Physicsaholics

DPP - 4

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Q 1. If a bullet of mass 5 gm moving with velocity 100 m /sec, penetrates the wooden block upto 6 cm. Then the average force imposed by the bullet on the block is

(a) 8300 N (b) 417 N

(c) 830 N (d) zero

Q 2. A vehicle of 100 kg is moving with a velocity of 5 m/sec. To stop it in $\frac{1}{10}$ sec, the required force in opposite direction is:

(a) 5000 N (b) 500 N

(c) 50 N (d) 1000 N

Q 3. A block of mass 5kg is moving horizontally at a speed of 1.5 m/s. A perpendicular force of 5N (in horizontal plane) acts on it for 4 sec. What will be the distance of the block from the point where the force started acting:

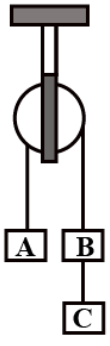
(a) 10 m (b) 8 m

(c) 6 m (d) 2 m

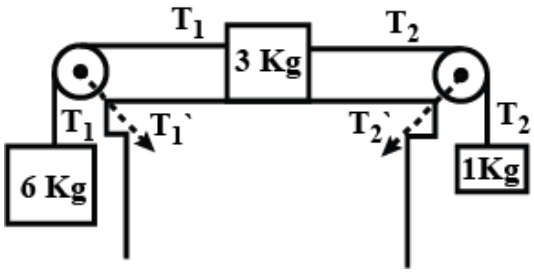
Q 4. Three equal weights of mass 2 kg each are hanging on a string passing over a fixed pulley as shown in the fig. What is the tension in the string connecting the weights B and C? ($g = 9.8\ m/s^2$)

(a) zero (b) 13 N

(c) 303 N (d) 19.6 N

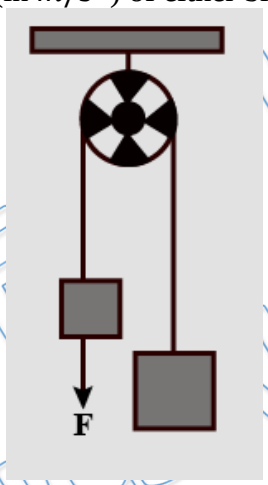


Q 5. A system of three blocks are connected by strings as shown in figure. Calculate acceleration of each block and tension in the strings: ($g = 10\ m/s^2$)



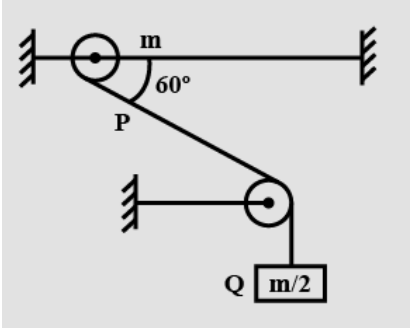
(a) $a = 5\ m/s^2, T_1 = 30N, T_2 = 15N$
(b) $a = 5\ m/s^2, T_1 = 15N, T_2 = 30N$
(c) $a = 2.5\ m/s^2, T_1 = 40N, T_2 = 20N$
(d) $a = 2.5\ m/s^2, T_1 = 20N, T_2 = 40N$

Q 6. Two unequal masses of 1kg and 2kg are connected by an inextensible light string passing over a smooth pulley as shown in the figure. A force F=20N is applied on 1kg block. Find the acceleration (in m/s^2) of either block: ($g = 10\ m/s^2$)



(a) $\frac{10}{3}$ (b) $\frac{20}{3}$
(c) 10 (d) 20

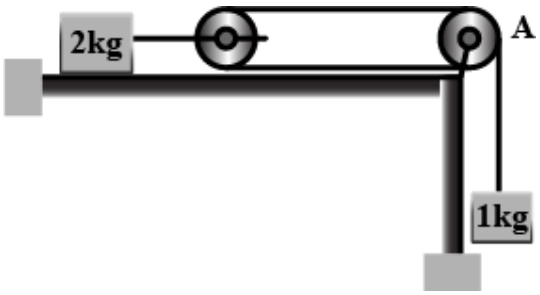
Q 7. A smooth ring P of mass m can slide on a fixed horizontal rod. A string tied to the ring passes over a fixed pulley and carries a block Q of mass (m/2) as shown in the figure. At an instant, the string between the ring and the pulley makes an angle 60^0 with the rod. The initial acceleration of the ring is:



(a) $\frac{2g}{9}$ (b) $\frac{g}{6}$

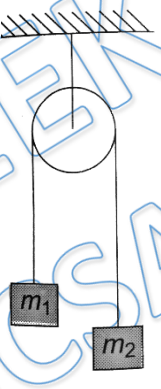
(c) $\frac{2g}{6}$ (d) $\frac{g}{3}$

Q 8. Consider the situation shown in figure. Both the pulleys and the string are light and all the surfaces are smooth. Find the tension in the string attached with 1kg block: ($g = 10\ m/s^2$)



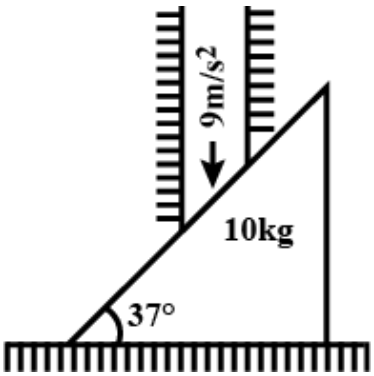
(a) $\frac{20}{3}N$ (b) $\frac{5}{3}\ N$ (c) $\frac{40}{3}\ N$ (d) $\frac{10}{3}\ N$

Q 9. Two masses $m_1 = 5\ kg$ and $m_2 = 10\ kg$ are connected at the ends of an inextensible string passing over a frictionless pulley as shown. When the masses are released, then the acceleration of the masses will be:



(a) g (b) $\frac{g}{2}$ (c) $\frac{g}{3}$ (d) $\frac{g}{4}$

Q 10. System is shown in figure. All the surfaces are smooth. Rod is moved by external agent with acceleration $9\ m/s^2$ vertically downwards. Force exerted on the rod by the wedge will be:



(a) $120\ N$
(b) $200\ N$

(c) $\frac{135}{2}\ N$

(d) $\frac{225}{2} N$

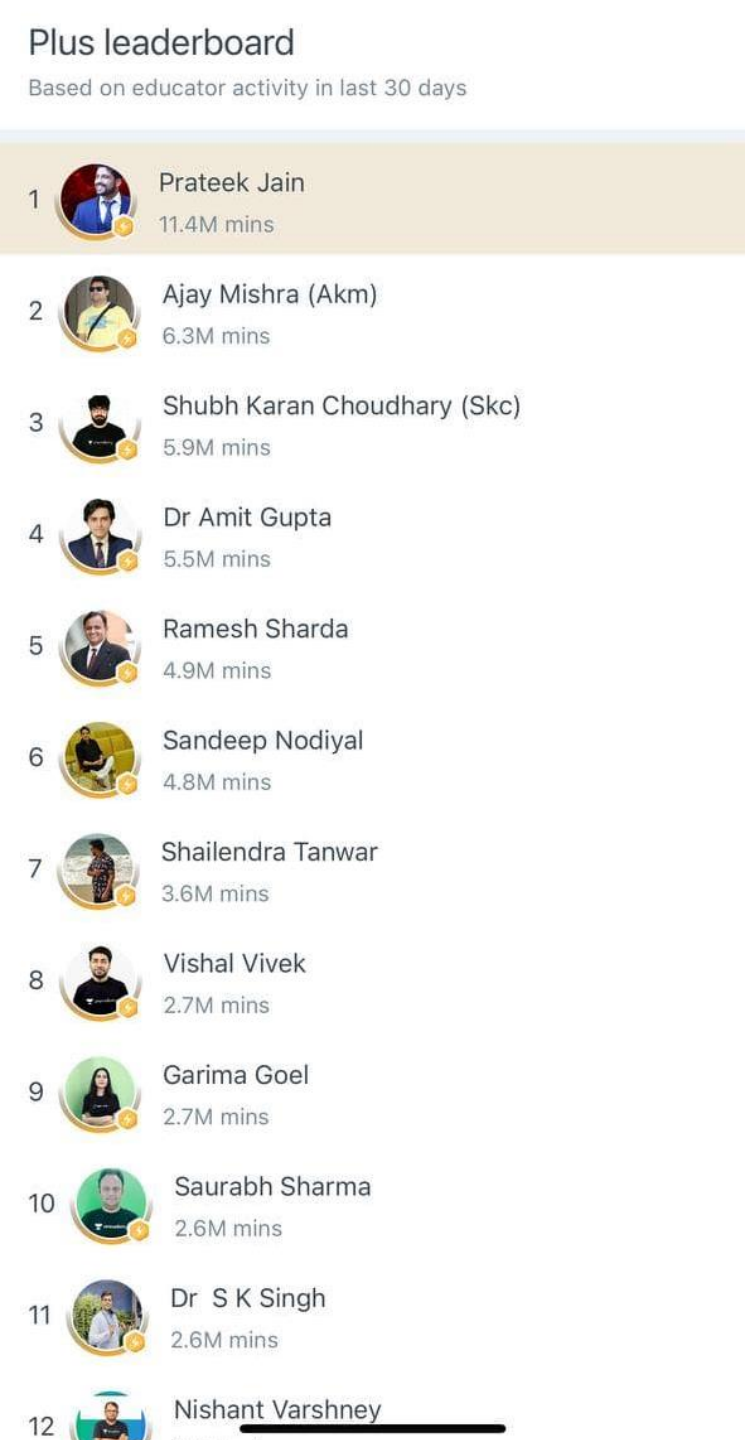
Q 11. A person of mass 50 kg stands on a weighing scale on a lift . If the lift is descending with a downward acceleration of $9 m/s^2$. what would be the reading of the weighing scale? ($g = 10\ m/s^2$)

(a) $50\ kg$ (b) $25\ kg$

(c) $250\ kg$ (d) $5\ kg$

Answer Key

Q.1 b	**Q.2 a**	**Q.3 a**	**Q.4 b**	**Q.5 a**
Q.6 a	**Q.7 a**	**Q.8 d**	**Q.9 c**	**Q.10 b**
Q.11 d				



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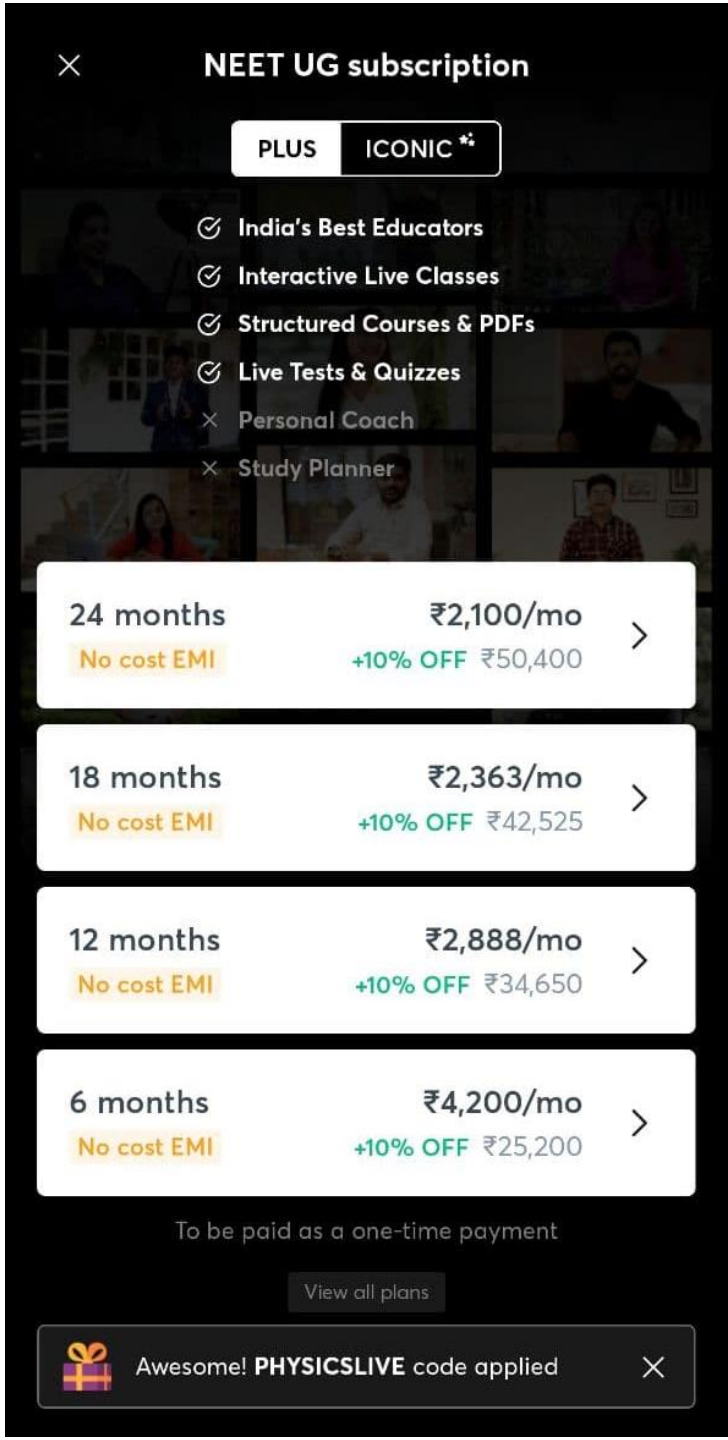
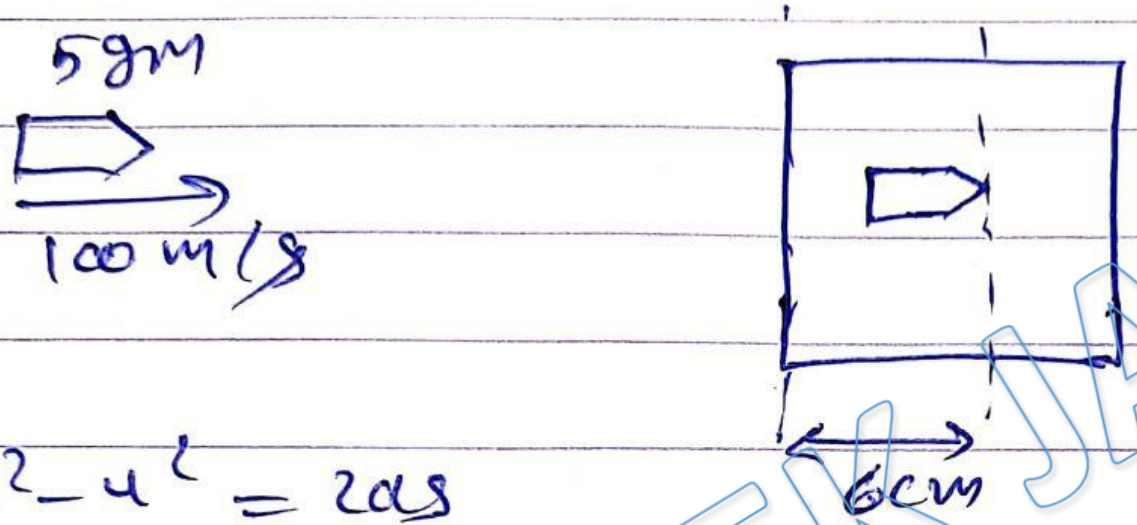


Written Solution
Physics DPP

DPP-4 NLM: Newton's 2nd Law

By Physicsaholics Team

Solution: 1



$v^2 - u^2 = 2as$

$0 - (100)^2 = 2a(6 \times 10^{-2})$

$a = 83333.33 \ m/s^2$ (retardation)

$F = ma$

$F = 5 \times 10^{-3} \times 83333.33$

$F = 416.67 \ N \approx 417 \ N$

$\boxed{F = 417 N}$

Ans. b

Solution: 2 $v = u + at$

$0 = 5 + a(t_0)$

$a = -50 \text{ m/s}^2$

$\therefore a = 50 \text{ m/s}^2$ (retardation)

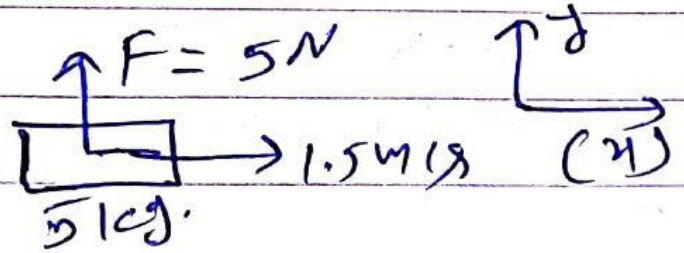
$F = ma$

$F = 100 \times 50$

$\boxed{F = 5000 \text{ N}}$

Ans. a

Solution: 3



in x-dirⁿ.

$u = 1.5\ m/s$

$a = 0$

$\therefore v = 1.5\ m/s$

at $t = 4$ sec

$x = 1.5 \times 4$

$x = 6\ m.$

in y-dirⁿ

$u = 0$

$a = \frac{F}{m} = \frac{5}{5} = 1\ m/s^2$

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

$y = 0 + \frac{1}{2}(1)(4)^2$

$y = 8\ m.$

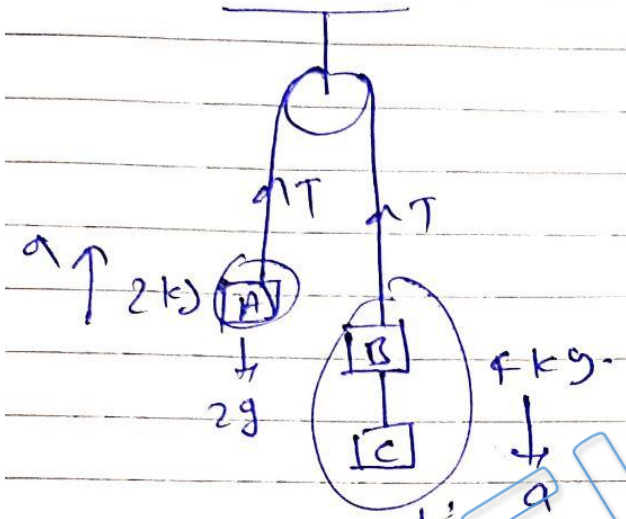
$\therefore d = \sqrt{x^2 + y^2}$

$d = \sqrt{6^2 + 8^2}$

$\boxed{d = 10\ m.}$

Ans. a

Solution: 4



for Block A

$$T - 2g = 2a \quad -(1)$$

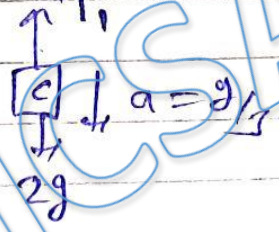
for block (B+C)

$$4g - T = 4a \quad -(2)$$

from (1) & (2)

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

for 'C'



T_1 = Tension in the string connecting the weights B & C

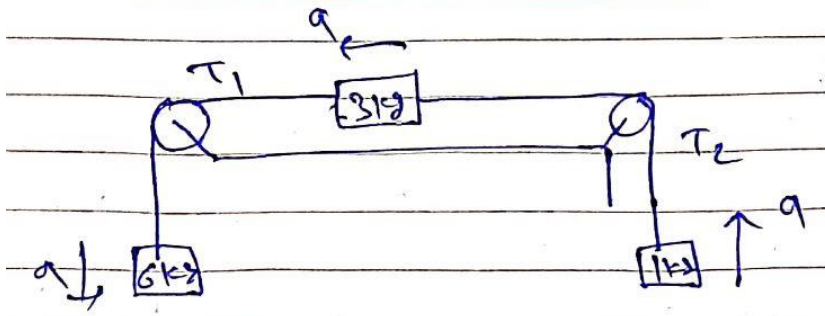
$$2g - T_1 = 2\left(\frac{g}{3}\right)$$

$$T_1 = \frac{4g}{3}$$

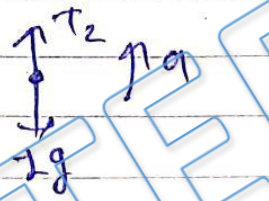
$$\boxed{T_1 \simeq 13\ N}$$

Ans. b

Solution: 5

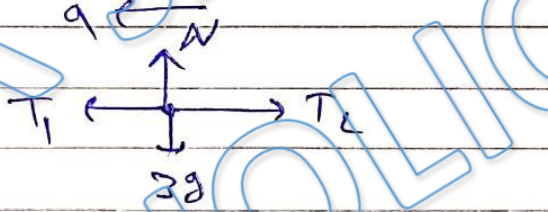


FBD of 1 kg.



$T_2 - g = a$ — (1)

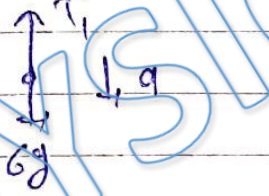
FBD of 3 kg



$N = 3g$

and $T_1 - T_2 = 3a$ — (2)

FBD of 6 kg.



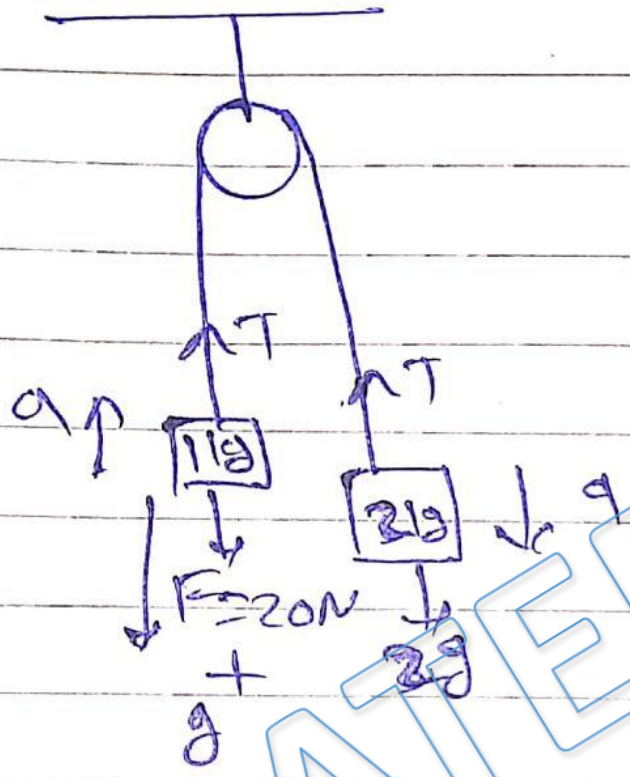
$6g - T_1 = 6a$ — (3)

from eq^n (1), (2) & (3) $\Rightarrow$ $\boxed{a = 5\ m/s^2}$

$\boxed{T_1 = 30\ N}$ & $\boxed{T_2 = 15\ N}$

Ans. a

Solution: 6



$2g - T = 2a$ — (1)

$T - 20 - g = a$ — (2)

from eq (1) & (2)

(1) + (2) =

$2g - 20 - g = 3a$

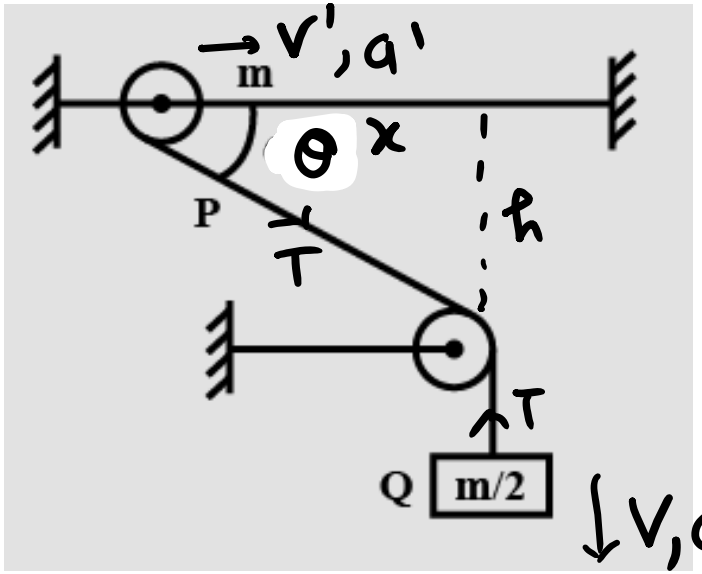
$$a = -g/3$$

-ve sign shows that acceleration of 2kg block will be upward and of 1kg block will be downward.

$$a = \frac{10}{3}\ m/s^2$$

Ans. a

Solution: 7



by using tension method (power method)—

$$TV'\cos\theta - TV = 0$$

$$\Rightarrow \quad V = V'\cos\theta$$

$$\Rightarrow \quad \frac{dv}{dt} = \frac{dv'}{dt}\cos\theta + v'(-\sin\theta)\frac{d\theta}{dt}$$

from figure → $\tan\theta = \frac{h}{x}$

$$\Rightarrow \sec^2\theta \frac{d\theta}{dt} = -\frac{h}{x^2}\frac{dx}{dt}$$

at $t = 0$, $v' = 0$ (released from rest)

$$\Rightarrow \quad \frac{d\theta}{dt} = 0$$

$$\Rightarrow \quad \frac{dv}{dt} = \frac{dv'}{dt}\cos\theta$$

$$a = a'\cos\theta \quad \ldots (1)$$

At $t=0$, $\theta = 60^\circ \Rightarrow a = \frac{a'}{2} \Rightarrow a' = 2a$ --- (i)

$$\frac{mg}{2} - T = \frac{m}{2}a \quad --- (ii)$$

$$T\cos 60^\circ = m a' = 2ma \quad --- (iii)$$

$$T = 4ma$$

$$\Rightarrow \quad \frac{mg}{2} - 4ma = \frac{m}{2}a$$

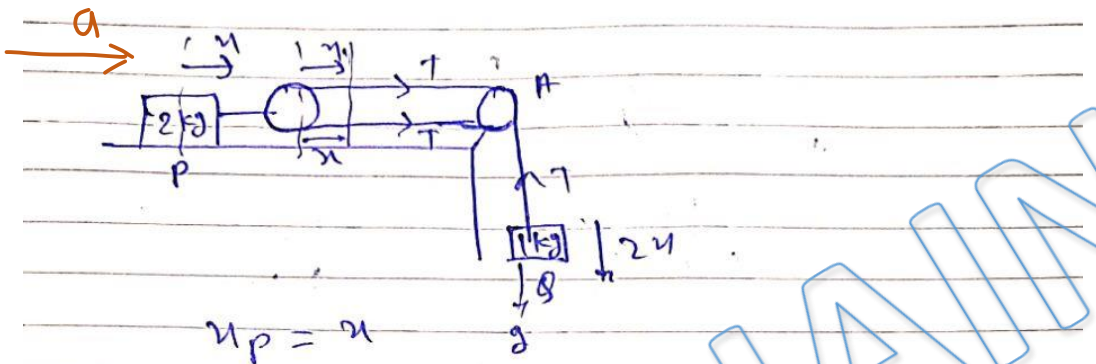
$$\Rightarrow \quad \frac{mg}{2} = \frac{9}{2}ma$$

$$\Rightarrow \quad a = g/9$$

$$a' = 2g/9$$

fbs(a)

Solution: 8



$x_P = x$

$x_Q = 2x$

$x_Q = 2x_P$

$v_Q = 2v_P$

$\boxed{a_Q = 2a_P}$ if $a_P = a$ then $a_Q = 2a$

for 'Q'

$g - T = 1(2a)$

$g - T = 2a$ — (1)

for 'P'

$2T = 2(a)$

$T = a$ — (2)

from (1) & (2)

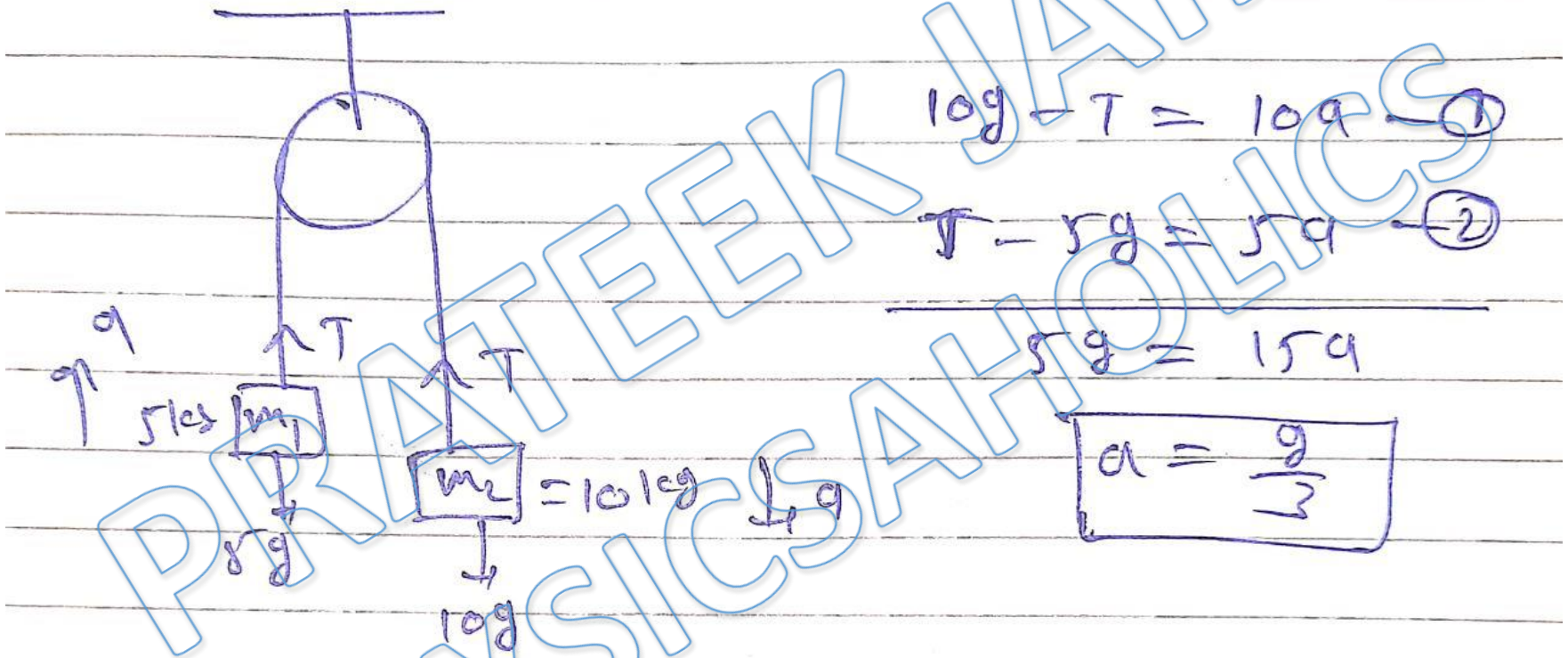
$g - a = 2a$

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

$\boxed{a = \frac{10}{3}\ m/s^2}$ $\boxed{T = \frac{10}{3}\ N}$

Ans. d

Solution: 9



$10g - T = 10a$ — (1)

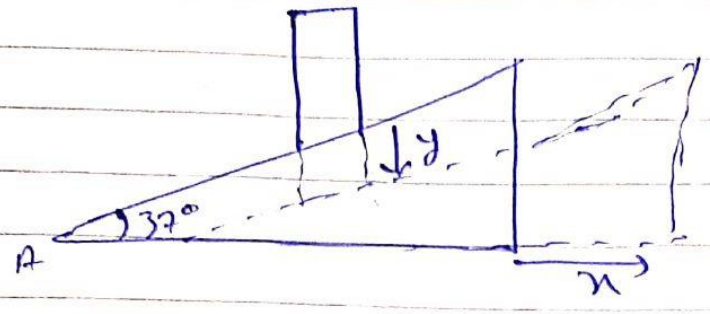
$T - 5g = 5a$ — (2)

$5g = 15a$

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

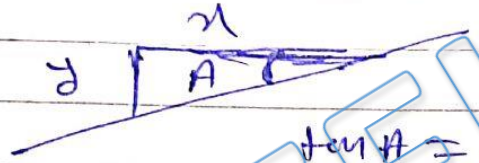
Ans. c

Solution: 10



y = vertical displacement of rod

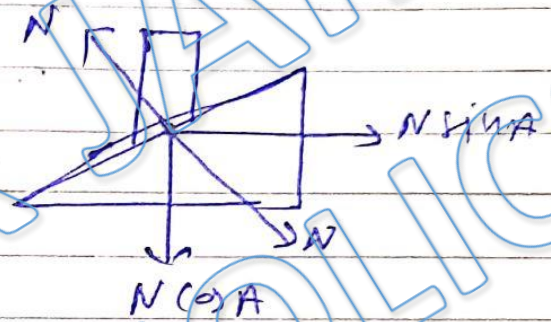
x = Horizontal displacement of wedge



$$\tan A = \frac{y}{x}$$

$$y = x \tan A$$

$$\boxed{a_y = a_x \tan A} \quad \text{--- (1)}$$



$$N \sin A = M a_x \qquad M = 10\ kg$$

$$a_x = \frac{a}{\tan A} \qquad a = 3\ m/s^2$$

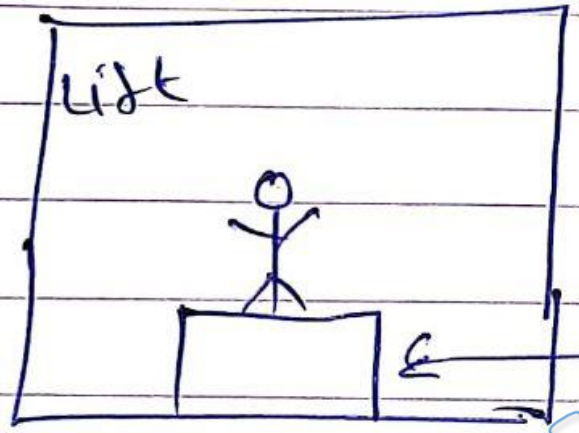
$$N \sin A = \frac{Ma}{\tan A}$$

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

$$\boxed{N = 200\ N}$$

Ans. b

Solution: 11



FBD of man

$$mg - N = m(g)$$

$$N = m(g - g) = m(1)$$

$$\boxed{N = 50\ N}$$

N = Normal reaction between man & weighing machine.

Reading of weighing scale = $N = 50N$

or $\frac{50}{g} = \frac{50}{10} = 5$ kg wt.

Ans. d

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Chalo Niklo