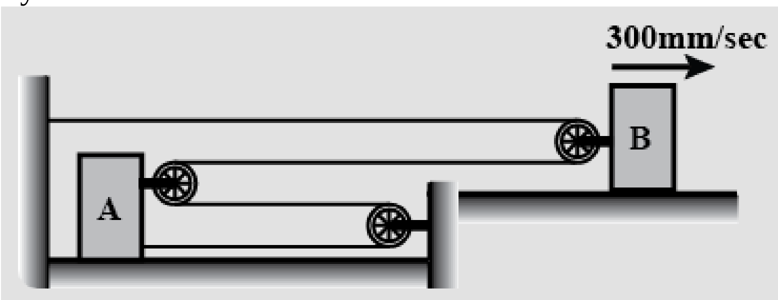
DPP – 2 (NLM)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/53

Video Solution on YouTube:- https://youtu.be/rTg2MIwPV6g

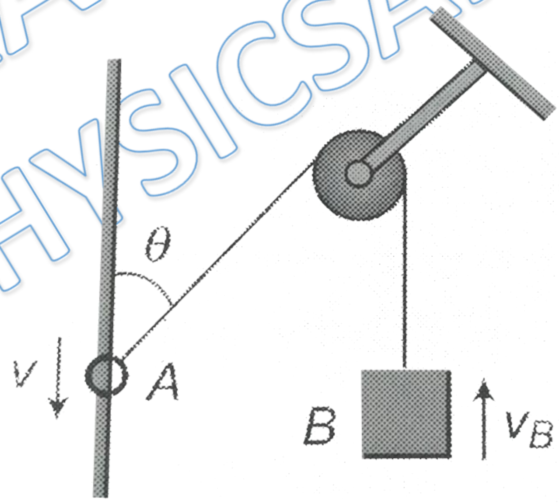
Written Solutionon Website:- https://physicsaholics.com/note/notesDetalis/75

Q 1. If the velocity of block B in the given arrangement is 300 mm/sec towards right. Find the velocity of A:



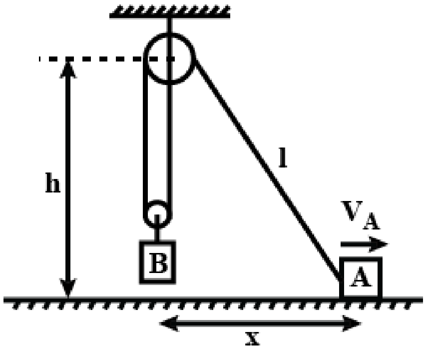
(a) 100 mm/sec
(b) 200 mm/sec
(c) 300 mm/sec
(d) 400 mm/sec

Q 2. Find the velocity of block B when ring A is moving downward with velocity v:



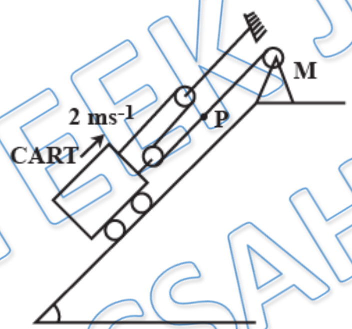
(a) v sin θ
(b) $\frac{v}{2}$ sin θ
(c) v cos θ
(d) $\frac{v}{2}$ cos θ

Q 3. If block A is moving horizontally with velocity V_A, then find the velocity of block B at the instant as shown in fig:.



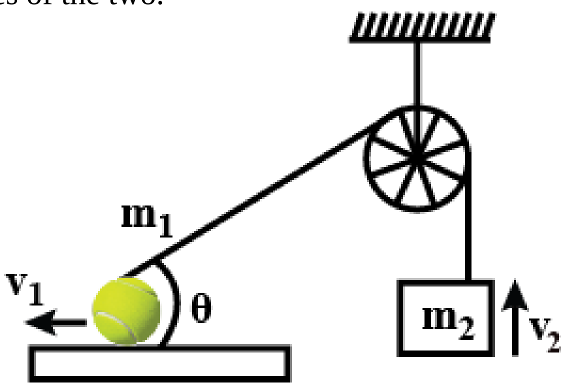
(a) $\frac{hV_A}{2\sqrt{x^2+h^2}}$ (b) $\frac{xV_A}{\sqrt{x^2+h^2}}$
(c) $\frac{xV_A}{2\sqrt{x^2+h^2}}$ (d) $\frac{hV_A}{\sqrt{x^2+h^2}}$

Q 4. A cart is being pulled up the incline, using a motor M and an ideal pulley and ideal rope arrangement as shown in figure. Then the speed of point $'P'$ of the string with which it moves so that the car moves up the inclined plane with a constant speed of $V_{cart} = 2\ m/s$ is (Incline is at rest):



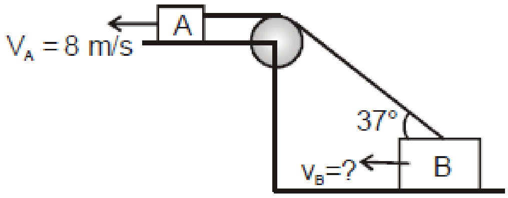
(a) $12\ m/s$ (b) $3\ m/s$
(c) $5\ m/s$ (d) $6\ m/s$

Q 5. In *Fig.* a ball of mass m_1 and a block of mass m_2 are joined together with an inextensible string. The ball can slide on a smooth horizontal surface. If V_1 and V_2 are the respective speeds of the ball and the block, then determine the constraint relation between velocities of the two.



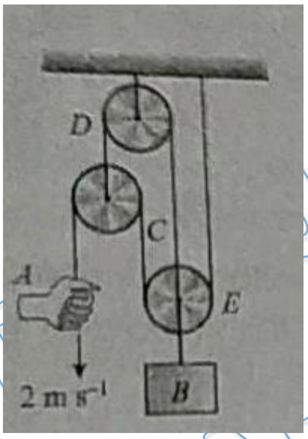
(a) $V_2 = V_1 \cos\theta$ (b) $V_1 = V_2 \cos\theta$
(c) $V_1 = V_2$ (d) $V_2 = V_1 \sin\theta$

Q 6. Find V_B =?



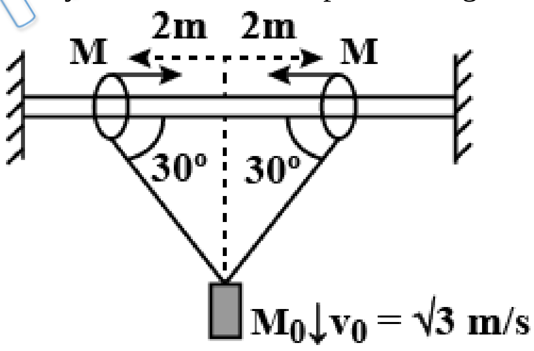
(a) 10 m/s (b) 8 m/s
(c) 14 m/s (d) 6 m/s

Q 7. Determine the speed with which block *B* rises in Fig. if the end of the cord at *A* is pulled down with a speed of 2 m/s.



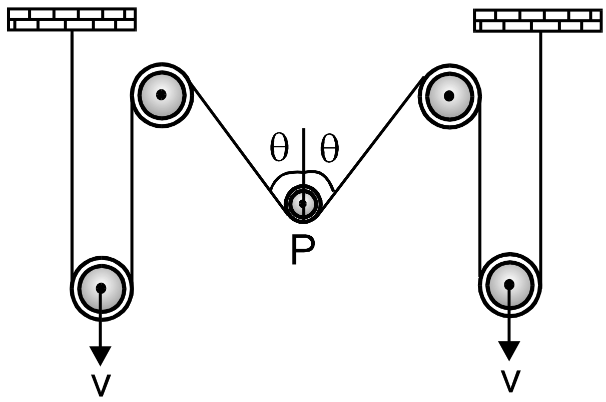
(a) 4 m/s (b) 3 m/s
(c) $\frac{3}{2}$ m/s (d) $\frac{1}{2}$ m/s

Q 8. Two rings each of mass M = 100 gm are constrained to move along a fixed horizontal rod An ideal string is connected with rings and block of mass $M_o = 200\ gm$ is connected to the mid point of string At a certain moment the mass m is moving downward with velocity $\sqrt{3}$ m/s. Find the speed of ring of M at the moment:



(a) 4 m/s (b) 3 m/s
(c) 2 m/s (d) 1 m/s

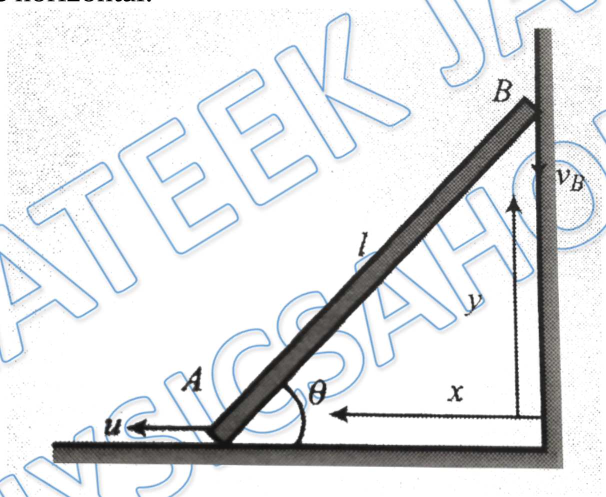
Q 9. In the given figure, find the speed of pulley P –



(a) $\frac{V}{2}$ (b) $2V\cos\theta$

(c) $\frac{2V}{\cos\theta}$ (d) $\frac{V}{2\sin\theta}$

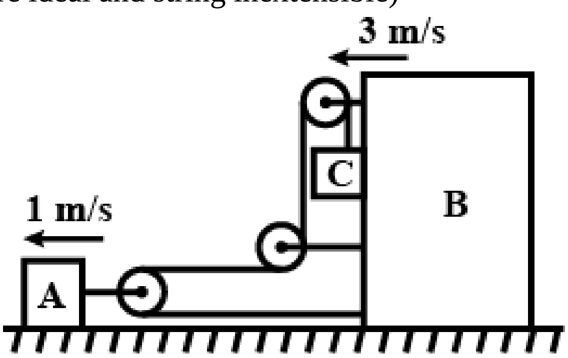
Q 10. Figure shows a rod of length l resting on a wall and the floor. Its lower end A is pulled towards left with a constant velocity u. As a result of this, end A starts moving down along the wall. Find the velocity of the other end B downward when the rod makes an angle θ with the horizontal:



(a) $u\tan\theta$ (b) $u\cot\theta$

(c) $u\sin\theta$ (d) $u\cos\theta$\

Q 11. The velocities of A and B are marked in the figure. Find the velocity of block C (assume that the pulleys are ideal and string inextensible)

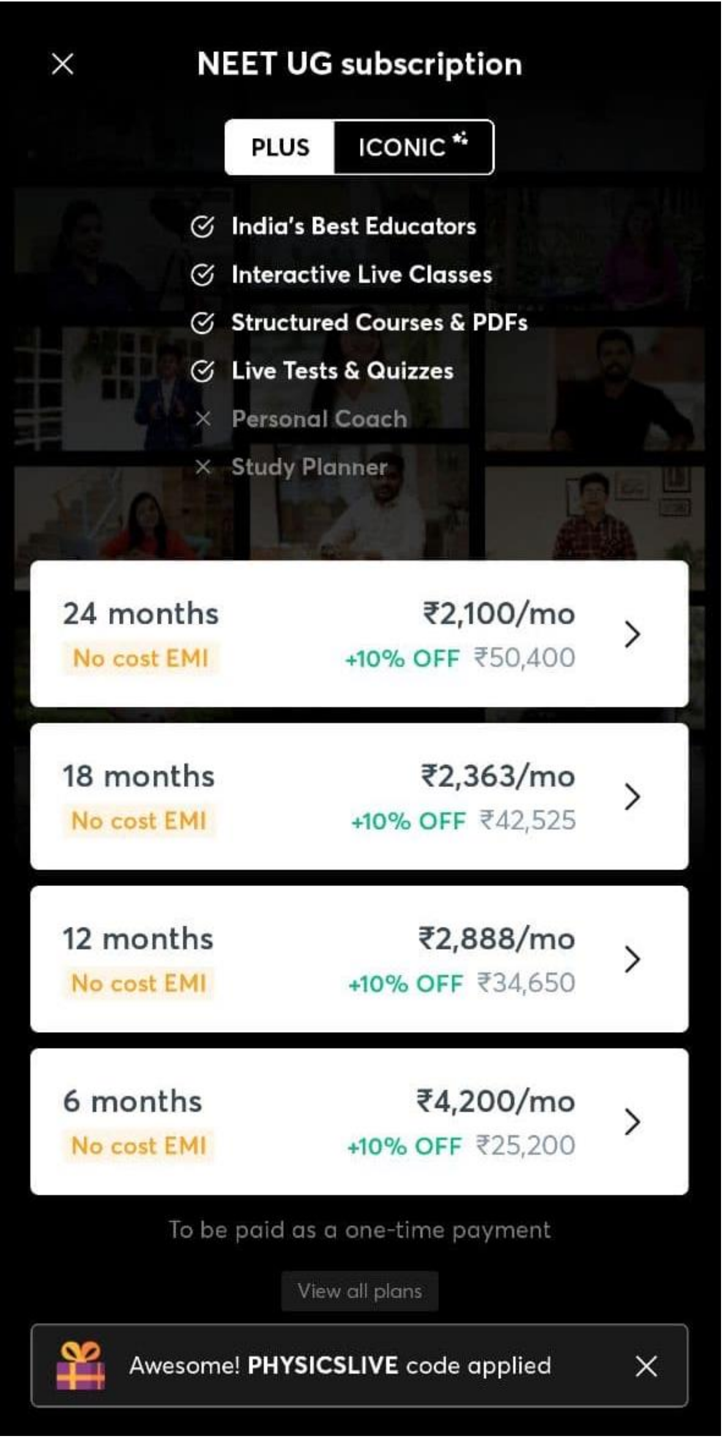


(a) 2 m/s (b) 4 m/s

(c) 5 m/s (d) $\sqrt{10}$ m/s

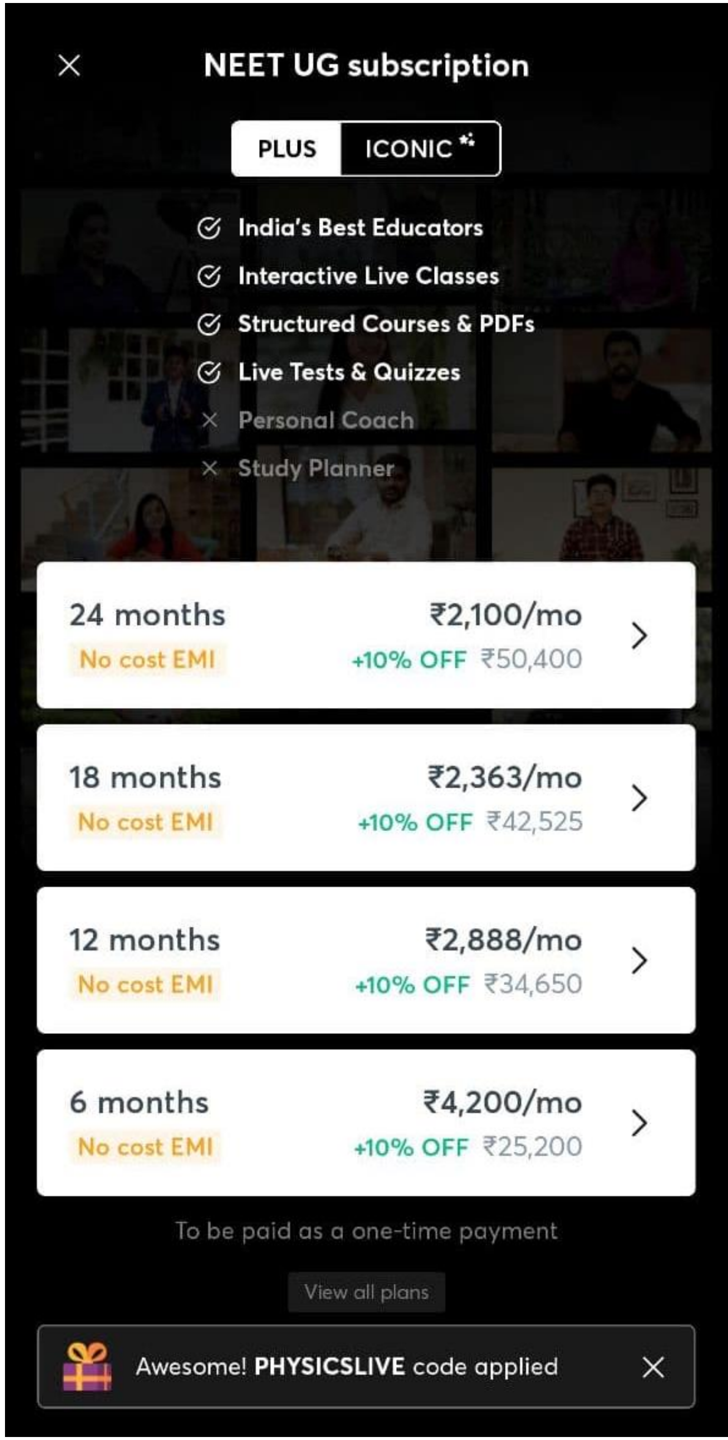
Answer Key

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



PHYSICSLIVE

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

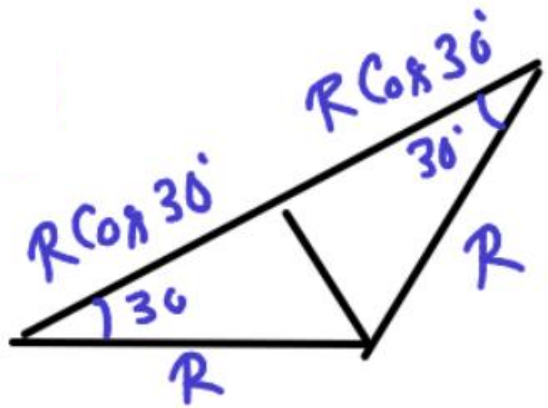


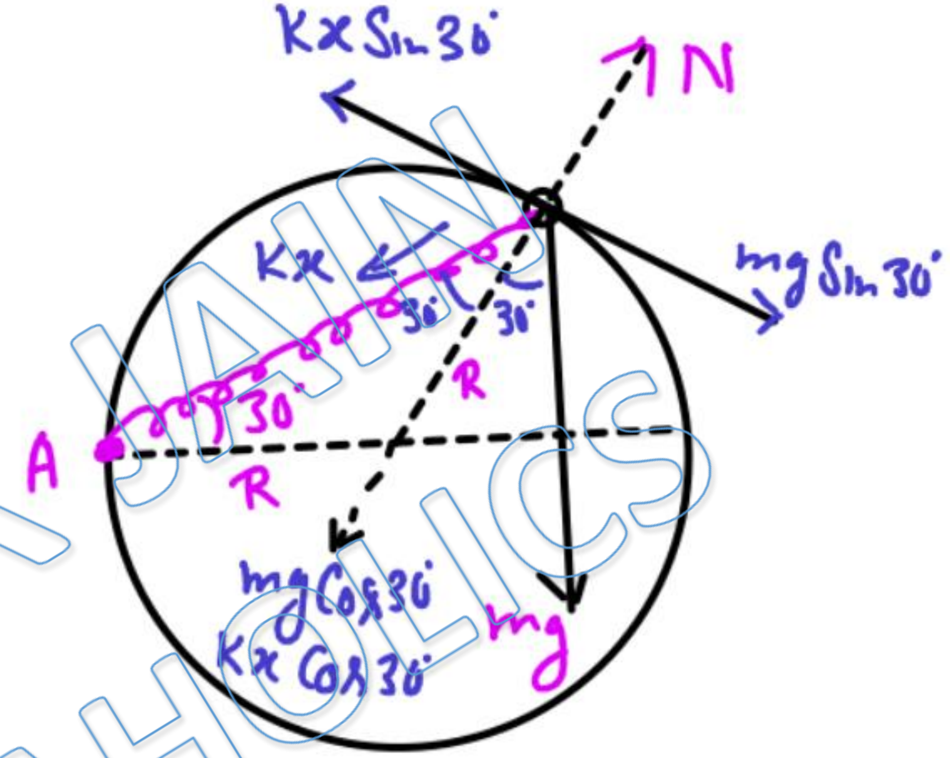
Written Solution

DPP-5 NLM: Spring Force

By Physicsaholics Team

Solution:1





length of spring

$= 2R\cos 30^\circ = R\sqrt{3}$

elongation in spring $= R\sqrt{3} - R = R(\sqrt{3}-1)$

spring force $Kx = (\sqrt{3}+1)\dfrac{mg}{R} \times R(\sqrt{3}-1)$

$= 2mg$

$N = mg\cos 30 + Kx\cos 30^\circ = \dfrac{mg\sqrt{3}}{2} + 2mg\dfrac{\sqrt{3}}{2}$

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

(D)

Ans.d

Solution: 2

maximum elongation in spring

= maximum Displacement of A

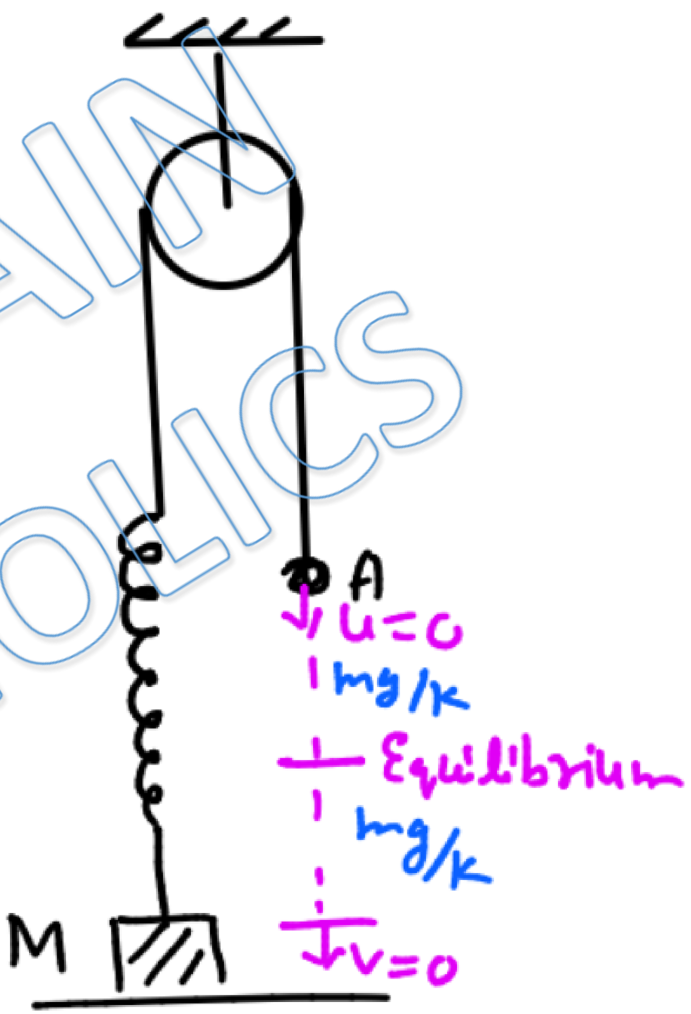
$= 2mg/k$

maximum spring force

$= k \times \frac{2mg}{k} = 2mg$

If this force is greater than or equal to Mg, It will lift.

$2mg \geq Mg \Rightarrow m \geq M/2$



(c)

Ans.c

Solution:3

Since spring is directly connected to string.

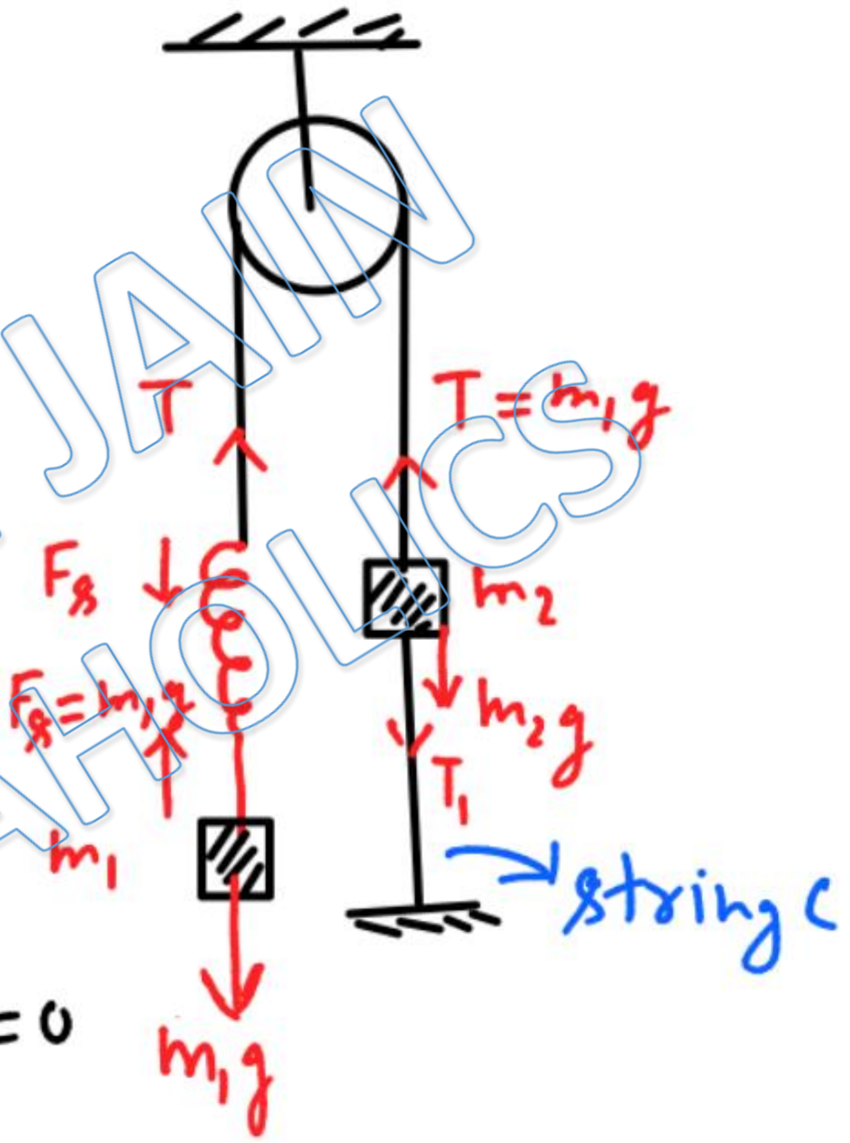
$T = F_s = m_1 g$

After burning string C, $T_1 = 0$ but all other forces will remain same.

$\Rightarrow$ acceleration of $m_1 = 0$

acceleration of m_2

$= \frac{m_1 g - m_2 g}{m_2} \uparrow$



(A, C)

Ans.a,c

Solution:4

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

$$a = \frac{4g - 2g}{6} = g/3$$

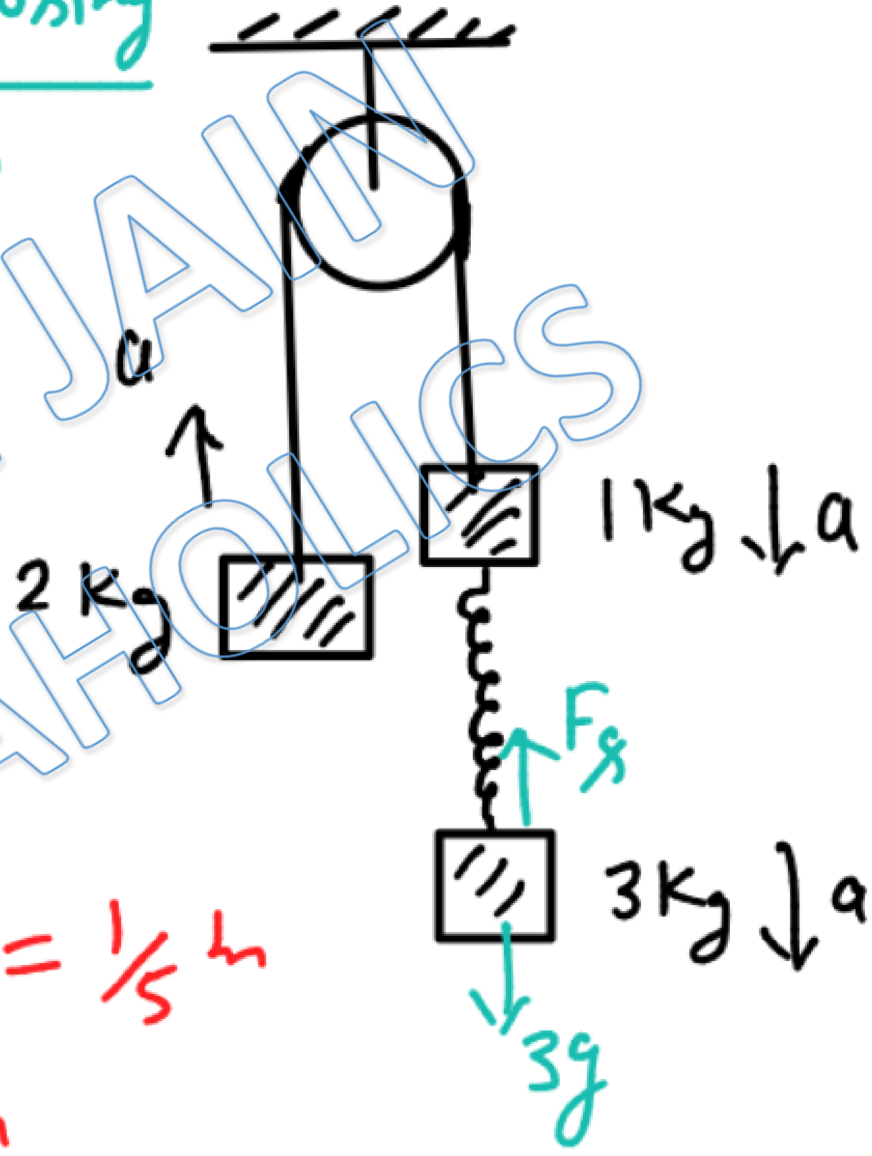
from F.B.D of 3kg

$$3g - F_s = 3a$$

$$3g - 100x = g$$

$$x = 2g/100 = 1/5 \text{ m}$$

$$x = 20 \text{ cm}$$



Ans.b

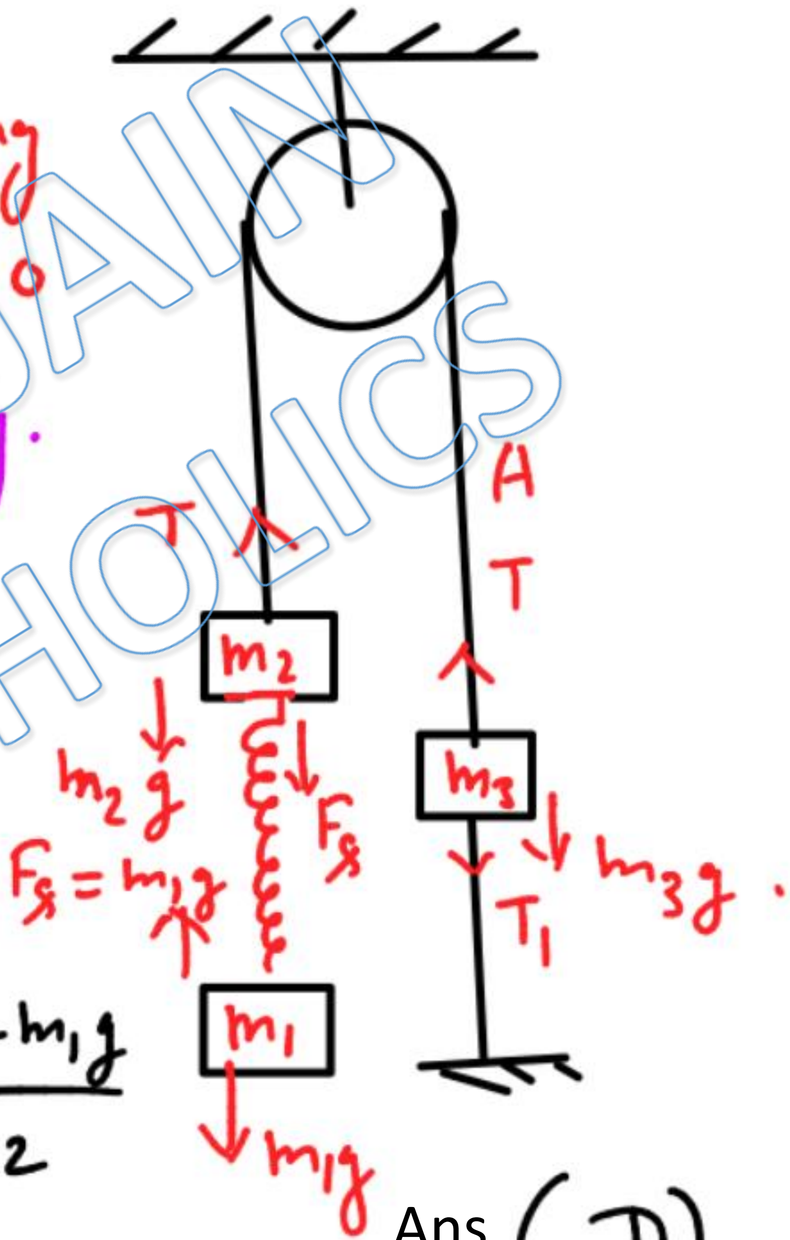
(B)

Solution:5

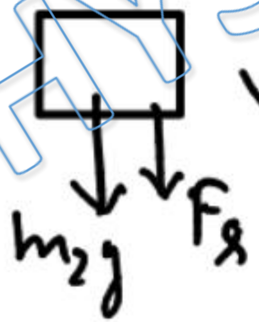
Just after cutting A, $T=0$ & $T_1=0$

m_3 will fall freely.

m_1 will be in equilibrium



F.B.D of m_2

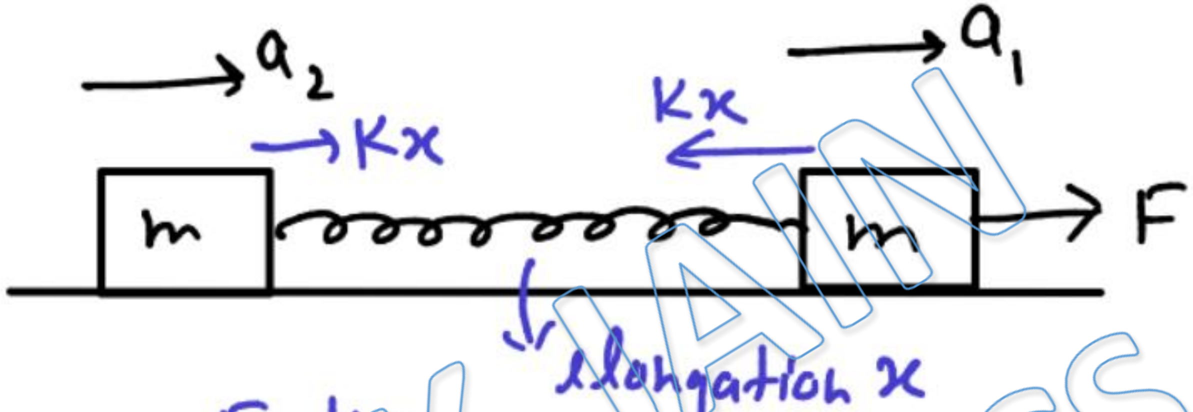


$$a_2 = \frac{m_2g + m_1g}{m_2}$$

Ans. (D)

Solution:6

6)



$$a_1 = \frac{F-kx}{m}, \quad a_2 = \frac{kx}{m}$$

relative acceleration $a = a_1 - a_2 = \frac{F-2kx}{m}$

$$\Rightarrow v\frac{dv}{dx} = \frac{F-2kx}{m}$$ where v is relative velocity

at maximum elongation $v=0$

$$\Rightarrow \int_0^0 v\,dv = \int_0^x \frac{F-2kx}{m}\,dx$$

$$\Rightarrow Fx - kx^2 = 0 \Rightarrow x = F/k$$

Ans.a

Solution:7

7)

$T\cos\theta + kx = N\sin\theta + T$

$\Rightarrow N\sin\theta + T(1-\cos\theta) = kx$ ---- (i)

$T = mg\sin\theta$ ---- (ii)

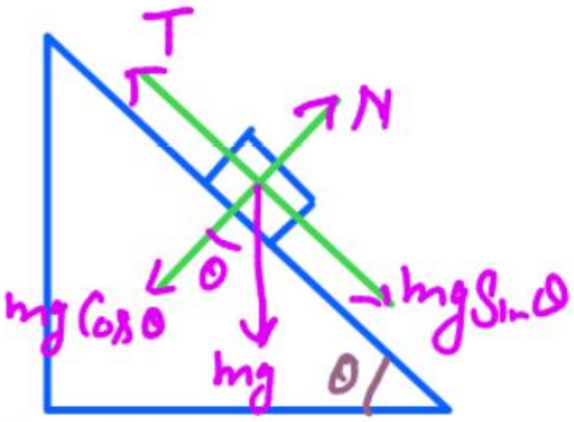
$N = mg\cos\theta$ ---- (iii)

$\Rightarrow mg\sin\theta\cos\theta + mg\sin\theta(1-\cos\theta) = k.x$

$\Rightarrow x = \dfrac{mg\sin\theta}{k}$

F.B.D of wedge

(A)



F.B.D of block

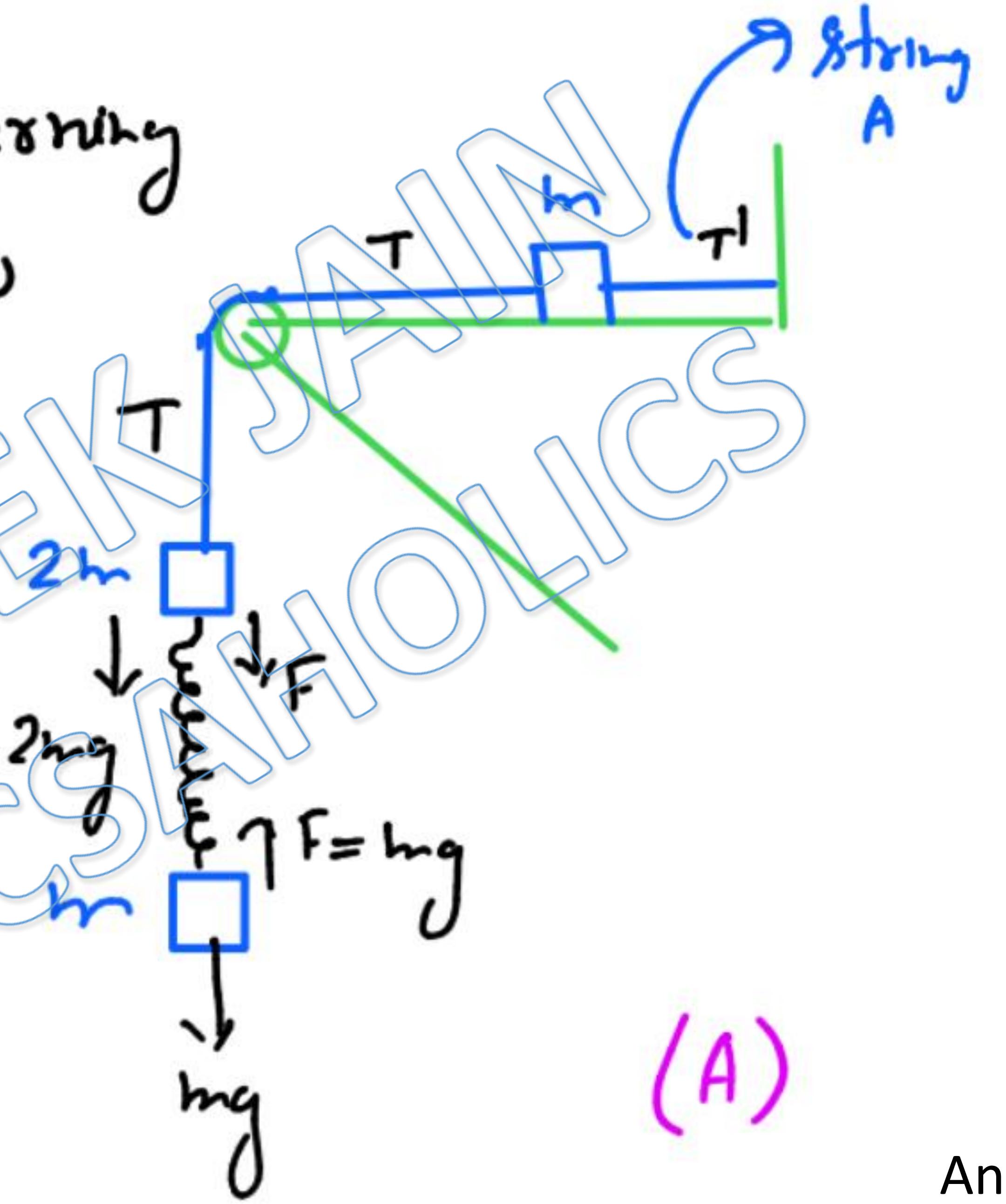
Ans.a

Solution:

8) Just after burning string A, $T' = 0$

T will change & block 2m & upper block m move together

acceleration of 2m $= \frac{2mg + F}{3m} = g \downarrow$

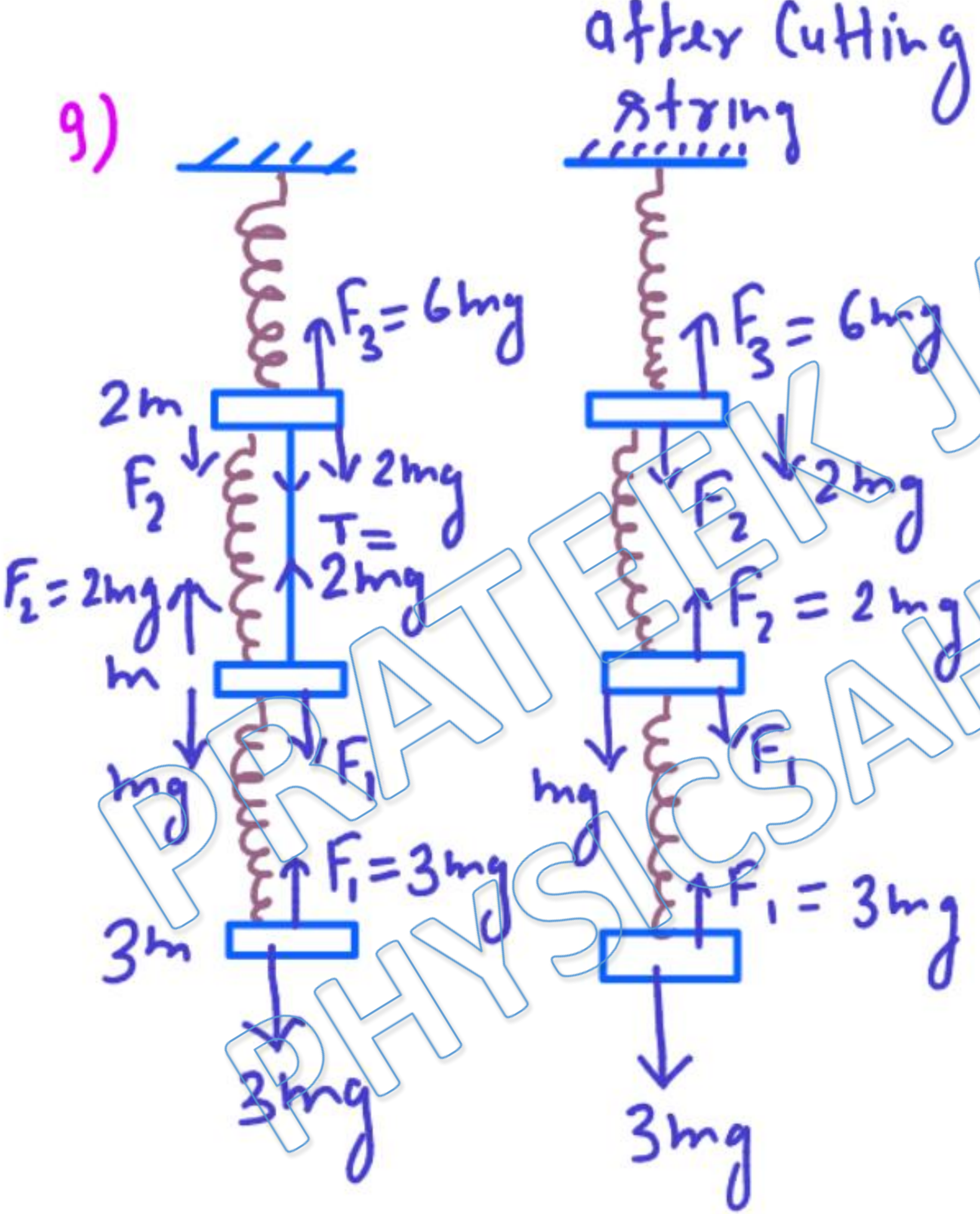


(A)

Ans.a

Solution:

9)



acceleration of m

$$= \frac{2mg}{m} = 2g \downarrow$$

acceleration of 2m

$$= \frac{2mg}{2m} = g \uparrow$$

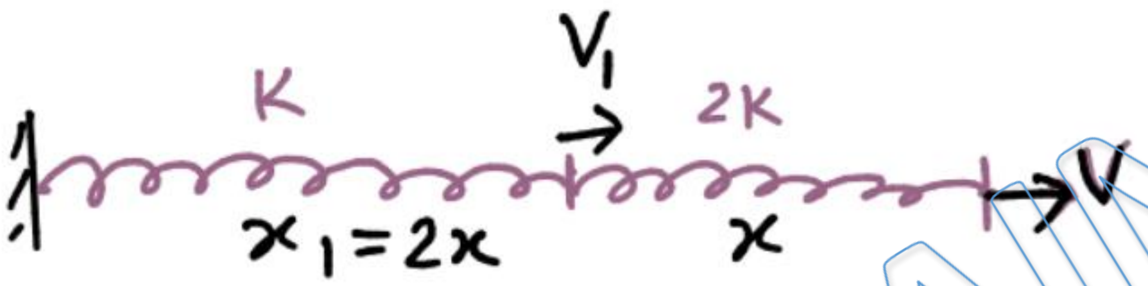
relative acceleration

$$= 3g$$

(c)

Ans.c

Solution: 10)



Let elongation in 2K is x & that of K is x_1.

Since net force on joint is zero.

$$Kx_1 = 2Kx \Rightarrow x_1 = 2x$$

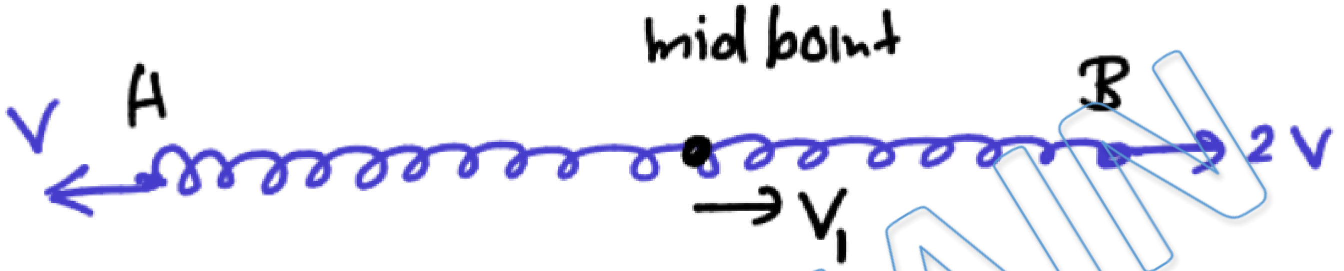
$$V = \frac{d}{dt}(3x) = 3\frac{dx}{dt}$$

$$V_1 = \frac{d}{dt}(2x) = 2\frac{dx}{dt} = \frac{2V}{3}$$ (b)

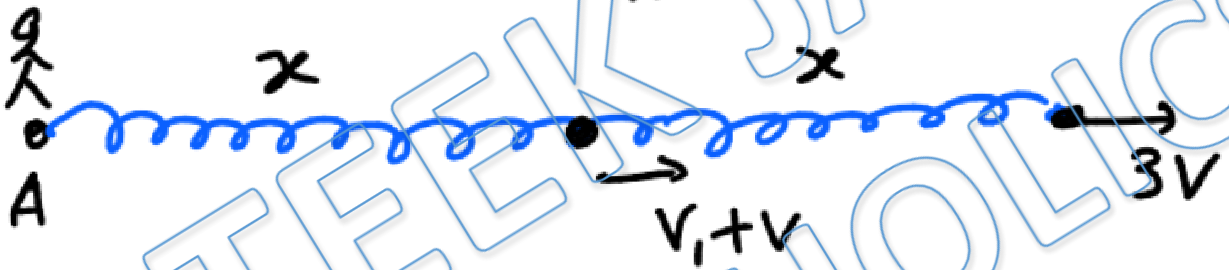
Ans.b

Solution:

11)



w.r.t. A



* all parts of spring elongate uniformly.

$$V_1 + V = \frac{dx}{dt}$$

$$V_1 + V = 3V/2$$

$$V_1 = V/2$$

$$3V = \frac{d}{dt}(2x) = 2\frac{dx}{dt}$$

$$\Rightarrow \frac{dx}{dt} = \frac{3V}{2}$$

Ans.b

For Video Solution of this DPP, Click on below link

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/53

Video Solution on YouTube:- https://youtu.be/5hJdZ_raBLQ

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/75

Chalo Niklo