Physicsaholics

DPP – 2 (Kinematics)

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Q 1. A dog walking to the right with a velocity of 1.5 m/s sees a cat and speeds up with a constant rightward acceleration of magnitude 12 m/s^2. What is the velocity of the dog after speeding up for 3.0 m?

(a) 4 m/s (b) 8.6 m/s (c) 12.6 m/s (d) 16.6 m/s

Q 2. A particle moving in straight line experience constant acceleration for 20 second after starting from rest. If it travel a distance S_1 in the first 10 seconds and distance S_2 in the next 10 seconds then find the relation between S_1 and S_2:

(a) $S_1 = 3S_2$ (b) $S_1 = \frac{3}{2}S_2$

(c) $S_2 = 3S_1$ (d) $S_2 = \frac{3}{2}S_1$

Q 3. A car travels a distance 100m with a constant acceleration and average velocity of 20 m/s. The final velocity acquired by the car is 25 m/s. Find the initial velocity.

(a) 15 m/s (b) 30 m/s

(c) 10 m/s (d) zero

Q 4. A body starting from rest is travelling on a straight road with constant non-zero acceleration. If the speeds after covering distances S_1 and S_2 (after S_1) are V_1 and V_2 respectively. If $\frac{V_2}{V_1} = 2$, then $\frac{S_2}{S_1} = N$. Find N?

(a) 1 (b) 2

(c) 1/2 (d) 3

Q 5. A bike moving along a straight road covers 35 m in the 4th second and 40 m in the 5th second. What is its initial velocity: (if the acceleration is assumed to be uniform)?

(a) 5 m/s (b) 10 m/s

(a) (c) 17.5 m/s (d) 15.5 m/s

Q 6. A truck moving on a straight road with constant acceleration covers the distance between two points 180 m apart in 6 seconds. Its speed as it passes the second points 45 m/s. Find its speed when it was at the first point:

(a) 5 m/s (b) 10 m/s

(c) 15 m/s (d) 20 m/s

Q 7. A car accelerates uniformly from 18 km/h to 36 km/h in 5 seconds. Calculate the acceleration of truck:

(a) 1 m/s^2 (b) 1 km/h^2

(c) 3 m/s^2 (d) 2.5 m/s^2

Q 8. A body starts from rest and travels with a uniform acceleration of $3\ m/s^2$ and then decelerates at a uniform rate of $2\ m/s^2$ again to come to rest. Total time of travel is 10 sec. find the maximum velocity during the journey:
(a) 10 m/s (b) 12 m/s
(c) 15 m/s (d) 27 m/s

Q 9. Consider a train which can accelerate with an acceleration of 20 cm/s^2 and slow down with deceleration of 100 cm/s^2. Find the minimum time for the train to travel between the stations 2.7km apart:
(a) 90 s (b) 180 s
(c) 160 s (d) 240 s

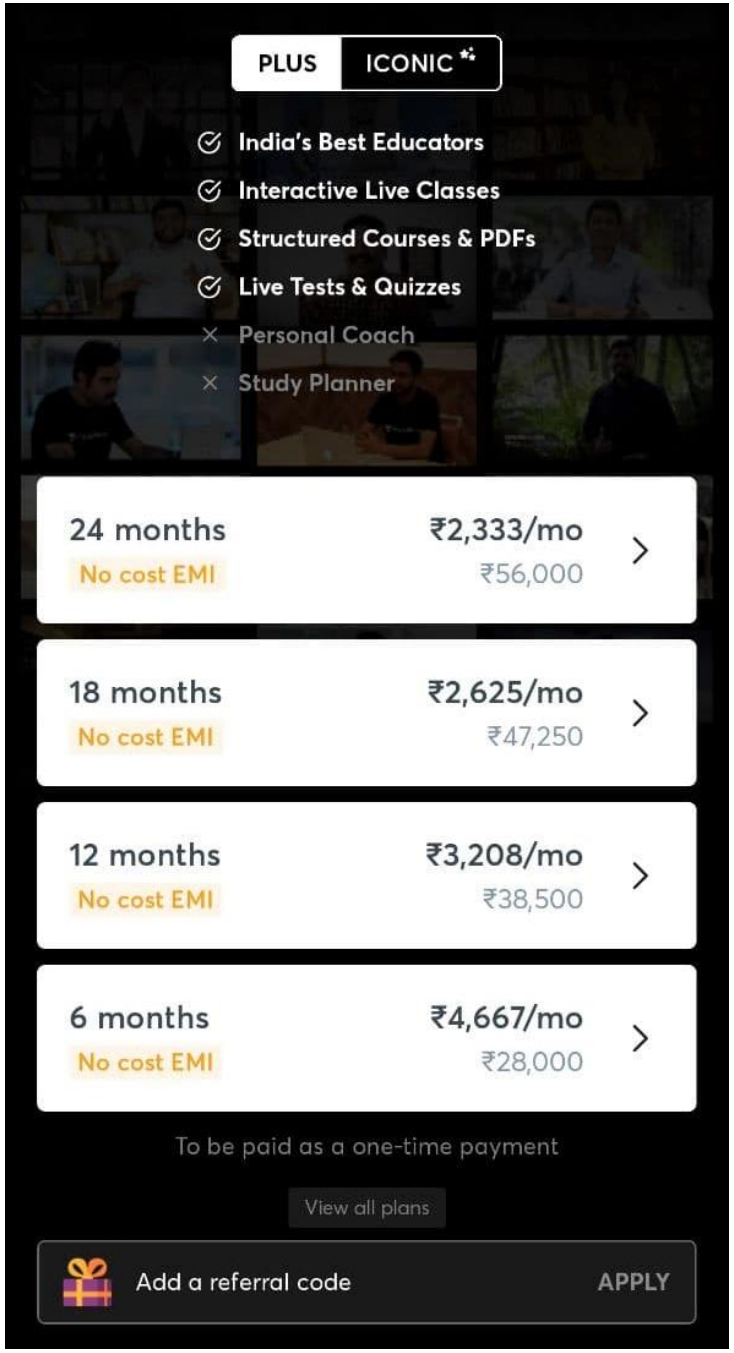
Q 10. An automobile travelling with the speed of 72 km/h, is stopped within a distance of 20m, by applying brakes. Determine the distance travelled in the first second:
(a) 10 m (b) 25 m
(c) 15 m (d) 35 m

Q 11. A body starting from rest is moving with a uniform acceleration of 8 m/s^2. Then the distance travelled by it in 5th second will be:
(a) 40 m (b) 36 m
(c) 100 m (d) zero

Q 12. A motor cycle moving with speed of 15m/s is subject to an acceleration of 0.2 m/s^2 in the direction of motion. Calculate the speed of motorcycle after 10 second,
(a) 7 m/s (b) 10 m/s
(c) 13 m/s (d) 17 m/s

Answer Key

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



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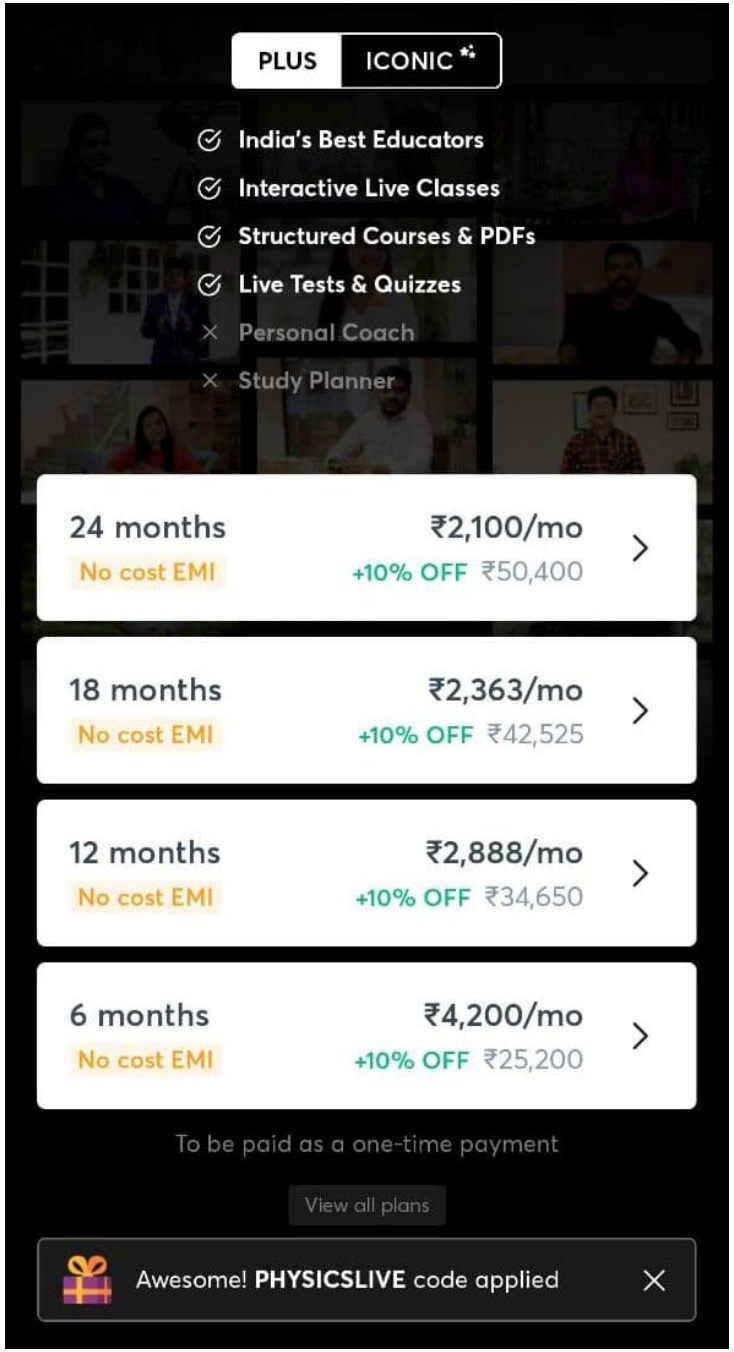


Written Solution

DPP-2 Equation of kinematics

By Physicsaholics Team

SOLUTION : 1

$u = 1.5 \text{ m/s}$

$a = 12 \text{ m/s}^2$

$s = 3 \text{ m}$

$v = ?$

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

$v^2 - (1.5)^2 = 2(12)(3)$

$v^2 = (1.5)^2 + 72$

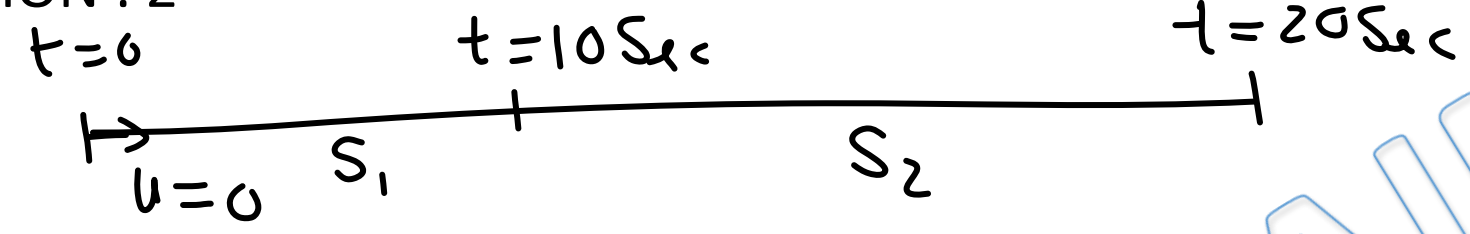
$v^2 = 2.25 + 72$

$v^2 = 74.25$

$\boxed{v = 8.61 \text{ m/s}}$

ANS : b

SOLUTION : 2



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

$$S_1 = \frac{1}{2}a(10)^2 = 50a$$

$$S_1 + S_2 = \frac{1}{2}a(20)^2 = 200a$$

$$\Rightarrow \quad S_2 = 150a$$

$$\frac{S_1}{S_2} = \frac{1}{3} \Rightarrow S_2 = 3S_1$$

ANS : c

SOLUTION : 3

$u = ?$

$V = 25 \text{ m/s}$

for constant acceleration

$$V_{avg} = \frac{V + u}{2}$$

$$20 = \frac{25 + u}{2}$$

$$u = 40 - 25$$

$$\boxed{u = 15 \text{ m/s}}$$

ANS : a

SOLUTION : 4

Let acceleration = a

& given; $\frac{v_2}{v_1} = 2$

$u = 0$

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

for $v = v_1$

given; $s = s_1$

$\therefore \quad v_1^2 - (0)^2 = 2as_1$

$v_1^2 = 2as_1 \quad -(1)$

Now $u = v_1$

& $s = s_2$ & $v = v_2$

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

$\Rightarrow v_2^2 - v_1^2 = 2as_2 \quad -(2)$

Put value of v_1^2 in eq^n (2)

$v_2^2 - 2as_1 = 2as_2$

$v_2^2 = 2a(s_1 + s_2) \quad -(3)$

$\frac{(3)}{(1)} \Rightarrow \left(\frac{v_2}{v_1}\right)^2 = \frac{2a(s_1 + s_2)}{2as_1}$

$(2)^2 = \frac{s_1 + s_2}{s_1} \Rightarrow 4 = \frac{s_1 + s_2}{s_1}$

$4s_1 = s_1 + s_2 \Rightarrow 3s_1 = s_2$

$\Rightarrow \boxed{\frac{s_2}{s_1} = 3} \Rightarrow \boxed{N = 3}$

ANS : d

SOLUTION : 5

$$x_t = u + \frac{1}{2}a(2t-1)$$

$$35 = u + \frac{1}{2}a(8-1)$$

$$40 = u + \frac{1}{2}a(10-1)$$

$$5 = a$$

$$\Rightarrow 35 = u + \frac{7}{2}\times 5$$

$$\Rightarrow u = \frac{35}{2}\ m/sec$$

ANS : c

SOLUTION : 6

$$v_{av} = \frac{u+v}{2} = \frac{x}{t}$$

$$\frac{u+45}{2} = \frac{180}{6}$$

$$u + 45 = 60$$

$$u = 15 \text{ m/sec}$$

ANS : c

SOLUTION : 7

$u = 18 \text{ km/h} = 18 \times \frac{5}{18} = 5 \text{ m/s}$

$v = 36 \text{ km/h} = 10 \text{ m/s}$

$a = \frac{v-u}{t}$ $(\because v = u + at)$

$t = 5 \text{ sec}$

$a = \frac{10-5}{5}$

$\boxed{a = 1 \text{ m/s}^2}$

ANS : a

SOLUTION : 8

$u = 0$

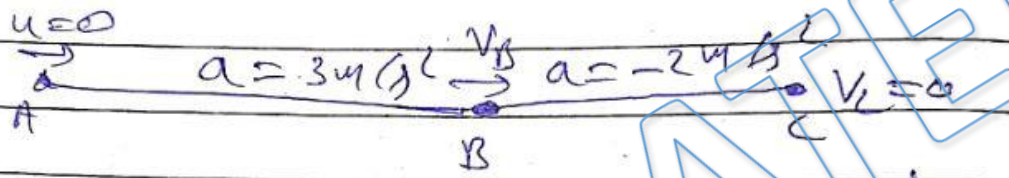
$a = 3\ m/s^2$

for $t = t_1$

and $a = 2\ m/s^2$

for $t = t_1$ to $t = t_2$

$t_1 + t_2 = 10$ sec



for A → B [max speed will be at point B]

$u = 0$

$a = 3\ m/s^2$

$t = t_1$

$\therefore$ v at B

$v_B = u + at$

$= 0 + 3 \times t_1$

$v_B = 3t_1$

in net $t_2 = 10 - t_1$ time

it's final velocity $= 0$

$v = u + at$

$v_C = v_B + (-2)(10 - t_1)$

$0 = 3t_1 - 20 + 2t_1$

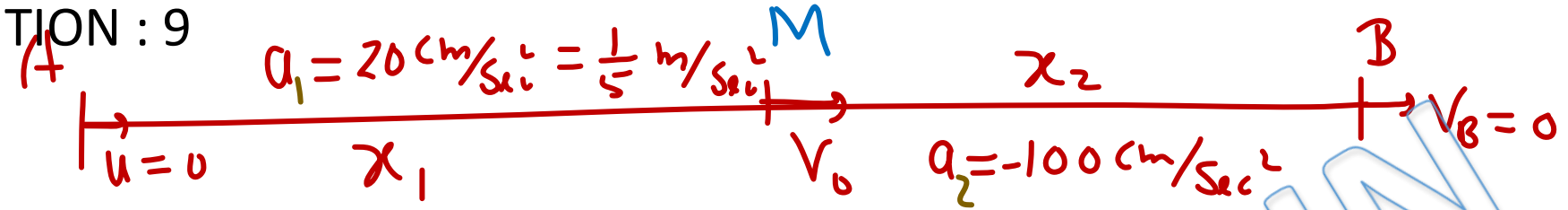
$20 = 5t_1 \Rightarrow t_1 = 4$ sec

$v_B = 3 \times 4 = 12\ m/s$

$\therefore v_B$ = max speed = 12 m/s

ANS : b

SOLUTION : 9



from A to M →

$$V^2 = u^2 + 2ax \Rightarrow V_0^2 = 0 + 2 \times \frac{1}{5} x_1 \Rightarrow x_1 = \frac{5V_0^2}{2}$$

from M to B →

$$0 = V_0^2 - 2 \times 1 \times x_2 \Rightarrow x_2 = \frac{V_0^2}{2}$$

now $x_1 + x_2 = 2.7\,Km \Rightarrow \frac{5V_0^2}{2} + \frac{V_0^2}{2} = 2700 \Rightarrow V_0 = 30\,m/sec$

time from A to M $\Rightarrow t_1 = \frac{V_0}{a_1} = \frac{30}{1/5} = 150\,Sec$

" " M to B $\Rightarrow t_2 = \frac{V_0}{|a_2|} = \frac{30}{1} = 30\,Sec$

total time of motion $= 180\,Sec$

ANS : b

SOLUTION : 10

$u = 72 \text{ km/h} = 72 \times \frac{5}{18}$

$u = 20 \text{ m/s}$

$d = 20 \text{ m}$

$v = 0$

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

$0 - (20)^2 = 2a(-20)$

$\boxed{a = -10 \text{ m/s}^2}$

∴ distance travelled in 1st sec is

$S_1 = ut + \frac{1}{2}at^2$

$S_1 = 20(1) - \frac{1}{2}(10)(1)^2$

$S_1 = 20 - \frac{1}{2}(10)$

$S_1 = 20 - 5$

$\boxed{S_1 = 15 \text{ m}}$

ANS : c

SOLUTION : 11

$$x_t = u + \frac{1}{2}a(2t-1)$$

$$= 0 + \frac{1}{2} \times 8 (2 \times 5 - 1)$$

$$= 36\,m$$

ANS : b

SOLUTION : 12

$u = 15 \text{ m/s}$

$a = 0.2 \text{ m/s}^2$

$t = 10 \text{ sec}$

$v = u + at$

$v = 15 + (0.2)(10)$

$= 15 + 2$

$v = 17 \text{ m/s}$

ANS : d

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