DPP – 6

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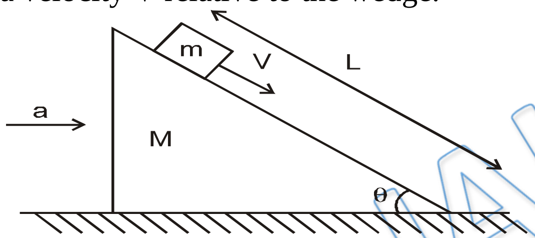
Q 1. A wedge of mass M is pushed with an constant acceleration of a = gtanq along a smooth horizontal surface and a block of mass m is projected down the smooth incline of the wedge with a velocity V relative to the wedge.



(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 secq

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

Q 2. 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

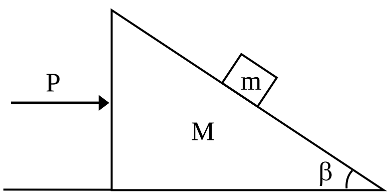
(c) g/5 (d) g/6

Q 3. A block can slide on a smooth inclined plane of inclination q 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 q (b) (g – a)

(c) g sin q (d) (g – a) sin q

Q 4. 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 –



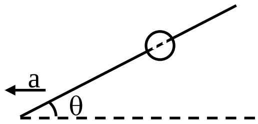
(a) (M + m) g tan b (b) g tan b

(c) mg cos b (d) (M + m) cosec b

Q 5. 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-

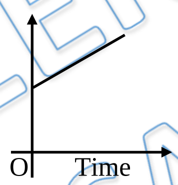
(a) $4w_1\ w_2\ /\ (w_1 + w_2)$
(b) $2w_1\ w_2\ /\ (w_1 + w_2)$
(c) $(w_1 - w_2)\ /\ (w_1 + w_2)$
(d) $w_1\ w_2\ /\{2\ (w_1 + w_2)\}$

Q 6. 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 q with the wire. The acceleration of the pearl w.r.t. wire is–



(a) g sin q – a cos q
(b) g sin q – g cos q
(c) g sin q + a cos q
(d) g cos q + a sin q

Q 7. 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) $F_1 = 0$, $F_2\ ^{1}\ 0$
(b) $F_1\ ^{1}\ 0$, F2 = 0
(c) $F_1\ ^{1}\ 0$, F2 ^{1} 0
(d) $F_1 = 0$, F2 = 0

Q 8. A particle slides down a smooth inclined plane of elevation a. 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–

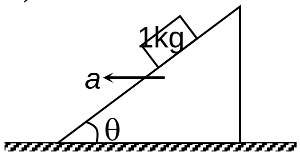
(a) the particle has to travel a length l cosa with acceleration (g + a_0)sina down the incline in a time $\sqrt{\frac{\ell}{(g+a_0)\sin 2\alpha}}$

(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 $\sqrt{\frac{2\ell}{a_0 \sin 2\alpha}}$

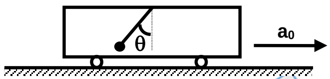
(d) the incline offers a normal reaction m(a_0 + g)cos a to the block so that it remains in contact with the incline.

Q 9. 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) $\tan\theta = 2$

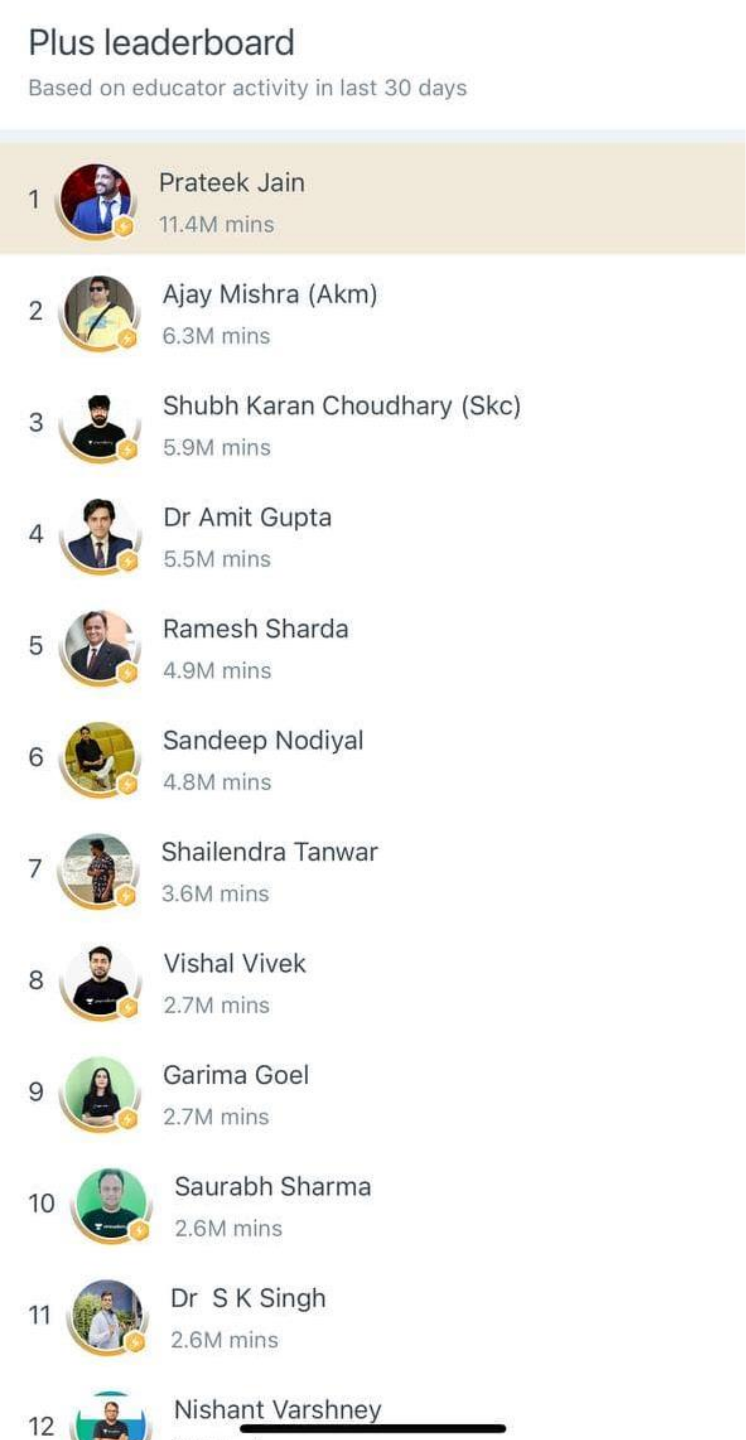
Q 10. A pendulum of mass m is hanging from the ceiling of a car having an acceleration a_o with respect to the road in the direction shown. If angle made by the string with the vertical is θ , find tan θ ?



(a) a_o/g
(b) $a_o/2g$
(c) 2 a_o/g
(d) none of these

Answer Key

Q.1 a,c,d	Q.2 a	Q.3 a	Q.4 a	Q.5 a
Q.6 a	Q.7 d	Q.8 d	Q.9 a,c	Q.10 a



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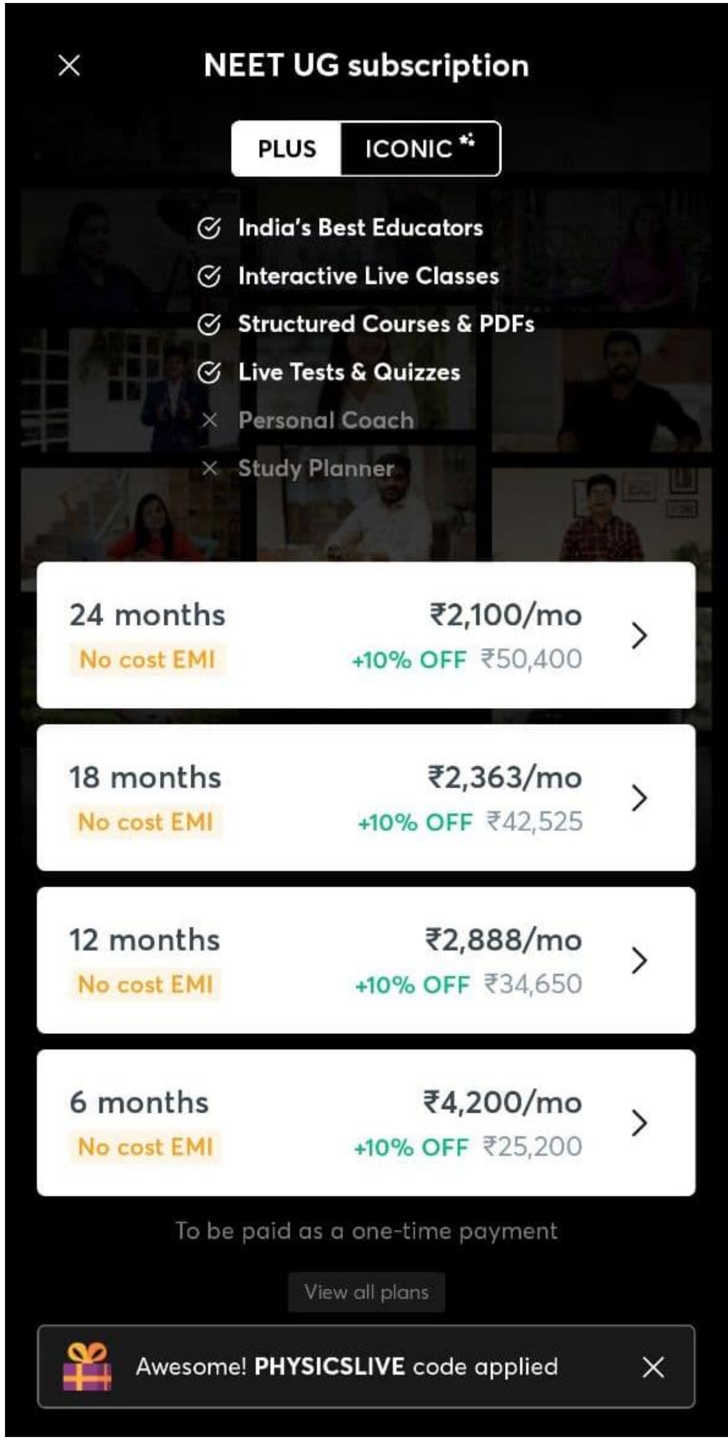


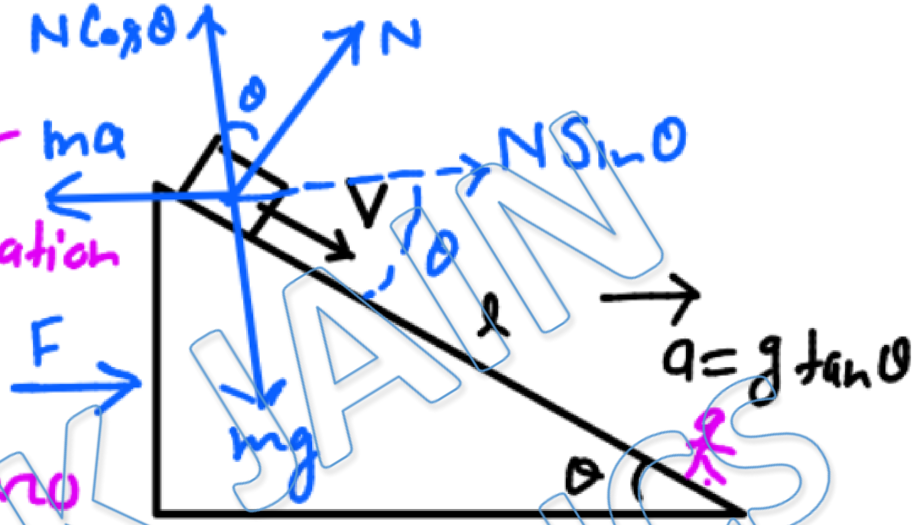
Written Solution
Physics DPP

DPP-6 NLM: Pseudo Force

By Physicsaholics Team

Solution: 1

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.

$$t = \frac{\ell}{v}$$

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

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

Ans. a, c, d

Solution: 2

$$N_1 = mg + ma$$

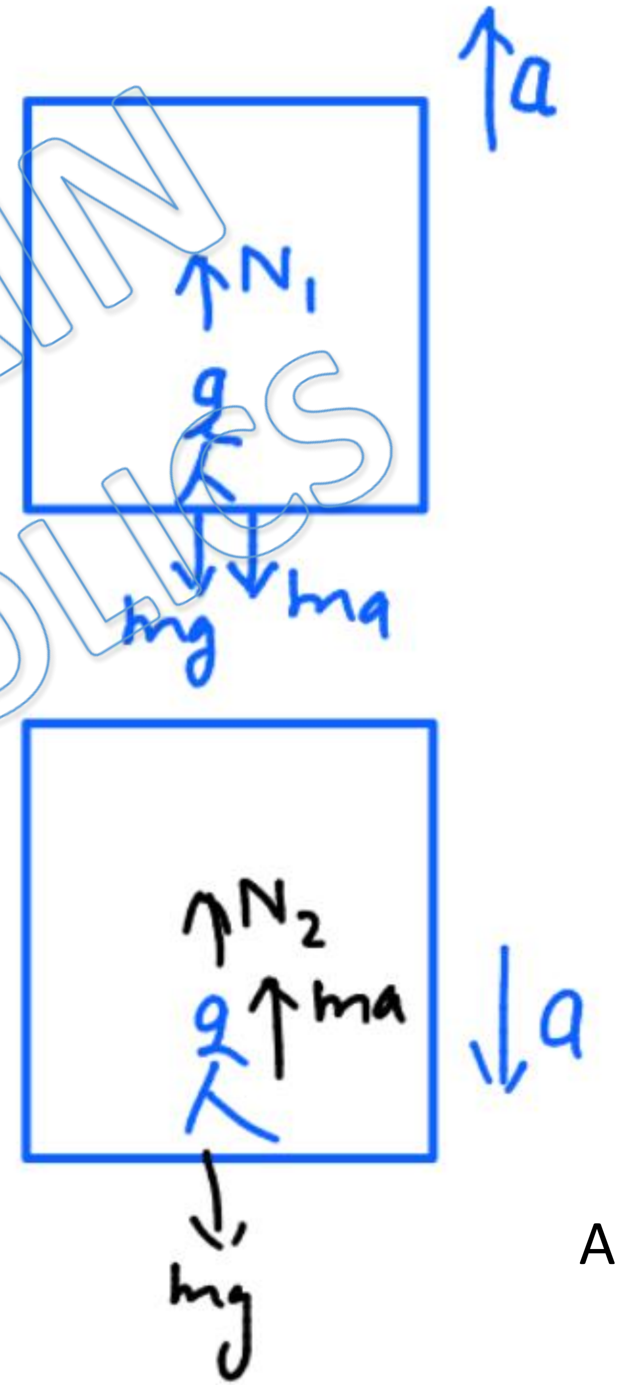
$$N_2 = mg - ma$$

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

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

$$3a = g$$

$$a = g/3$$



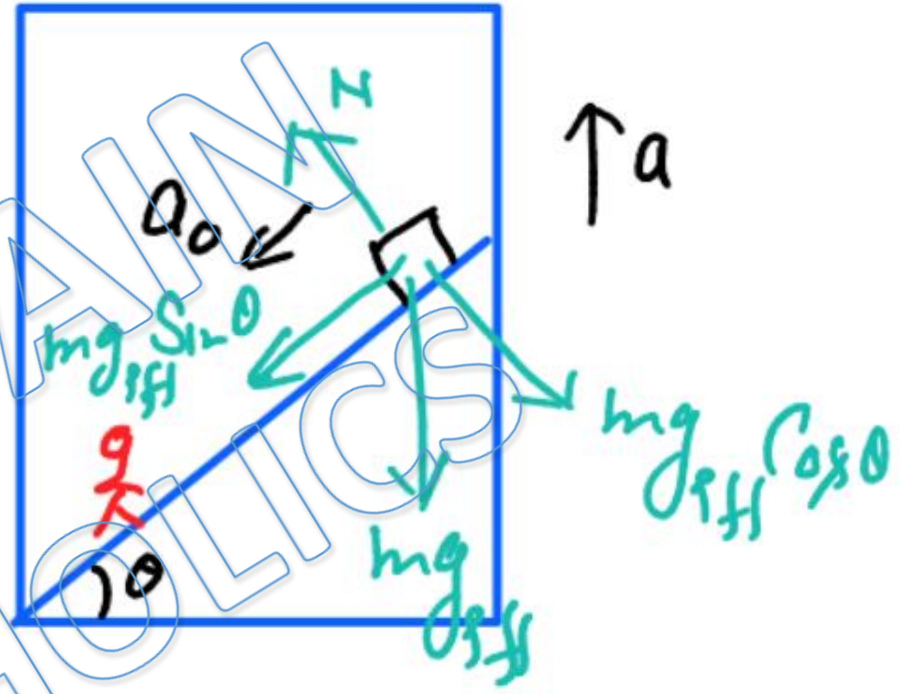
Ans. a

Solution: 3

descending with retardation a

$\Rightarrow$ acceleration is a upward w.r.t. lift

$g_{eff} = g + a$



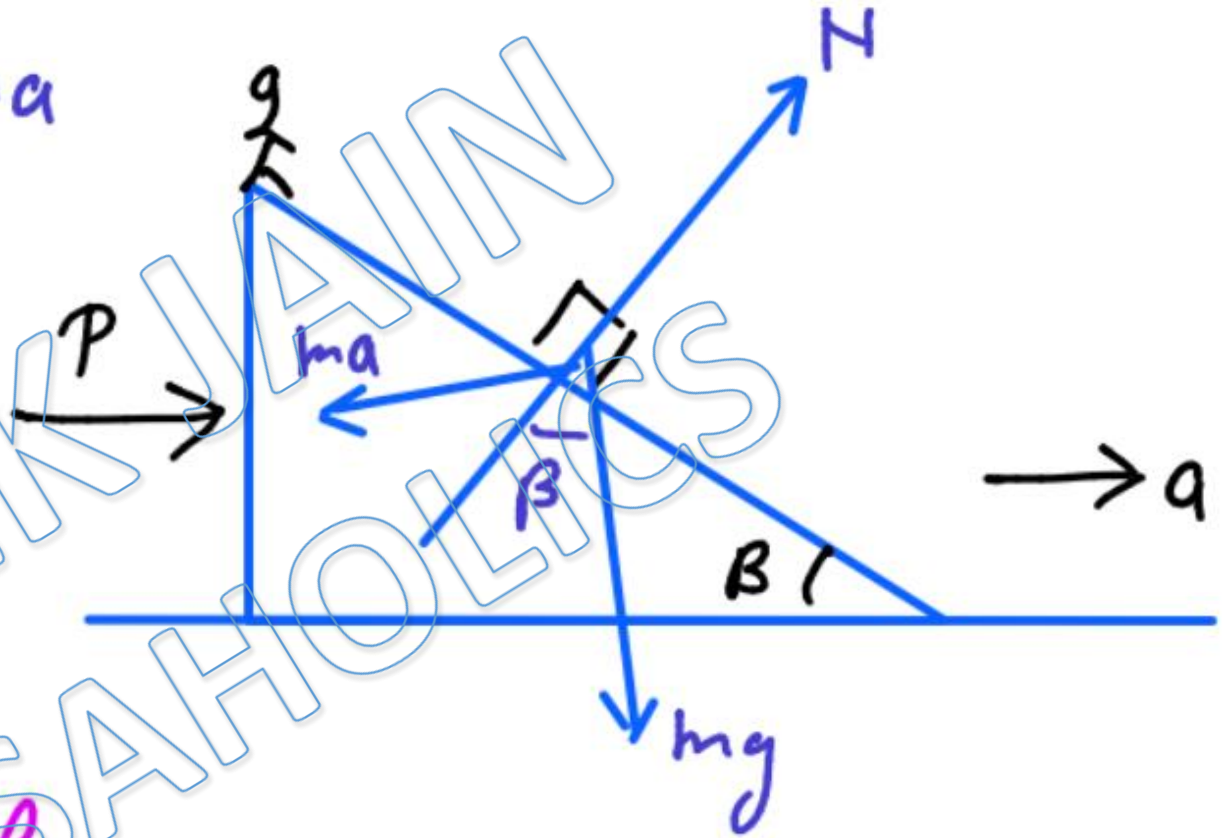
$$m g_{eff} \sin\theta = m a_0 \Rightarrow a_0 = g_{eff} \sin\theta$$

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

(A)

Solution: 4

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



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

$a = g\tan\beta$

for system of (block + wedge)

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

Ans. a

Solution: 5

w.r.t. pulley

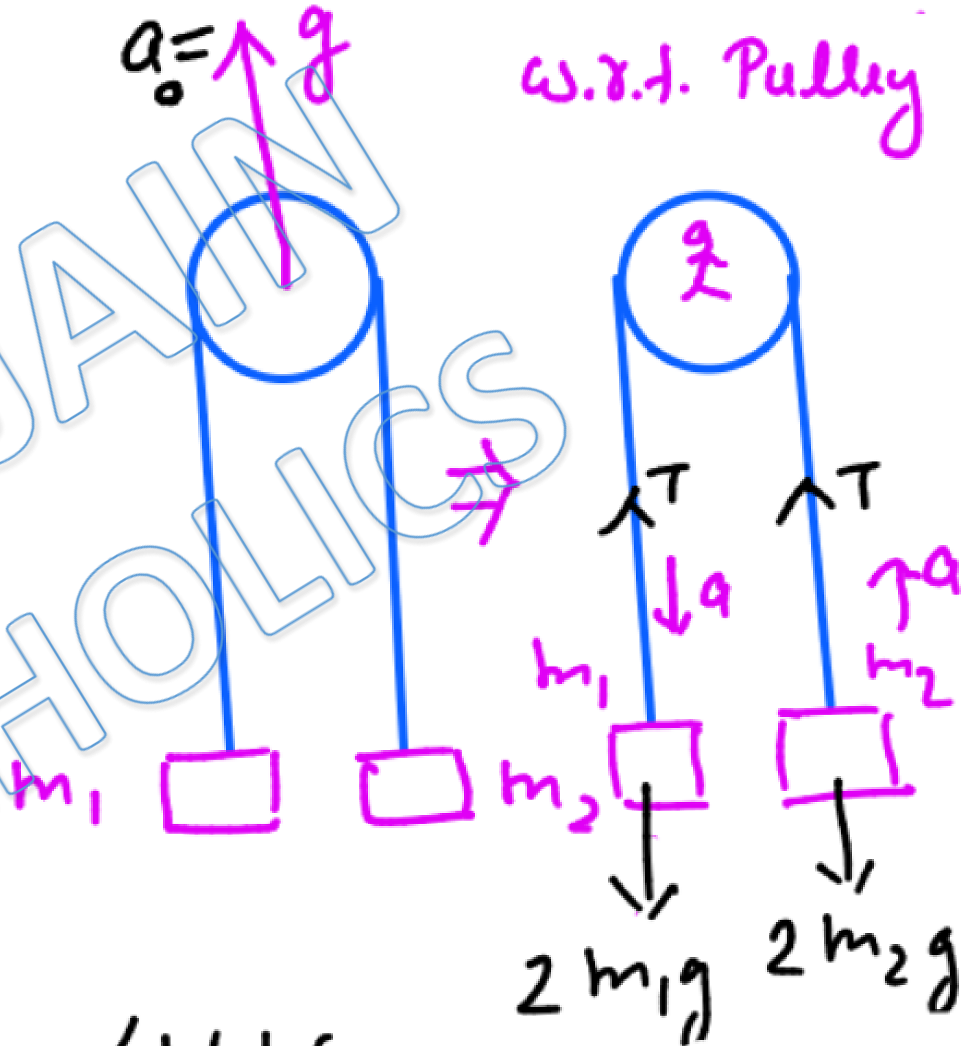
$$g_{eff} = g + a_0 = 2g$$

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

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

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

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

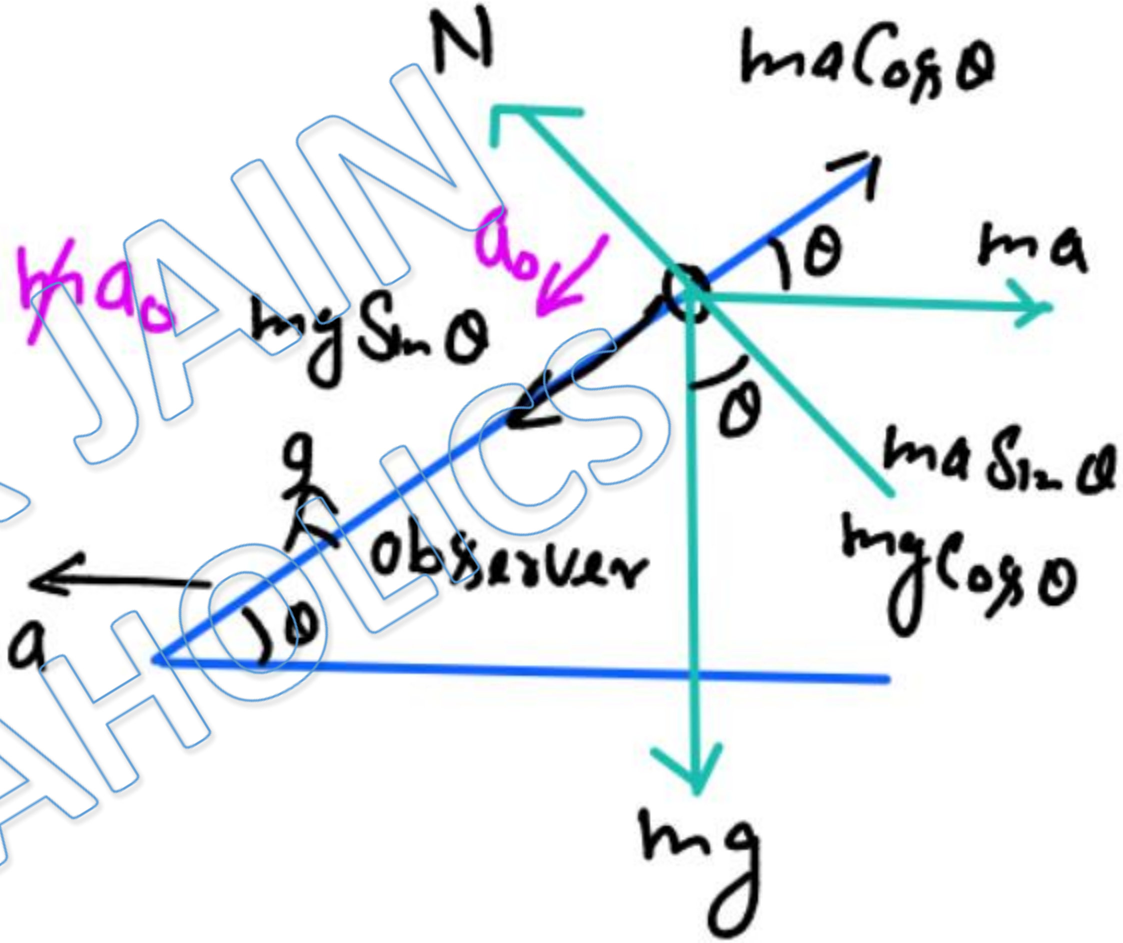


(A)

Solution: 6

$$mg\sin\theta - ma\cos\theta = ma_0$$

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



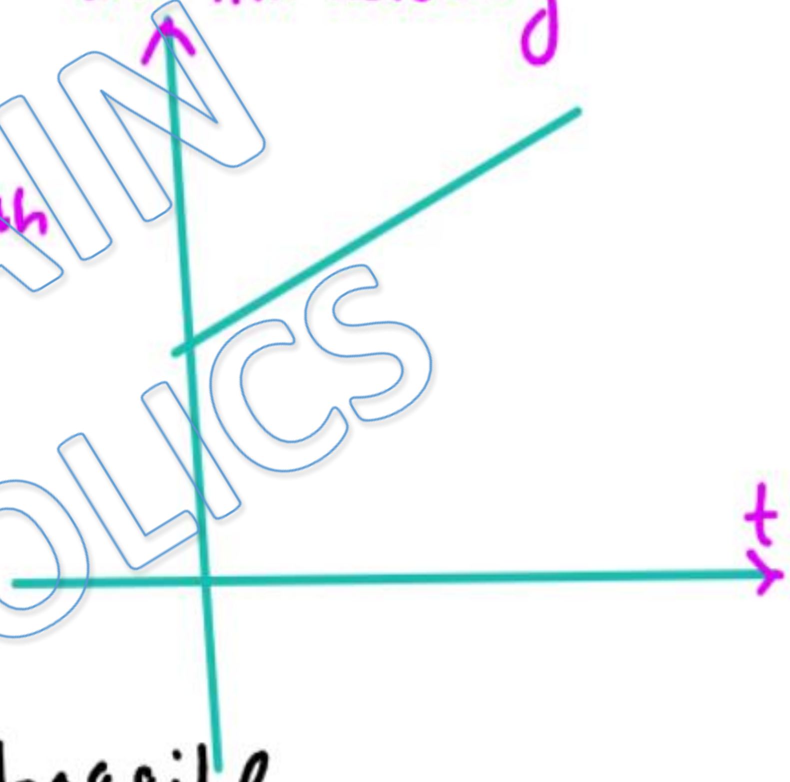
(A)

Solution: 7

Slope of graph ≠ 0

⇒ relative acceleration is nonzero.

⇒ acceleration of S_1 ≠ acceleration of S_2



⇒ option D is not possible

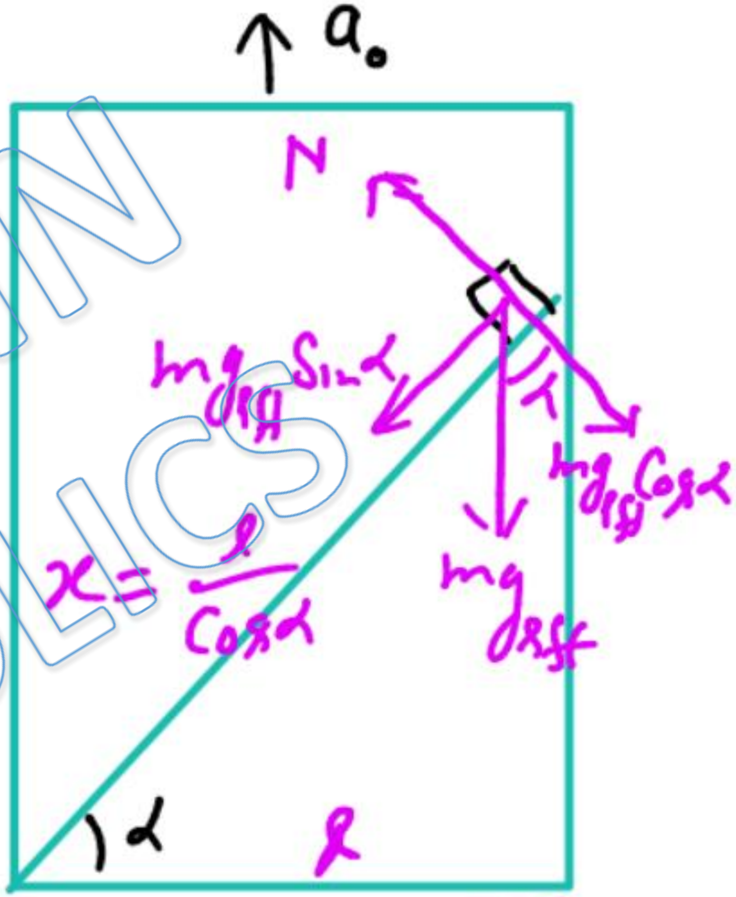
(D)

Solution: 8

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

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

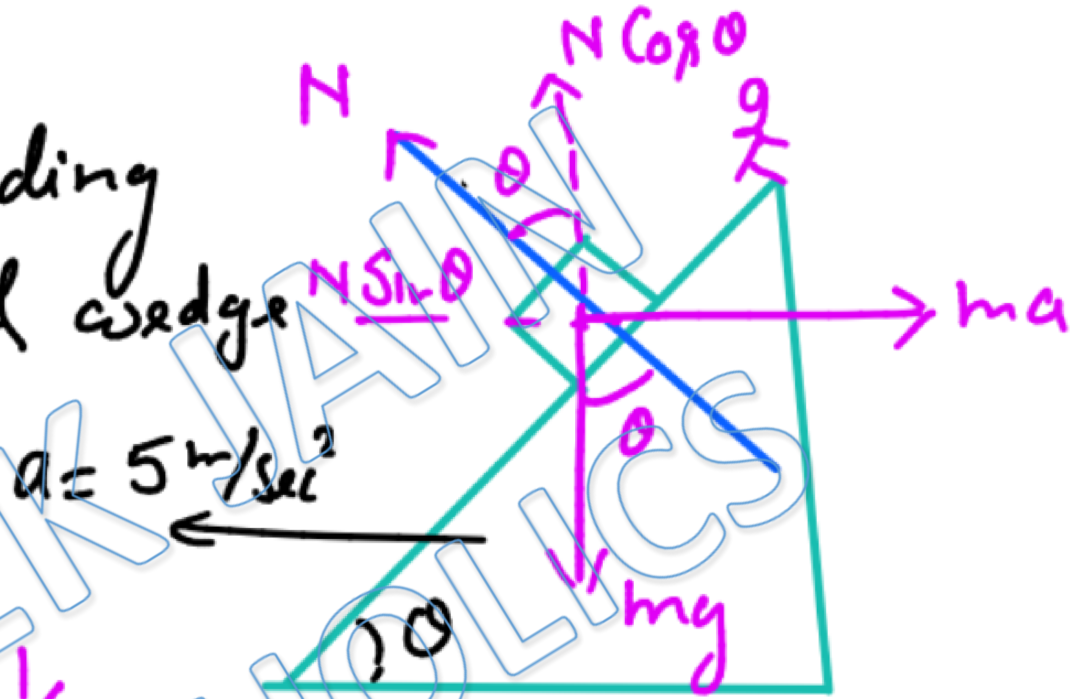
$$\Rightarrow t = \sqrt{\frac{2l}{(g+a_0)\sin\alpha\cos\alpha}} = \sqrt{\frac{4l}{(g+a_0)\sin 2\alpha}}$$

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

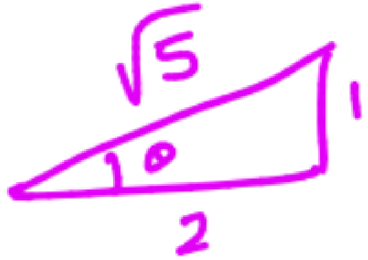
Ans. d

Solution: 9

For no sliding b/w block & wedge



$$\tan\theta = \frac{a}{g} = \frac{5}{10} = \frac{1}{2}$$



$$N\cos\theta = mg$$

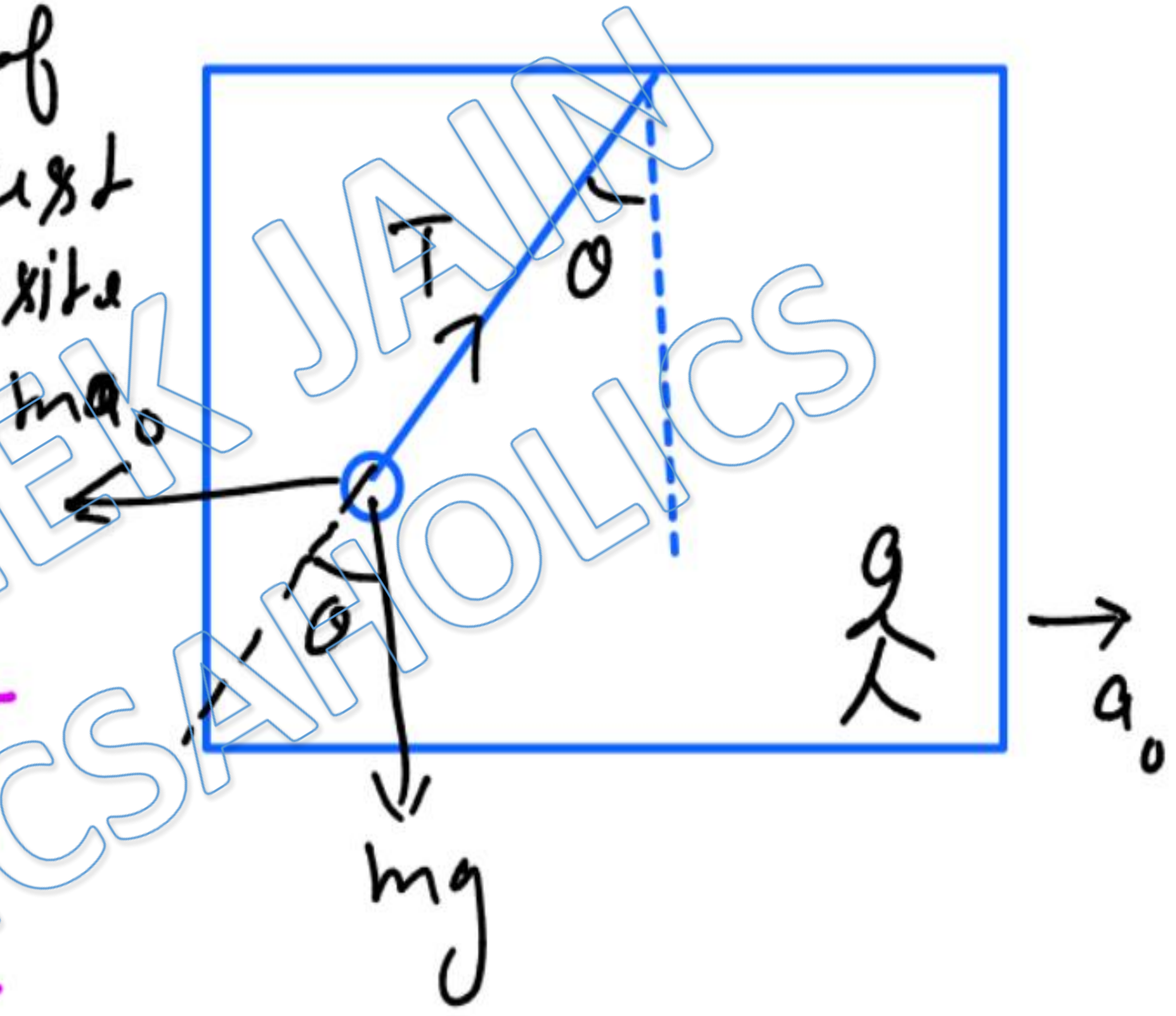
$$N \times \frac{2}{\sqrt{5}} = mg$$

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

(A, C)

Solution: 10

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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Chalo Niklo