YAKEEN NEET 2.0

2026

Laws of Motion

Physics | Lecture - 11

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Todays Goal.

H/W solution of

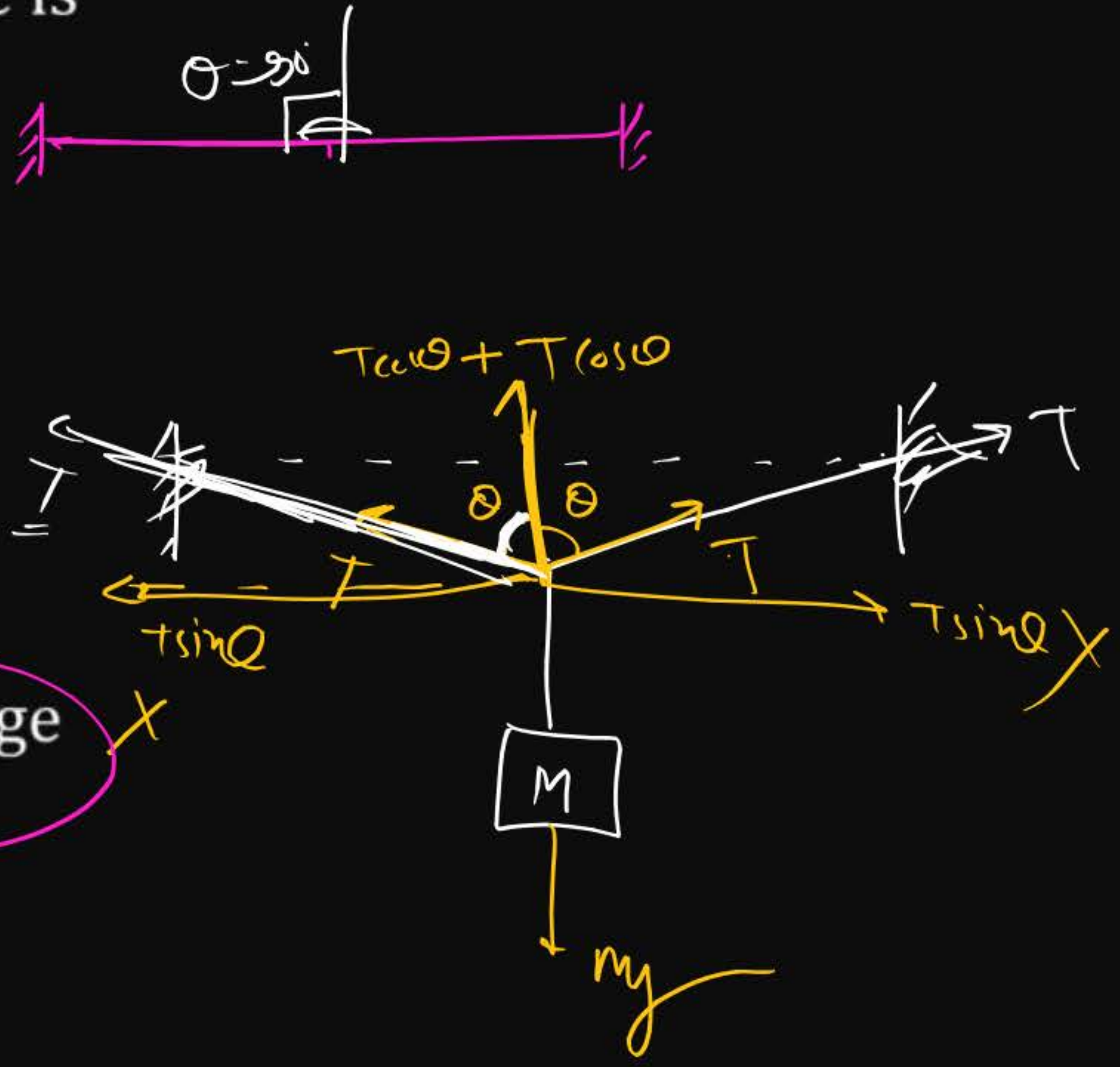
Lecture-10

Question

H/W on equilibrium

A weight Mg is suspended from the middle of a rope whose ends are at the same level. The rope is no longer horizontal. The minimum tension required to completely straighten the rope is

1. $Mg/2$
2. $Mg \cos 8$
3. $2\,Mg \cos 8$
4. Infinitely large



$$2T\cos\theta = mg$$

$$\boxed{T = \frac{mg}{2\cos\theta}}$$

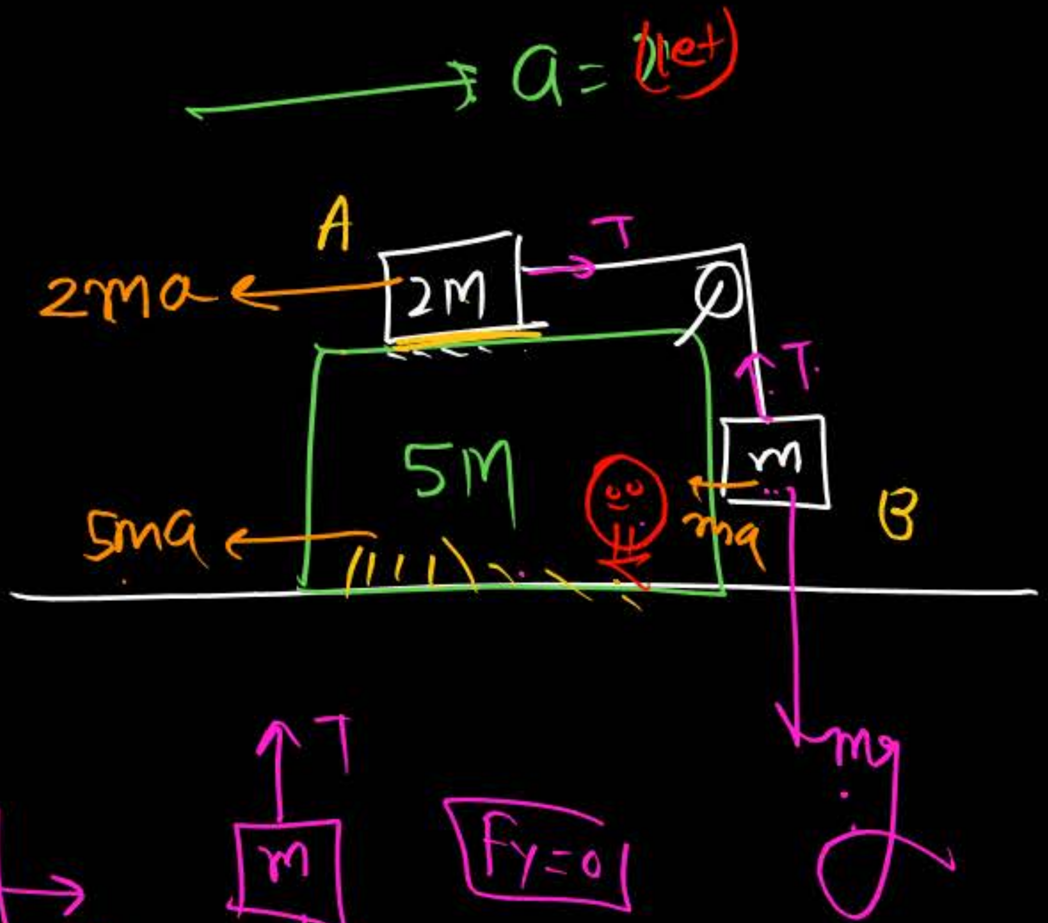
$$T = \frac{mg}{2(\cos 90^\circ)} = \frac{mg}{0}$$

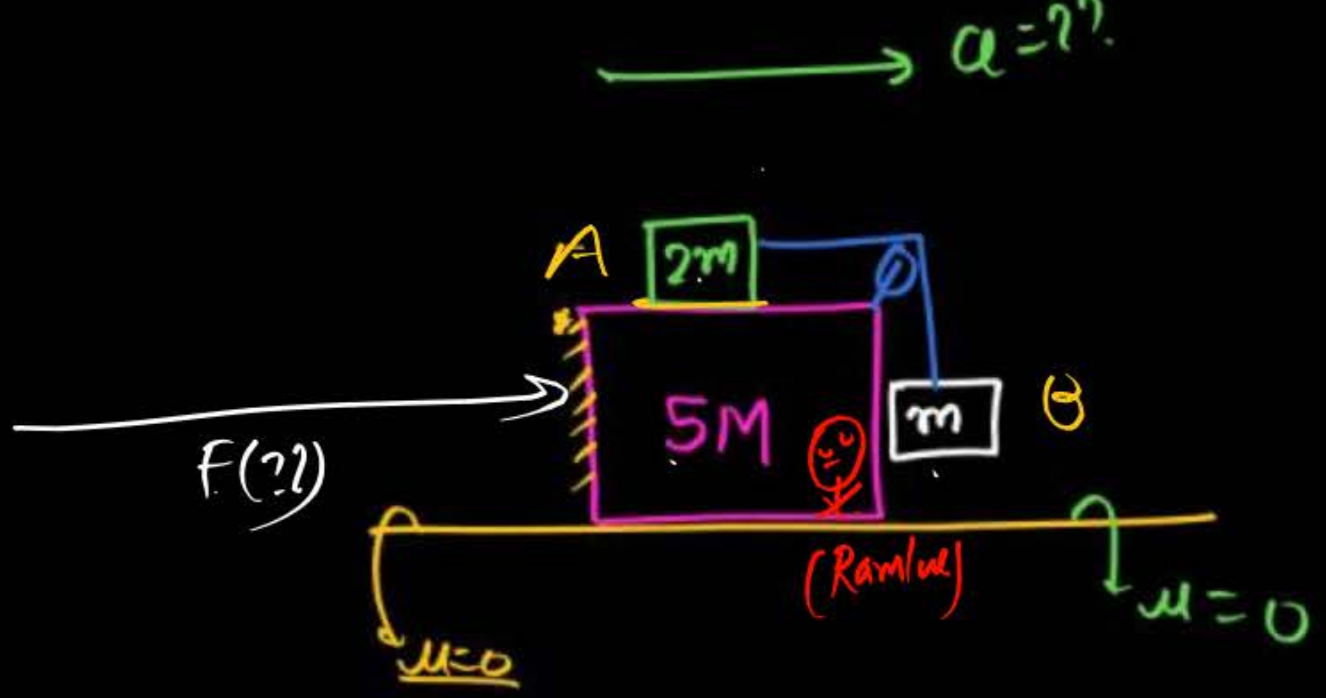
T = infinite

find acc^n of system so that Block A & B does not slid on wedge.

H/W

g will discuss





$2ma \leftarrow \boxed{2m} \rightarrow T$

$\boxed{m}$: $T \uparrow$, $mg \downarrow$

$\boxed{F_y = 0}$

$T = mg \quad \text{—} \; (1)$

$2\cancel{m}a = \cancel{m}g$

$\boxed{a = g/2}$

$F = M_{sys} \times a_{sys}$

$$\boxed{F = 8m\left(g/2\right)}$$

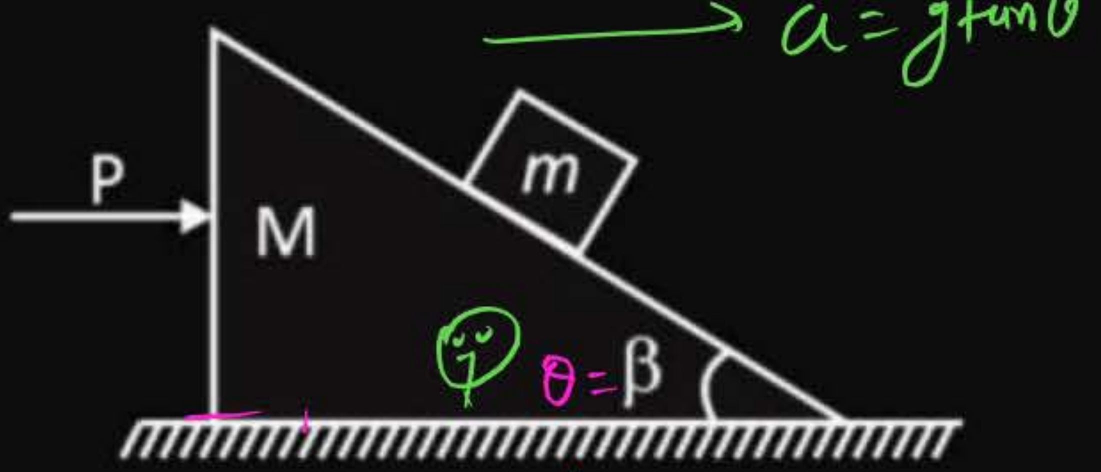
$$\boxed{\text{Ans } a = g/2}$$

Question

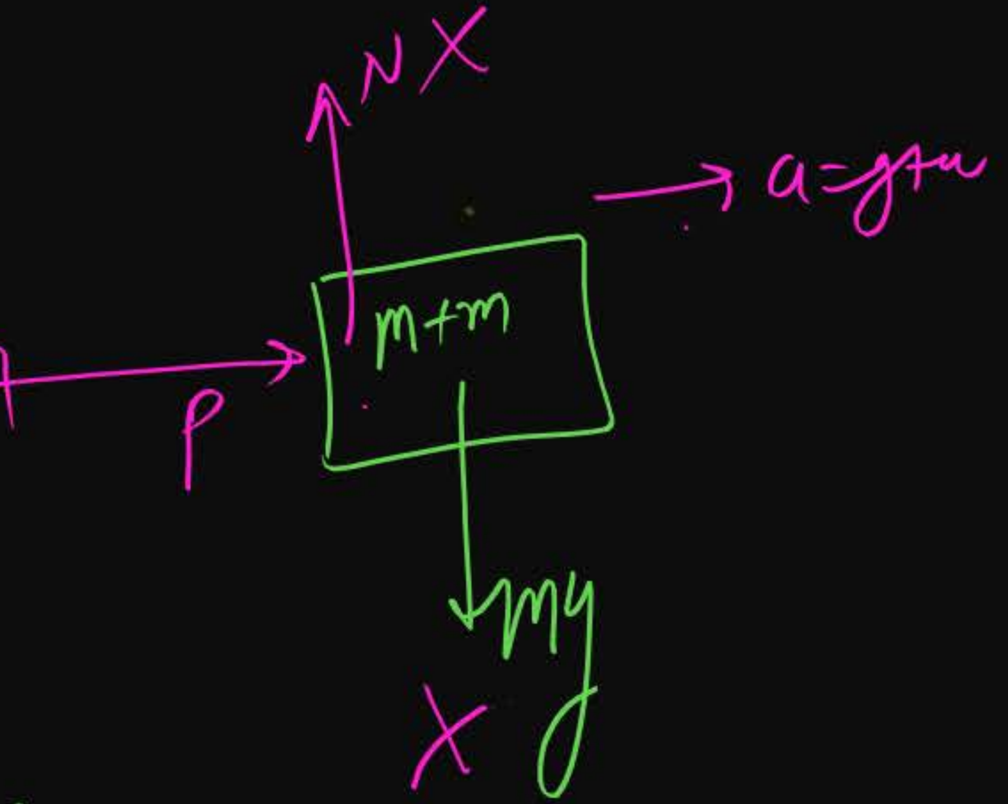
M/W

A block of mass m, is kept on a wedge of mass M, as shown in figure such that mass m remains stationary w.r.t. wedge. The magnitude of force P is

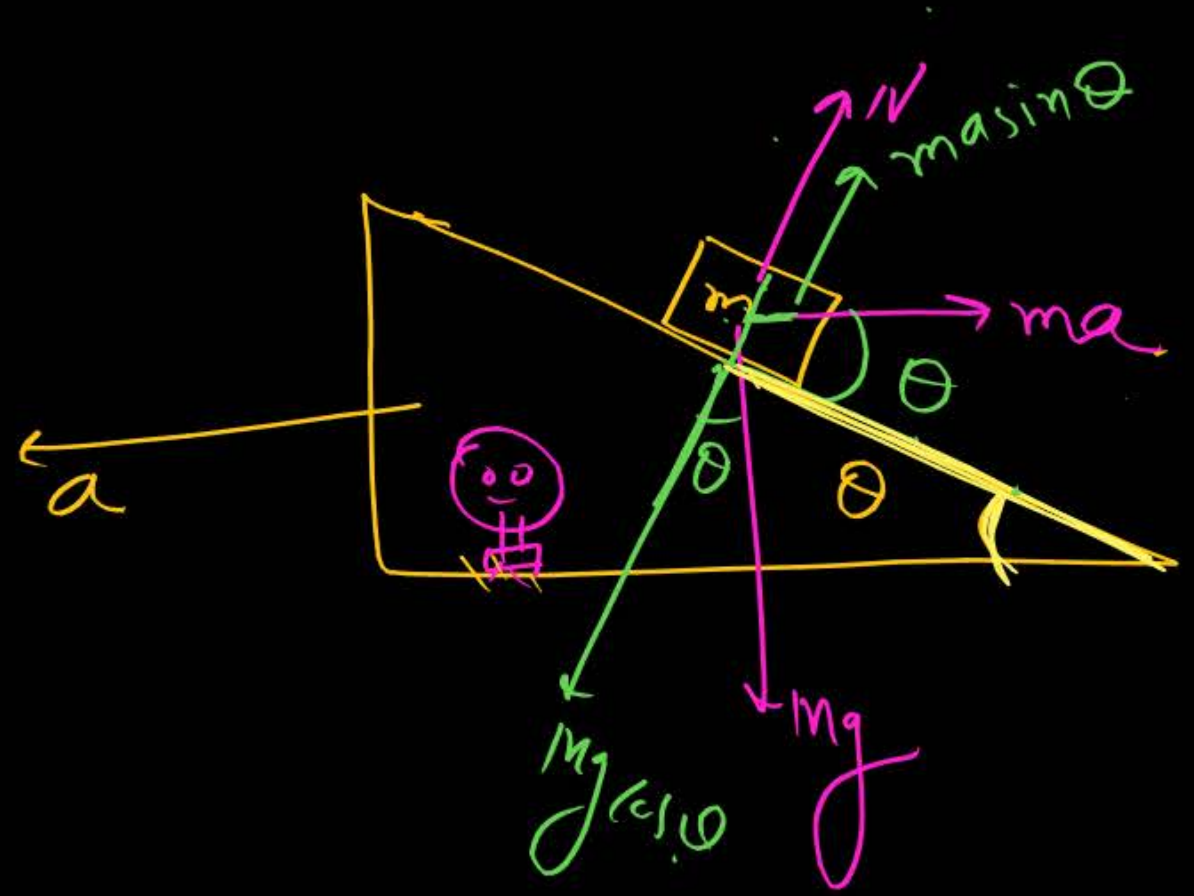
1. $g \tan \beta$
2. $mg \tan \beta$
3. ✓ $(m + M)g \tan \beta$
4. $mg \cot \beta$

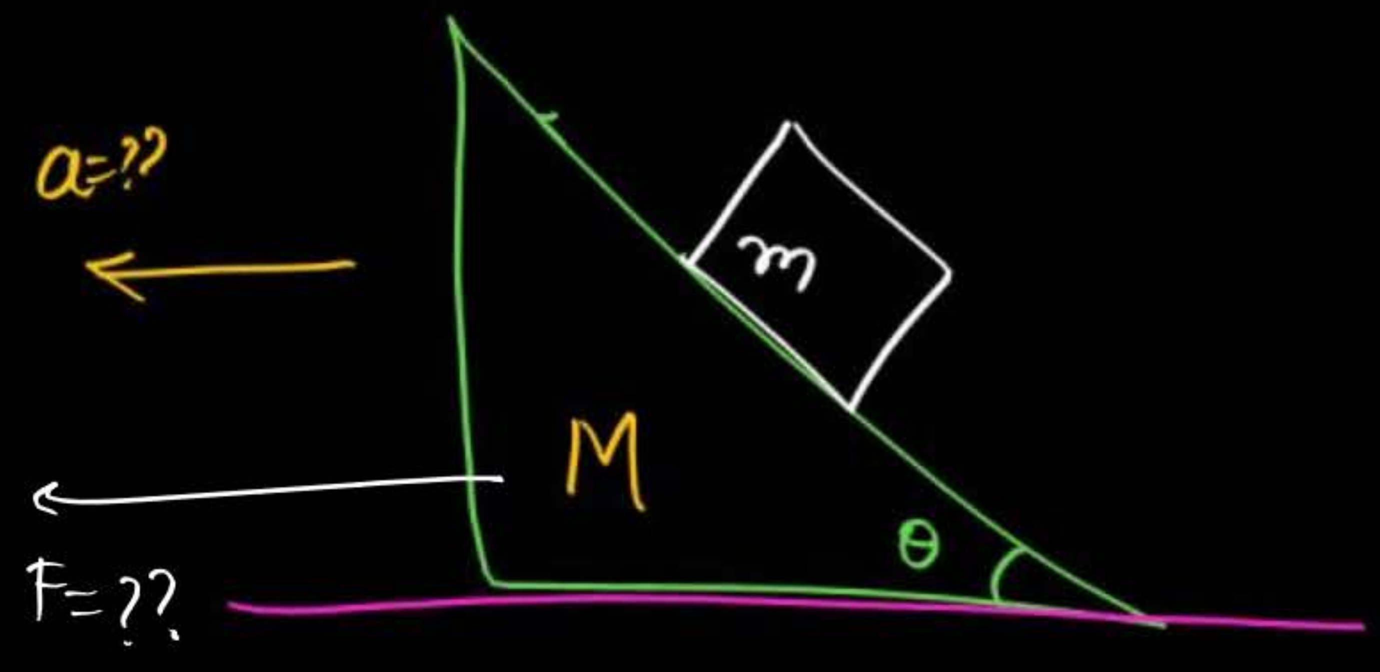


$$\boxed{P = (M+m)\, g \tan\theta}$$



Q find accⁿ of Inclied plane so that Block will free fall. & force applied on Inclied for this acceleration.





$\perp_r$ to Inclind Plane

$F_{net} = 0$

$\cancel{N}^{0} + \cancel{m}a\sin\theta = \cancel{m}g\cos\theta$

$$\boxed{a = \frac{g\cos\theta}{\sin\theta} = g\cot\theta}$$

In last question

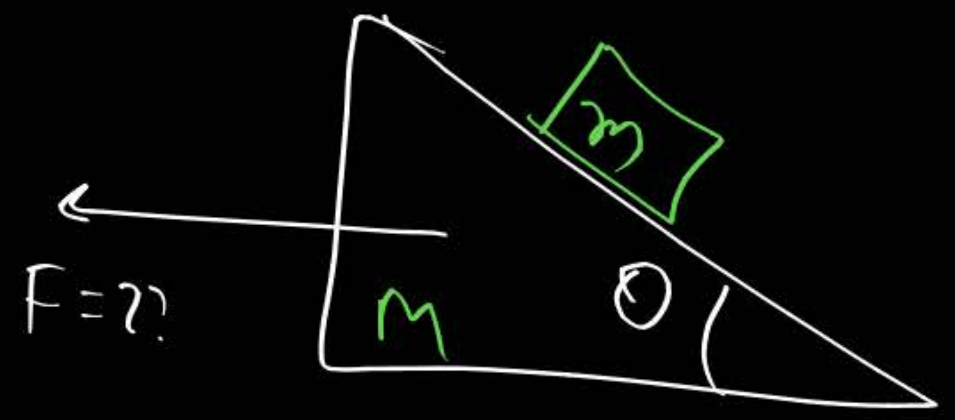
what should be force on inclined so that

Block of mass (m) free fall.

(a) $F = (M+m) g \cot\theta$ ✗

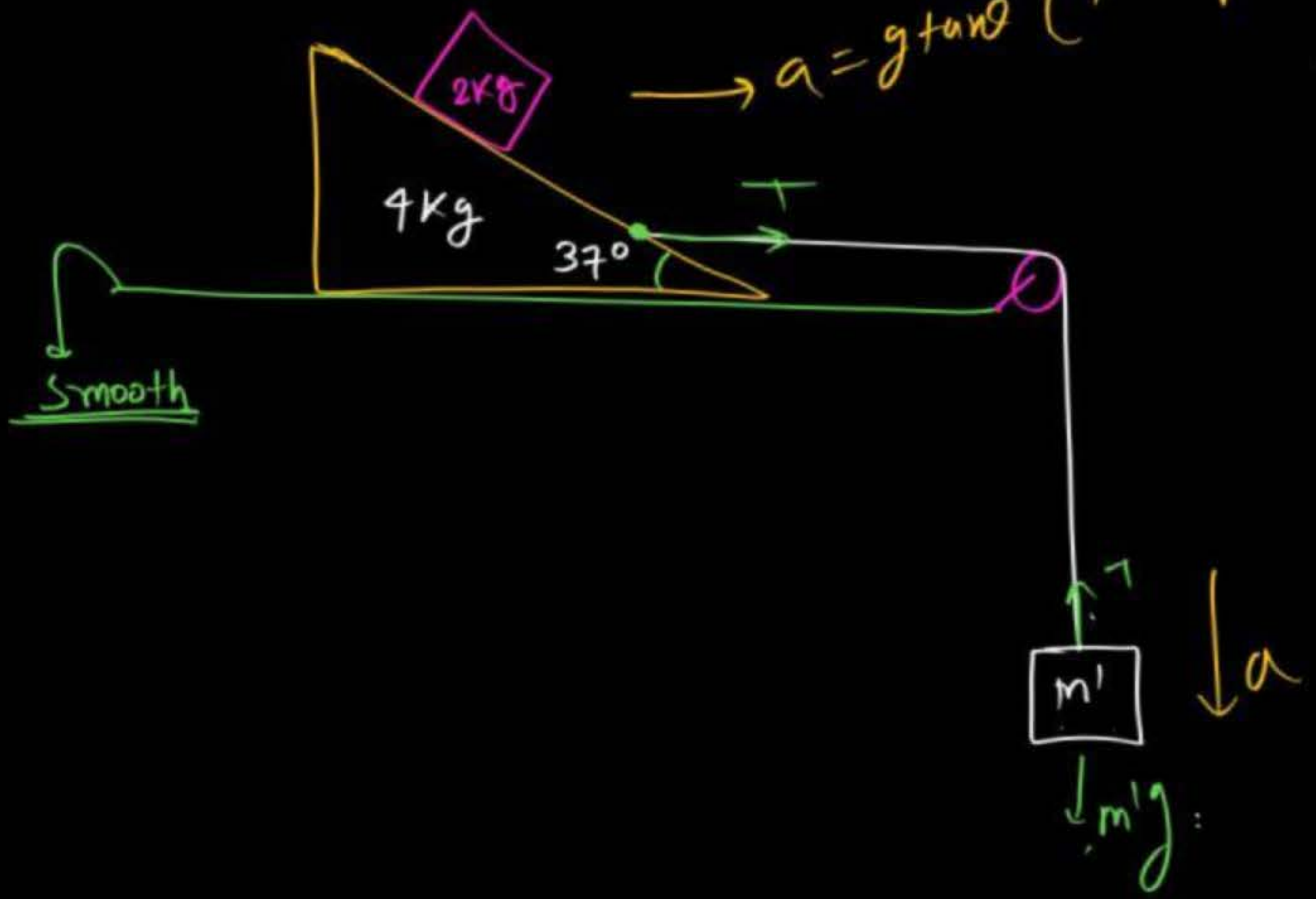
$$\boxed{F = Mg\cot\theta} \checkmark$$

Think about it



find value of m' so that Block of mass (2kg) does not slide on smooth Inclined Plane.

HC Verma



$a = g\tan\theta$ (No slide ki condn)

$$a = \frac{m'\cancel{g}}{(4+2+m')} = \cancel{g}\tan\theta$$

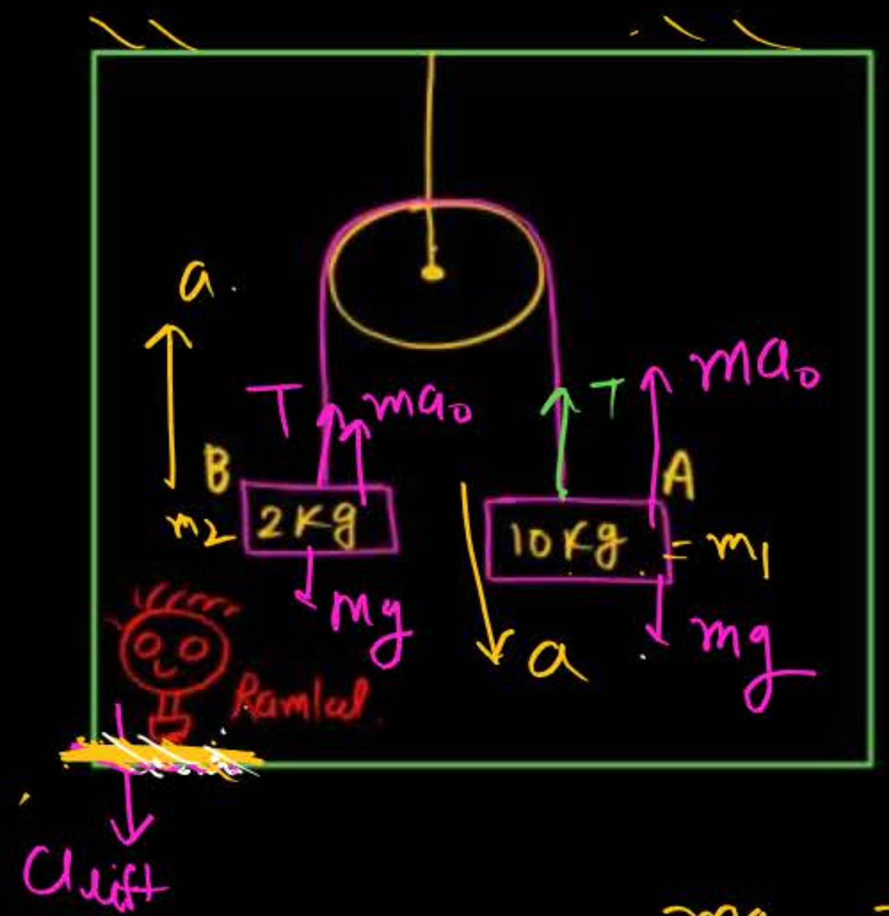
$$\frac{m'}{6+m'} = \tan 37° = \frac{3}{4}$$

$$4m' = 18 + 3m'$$

$$4m' - 3m' = 18$$

$$\boxed{m' = 18\ kg}$$

find acc^n of Block A & B w.r.t Ramlal (lift) and w.r.t Ground.



$\downarrow a_{lift} = 4 m/s^2 (a_0)$

$$T = \frac{2(m_1 m_2)}{m_1+m_2} g_{eff} = \frac{2 m_1 m_2}{m_1+m_2}(g-4)$$

$$a_{m_1 \, lift} = \left(\frac{m_2-m_1}{m_2+m_1}\right) g_{eff}$$

$$\boxed{a_{m_1 \, lw} = \left(\frac{m_2-m_1}{m_2+m_1}\right)(g-a)}$$

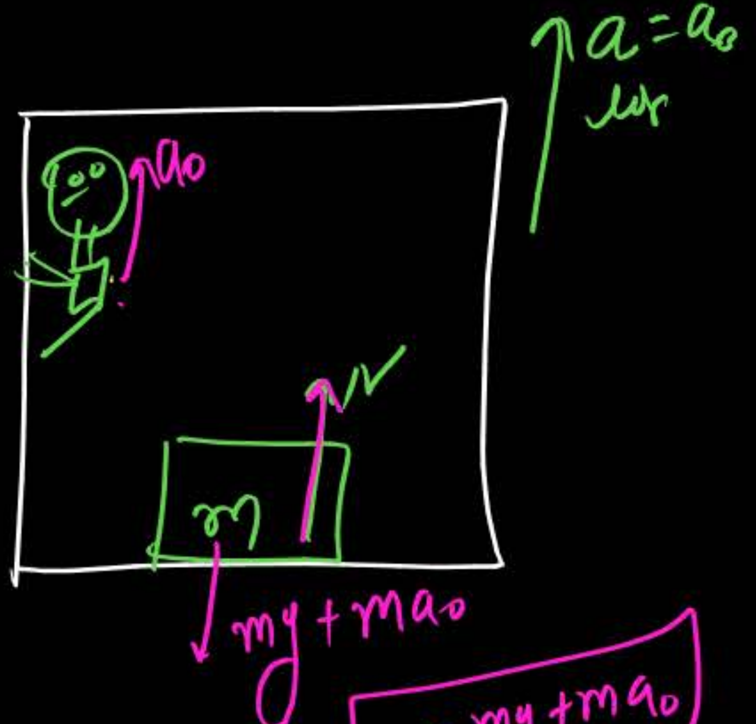
$$mg - T - ma_0 = ma$$

$$m_1(g-a_0) - \cancel{T} = m_1 a$$

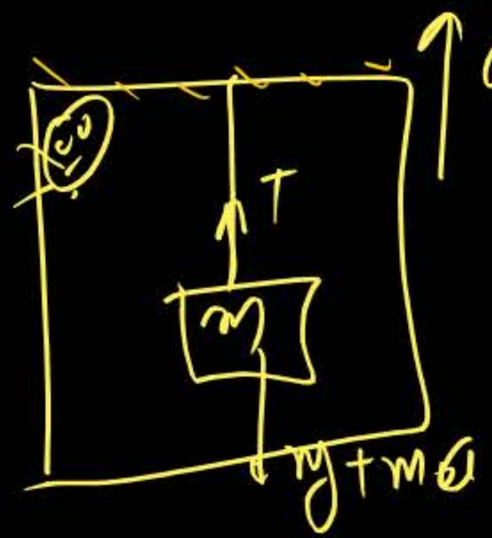
$$\cancel{T} + m_2 a_0 - m_2 g = m_2 a$$

$$m_1(g-a_0) - m_2(g-a_0) = (m_1+m_2)a$$

$$\boxed{a = \frac{(m_1-m_2)(g-a_0)}{m_1+m_2}}$$

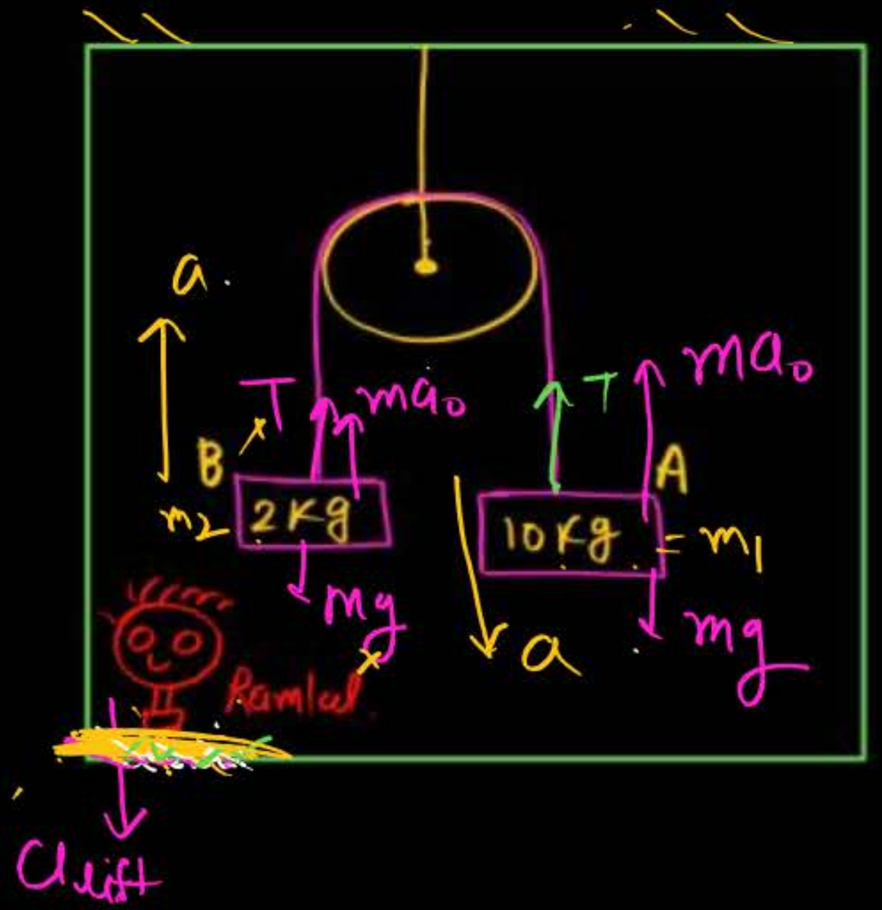


$\boxed{N = mg + ma_0}$ apparent weight



$T = m(g+a_0)$

find acc^n of Block A & B w.r.t Ramlal (lift) and w.r.t Ground.



$a_{lift} = 4 m/s^2$ (a)

$$T = \frac{2 \times 10 \times 2}{10+2} \times 6 = \frac{\cancel{4}^{2} \times 10}{\cancel{12}_{\cancel{6}}} \times \cancel{6} = 20$$

$$\boxed{T = \frac{2(m_1 m_2)}{m_1+m_2} g_{eff} = \frac{2 m_1 m_2}{m_1+m_2}(g-4)}$$

$$\vec{a}_{m_1 lift} = \left(\frac{m_1-m_2}{m_1+m_2}\right) g_{eff}$$

$$\vec{a}_{m_1 lift} = \left(\frac{10-2}{10+2}\right)(10-4) = \frac{\cancel{8}^{4}}{\cancel{12}_{\cancel{6}}} \times \cancel{6}$$

$$\boxed{\begin{aligned} \vec{a}_{m_1 lift} &= 4 m/s^2 \downarrow \\ \vec{a}_{m\ lift} &= 4 m/s^2 \uparrow \end{aligned}}$$

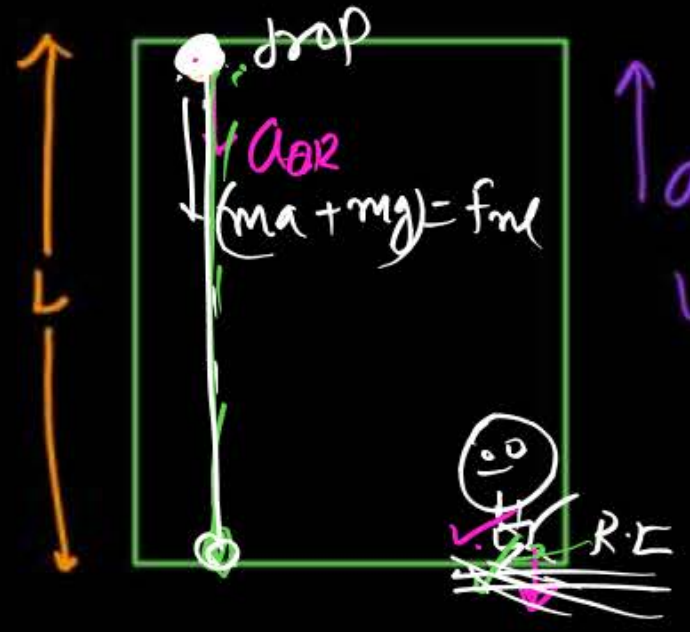
$$\vec{a}_{m_1 lift} = \vec{a}_{m_1 ground} - \vec{a}_{lift\ ground}$$

$$4 = \vec{a}_{m_1 g} - 4$$

$$\boxed{\vec{a}_{m_1 g} = 8 m/s^2}$$

$$\boxed{\vec{a}_{m_2 g} = 0}$$

Ball is droped from top of lift as shown in fig. then find time when it will collide the base of lift.



$\uparrow a_{lift} = 4\,m/s^2$
$v_{lift} = 20\,m/s$ at time of drop.

$F_{psl} = m(g+a)$

$\cancel{m}\,a_{Ball\ R.L} = \cancel{m}(g+a)$

$a_{Ball\ RL} = g+a$

$u_{Ball\ R.L} = 0$

$a_{Ball\ R.L} = (g+a)$

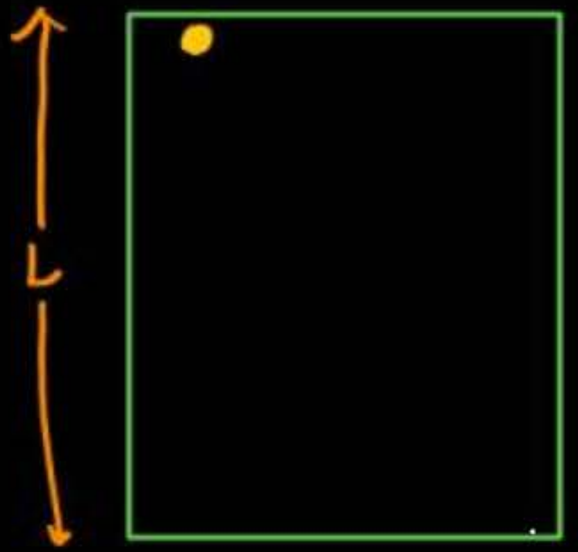
$disp = L$

$S = \cancel{ut}^{\,0} + \frac{1}{2}at^2$

$L = \frac{1}{2}(g+a)t^2$

$t = \sqrt{\dfrac{2L}{(g+a)}}$ ✓

Ball is droped from top of lift as shown in fig. then find time when it will collide the base of lift.



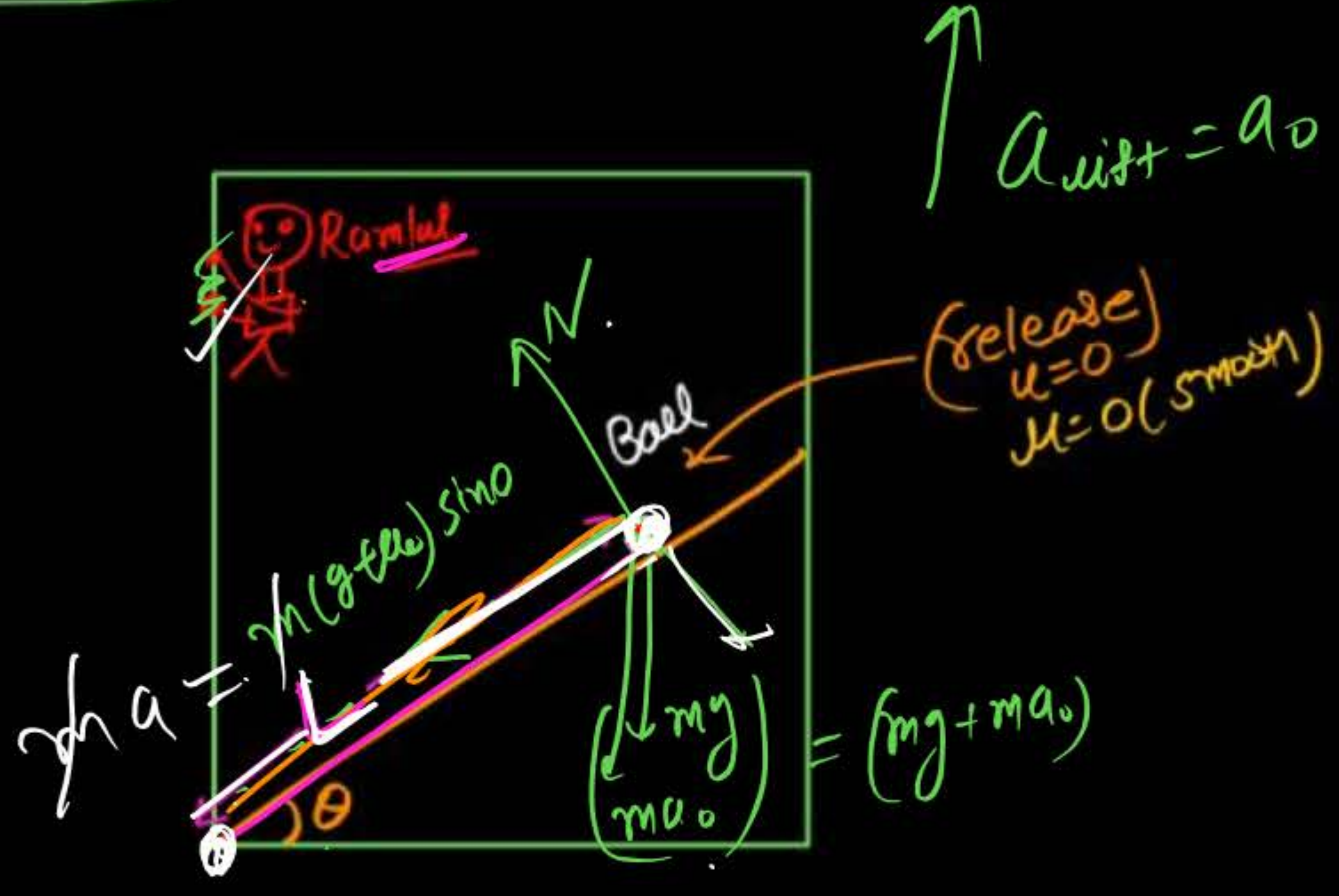
$\downarrow a_{lift} = 5\,m/s^2$

$\uparrow v_{lift} = 10\,m/s$

at time of drop.

$$\boxed{t = \sqrt{\frac{2L}{(g-a)}}}$$

Time taken to reach the Base of lift :- (HCV)



$$a = (g+a_0)\sin\theta$$

$$u = 0$$

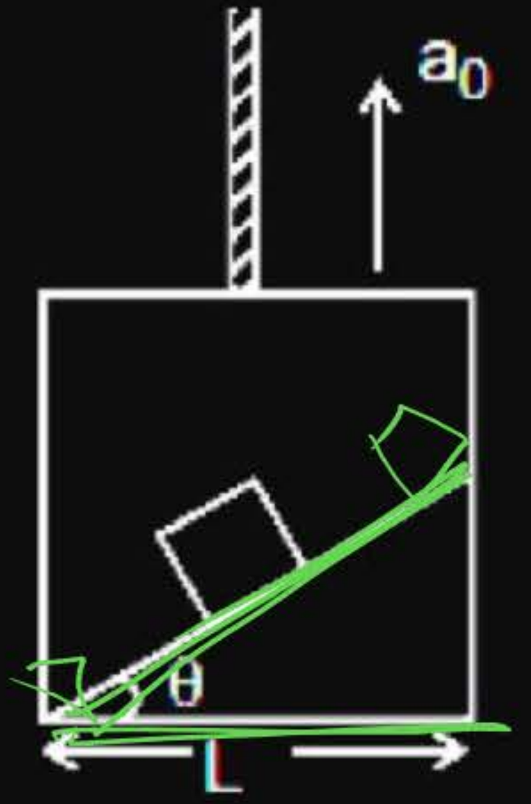
$$S = \frac{1}{2} a_{net} t^2$$

$$\boxed{t = \sqrt{\frac{2L}{(g+a_0)\sin\theta}}} \quad t = \sqrt{\frac{2L}{a_{net}}}$$

Question

(HCV)

A particle slides down a smooth inclined plane of elevation θ, fixed in an elevator going up with an acceleration a_0 (see in figure). The base of the incline has a length L. Find the time taken by the particle to reach the bottom.



H/W

Question (5)

If the force on a rocket, that releases the exhaust gases with a velocity of 300 m/s is 210 N, then the rate of combustion of the fuel is :

1. 0.07 kg/s
2. 1.4 kg/s
3. 0.7 kg/s
4. 10.7 kg/s

$u = 300 \, m/s$

$F = 210 \, N = u \frac{dm}{dt}$

$2.1\cancel{0} = 3\cancel{00} \frac{dm}{dt}$

$\frac{2.1}{3} = \frac{dm}{dt}$

$\boxed{0.7 \, kg/s = \frac{dm}{dt}}$

Question

(3)

A cracker rocket is ejecting gases at a rate of 0.05 kg/s with a velocity 400 m/s. The accelerating force on the rocket is:

1. 20 dyns
2. 20 N ✓
3. 200 N
4. Zero

$$\frac{dm}{dt} = 0.05\ \text{kg/s}$$

$$u = 400\ \text{m/s}$$

$$F = u\frac{dm}{dt} = \cancel{400} \times \frac{5}{\cancel{100}}$$

$$= 20\ \text{N}$$

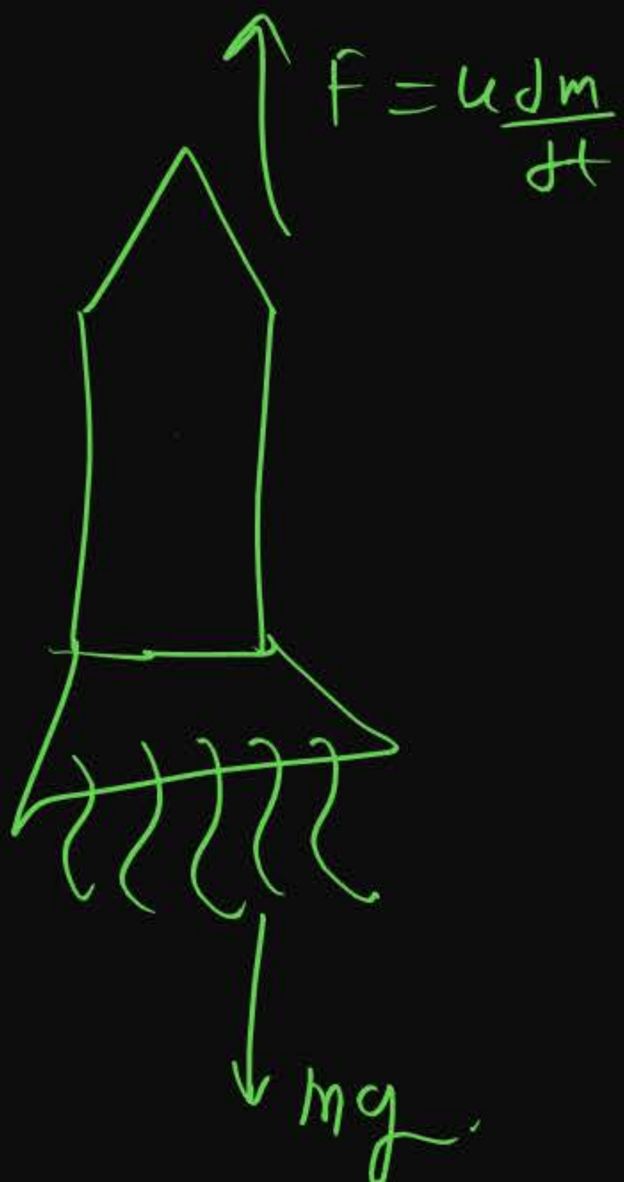
Question 2

A 800 kg rocket is fired from earth so that exhaust speed is 1200 m/s. Then calculate mass of fuel burning per second, to provide initial thrust to overcome its weight. $(g = 10\ \text{m/s}^2)$

$$u\frac{dm}{dt} = mg$$

$$12\cancel{00} \times \frac{dm}{dt} = 80\cancel{0} \times 1\cancel{0}$$

$$\frac{dm}{dt} = \frac{8\cancel{0}}{12} \quad 6.6\ \text{kg/sec}$$



Question (4)

A rocket of mass 5700 kg ejected mass at a constant rate of 15 kg/s with constant speed of 12 km/s. The acceleration of the rocket 1 minute after the blast is $(g = 10\ \text{m/s}^2)$

$\frac{dm}{dt}$

1. $34.9\ \text{m/s}^2$
2. $27.5\ \text{m/s}^2$
3. $3.50\ \text{m/s}^2$
4. $13.5\ \text{m/s}^2$

$$\boxed{a_{(t=0)} = \frac{\left(u\frac{dm}{dt}\right)}{M_0} - g}$$

$$\boxed{\frac{dm}{dt} = 15\ \text{kg/sec.}}$$

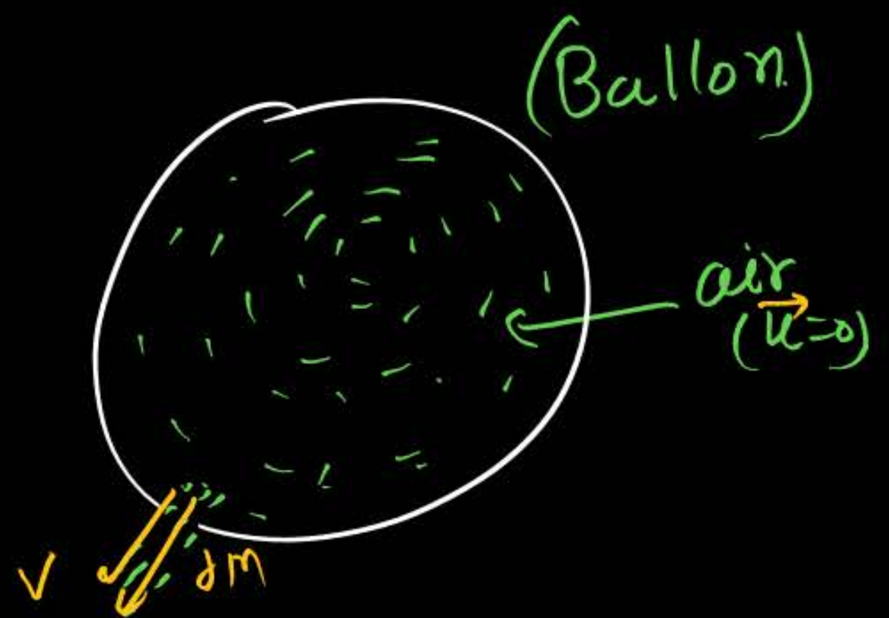
$u = 12 \times 10^3\ \text{m/s}$

$M = 5700\ \text{kg}$

$$a_t = \frac{\left(u\frac{dm}{dt}\right)}{M_0 - t\frac{dm}{dt}} - g$$

$$a_t = \frac{12\times10^3\times15}{5700 - \underbrace{15\times60}} - 10 = \frac{\cancel{12}\times15\times\cancel{10^3}10}{\cancel{4800}\,4} - 10 = \frac{150-40}{4} = \frac{\cancel{110}}{\cancel{4}} = 27.5$$

(6) A Ballon has 2 grm air, A small hole is made, air comes out with velocity 4 m/s & completly shrinks in 2.5 sec Then Avg. force on Ballon.



Sol^n $M = 2$ grm

$$dp = v\,dm$$

$$F_{Avg} = v\frac{\Delta m}{\Delta t}$$

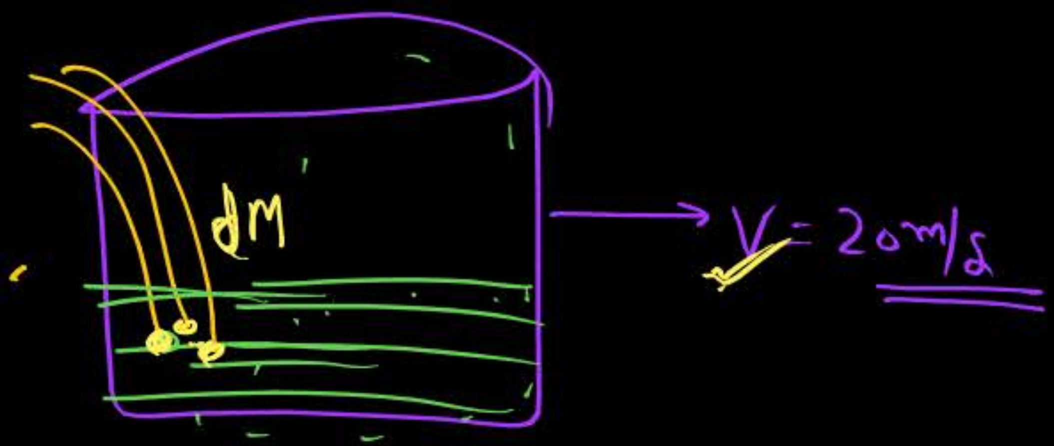
$$= 4 \times \frac{2\times 10^{-3}}{2.5}$$

$$= \frac{4\times 2\times}{\frac{5}{2}\,10^3} = \left(\frac{4\times 4}{5\times 10^3}\right) N$$

$$F = \frac{dp}{dt} = \left|\frac{v\,dm}{dt}\right|$$

$$F = m\frac{dv}{dt} = ma$$

(7) A cart is moving with constant velocity 20m/s and sand being droped in the cart at rate 50 kg/mint, then force required to move the cart with constant velocity



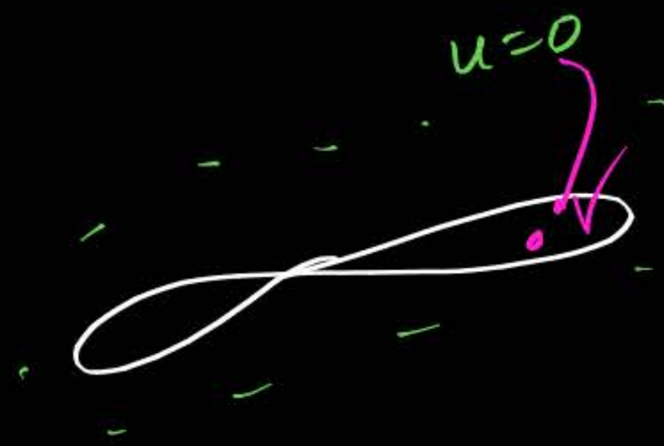
$$\frac{dm}{dt} = 50\,kg/min = \frac{50}{60}\,kg/sec$$

$$\frac{dp}{dt} = V\frac{dm}{dt}$$

$$F = V\frac{dm}{dt} = \frac{\cancel{20} \times 50}{\cancel{60}_{3}} = \frac{50}{3}\text{ newtn}$$

(8) A Satellite in force free space sweeps stationary interplanetary dust at rate $\boxed{\frac{dM}{dt} = \alpha v}$, v = velocity, M = mass of satellite then acceleration of Satellite.

gravity free ($F_{net} = 0$)



$\frac{dm}{dt} = \alpha v$

v = velocity

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

$$\cancel{F}^{\,0} = m\frac{dv}{dt} + v\frac{dm}{dt}$$

$$0 = Ma + v\frac{dm}{dt}$$

$$Ma = -v\frac{dm}{dt} = -v(\alpha v)$$

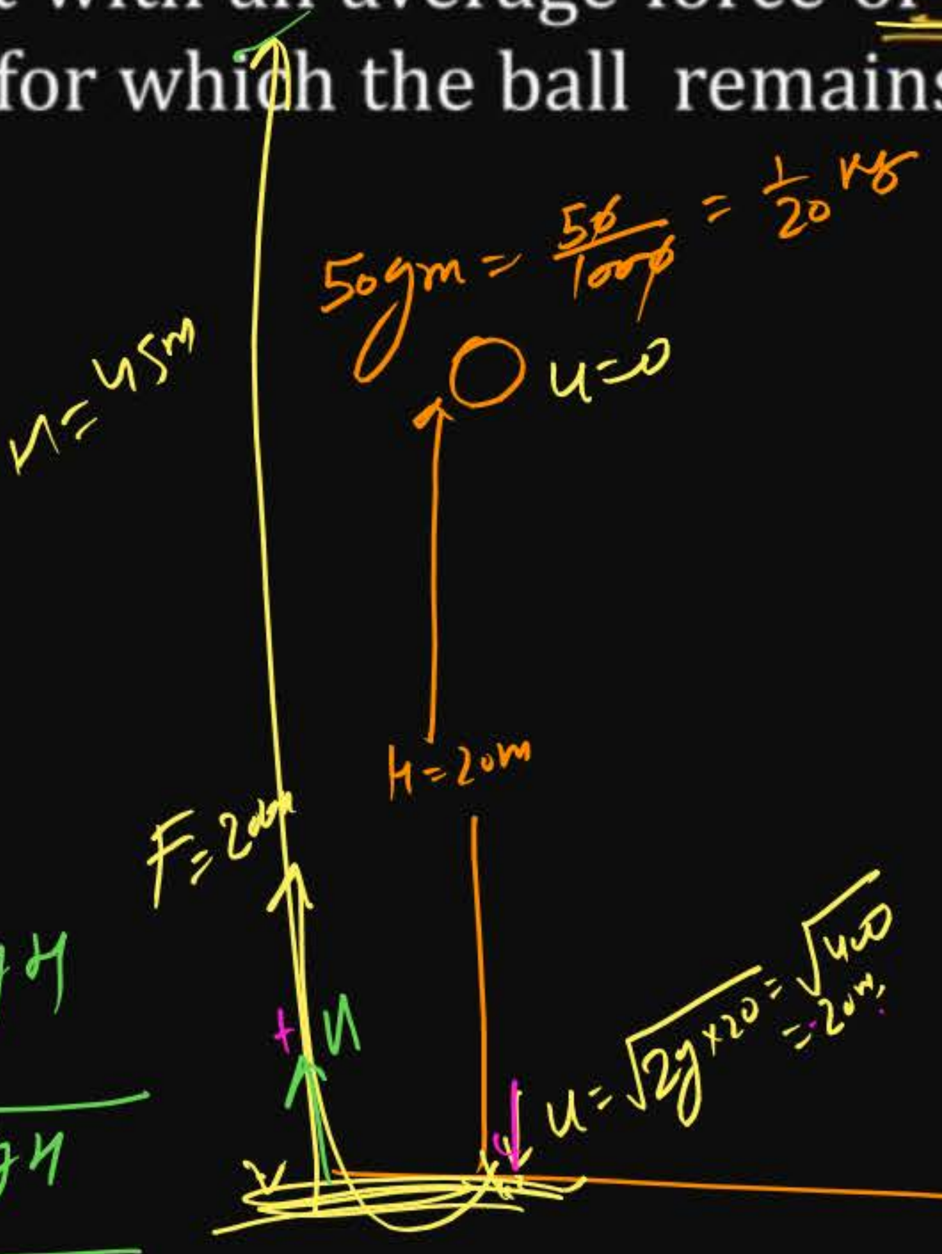
$$\boxed{a = -\frac{\alpha v^2}{M}}$$

Ans

Question $\boxed{H|W}$ Note मे नही लिखना

A ball of mass 50 g is dropped from a height of 20 m. A boy on the ground hits the ball vertically upwards with a bat with an average force of 200 N, so that it attains a vertical height of 45 m. The time for which the ball remains in contact with the bat is
[Take $g = 10\ m/s^2$]

1. $1/20^{th}$ of a second
2. $1/40^{th}$ of a second
3. $\boxed{1/80^{th} \text{ of a second}}$
4. $1/120^{th}$ of a second



$H = \frac{u_{in}^2}{2g}$

$u_{in}^2 = 2gH$

$u_{in} = \sqrt{2gH}$

$= \sqrt{2\times10\times45} = 30\,m$

$F_{Avg} = \frac{\Delta p}{\Delta t}$

$200 = \frac{p_f - p_i}{\Delta t}$

$\Delta t = \frac{\left(\frac{30}{20}\right) + \left(\frac{20}{20}\right)}{200}$

$= \frac{5\cancel{0}}{200\times 2\cancel{0}}$

$\Delta t = \frac{5}{4000} = \frac{1}{80}$

@MRPHYSICSS

THANK YOU

Rapid Test
(must do)