Physicsaholics

DPP – 5

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/37

Video Solution on YouTube:- https://youtu.be/6wfjytYO0eo

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/49

Q 1. A player caught a cricket ball of mass 150 gm moving at a rate of 20 m/s. If the catching process be completed in 0.1 s, then the force of the blow exerted by the ball on the hands of the player is
(a) 0.3 N (b) 30 N
(c) 300 N (d) 3000 N

Q 2. A cricket ball of mass 150 g is moving with a velocity of 12m/s and is hit by a bat so that ball is turned back with a velocity of 20m/s . The force of the blow acts for 0.01 s on the ball . Find the average force exerted by the bat on the ball
(a) 480 N (b) 240 N
(c) 60 N (d) 520 N

Q 3. A ball of mass 400 gm is dropped from a height of 5 m. A boy on the ground hits the ball vertically upwards with a bat with an average force of 100 N so that it attains a vertical height of 20 m. The time for which the ball remains in contact with the bat is: $[g = 10\ m/s^2]$
(a) 0.12 sec (b) 0.08 sec
(c) 0.04 sec (d) 12 sec

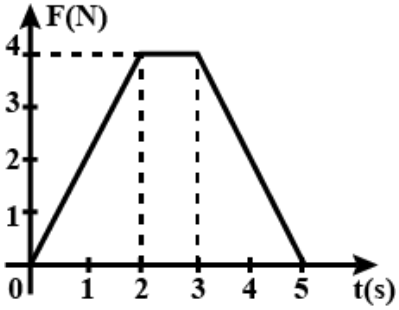
Q 4. A boy hits a baseball with a bat and imparts an impulse J to the ball. The boy hits the ball again with the same force, except that the ball and the bat are in contact for twice the amount of time as in the first hit. Then new impulse imparted is
(a) half the original impulse (b) the original impulse
(c) twice the original impulse (d) four times the original impulse

Q 5. If a force of 250 N act on body, the momentum acquired is 125 kg-m/s. What is the period for which force acts on the body
(a) 0.5 sec (b) 0.2 sec
(c) 0.4 sec (d) 0.25 sec

Q 6. A bullet is fired from a gun. The force on the bullet is given by $F=600-2\times10^5 t$, where F is in newtons and t in seconds. The force on the bullet becomes zero as soon as it leaves the barrel. What is the impulse imparted to the bullet
(a) 9 Ns (b) Zero
(c) 0.9 Ns (d) 1.8 Ns

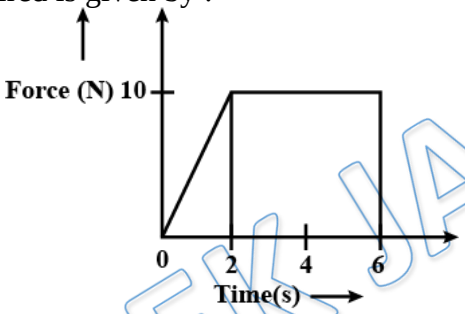
Q 7. A force acting on a body of mass 2 kg varies with time as shown in fig. Find total impulse of the force

PRATEEK JAIN PHYSICSAHOLICS



(a) 12 Ns (b) 16 Ns
(c) 6 Ns (d) 8 Ns

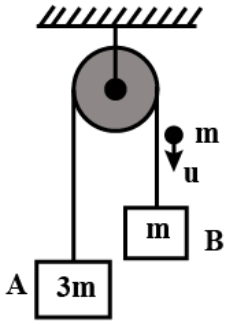
Q 8. A body of mass 3 kg is acted upon by a force which varies as shown in the graph below. The momentum acquired is given by :



(a) Zero (b) 5 Ns
(c) 30 Ns (d) 50 Ns

Q 9. A bullet of mass 0.01kg and travelling at a speed of 500m/s strikes a block of mass 2kg which is suspended by a string of length 5m. The center of gravity of the block (after bullet emerges from it) is found to raise a vertical distance of 0.2m. What is the speed of the bullet after it emerges from the block?
(a) 15 m/s (b) 20 m/s
(c) 100 m/s (d) 50 m/s

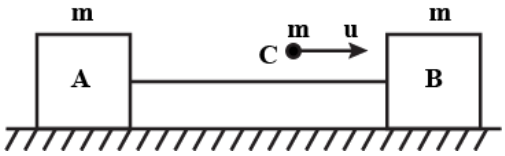
Q 10. A system of two blocks A and B are connected by an inextensible massless string as shown in figure. The pulley is massless and frictionless. Initially, the system is at rest. A bullet of mass 'm' moving with a velocity 'u' as shown hits block 'B' and gets embedded into it. The impulse imparted by tension force to the block of mass 3m is:



(a) $\frac{5mu}{4}$ (b) $\frac{4mu}{5}$
(c) $\frac{2mu}{5}$ (d) $\frac{3mu}{5}$

PRATEEK JAIN PHYSICSAHOLICS

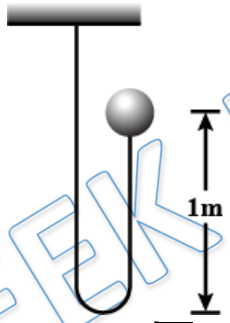
Q 11. Two identical blocks `A` and `B` connected by massless string, are placed on a frictionless horizontal plane. A bullet having the same mass, moving with speed `u` strikes block `B` from behind as shown. If the bullet gets embedded into block `B` then find impulse on A due to tension in the string



(a) $\frac{5mu}{3}$ (b) $\frac{mu}{3}$

(c) $\frac{2mu}{3}$ (d) $\frac{3mu}{2}$

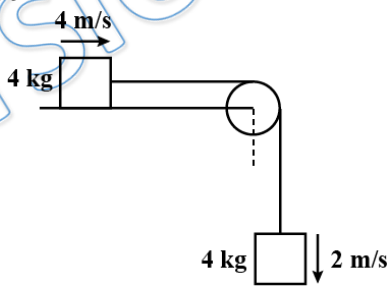
Q 12. A ball of mass 1kg is attached to an inextensible string. The ball is released from the position shown in figure. Find the impulse imparted by the string to the ball immediately after the string becomes taut



(a) $\sqrt{20}$ kg-m/s (b) $\sqrt{10}$ kg-m/s

(c) $2\sqrt{20}$ kg-m/s (d) $2\sqrt{10}$ kg-m/s

Q 13. Two blocks of same mass (4kg) are placed according to diagram. Initial velocities of bodies are 4 m/s and 2 m/s and the string is just taut. Find the impulse on 4 kg when the string again becomes taut



(a) 24 N-s (b) 6 N-s

(c) 4 N-s (d) 2 N-s

PRATEEK JAIN PHYSICSAHOLICS

Answer Key

Q.1 b	**Q.2 a**	**Q.3 a**	**Q.4 c**	**Q.5 a**
Q.6 c	**Q.7 a**	**Q.8 d**	**Q.9 c**	**Q.10 d**
Q.11 b	**Q.12 d**	**Q.13 c**		

PRATEEK JAIN
PHYSICSAHOLICS

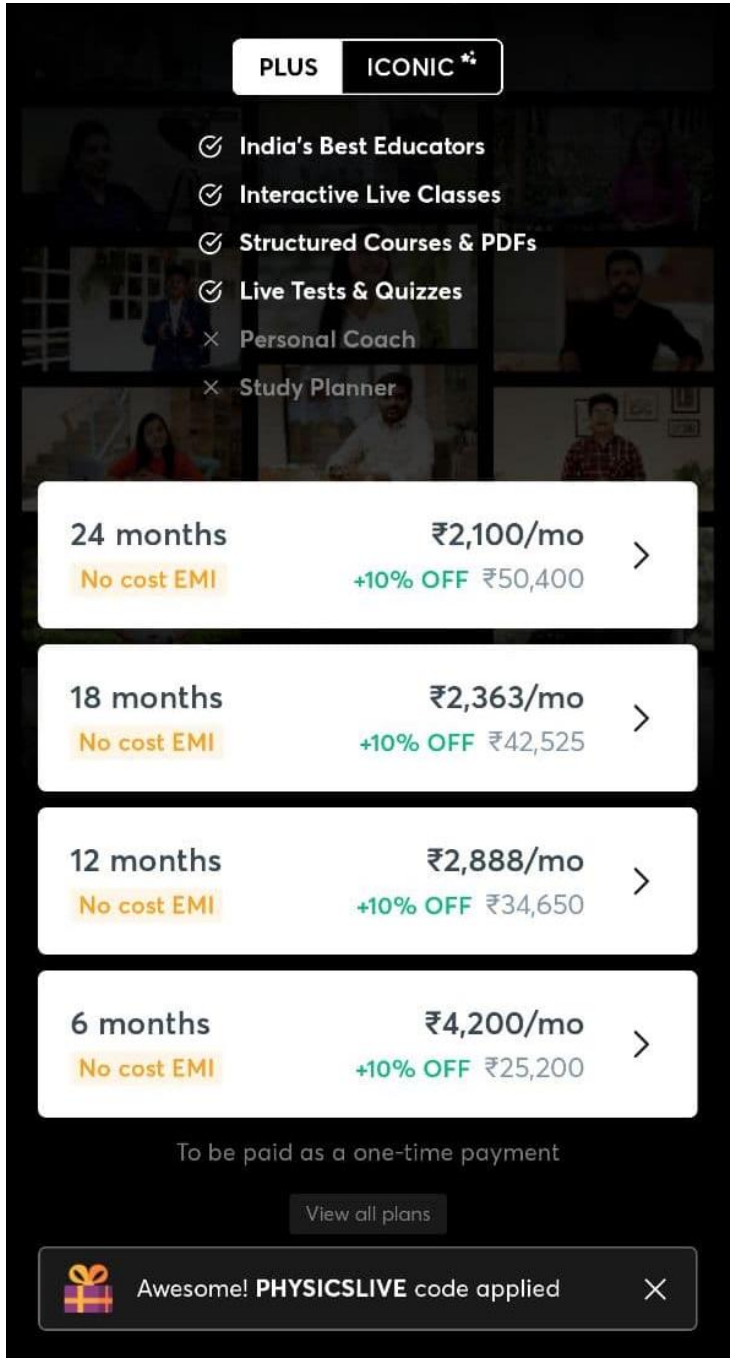
Plus leaderboard

Based on educator activity in last 30 days

1	Prateek Jain	11.4M mins
2	Ajay Mishra (Akm)	6.3M mins
3	Shubh Karan Choudhary (Skc)	5.9M mins
4	Dr Amit Gupta	5.5M mins
5	Ramesh Sharda	4.9M mins
6	Sandeep Nodiyal	4.8M mins
7	Shailendra Tanwar	3.6M mins
8	Vishal Vivek	2.7M mins
9	Garima Goel	2.7M mins
10	Saurabh Sharma	2.6M mins
11	Dr S K Singh	2.6M mins
12	Nishant Varshney	

PHYSICSLIVE

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



Written Solution

DPP-5 COM: Impulse

By Physicsaholics Team

Solution: 1

$m = 150\ gm$

$V = 20\ m/s$

$p = mV = 150 \times 10^{-3} \times 20$

$\boxed{p = 3\ kg\text{-}m/s}$

Impulse; $I = \Delta p$

$I = (3 - 0) = 3$

$I = 3\ kg\text{-}m/s$

$I = \int F\,dt \Rightarrow F_{avg} = \frac{I}{t}$

$F_{avg} = \frac{3}{0.1}$

$\boxed{F_{avg} = 30\ N}$ Ans.

Ans. b

PRATEEK JAIN PHYSICSAHOLICS

Solution: 2

$I = \Delta P$

$= 3 - (-1.8)$

$I = 4.8 \text{ kg-m/s}$

$F_{avg} = \frac{I}{t}$

$F_{avg} = \frac{4.8}{0.01}$

$F_{avg} = 480 \text{ N}$ Ans

$p_i = -mv = -150 \times 10^{-3} \times 12 = -1.8 \text{ kg-m/s}$

$p_f = 150 \times 10^{-3} \times 20 = 3 \text{ kg-m/s}$

PRATEEK JAIN PHYSICSAHOLICS

Ans. a

Solution: 3

Let time of contact = t

$$I = F_{avg} \cdot t = 100t$$

$h_1 = 5\,m$, $h_2 = 20\,m$

so; $v_1 = \sqrt{2 \times 10 \times 5} = 10\,m/s$

$v_2 = \sqrt{2 \times 10 \times 20} = 20\,m/s$

$I = p_f - p_i = m(v_f - v_i)$

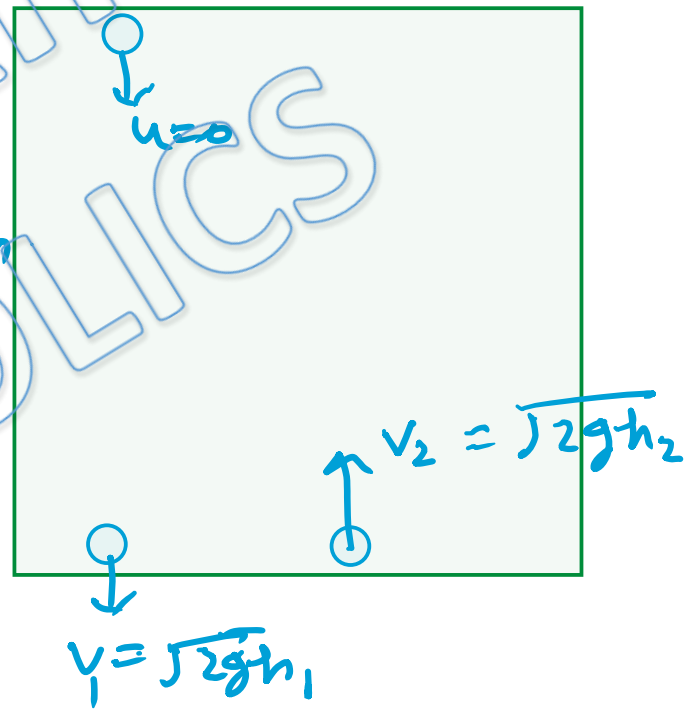
$= 400 \times 10^{-3}(20 - (-10))$

$= 400 \times 10^{-3} \times 30$

$$\boxed{I = 12\ kg\text{-}m/s}$$

$F_{avg} = \frac{I}{t} \Rightarrow t = \frac{12}{100}$

$$\boxed{t = 0.12\ sec}$$ Ans.



Ans. a

PRATEEK JAIN PHYSICSAHOLICS

Solution: 4

$I_1 = F\Delta t$

$I_2 = F(2\Delta t)$

$\Rightarrow \boxed{I_2 = 2I_1}$ Ans

PRATEEK JAIN
PHYSICSAHOLICS

Ans. c

Solution: 5

$$f = \frac{I}{t}$$

$$250 = \frac{125}{t}$$

$$t = \frac{125}{250} = \frac{1}{2}$$

$$\boxed{t = 0.5 \text{ sec}} \text{ Ans}$$

PRATEEK JAIN
PHYSICSAHOLICS

Ans. a

Solution: 6

$F = 600 - 2\times10^5 t$

For $F = 0$

$\frac{600}{2\times10^5} = t \Rightarrow t = 300\times10^{-5} \Rightarrow \boxed{t = 0.003\ \text{sec}}$

$I = \int_0^t F\,dt = \int_0^{0.003} (600 - 2\times10^5 t)\,dt$

$I = \left[600t - 2\times10^5 \frac{t^2}{2}\right]_0^{0.003} = \left[600(0.003) - 10^5(0.003)^2\right]$

$I = 1.8 - 0.9$

$\boxed{I = 0.9\ \text{Ns}}$ Ans.

Ans. c

PRATEEK JAIN PHYSICSAHOLICS

Solution: 7

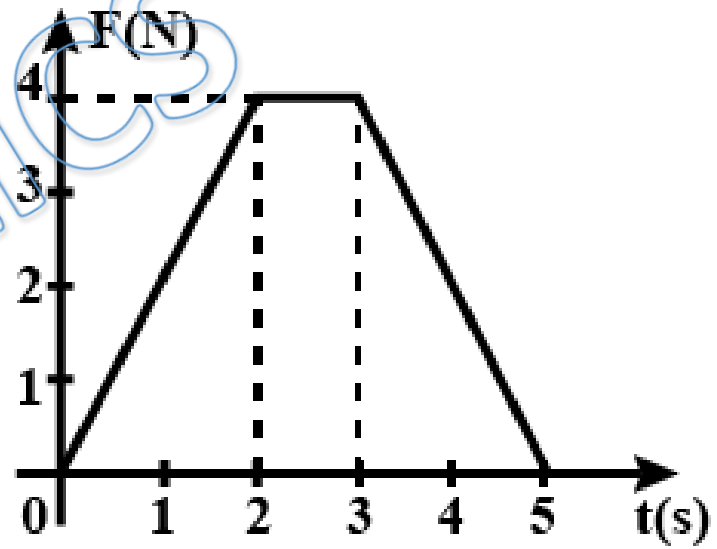
$I = \int F \cdot dt$

= Area under F-t curve

$I = \left(\frac{1}{2} \times 2 \times 4\right) + (1 \times 4) + \left(\frac{1}{2} \times 2 \times 4\right)$

$I = 4 + 4 + 4$

$I = 12 \text{ kg-m/s}$ Ans.



Ans. a

PRATEEK JAIN
PHYSICSAHOLICS

Solution: 8

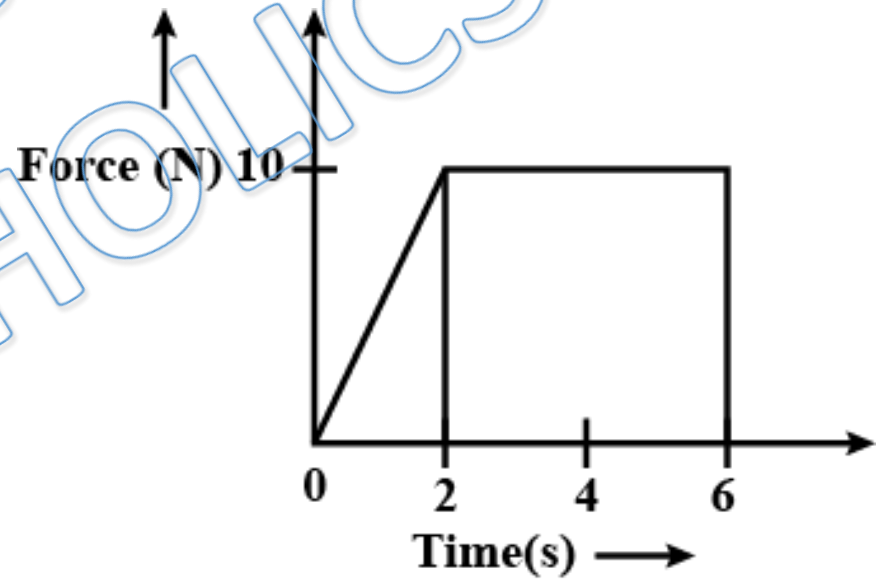
$\Delta P = I = \int F \cdot dt$

ΔP = Area under F-t curve

$\Delta P = \left(\frac{1}{2} \times 2 \times 10\right) + (4 \times 10)$

$\Delta P = 10 + 40$

$\Delta P = 50$ Ns Ans



Ans. d

PRATEEK JAIN
PHYSICSAHOLICS

Solution: 9

$\frac{1}{2}mv_1^2 = mgh$

$v_1 = \sqrt{2gh} = \sqrt{2 \times 10 \times 0.2}$

$\boxed{v_1 = 2\ m/s}$

$\because F_{ext} = 0$

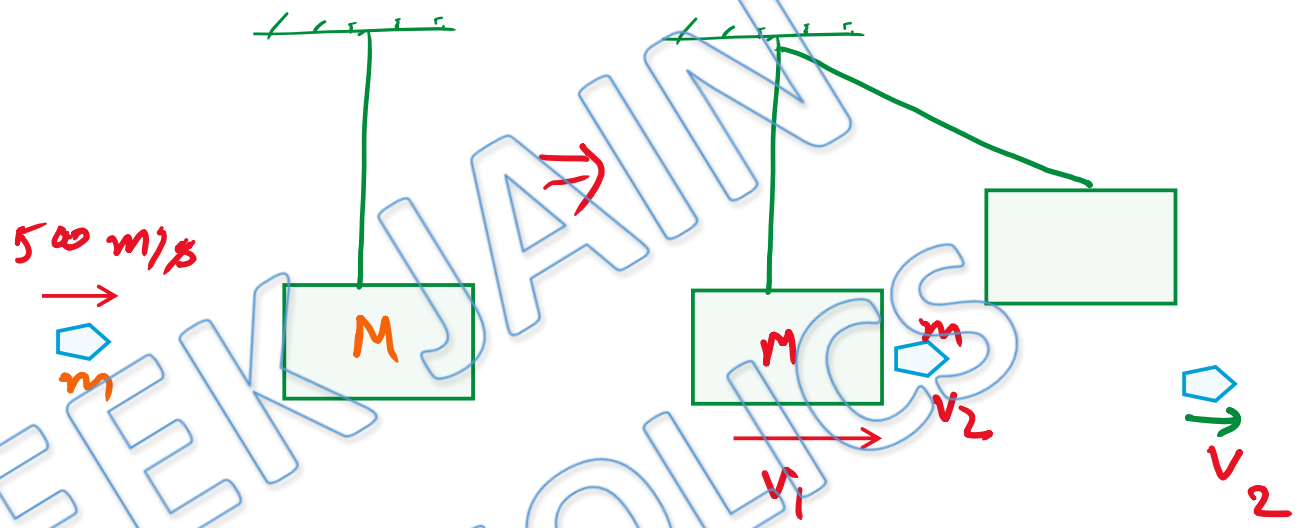
$\therefore p_i = p_f$

$mu = Mv_1 + mv_2$

$(0.01)500 = 2(2) + (0.01)v_2$

$5 - 4 = 0.01\, v_2$

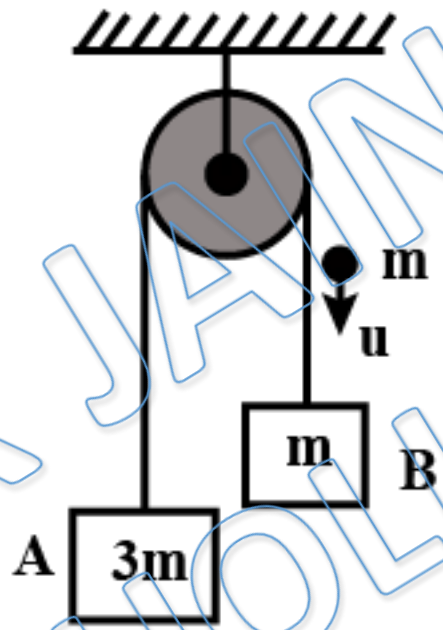
$\boxed{v_2 = 100\ m/s}$ Ans.

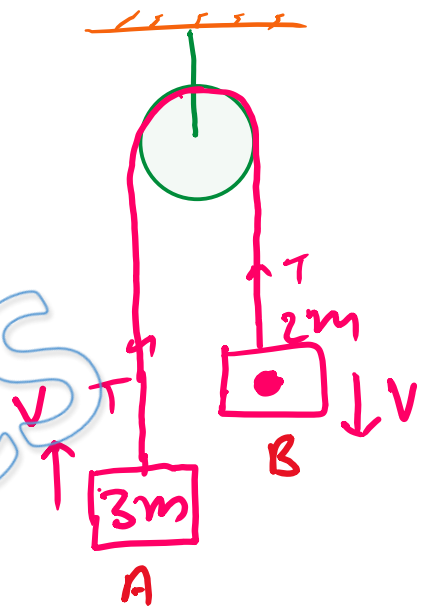


PRATEEK JAIN
PHYSICSAHOLICS

Ans. c

Solution: 10





Let impulse imparted by Tension = I_T

then; for (B + bullet)

$mu - I_T = (2m)V$ — ①

for (A)

$I_T = 3mV$ — ②

so; from ① & ②

$mu - 3mV = 2mV$

$mu = 5mV$

$\boxed{V = \frac{u}{5}}$ Ans.

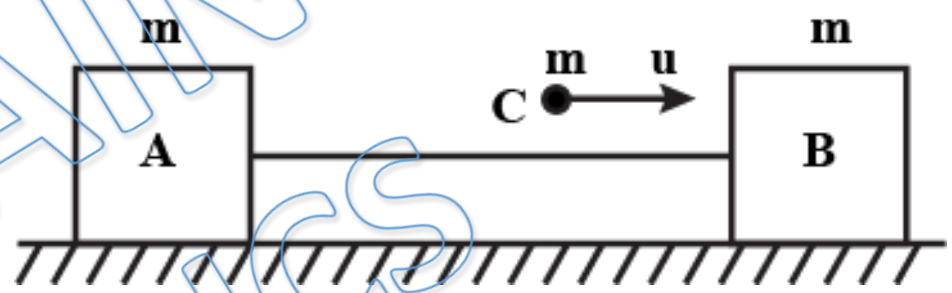
so, $I_T = 3m\left(\frac{u}{5}\right)$

$\boxed{I_T = \frac{3mu}{5}}$ Ans

Ans. d

PRATEEK JAIN PHYSICSAHOLICS

Solution: 11



Let ; I_T = Impulse imparted by tension force.

for (B + C)

$mu - I_T = (2m)V$ — ①

for (A)

$I_T = mV$ — ②

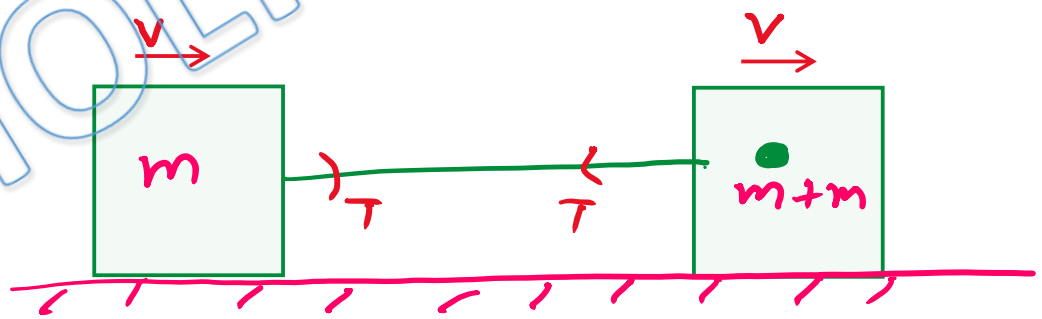
from ① & ②

$mu - mV = 2mV$

$V = \frac{u}{3}$

$I_T = mV$

$I_T = \frac{mu}{3}$ Ans



OR → by Conservation of momentum →

$mu = 3mV \Rightarrow V = u/3$

Impulse on A = $mv = mu/3$ Ans. b

PRATEEK JAIN PHYSICSAHOLICS

Solution: 12

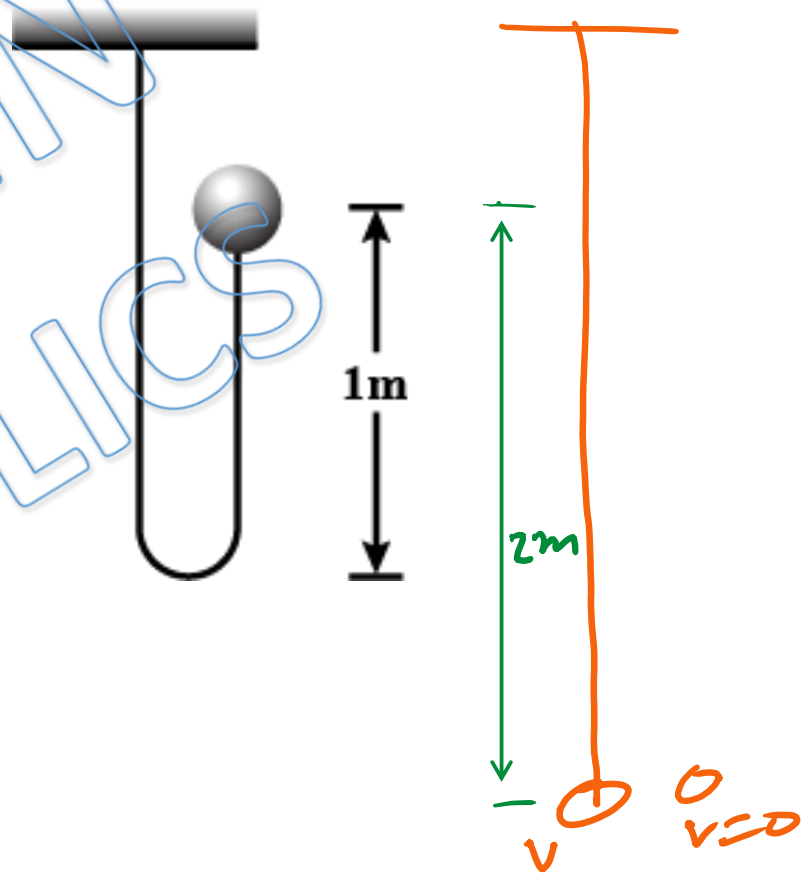
$mgh = \frac{1}{2}mv^2$

$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 2} = \sqrt{40}$ m/s

$I_T = \Delta P = mv$

$I_T = 1 \times \sqrt{40}$

$\boxed{I_T = 2\sqrt{10} \text{ kg-m/s}}$ Ans.



PRATEEK JAIN
PHYSICSAHOLICS

Ans. d

Solution: 13

as; A is moving faster than B
so; first string will loose.
when speed of B will increase
so; after some time, string will be taut again.

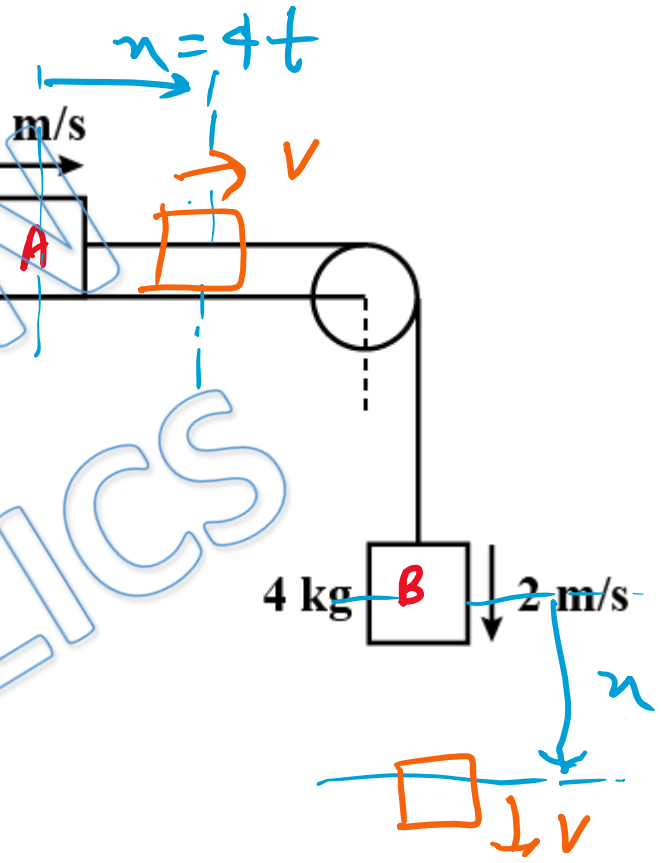
$x = 4t = 2t + \frac{1}{2}gt^2 \Rightarrow 2t = \frac{1}{2}gt^2$

$\boxed{t = 4/g \text{ sec}}$

Speed of B after $t = 4/g$

$V = u + at = 2 + g(4/g)$

$\boxed{V = 6 \text{ m/s}}$



so; Let Impulse due to tension = I

for (A) $4 \times 4 + I = 4(V') \quad -①$

for (B)

$(4 \times 6) - I = 4V' \quad -②$

for ① & ② $\Rightarrow 4 \times 4 + I = 4 \times 6 - I$

$16 - 24 = -2I \Rightarrow 2I = 8$

$\boxed{I = 4 \text{ N-s}}$ Ans.

Ans. c

PRATEEK JAIN PHYSICSAHOLICS

For Video Solution of this DPP, Click on below link

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/37

Video Solution on YouTube:- https://youtu.be/6wfjytYO0eo

Written Solution on Website:- https://physicsaholics.com/note/notesDetalis/49

SUBSCRIBE

@Physicsaholics

@Physicsaholics_prateek

@NEET_Physics
@IITJEE_Physics

physicsaholics.com

Unacademy

CLICK

Chalo Niklo