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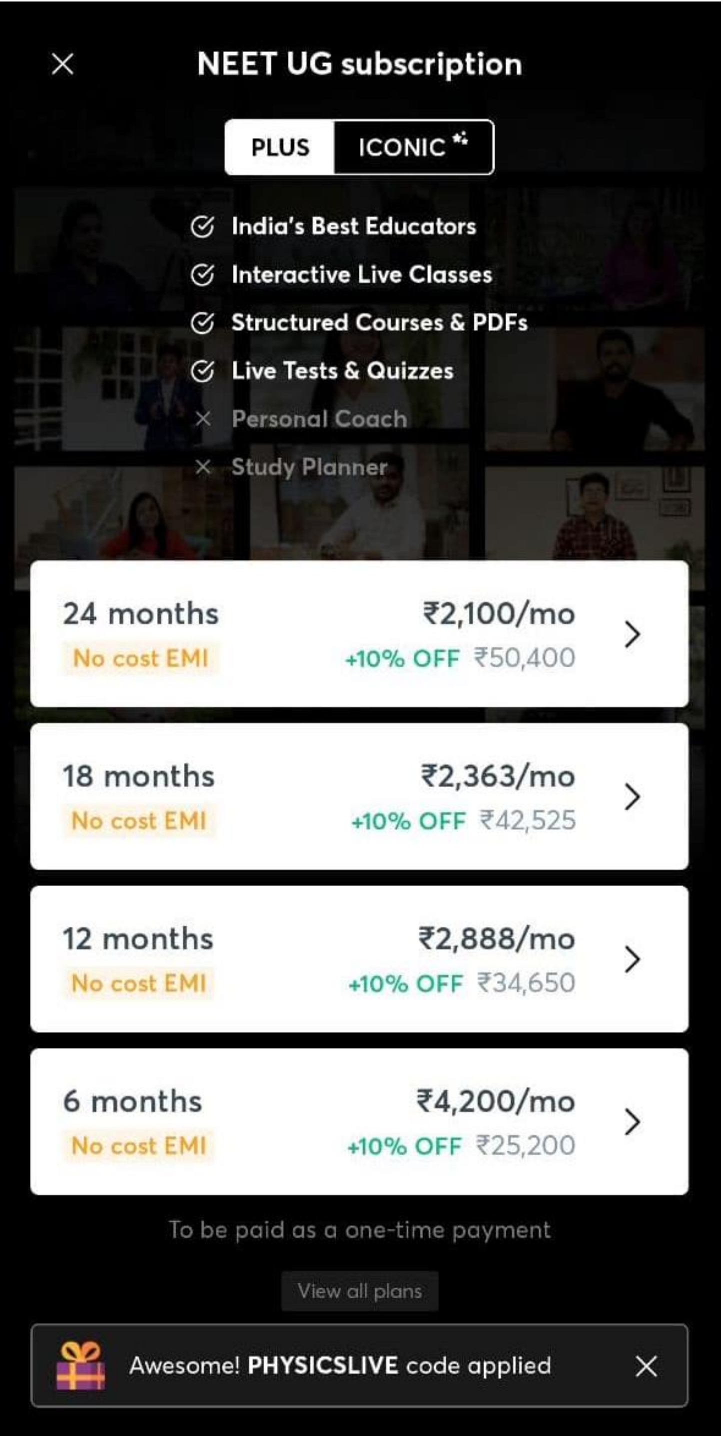

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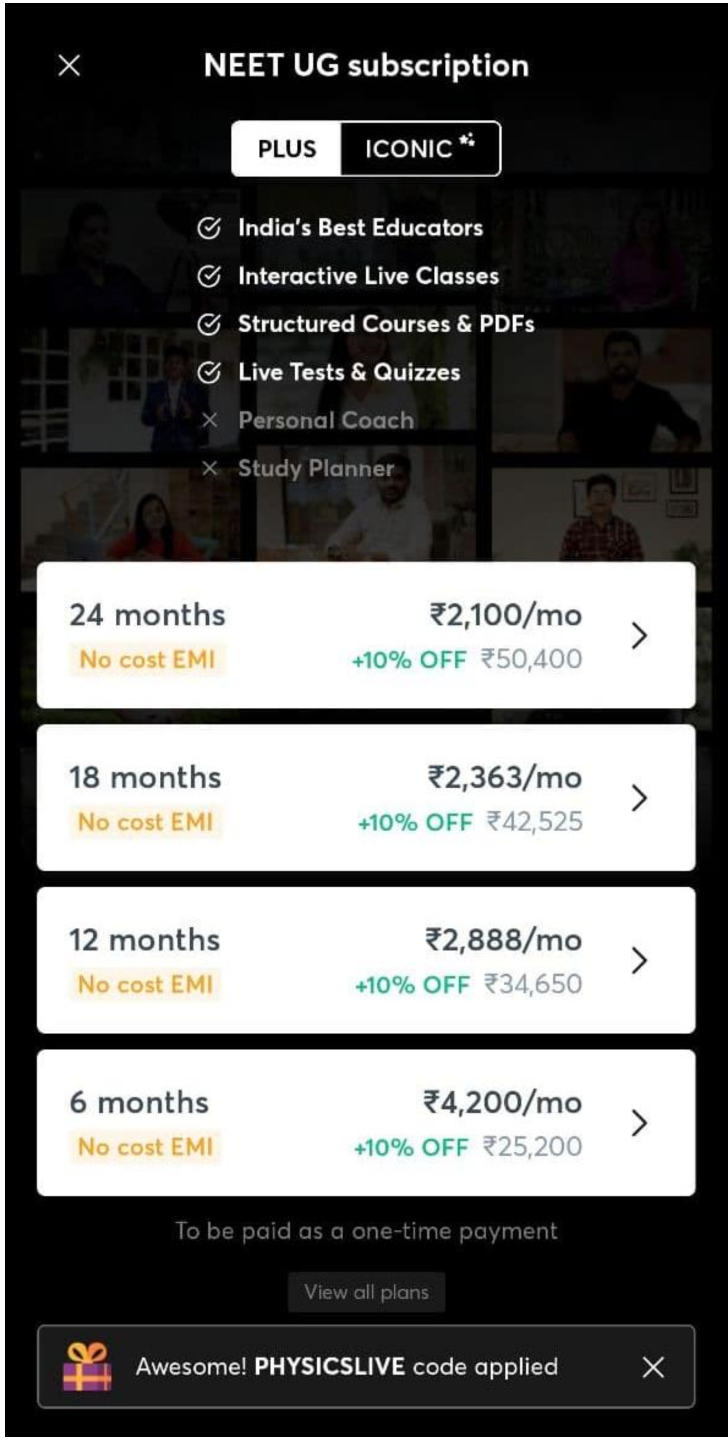

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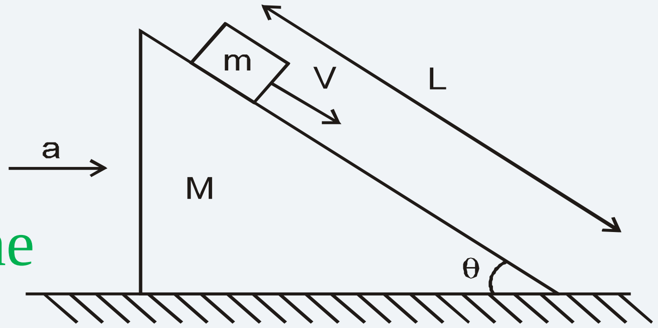
Physics DPP

DPP-6 NLM: Pseudo Force

By Physicsaholics Team

Q) A wedge of mass M is pushed with an constant acceleration of a = gtanθ along a smooth horizontal surface and a block of mass m is projected down the smooth incline of the wedge with a velocity V relative to the wedge.



(a)The time taken by the block to cover distance L on the incline plane is $\frac{L}{V}$

(b) The time taken by the block to cover distance L on the incline plane is $\sqrt{\frac{2L}{g \sin \theta}}$

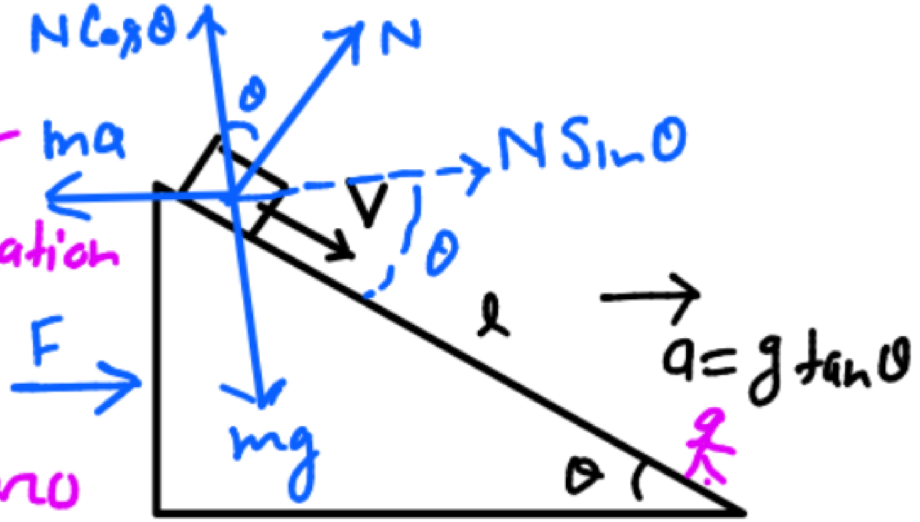
(c) The normal reaction between the block and wedge is mg secθ

(d) The horizontal force applied on the wedge to produce acceleration a is (M + m) g tanθ.

Ans. a,c,d

Solution:

we know that at ma $a = g\tan\theta$, acceleration of block w.r.t. wedge will be zero



⇒ w.r.t. wedge block moves with Constant velocity V.

$$t = \frac{l}{V}$$

$$N\cos\theta = mg \Rightarrow N = mg\sec\theta$$

$$F = (M+m)a = (M+m)g\tan\theta$$

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Q) A man goes up in a uniformly accelerating lift. He returns downward with the lift accelerating at the same rate. The ratio of apparent weighs in the two cases is 2 : 1. The acceleration of the lift is -

(a) g/3 (b) g/4

(c) g/5 (d) g/6

Ans. a

Solution:

$$N_1 = mg + ma$$

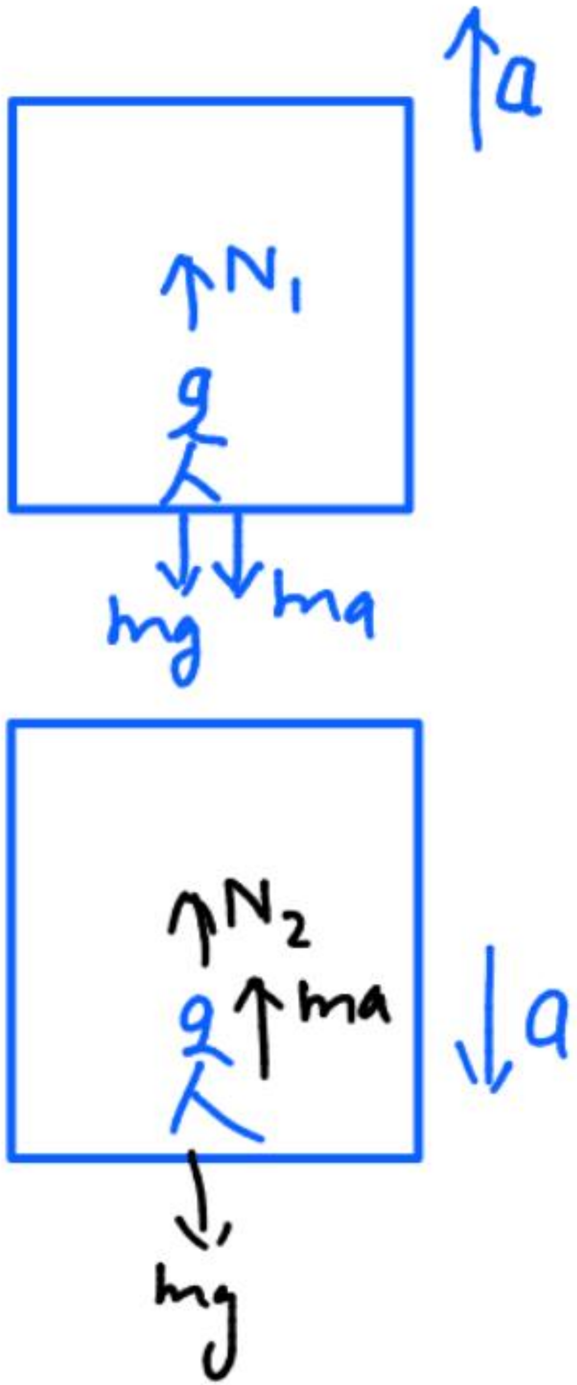
$$N_2 = mg - ma$$

$$\frac{N_1}{N_2} = \frac{g+a}{g-a} = \frac{2}{1}$$

$$\Rightarrow \quad g + a = 2g - 2a$$

$$3a = g$$

$$a = g/3$$



Q) A block can slide on a smooth inclined plane of inclination θ kept on the floor of a lift. When the lift is descending with a retardation a. the acceleration of the block relative to incline is -

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

(b) $(g - a)$

(c) $g \sin \theta$

(d) $(g - a) \sin \theta$

Ans. a

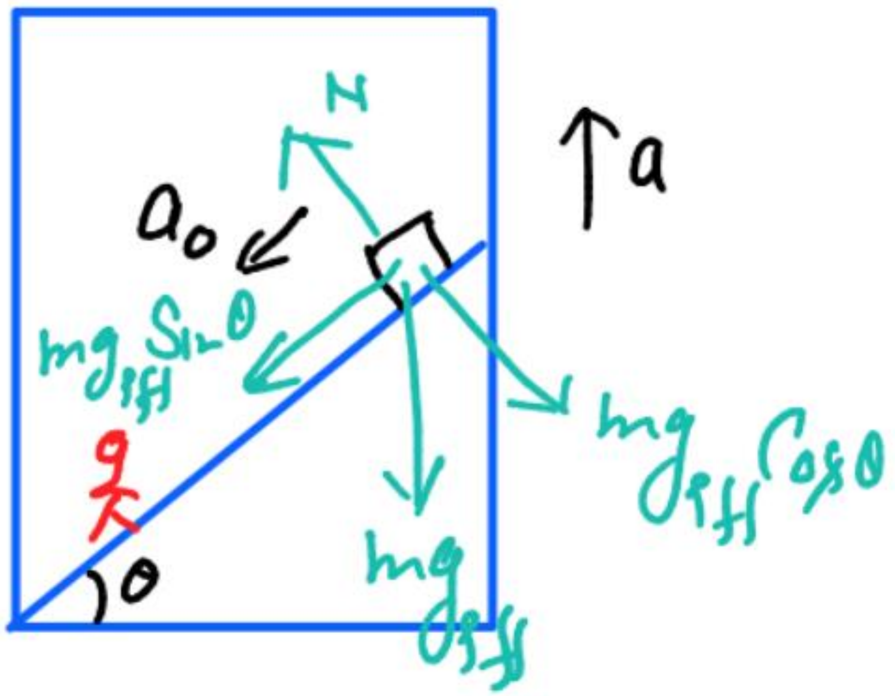
Solution:

descending with retardation a

$\Rightarrow$ acceleration is a upward.

w.r.t. lift

$g_{eff} = g + a$

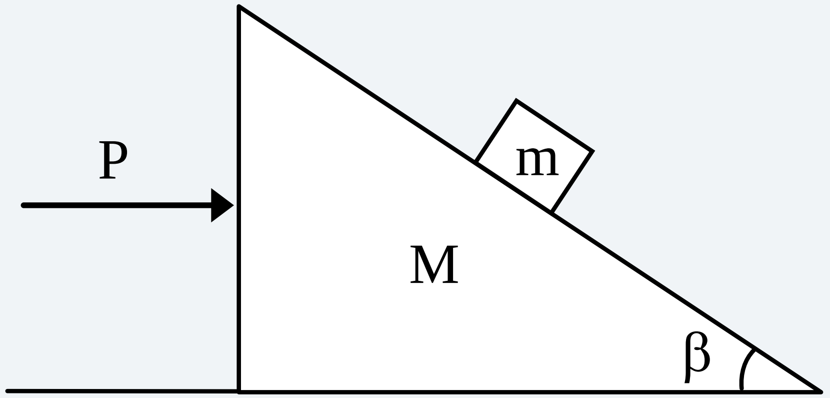


$$\cancel{m}g_{eff}\sin\theta = \cancel{m}a_0 \Rightarrow a_0 = g_{eff}\sin\theta$$

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

(A)

Q) Two wooden blocks are moving on a smooth horizontal surface such that the mass m remains stationary with respect to block of mass M as shown in figure. The magnitude of force P is –



(a) $(M + m)\ g \tan\beta$

(b) $g \tan\beta$

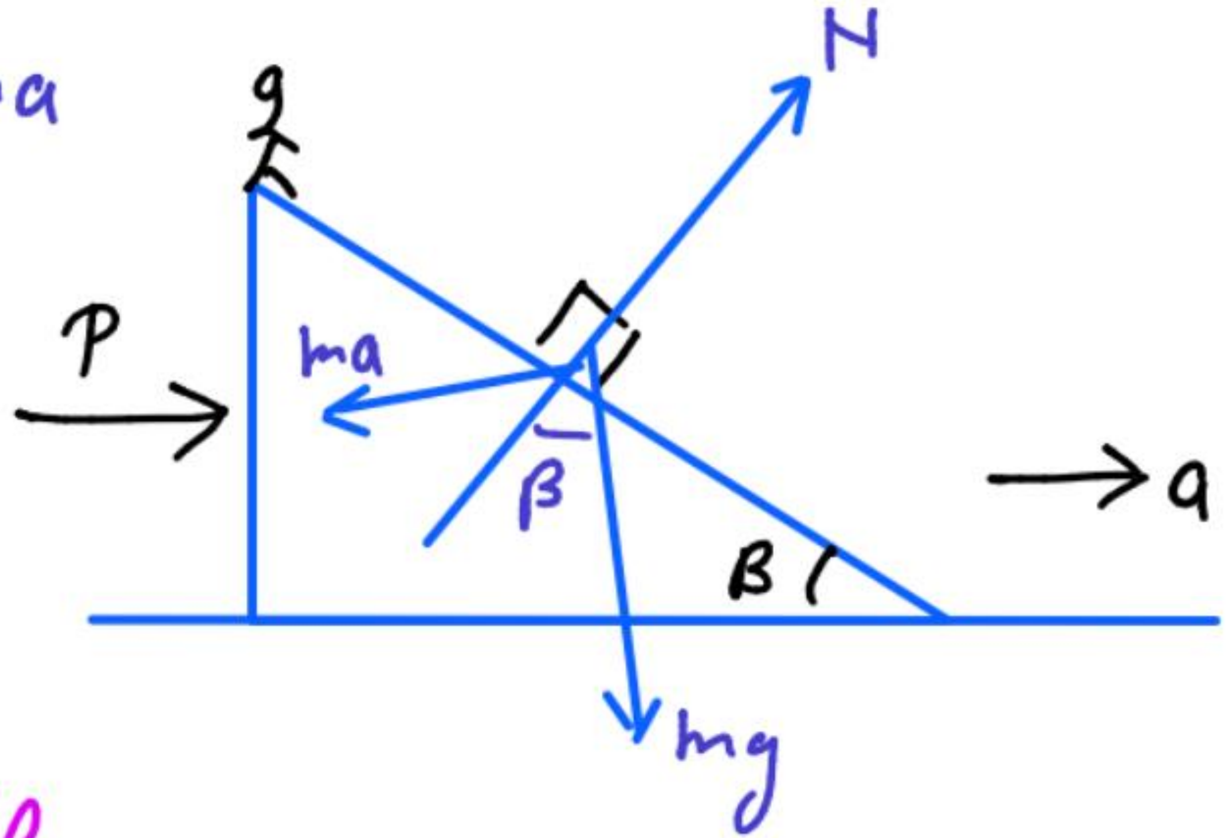
(c) $mg \cos\beta$

(d) $(M + m) \operatorname{cosec}\beta$

Ans. a

Solution:

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



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

$$a = g\tan\beta$$

for system of (block + wedge)

$$P = (M+m)a = (M+m)g\tan\theta$$

Q) Two weights w_1 and w_2 are suspended from the ends of a light string passing over a smooth fixed pulley. If the pulley is pulled up at an acceleration g , the tension in the string will be-

(a) $4w_1 w_2 / (w_1 + w_2)$

(b) $2w_1 w_2 / (w_1 + w_2)$

(c) $(w_1 - w_2) / (w_1 + w_2)$

(d) $w_1 w_2 /\{2 (w_1 + w_2)\}$

Ans. a

Solution:

w.r.t. pulley

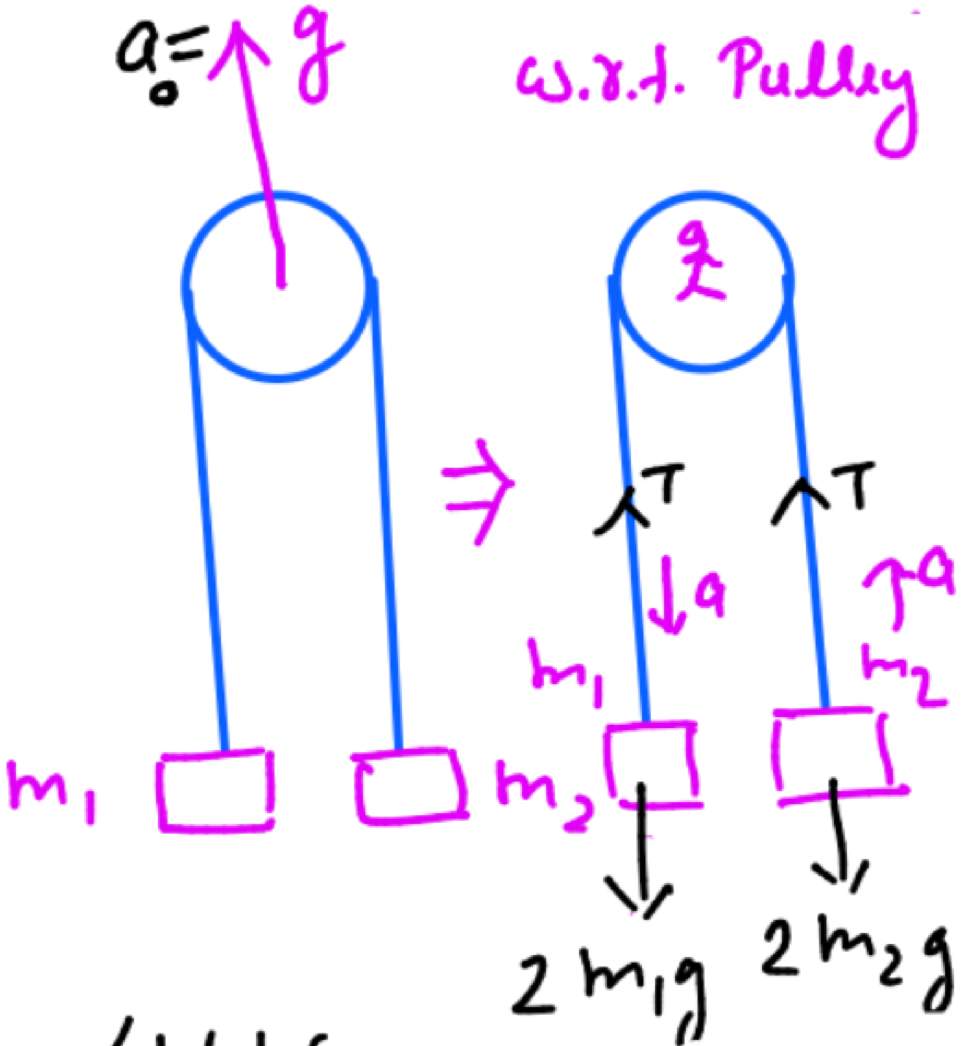
$$g_{eff} = g + a_0 = 2g$$

$$\Rightarrow \quad 2m_1 g - T = 2m_1 a$$

$$T - 2m_2 g = 2m_2 a$$

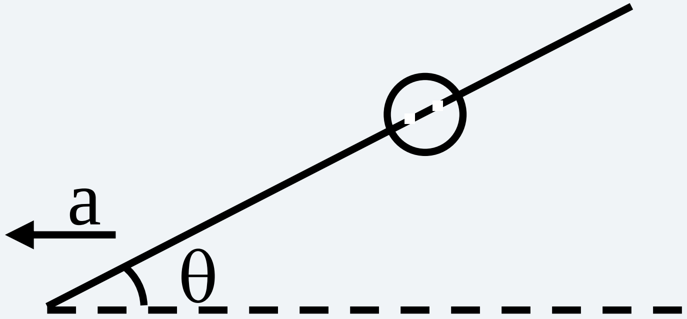
$$a = \frac{m_1 - m_2}{m_1 + m_2} \times 2g$$

$$\Rightarrow \quad T = \frac{4m_1 m_2 g}{m_1 + m_2} = \frac{4W_1 W_2}{W_1 + W_2}$$



(A)

Q) A pearl of mass m is in a position to slide over a smooth wire. At the initial instant the pearl is in the middle of the wire. The wire moves linearly in a horizontal plane with an acceleration *a* in a direction having angle θ with the wire. The acceleration of the pearl w.r.t. wire is–



(a) $g \sin \theta - a \cos \theta$

(b) $g \sin \theta - g \cos \theta$

(c) $g \sin \theta + a \cos \theta$

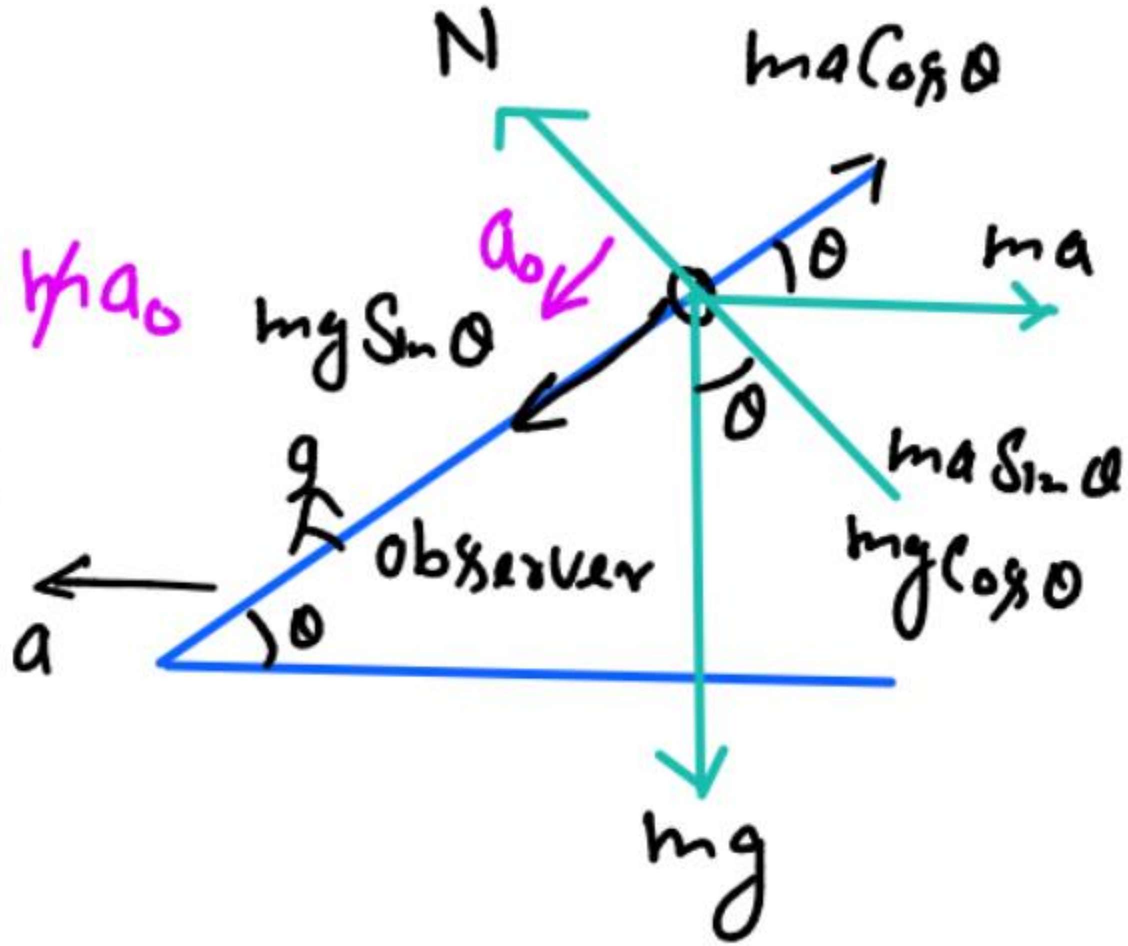
(d) $g \cos \theta + a \sin \theta$

Ans. a

Solution

$$\cancel{m} g \sin\theta - \cancel{m} a \cos\theta = \cancel{m} a_0$$

$$a_0 = g\sin\theta - a\cos\theta$$



(A)

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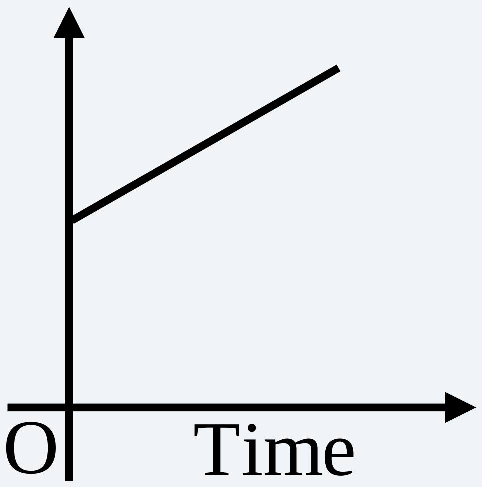
Q) A particle is observed from two frames S_1 and S_2. The graph of relative velocity of S_1 with respect to S_2 is shown in figure. Let F_1 and F_2 be the pseudo forces on the particle when seen from S_1 and S_2 respectively. Which one of the following is not possible ?



(a) $F_1 = 0, F_2 \neq 0$

(b) $F_1 \neq 0$, F2 = 0

(c) $F_1 \neq 0$, F2 ≠ 0

(d) $F_1 = 0$, F2 = 0

Ans. d

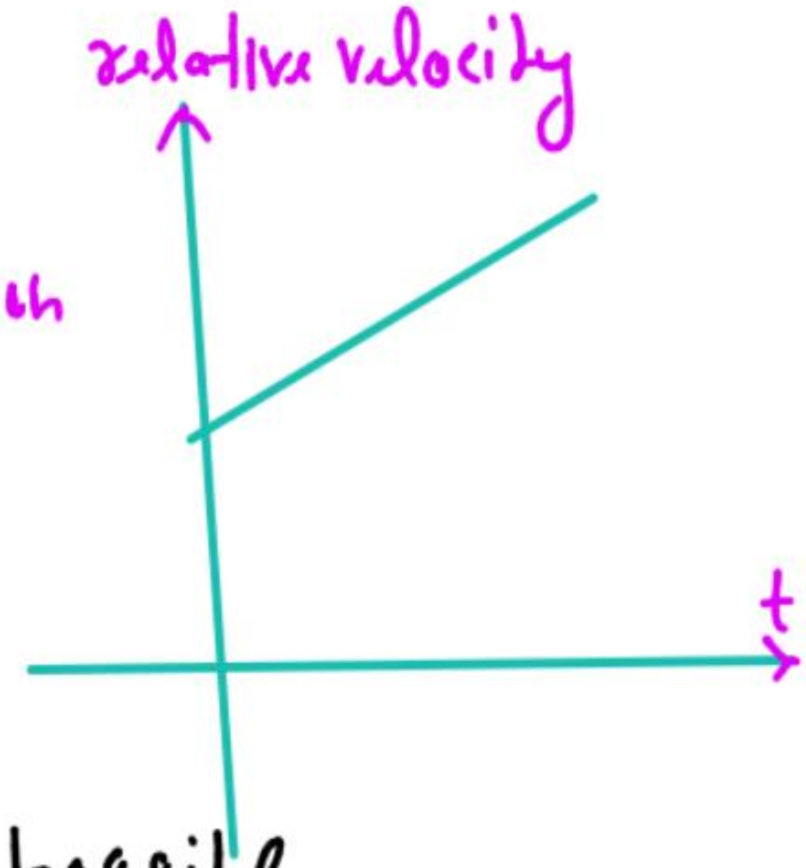
Solution:

Slope of graph $\neq 0$

$\Rightarrow$ relative acceleration is nonzero.

$\Rightarrow$ acceleration of S_1

$\neq$ " " S_2



$\Rightarrow$ option D is not possible

(D)

Q) A particle slides down a smooth inclined plane of elevation α. The incline is fixed end to end in an elevator of base length ℓ accelerating up with acceleration a_0. Assume at t = 0 the particle is at the top of the incline then–

(a) the particle has to travel a length ℓ cosα with acceleration (g + a_0)sinα down the incline in a time $\sqrt{\frac{\ell}{(g+a_0)\sin 2\alpha}}$

(b) the particle has to travel a length $\frac{\ell}{\cos\alpha}$ with acceleration g sin α down the incline in a time $\sqrt{\frac{2\ell}{a_0\sin 2\alpha}}$

(c) the particle has to travel a length $\frac{\ell}{\cos\alpha}$ with acceleration g sin α down the incline in a time $\sqrt{\frac{2\ell}{a_0\sin 2\alpha}}$

(d) the incline offers a normal reaction m(a_0 + g)cos α to the block so that it remains in contact with the incline.

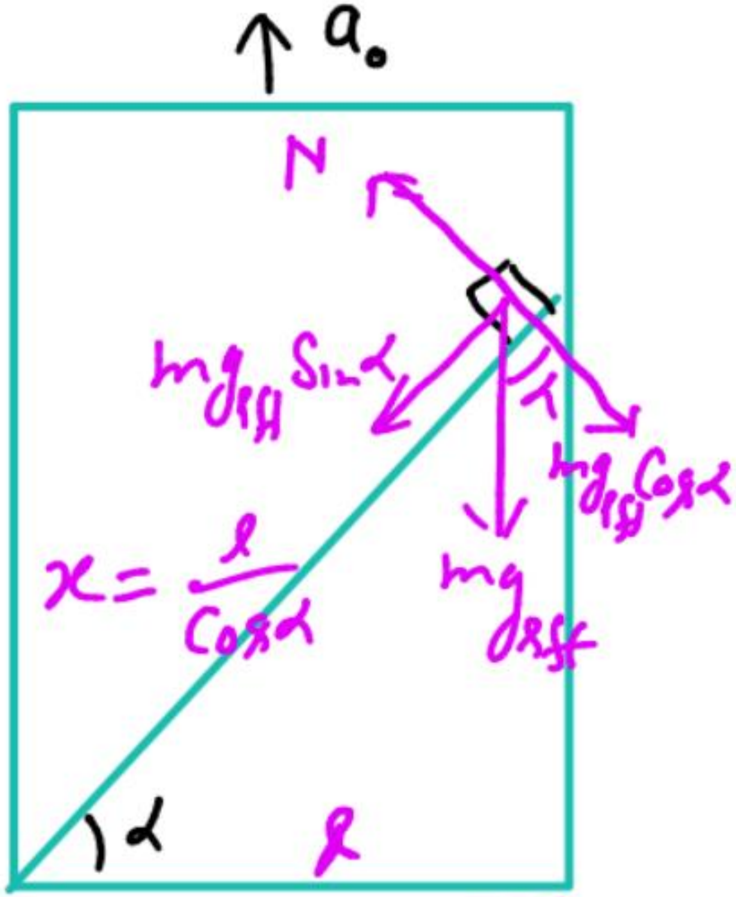
Ans. d

Solution:

w.r.t. Lift $g_{eff} = g + a_0$

$\Rightarrow$ acceleration of block w.r.t. lift $= g_{eff} \sin\alpha$

$= (g + a_0) \sin\alpha$.



Using $x = ut + \frac{1}{2}at^2$

$\frac{l}{\cos\alpha} = \frac{1}{2} g_{eff} t^2$

$\Rightarrow t = \sqrt{\frac{2l}{(g+a_0)\sin\alpha\cos\alpha}} = \sqrt{\frac{4l}{(g+a_0)\sin 2\alpha}}$

$N = mg_{eff}\cos\alpha = m(g+a_0)\cos\alpha$

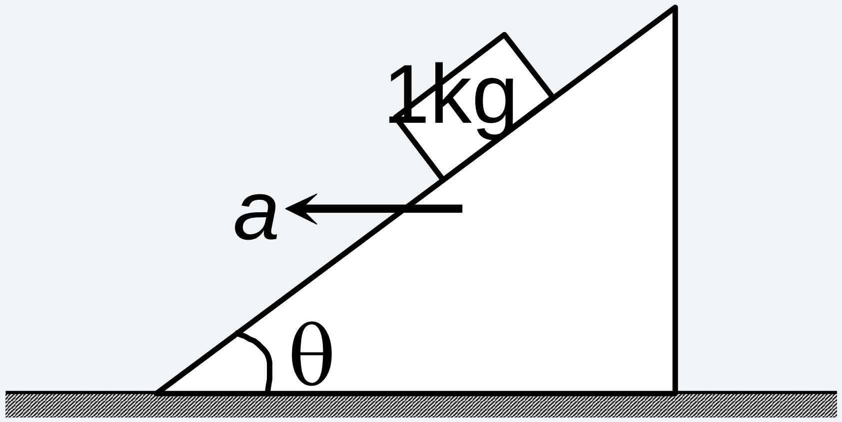
Q) A block of mass 1 kg is at rest relative to a smooth wedge moving leftwards left with constant acceleration $a = 5$ m/s^2. Let N be the normal reaction between the block and the wedge. Then ($g = 10$ m/s^2)

(a) $N = 5\sqrt{5}$ N

(b) $N = 15$ N

(c) $tan\,\theta = \frac{1}{2}$

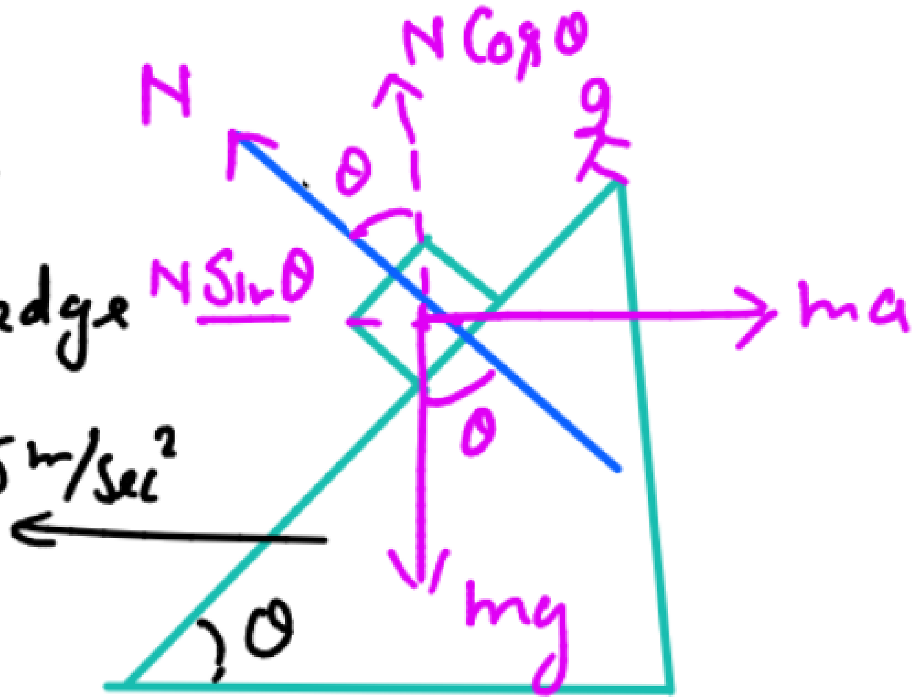
(d) $tan\,\theta = 2$



Ans. a,c

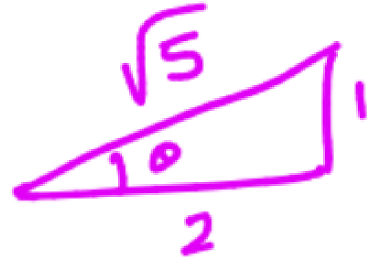
Solution:

for no sliding b/w block & wedge



$\tan\theta = \frac{a}{g}$

$= \frac{5}{10} = \frac{1}{2}$



$N\cos\theta = mg$

$N \times \frac{2}{\sqrt{5}} = mg$

$N = \frac{mg\sqrt{5}}{2} = 1 \times \frac{10}{2}\sqrt{5} = 5\sqrt{5}$

(A, C)

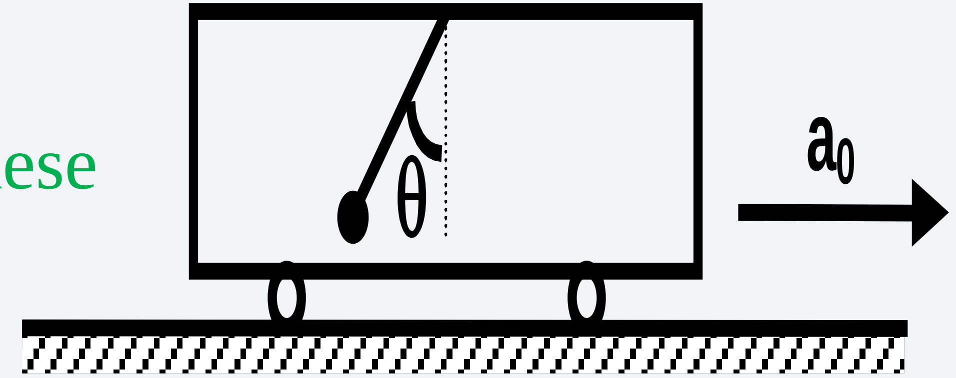
Q) A pendulum of mass m is hanging from the ceiling of a car having an acceleration a_o with respect to the road in the direction shown. If angle made by the string with the vertical is θ , find $\tan \theta$?

(a) a_o/g

(b) $a_o/2g$

(c) $2\ a_o/g$

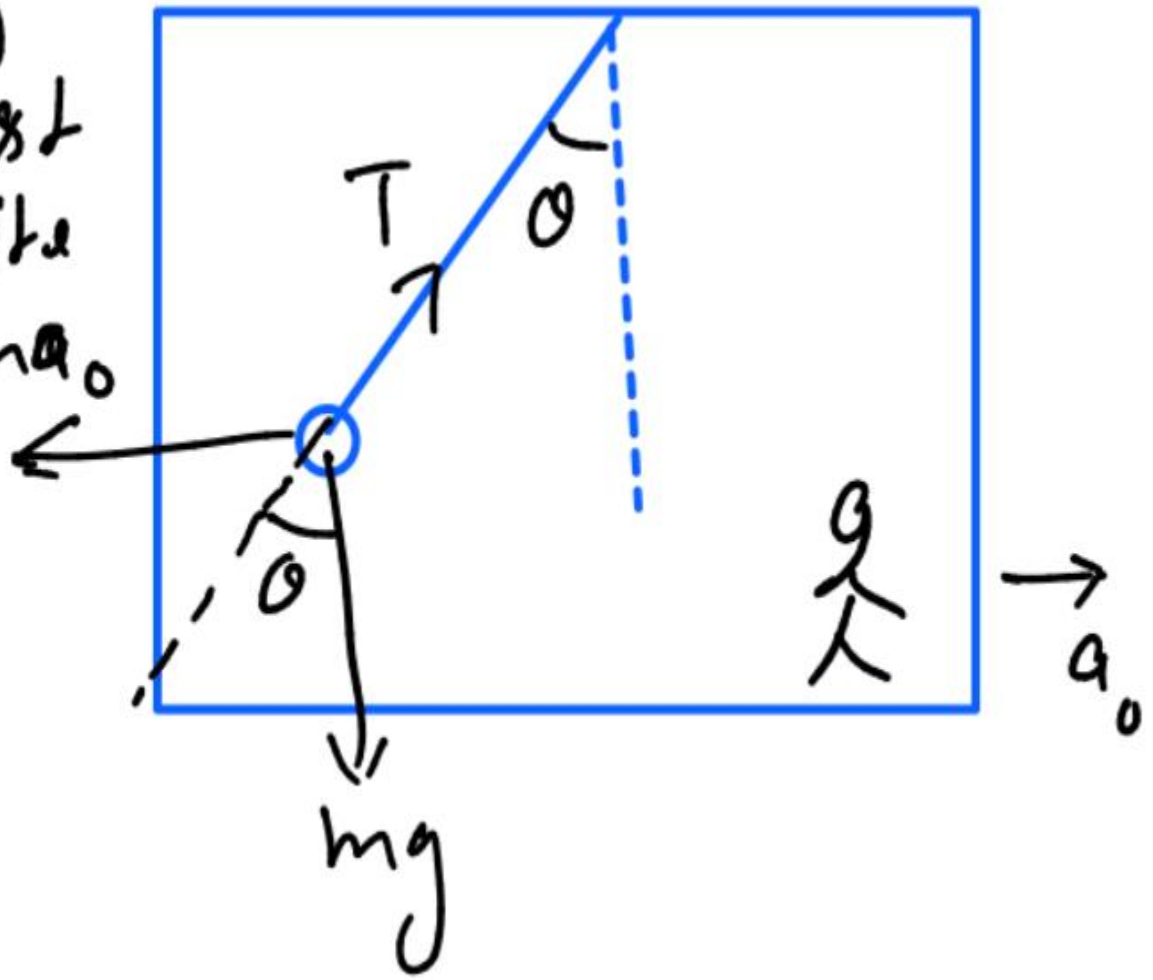
(d) none of these



Ans. a

Solution:

Resultant of ma_0 & mg must be just opposite to tension.



$$\tan\theta = \frac{ma_0}{mg} = \frac{a_0}{g}$$

(A)

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