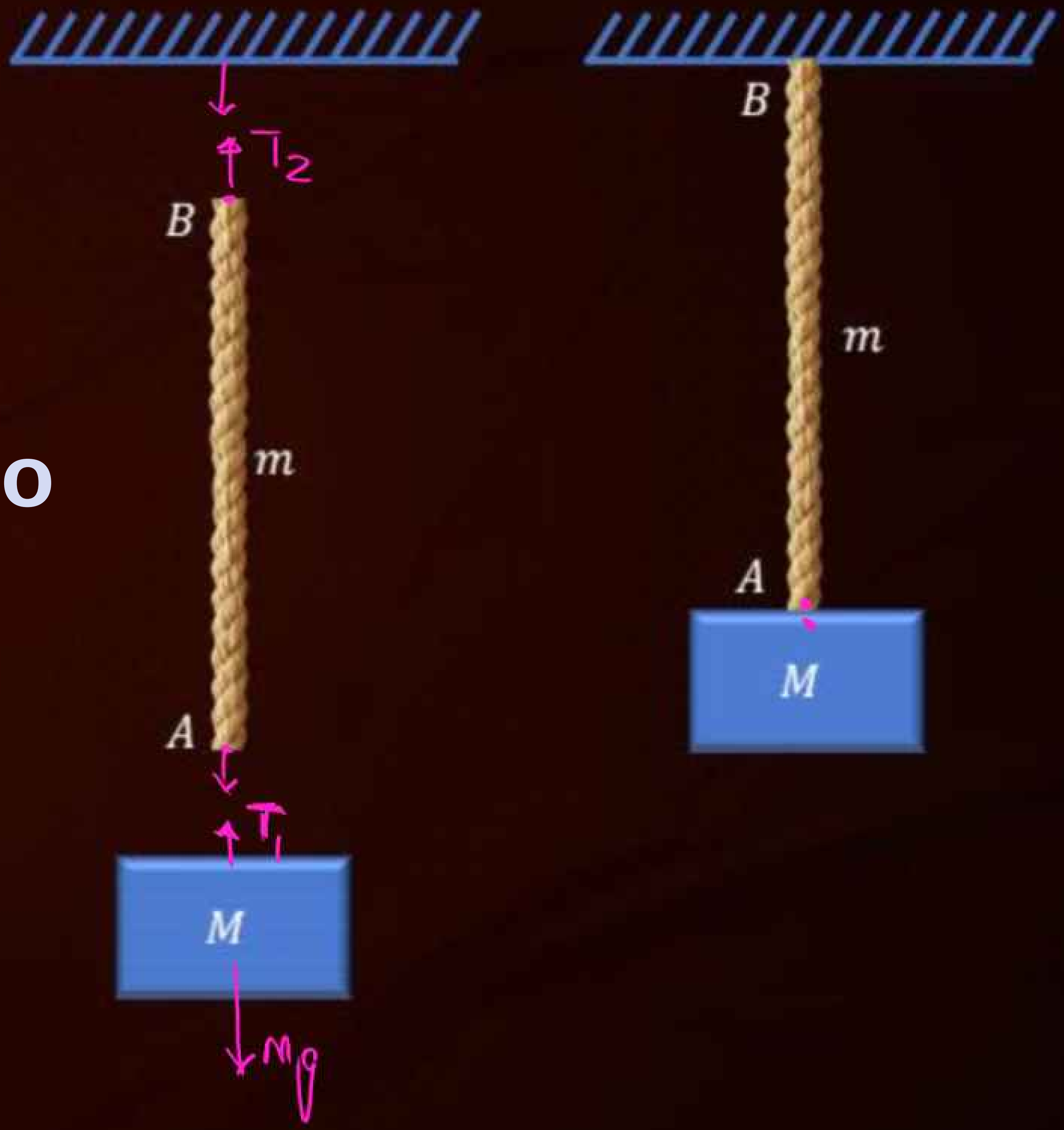
Tension Force

force in String

T → pull force

→ away from object of FBD

→ Along the String



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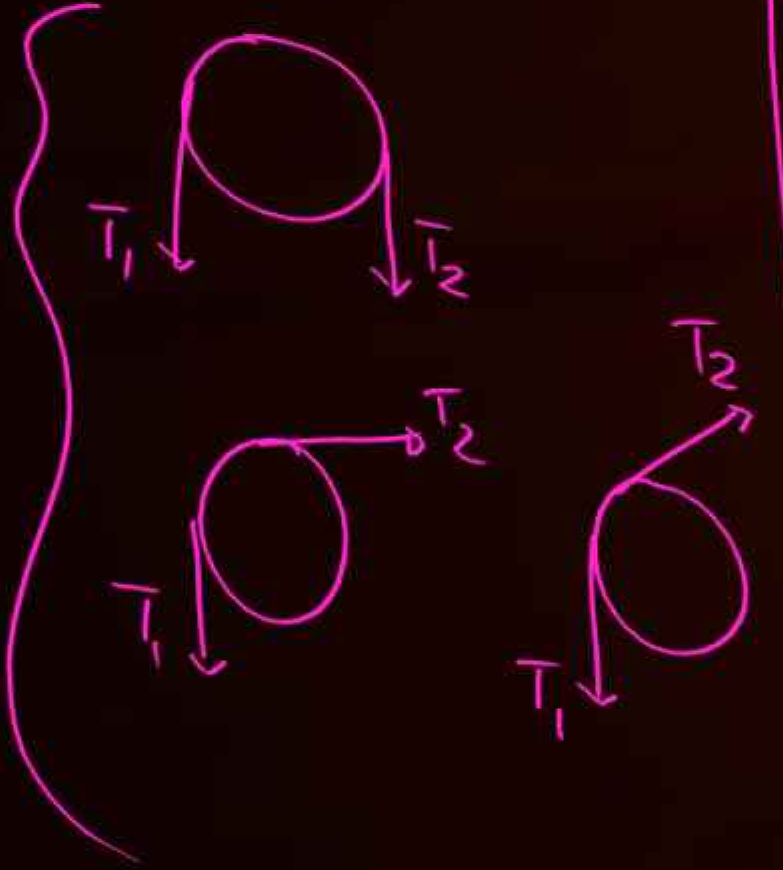
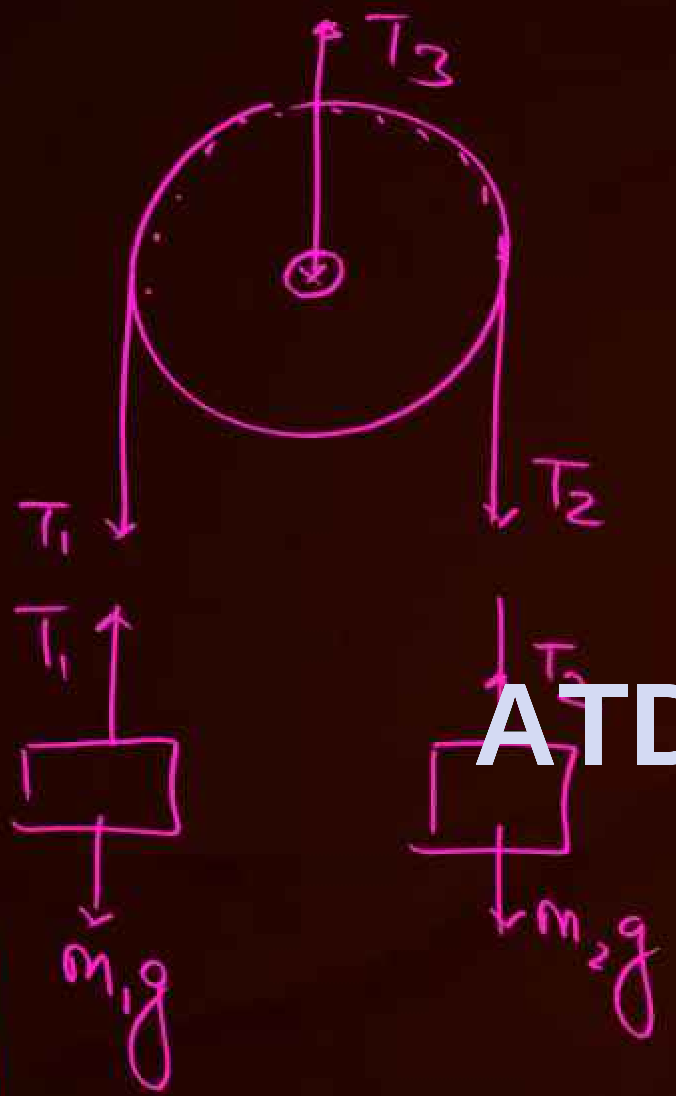
string → massless

Tension Force

if pulley is frictionless then

$T_1 = T_2$





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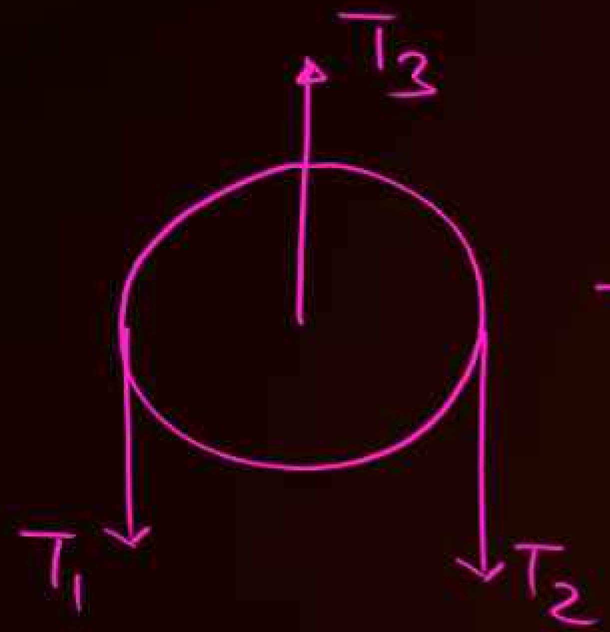
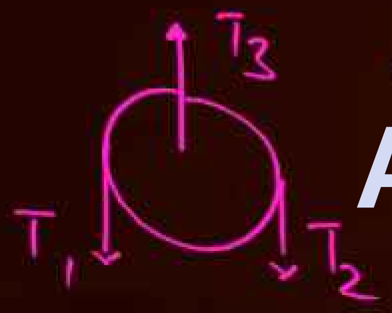
String → massless



frictionless $T_1 = T_2 = T$

massless $\vec{F}_{net} = m\vec{a} = 0(\vec{a}) = 0$

(massless spring $m = 0 \Rightarrow F_{net} = 0$ for any acc.)



$T_3 = T_1 + T_2 = 2T$

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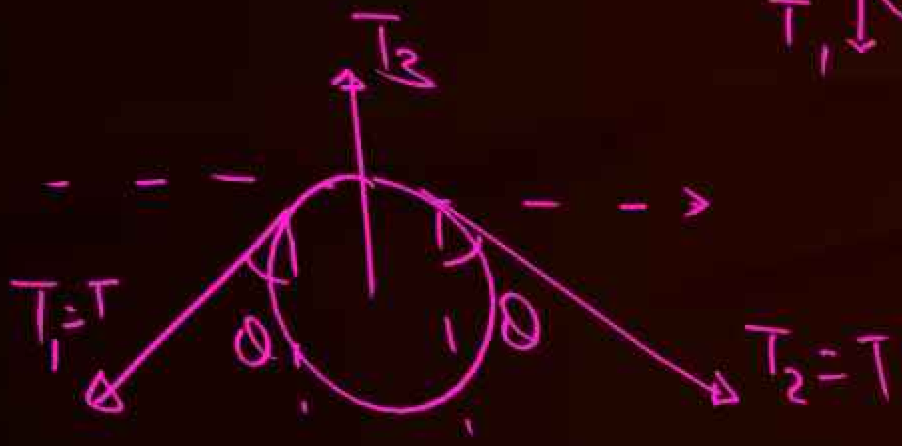

$T_3 = 2T\cos\theta$

{ ideal pulley → massless
frictionless }

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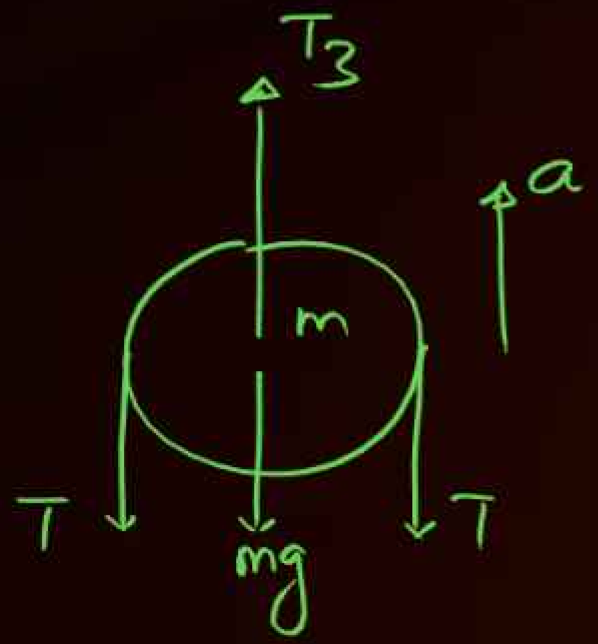

frictionless, have mass

$$T_3 - 2T - mg = ma$$

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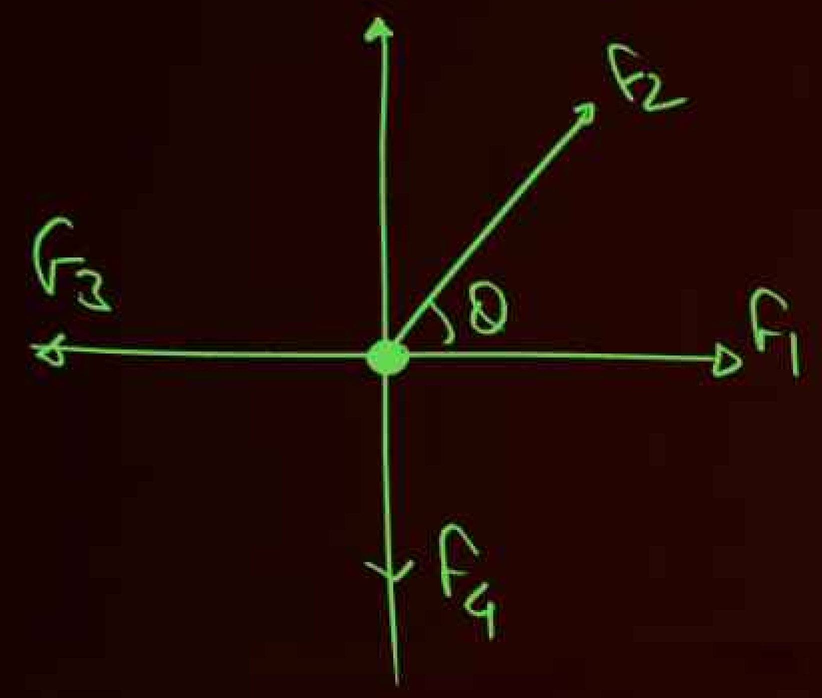
Equilibrium (संतुलन दशा)

if net force on object is Zero

$$F_x)_{net} = 0 = F_y)_{net} = F_z)_{net}$$



$$F_1 + F_2\cos\theta = F_3$$

$$F_2\sin\theta = F_4$$

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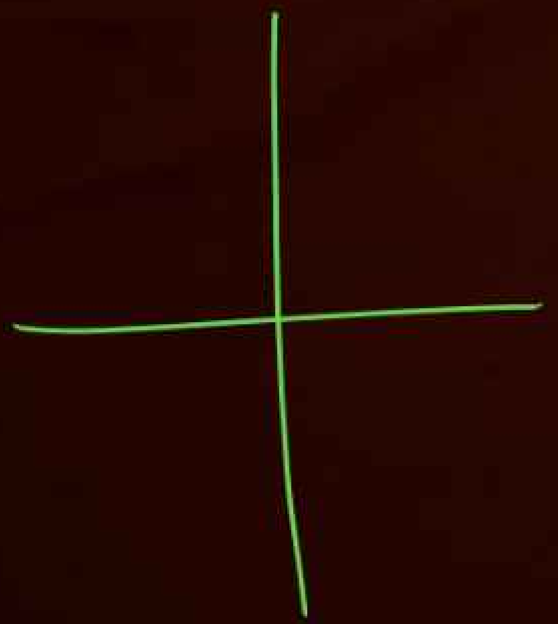

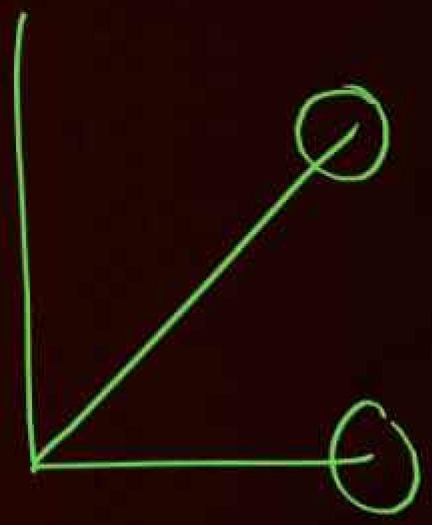

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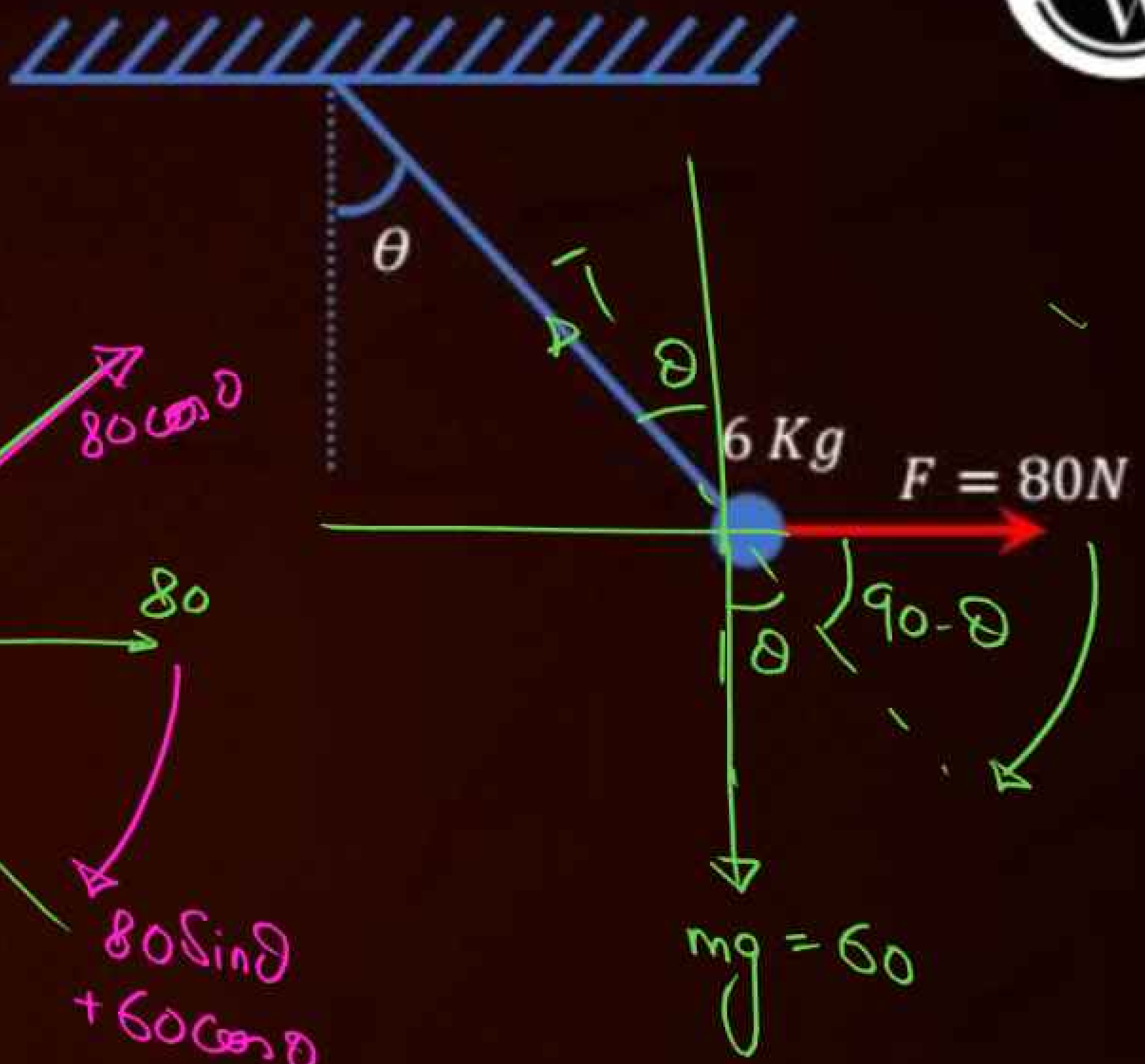
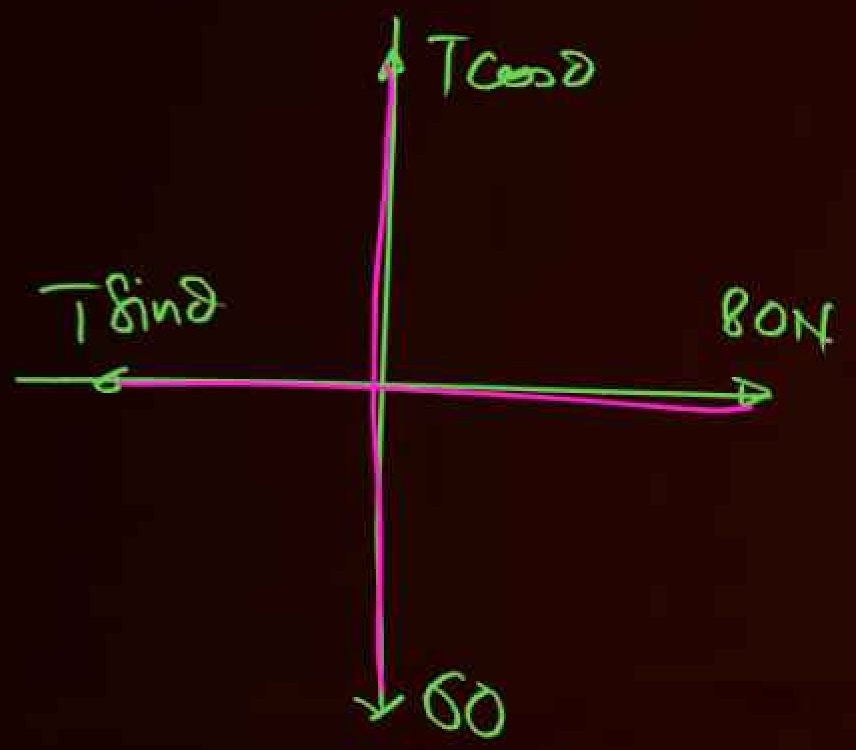
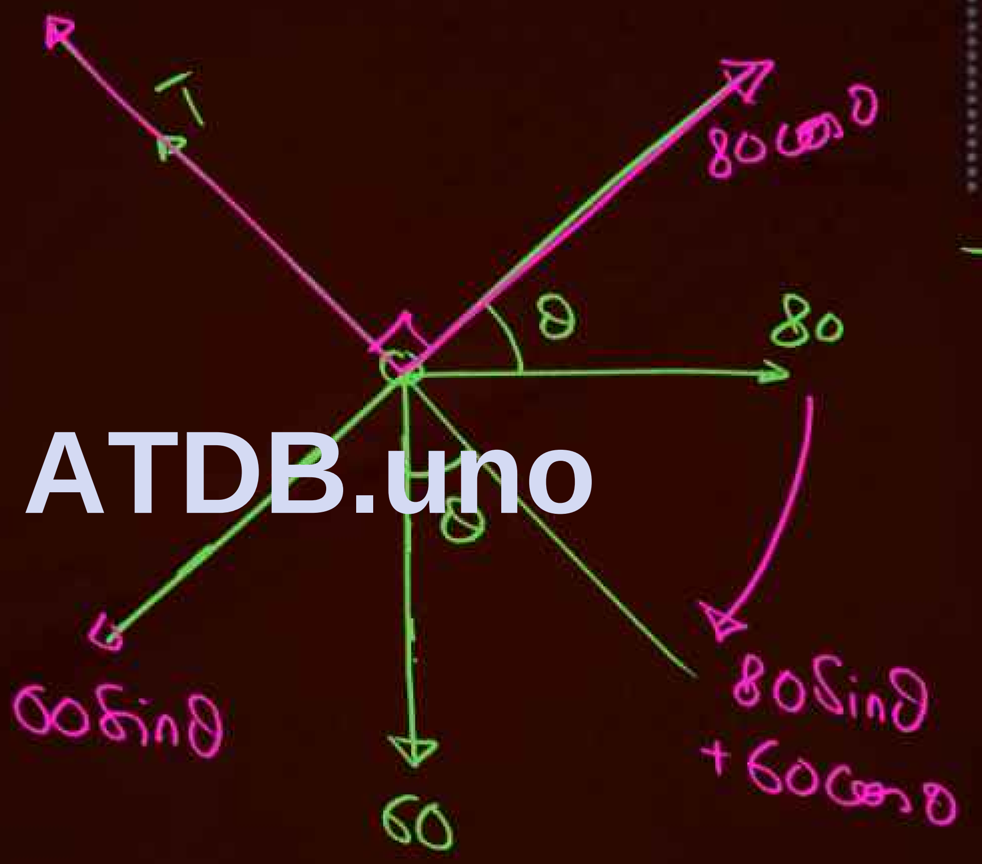
Q: find Tension and θ

6 kg is in Equilibrium







$$T\cos\theta = 60$$
$$T\sin\theta = 80$$
$$\Rightarrow \tan\theta = \frac{4}{3} \Rightarrow \theta = 53^\circ$$

$$T = 100\text{N}$$

$$60\sin\theta = 80\cos\theta \Rightarrow \tan\theta = 4/3$$

$$T = 80\sin\theta + 60\cos\theta$$
$$= 100\text{N}$$

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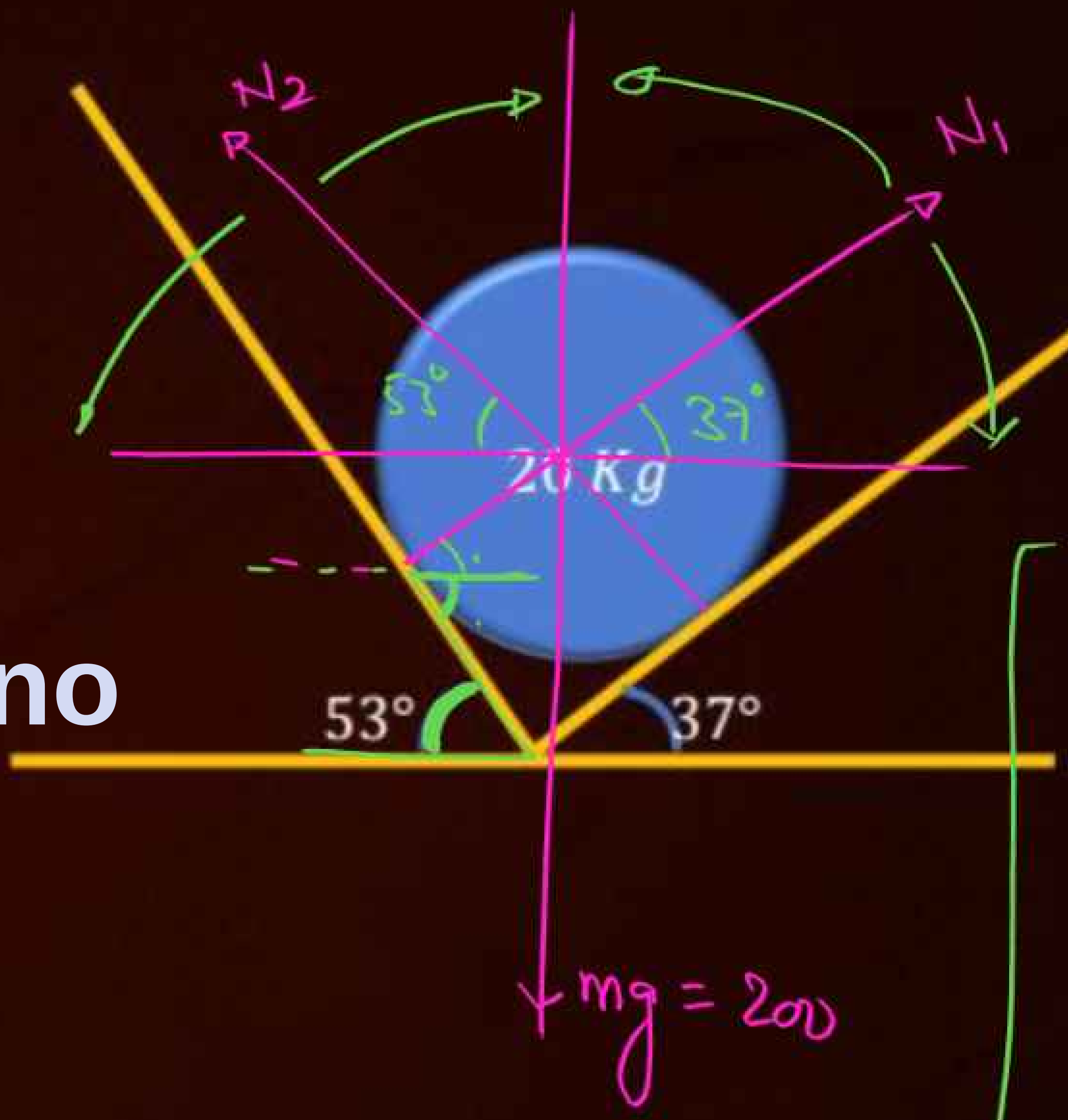
find Normal forces (Smooth surfaces)

$N_1 \cos 37° = N_2 \cos 53°$

$N_1 \sin 37° + N_2 \sin 53° = mg$



Normal
friction
Tension
Spring
mg

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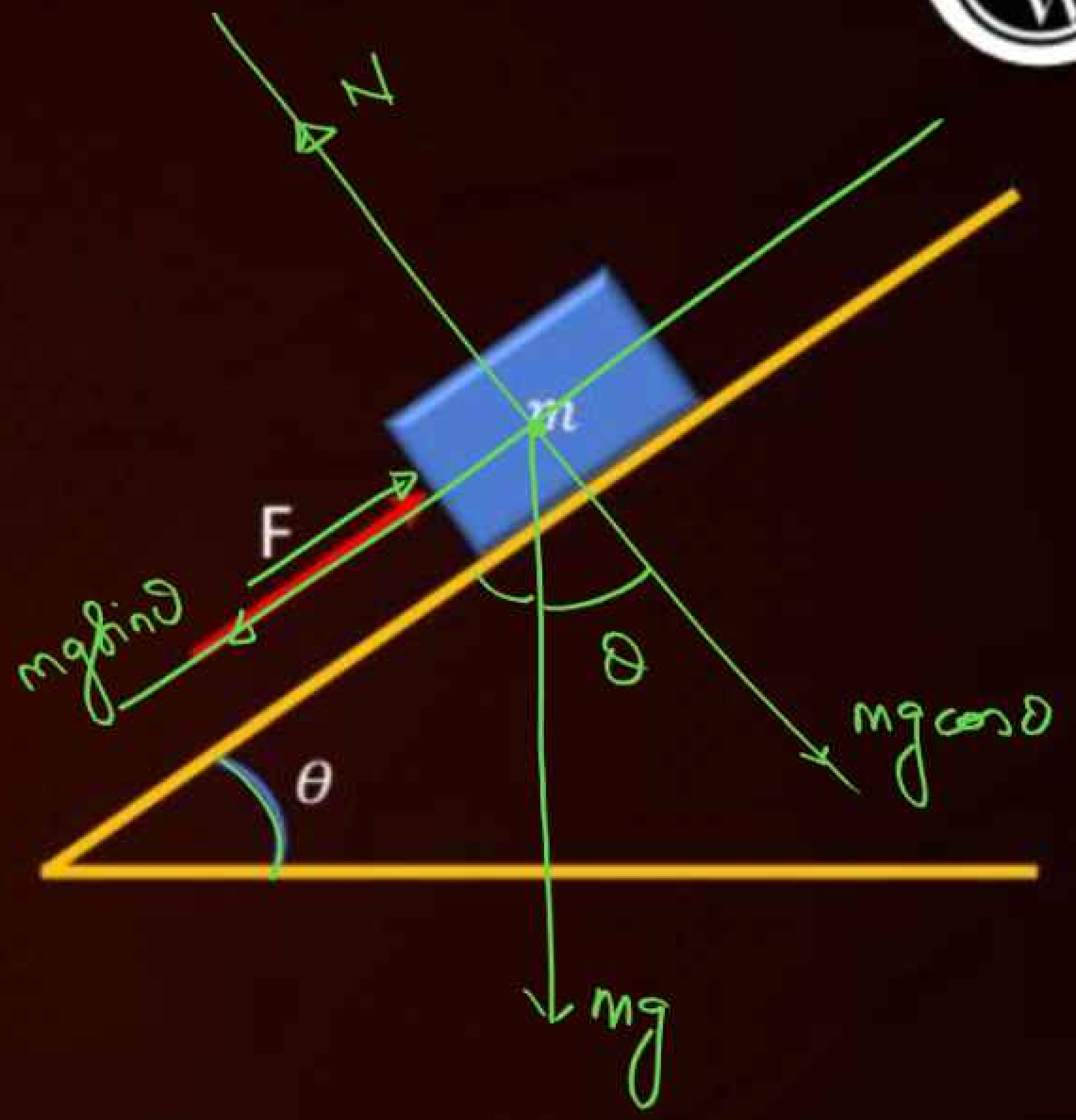
find F for which block remain
in Equilibrium
(Smooth Surface)

$$N = mg\cos\theta \quad , \quad F = mg\sin\theta$$



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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 T in the string is: (Given $g = 10\ ms^{-2}$) **[30 Jan, 2023 (Shift-II)]**

(1) 20 N

(2) 25 N

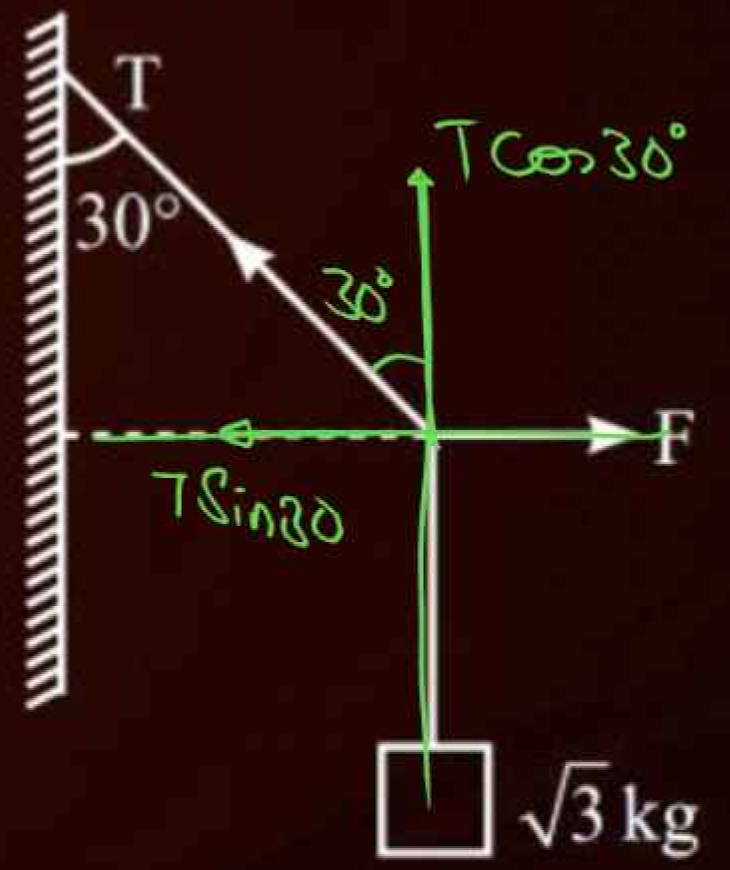
(3) 10 N

(4) 15 N

$\frac{T}{2} = F$

$F = 10N$

$T = 20$



Ans : (1)

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Question

A mass of 10 kg is suspended by a rope of length 4 m, from the ceiling. A force F is applied horizontally at the mid-point of the rope such that the top half of the rope makes an angle of 45° with the vertical. Then F equals
(Take $g = 10\ ms^{-2}$ and the rope to be massless). [7 Jan, 2020 (Shift-II)]

1. 75 N
2. 90 N
3. 100 N
4. 70 N

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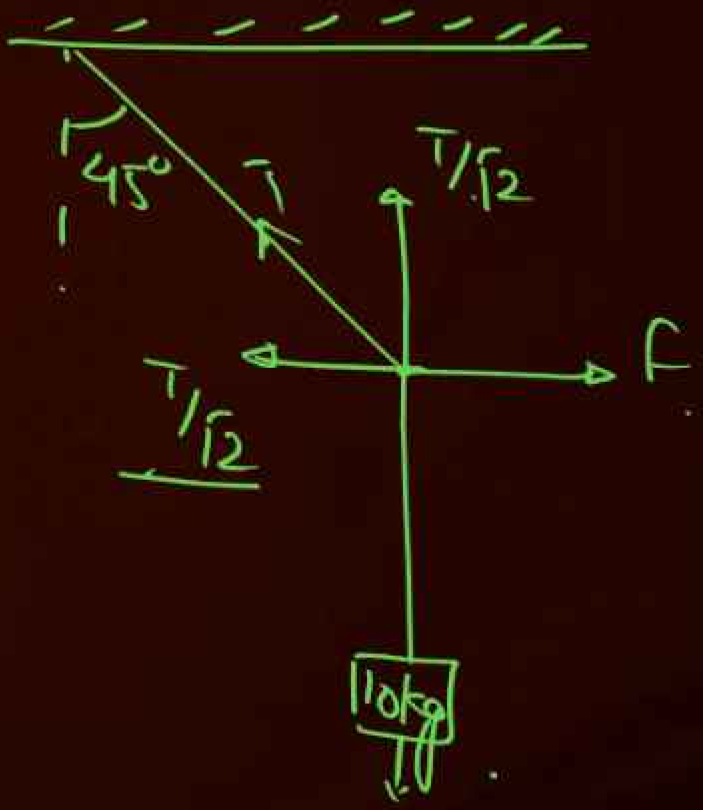

Ans : (3)

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Question

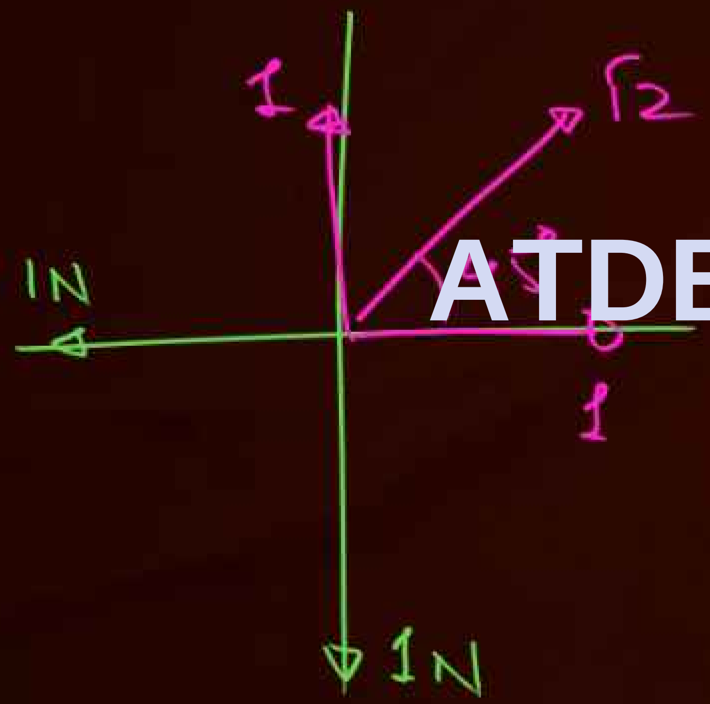
For a free body diagram shown in the figure, the four forces are applied in the 'x' and 'y' directions. What additional force must be applied and at what angle with positive x-axis so that the net acceleration of body is zero? [25 July, 2022 (Shift-II)]

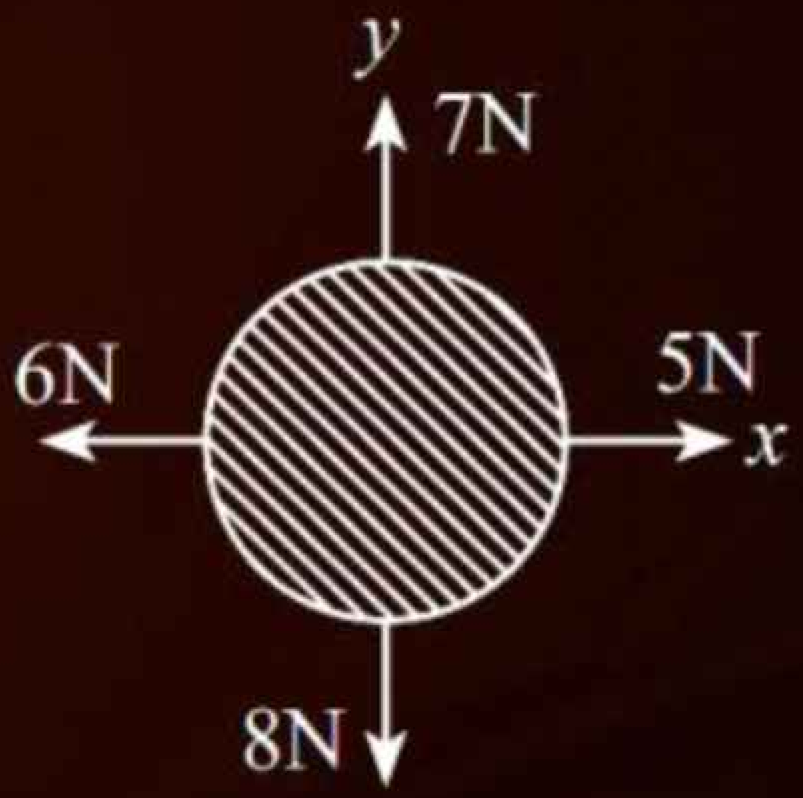
(1) $\sqrt{2}$ N, 45°

(2) $\sqrt{2}$ N, 135°

(3) $\frac{2}{\sqrt{3}}$ N, 30°

(4) 2 N, 45°





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Ans : (1)

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Question

H (a)

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 $x =$ ______.

[25 July, 2022 (Shift-I)]

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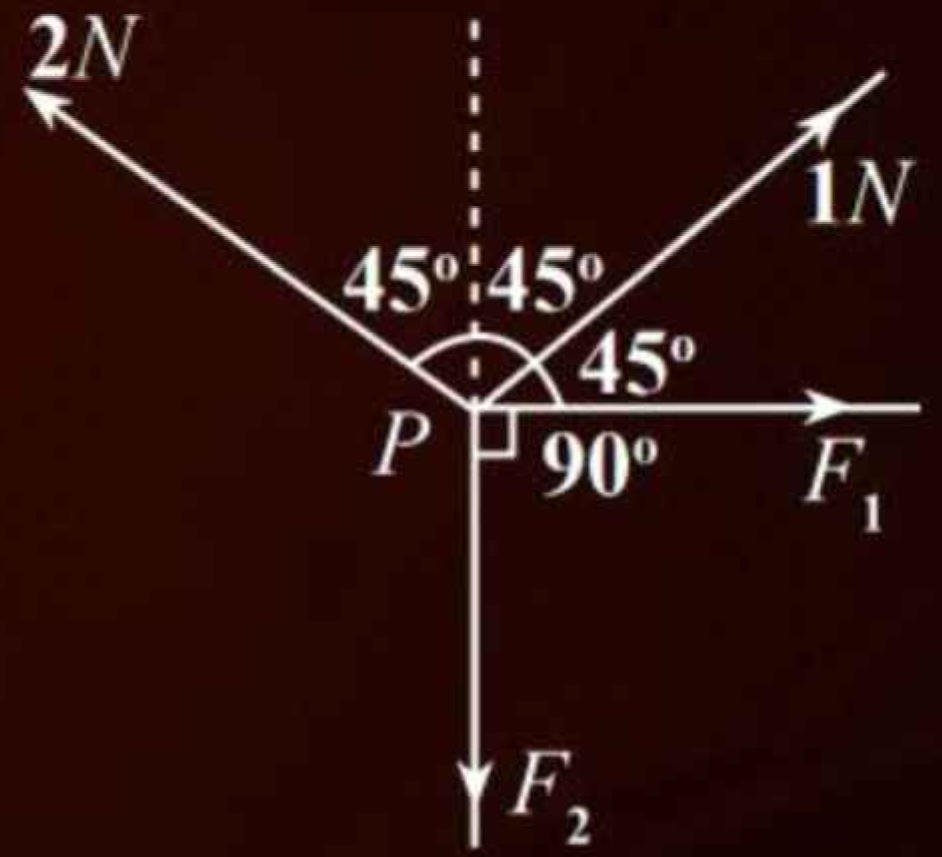

Ans : (3)

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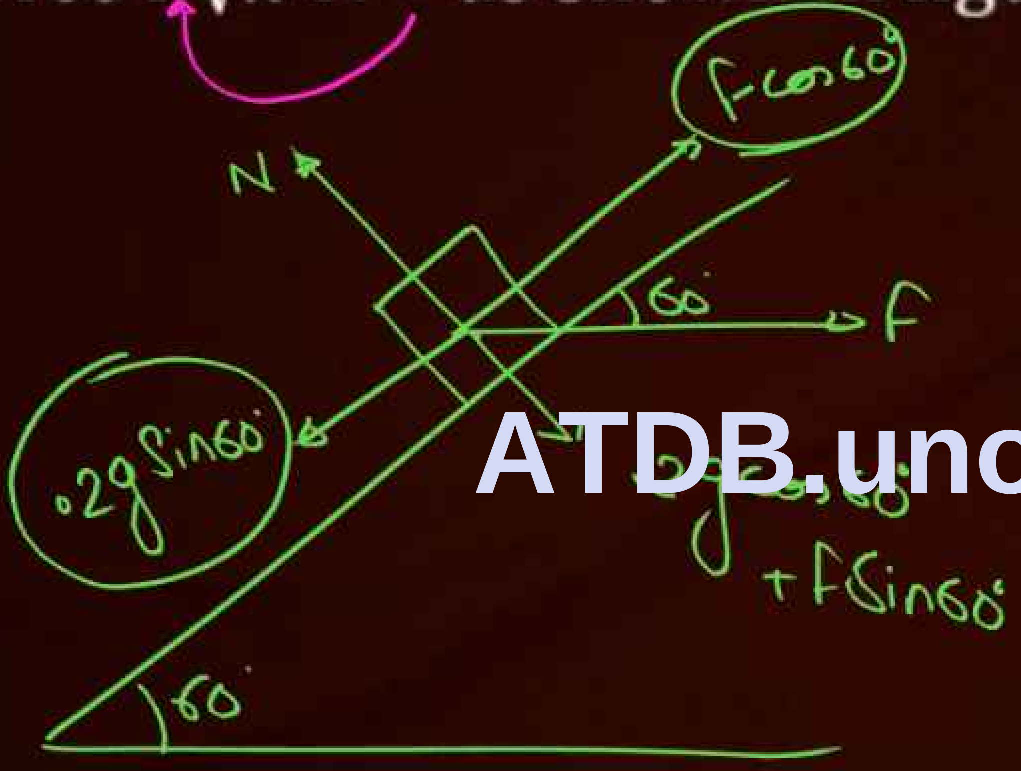
Question

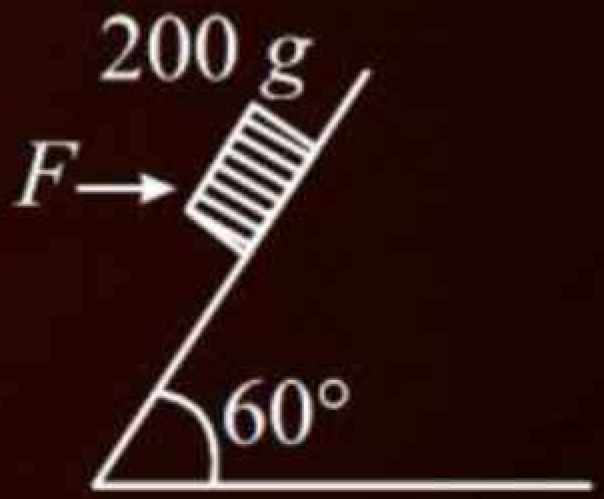
A block of mass 200 g is kept stationary on a smooth inclined plane by applying a minimum horizontal force $F\sqrt{x}$ N = as shown in figure. The value of x = ________.

[25 June, 2022 (Shift-II)]

$\frac{F}{2} = 2\cdot\frac{\sqrt{3}}{2}$

$F = \sqrt{12}$





Ans : (12)

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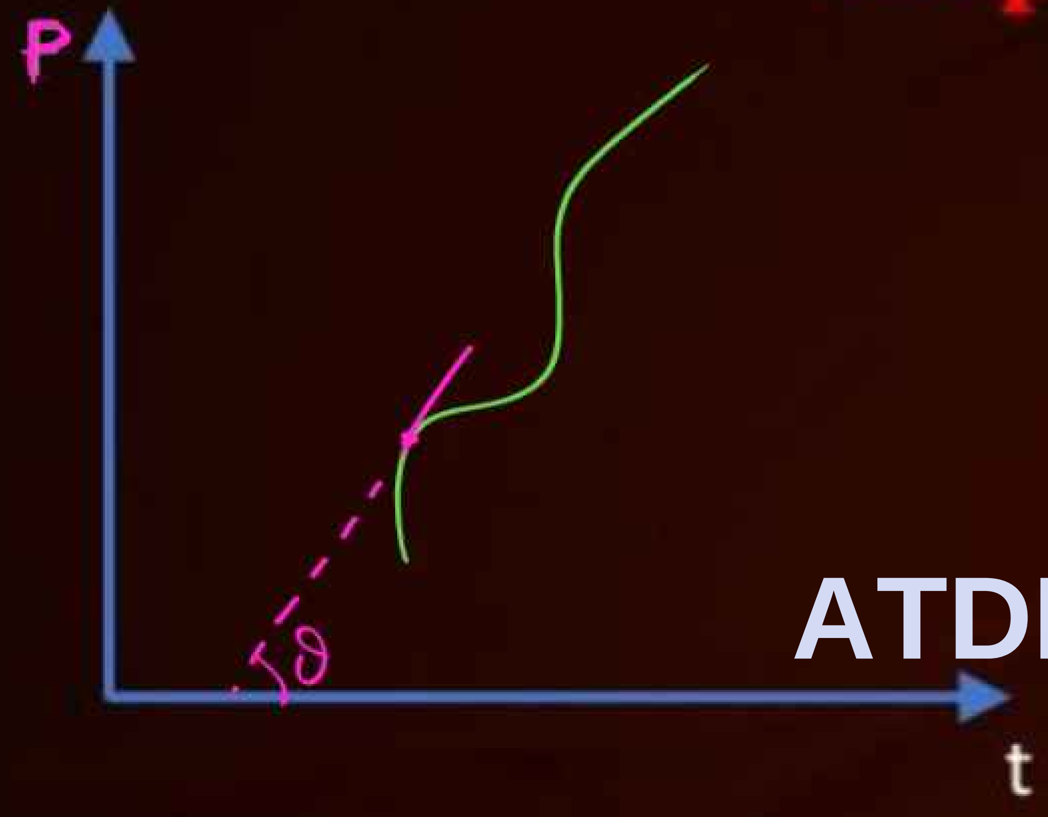
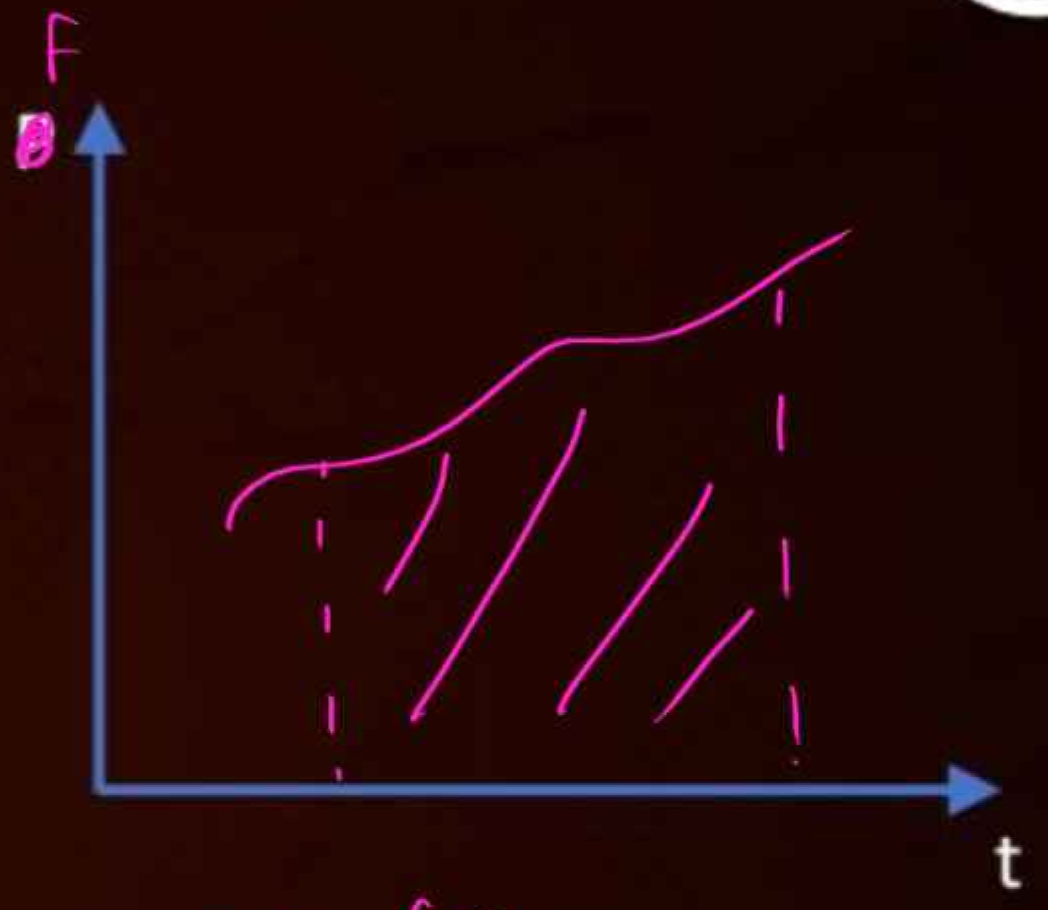
Relation in Force and Momentum, Impulse





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$\vec{F} = \frac{d\vec{P}}{dt}$

$\left(F = \frac{dP}{dt} = \text{Slope in } p\text{-}t \text{ Graph} \right)$

$\Delta\vec{P} = \int \vec{F}\,dt = \text{impulse}$

$= \text{Area in } F\text{-}t \text{ Graph}$

Change in momentum

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Question

$\vec{a} = \frac{d\vec{v}}{dt}$

At any instant the velocity of a particle of mass 500 g is $(2t\hat{i} + 3t^2\hat{j})\,\text{ms}^{-1}$. If the force acting on the particle at $t = 1$ s is $(\hat{i} + x\hat{j})$N. Then the value of x will be:

[08 Apr, 2023 (Shift-1)]

$\vec{P} = \frac{1}{2}(2t\hat{i} + 3t^2\hat{j})$

$\vec{F} = \frac{d\vec{P}}{dt} = \hat{i} + 3t\hat{j}$

$= \hat{i} + 3\hat{j}$

(1) 3

(2) 4

(3) 6

(4) 2

Ans : (1)

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Average Force due to Collision

$$\vec{F} = \frac{d\vec{P}}{dt} \Rightarrow \boxed{\vec{F}_{avg.} = \frac{\Delta \vec{P}}{\Delta t}} = \frac{\vec{P}_f - \vec{P}_i}{\Delta t}$$

Ex. 1

t = 2, 10 kg, 4 m/s

t = 0, 10 kg, 5 m/s

find Avg. Force

$$\vec{F}_{avg} = \frac{40\hat{i} - 50\hat{j}}{2} = 20\hat{i} - 25\hat{j}$$

20, 25

Ex. 2 stationary

rest

m → v

fires n bullets per sec.

find Avg. force required to hold the gun

$$\vec{F}_{avg} = \frac{mv - 0}{1/n} = n(mv)$$

$$= \frac{n(\text{change of momentum of one bullet})}{1}$$

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Question

$\vec{a} = \frac{40\hat{i}+10\hat{j}}{5} = 8\hat{i}+2\hat{j}$, $u = 0$

A force $\vec{F} = (40\hat{i} + 10\hat{j})N$ acts on a body of mass 5 kg. If the body starts from rest, its position vector $\vec{r}$ at time $t = 10$ s, will be: **[25 July, 2021 (Shift-II)]**

$\vec{s} = \cancel{\vec{u}t}^{\,0} + \frac{1}{2}\vec{a}t^2 = \vec{r}_f - \cancel{\vec{r}_i}^{\,0}$

$= \frac{1}{2} \times (8\hat{i} + 2\hat{j})(100)$

1. $(100\hat{i} + 100\hat{j})m$
2. $(400\hat{i} + 100\hat{j})m$
3. $(400\hat{i} + 400\hat{j})m$
4. $(100\hat{i} + 400\hat{j})m$

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Ans : (2)

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Question

HW

A body of mass 2 kg moves under a force of $(2\hat{i} + 3\hat{j} + 5\hat{k})N$. It starts from rest and was at the origin initially. After $4s$, its new coordinates are $(8, b, 20)$. The value of b is: (Round off to the Nearest Integer). **[16 March, 2021 (Shift-II)]**

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Ans : (12)

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Question

$F = \frac{dP}{dt} = \text{Slope}$

The figure represents the momentum time (P – t) curve for a particle moving along an axis under the influence of the force. Identify the regions on the graph where the magnitude of the force is maximum and minimum respectively? If $(t_3 - t_2) < t_1$.

[30 Jan, 2023 (Shift-I)]

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

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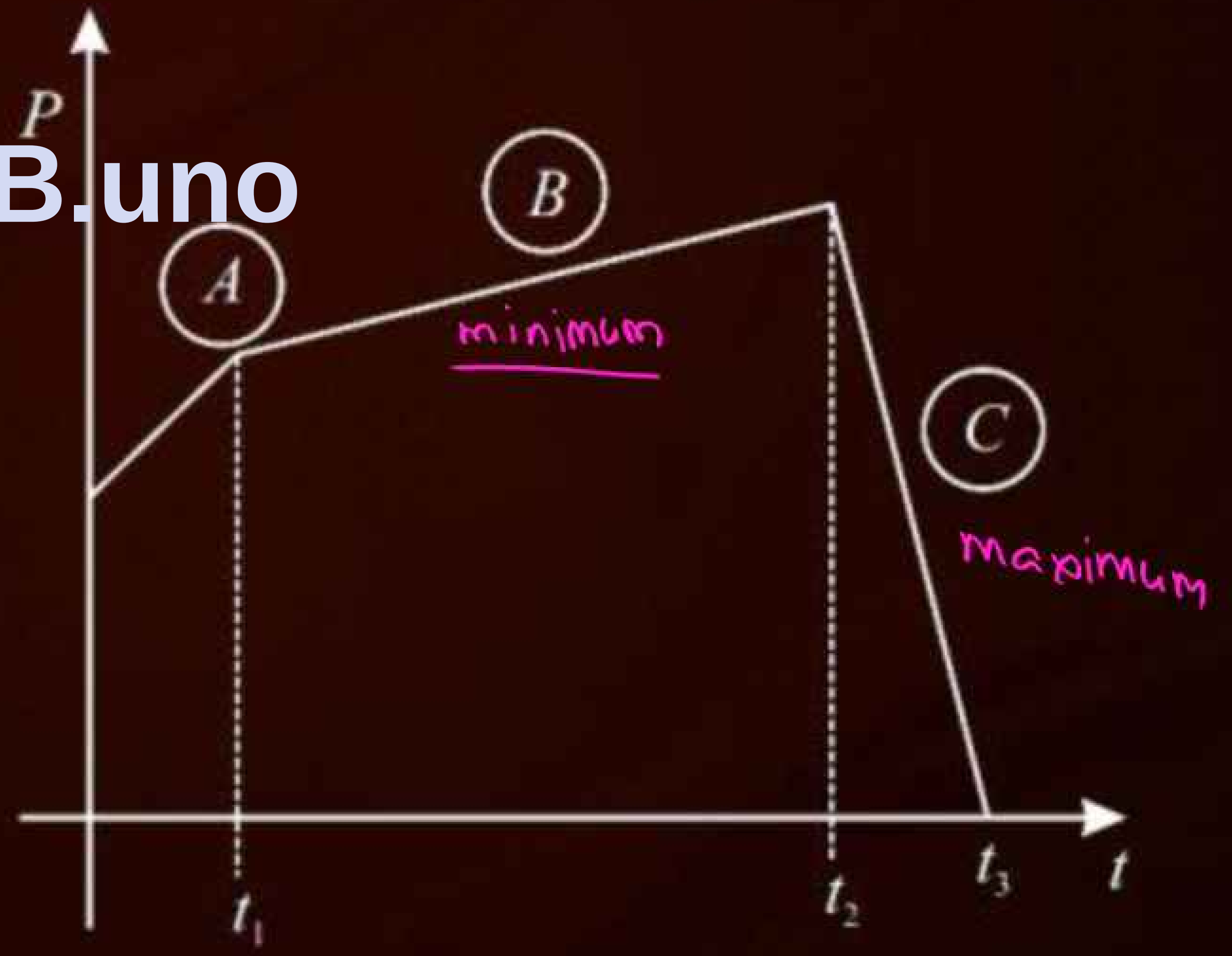

Ans : (3)

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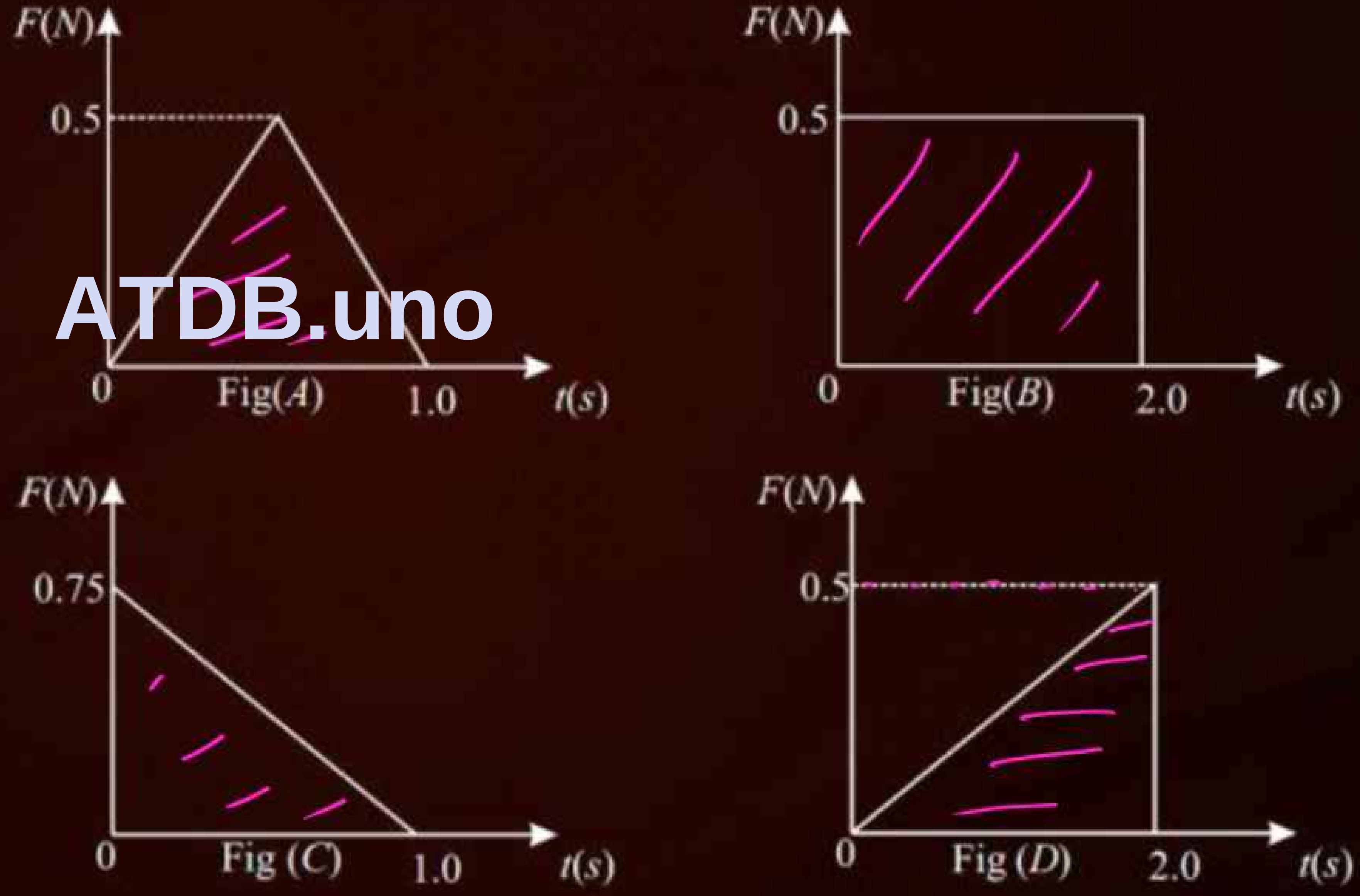
Question

Impulse = ΔP = Area under $\int \vec{F} dt$

Figures (A), (B), (C) and (D) show variation of force with time. The impulse is highest in figure. **[1 Feb, 2023 (Shift-II)]**

1. Fig (C)
2. Fig (B)
3. Fig (A)
4. Fig (D)



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Ans : (2)

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Question

Force acts for 20 sec on a body of mass 20 kg, starting from rest, after which the force ceases and then the body describes 50 m in the next 10 s. The value of force will be:

[29 Jan, 2023 (Shift-II)]

1. 40 N
2. 5 N
3. 20 N
4. 10 N

20kg
rest
F
$u=0$
20sec.
$t=10$
$\longleftarrow 50 \longrightarrow$
V

$V=\frac{50}{10}=5\,m/s$

$V=u+at$

$5=0+a(20) \Rightarrow a=\frac{1}{4}$

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Ans : (2)

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Question

100 balls each of mass m moving with speed v simultaneously strike a wall normally and are reflected back with the same speed, in time t s. The total force exerted by the balls on the wall is: **[31 Jan, 2023 (Shift-I)]**

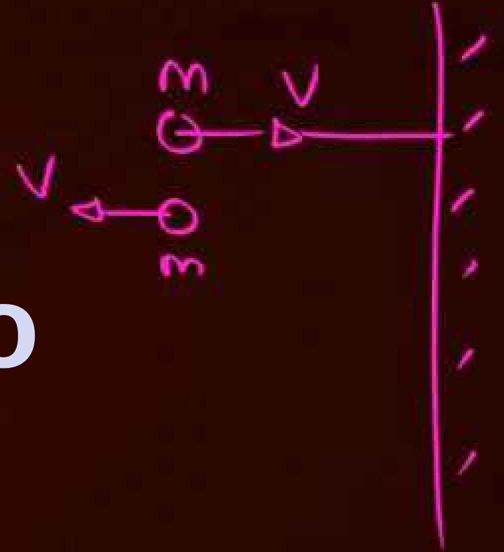
(1) $\frac{100mv}{t}$

(2) $\frac{200mv}{t}$

(3) $200\ mvt$

(4) $\frac{mv}{100t}$

$F = \frac{\Delta P}{\Delta t} = \frac{100(2mv)}{t}$



$\vec{\Delta P} = -mv\hat{i} - (mv\hat{i})$
$= -2mv\hat{i}$

$\Delta P = 2mv$

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Ans : (2)

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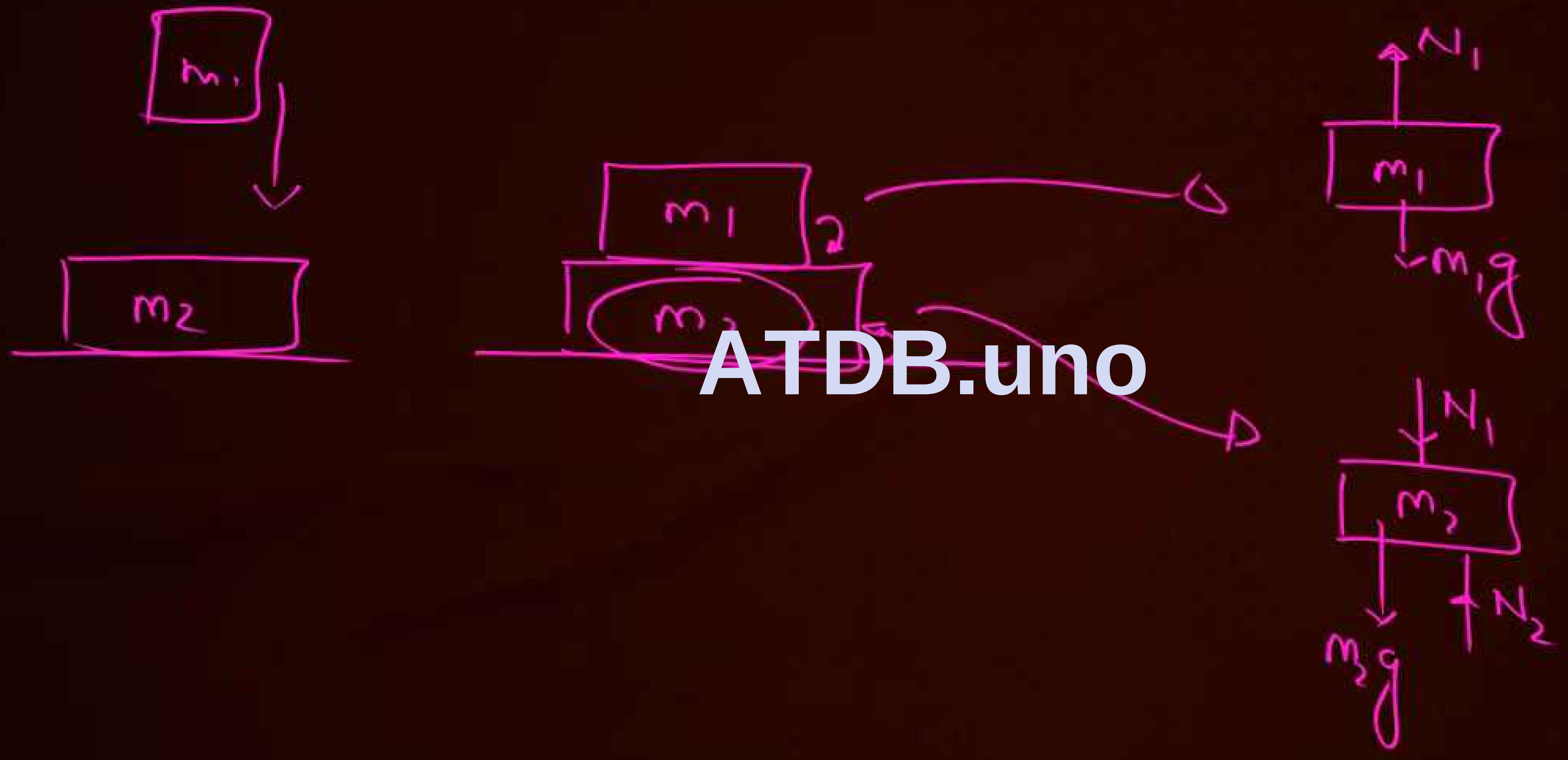
FBD Making and F = ma

free the object with all direct real forces (also Pseudo for non-inertial)



$$N_1 = m_1 g$$

$$N_2 = N_1 + m_2 g$$

$$= m_1 g + m_2 g$$

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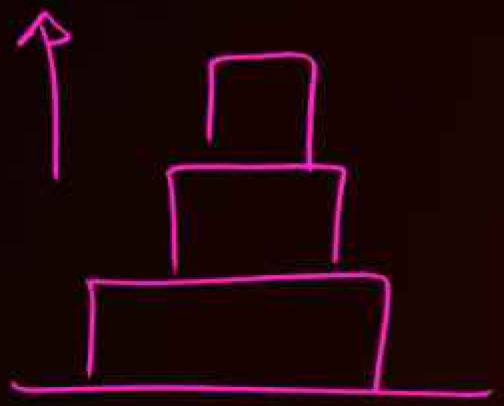
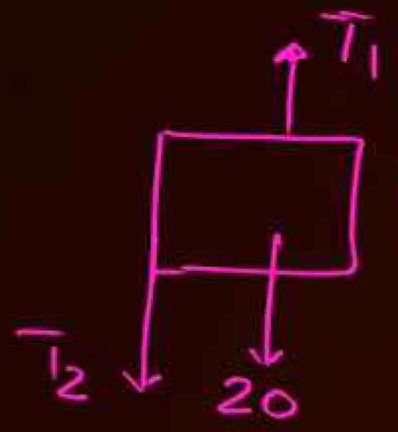
find T_1, T_2, T_3

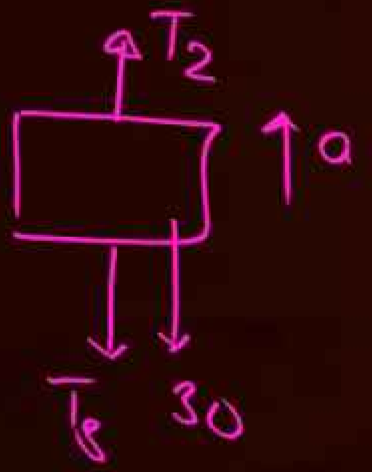


$$T_1 - 100 = 20$$

$$T_1 = 120\,N$$

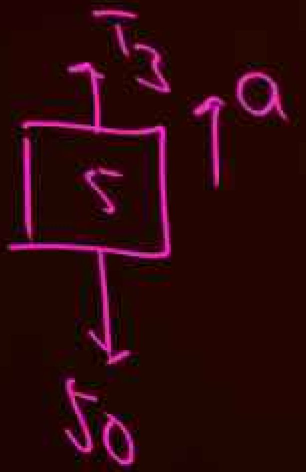


$$T_1 - T_2 - 20 = 2 \times 2$$

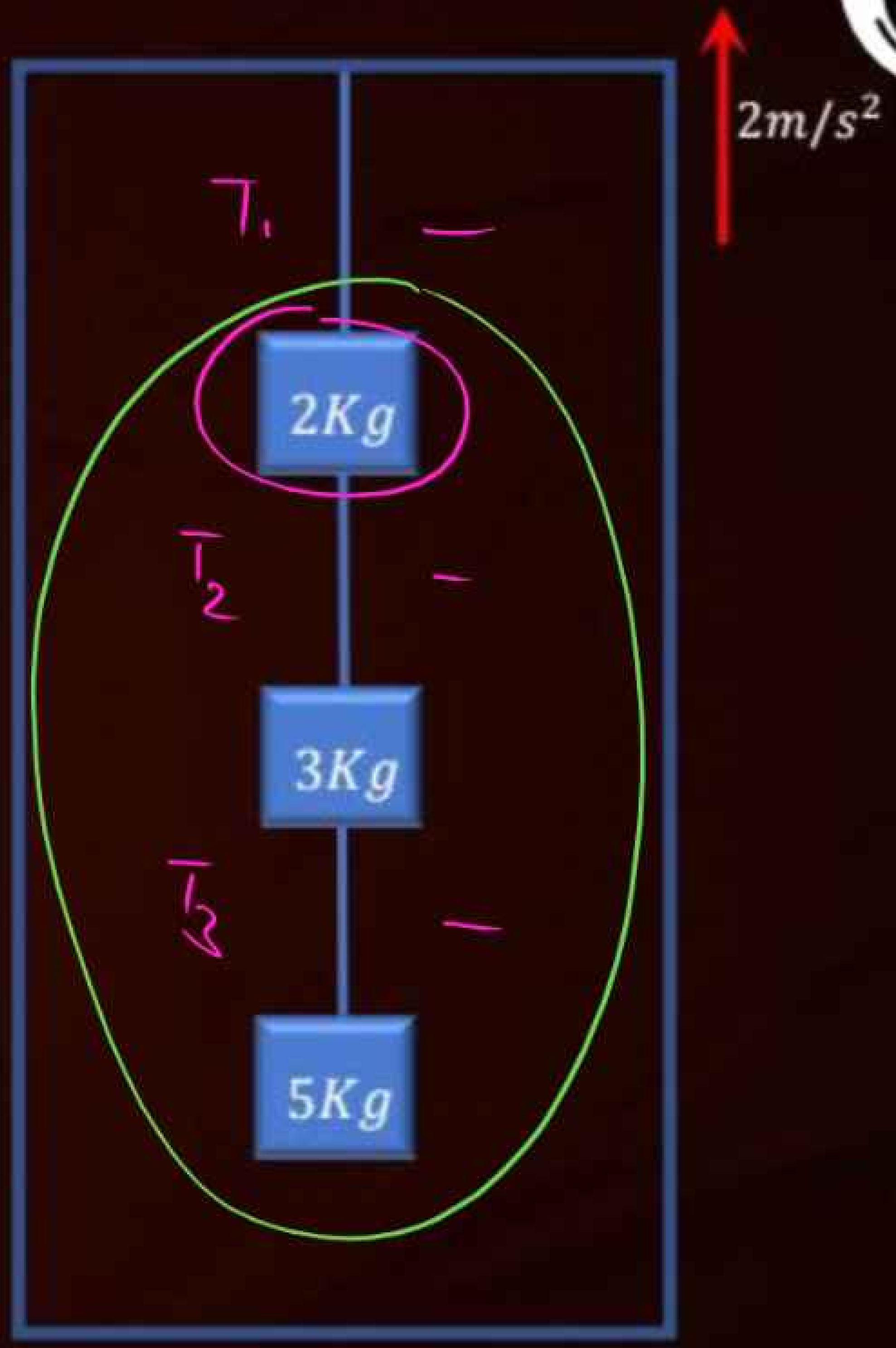


$$T_2 - T_3 - 30 = 3 \times 2$$

$$T_3 = 60$$



$$T_3 - 50 = 5 \times 2$$



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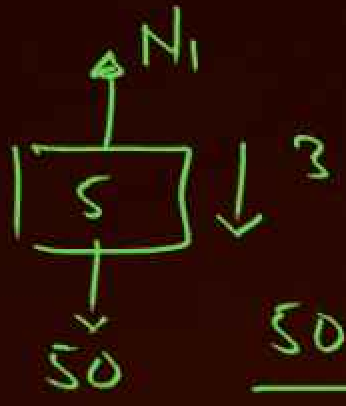
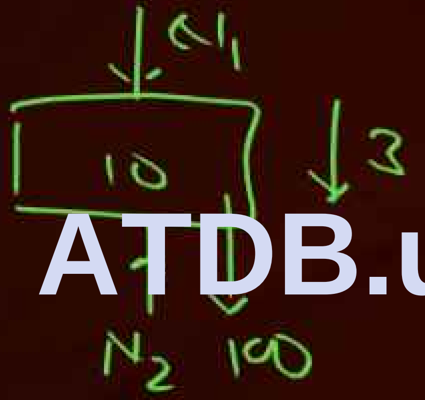
HW



$$50 - N_1 = 5 \times 3$$



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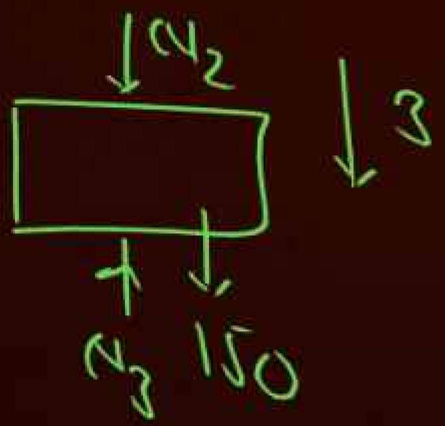

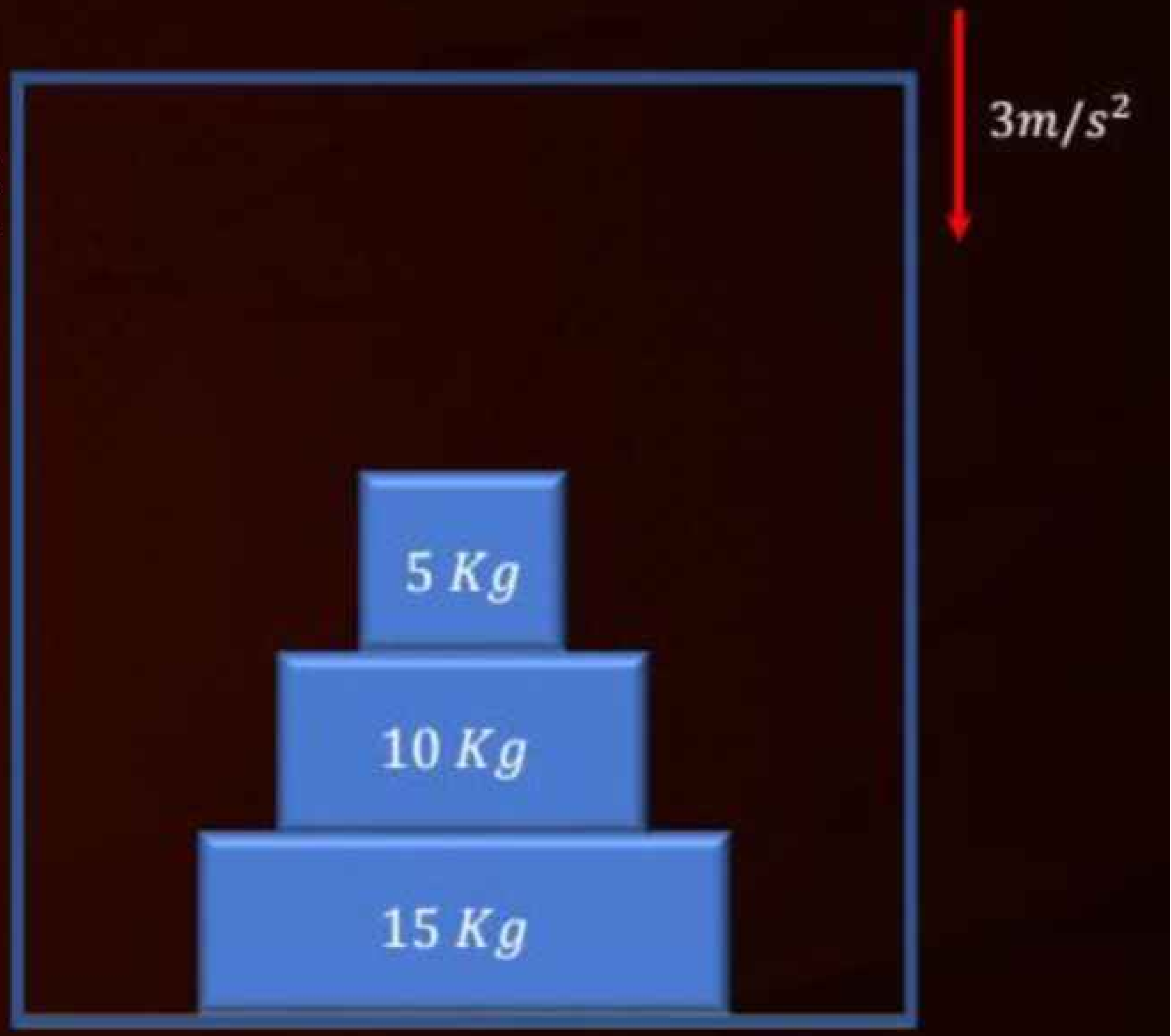

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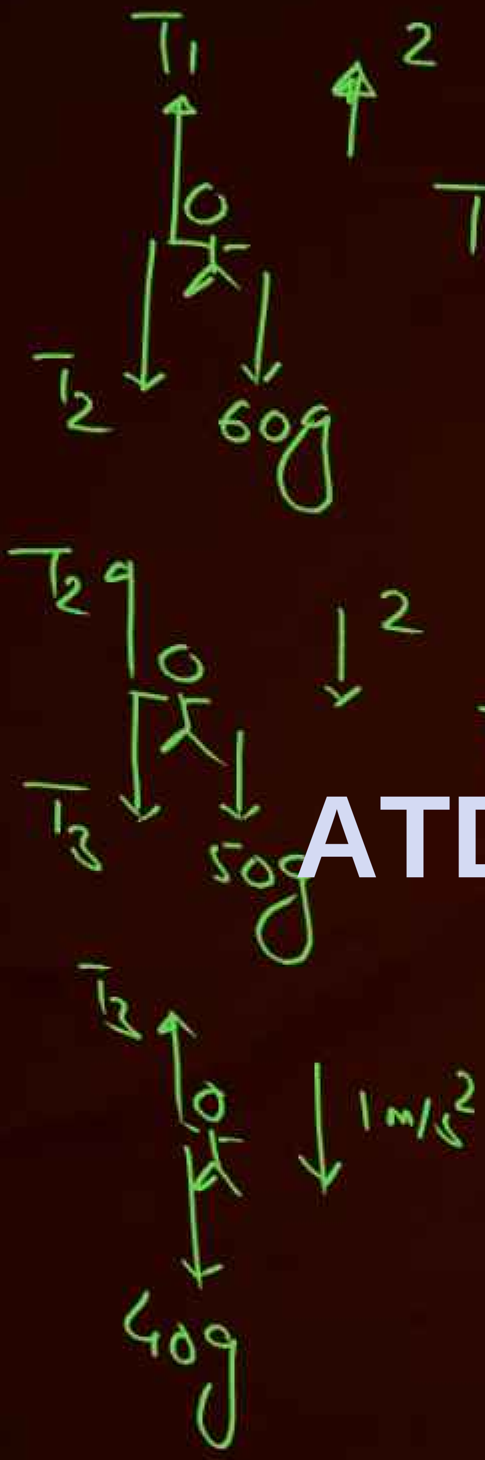

$$T_1 - T_2 - 60g = 60\times 2$$

$$T_3 - 50g - T_2 = 50\times 2$$

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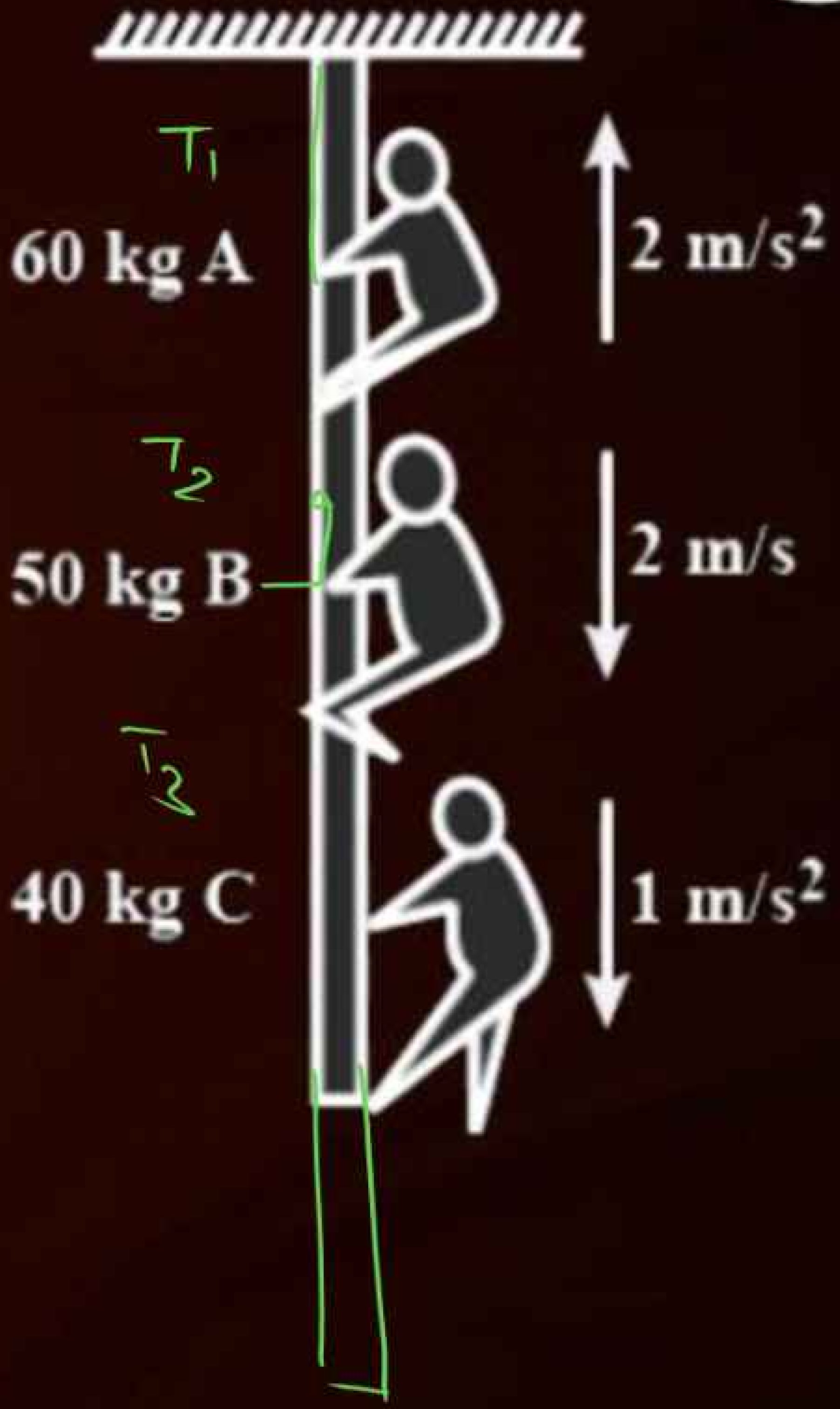
$$40g - T_3 = 40\times 2$$



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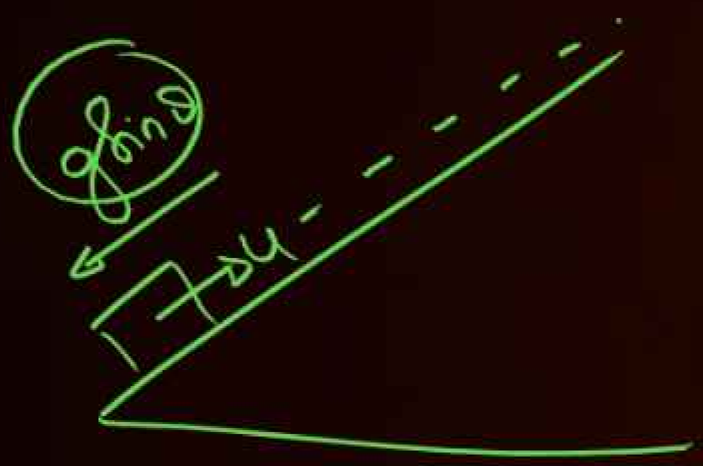
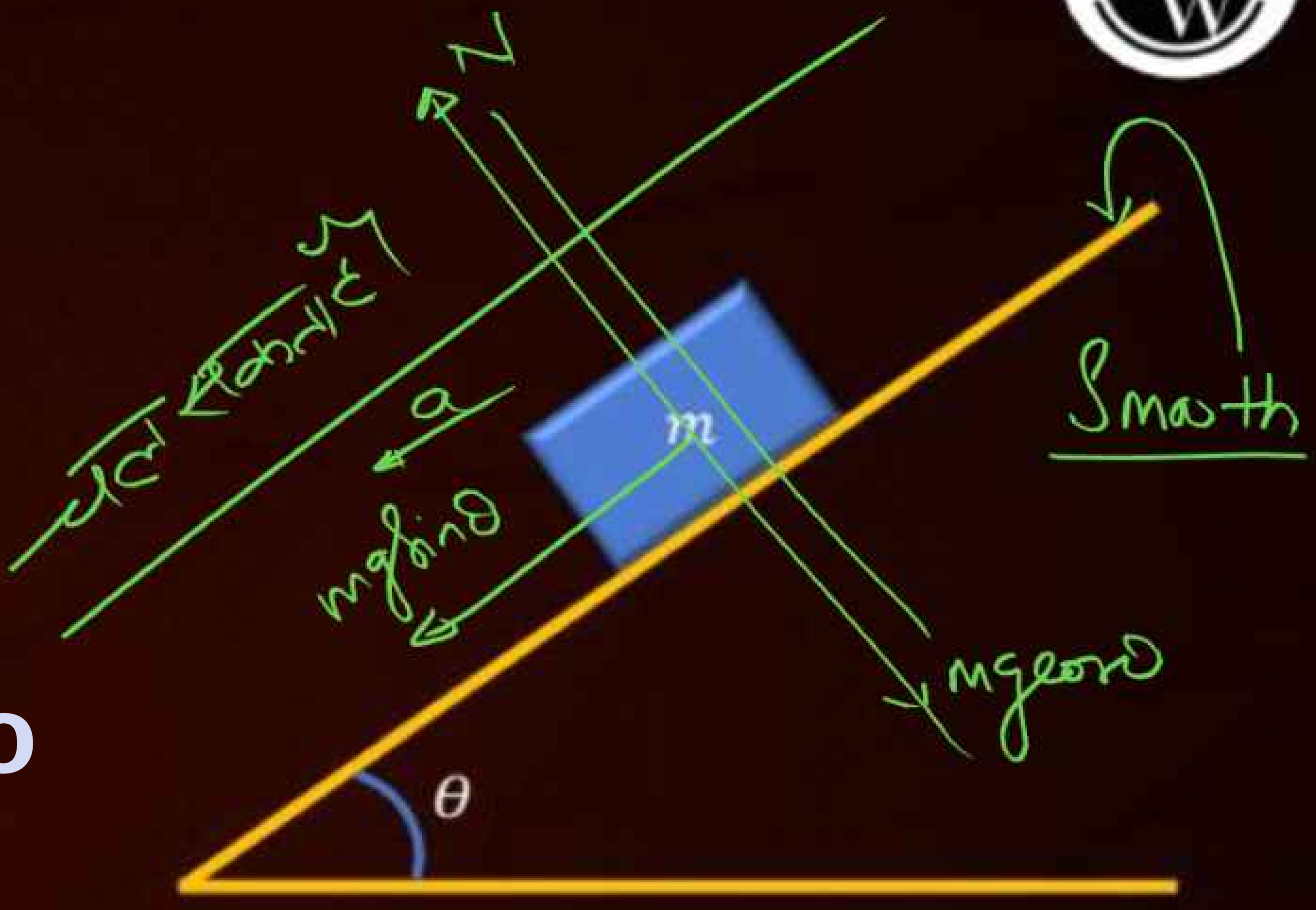
find acc. of block

$N = mg\cos\theta$

$mg\sin\theta = ma$

$\underline{a = g\sin\theta}$





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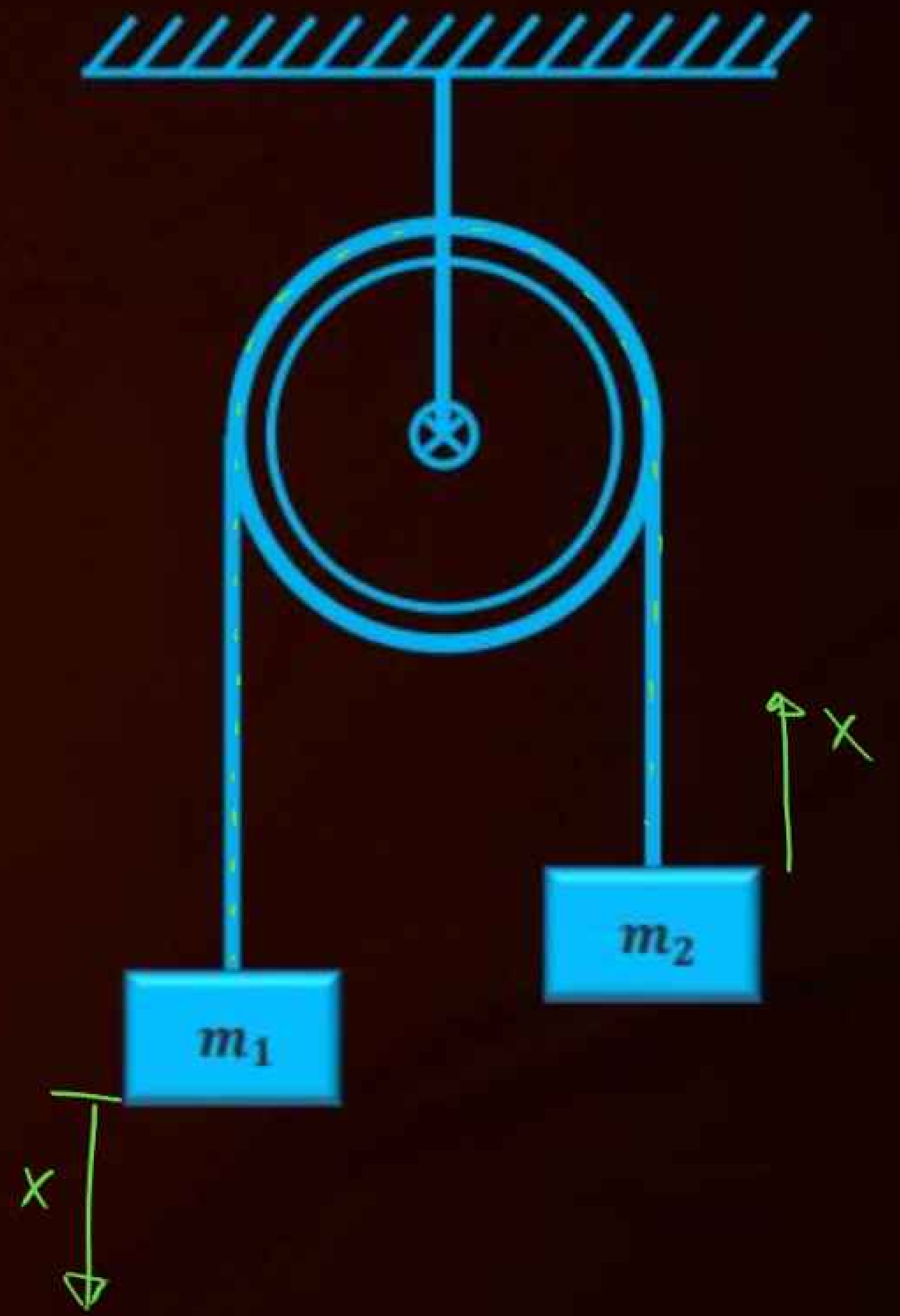
String Constrain

ideal String → length constant



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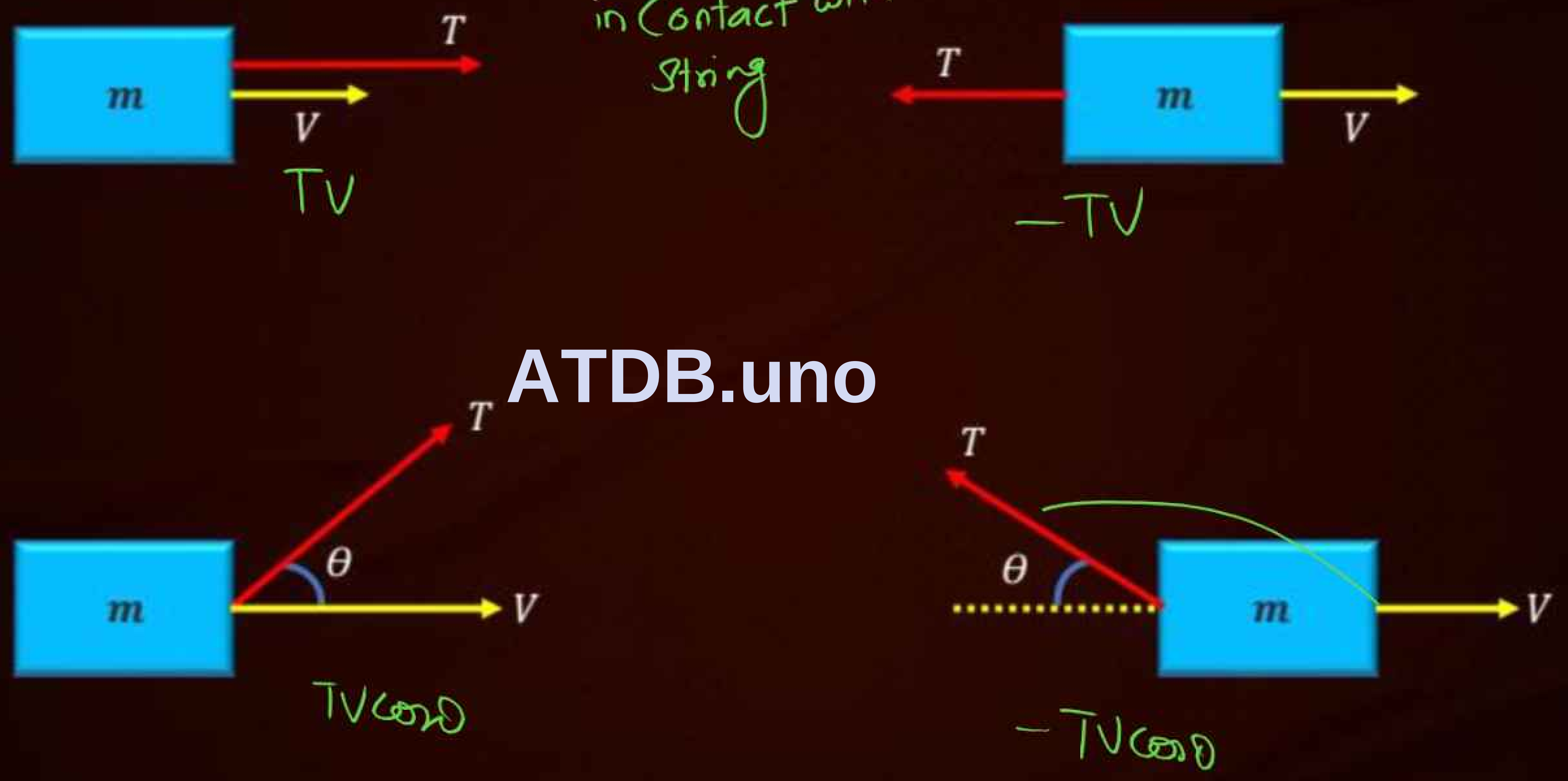
$\vec{T} \cdot \vec{V} = TV\cos\theta$

$$\sum \vec{T}.\vec{V} = 0$$

↓ object | Point in Contact with String

the Contact points of String



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String Constrain

$TV\cos\theta + -$

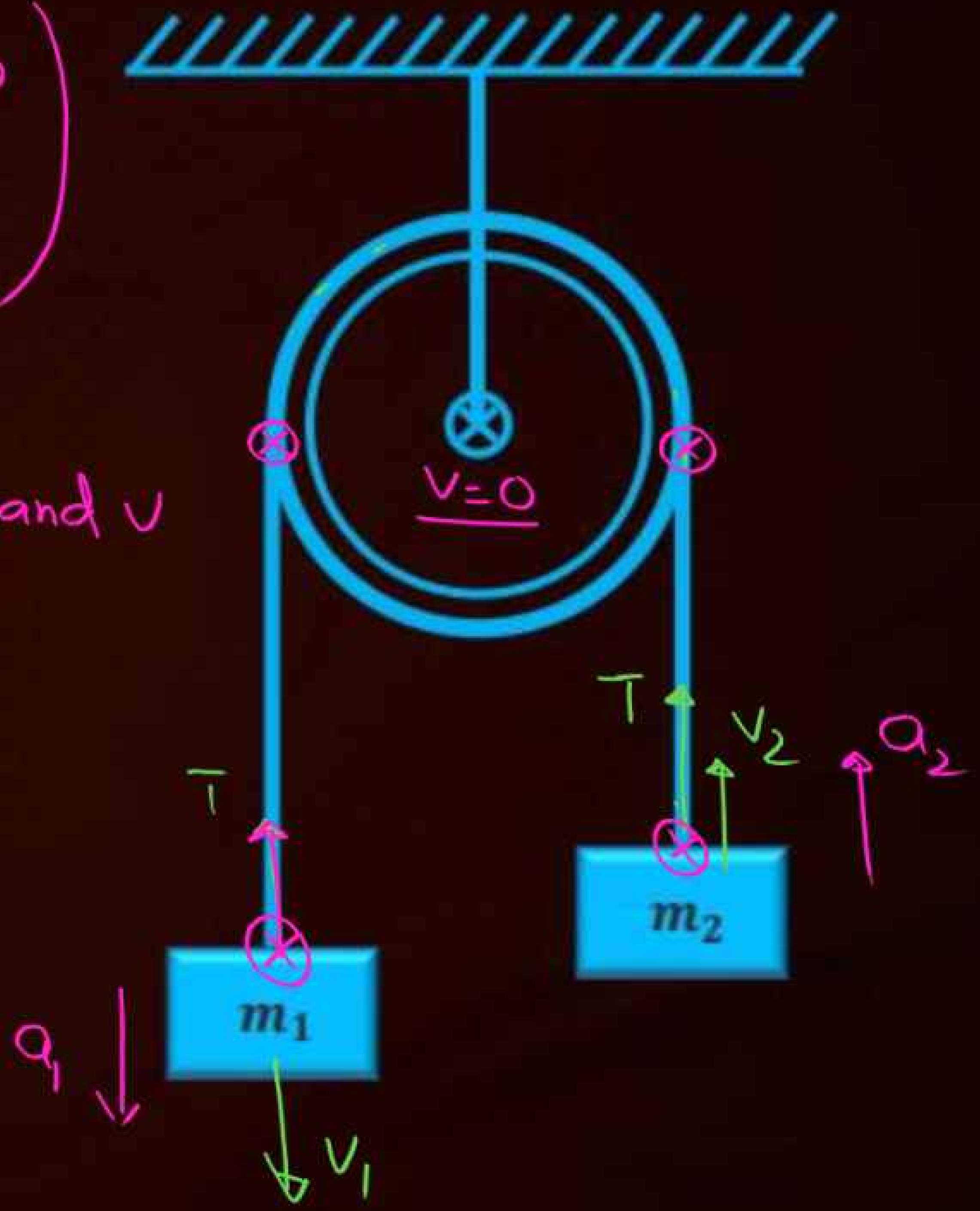
$$-TV_1 + TV_2 = 0$$

$$\underline{V_1 = V_2}$$

$$\sum \vec{T}\cdot\vec{V} = 0$$

$$\sum \vec{T}\cdot\vec{a} = 0$$ if angle b/w T and V remain Constant

$$a_1 = a_2$$



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$$150 - T = 15a$$

$$\underline{T - 100 = 10a}$$

$$50 = 25a$$

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

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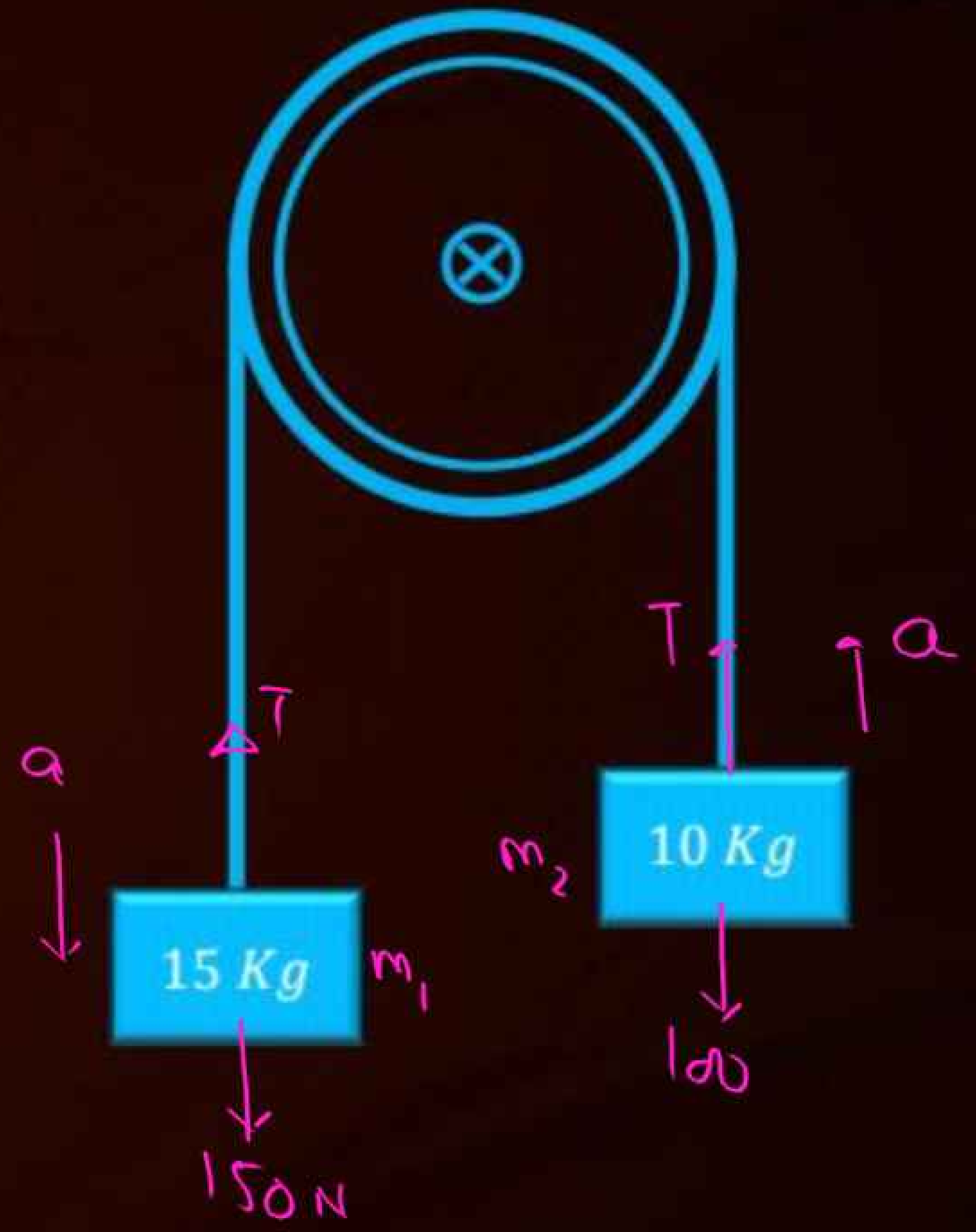

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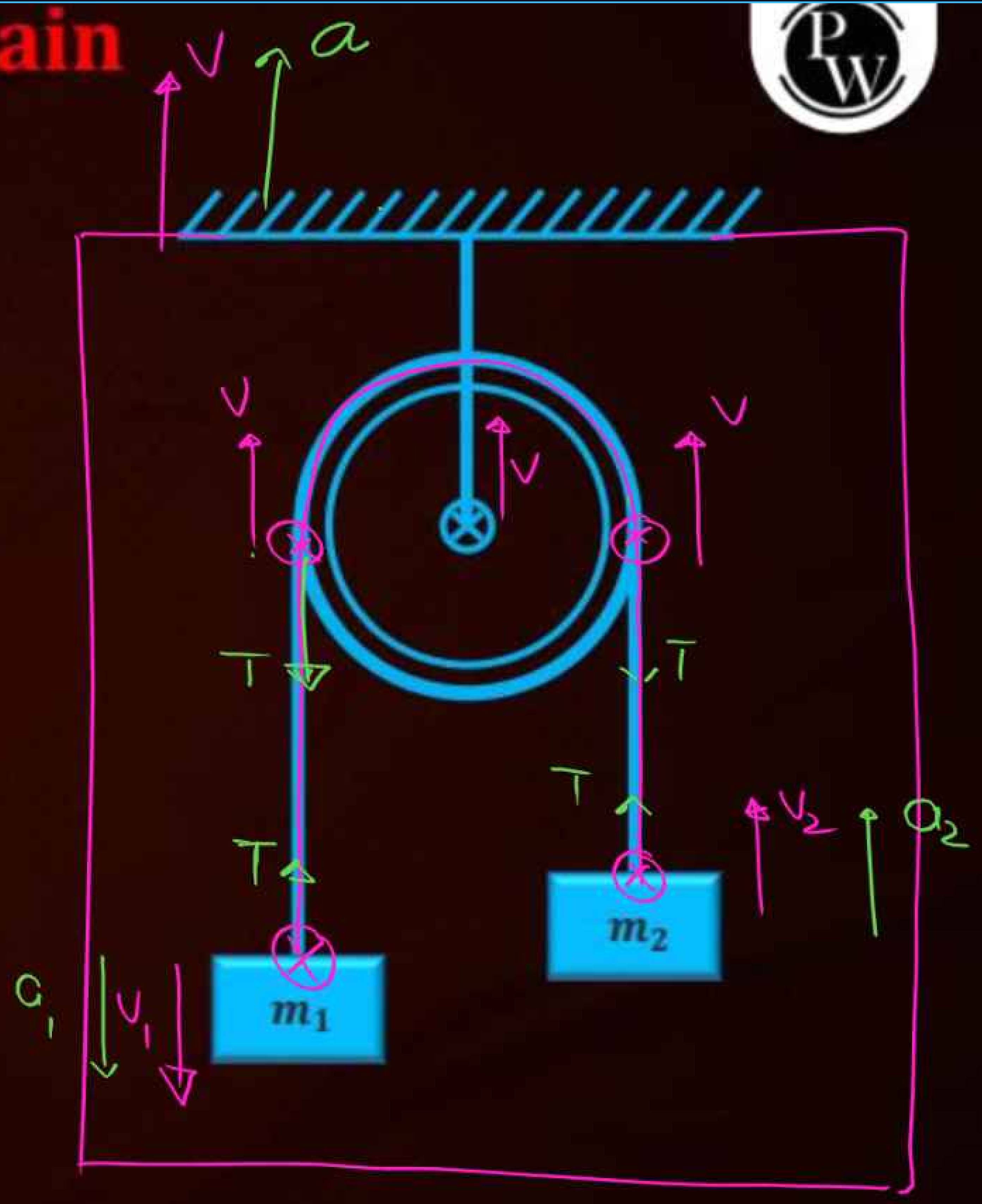
$TV\cos\theta + -$

String Constrain

$$-TV_1 - TV - TV + TV_2 = 0$$

$$2V = V_2 - V_1$$

$$2a = a_2 - a_1$$



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$$-Ta_1 + Ta_4 + Ta_4 + Ta_2 = 0$$

$$a_1 = 2a_4 + a_2$$

$$2Ta_3 + 0 + 0 - 2Ta_4 = 0$$

$$a_3 = a_4$$

$$a_1 = 2a_3 + a_2$$

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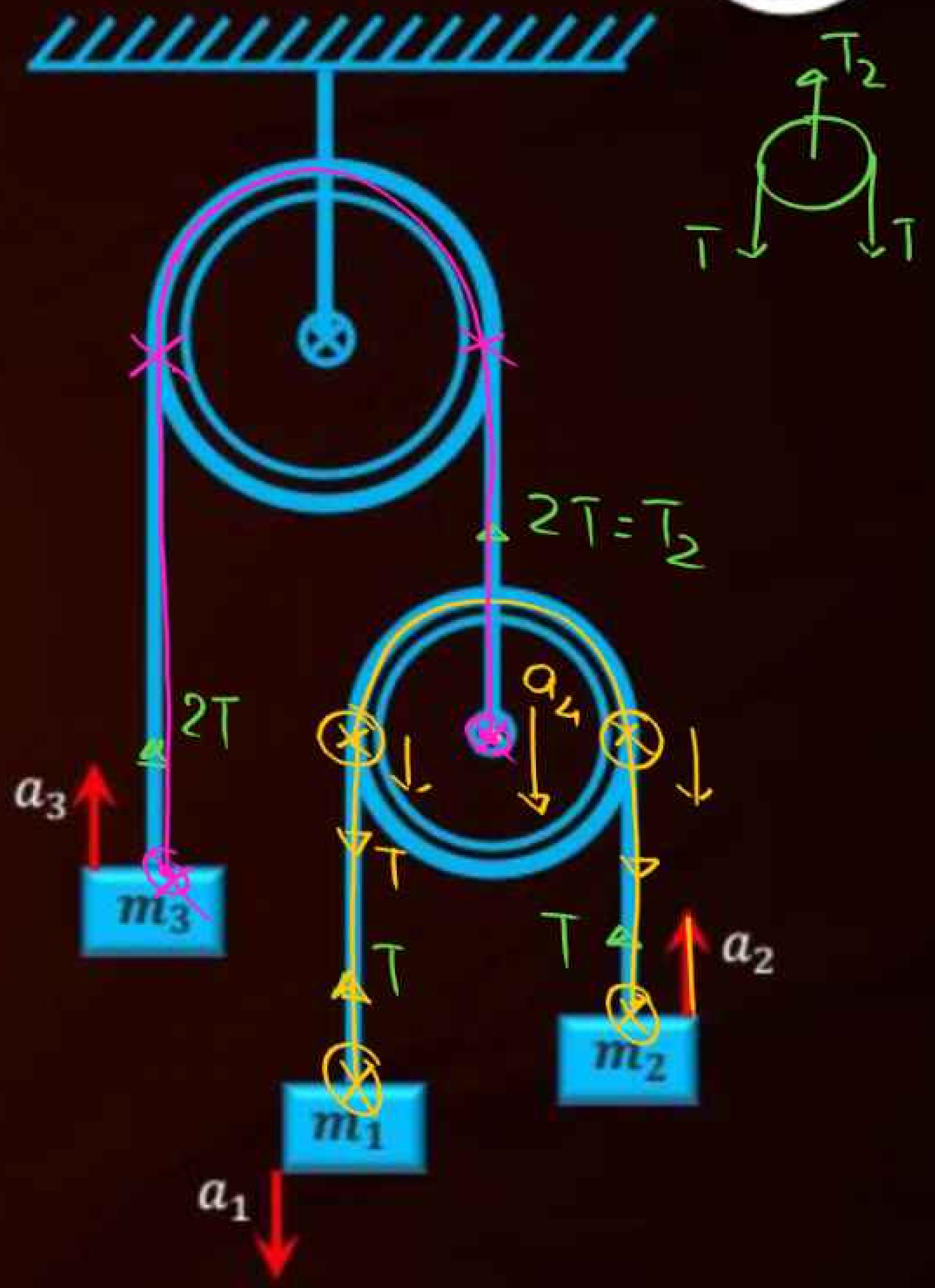

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2 strings

$$-Ta_1 + Ta_2 + \underbrace{(Ta_4 + Ta_4 - 2Ta_4)}_{0} + 2Ta_3 = 0$$

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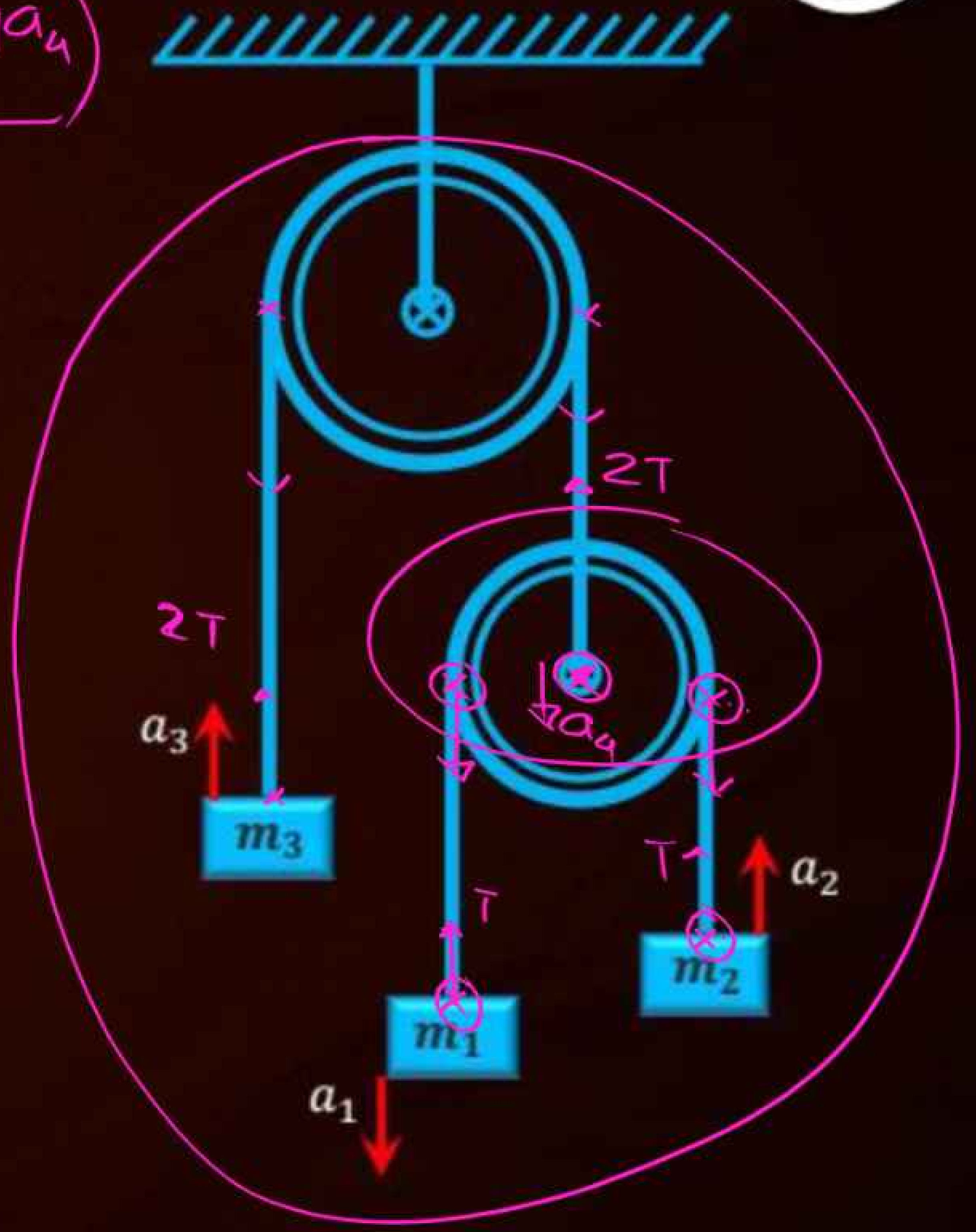

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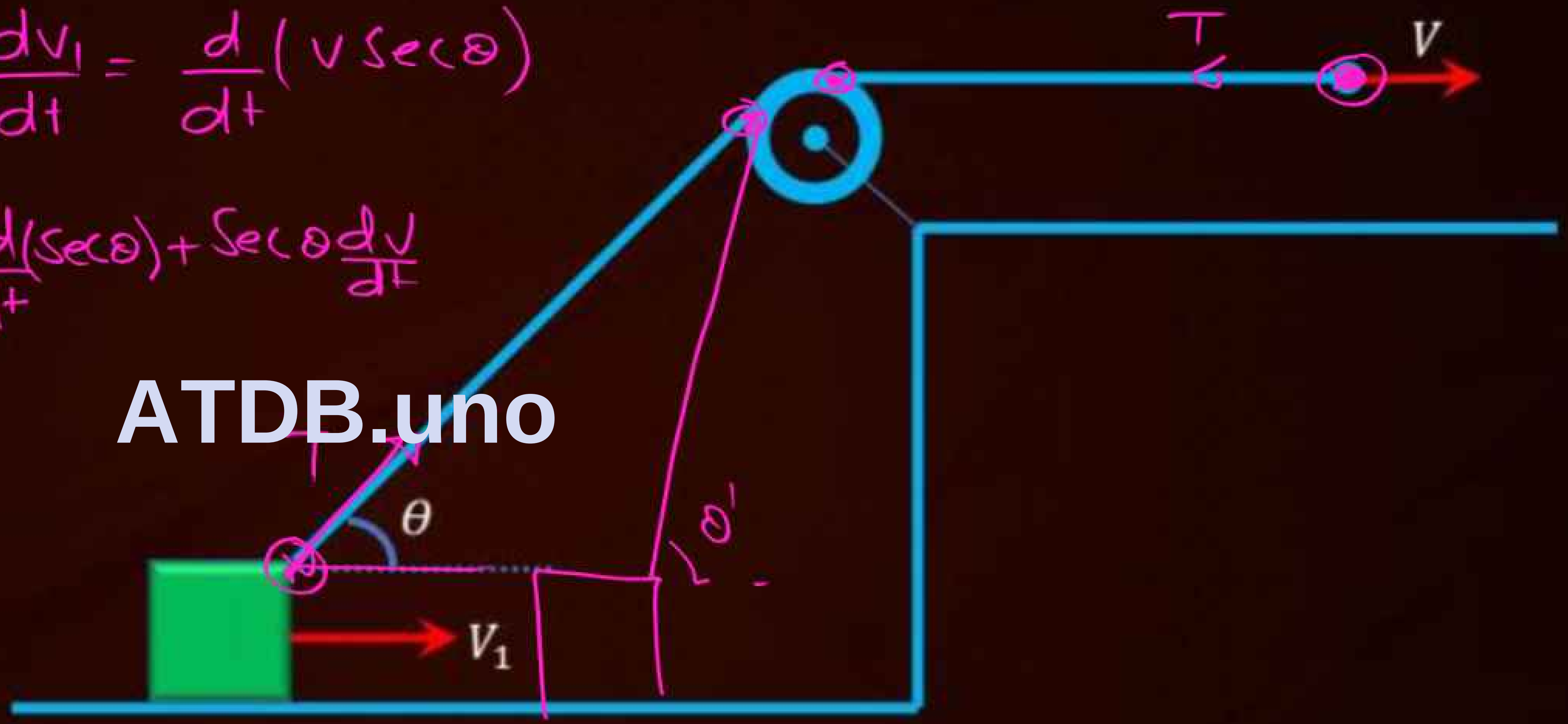
$$TV_1\cos\theta - TV = 0 \Rightarrow V_1\cos\theta = V$$

$$V_1 = V\sec\theta$$

$$a_1 = \frac{dV_1}{dt} = \frac{d}{dt}(V\sec\theta)$$

$$a_1 = V\frac{d(\sec\theta)}{dt} + \sec\theta\frac{dV}{dt}$$



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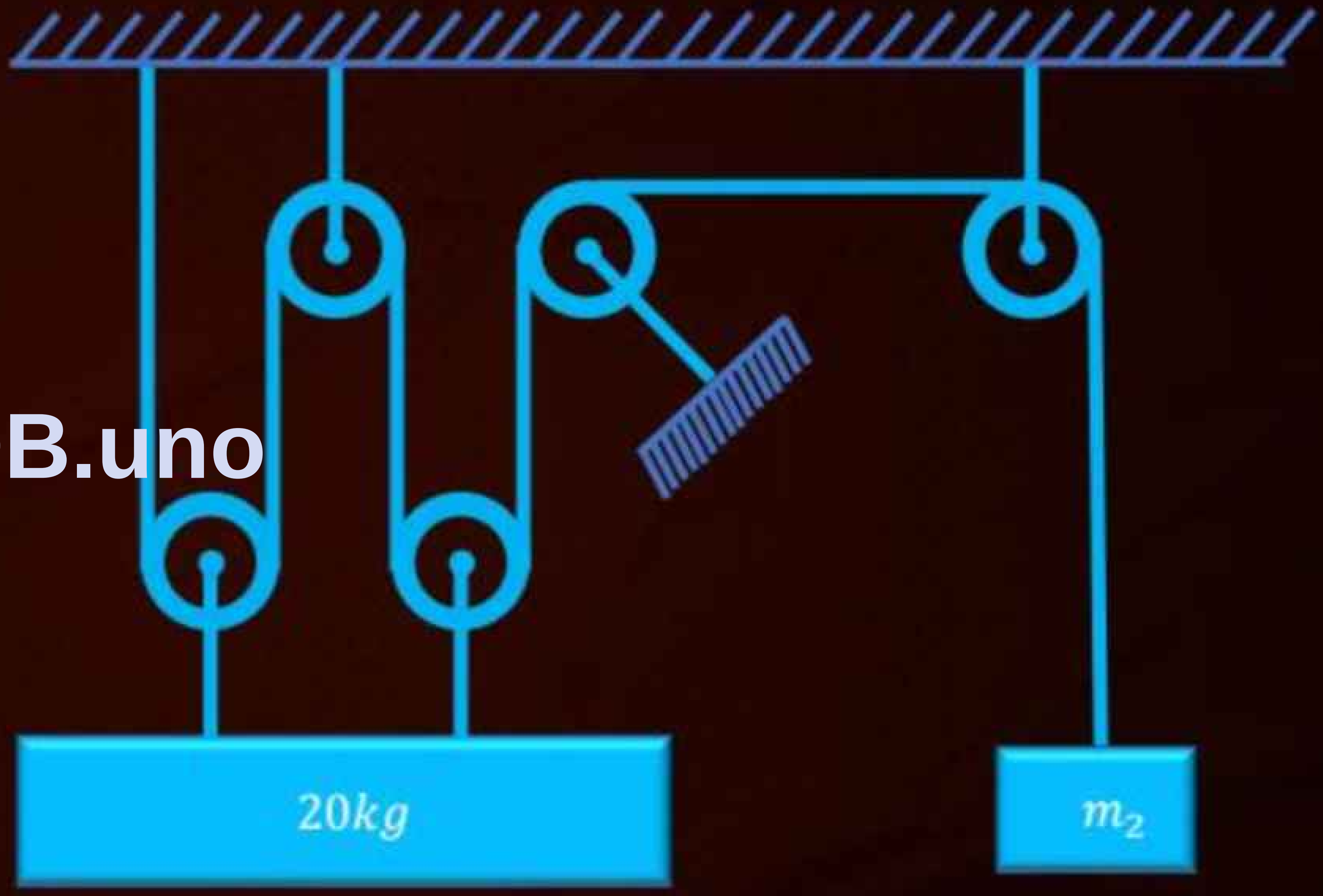

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Spring Force

(ideal spring)
mass less

natural length
l_0

net Force = 0 ; force at both ends is Same

$$\boxed{F = kx}$$

Elongation

$x \rightarrow$ Elongation / Compression

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compression

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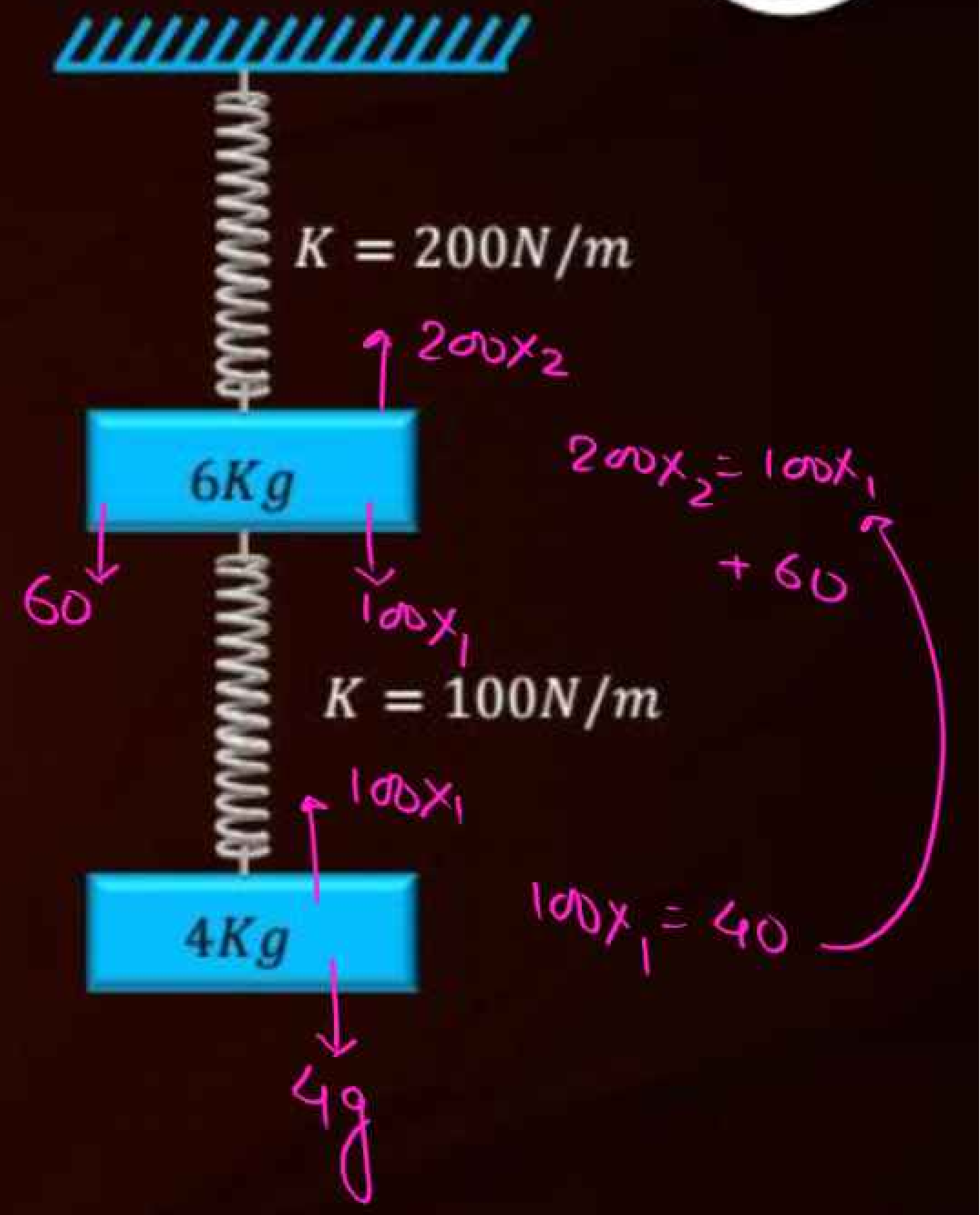
Find Elongation in each spring at Equilibrium



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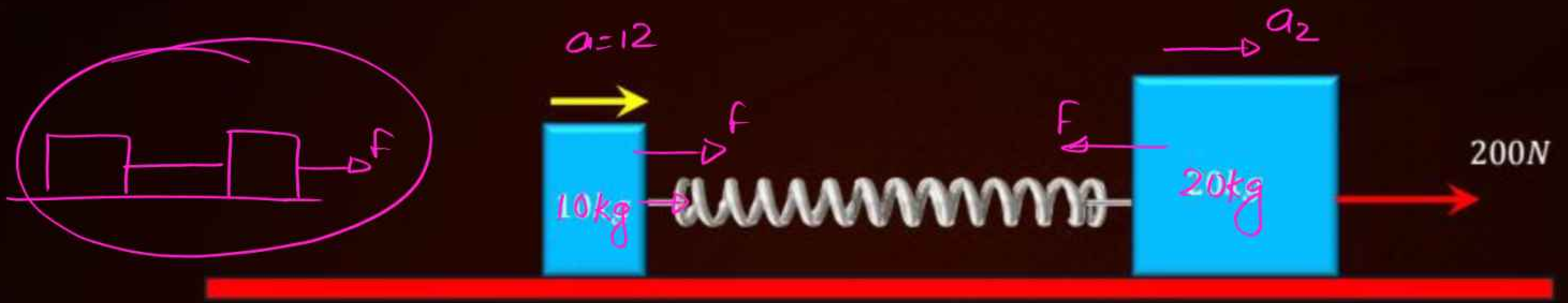
Acceleration of 10 kg block is $12m/s^2$ as shown . find acceleration of 20 Kg block



$F = 10 \times 12 = 120\,N$

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$200 - F = 20a_2 \Rightarrow \underline{a_2 = 4\,m/s^2}$

$\left.\begin{matrix}\text{Compo.}\\ \text{Elong}\end{matrix}\right\} \rightarrow$ पता नहीं

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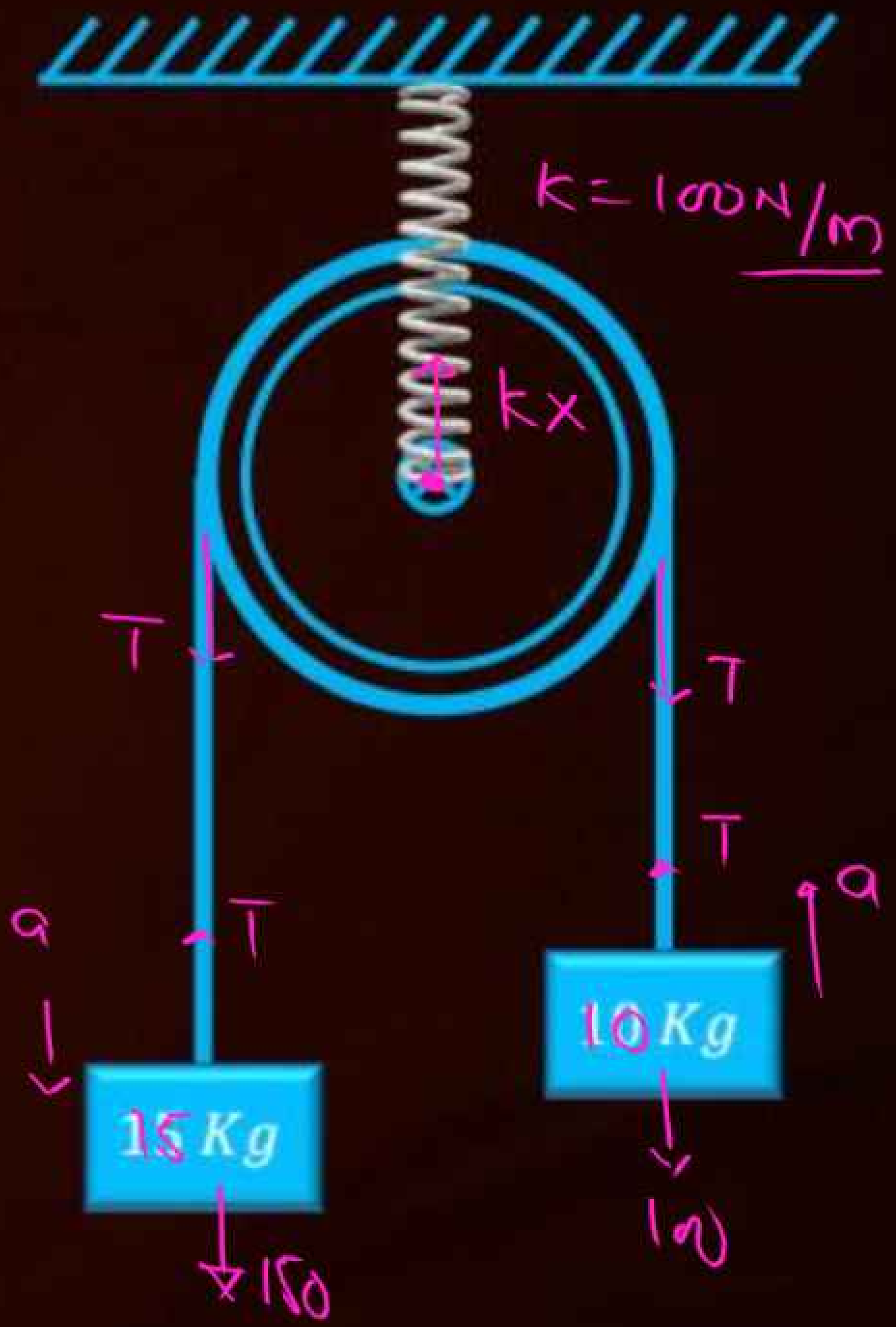
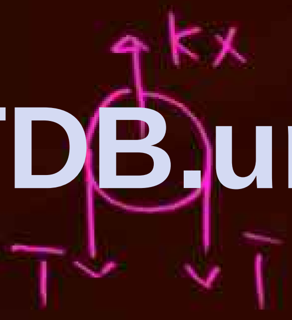
Find elongation in Spring
(Pulley is at rest)



$$\left.\begin{aligned} 150 - T &= 15a \\ T - 100 &= 10a \end{aligned}\right\} \rightarrow \begin{aligned} a &= 2\,m/s^2 \\ T &= 120\,N \end{aligned}$$



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$$kx = 2T = 240$$

$$x = \frac{240}{100} = 2.4\,m$$

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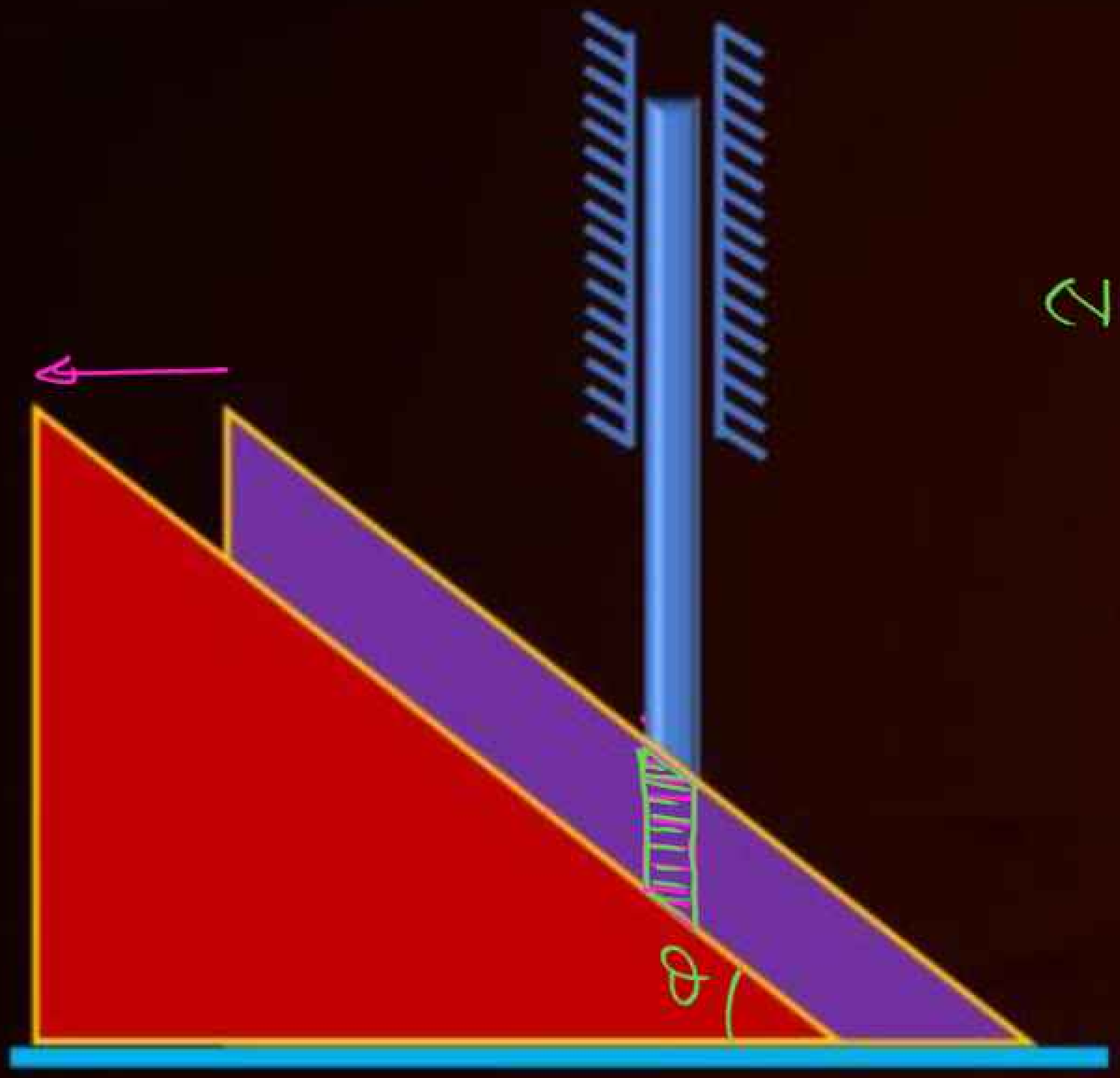
Wedge Constrain



$$\boxed{\sum \vec{N}\cdot\vec{V} = 0}$$

$$\sum \vec{N}\cdot\vec{a} = 0$$

$$NV_1\cos(90-\theta) +$$

$$NV_2\cos(180-\theta) = 0$$

$$V_1\sin\theta = V_2\cos\theta$$

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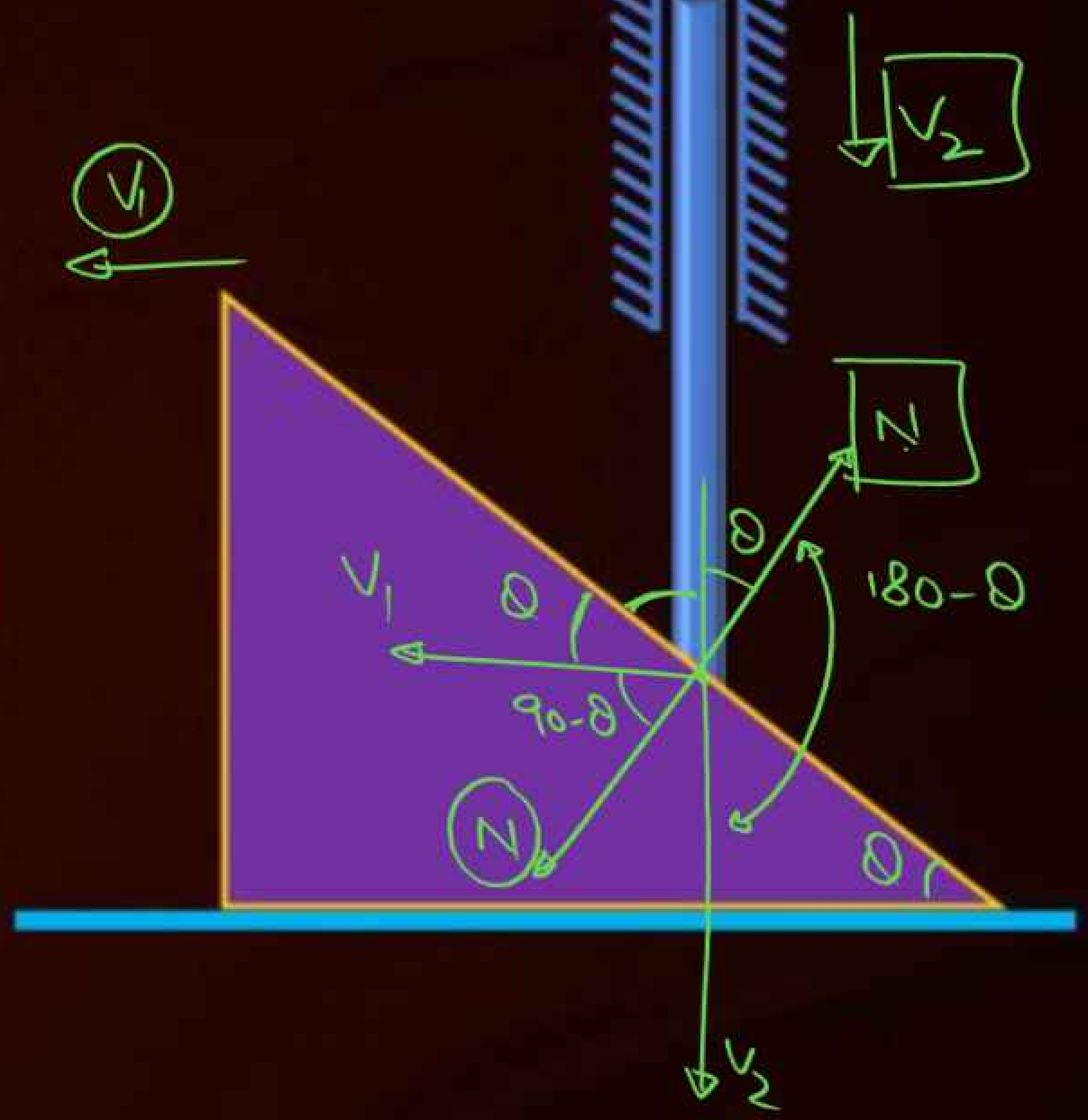
$$V_2 = V_1\tan\theta$$

$$a_2 = a_1\tan\theta$$



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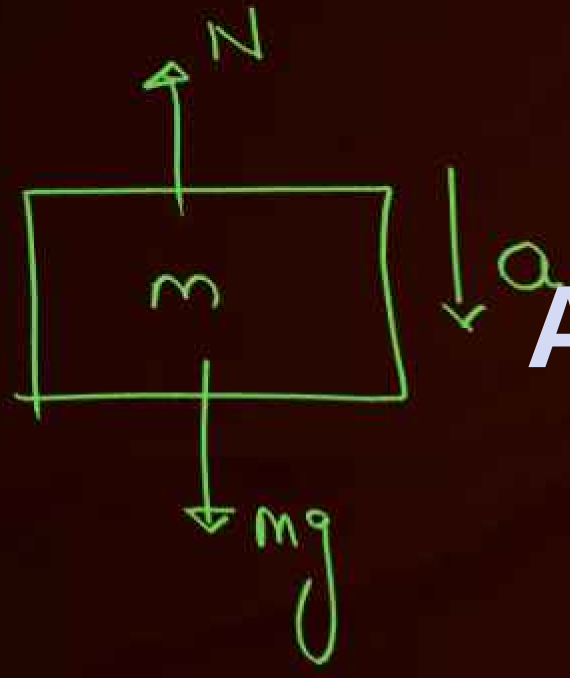
Question

A block of mass M placed inside a box descends vertically with acceleration '*a*'. The block exerts a force equal to one-fourth of its weight on the floor of the box. The value of '*a*' will be: **[29 June, 2022 (Shift-II)]**

1. $g/4$
2. $g/2$
3. $3g/4$
4. g



$mg - N = ma$

$mg - \frac{mg}{4} = ma$

$a = \frac{3g}{4}$

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Ans : (3)

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Question

Weight machine → Nor

A person standing on a balance inside a stationary lift measures 60 kg. The weight of that person if the lift descends with uniform downward acceleration of 1.8 m/s^2 will be ______ N. [$g = 10\ m/s^2$]. **[26 Feb, 2021 (Shift-I)]**

acc. = 0 $\quad N = mg = 60g \Rightarrow \underline{m = 60\,kg}$

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$60g - N = \underline{60a}$

$N = 600 - 60 \times 1.8$

Ans : (492)

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Question

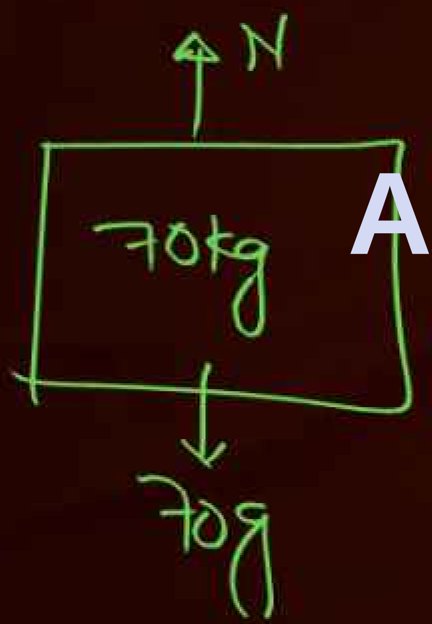
A steel block of 10 kg rests on a horizontal floor as shown. When three iron cylinders are placed on it as shown, the block and cylinders go down with an acceleration $0.2\ m/s^2$. The normal reaction R' by the floor if mass of the iron cylinders are equal and of 20 kg each, is ______ N. [Take $g = 10\ m/s^2$ and $\mu_s = 0.2$]. **[20 July, 2021 (Shift-I)]**

(1) 714

(2) 684

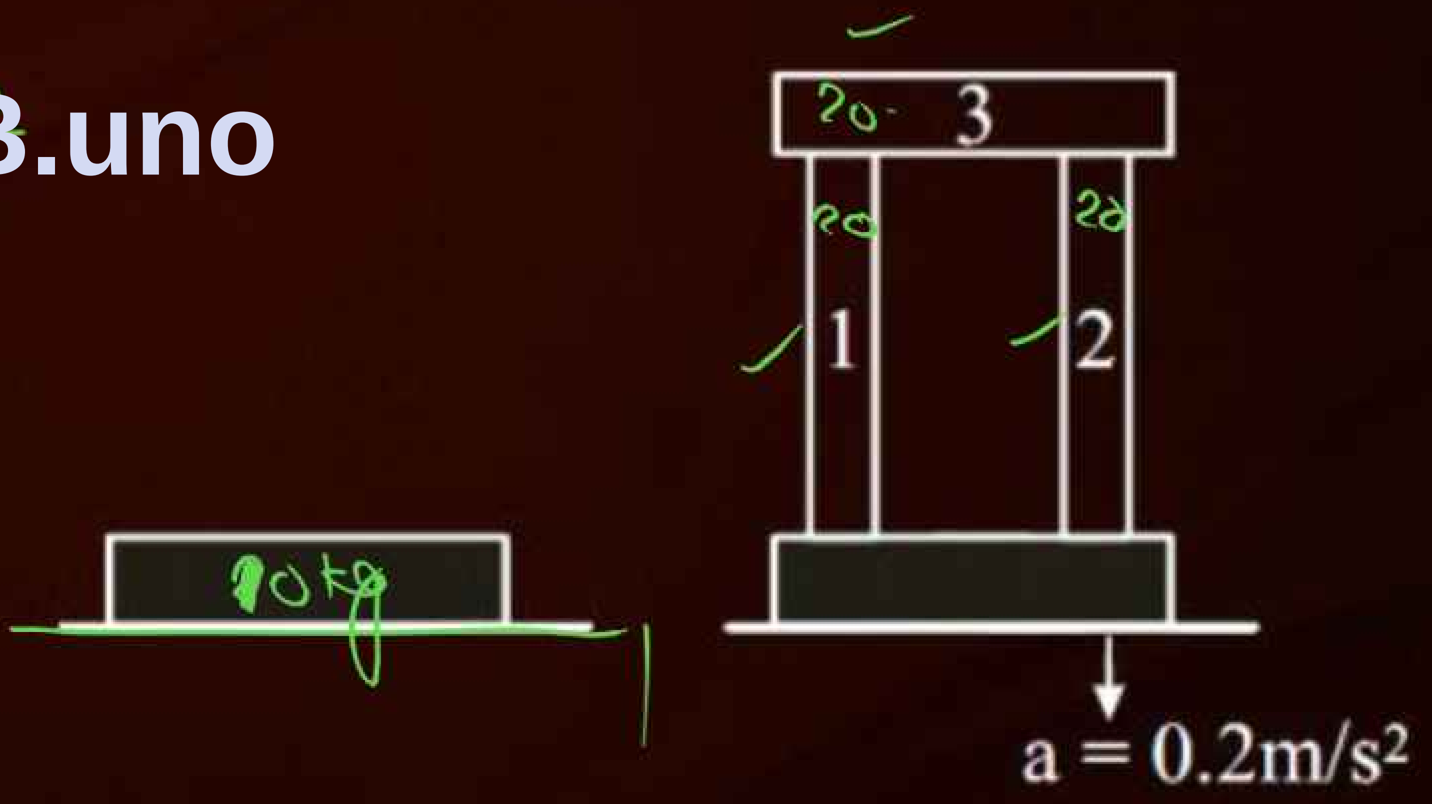
(3) 716

(4) 686



$700 - N = 70 \times .2$

$N = 700 - 14 = 686$



Ans : (4)

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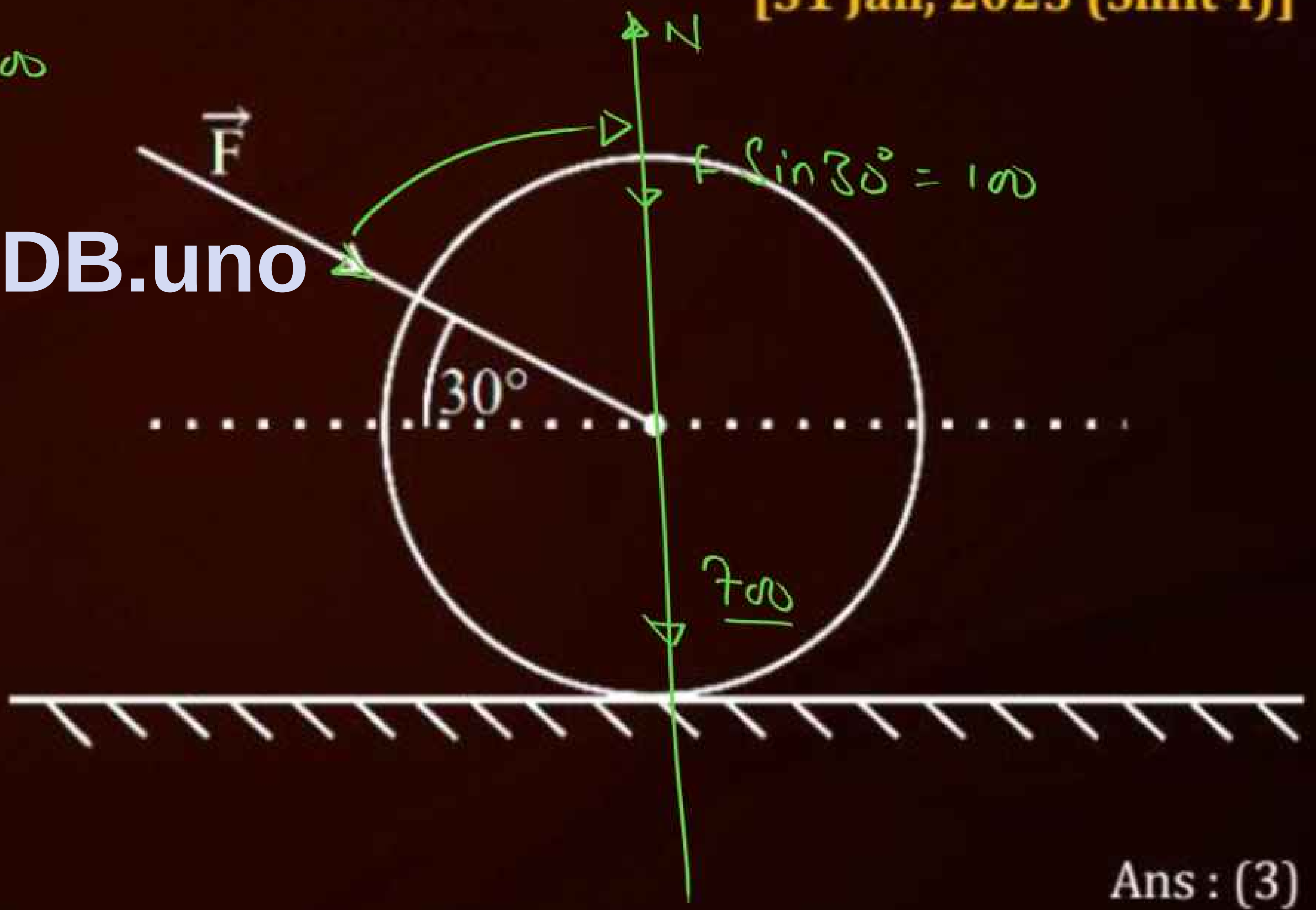
Question

As shown in figure, a 70 kg garden roller is pushed with a force of $\vec{F} = 200$ N at an angle of 30° with horizontal. The normal reaction on the roller is (Given $g = 10$ ms^{-2}).

[31 Jan, 2023 (Shift-I)]

$N = 100 + 700$



1. $800\sqrt{2}$ N
2. 600 N
3. 800 N
4. $200\sqrt{3}$ N

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Ans : (3)

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Question

A hanging mass M is connected to a four times bigger mass by using a string pulley arrangement, as shown in the figure. The bigger mass is placed on a horizontal ice-slab and being pulled by 2 Mg force. In this situation, tension in the string is $x/5$ Mg for x = ______. Neglect mass of the string and friction of the block (bigger mass) with ice slab.

[28 June, 2022 (Shift-I)]

$2Mg - T = 4Ma$

$T - Mg = Ma$

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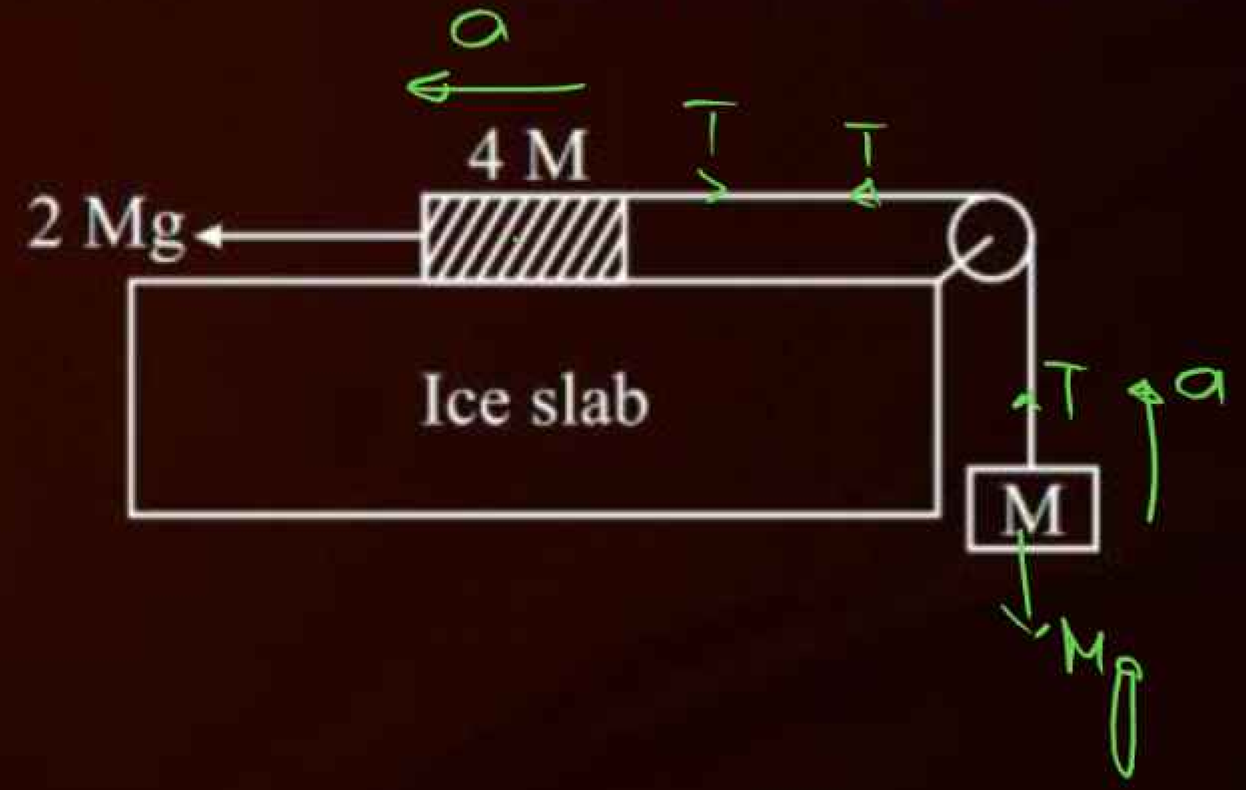
$a = g/5$

$T = \frac{6Mg}{5}$



Ans : (6)

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Question

A monkey of mass 50 kg climbs on a rope which can withstand the tension (T) of 350 N. If monkey initially climbs down with an acceleration of 4 m/s^2 and then climbs up with an acceleration of 5 m/s^2. Choose the correct option. (Take $g = 10\ ms^{-2}$)

[26 July, 2022 (Shift-I)]

1. T = 700 N while climbing upward
2. T = 350 N while going downward
3. Rope will break while climbing upward
4. Rope will break while going downward

$500 - T = 50 \times 4$

$T = 300N$

$T - 500 = 50 \times 4$

$T = 700$

> 350

Ans : (3)

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Question

$a = \left(\frac{L-2x}{L}\right) g = \frac{g}{2}$

$2L - 4\ell = L \Rightarrow \ell = L/4$

Let 1m chain $\rightarrow \lambda$ kg $= \frac{\ }{L}$

A uniform metal chain of mass m and length 'L' passes over a massless and frictionless pulley. It is released from rest with a part of its length 'ℓ' is hanging on one side and rest of its length '$L-\ell$' is hanging on the other side of the pully. At a certain point of time, when $\ell = \frac{L}{x}$ the acceleration of the chain is $\frac{g}{2}$. The value of x is ______.

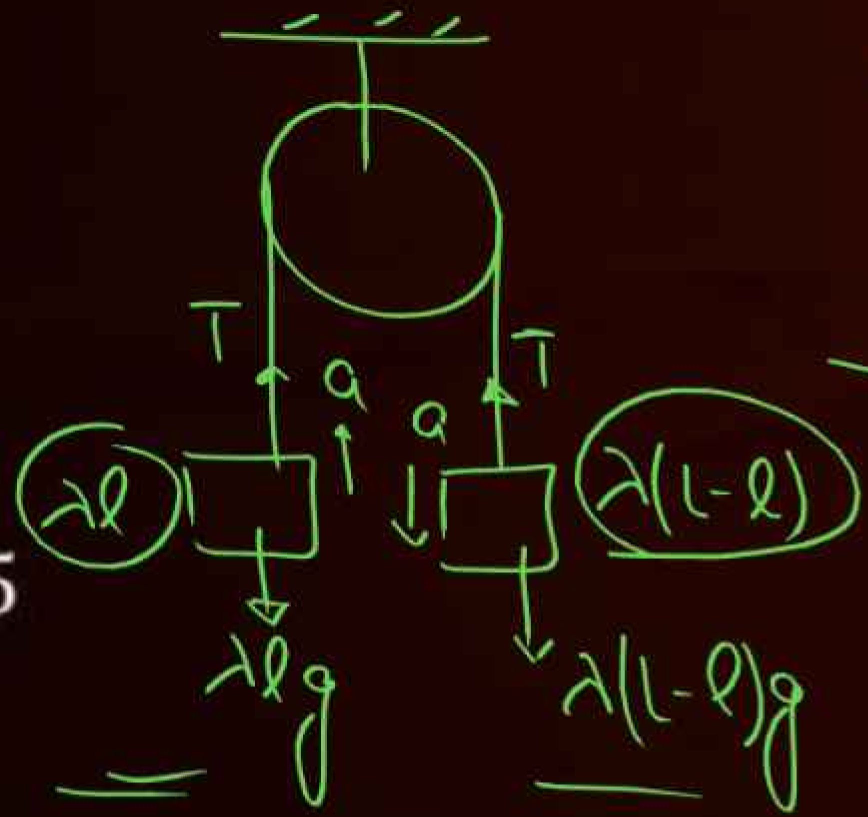
[28 July, 2022 (Shift-II)]

(1) 6

(2) 2

(3) 1.5

(4) 4



$\lambda(L-\ell)g - T = \lambda(L-\ell)a$

$T - \lambda\ell g = \lambda\ell a$

$\lambda(L-\ell-\ell)g = \lambda(L)a$

$a = \left(\frac{L-2\ell}{L}\right)g$

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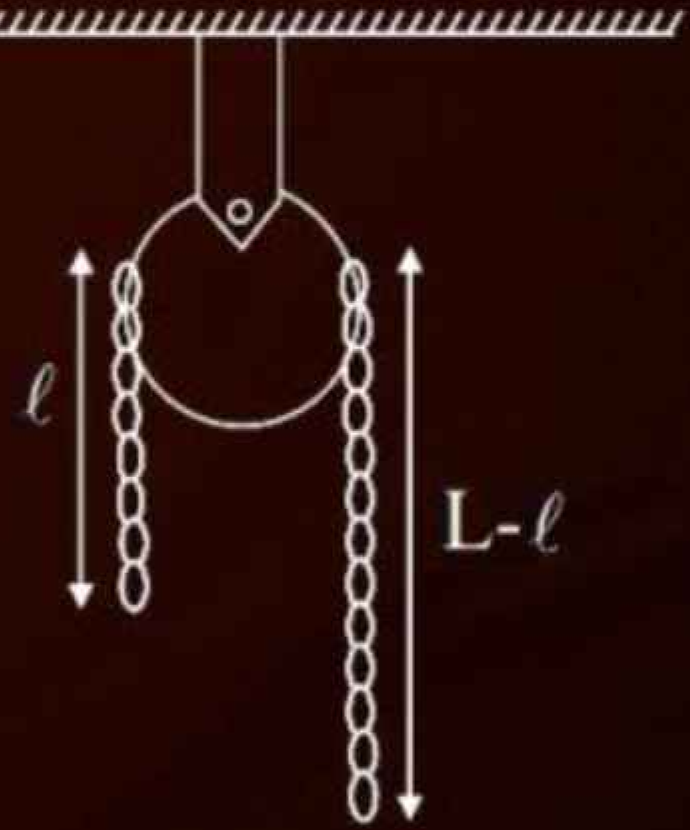

Ans : (4)

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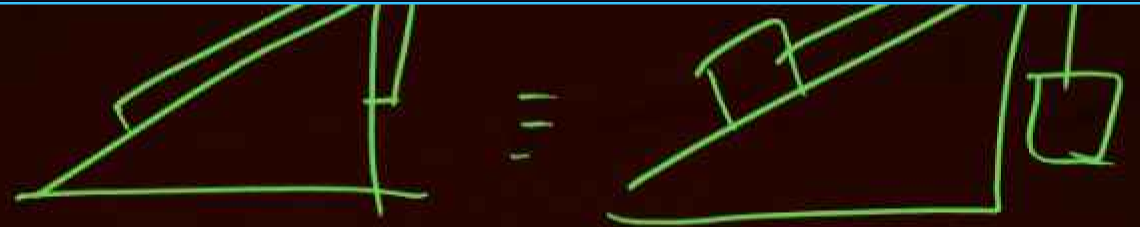
Question



Two bodies of masses $m_1 = 5$ kg and $m_2 = 3$ kg are connected by a light string going over a smooth light pulley on a smooth inclined plane as shown in the figure. The system is at rest. The force exerted by the inclined plane on the body of mass m_1 will be:
[Take $g = 10$ ms^{-2}]. **[29 July, 2022 (Shift-II)]**

$T = m_2 g = m_1 g \sin\theta \Rightarrow 3 = 5 \sin\theta \Rightarrow \underline{\theta = 37^\circ}$

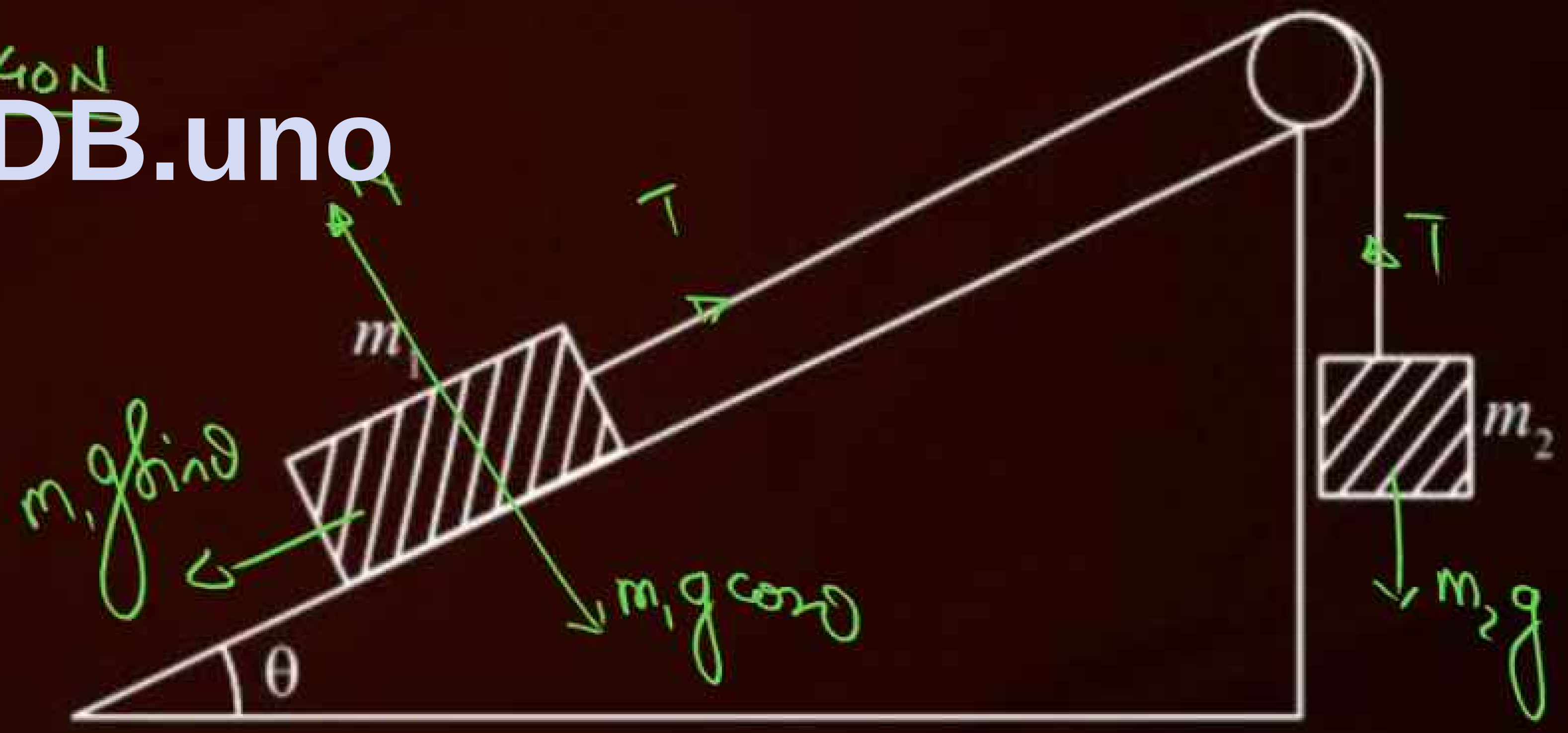
$N = 5g \cos 37^\circ = 40\text{N}$

(1) 30 N

(2) 40 N

(3) 50 N

(4) 60 N



Ans : (2)

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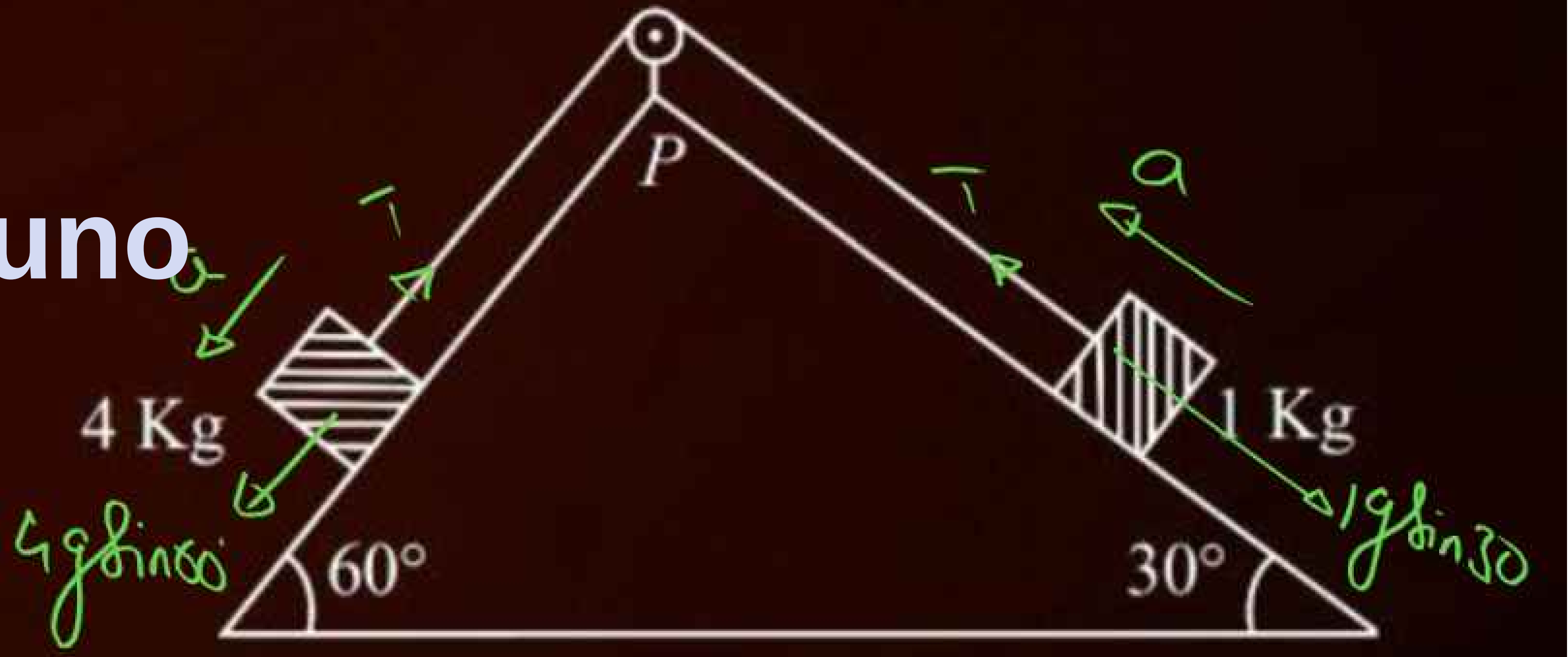
Question

As per given figure, a weightless pulley P is attached on a double inclined frictionless surface. The tension in the string (massless) will be (if $g = 10 \text{m/s}^2$) **[24 Jan, 2023 (Shift-I)]**

1. $(4\sqrt{3} + 1)$N
2. $(4(\sqrt{3} + 1)$N
3. $4(\sqrt{3} - 1)$N
4. $(4\sqrt{3} - 1)$N



Ans : (2)

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Question

Two masses M_1 and M_2 are tied together at the two ends of a light inextensible string that passes over a frictionless pulley. When the mass M_2 is twice that of M_1 the acceleration of the system is a_1. When the mass M_2 is thrice that of M_1. The acceleration of system is a_2. The ratio a_1/a_2 will be: [26 July, 2022 (Shift-II)]

$M_2 g - T = M_2 a$

$T - M_1 g = M_1 a$

$\Rightarrow a = \left(\frac{M_2 - M_1}{M_2 + M_1}\right) g$

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(1) 1/3

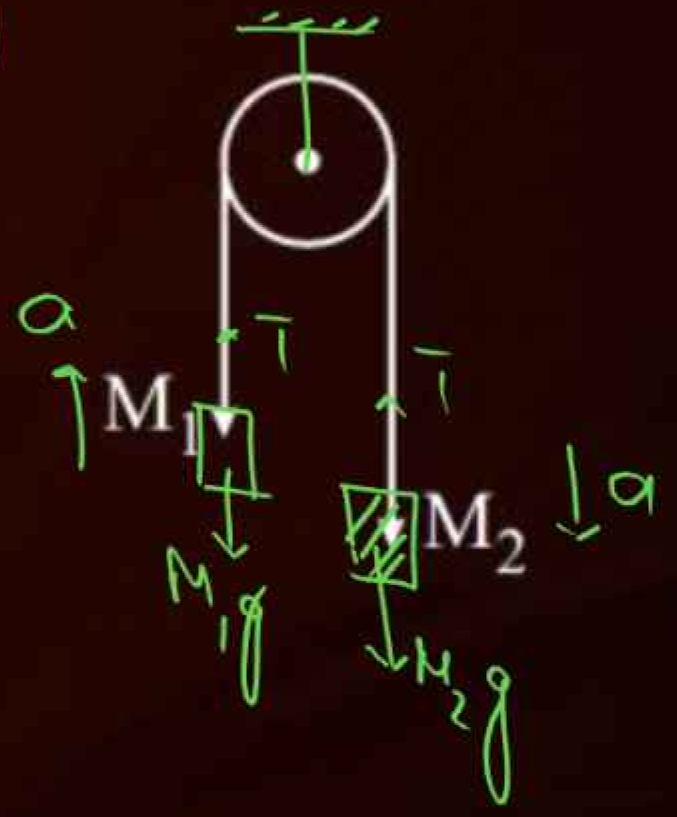
(2) 2/3

(3) 3/2

(4) 1/2

$a_1 = \left(\frac{2M_1 - M_1}{2M_1 + M_1}\right) g = g/3$

$a_2 = \left(\frac{3M_1 - M_1}{3M_1 + M_1}\right) g = g/2$



Ans : (2)

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Question

$S = ut + \frac{1}{2}at^2 \Rightarrow \frac{1}{5} = \frac{1}{2} \times \frac{5}{2}t^2$

$\Rightarrow t = \frac{2}{5}\,sec = 0.4\,sec$

The boxes of masses 2 kg and 8 kg are connected by a massless string passing over smooth pulleys. Calculate the time taken by box of mass 8 kg to strike the ground starting from rest. (use $g = 10\ \mathrm{m/s^2}$). **[27 Aug, 2021 (Shift-II)]**

$-Ta_2 - Ta_2 + Ta_1 = 0$

$a_1 = 2a_2$

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$T - 20 = 2a_1 = 4a_2 \quad -(i)$

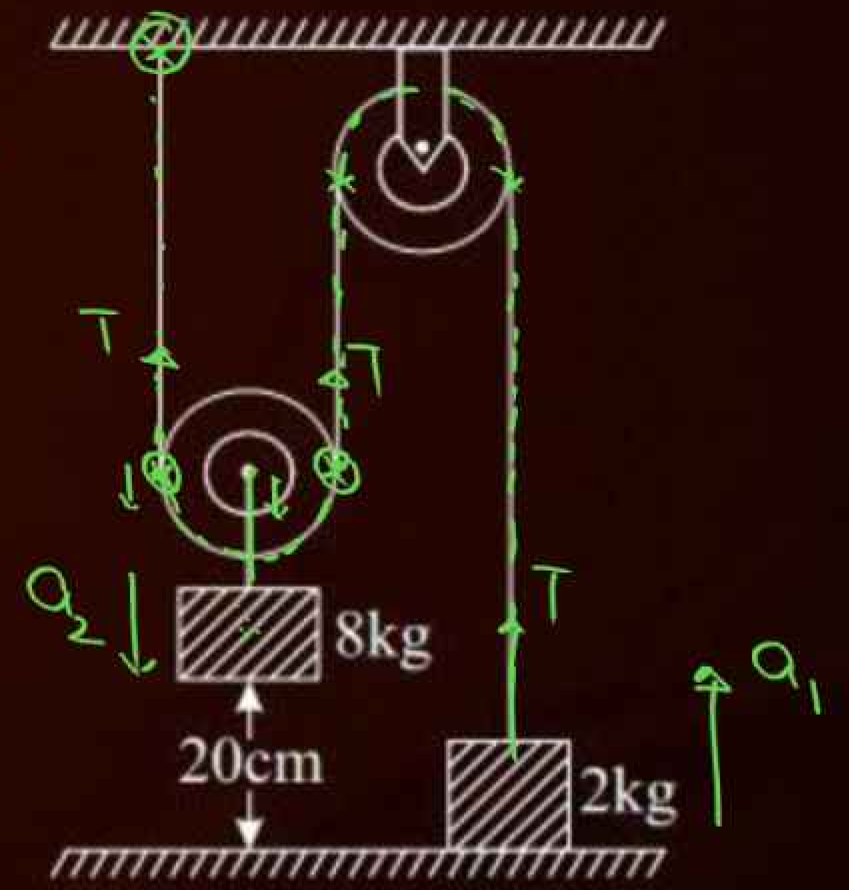
$80 - 2T = 8a_2$

$\Rightarrow 40 - T = 4a_2 \quad -(ii)$

$20 = 8a_2 \Rightarrow a_2 = 5/2$

2T

80



(1) 0.25 s

(2) 0.4 s

(3) 0.34 s

(4) 0.2 s

Ans : (2)

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Friction

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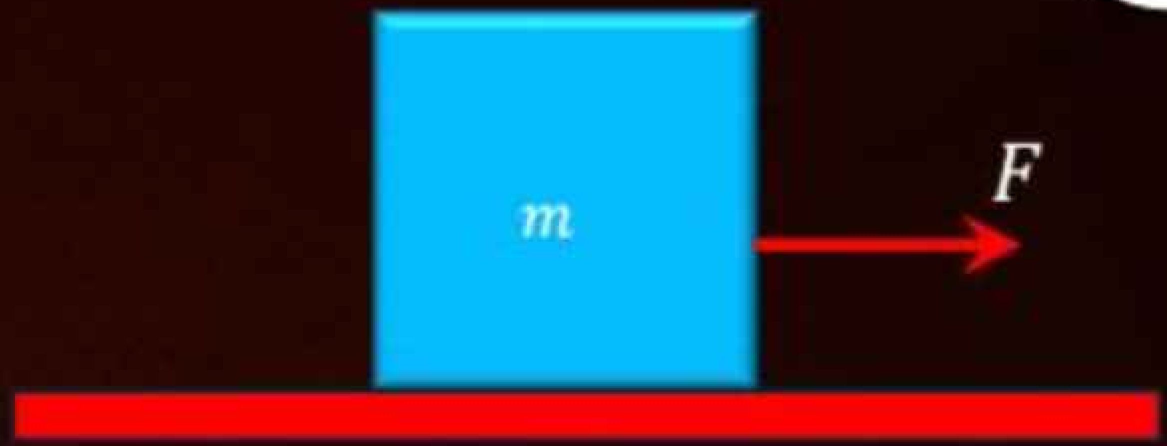
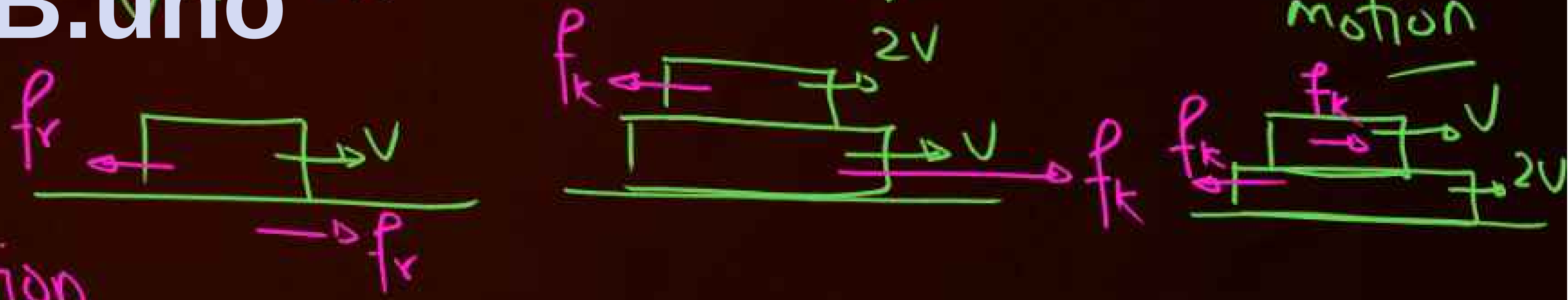
friction always oppose relative motion of ~~at~~ Contact points or tendancy of relative motion ~~at~~ of Contact points



Relative motion → kinetic friction $f_k = \mu_k N$ dir^n opposite to relative motion



Relative motion नहीं → Static friction
(tendancy है)

$0 \le f_s \le \mu_s N$ dir^n → opposite of tendancy

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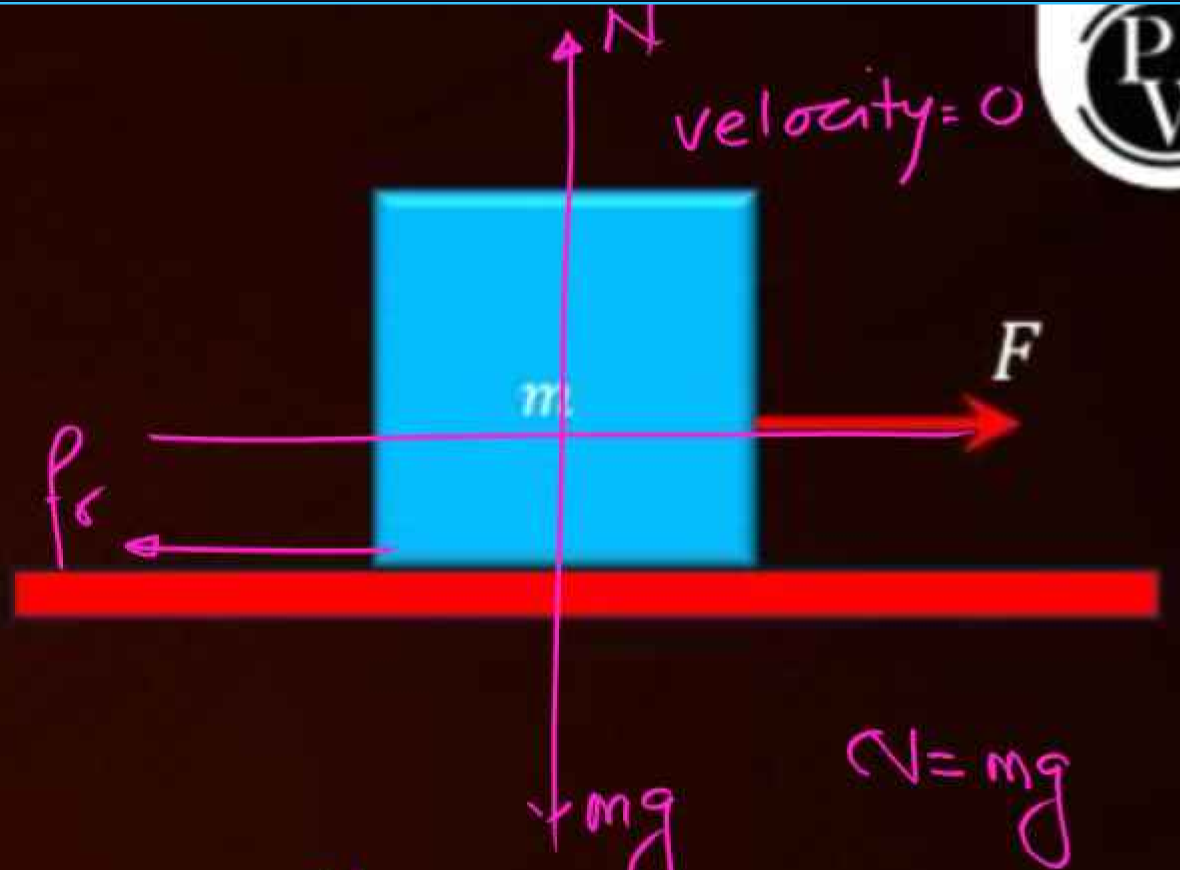
velocity = 0



$N = mg$

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if $F < f_s)_{max} = \mu_s mg$

then $f_r = F$ (Static) (block will not Slide)

if $F > f_s)_{max}$

then $f_r = \mu_k mg$ (kinetic) block will slide

$$\left(\frac{F - \mu_k mg}{m} = a\right)$$

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mistake → $\cancel{N = mg}$

$\cancel{f_s)_{max} = \mu mg}$

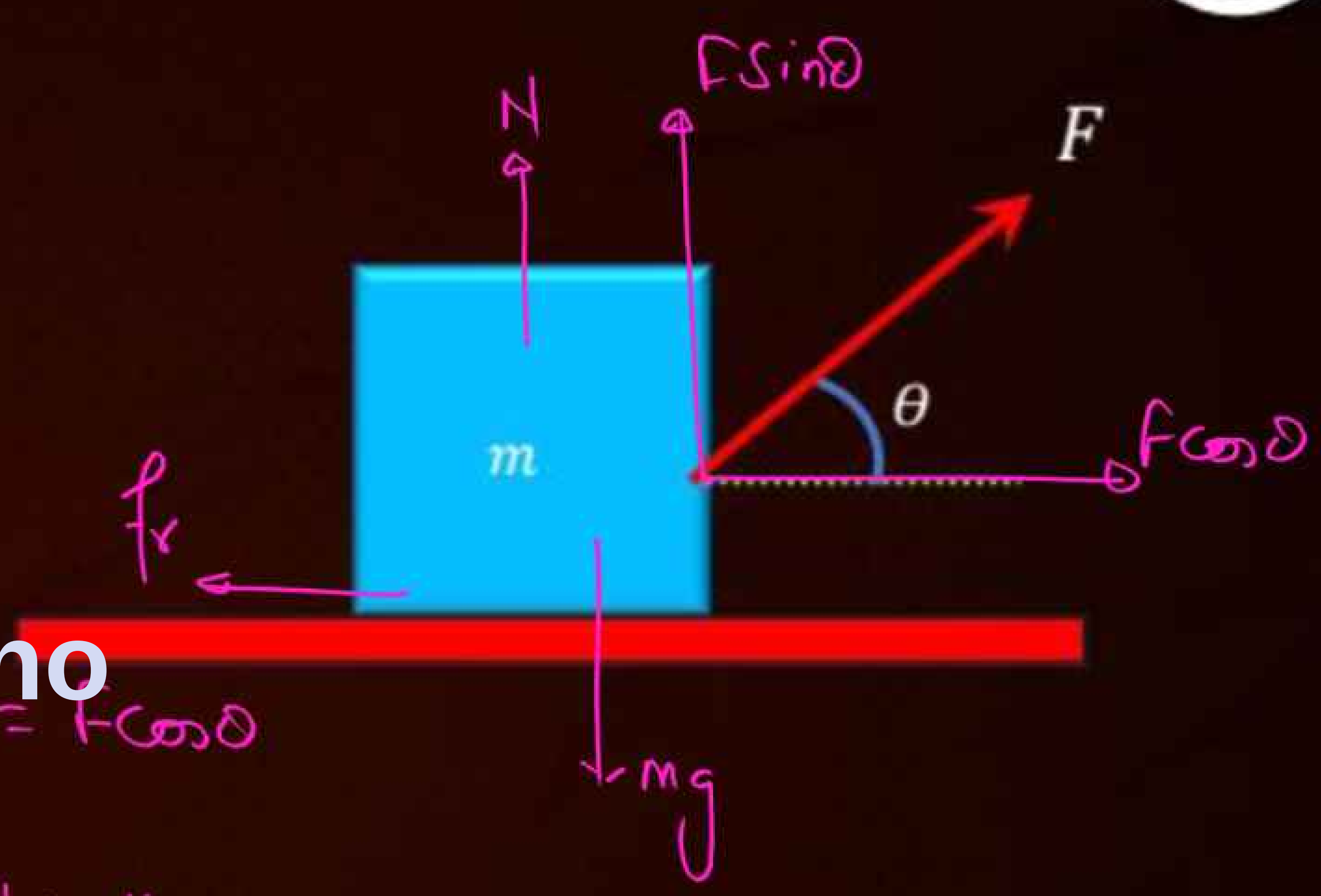
$N + F\sin\theta = mg \Rightarrow N = mg - F\sin\theta$

$f_r)_{max} = \underline{\mu(mg - F\sin\theta)}$

if $F\cos\theta < f)_{max}$ block will not slide $f_r = F\cos\theta$

if $F\cos\theta > f)_{max}$ block will slide $f_r \rightarrow$ kinetic

$f_r = \mu_k(mg - F\sin\theta)$



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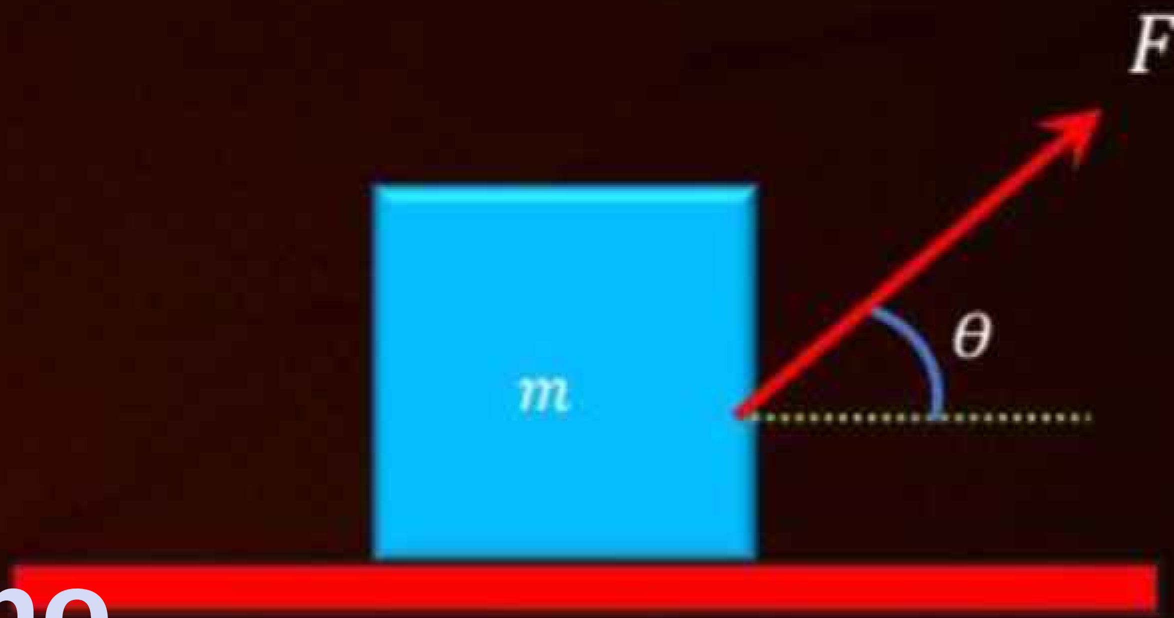

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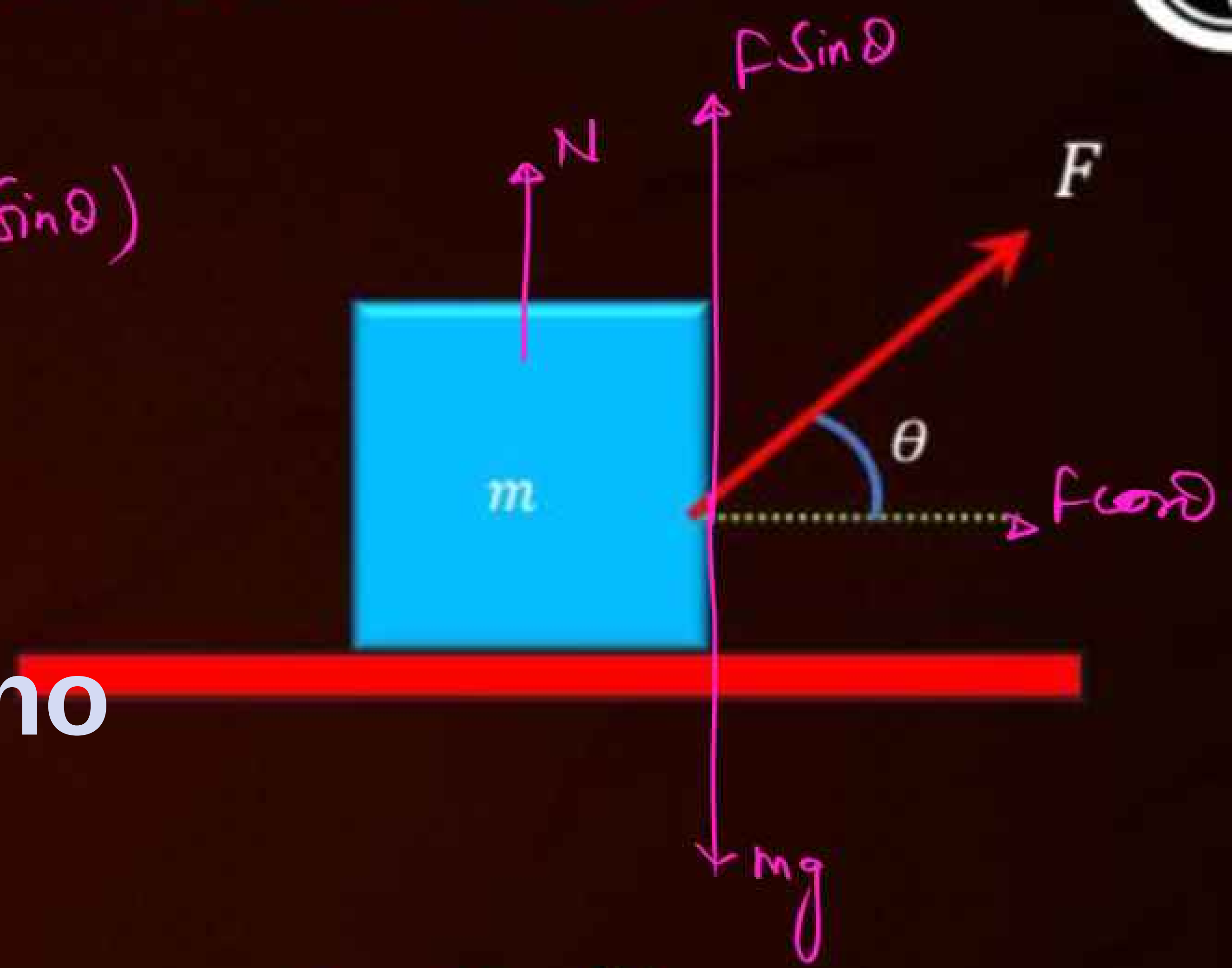
Minimum Force to slide block

Condition for just Slipping

$$F\cos\theta = f_s\big)_{max} = \mu_s(mg - F\sin\theta)$$



$$F = \frac{\mu_s mg}{\cos\theta + \mu\sin\theta}$$

θ → adjust ** $\boxed{F_{min.} = \frac{\mu_s mg}{\sqrt{1+\mu^2}}}$ $\boxed{\tan\theta = \mu}$

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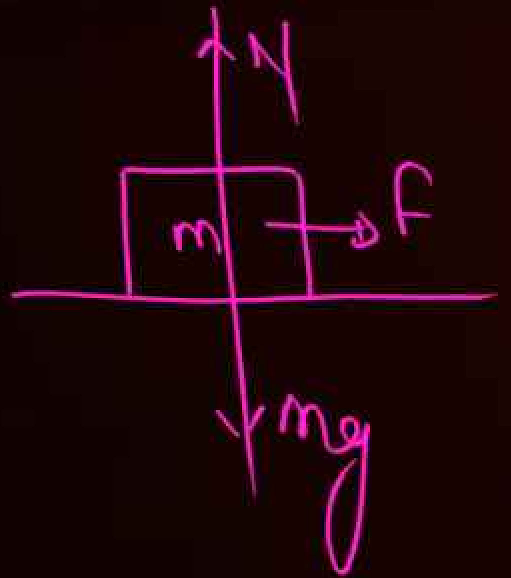
$N = mg - F\sin\theta$

$f_r\big)_{max} = \mu_s(mg - F\sin\theta)$



min^m horizontal force to slide the block $= \mu_s mg$

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Question

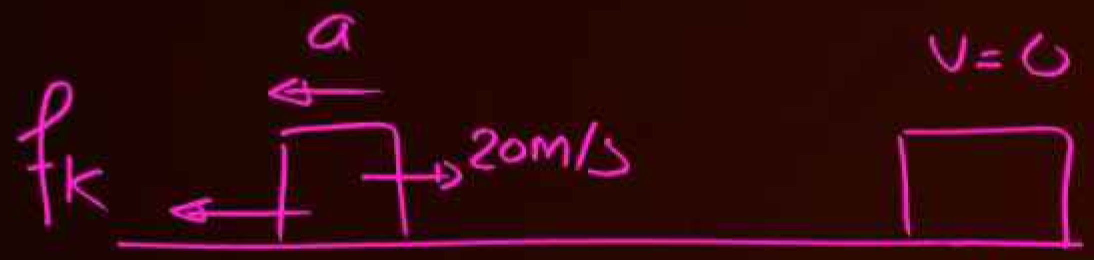
A body of mass 10 kg is moving with an initial speed of 20 m/s. The body stops after 5 s due to friction between body and the floor. The value of the coefficient of friction is: (Take acceleration due to gravity $g = 10\ ms^{-2}$) **[31 Jan, 2023 (Shift-II)]**

(1) 0.2

(2) 0.3

(3) 0.5

(4) 0.4



$V = u + at$

$0 = 20 - (10\mu_k)(5)$

$\Rightarrow \underline{0.4}$

$f_k = \mu_k mg$

$a = \mu_k g = 10\mu_k$

Ans : (4)

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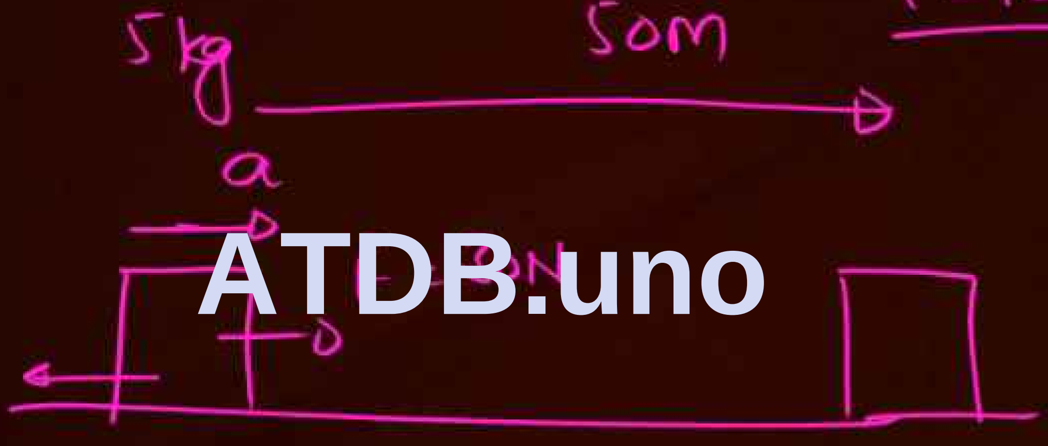
Question

$\frac{30-50\mu}{5} = 6-10\mu$

$\frac{1}{2} \times (6-10\mu)(100) = 50$

A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30 N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10 s. Coefficient of kinetic friction is (given, $g = 10\ ms^{-2}$):

[1 Feb, 2023 (Shift-1)]



(1) 0.60

(2) 0.75

(3) 0.50

(4) 0.25

$50\mu = f_k$

$a = \frac{30-50\mu}{5} = 6-10\mu$

$S = \frac{1}{2}at^2$

$50 = \frac{1}{2}(6-10\mu)(100)$

$\mu = 0.6$

Ans : (3)

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Question

A block of mass 10 kg, starts sliding on a surface with an initial velocity of 9.8 ms^{-1}. The coefficient of friction between the surface and block is 0.5. The distance covered by the block before coming to rest is: [Used $g = 9.8\ ms^{-2}$] **[24 June, 2022 (Shift-I)]**

1. 4.9 m
2. 9.8 m
3. 12.5 m
4. 19.6 m

Ans : (2)

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Question

$400 \times .02$

A block of mass 40 kg slides over a surface, when a mass of 4 kg is suspended through an inextensible massless string passing over frictionless pulley as shown below.
The coefficient of kinetic friction between the surface and block is 0.02. The acceleration of block is. (given $g = 10\ ms^{-2}$)

[29 June, 2022 (Shift-II)]

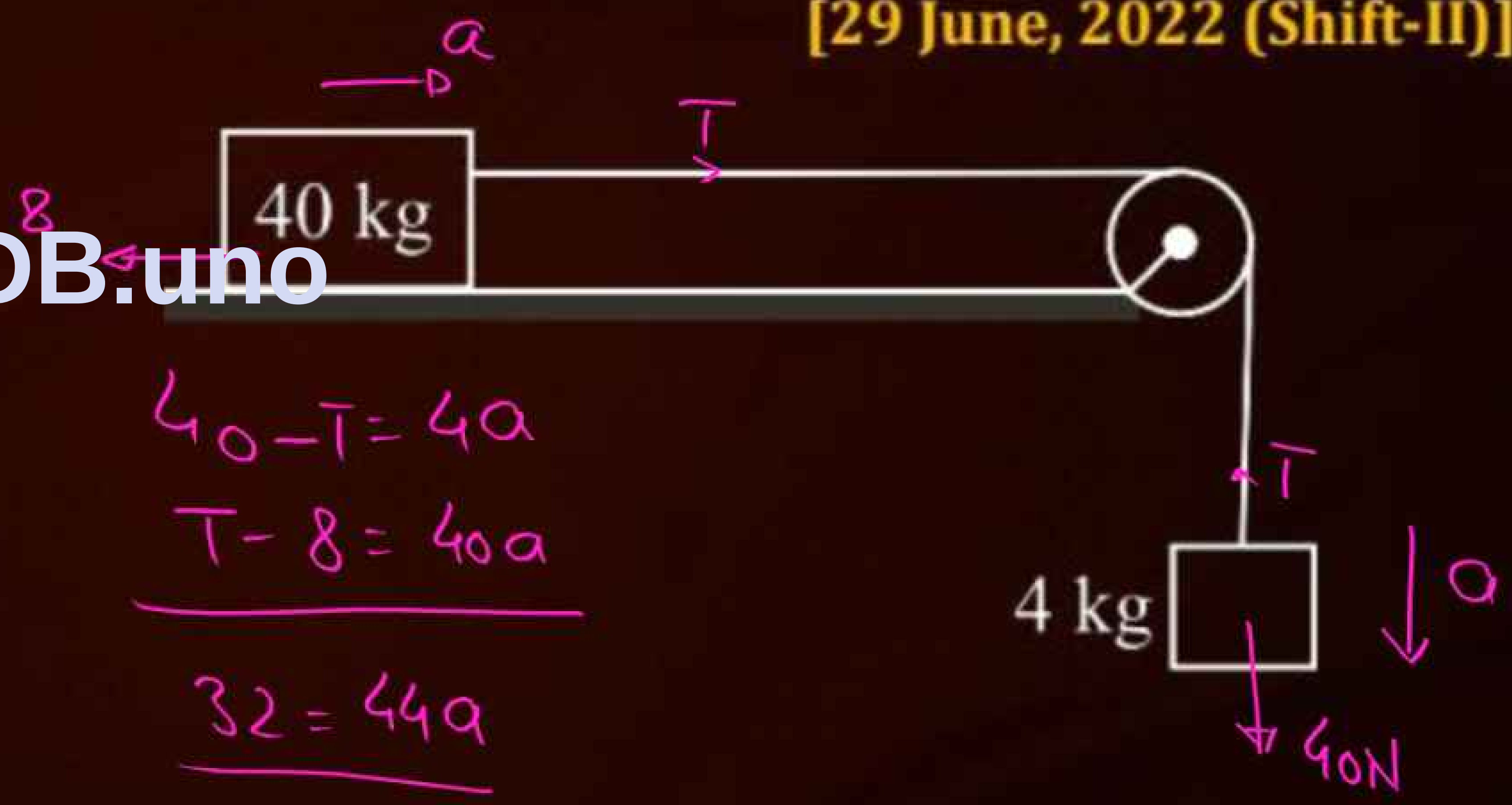
(1) $1\ ms^{-2}$

(2) $1/5\ ms^{-2}$

(3) $4/5\ ms^{-2}$

(4) $8/11\ ms^{-2}$

$a = \frac{8}{11}$



$40 - T = 4a$

$T - 8 = 40a$

$32 = 44a$

Ans : (4)

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Question

As shown in the figure a block of mass 10 kg lying on a horizontal surface is pulled by a force F acting at an angle 30°, with horizontal. For $\mu_s = 0.25$, the block will just start to move for the value of F : [Given $g = 10ms^{-2}$] **[1 Feb, 2023 (Shift-II)]**

(1) 33.3 N

(2) 25.2 N

(3) 20 N

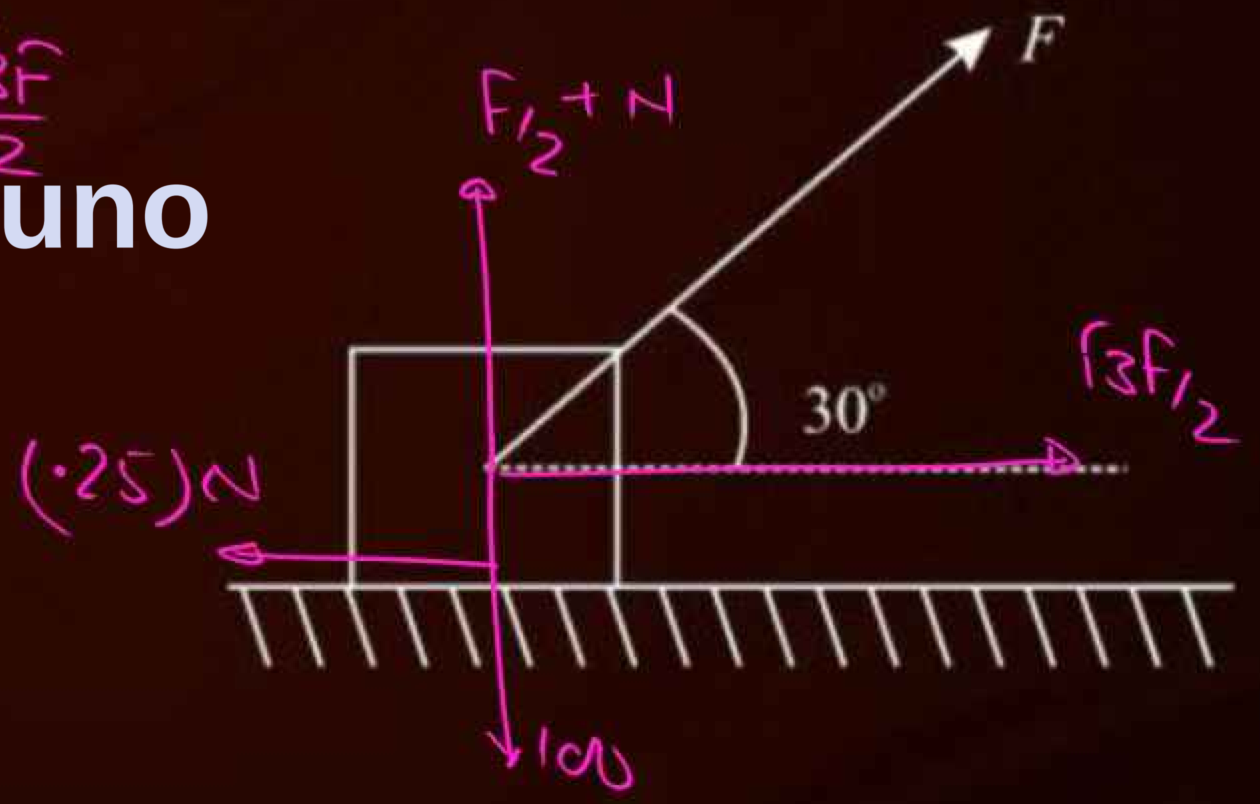
(4) 35.7 N

$N = 100 - F/2$

$.25N = \frac{1}{4}\left(100 - \frac{F}{2}\right) = \frac{\sqrt{3}F}{2}$

$25 = \frac{F}{8}\left[4\sqrt{3} + 1\right]$

$\frac{200}{4\sqrt{3}+1}$



Ans : (2)

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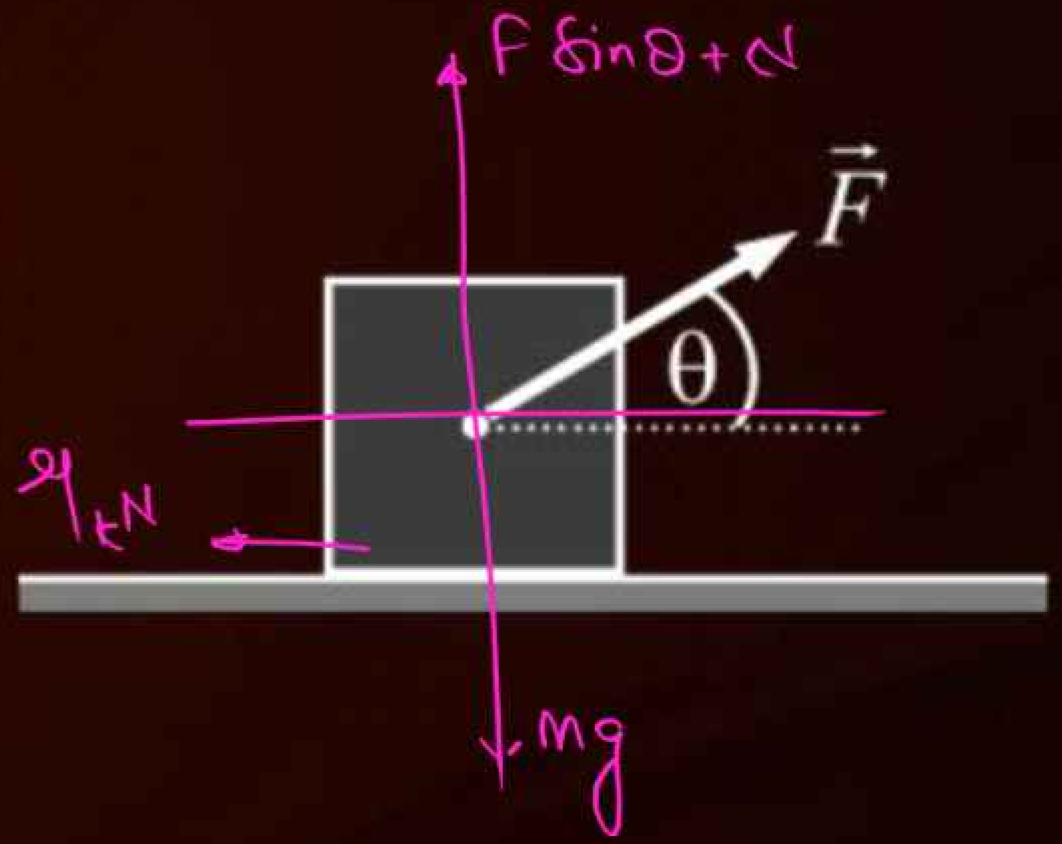
Question

A block of mass m slides along a floor while a force of magnitude F is applied to it at an angle θ as shown in figure. The coefficient of kinetic is μ_K. Then, the block's acceleration 'a' is given by:

(g is acceleration due to gravity)

$a = \frac{F\cos\theta - \mu_k N}{m}$

[16 March, 2021 (Shift-I)]



(1) $\frac{F}{m}\cos\theta + \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

(2) $\frac{F}{m}\cos\theta + \mu_K\left(g + \frac{F}{m}\sin\theta\right)$

(3) $\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

(4) $-\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

Ans : (3)

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Question

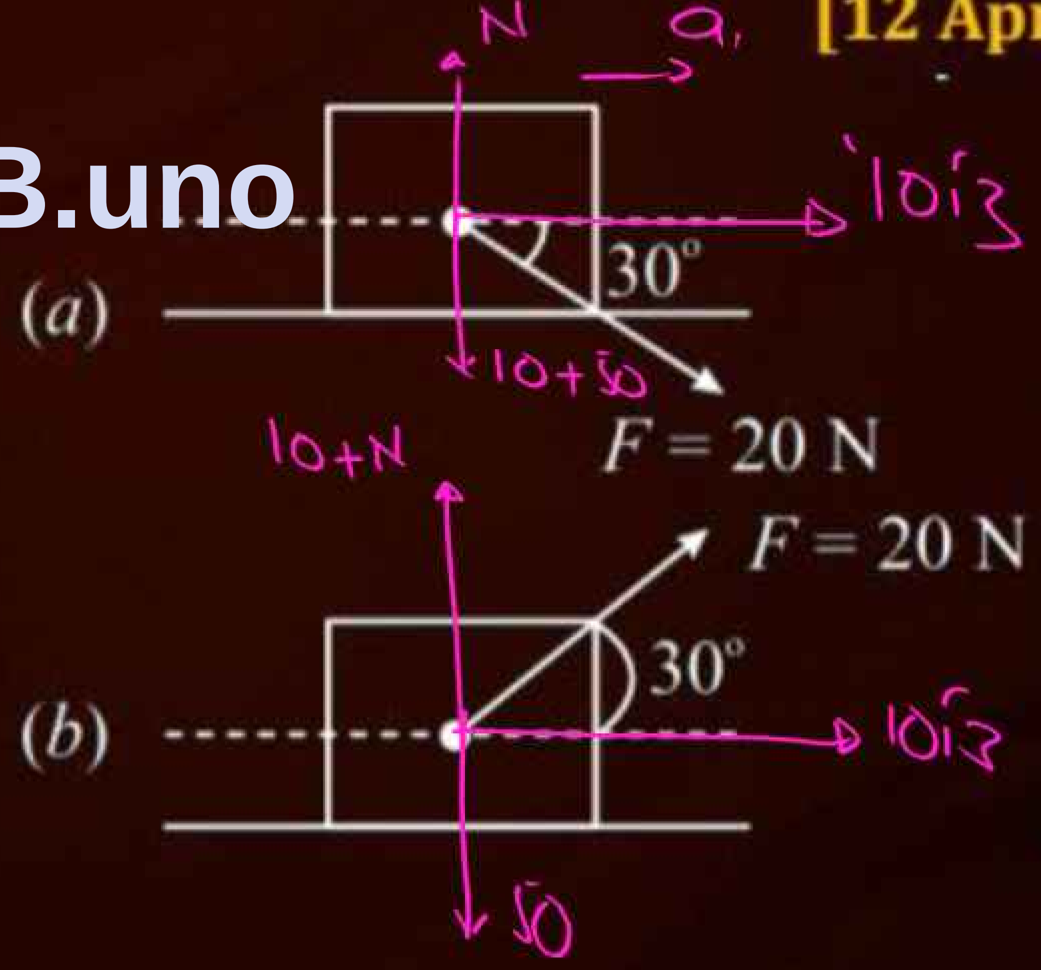
A block of mass 5 kg is (i) pushed in case (a) and (ii) pulled in case (b). by a force F = 20 N. Making an angle of 30° with the horizontal, as shown in the figures. The coefficient of friction between the block and floor is m = 0.2. The difference between the accelerations of the block, in case (b) and case (a) will be: ($g = 10\ ms^{-2}$)

[12 April, 2019 (Shift-II)]

1. $0\ ms^{-2}$
2. $0.8\ ms^{-2}$
3. $0.4\ ms^{-2}$
4. $3.2\ ms^{-2}$

$a_1 = \frac{10\sqrt{3} - 12}{5}$

$a_2 = \frac{10\sqrt{3} - 8}{5}$



$N = 60$

$f_k = 60 \times .2 = 12$

$N = 40$

$f_k = 8$

Ans : (2)

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Question

A body of mass 1 kg rests on a horizontal floor with which it has a coefficient of static friction $\frac{1}{\sqrt{3}}$. It is desired to make the body move by applying the minimum possible force F (in N). The value of F will be ______. (Round off to the Nearest Integer)
[Take $g = 10\ \text{ms}^{-2}$]

[17 March, 2021 (Shift-II)]

$$\frac{\mu mg}{\sqrt{1+\mu^2}} = \frac{\frac{1}{\sqrt{3}} 10}{\sqrt{1+\frac{1}{3}}} = 5$$

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Ans : (5)

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Not Sliding on inclined

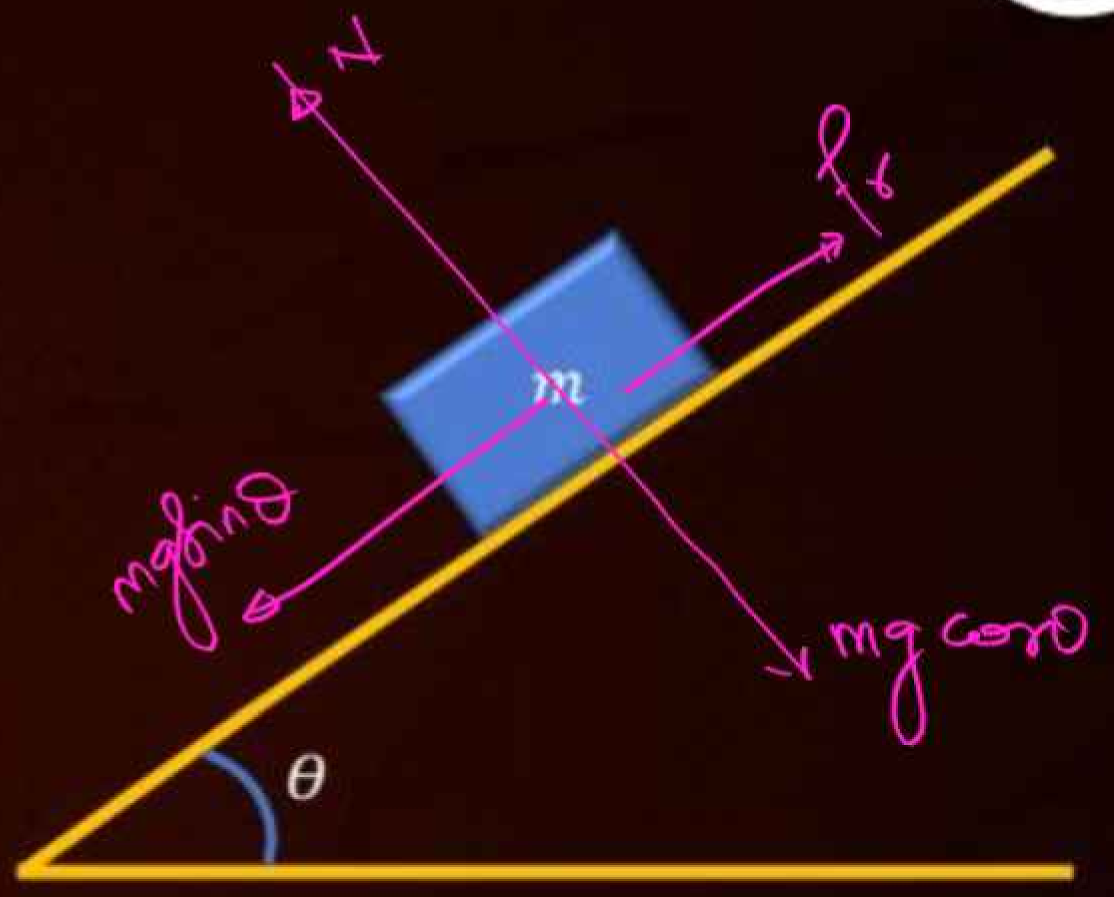
$N = mg\cos\theta$

not slide $\quad mg\sin\theta < f_s)_{max}$

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

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

$f_r = mg\sin\theta$



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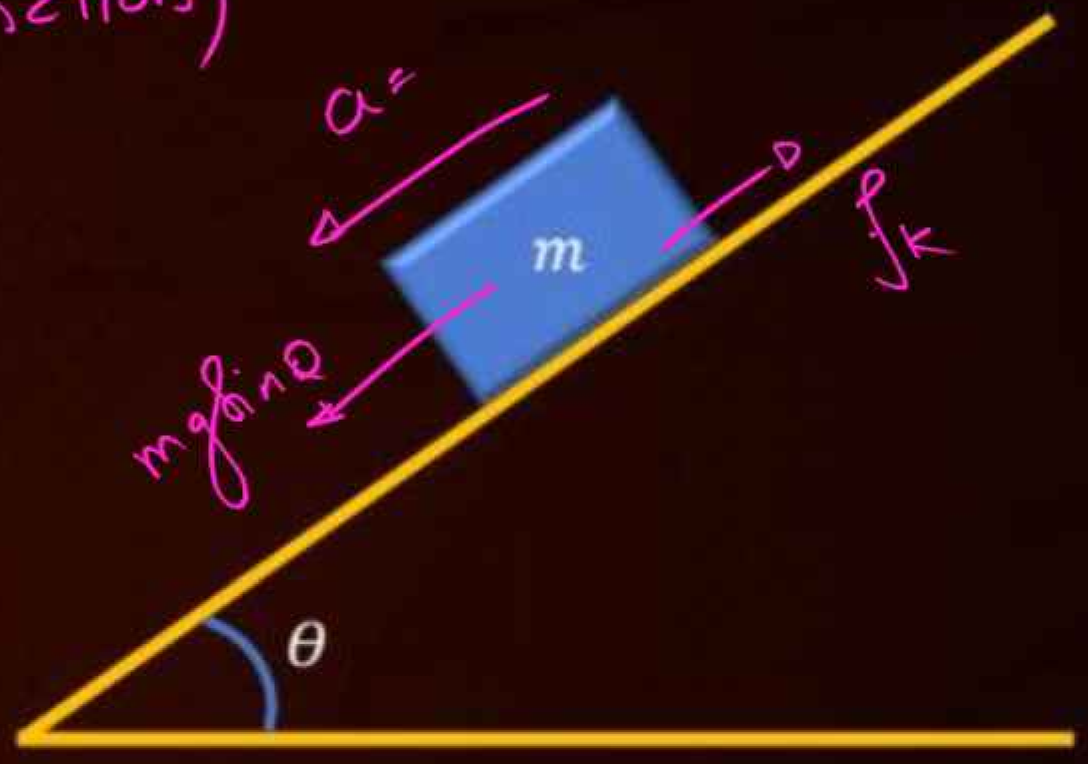
Sliding

if $mg\sin\theta > \mu_s mg\cos\theta \Rightarrow \tan\theta = \mu_s$

$f_r = \mu_k mg\cos\theta$ (kinetic friction)



$$a = \frac{mg\sin\theta - \mu_k mg\cos\theta}{m}$$

$$= g(\sin\theta - \mu_k\cos\theta)$$

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Angle of repose

$\tan\theta < \mu_s$ not Slide

$\tan\theta > \mu_s$ slide

$\boxed{\tan\theta = \mu_s}$

angle of repose

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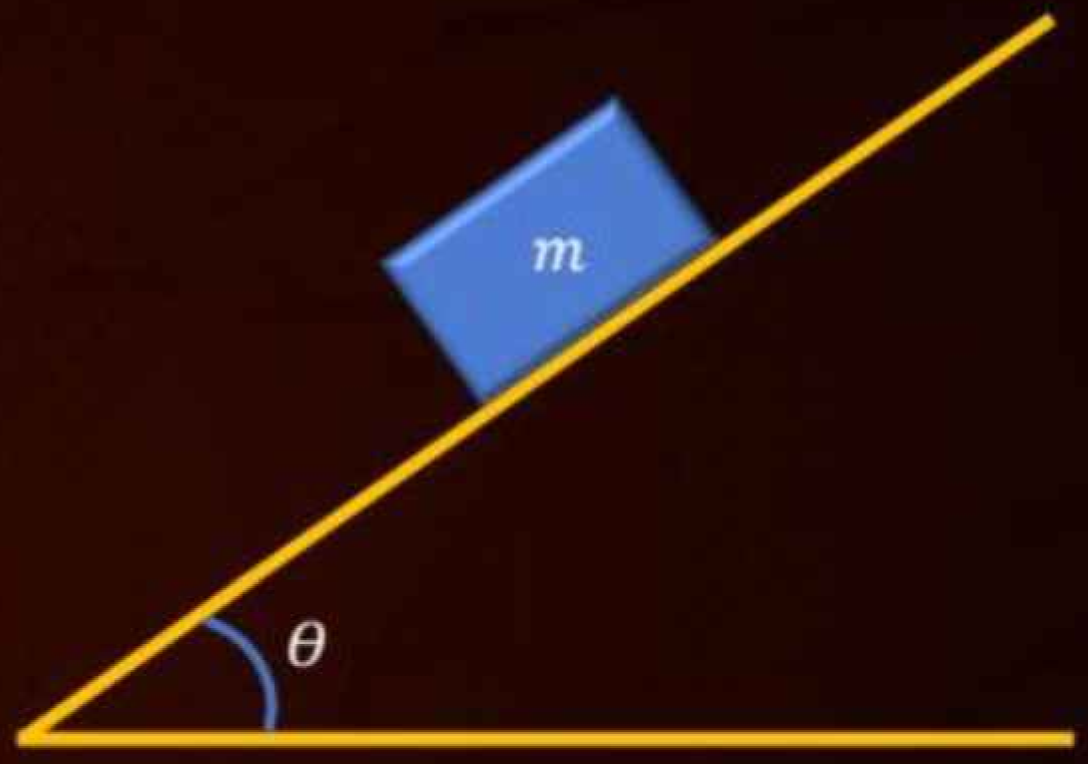

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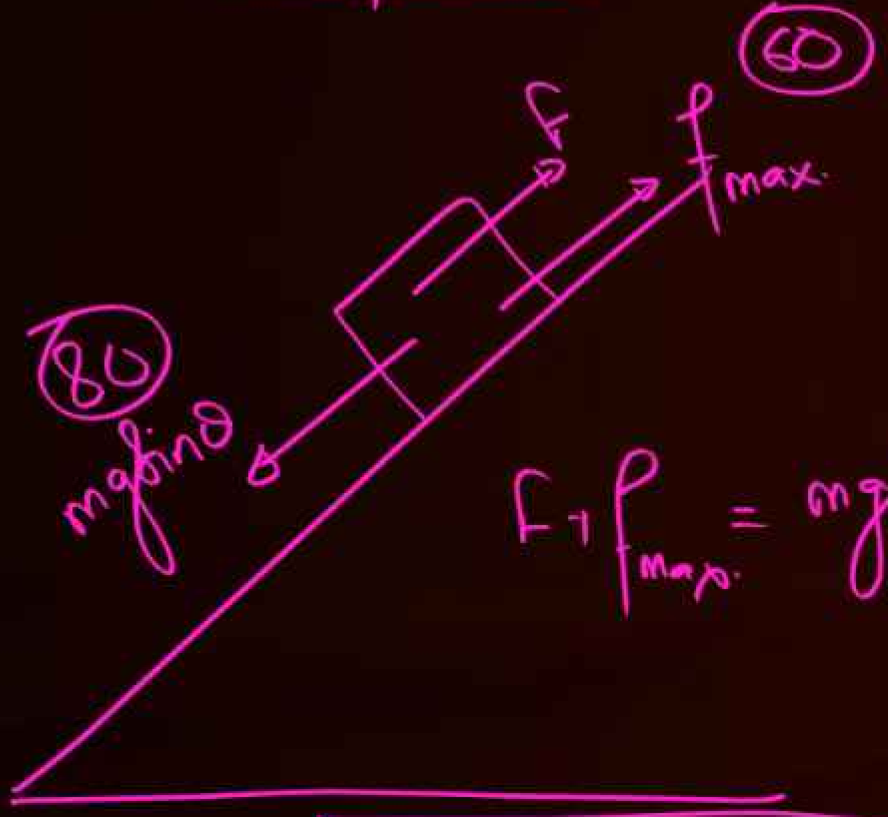
Minimum and Maximum force $(\tan\theta > \mu)$

for which block remain at rest

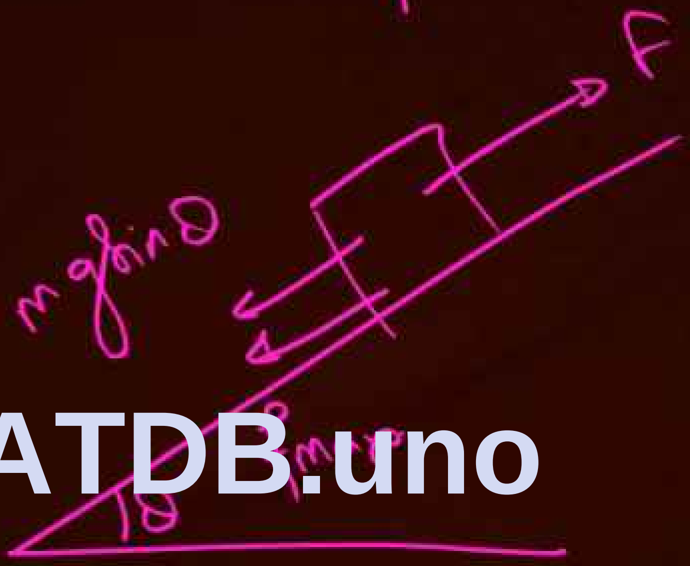
minimum force

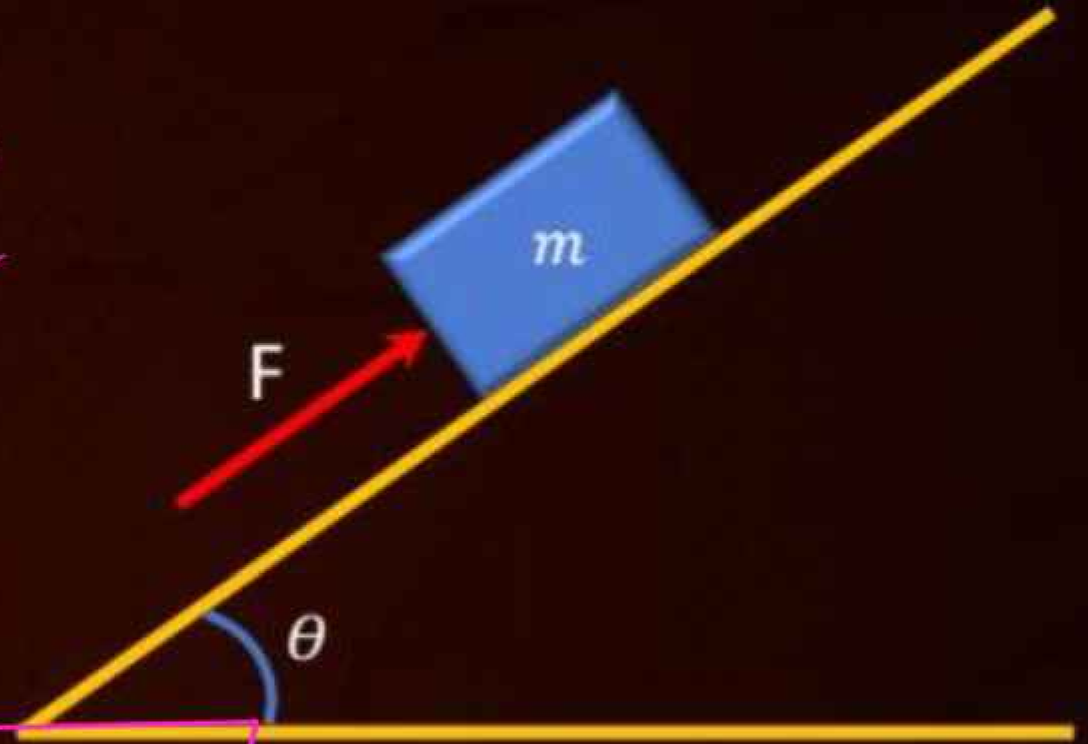


$F + f_{max.} = mg\sin\theta$

★★ $\boxed{F_{min.} = mg\sin\theta - \mu mg\cos\theta}$

maximum force





$\boxed{F_{max} = mg\sin\theta + \mu mg\cos\theta}$

$F_{min} < F < F_{max} \rightarrow$ Static

block will not move

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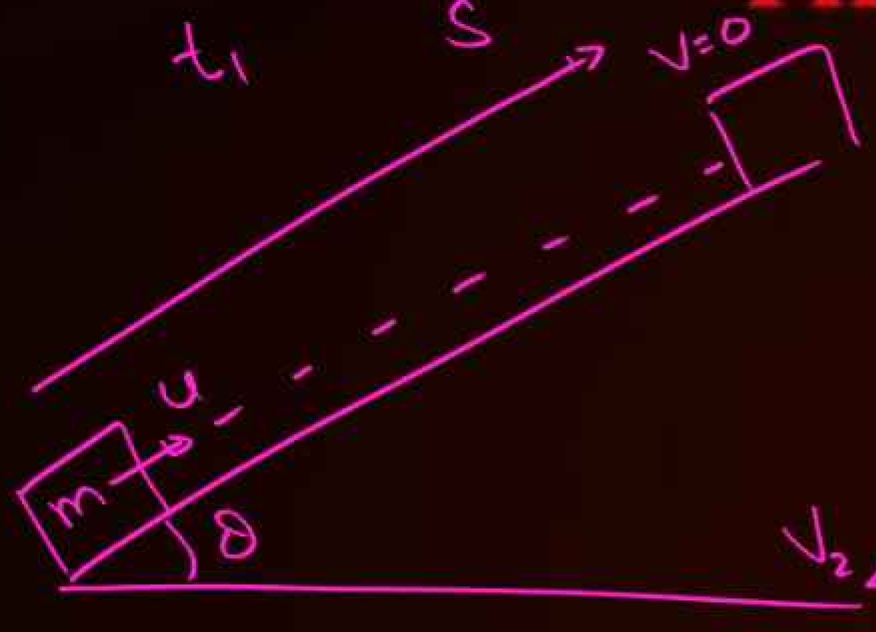
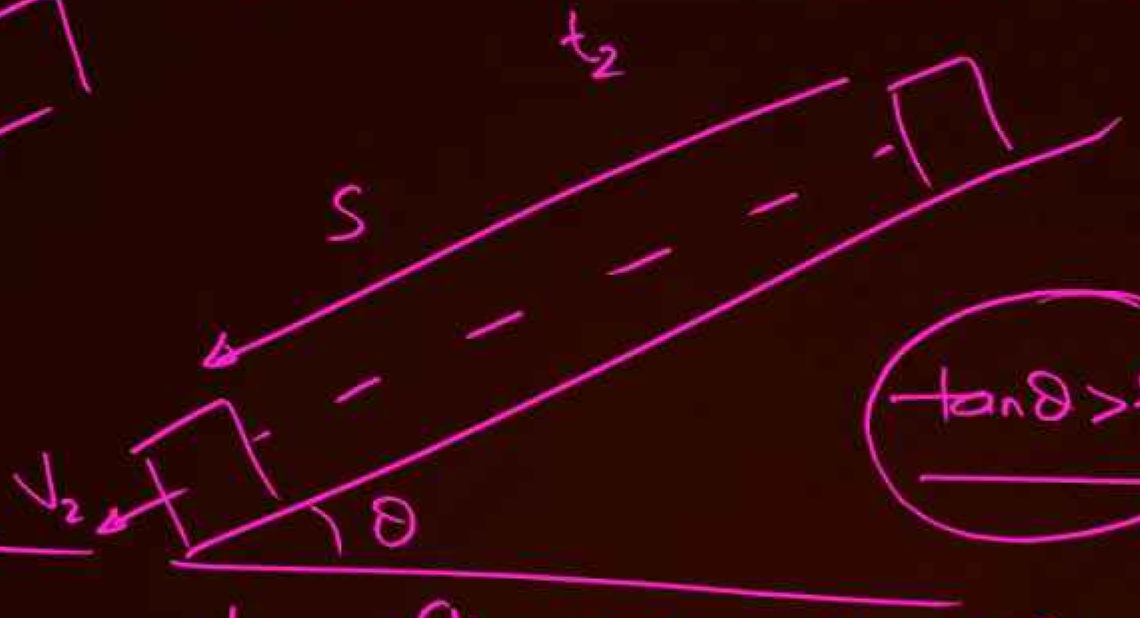
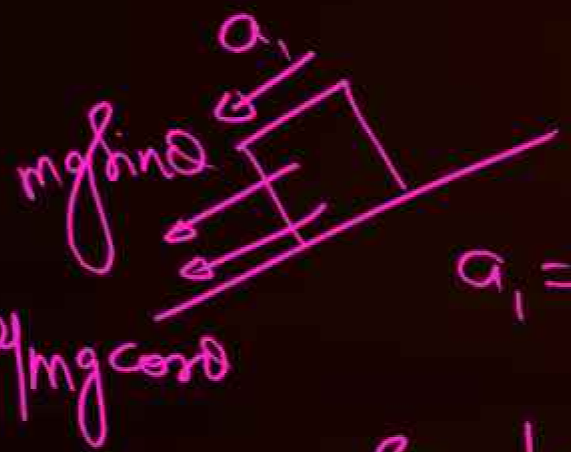
Time of ascent and decent





$\tan\theta > \mu_s$

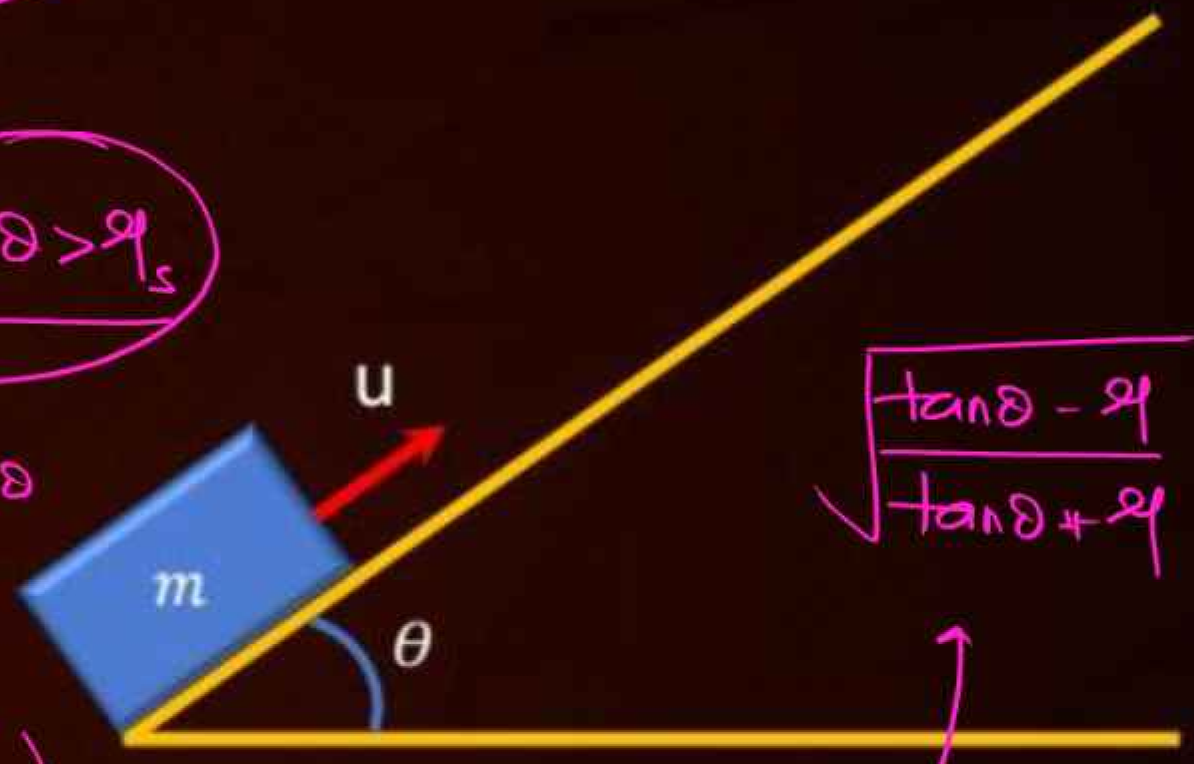


$a_1 = g(\sin\theta + \mu\cos\theta)$

$S = \frac{1}{2}a_1 t_1^2 \Rightarrow t_1 = \sqrt{\frac{2S}{a_1}}$

$a_2 = g(\sin\theta - \mu\cos\theta)$

$S = \frac{1}{2}a_2 t_2^2 \Rightarrow t_2 = \sqrt{\frac{2S}{a_2}}$



$$\sqrt{\frac{\tan\theta - \mu}{\tan\theta + \mu}}$$

$$\frac{t_1}{t_2} = \sqrt{\frac{a_2}{a_1}} = \sqrt{\frac{\sin\theta - \mu\cos\theta}{\sin\theta + \mu\cos\theta}}$$

$t_1 < t_2$

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Question

$S = \frac{1}{2}at^2$

The time taken by an object to slide down a 45° rough inclined plane is n times as it takes to slide down a perfectly smooth 45° inclined plane. The coefficient of kinetic friction between the object and the incline plane is [29 Jan, 2023 (Shift-II)]

(1) $\sqrt{\frac{1}{1-n^2}}$

(2) $\sqrt{1-\frac{1}{n^2}}$

(3) $1+\frac{1}{n^2}$

(4) $1-\frac{1}{n^2}$

$S = \frac{1}{2}(g\sin 45^\circ - \mu g\cos 45^\circ)t_1^2 = \frac{1}{2}g\sin 45^\circ t_2^2$

$t_1 \rightarrow nt_2$

$n^2\left(\frac{1}{\sqrt{2}} - \frac{\mu}{\sqrt{2}}\right) = \frac{1}{\sqrt{2}} \Rightarrow n^2 - \mu n^2 = 1$

$\mu = \frac{n^2-1}{n^2}$

Ans : (4)

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Question

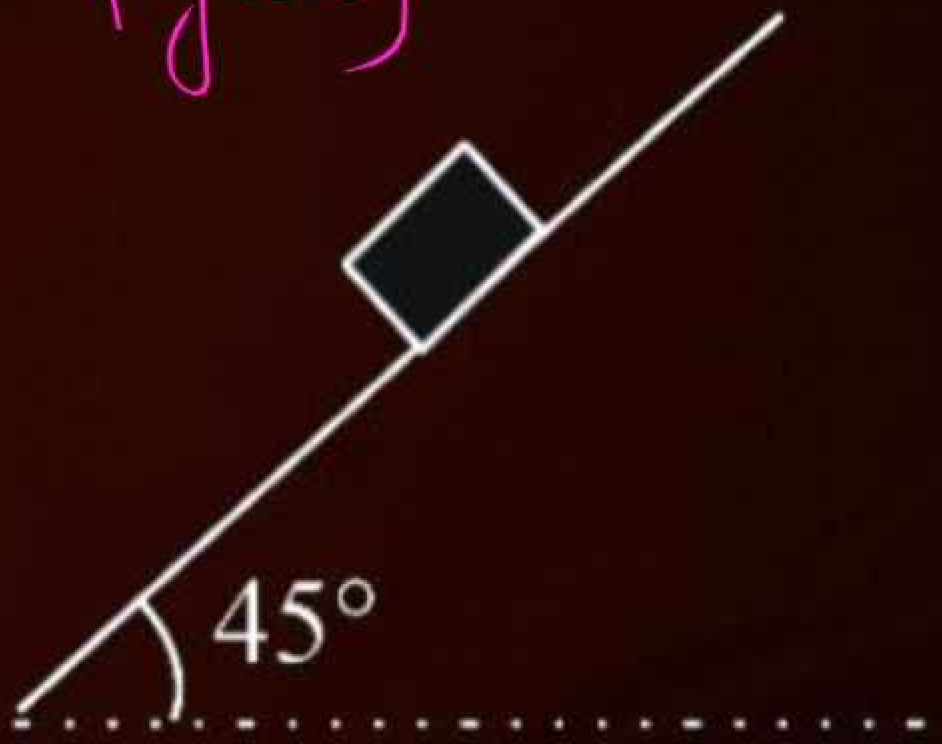
$$\mu \rightarrow m$$

Consider a block kept on an inclined plane (inclined at 45°) as shown in the figure. If the force required to just push it up the incline is 2 times the force required to just prevent it from sliding down, the coefficient of friction between the block and inclined plane (m) is equal to:

[25 Jan, 2023 (Shift-II)]

$$mg\sin\theta + \mu mg\cos\theta = 2(mg\sin\theta - \mu mg\cos\theta)$$

$$1+\mu = 2-2\mu$$



(1) 0.33

(2) 0.60

(3) 0.25

(4) 0.50

Ans : (1)

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Question

HW

A block of mass m slides down an inclined plane inclined at angle $30°$ with an acceleration $\frac{g}{4}$. The value of coefficient of kinetic friction will be: [29 Jan, 2023 (Shift-I)]

(1) $\frac{2\sqrt{3}+1}{2}$

(2) $\frac{1}{2\sqrt{3}}$

(3) $\frac{\sqrt{3}}{2}$

(4) $\frac{2\sqrt{3}-1}{2}$

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Ans : (3)

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Question

A block 'A' takes 2 s to slide down a frictionless incline of 30° and length 'ℓ', kept inside a lift going up with uniform velocity 'v'. If the incline is changed to 45°, the time taken by the block, to slide down the incline, will be approximately: **[27 July, 2022 (Shift-II)]**

1. 2.66 s
2. 0.83 s
3. 1.68 s
4. 0.70 s

$\frac{t_1^2}{2} = \frac{t_2^2}{\sqrt{2}}$

$S = \frac{1}{2}at^2$

$S = \frac{1}{2} g \sin 30^\circ t_1^2 = \frac{1}{2} g \sin 45^\circ t_2^2$

$t_2^2 = \frac{t_1^2}{\sqrt{2}} \Rightarrow t_2 = \frac{t_1}{(2)^{1/4}}$

$t_2 \approx \frac{2}{1.2} = \frac{20}{12} = \frac{5}{3}$

Ans : (3)

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Question

H|W

A body of mass 'm' is launched up on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of friction between the body and plane is $\frac{\sqrt{x}}{5}$ if the time of ascent is half of the time of descent. The value of x is ________.

[20 July, 2021 (Shift-II)]

$$\sqrt{\frac{\tan\theta+\mu}{\tan\theta-\mu}} = 2$$

$$\tan\theta+\mu = 4\tan\theta - 4\mu$$

$$\mu = \frac{3}{5}\tan\theta = \frac{\sqrt{3}}{5}$$

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Ans : (3)

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Question

A block of mass 10 kg is kept on a rough inclined plane as shown in the figure. A force of 3 N is applied on the block. The coefficient of static friction between the plane and the block is 0.6. What should be the minimum value of force P, such that the block does not move downward?
(Take $g = 10\ ms^{-2}$)

[9 Jan, 2019 (Shift-I)]

$N = 10g\cos 45^\circ = 50\sqrt{2}$

$f_s)_{max} = (0.6)(50\sqrt{2}) = 30\sqrt{2}$

$mg\sin 45^\circ = 50\sqrt{2}$

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(1) 32 N

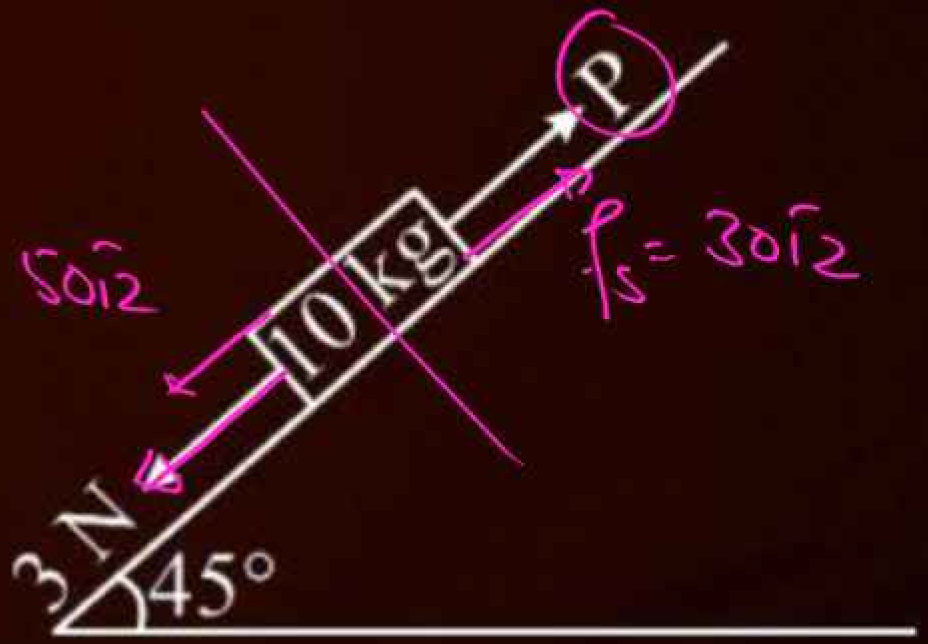
(2) 18 N

(3) 23 N

(4) 25 N

$P + 30\sqrt{2} = 50\sqrt{2} + 3$

$P = 20\sqrt{2} + 3$



Ans : (1)

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Jee Main 2025

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Question

$f = kx$

A massless spring gets elongated by amount x_1 under a tension of 5 N. Its elongation is x_2 under the tension of 7 N. For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be,

(January 2025)/23-01-2025/Evening Shift)

$kx_1 = 5$

$kx_2 = 7$

$k(5x_1 - 2x_2) = F$

$= 5(5) - 2 \times 7 = \underline{11\ N}$

(1) 15 N

(2) 20 N

(3) 11 N

(4) 39 N

Ans : (3)

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Question

A balloon and its content having mass M is moving up with an acceleration 'a'. The mass that must be released from the content so that the balloon starts moving up with an acceleration '3 a' will be : (Take 'g' as acceleration due to gravity)

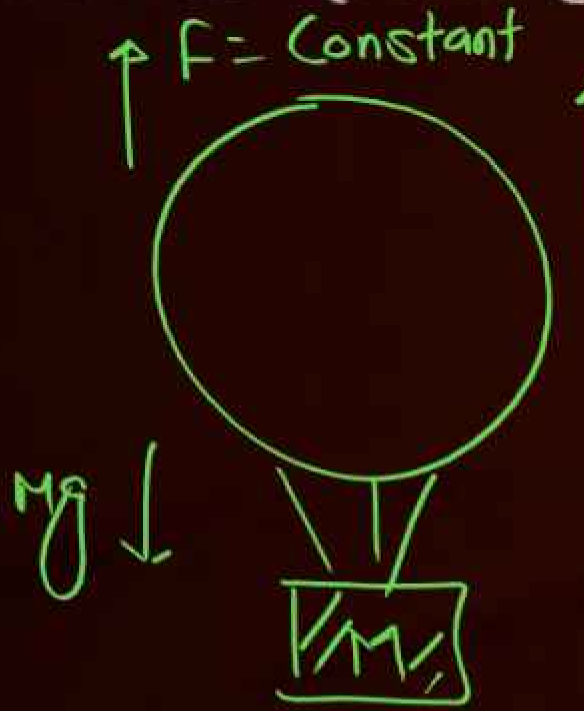
(January 2025)/28-01-2025/Evening Shift)

(1) $\dfrac{3Ma}{2a-g}$

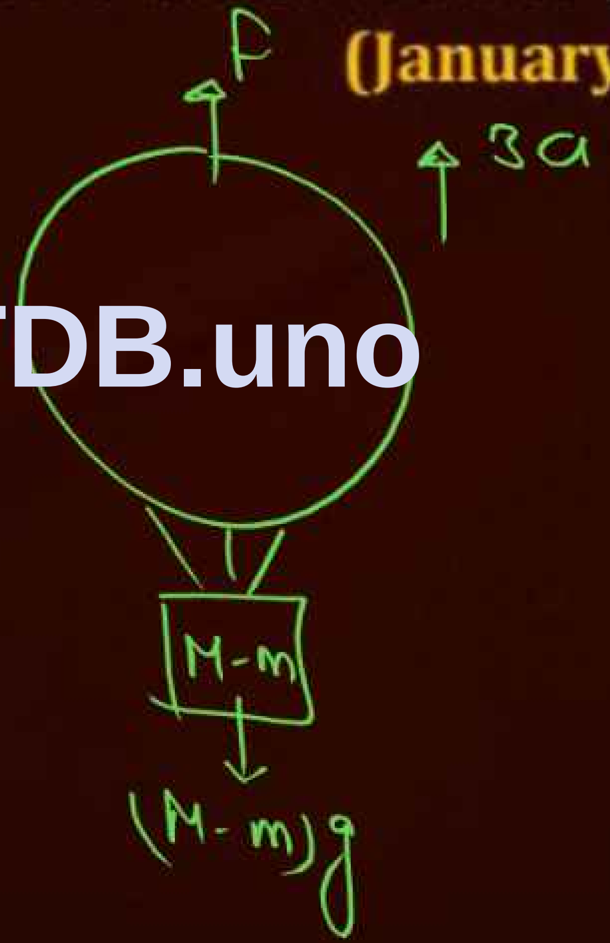
(2) $\dfrac{3Ma}{2a+g}$

(3) $\dfrac{2Ma}{3a+g}$

(4) $\dfrac{2Ma}{3a-g}$



$F - Mg = Ma$



$F - Mg = Ma$

$F - (M-m)g = (M-m).3a$

$mg = -2Ma + 3ma$

$m = \dfrac{2Ma}{3a+g}$

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Ans : (3)

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Question

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. [25 June, 2022 (Shift-I)]

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Ans : (2)

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Question

The coefficient of static friction between a wooden block of mass 0.5 kg and a vertical rough wall is 0.2. The magnitude of horizontal force that should be applied on the block to keep it adhere to the wall be ________N. [$g = 10\ ms^{-2}$] [24 Feb, 2021 (Shift-I)]

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Ans : (25)

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Question

As shown in the figure, a block of mass $\sqrt{3}$ kg is kept on a horizontal rough surface of coefficient of friction $\frac{1}{3\sqrt{3}}$. The critical force to be applied on the vertical surface as shown at an angle 60° with horizontal such that it does not move, will be 3x. The value of x will be

$\left[g = 10\ \text{m/s}^2; \sin 60° = \frac{\sqrt{3}}{2}; \cos 60° = \frac{1}{2}\right]$ **[26 Feb, 2021 (Shift-I)]**

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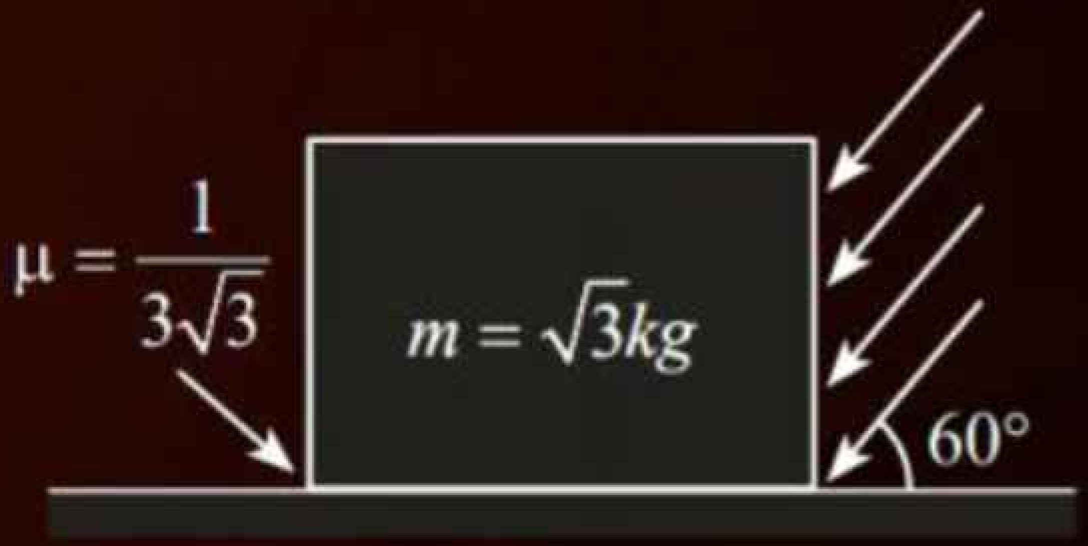

Ans : (3.3)

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Question

Two blocks A and B of masses $m_A = 1$ kg and $m_B = 3$ kg are kept on the table as shown in figure. The coefficient of friction between A and B is 0.2 and between B and the surface of the table is also 0.2. The maximum force F that can be applied on horizontally, so that the block A does not slide over the block B is: (Take $g = 10\ m/s^2$) [10 April, 2019 (Shift-II)]

(1) 16 N

(2) 40 N

(3) 12 N

(4) 8 N

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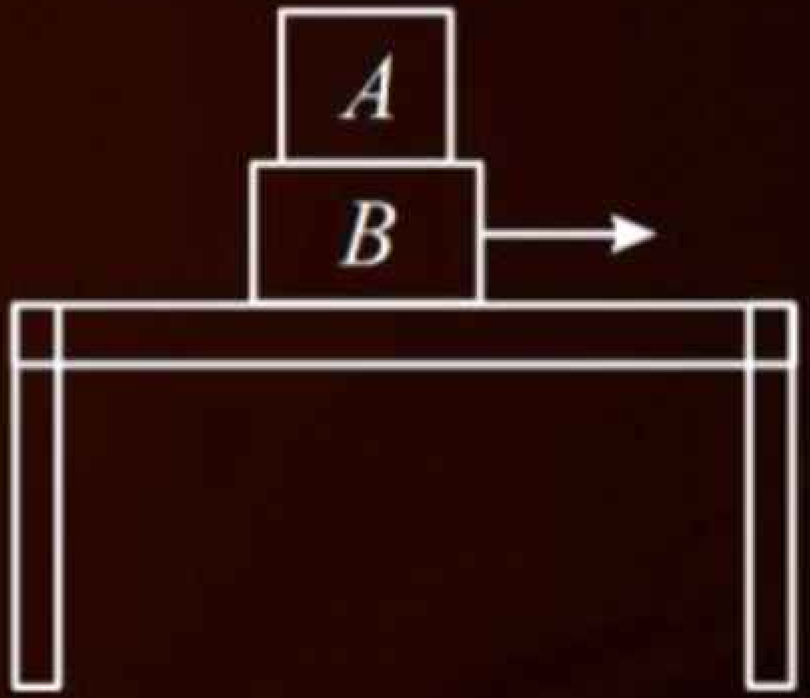

Ans : (1)

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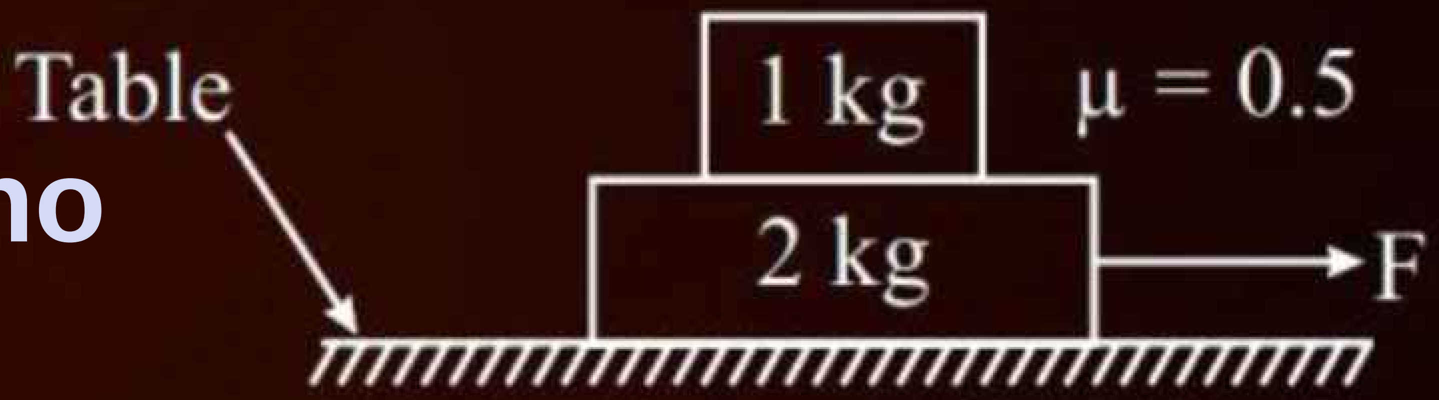
Question

The coefficient of static friction between two blocks is 0.5 and the table is smooth. The maximum horizontal force that can be applied to move the blocks together is ______ N. (take $g = 10\ ms^{-2}$)

[26 Aug, 2021 (Shift-II)]



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Ans : (15)

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Question

Two blocks ($m = 0.5$ kg and $M = 4.5$ kg) are arranged on a horizontal frictionless table as shown in figure. The coefficient of static friction between the two blocks is $\frac{3}{7}$. Then the maximum horizontal force that can be applied on the larger block so that the blocks move together is ______ N. (Round off to the Nearest Integer) [Take g as 9.8 ms^{-2}]

[17 March, 2021 (Shift-I)]

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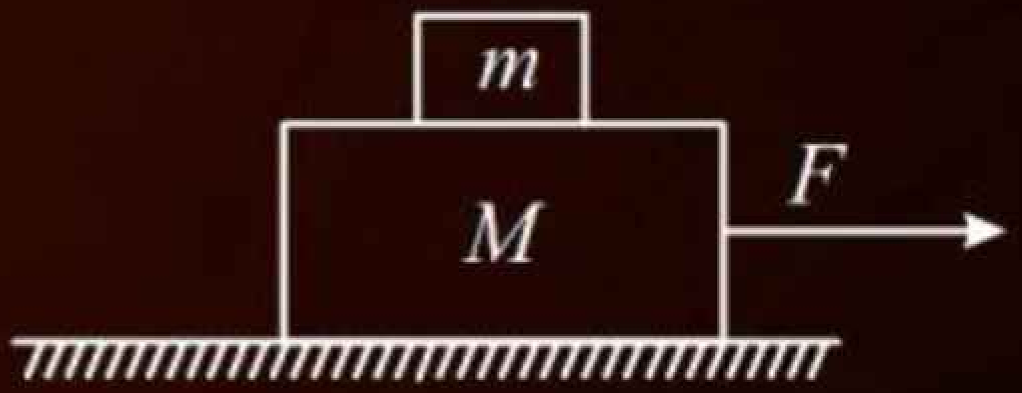

Ans : (21)

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Question

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): An electric fan continues to rotate for some time after the current is switched off.

Reason (R): Fan continuous to rotate due to inertia of motion.

In the light of above statements, choose the most appropriate answer from the options given below. [10 Apr, 2023 (Shift-2)]

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1. A is correct but R is not correct.
2. Both A and R are correct and R is the correct explanation of A.
3. A is not correct but R is correct.
4. Both A and R are correct but R is not the correct explanation of A.

Ans : (2)

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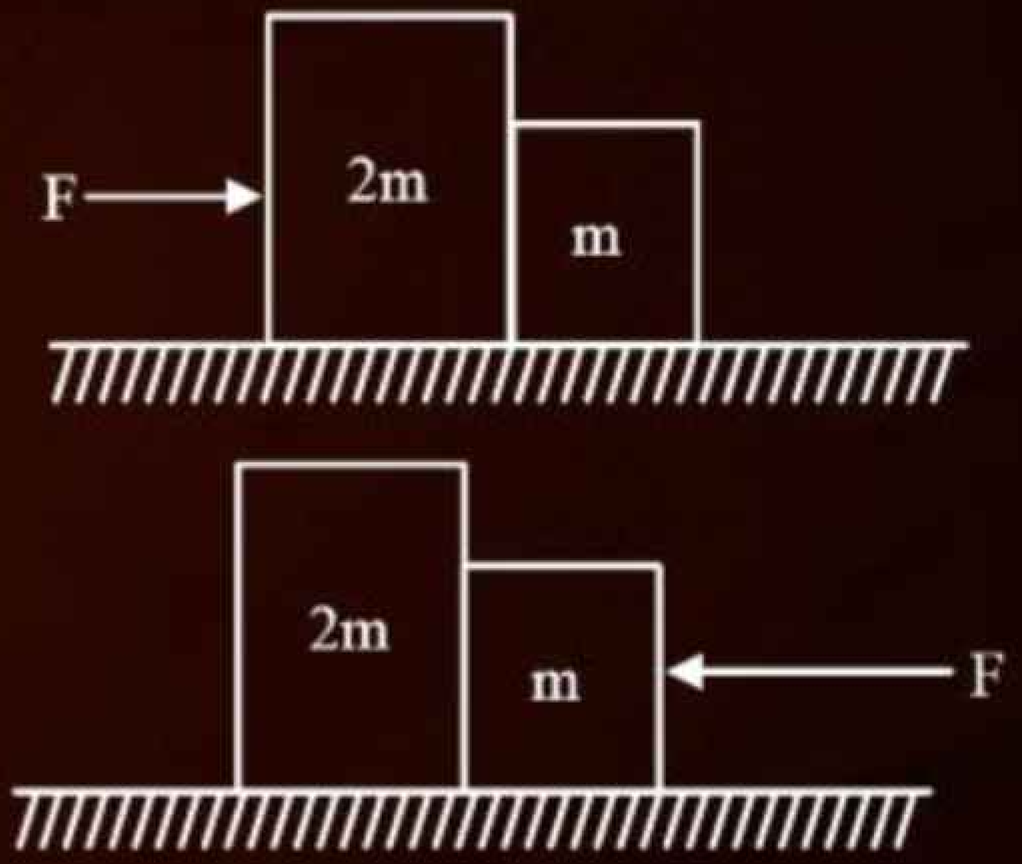
Question

Two blocks are in contact on a frictionless table. One has mass m and the other 2 m. A force F is applied on 2 m as shown in the figure. Now the same force F is applied from the right on m. In the two cases respectively, the ratio of force of contact between the two blocks will be :



a. Same

b. 1:2

c. 2:1

d. 1:3

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Ans: (b)

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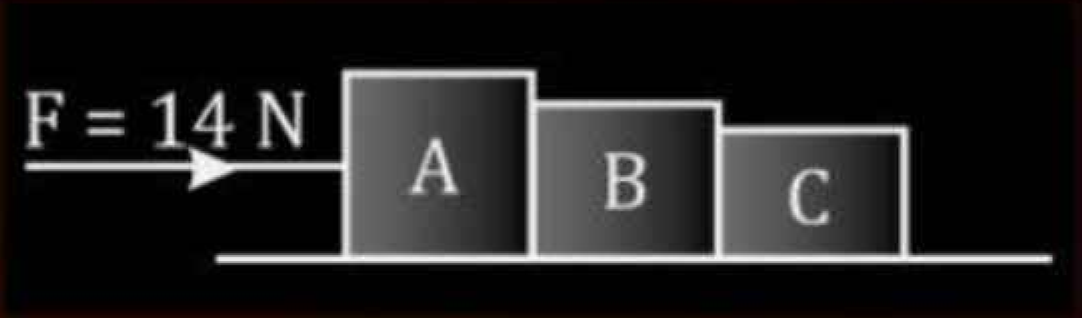
Question

Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is



a. 18 N

b. 2 N

c. 6 N

d. 8 N

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Ans: (c)

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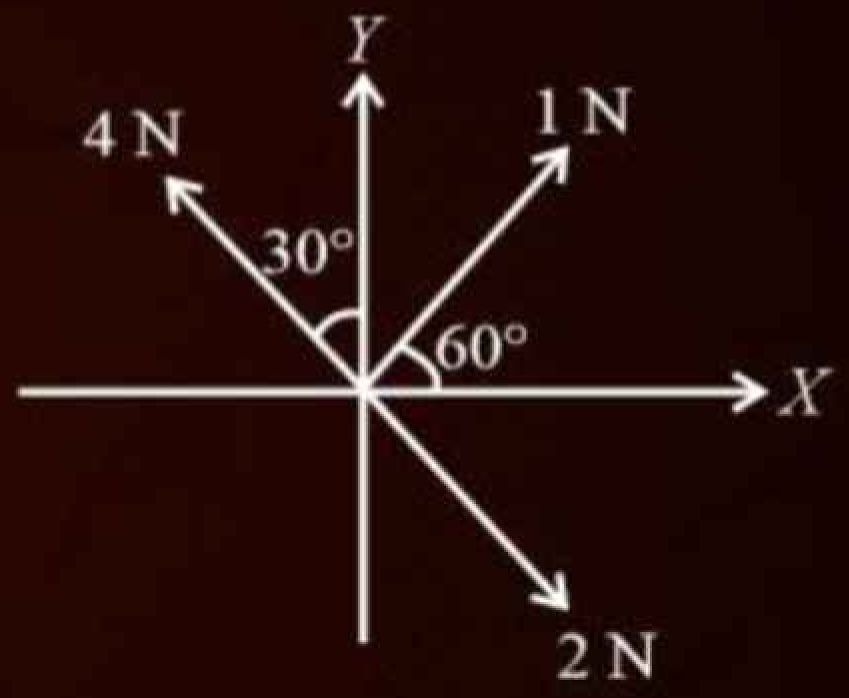
Question

Three forces acting on a body are shown in the figure. To have the resultant force only along the y – direction, the magnitude of the minimum additional force need is



a. $\frac{\sqrt{3}}{4}$ N

b. $\sqrt{3}$ N

c. 0.5 N

d. 1.5 N

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Ans: (c)

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Question

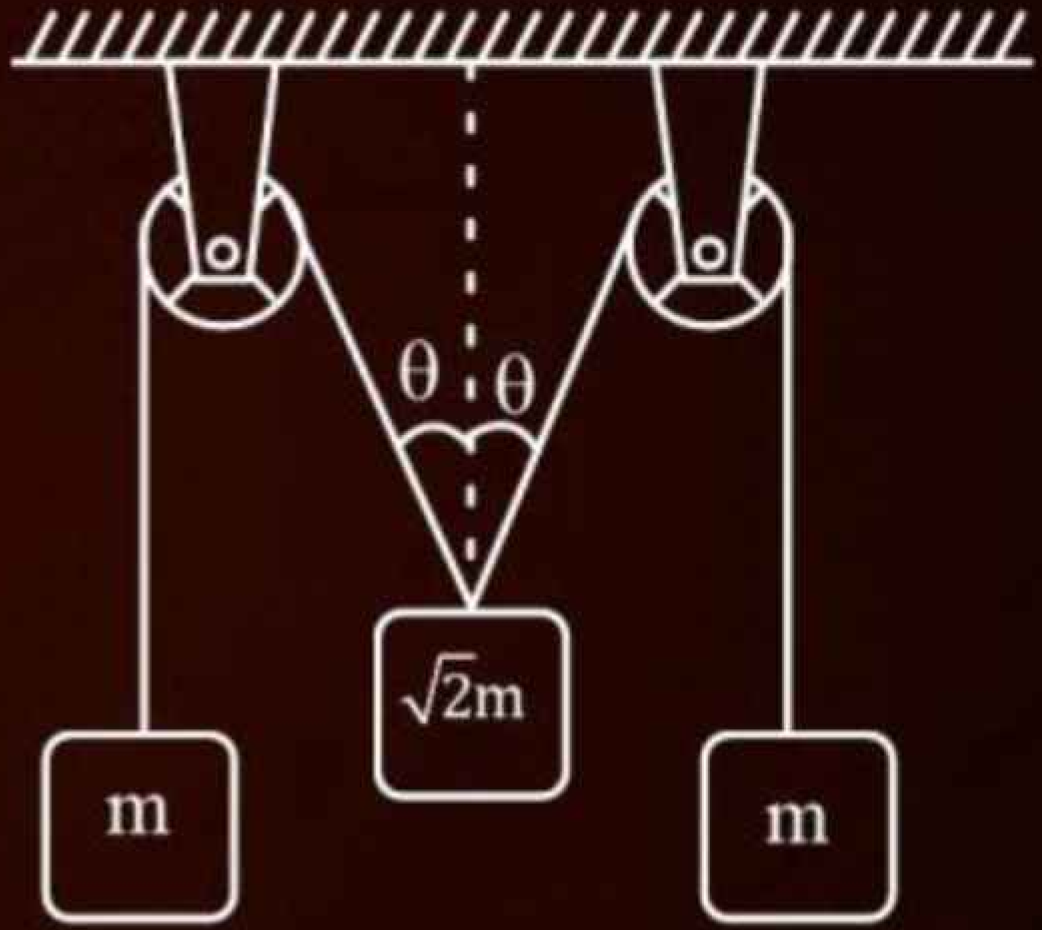
The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ should be [2001]

a. $0°$

b. $30°$

c. $45°$

d. $60°$



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Ans: (c)

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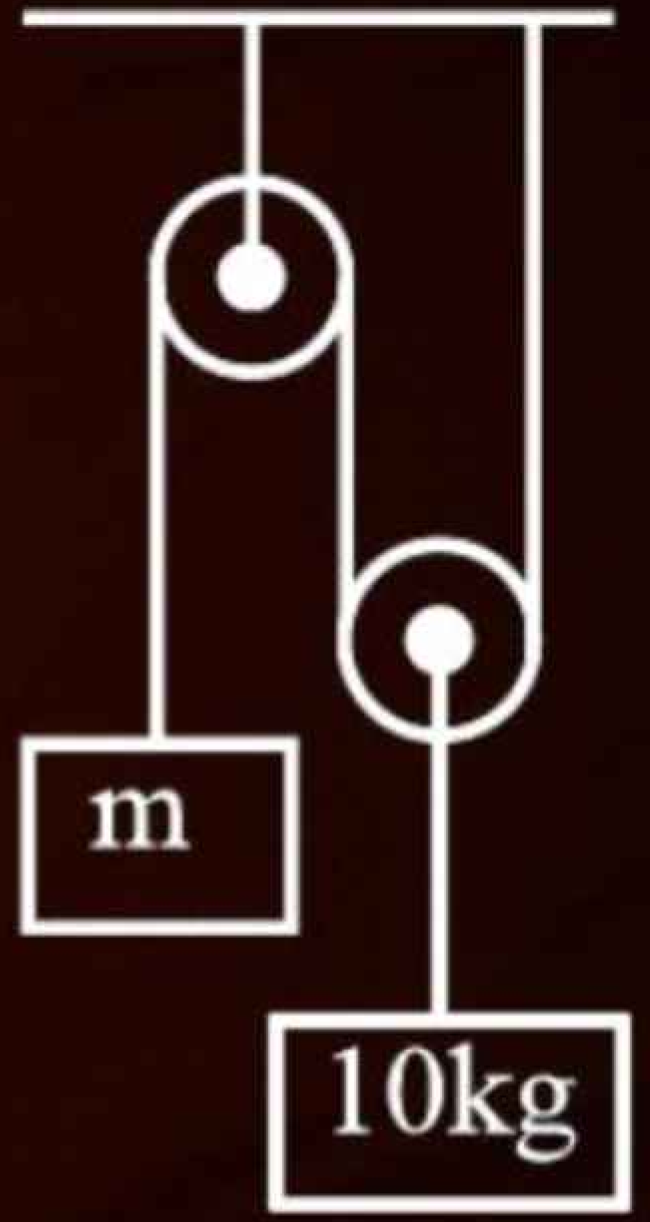
Question

Find m for equilibrium



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Question

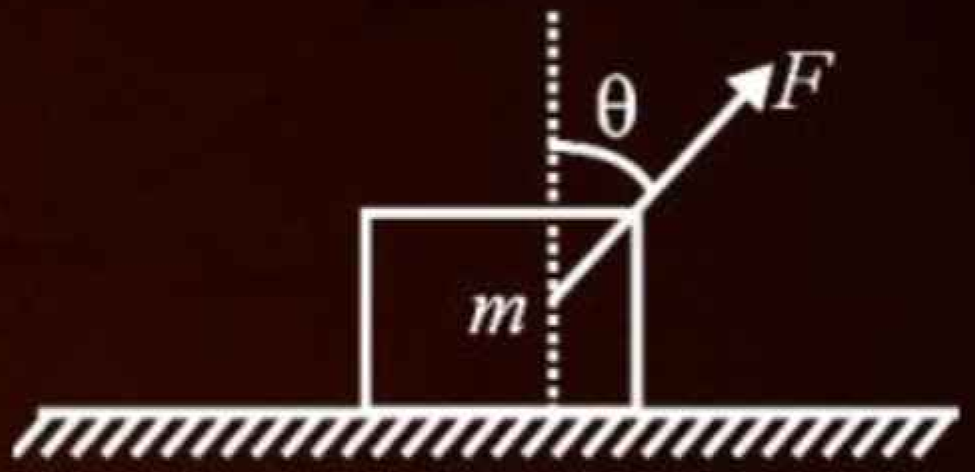
In the given arrangement, the normal force applied by block on the ground is

a. Mg

b. mg – F cos θ

c. mg + F cos θ

d. F cos θ



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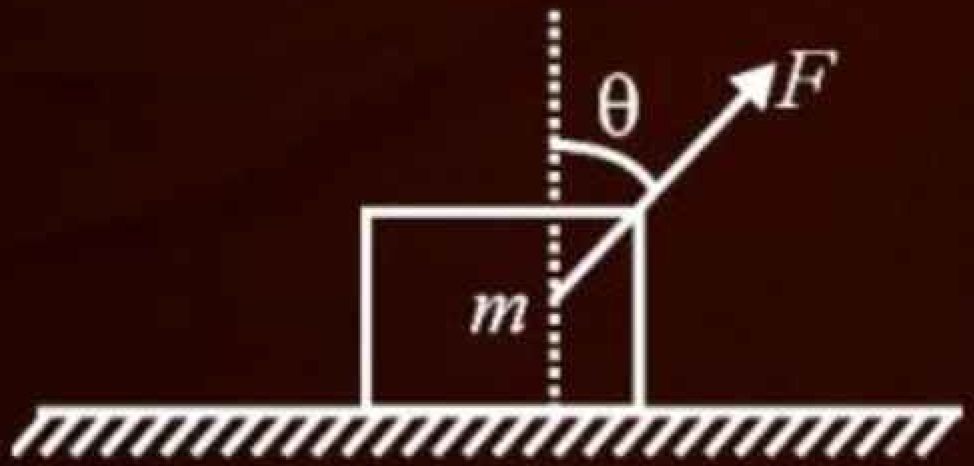

Ans: (b)

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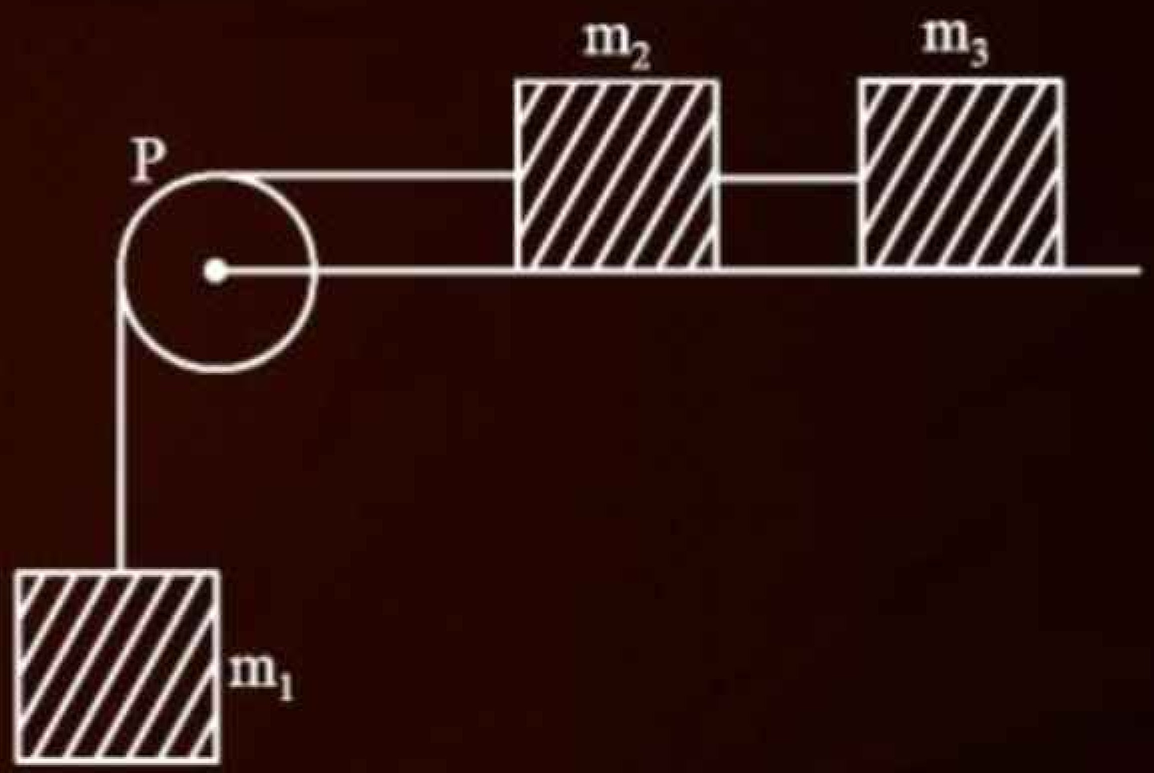
Question

A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (The coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is :



a. $\dfrac{g(1-g\mu)}{9}$

b. $\dfrac{2g\mu}{3}$

c. $\dfrac{g(1-2\mu)}{3}$

d. $\dfrac{g(1-2\mu)}{2}$

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Ans: (c)

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Question

When a body slides down from rest along a smooth inclined plane making an angle of $30°$ with the horizontal, it takes time T. When the same body slides down from the rest along a rough inclined plane making the same angle and through the same distance, it takes time αT, where α is a constant greater than 1 . The co-efficient of friction between the body and the rough plane is $\frac{1}{\sqrt{x}}\left(\frac{\alpha^2-1}{\alpha^2}\right)$ where $x =$__________. [1 Sep, 2021 (Shift-II)]

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Ans : $(\sqrt{3})$

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Question

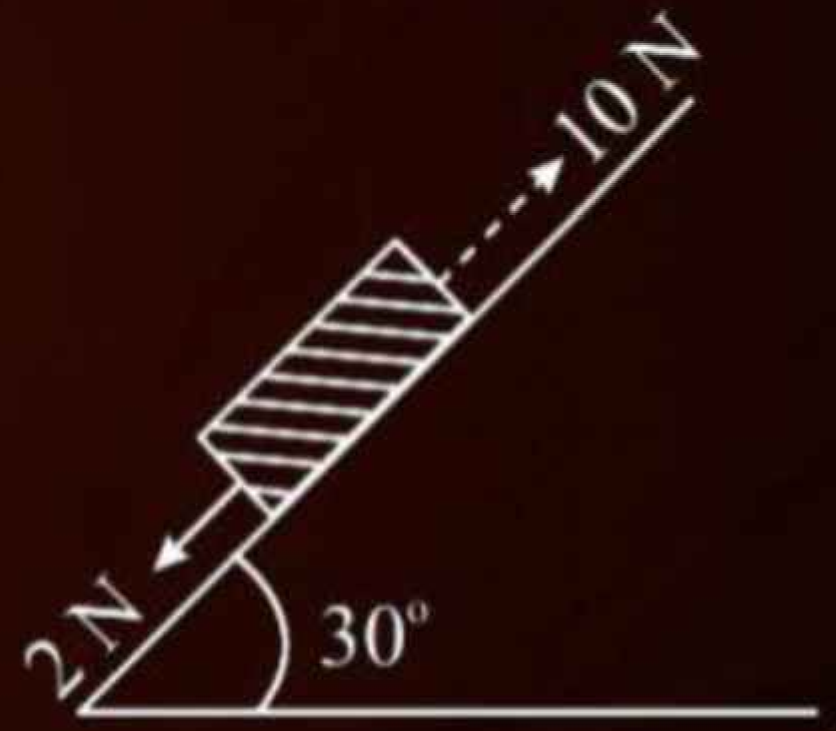
A block kept on a rough inclined plane, as shown in the figure, remains at rest up-to a maximum force 2 N down the inclined plane. The maximum external force up the inclined plane that does not move the block is 10 N. The coefficient of static friction between the block and the plane is: [12 Jan, 2019 (Shift-II)]

(1) $\frac{\sqrt{3}}{2}$

(2) $\frac{\sqrt{3}}{4}$

(3) $\frac{1}{2}$

(4) $\frac{2}{3}$



Ans : (1)

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Question

Two inclined planes are placed as shown in figure. A block is projected from the point A of inclined plane AB along its surface with velocity just sufficient to carry it to the top Point B at a height 10 m . After reaching the point B the block slide down on inclined plane BC. Time it takes to reach to the point C from point A is $t(\sqrt{2}+1)$s. The value of t is ________ (use $g = 10\ m/s^2$) [27 July, 2022 (Shift-II)]

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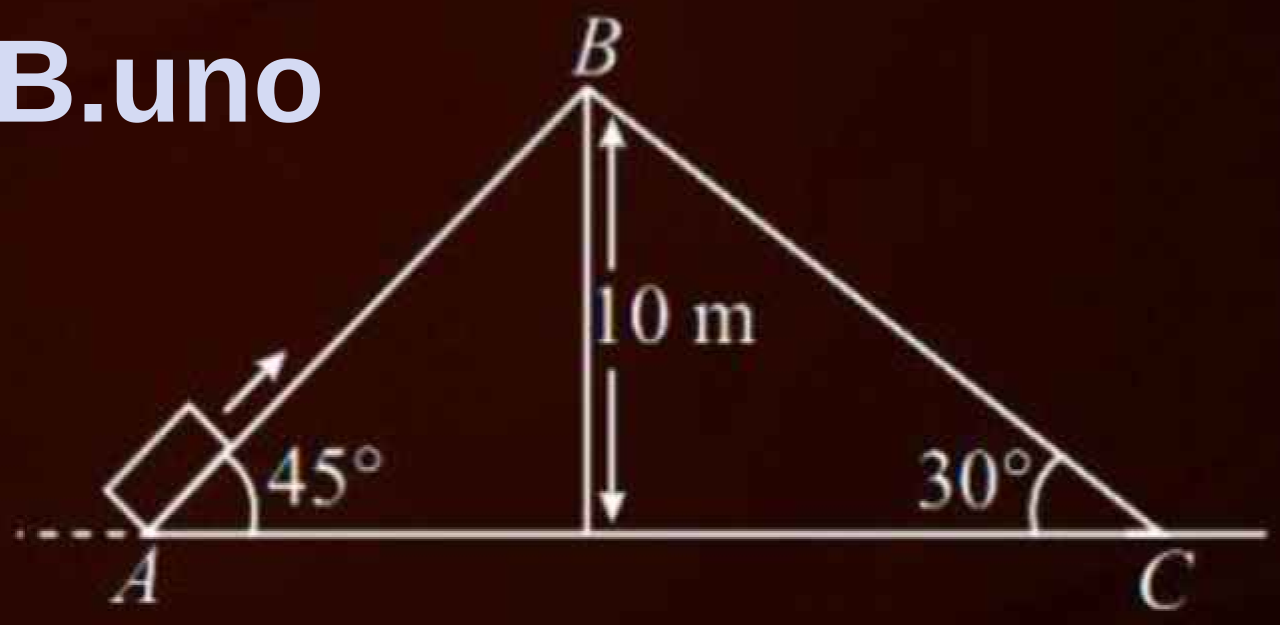

Ans : (2)

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Question

A block starts moving up an inclined plane of inclination 30° with an initial velocity of v_0. It comes back to its initial position with velocity $\frac{v_0}{2}$. The value of the coefficient of kinetic friction between the block and the inclined plane is close to $\frac{I}{1000}$. The nearest integer to I is ________. [3 Sep, 2020 (Shift-II)]

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Ans : (346)

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