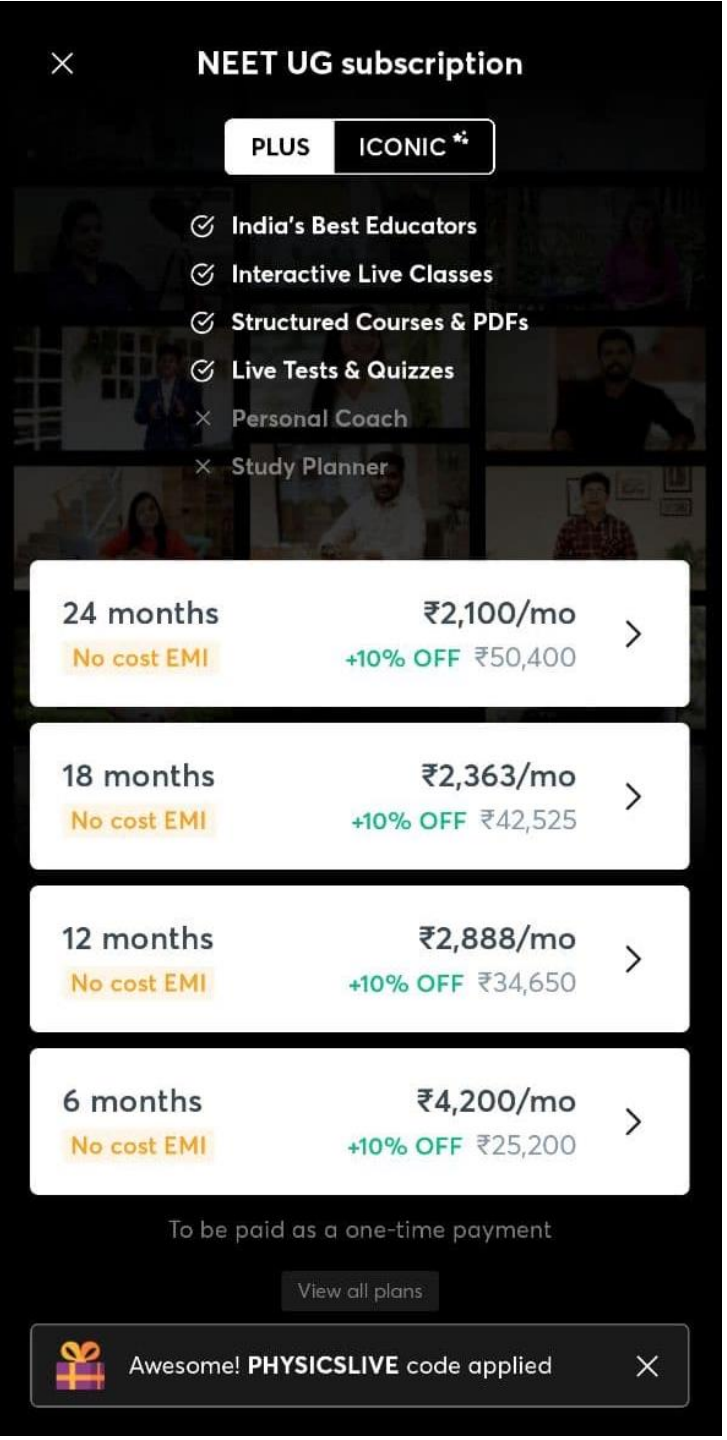
SIR PRATEEK JAIN

. Founder @ Physicsaholics
. Top Physics Faculty on Unacademy (IIT JEE & NEET)
. 8+ years of teaching experience in top institutes like FIITJEE (Delhi, Indore) , CP (KOTA) etc.
. Produced multiple Top ranks.
. Research work with HC Verma sir at IIT Kanpur
. Interviewed by International media.



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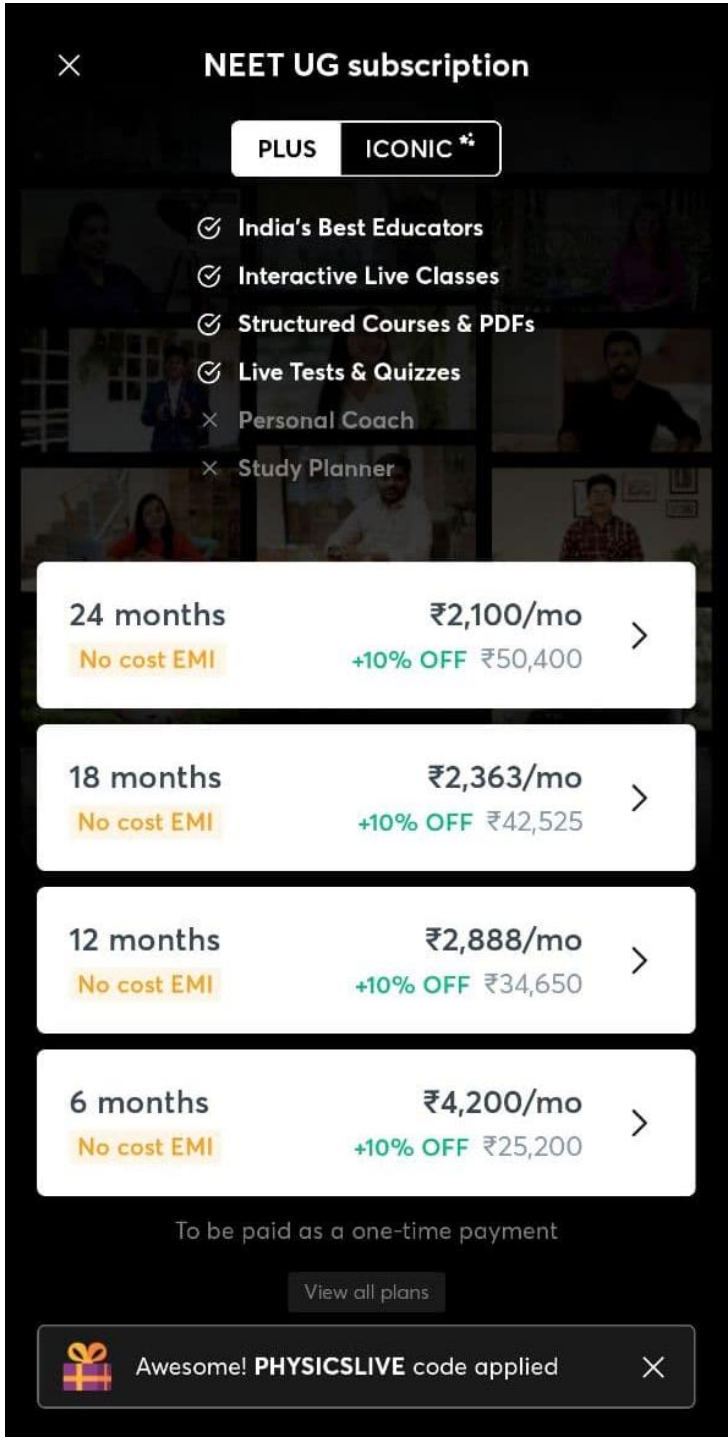

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Physics DPP

DPP-6 NLM: Pseudo Force

By Physicsaholics Team

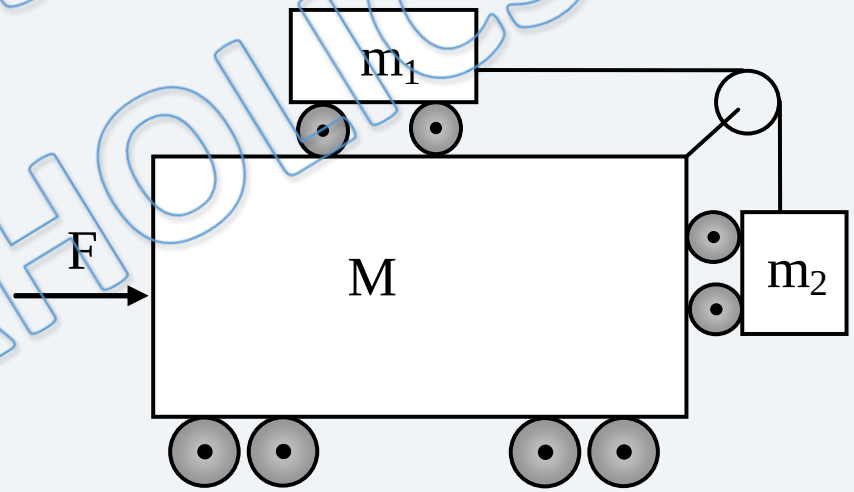
Q) A frictionless cart of mass M carries two other frictionless carts having masses m_1 and m_2 connected by a string passing over a pulley as shown in figure. The horizontal force that must be applied on M so that m_1 and m_2 do not move relative to it will be -

(a) $(M + m_1 + m_2)\,(m_2/m_1)\,g$

(b) $(M + m_1 + m_2)\,(m_1/m_2)\,g$

(c) $(M + m_1)\,[(m_1 + m_2)/m_2]g$

(d) $(M + m_2)\,[m_2/(m_1 + m_2)]g$

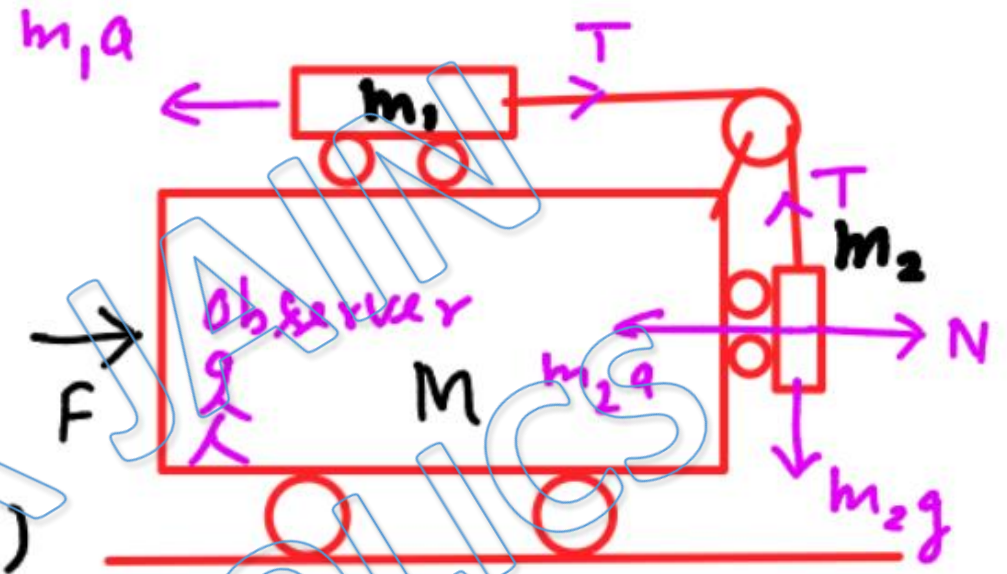


Ans. a

Solution:

Let acceleration of M is a.

$$F = (M + m_1 + m_2)a \quad \text{---(i)}$$



Since m_1 & m_2 are not sliding on M.

Supporting force = Opposing force

$$\Rightarrow m_1a = m_2g \Rightarrow a = \frac{m_2g}{m_1}$$

$$\Rightarrow F = (m_1 + m_2 + M)\frac{m_2g}{m_1} \quad (A)$$

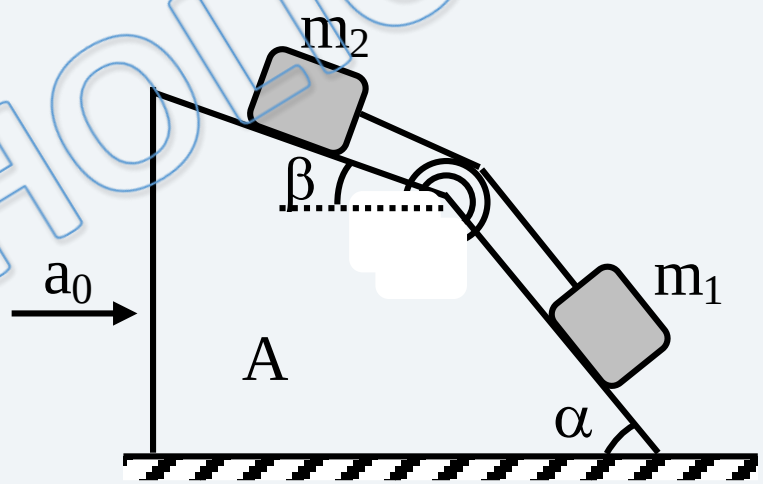
Q) Two cubes of masses m_1 and m_2 lie on frictionless slopes of a block A which rests on a horizontal table. The cubes are connected by a string which passes over a pulley as shown in figure. If a_0 be the horizontal acceleration to which the whole system (block + masses) is subjected so that m_1 and m_2 do not move and T be the tension in the string in that situation then–

(a) $a_0 = \left(\frac{m_1 \sin\alpha + m_2 \sin\beta}{m_1 + m_2}\right) g$

(b) $a_0 = \left(\frac{m_1 \sin\alpha + m_2 \sin\beta}{m_1 \cos\alpha + m_2 \cos\beta}\right) g$

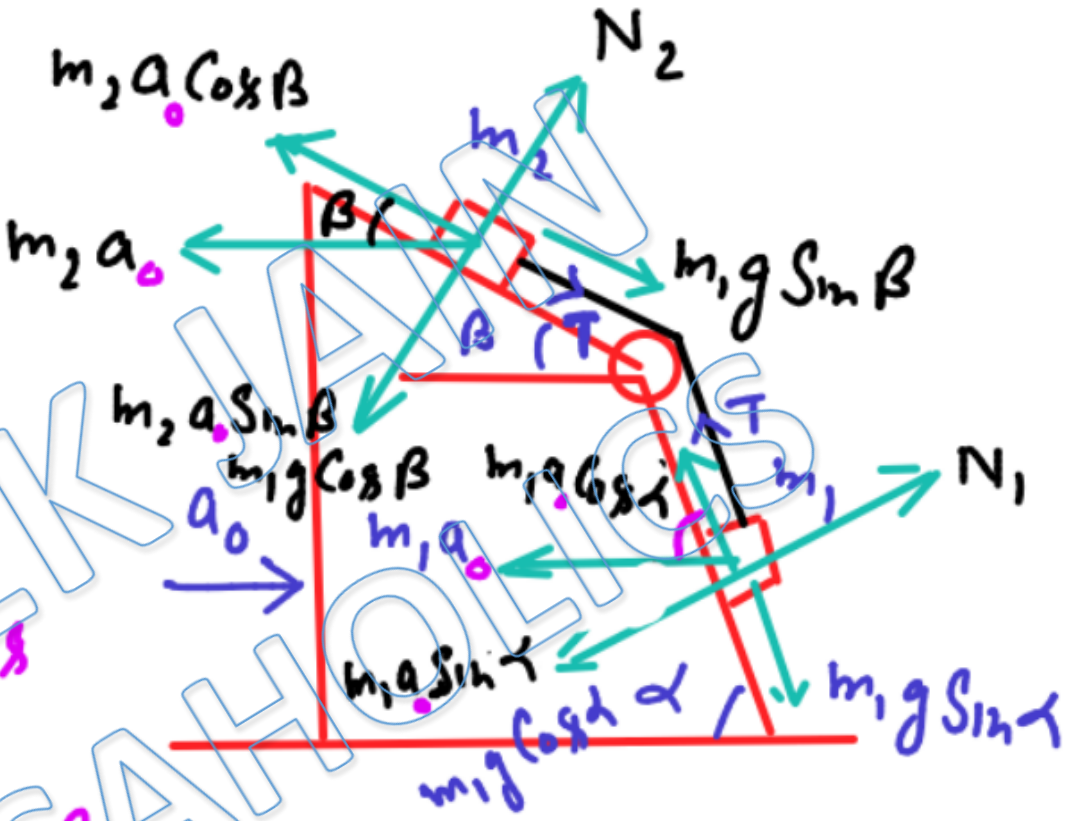
(c) $T = \frac{m_1 m_2}{m_1 + m_2} g \sin(\alpha + \beta)$

(d) $T = \left(\frac{m_1 m_2}{m_1 \cos\alpha + m_2 \cos\beta}\right) g \sin(\alpha - \beta)$



Ans. b, d

Solution:



Since blocks are not Sliding.

Supporting forces = opposing forces

$$\Rightarrow m_1 g \sin\alpha + m_2 g \sin\beta = m_1 a_0 \cos\alpha + m_2 a_0 \cos\beta$$

$$\Rightarrow a_0 \left[m_1 \cos\alpha + m_2 \cos\beta \right] = \left(m_1 \sin\alpha + m_2 \sin\beta \right) g$$

$$\Rightarrow a_0 = \frac{m_1 \sin\alpha + m_2 \sin\beta}{m_1 \cos\alpha + m_2 \cos\beta}\, g$$

from F.B.D of m_1

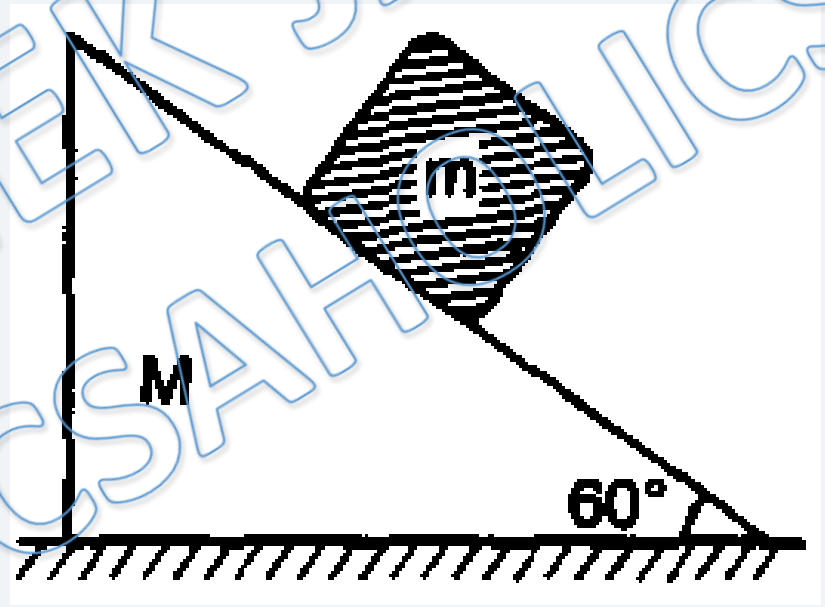
$$T + m_1 a_0 \cos\alpha = m_1 g \sin\alpha$$

On putting value of a_0

$$T = \frac{m_1 m_2 g \sin(\alpha-\beta)}{m_1 \cos\alpha + m_2 \cos\beta}$$

(B, D)

Q) In the arrangement shown in figure wedge of mass M moves towards left with an acceleration a. All surfaces are smooth. The acceleration of block in relative to wedge is:



(a) a/2

(b) $\frac{2Ma}{m}$

(c) $\frac{a}{2}+\frac{g\sqrt{3}}{2}$

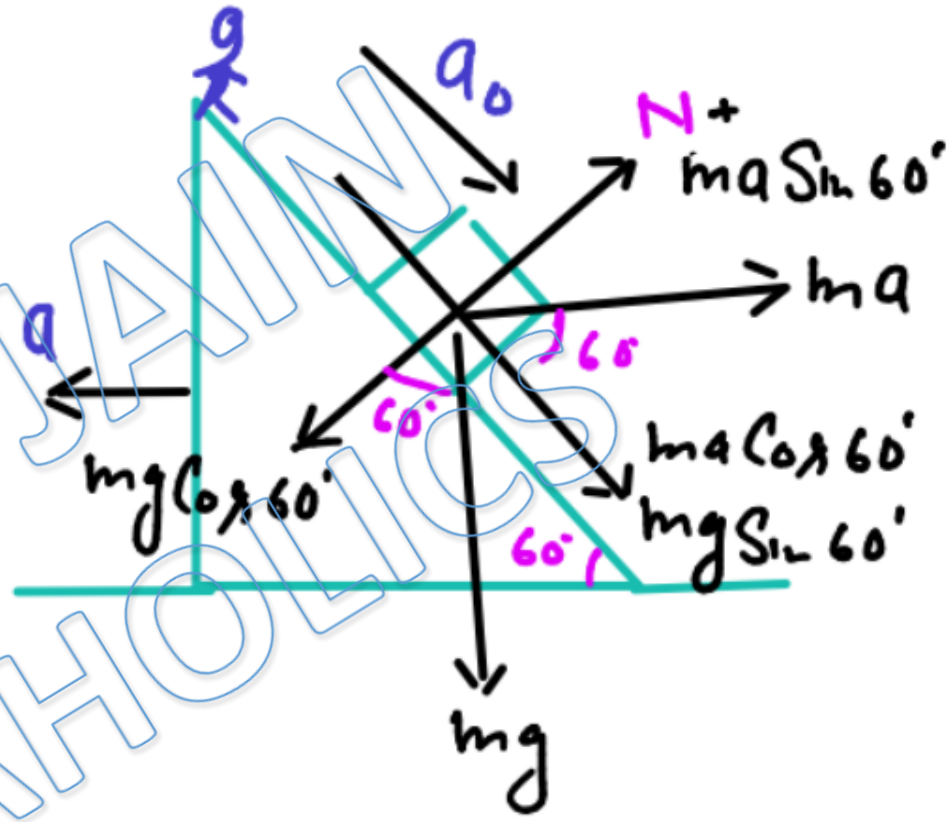
(d) $\frac{(M+m)a}{m}$

Ans. c

Solution:

$$m a \cos 60^\circ + m g \sin 60^\circ = m a_0$$

$$a_0 = \frac{a}{2} + \frac{g\sqrt{3}}{2}$$



(c)

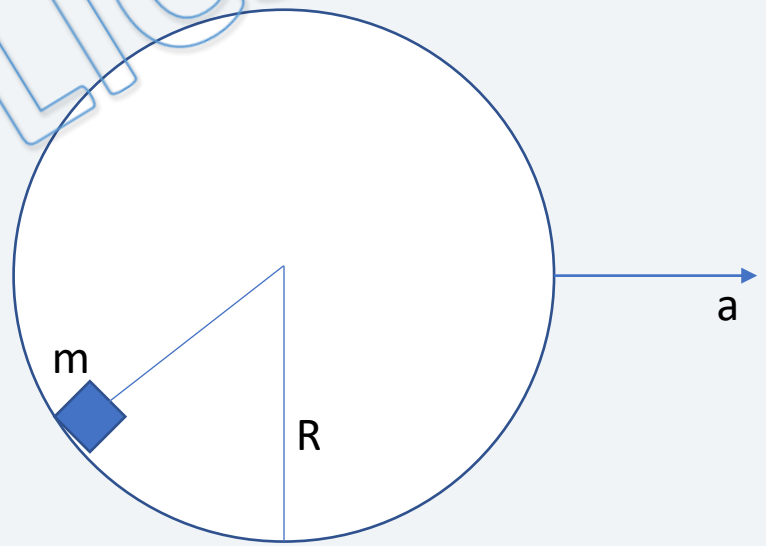
Q) A block is placed in a smooth cylinder which is moving horizontaly with constant acceleration a = 3g/4 . Find height of block from bottommost point of cylinder if block is stationary with respect to cylinder ?

(a) R/5

(b) R/3

(c) R/4

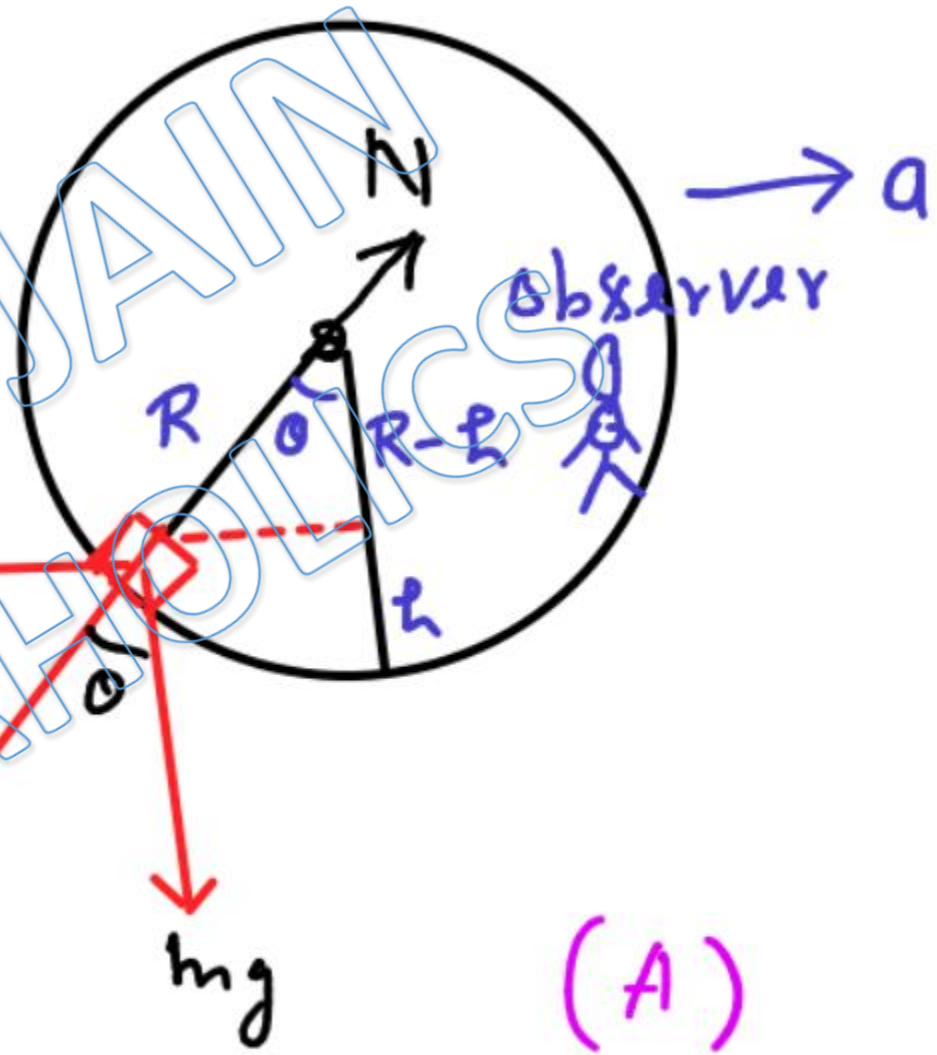
(d) R/2



Ans. a

Solution:

Resultant of ma & mg must be just opposite to N.



$$\tan\theta = \frac{ma}{mg}$$

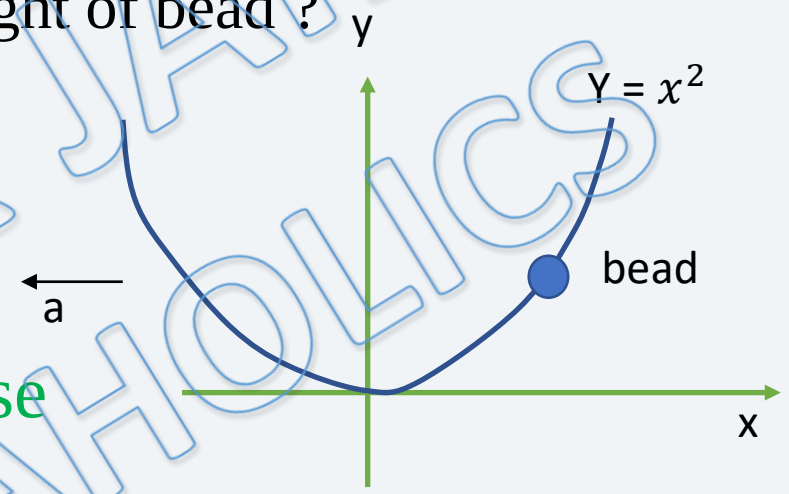
$$\Rightarrow \tan\theta = 3/4$$

$$\Rightarrow \cos\theta = \frac{4}{5} = \frac{R-h}{R}$$

$$\Rightarrow h = R/5$$

(A)

Q) x-y plane is a vertical plane in which a parabolic wire of shape $y = x^2$ is moving with constant acceleration a in negative x direction. At position shown in figure a bead is stationary with respect to wire. Find height of bead ?



(a) a/g

(b) a/2g

(c) $\frac{a^2}{4g^2}$

(d) none of these

Ans. c

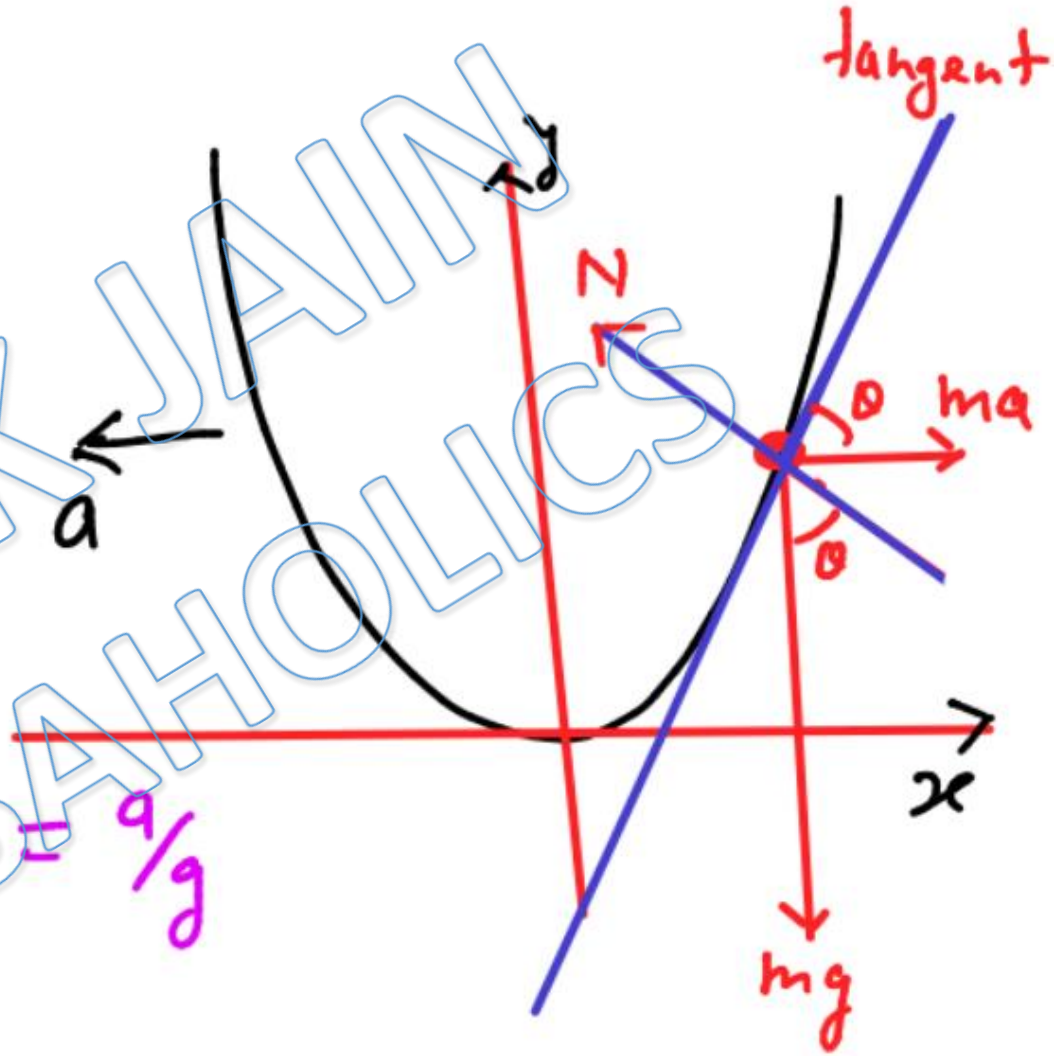
Solution:

Resultant of ma & mg must be perpendicular to N.

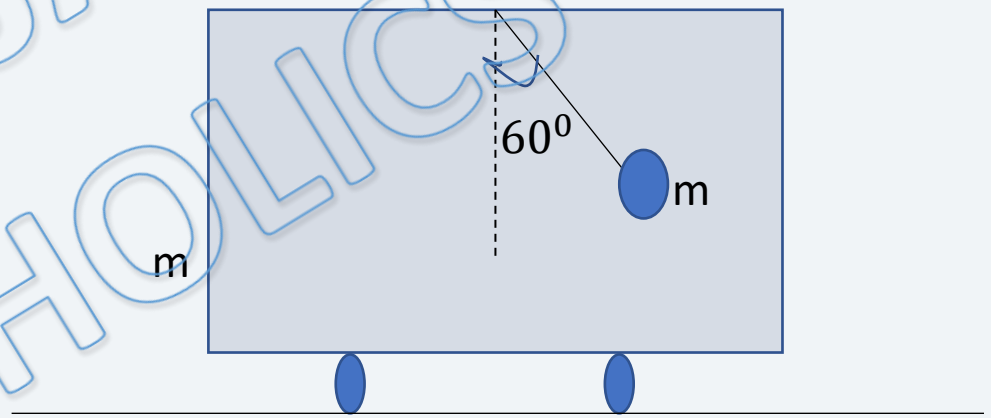
$$\Rightarrow \tan\theta = \frac{ma}{mg}$$

$$\Rightarrow \frac{dy}{dx} = \frac{a}{g} \Rightarrow 2x = a/g$$

$$\Rightarrow y = x^2 = \frac{a^2}{4g^2}$$



Q) In given figure all suraces are smooth and string is massless. System is released from given position. Find initial acceleration of cart ?



(a) g/7

(b) 2g/7

(c) $\frac{g\sqrt{3}}{7}$

(d) $\frac{g}{7\sqrt{3}}$

Ans. c

Solution:

for Cart

$T \sin 60^\circ = ma$

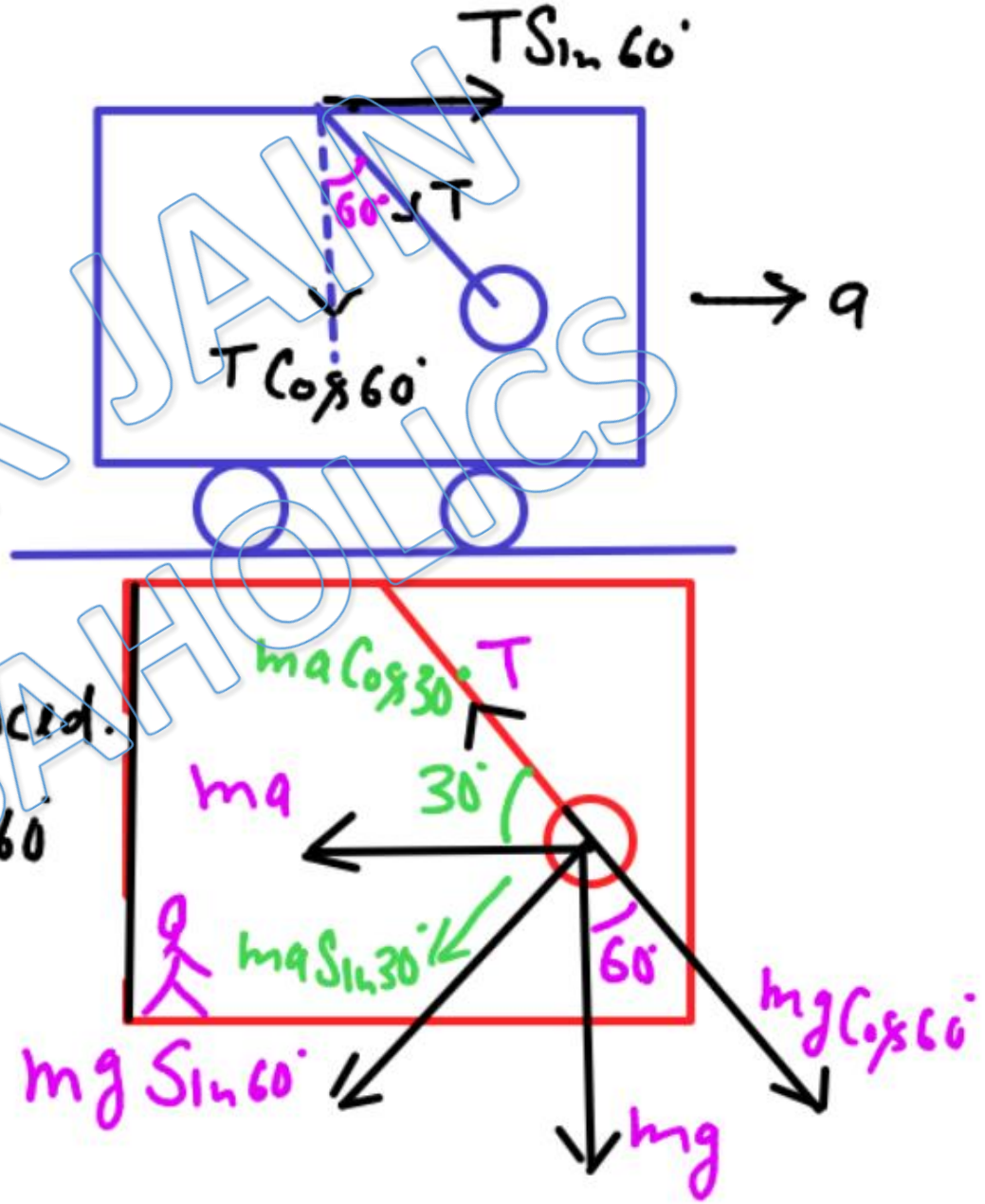
$\Rightarrow \quad T = \dfrac{2ma}{\sqrt{3}}$

forces along string on bob must be balanced.

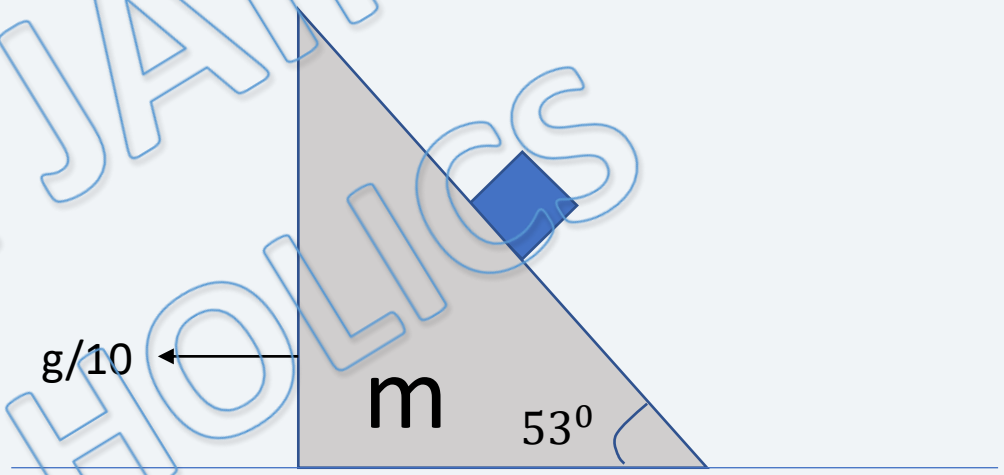
$T + ma\cos 30^\circ = mg\cos 60^\circ$

$\dfrac{2ma}{\sqrt{3}} + \dfrac{ma\sqrt{3}}{2} = \dfrac{mg}{2}$

$\Rightarrow \quad a = \dfrac{g\sqrt{3}}{7}$



Q) After releasing triangular wedge of mass m moves left by acceleration g/10. find mass of block if all surfaces are smooth ?



(a) m

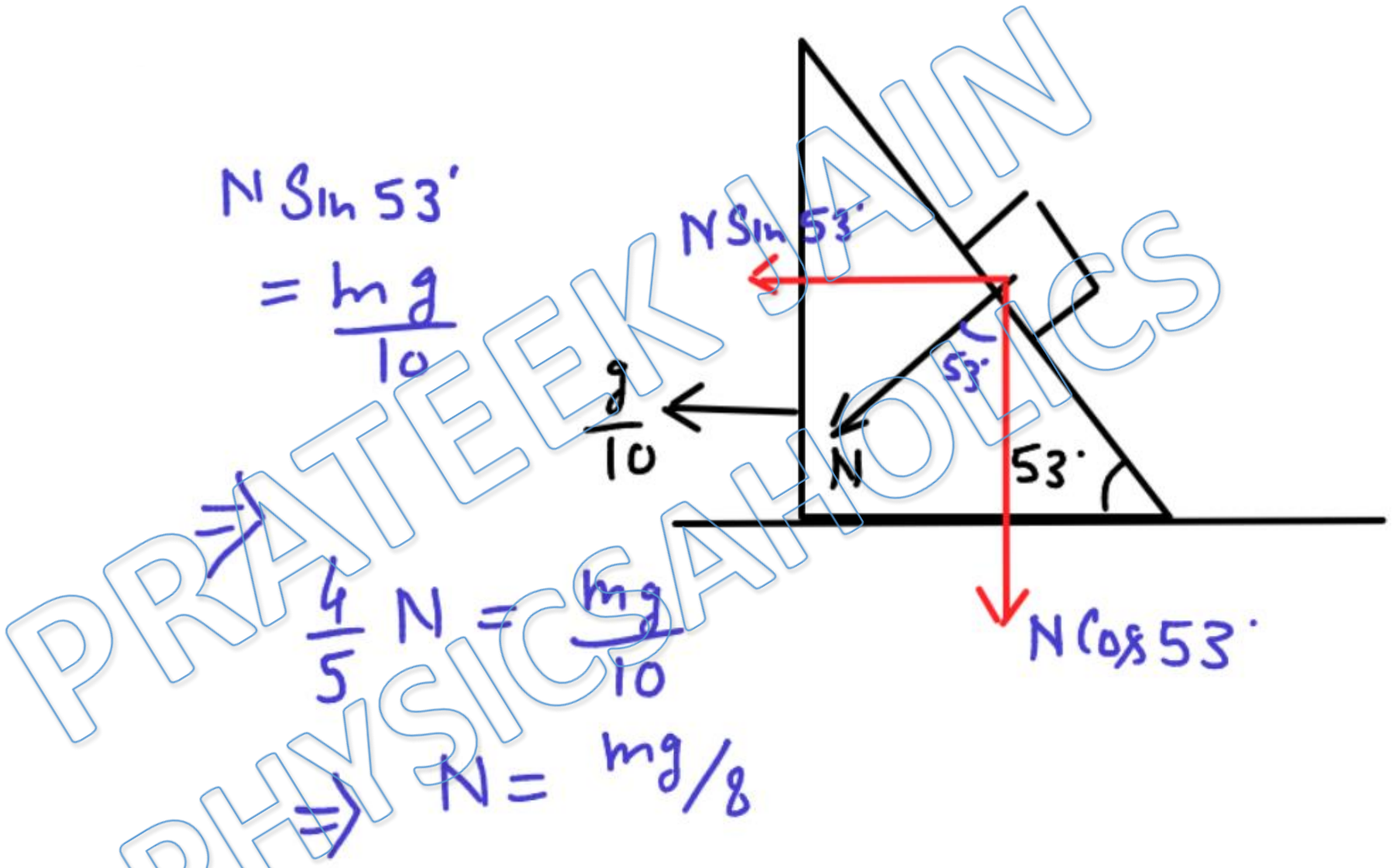
(b) m/37

(c) 5m/52

(d) 25m/104

Ans. d

Solution:



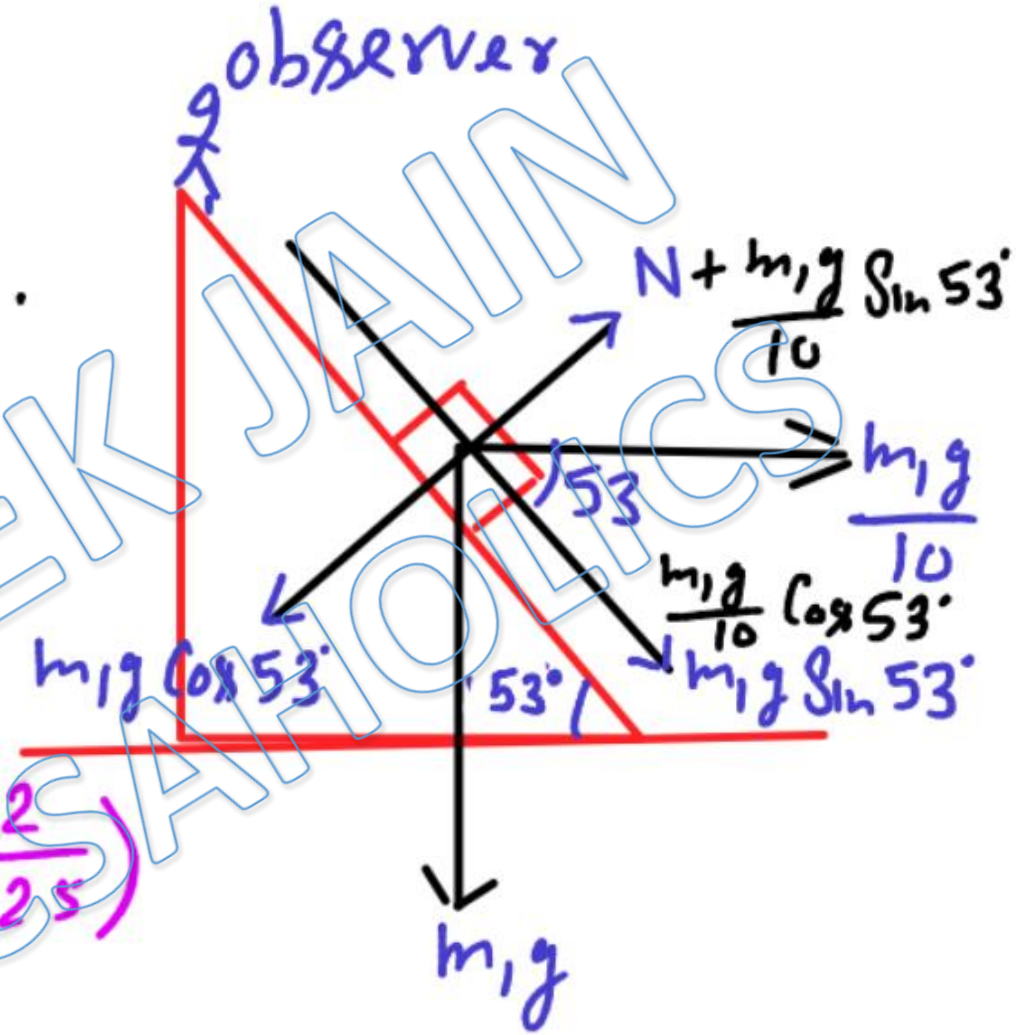
forces along normal must be ballanced.

$$\Rightarrow N + \frac{m_1 g}{10} \times \frac{4}{5}$$

$$= m_1 g \times \frac{3}{5}$$

$$\Rightarrow \frac{mg}{8} = m_1 g \left(\frac{3}{5} - \frac{2}{25}\right)$$

$$\Rightarrow m_1 = \frac{25}{104} m$$



(d)

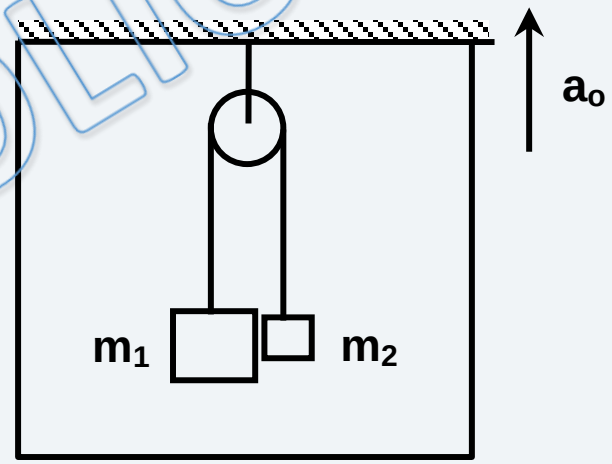
Q) A pulley fixed to the ceiling of an elevator car carries a thread whose ends are attached to the masses $m_1 = 3$ kg and $m_2 = 6$ kg . The car starts going up with an acceleration $a_o = 2$ m/sec^2 Assuming the masses of the pulley and the thread as well as the friction to be negligible, find acceleration of m_1 with respect to ground ?

(a) 4 m/Sec^2

(b) 2 m/Sec^2

(c) 6 m/Sec^2

(d) 8 m/Sec^2



Ans. c

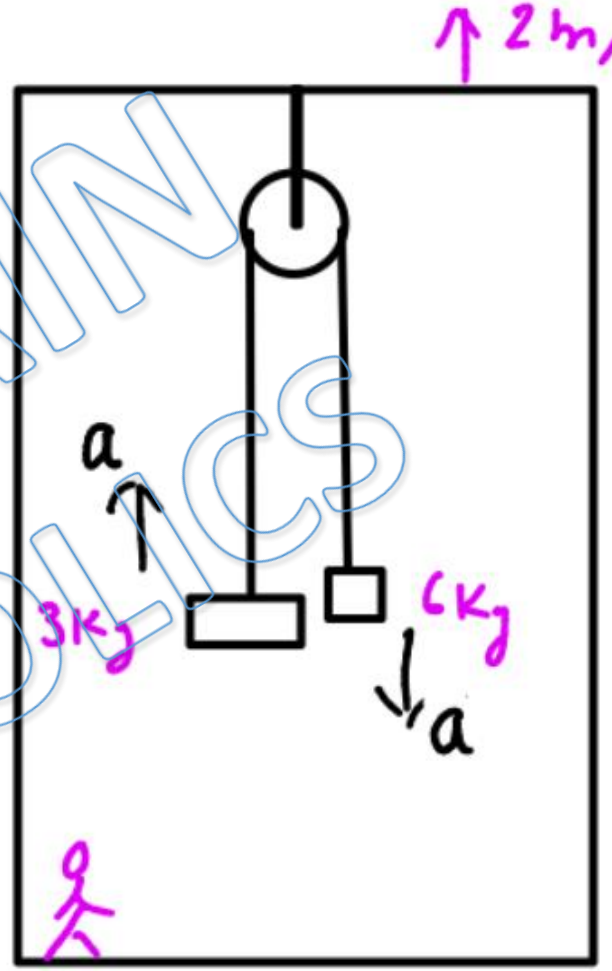
Solution:

$$g_{eff} = g + a_0 = 10 + 2$$

$$= 12 \text{ m/sec}^2$$

$$a = \frac{m_1 - m_2}{m_1 + m_2} g_{eff}$$

$$= \frac{6-3}{6+3} \times 12 = 4 \text{ m/sec}^2$$



Here a is acceleration of block w.r.t. lift

$$a_{m,g} = a_{m,L} + a_{L,g} = 4\uparrow + 2\uparrow$$

$$= 6 \text{ m/sec}^2$$

(C)

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Chalo Niklo