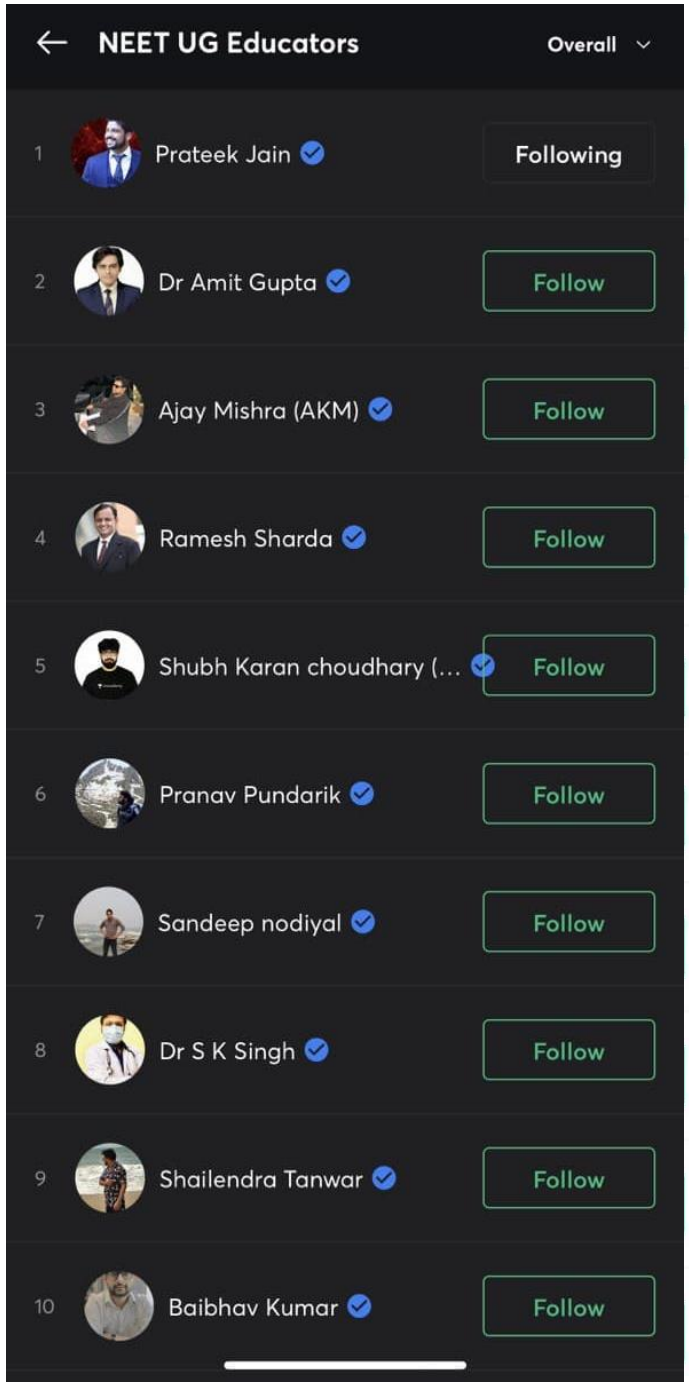
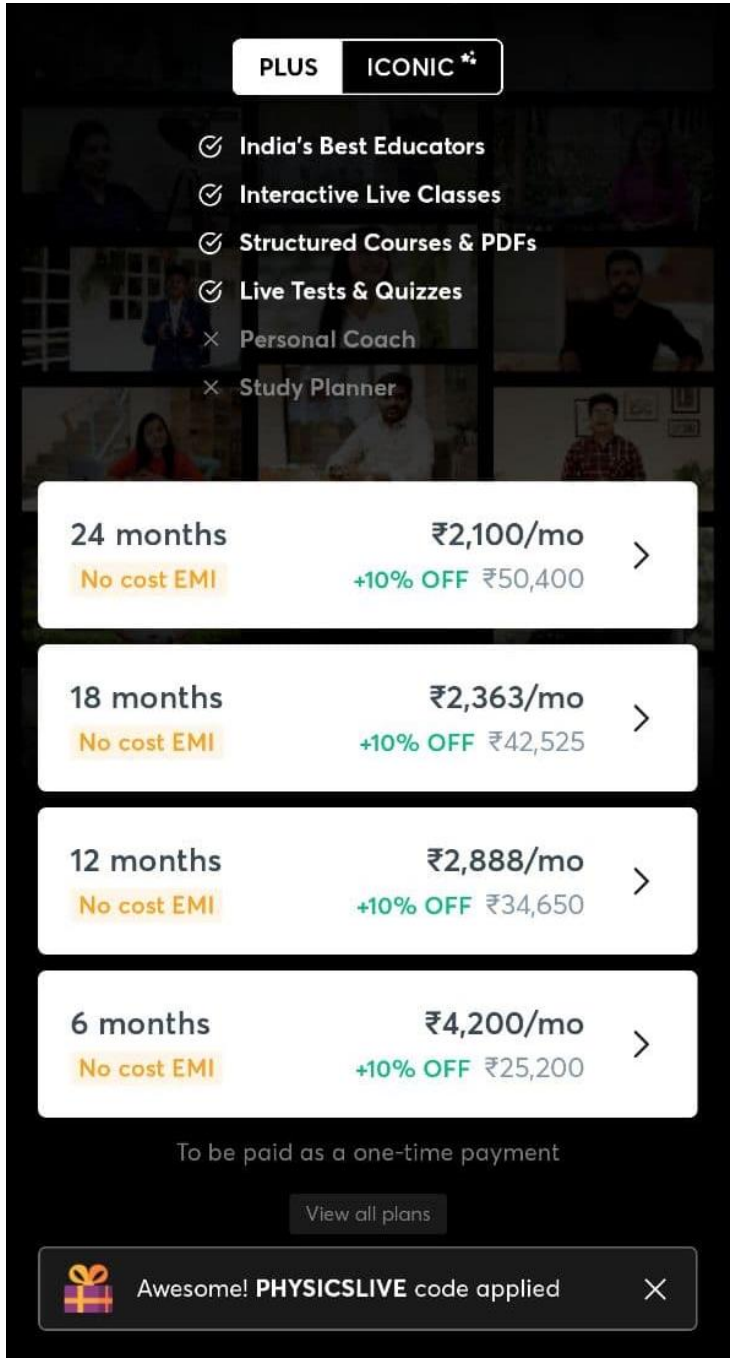
SIR PRATEEK JAIN

. 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.



PHYSICSLIVE

Use code PHYSICSLIVE to get 10% OFF on Unacademy PLUS and learn from India's Top Faculties.



SUBSCRIBE

@Physicsaholics

@Physicsaholics_prateek

@NEET_Physics
@IITJEE_Physics

physicsaholics.com

Unacademy

CLICK

Links are also in the description of the video.

For Video Solution of this DPP, Click on below link

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/71

Video Solution on YouTube:- https://youtu.be/6cClqrUGm3M

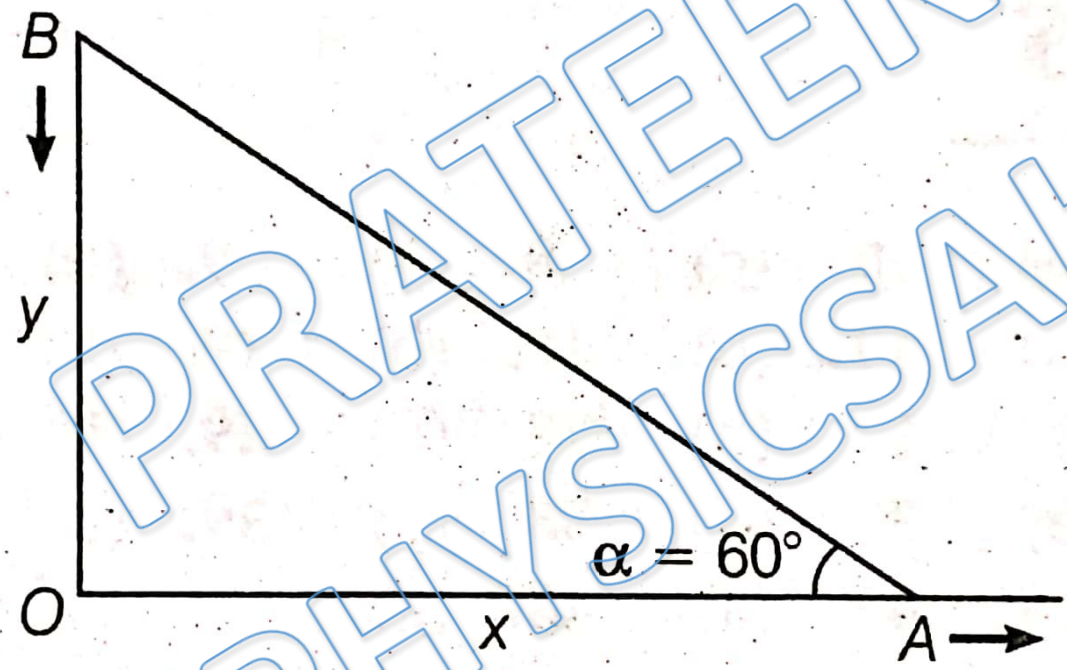
Solution
NEET & AIIMS PYQs

Newton’s Laws of Motion

By Physicsaholics Team

Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of A to the right is 10m/s. What is the velocity of B when angle $\alpha = 60°$?

[CBSE AIPMT 1998]



(a) 9.8 m/s (b) 10 m/s (c) 5.8 m/s (d) 17.3 m/s

Ans. c

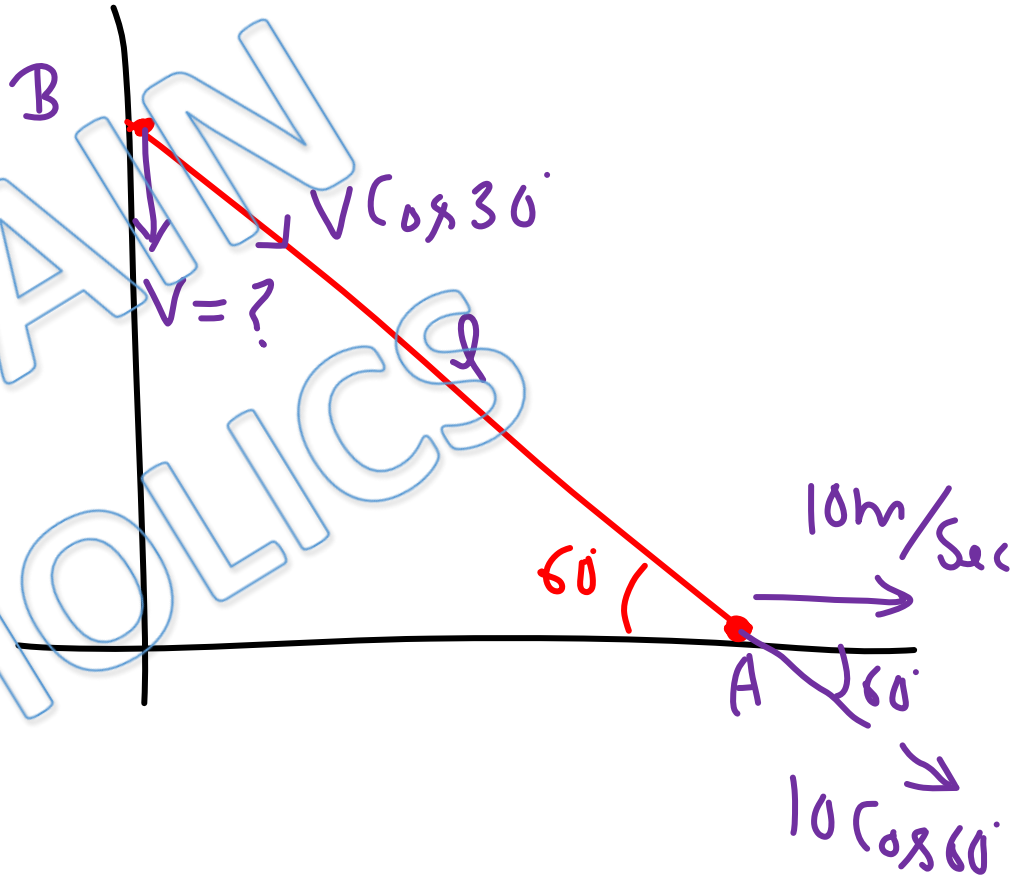
Since distance between A & B is Constant –

$$\frac{dl}{dt} = 0$$

$$\Rightarrow \quad 10\cos 60^\circ = V\cos 30^\circ$$

$$\Rightarrow \quad 5 = V\frac{\sqrt{3}}{2}$$

$$V = \frac{10}{\sqrt{3}} = \frac{10\sqrt{3}}{3} = 5.8\ m/Sec$$



Ans (c)

PYQs on Following Subtopic:

Second law of motion & Equilibrium

When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object is shot with the same velocity, it can travel x_2 distance. Then $x_1 : x_2$ will be

NEET 2019

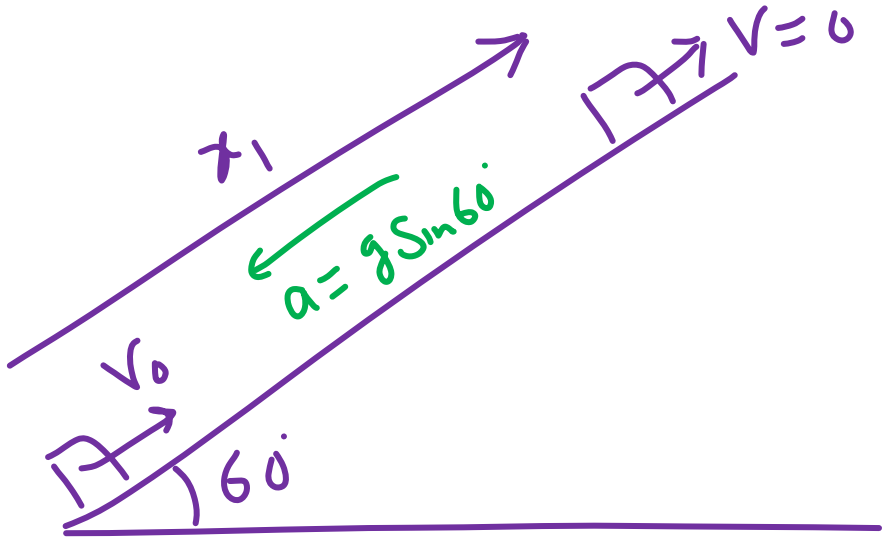
(a) $\sqrt{2}:1$

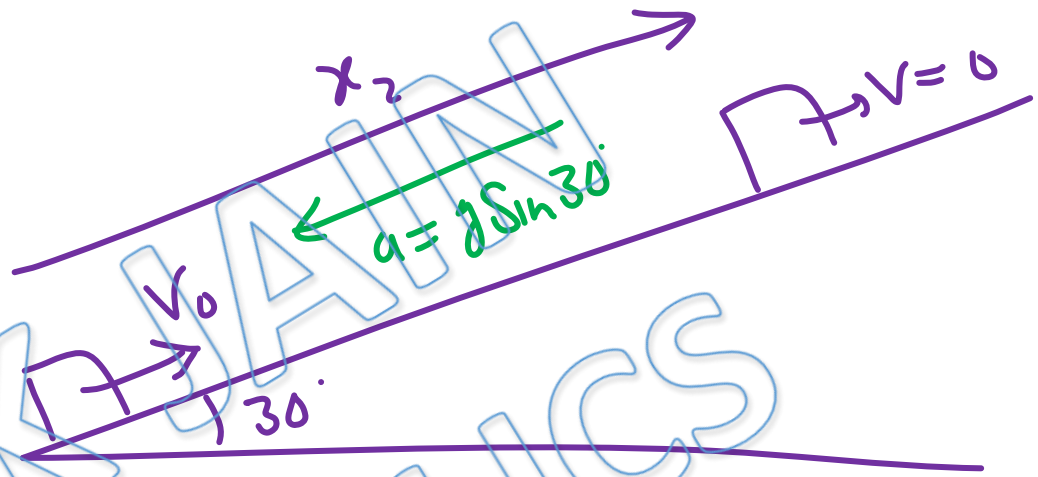
(b) $1:\sqrt{3}$

(c) $1:2\sqrt{3}$

(d) $1:\sqrt{2}$

Ans. b





$$V^2 = u^2 + 2ax$$

$$\Rightarrow \quad 0 = V_0^2 - 2g\sin 60^\circ x_1$$

$$\Rightarrow \quad x_1 = \frac{V_0^2}{2g\sin 60^\circ}$$

$$V^2 = u^2 + 2ax$$

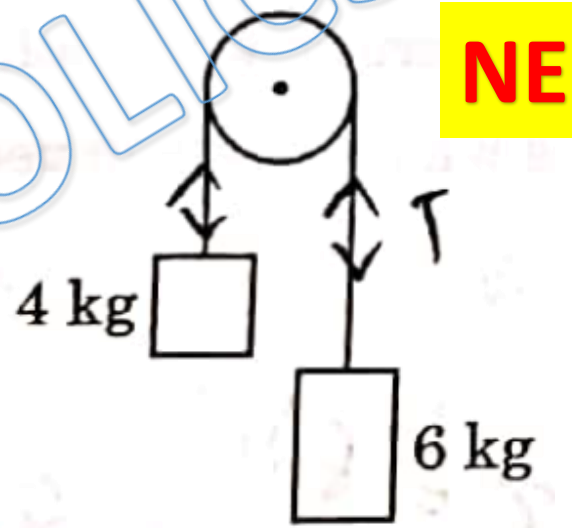
$$\Rightarrow \quad 0 = V_0^2 - 2g\sin 30^\circ x_2$$

$$\Rightarrow \quad x_2 = \frac{V_0^2}{2g\sin 30^\circ}$$

$$\Rightarrow \quad \frac{x_1}{x_2} = \frac{\sin 30^\circ}{\sin 60^\circ} = \frac{1}{\sqrt{3}}$$

Ans(b)

Q) Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is :



NEET 2020

(1) g/5

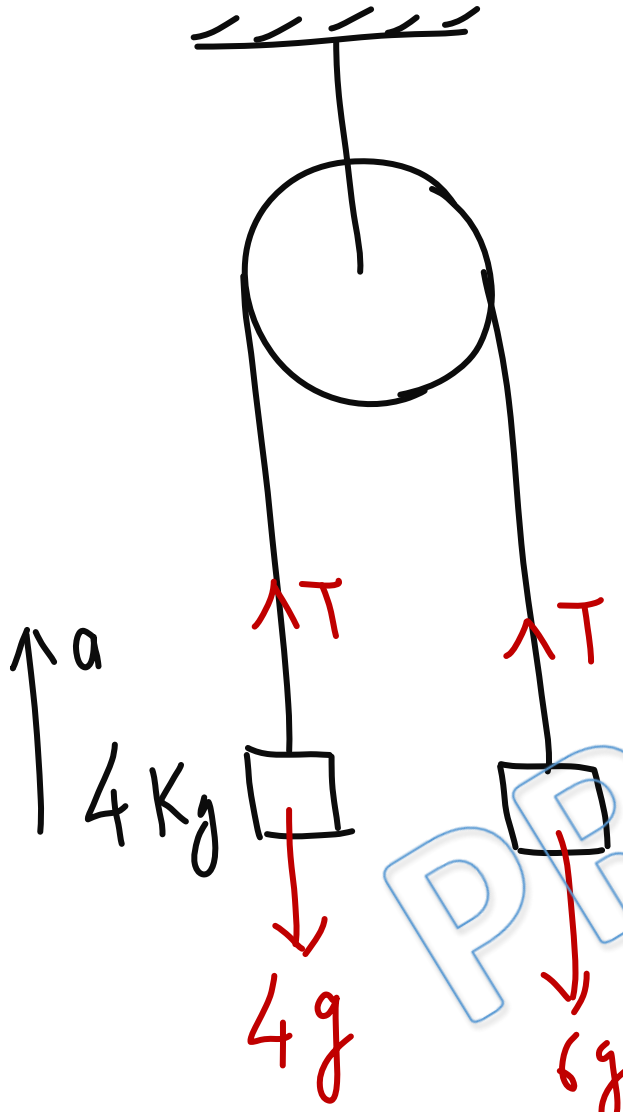
(2) g/10

(3) g

(4) g/2

Topic: NLM

Ans. 1



$$6g - T = 6a$$

$$T - 4g = 4a$$

$$2g = 10a$$

$$a = g/5$$

Ans(1)

7. A 10 N force is applied on a body produces an acceleration of 1 m/s^2. The mass of the body is [CBSE AIPMT 1996]

(a) 5 kg (b) 10 kg (c) 15 kg (d) 20 kg

Ans. b

$$m = \frac{F}{a} = \frac{10}{1} = 10\,Kg$$

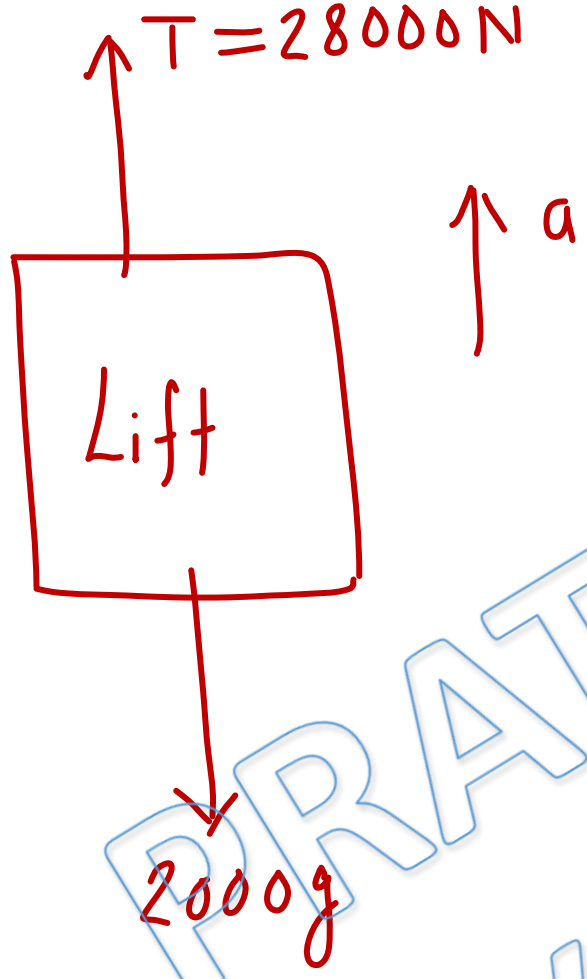
Ans(b)

7. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is *[CBSE AIPMT 2009]*

(a) 30 ms^{-2} downwards (b) 4 ms^{-2} upwards

(c) 4 ms^{-2} downwards (d) 14 ms^{-2} upwards

Ans. b



$$T - 2000g = 2000a$$

$$28000 - 20000 = 2000a$$

$$a = \frac{8}{2} = 4\ m/sec^2$$

Ans (b)

. A body, under the action of a force $\mathbf{F} = 6\hat{\mathbf{i}} - 8\hat{\mathbf{j}} + 10\hat{\mathbf{k}}$, acquires an acceleration of 1 ms^{-2}. The mass of this body must be

[CBSE AIPMT 2009]

(a) $2\sqrt{10}$ kg (b) 10 kg (c) 20 kg (d) $10\sqrt{2}$ kg

Ans. d

$$\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$$

$$\Rightarrow F = \sqrt{6^2 + 8^2 + 10^2} = 10\sqrt{2}\ N$$

$$m = \frac{F}{a} = \frac{10\sqrt{2}}{1} = 10\sqrt{2}\ kg$$

Ans (d)

A 0.2 kg object at rest is subjected to a force $(0.3\hat{i} - 0.4\hat{j})$ N. What is the velocity after 6 s?

(a) $(9\hat{i} - 12\hat{j})$ (b) $(8\hat{i} - 16\hat{j})$

(c) $(12\hat{i} - 9\hat{j})$ (d) $(16\hat{i} - 8\hat{j})$

(2011)

AIIMS

Ans. a

$$\vec{F} = .3\hat{i} - .4\hat{j}$$

$$\Rightarrow \vec{a} = \frac{\vec{F}}{m} = \frac{.3\hat{i} - .4\hat{j}}{.2} = \frac{3\hat{i} - 4\hat{j}}{2}$$

$$\vec{v} = \vec{u} + \vec{a}\,t$$

$$= 0 + \frac{3\hat{i} - 4\hat{j}}{2} \times 6$$

$$= 9\hat{i} - 12\hat{j}$$

Ans(a)

An object of mass 3 kg is at rest. If a force $\mathbf{F} = (6t^2\hat{i} + 4t\hat{j})$ N is applied on the object, then the velocity of the object at $t = 3$ s is

[CBSE AIPMT 2002]

(a) $18\hat{i} + 3\hat{j}$

(b) $18\hat{i} + 6\hat{j}$

(c) $3\hat{i} + 18\hat{j}$

(d) $18\hat{i} + 4\hat{j}$

Ans. b

$$\vec{F} = 6t^2\,\hat{i} + 4t\,\hat{j} \Rightarrow \vec{a} = \frac{\vec{F}}{m} = 2t^2\,\hat{i} + \frac{4}{3}t\,\hat{j}$$

$$\Rightarrow \frac{d\vec{v}}{dt} = 2t^2\,\hat{i} + \frac{4t}{3}\,\hat{j}$$

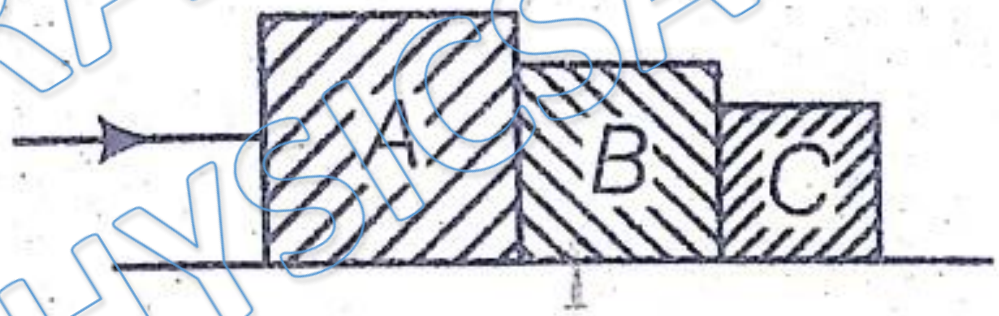
$$\Rightarrow \int_0^{\vec{v}} d\vec{v} = \int_0^3 \left(2t^2\,\hat{i} + \frac{4t}{3}\,\hat{j}\right) dt$$

$$\Rightarrow \vec{v} = \left(\frac{2t^3}{3}\,\hat{i} + \frac{4}{3}\frac{t^2}{2}\,\hat{j}\right)_0^3 = 18\,\hat{i} + 6\,\hat{j}$$

Ans(b)

Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is

[CBSE AIPMT 2015]

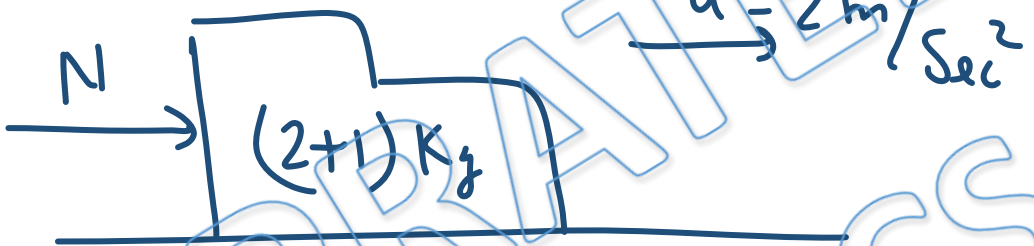


(a) 2 N (b) 6 N (c) 8 N (d) 18 N

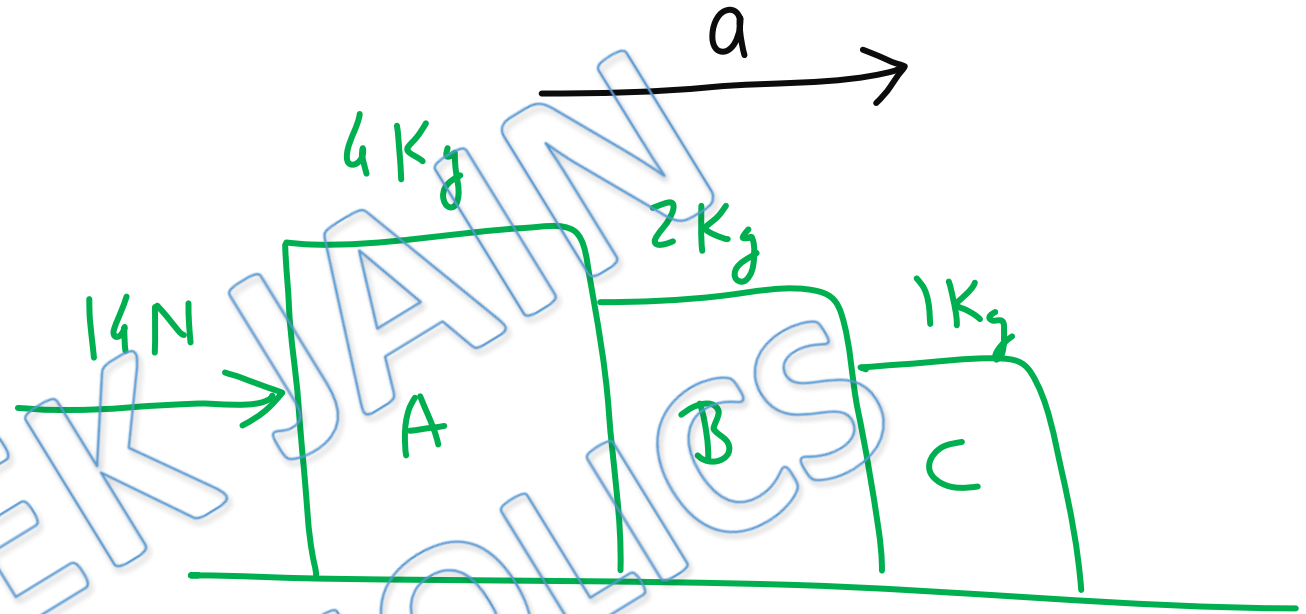
Ans. b

$$a = \frac{14}{4+2+1} = 2\,m/Sec^2$$

F.B.D of (B+C)

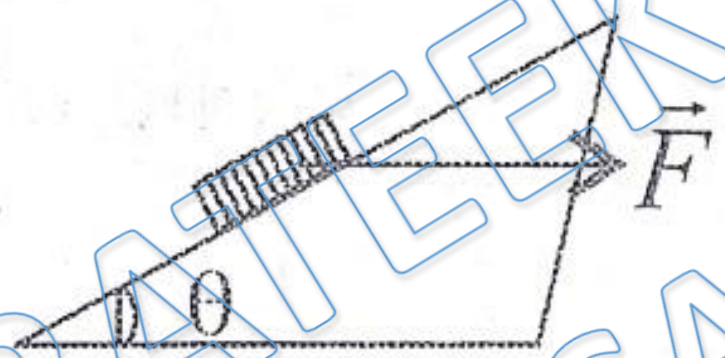


Contact force = N = 3 × 2 = 6N



Ans (b)

The figure shows a horizontal force acting on a block of mass m on an inclined plane (angle). What is the normal reaction N on the block?



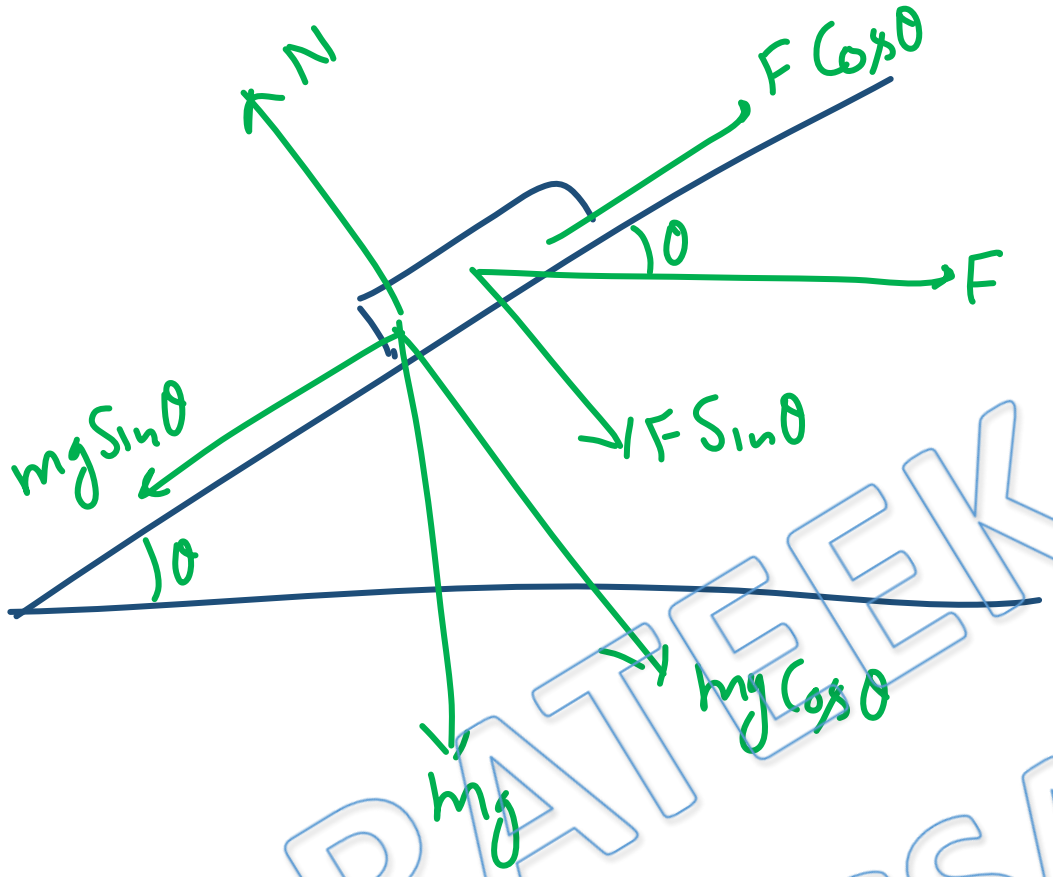
(a) $mg\sin\theta + F\cos\theta$ (b) $mg\sin\theta - F\cos\theta$

(c) $mg\cos\theta - F\sin\theta$ (d) $mg\cos\theta + F\sin\theta$

(2017)

AIIMS

Ans.d

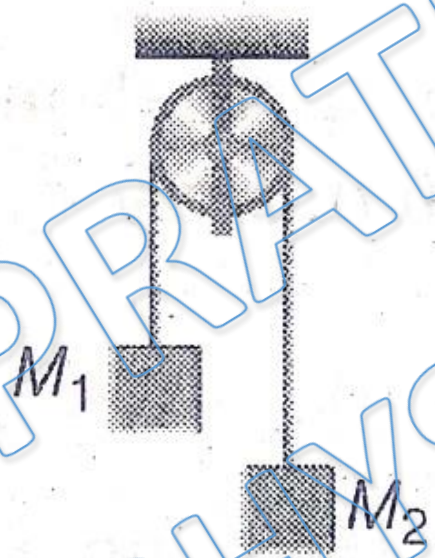


$$N = mg\cos\theta + F\sin\theta$$

Ans (d)

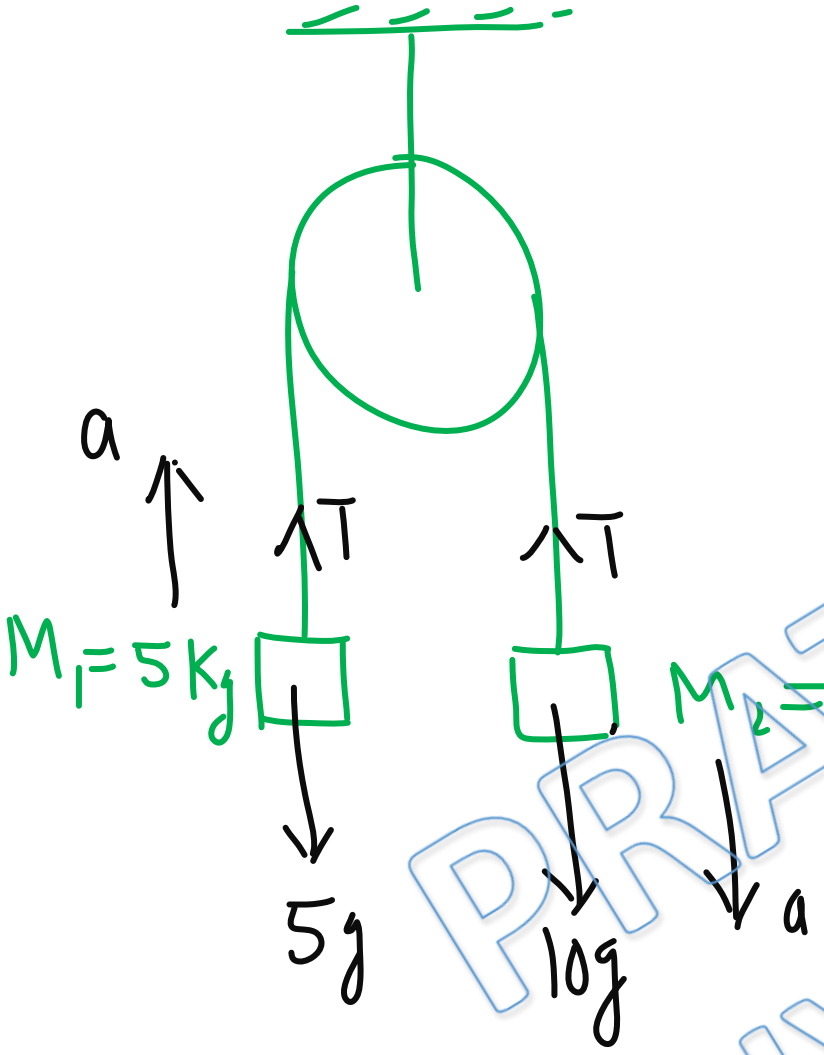
. Two masses $M_1 = 5$ kg, $M_2 = 10$ kg are connected at the ends of an inextensible string passing over a frictionless pulley as shown. When masses are released, then acceleration of masses will be

[CBSE AIPMT 2000]



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

Ans. c



$$10g - T = 10a$$

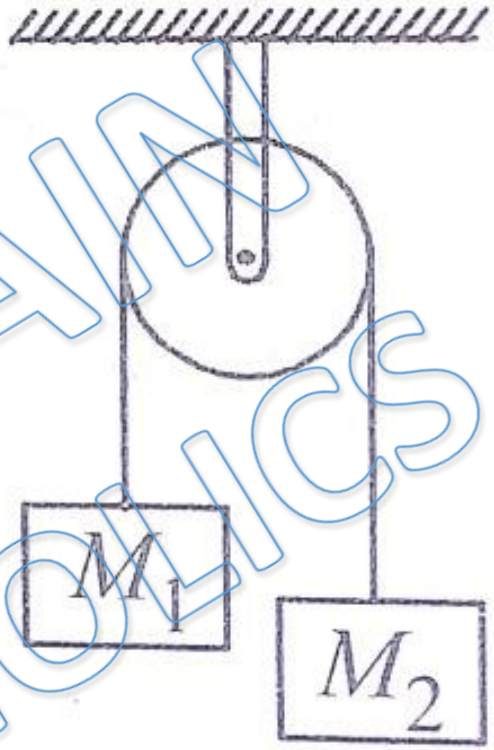
$$T - 5g = 5a$$

$$5g = 15a$$

$$a = g/3$$

Ans (c)

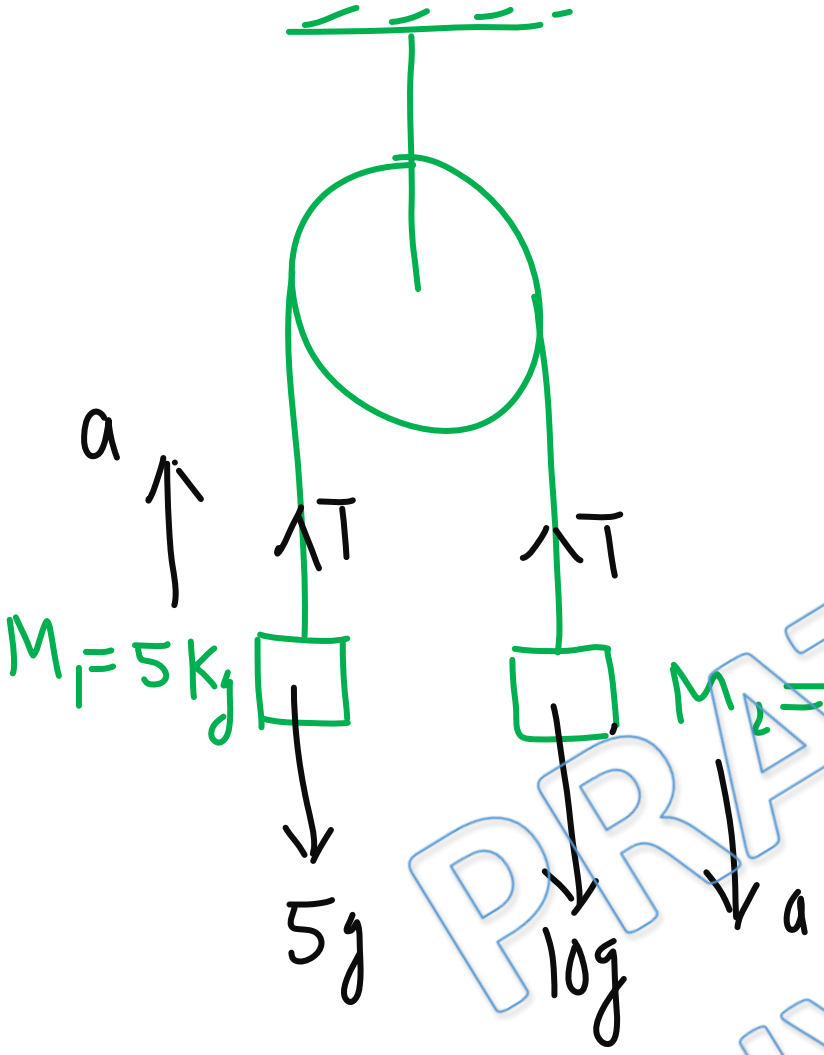
. Two masses $M_1 = 5$ kg and $M_2 = 10$ kg are connected at the ends of an inextensible string passing over a frictionless pulley as shown. When the masses are released, then the accelera-tion of the masses will be



(a) g (b) $g/2$

(c) $g/3$ (d) $g/4$ *(2010)*

Ans.c



$$10g - T = 10a$$

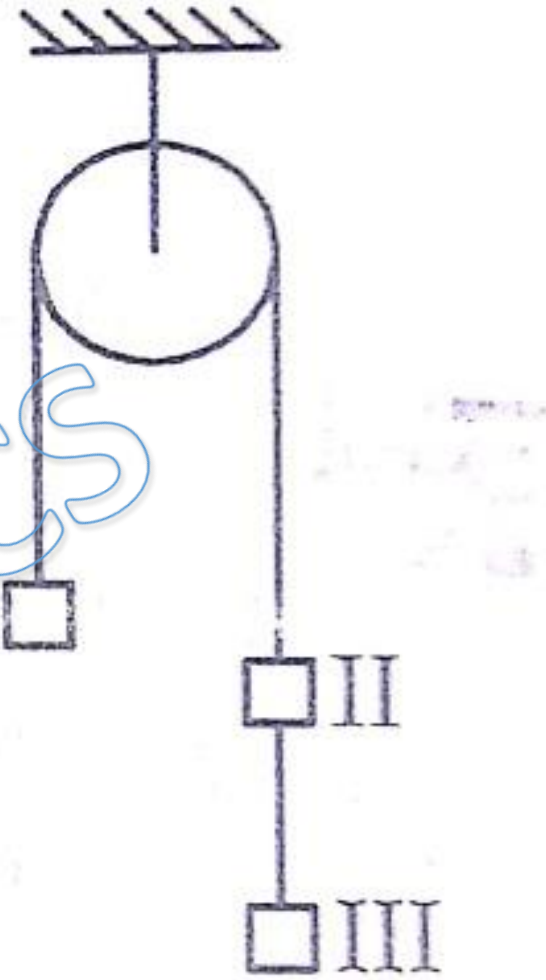
$$T - 5g = 5a$$

$$5g = 15a$$

$$a = g/3$$

Ans (c)

. Three equal weights of 3 kg each are hanging on a string passing over a frictionless pulley as shown in figure. The tension in the string between masses II and III will be (Take $g = 10$ m/sec^2)

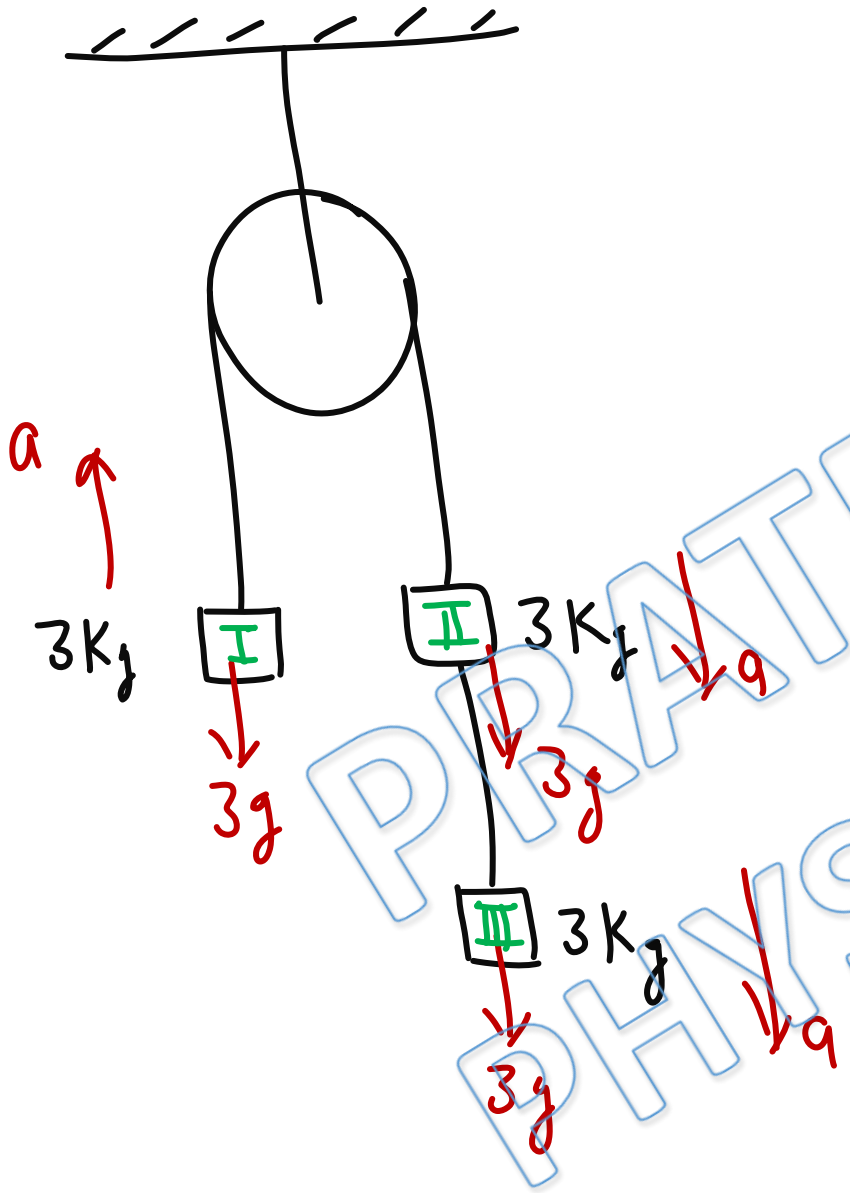


(a) 5 N (b) 6 N

(c) 10 N (d) 20 N

(2009)

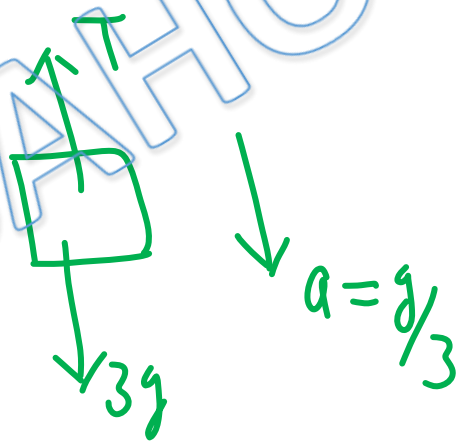
Ans.d



$$a = \frac{\text{supporting forces} - \text{opposing forces}}{\text{total mass}}$$

$$= \frac{3g + 3g - 3g}{9} = g/3$$

F.B.D of III block



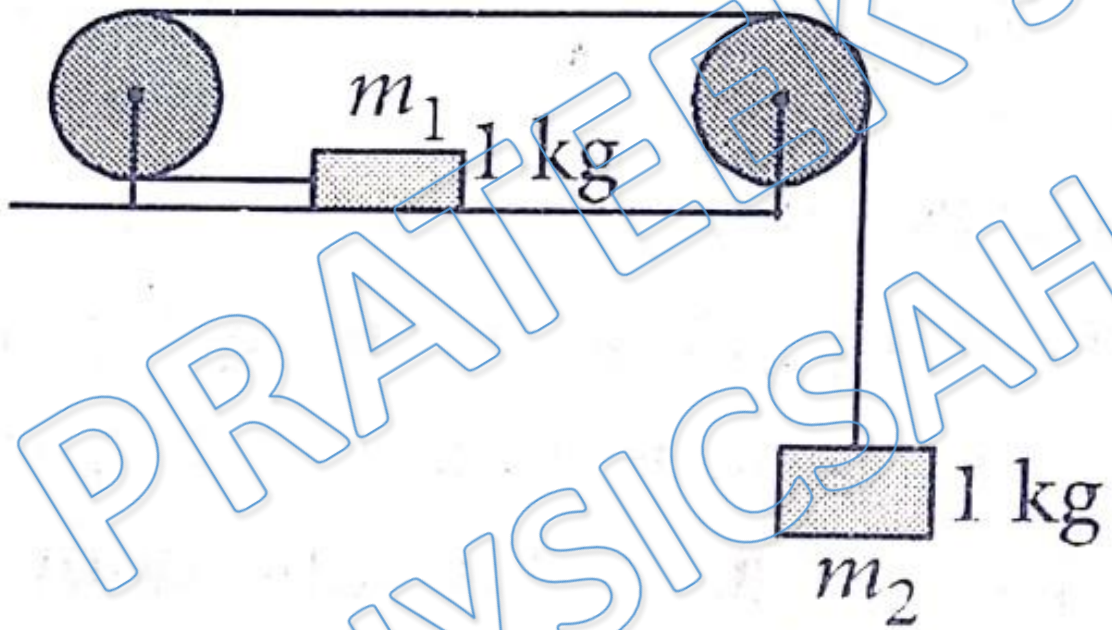
$$3g - T = 3(g/3)$$

$$T = 2g$$

$$T = 20\,N$$

Ans (d)

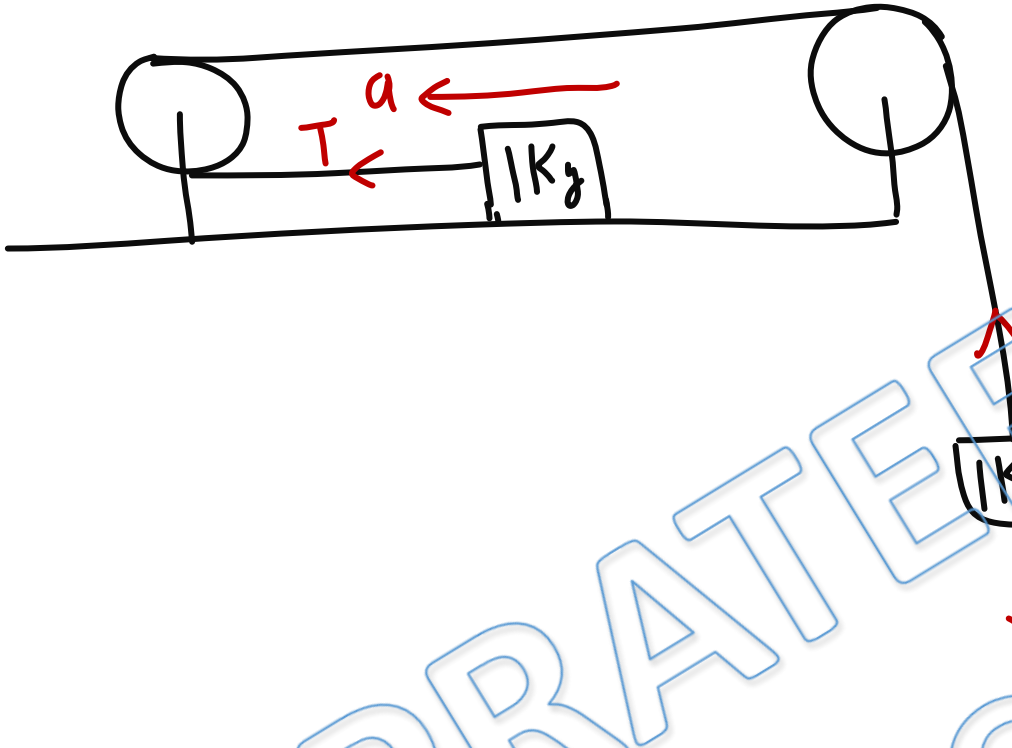
Consider the system shown in figure. The pulley and the string are light and all the surfaces are frictionless. The tension in the string is (take $g = 10\ \text{m s}^{-2}$)



(a) 0 N
(b) 1 N
(c) 2 N
(d) 5 N

(2016) AIIMS

Ans.d



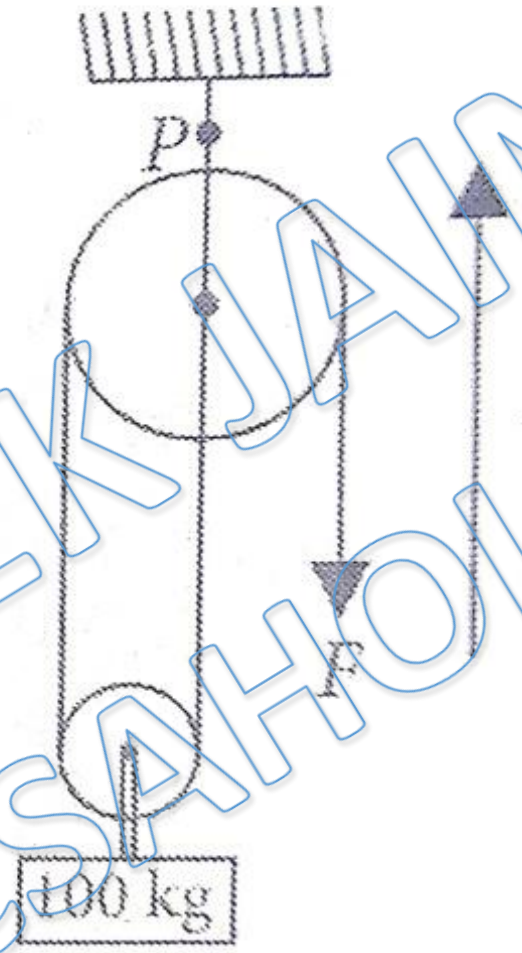
$$g - T = a$$
$$T = a$$
$$g = 2a$$

$$\Rightarrow a = g/2 = 5\ m/Sec^2$$

$$\Rightarrow T = a = 5\ N$$

Ans (d)

In the diagram 100 kg block is hanging from a pulley and force F is applied on the string to keep the system in equilibrium. If the whole system is moving up with a constant velocity v, then tension at point P in the string will be

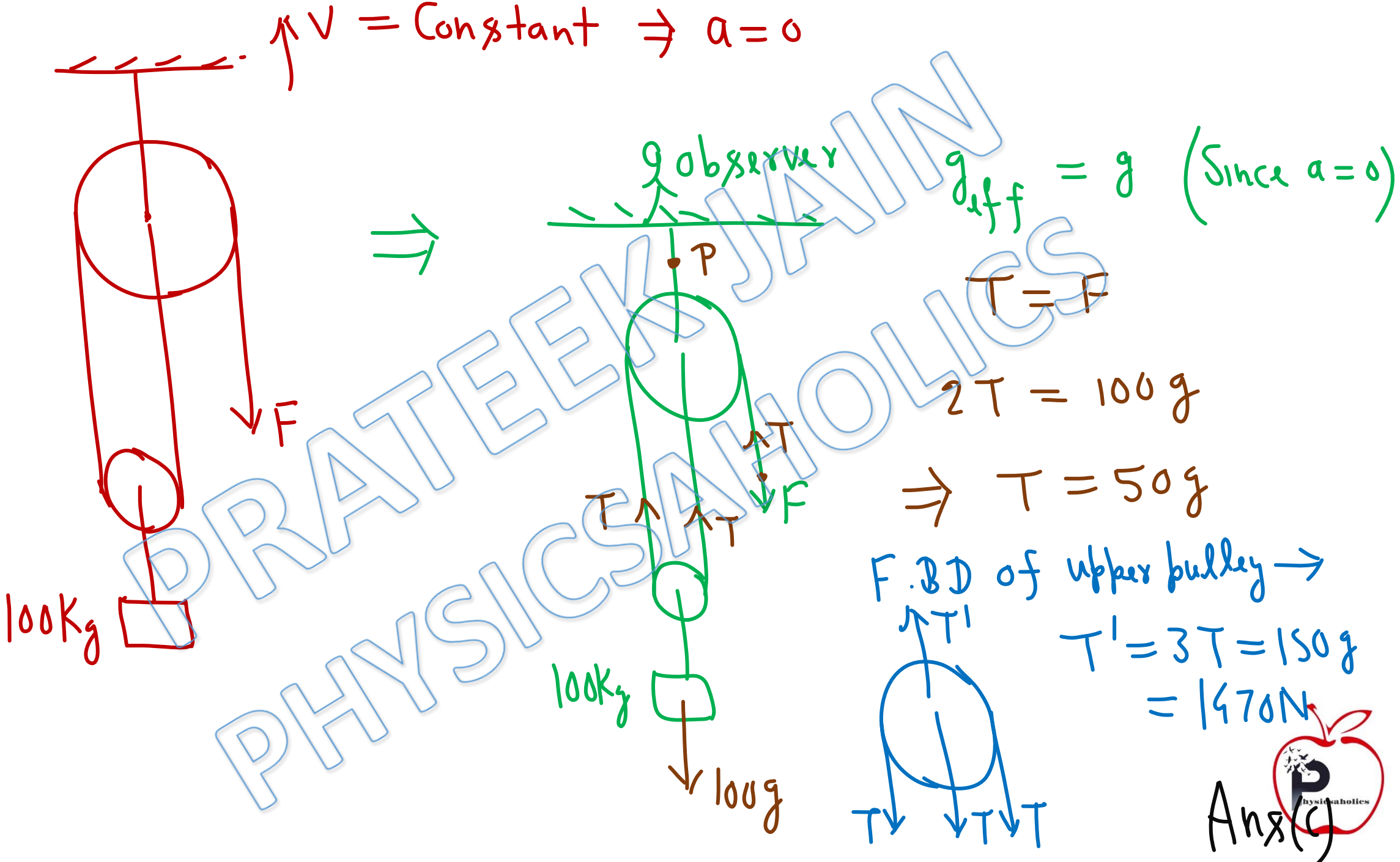


(a) 735 N (b) 1050 N

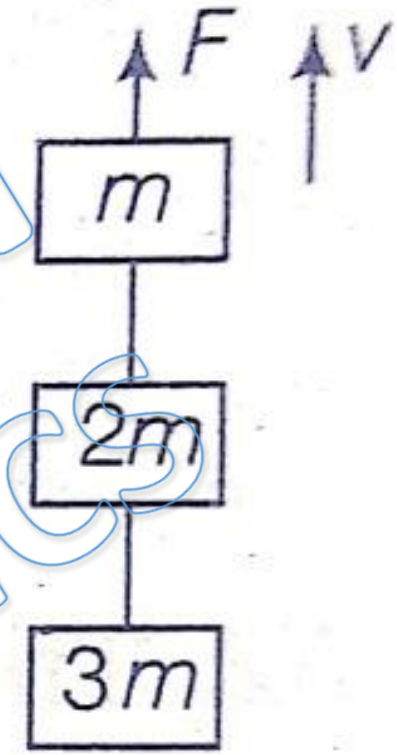
(c) 1470 N (d) 1200 N *(2018)*

AIIMS

Ans. C



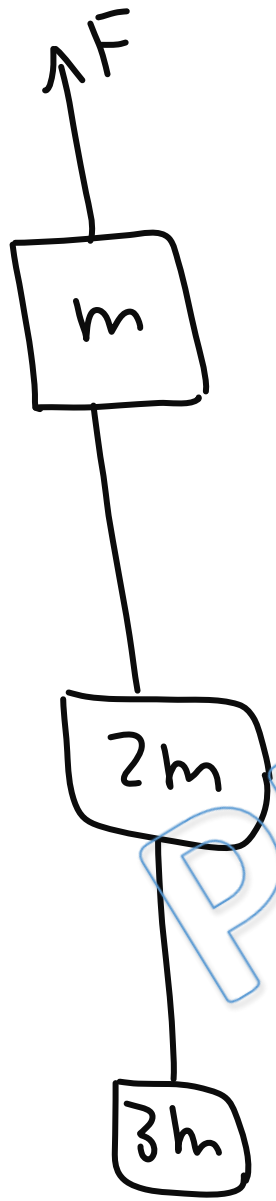
. Three blocks with masses m, $2m$ and $3m$ are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass $2m$? (g is the acceleration due to gravity).



[NEET 2013]

(a) Zero (b) $2mg$ (c) $3mg$ (d) $6mg$

Ans. a



$\uparrow$ V = Constant

$\Rightarrow a = 0$

F_{net} = mass × acceleration

$\Rightarrow$ Net force on 2m

$= 2m \times 0 = 0$

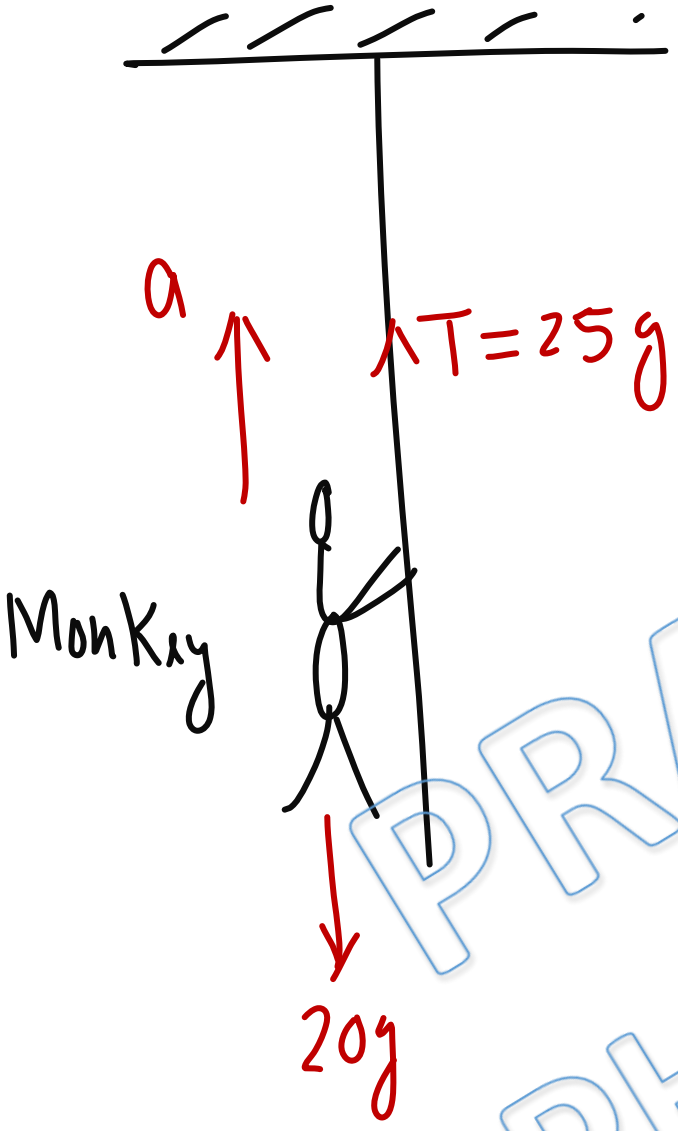
Ans (a)

3. A monkey of mass 20 kg is holding a vertical rope. The rope will not break, when a mass of 25 kg is suspended from it but will break, if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope? (Take $g = 10\ m/s^2$) *[CBSE AIPMT 2003]*

(a) $25\ m/s^2$ (b) $2.5\ m/s^2$

(c) $5\ m/s^2$ (d) $10\ m/s^2$

Ans. b



$$T - mg = ma$$

$$25g - 20g = 20a$$

$$a = \frac{5g}{20} = g/4$$

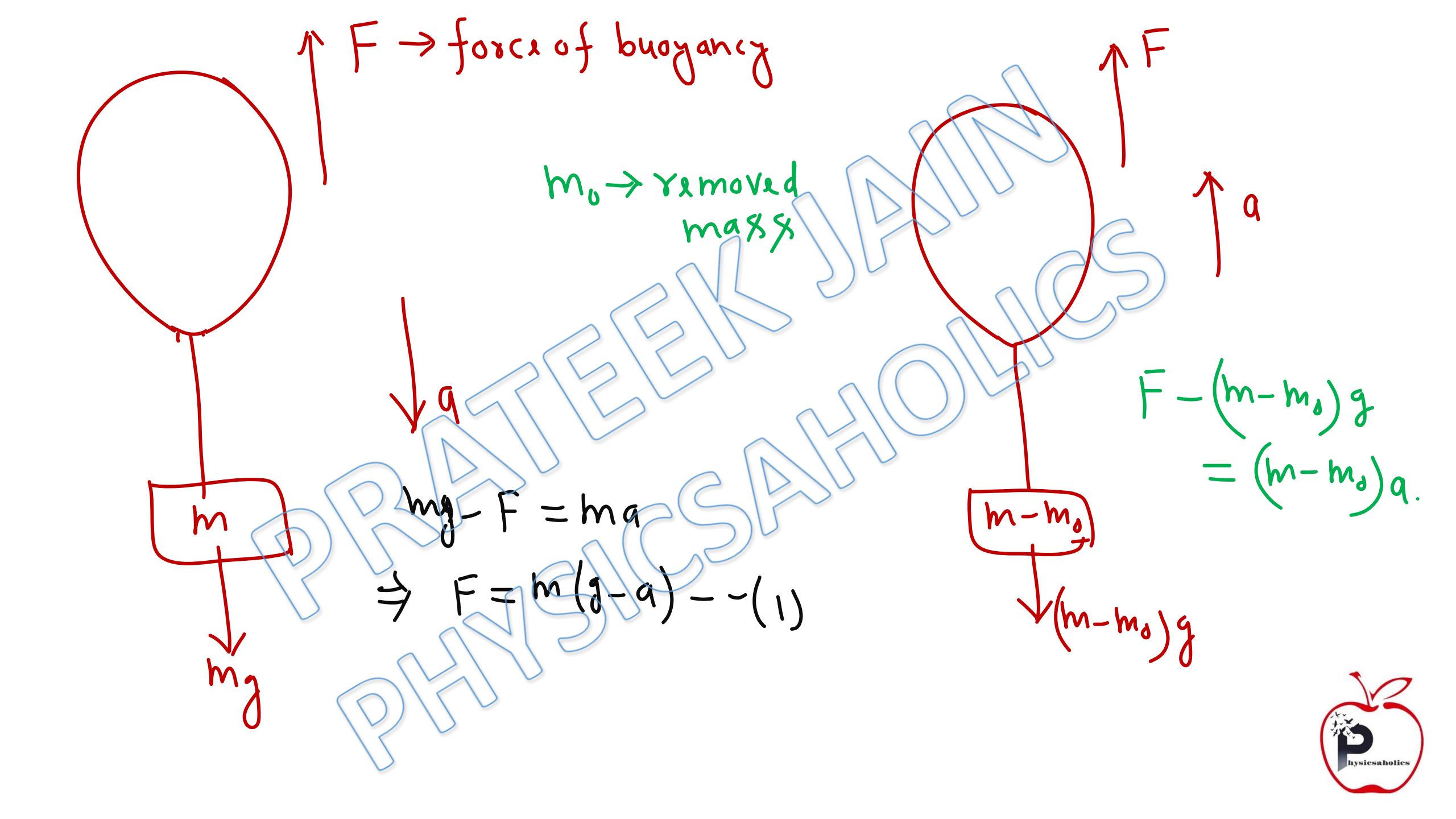
$$= 2.5\ m/sec^2$$

Ans (b)

6. A balloon with mass m is descending down with an acceleration a (where, $a < g$). How much mass should be removed from it so that it starts moving up with an acceleration a? *[CBSE AIPMT 2014]*

(a) $\frac{2ma}{g+a}$ (b) $\frac{2ma}{g-a}$ (c) $\frac{ma}{g+a}$ (d) $\frac{ma}{g-a}$

Ans. a



$$F = (m - m_0)(a + g) = m(g - a)$$

$$\Rightarrow \quad m - m_0 = \frac{m(g-a)}{g+a}$$

$$\Rightarrow \quad m_0 = m\left[1 - \frac{g-a}{g+a}\right] = \frac{2ma}{g+a}$$

Ans (a)

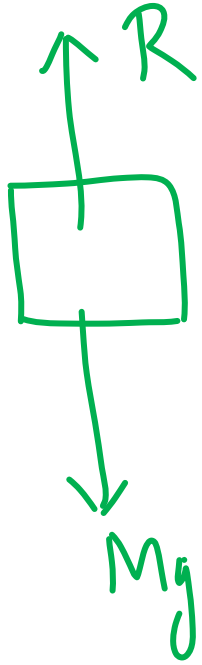
Assertion : The two bodies of masses M and m $(M > m)$ are allowed to fall from the same height if the air resistance for each be the same then both the bodies will reach the earth simultaneously.

Reason : For same air resistance, acceleration of both the bodies will be same.

AIIMS *[2014]*

Ans. d

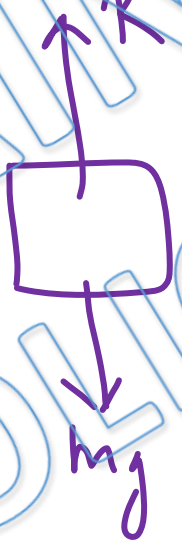
F.B.D of M



$$a_1 = \frac{Mg - R}{M}$$

$$= g - \frac{R}{M}$$

F.B.D of m



$$a_2 = \frac{mg - R}{m}$$

$$= g - R/m$$

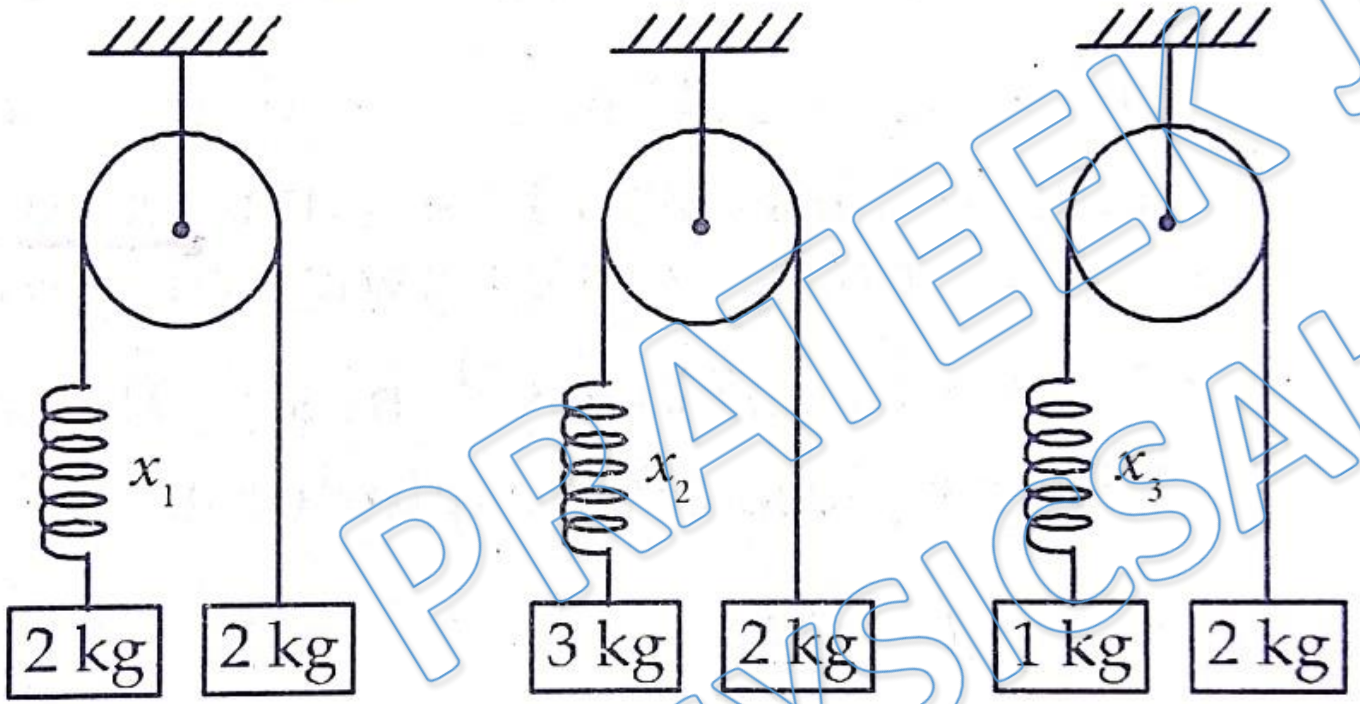
Since $M > m$, $a_1 > a_2 \Rightarrow$ M will fall earlier.

Ans(d)

PYQs on Following Subtopic:

Spring

Same spring is attached with 2 kg, 3 kg and 1 kg blocks in three different cases as shown in figure. If x_1, x_2, x_3 be the extensions in the spring in the three cases, then



(a) $x_1 = 0, x_3 > x_2$ (b) $x_1 > x_2 > x_3$

(c) $x_3 > x_2 > x_1$ (d) $x_2 > x_1 > x_3$

(2017) AIIMS

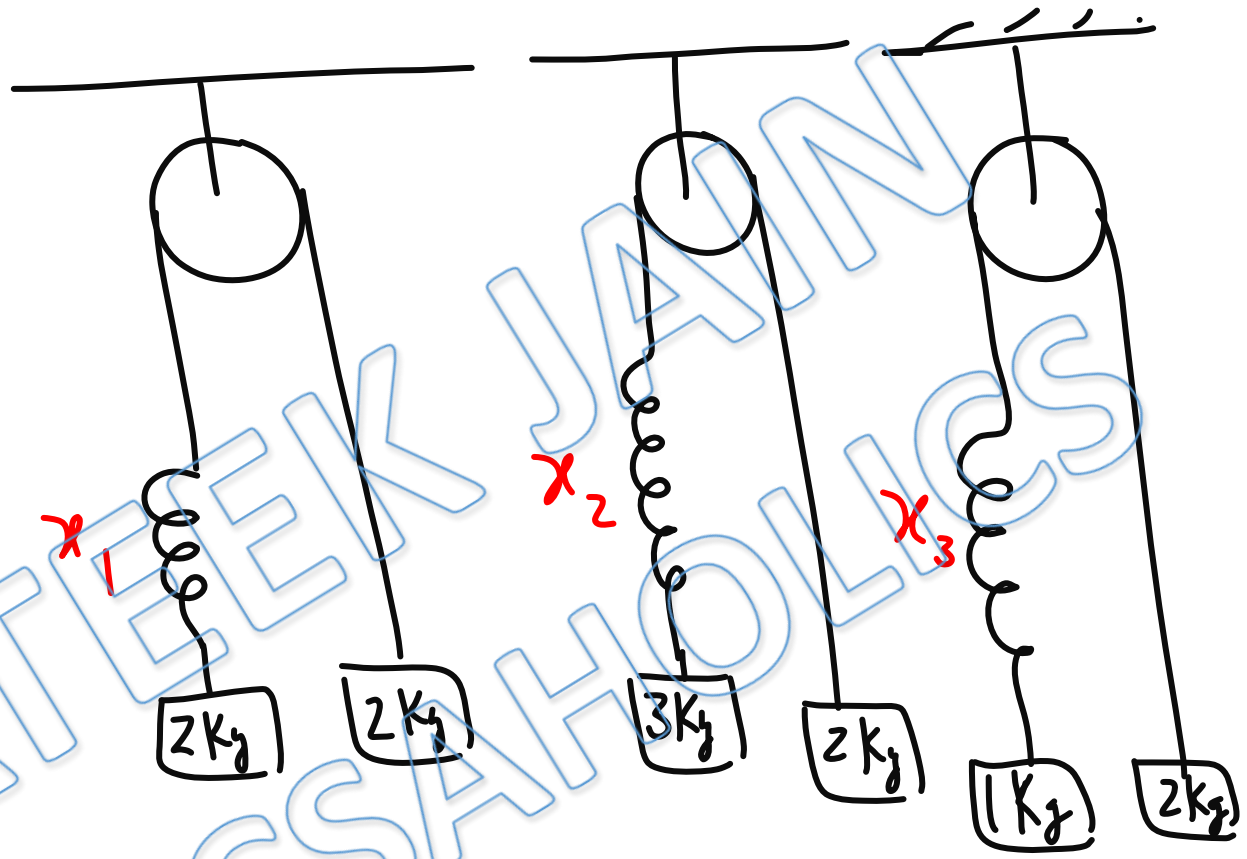
Ans. d

Tension in string

$$T = \frac{2m_1m_2}{m_1+m_2}g$$

elongation in spring

$$x = \frac{T}{k} = \frac{2m_1m_2}{m_1+m_2}\frac{g}{k}$$



$$\Rightarrow x_1 = \frac{2\times2\times2}{2+2}\frac{g}{k} = \frac{2g}{k},\ x_2 = \frac{2\times3\times2}{3+2}\frac{g}{k} = \frac{12}{5}\frac{g}{k},\ x_3 = \frac{2\times2\times1}{2+1}\frac{g}{k} = \frac{4}{3}\frac{g}{k}$$

$$\Rightarrow x_2 > x_1 > x_3$$

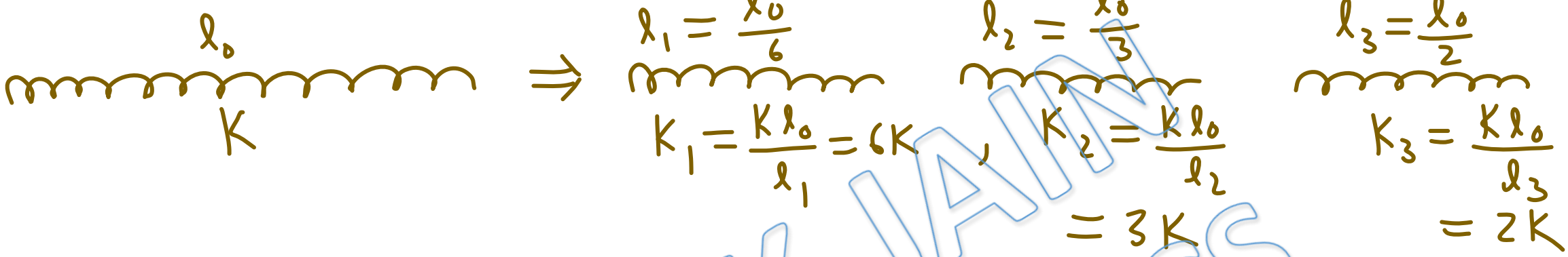
Ans (d)

A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k'. If they are connected in parallel and force constant is k'', then 1 $k' : k''$ is

[NEET 2017]

(a) 1 : 6 (b) 1 : 9 (c) 1 : 11 (d) 1 : 14

Ans. c



In series Combination springs will form original spring

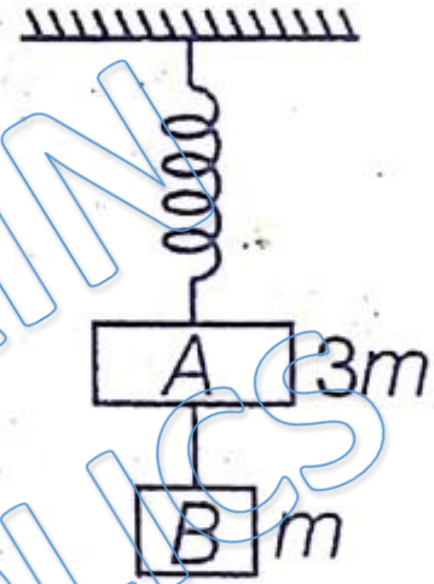
$\Rightarrow K' = K$

In parallel Combination $K'' = 6K + 3K + 2K = 11K$

$$\frac{K'}{K''} = \frac{K}{11K} = \frac{1}{11}$$

Ans (C)

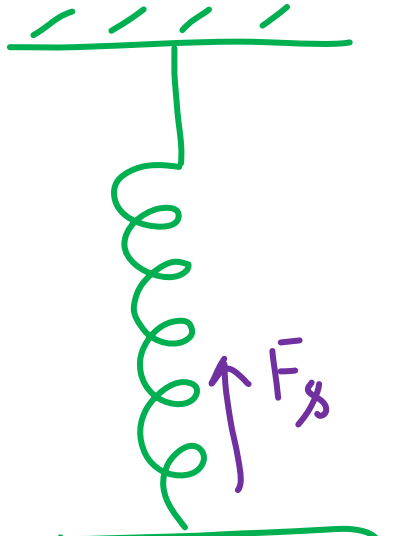
. Two blocks A and B of masses $3m$ and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively



[NEET 2017]

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

Ans. b

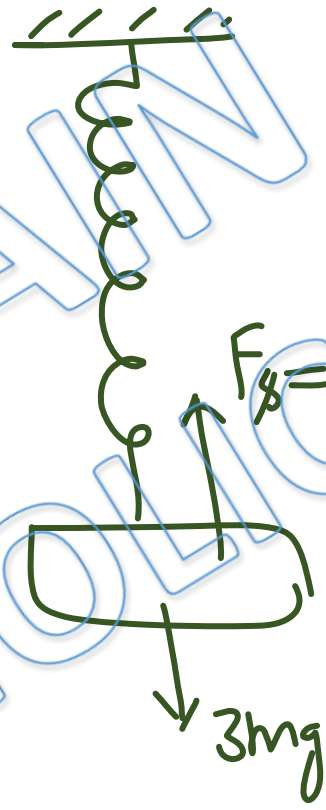


just after cutting string

$T = mg$

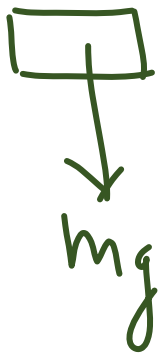
$F_s = T + 3mg$

$= 4mg$



$a_1 = \frac{4mg - 3mg}{3m}$

$= g/3$



$a_2 = mg/m = g$

Ans (b)

PYQs on Following Subtopic:

Artificial Gravity, Time Period of Pendulum

Assertion: If a pendulum falls freely, then its time period becomes infinite.

Reason: Free falling body has acceleration, equal to g. *(1997)*

AIIMS

a) If both assertion & reasons are true and reason is the correct explanation of assertion.

b) If both assertion & reasons are true but reason is not the correct explanation of assertion.

c) Is assertion is true but reason is false.

d) If both assertion & reason are false.

Ans. a

Acceleration of freely falling body $= g \downarrow$

$\Rightarrow \quad g_{eff} = g - a = g - g = 0$

$\Rightarrow T = 2\pi\sqrt{\frac{l}{g_{eff}}} = \infty$

Ans (a)

A seconds pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket *[CBSE AIPMT 1991]*

(a) comes down with uniform acceleration
(b) moves round the earth in a geostationary orbit
(c) moves up with a uniform velocity
(d) moves up with uniform acceleration

Ans. d

$$T = 2\pi\sqrt{\frac{l}{g_{eff}}}$$, where $g_{eff} = g + a$ if body is accelerating up

$= g - a$ " " " " down

To decrease time period $g_{eff} > g$

$\Rightarrow$ Rocket has upward acceleration.

Ans(d)

For Video Solution of this DPP, Click on below link

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/71

Video Solution on YouTube:- https://youtu.be/6cClqrUGm3M

@Physicsaholics

@Physicsaholics_prateek

@NEET_Physics
@IITJEE_Physics

physicsaholics.com

Unacademy

CLICK

Links are also in the description of the video.

Chalo Niklo