DPP – 3 (Kinematics)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/41

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Q 1. A body starts to fall freely under gravity. The distances covered by it in first, second and third second are in ratio:
(a) 1:3:5 (b) 1:2:3 (c) 1:4:9 (d) 1:5:6

Q 2. P, Q and R are three balloons ascending with velocities U, 4U and 8U respectively. If stones of the same mass be dropped from each, when they are at the same height, then:
(a) They reach the ground at the same time
(b) Stone from P reaches the ground first
(c) Stone from Q reaches the ground first
(d) Stone from R reaches the ground first

Q 3. A body, thrown vertically upwards with an initial velocity u, reaches maximum height in 6 seconds. The ratio of the distance travelled by body in the first second and the eleventh second is:
(a) 1:9 (b) 11:9 (c) 1:2 (d) 9:11

Q 4. A stone falls from a balloon that is descending at a uniform rate of 12 m/s. The displacement of the stone from the point of release after 10 sec is:($g = 9.8\ m/s^2$)
(a) 490 m (b) 510 m (c) 610 m (d) 725 m

Q 5. A stone thrown upward with a speed 'u' from the top of the tower reaches the ground with a velocity '3u'. The height of the tower is :-
(a) $\frac{3u^2}{g}$ (b) $\frac{4u^2}{g}$ (c) $\frac{6u^2}{g}$ (d) $\frac{9u^2}{g}$

Q 6. A ball is dropped from a tower. In the last second of its motion it travels a distance of 15 m. Find the height of the tower. [take $g = 10 m/s^2$]
(a) 10 m (b) 20 m (c) 30 m (d) 40 m

Q 7. A,B,C and D are points in a vertical line such that AB=BC=CD. If a body falls from rest from A, then the times of descend through AB, BC and CD are in the ratio:
(a) 1:2:$\sqrt{3}$ (b) $\sqrt{2}$: $\sqrt{3}$:1
(c) $\sqrt{3}$:1: $\sqrt{2}$ (d) 1:$(\sqrt{2}-1)$:$(\sqrt{3}-\sqrt{2})$

Q 8. Two stones of different masses are dropped simultaneously from the top of a building
(a) Smaller stone hit the ground earlier
(b) Larger stone hit the ground earlier

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(c) Both stones reach the ground simultaneously
(d) Which of the stones reach the ground earlier depends on the composition of the stone

Q 9. If a ball fallen freely from 'h' height reaches in time 't' at ground, then what will be the time when it reaches at height h/2?
(a) $\frac{t}{2}$ (b) $\frac{t}{\sqrt{2}}$ (c) $\sqrt{2}t$ (d) $\frac{t}{\sqrt{2}-1}$

Q 10. Two particles A and B having different masses are projected from a tower with same speed. A is projected vertically upward and B vertically downward. On reaching the ground:
(a) Velocity of A is greater than that of B
(b) Velocity of B is greater than that of A
(c) Both A and B attain the same velocity
(d) The particle with the larger mass attains higher velocity

Q 11. A man in a balloon rising vertically with an acceleration of 4.9 m/s^2 releases a ball 2 sec after the balloon is let go from the ground. The greatest height above the ground reached by the ball is: (g = 9.8 m/s^2)
(a) 14.7 m (b) 19.6 m (c) 9.8 m (d) 24.5 m

Q 12. A stone is dropped from a building and 2 seconds later another stone is dropped. How far apart are these two stones by the time the first one reaches a speed of 30m/s:(g = 10 m/s^2)
(a) 80 m (b) 100 m (c) 60 m (d) 40 m

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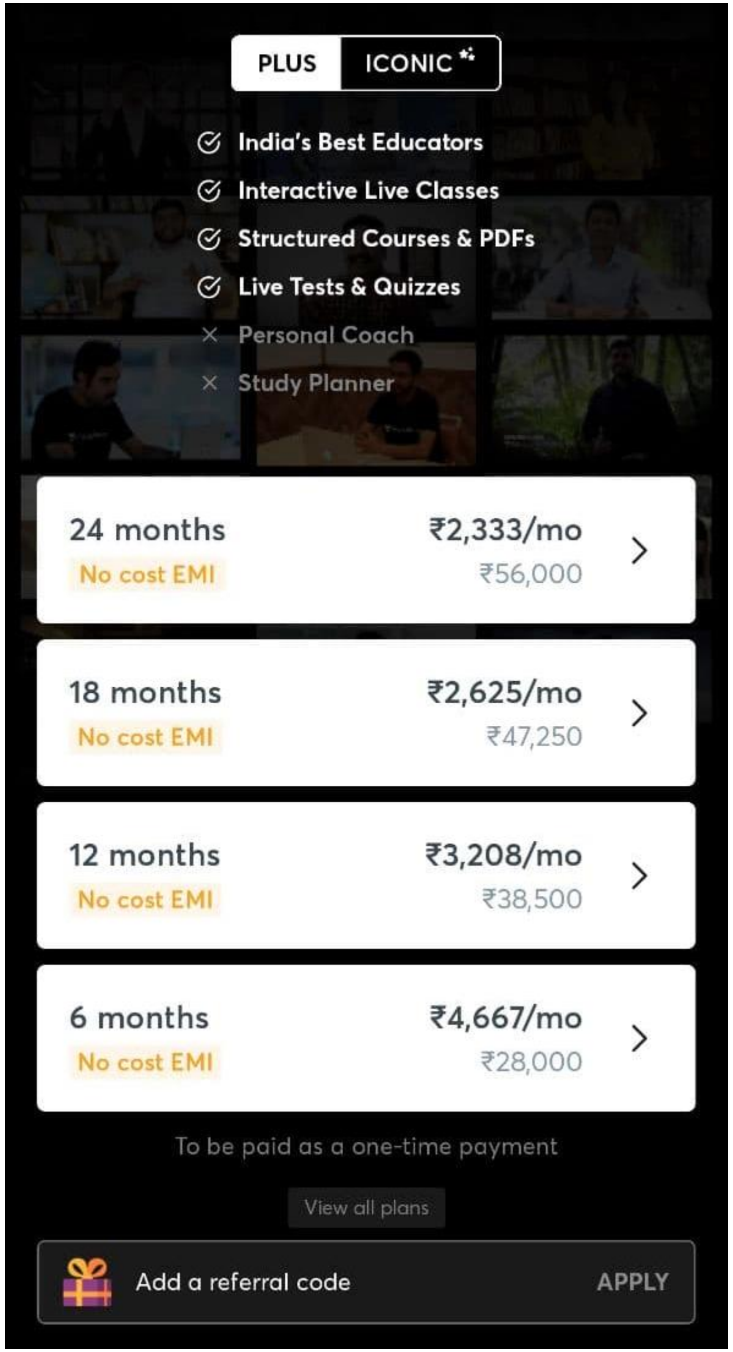
Answer Key

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



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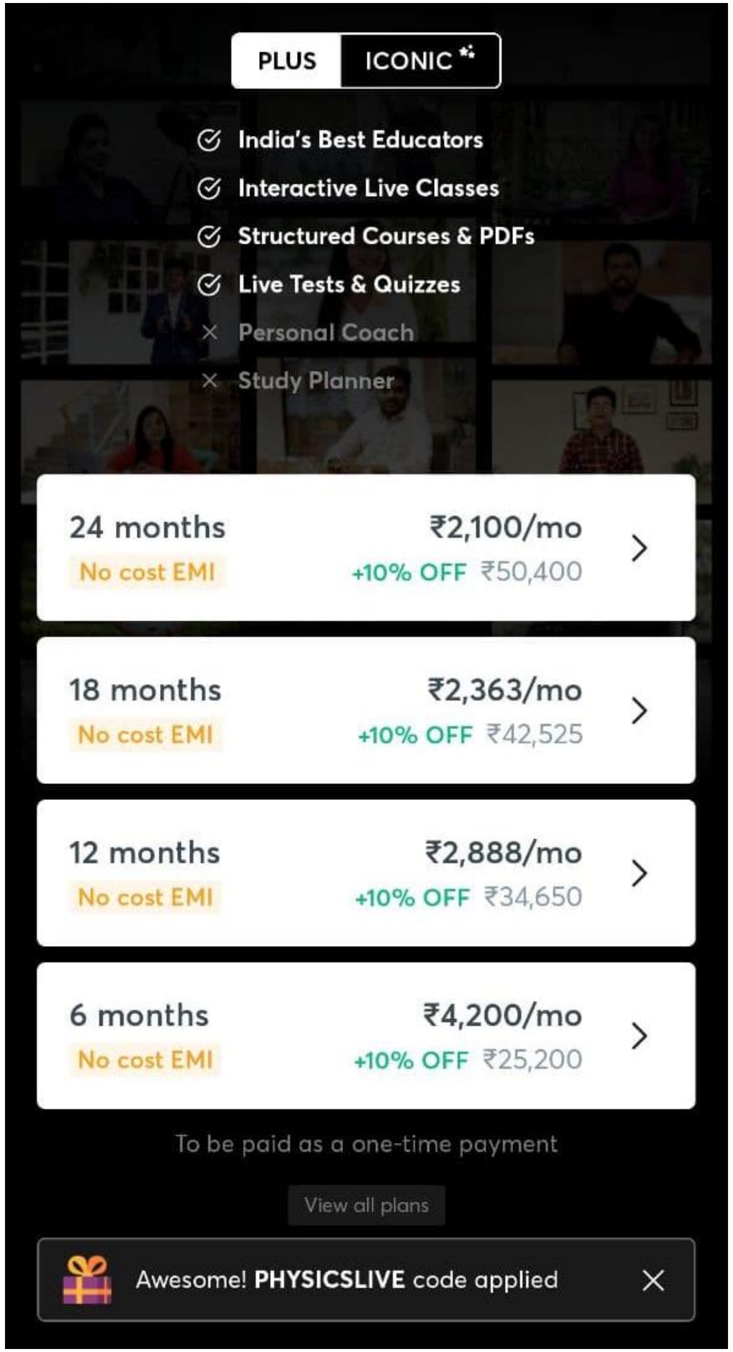

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Written Solution

DPP-3 Motion under gravity

By Physicsaholics Team

SOLUTION : 1

$$S_n = u + \frac{a}{2}(2n-1)$$

$a = g$

$u = 0$

$n_1 = 1, \; n_2 = 2, \; n_3 = 3$

$S_1 : S_2 : S_3 = 1 : 3 : 5$

ANS : a

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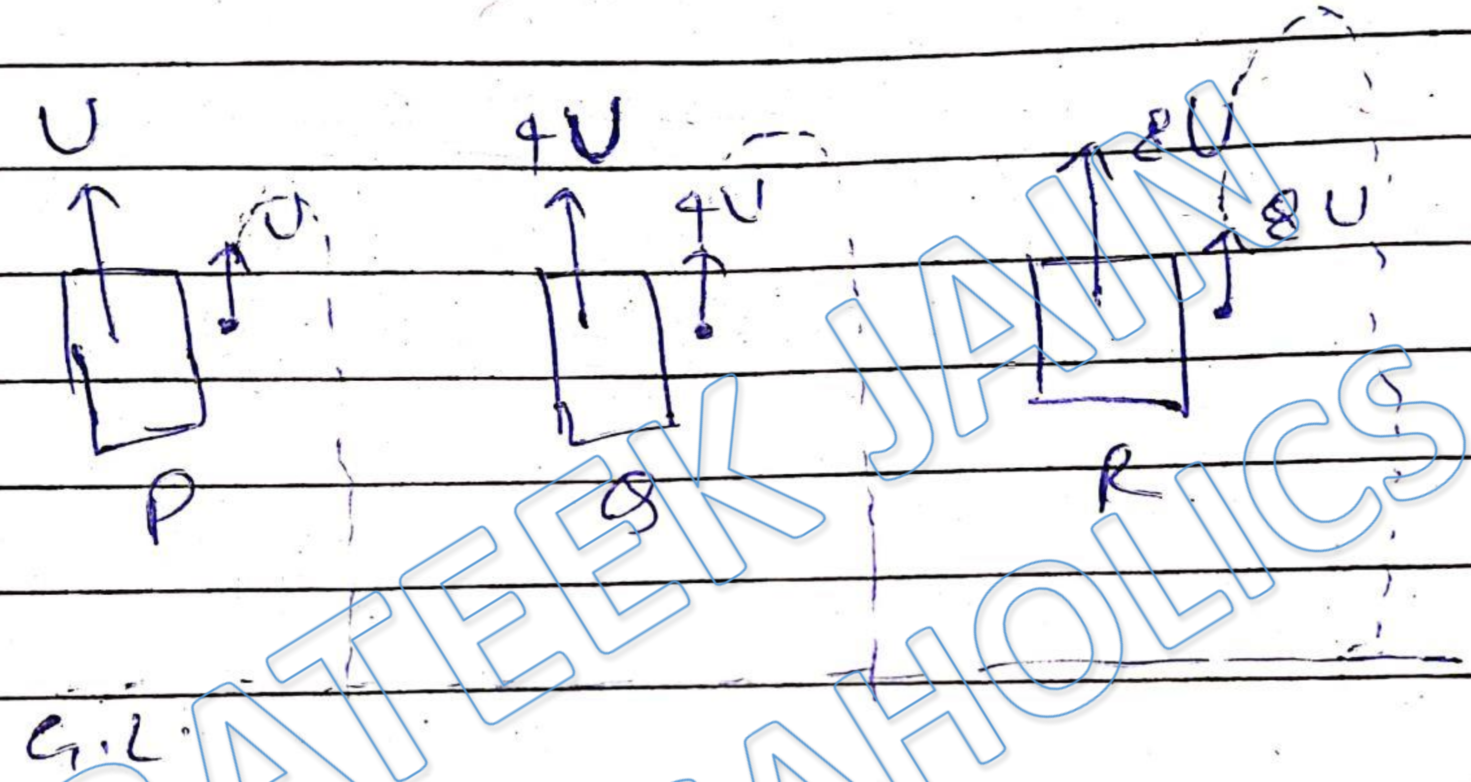
SOLUTION : 2



Stone from P has lesser initial upward velocity.

∴ It will take less time to reach the ground.

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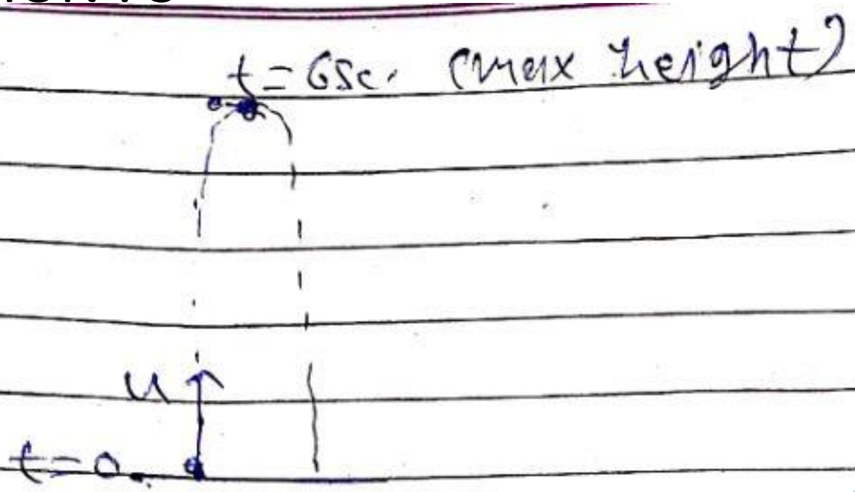
ANS : b

SOLUTION : 3



$$v = u + at$$

at; $t = 6$ sec $\Rightarrow v = 0$

$$0 = u - g(6)$$

$$\boxed{u = 6g \text{ m/s}}$$

$$S_n = u + \frac{a}{2}(2n-1)$$

$u = 6g$, $a = -g$

$n = 1$

$$S_1 = 6g - \frac{g}{2}(2\times1-1)$$

$$S_1 = 6g - \frac{g}{2} = \frac{11g}{2}$$

$$S_{11} = 6g - \frac{g}{2}(22-1)$$

$$S_{11} = 6g - \frac{21g}{2} = -9g/2$$

$$|S_{11}| = 9g/2$$

$$S_1 : S_2 = \frac{11g}{2} : \frac{9g}{2}$$

$$\boxed{S_1 : S_2 = 11 : 9}$$

ANS : b

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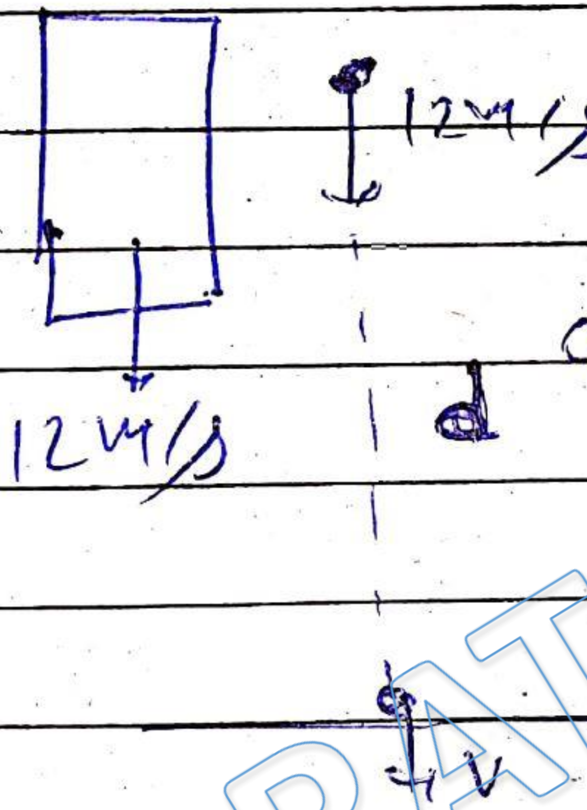
SOLUTION : 4



$S = ut + \frac{1}{2}gt^2 = 12 \times (10) + \frac{1}{2}(9.8)(10)^2$

$S = 120 + 490$

$\boxed{S = 610\ m}$

ANS : c

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SOLUTION : 5

$\uparrow u = u$

$-h$ $\quad \downarrow a = -g$

$g \downarrow$

$v = -3u$

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

$$(-3u)^2 - (u)^2 = -2gs$$

$$9u^2 - u^2 = -2gh$$

$$8u^2 = -2gh$$

$$h = \frac{-8u^2}{2g} = -\frac{4u^2}{g}$$

$$|h| = \frac{4u^2}{g}$$

ANS : b

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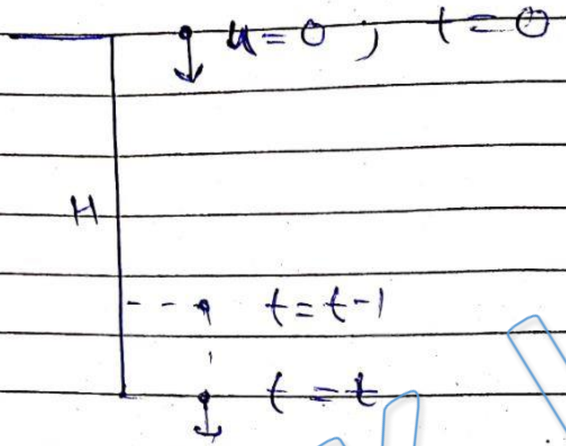
SOLUTION : 6



in last second
distance travelled = 15m

$$S_n = u + \frac{a}{2}(2n-1)$$

$n = t, \quad a = g, \quad u = 0$

$$15 = 0 + \frac{g}{2}(2\times t - 1)$$

$$30 = 10(2t-1)$$

$$\boxed{t = 2\text{ sec}}$$

$$t = \sqrt{\frac{2H}{g}} \Rightarrow t^2 = \frac{2H}{g}$$

$$H = \frac{gt^2}{2} = \frac{10\times(2)^2}{2}$$

$$\boxed{H = 20\text{ m}}$$

ANS : b

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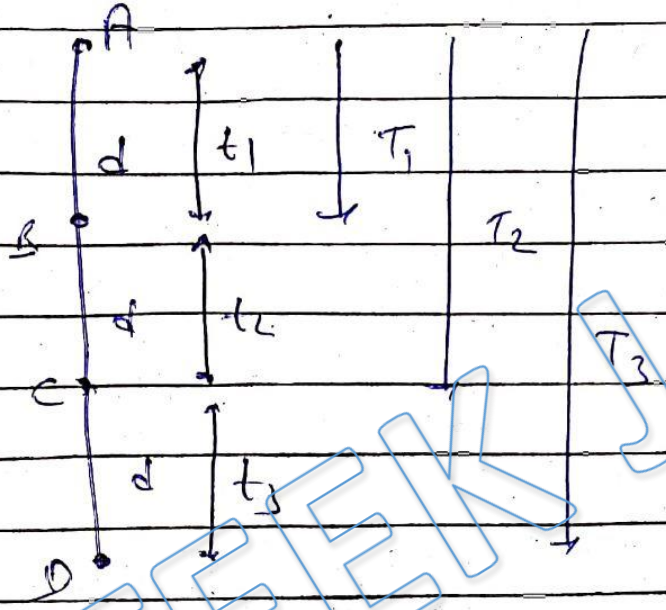
SOLUTION : 7



$$T_1 = \sqrt{\frac{2d}{g}} \; ; \quad T_2 = \sqrt{\frac{2(2d)}{g}}$$

$$T_3 = \sqrt{\frac{2(3d)}{g}}$$

$$t_1 = T_1 \; ; \quad t_2 = T_2 - T_1 , \quad t_3 = T_3 - T_2$$

$$t_1 : t_2 : t_3 = \sqrt{\frac{2d}{g}} : \left(\sqrt{\frac{2(2d)}{g}} - \sqrt{\frac{2d}{g}}\right) : \left(\sqrt{\frac{3(2d)}{g}} - \sqrt{\frac{2(2d)}{g}}\right)$$

$$\boxed{t_1 : t_2 : t_3 = 1 : (\sqrt{2} - 1) : (\sqrt{3} - \sqrt{2})}$$

ANS : d

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SOLUTION : 8

m_1 $\quad\quad$ m_2

$u = 0$ $\quad\quad$ $u = 0$

$a_1 = g$ $\quad\quad$ $a_2 = g$

acceleration of both particle is same

$S = \cancel{ut}^{\,0} + \frac{1}{2}at^2$

$S = \frac{1}{2}gt^2$; does not depend on mass

∴ t will be same for Both.

ANS : c

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SOLUTION : 9

$$t = \sqrt{\frac{2h}{g}}$$

$$t_2 = \sqrt{\frac{2(h/2)}{g}}$$

$$t_2 = \sqrt{\frac{1}{2}\left(\frac{2h}{g}\right)}$$

$$\boxed{t_2 = \frac{t}{\sqrt{2}}}$$

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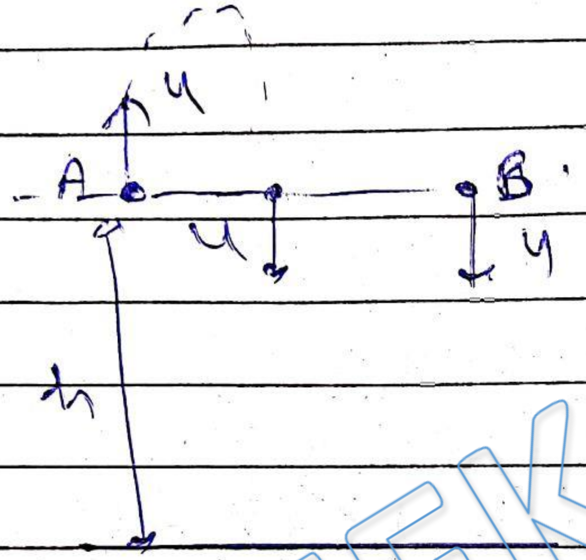
ANS : b

SOLUTION : 10



$$v^2 - u^2 = 2as \Rightarrow v^2 = u^2 + 2as$$

for A, $u = u$, $a = -g$, $s = -h$

$$v_A^2 = u^2 + 2(-g)(-h) = u^2 + 2gh \quad \text{—①}$$

for B, $u = -u$, $a = -g$, $s = -h$

$$v_B^2 = (-u)^2 + 2(-g)(-h) = u^2 + 2gh \quad \text{—②}$$

from eqⁿ ① & ②

$$\boxed{V_A = V_B}$$

ANS : c

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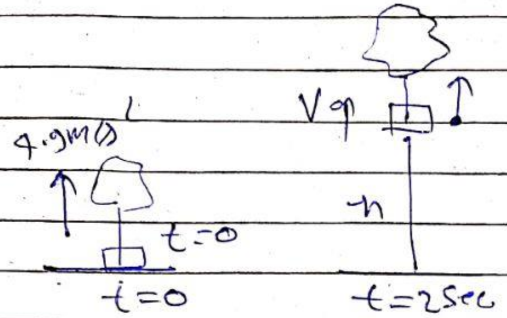
SOLUTION : 11

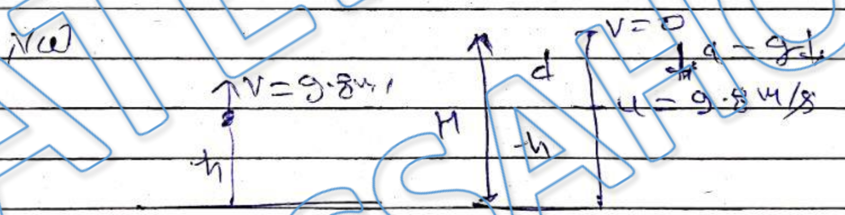


$$v = u + at = 0 + 4.9(2)$$

$$\boxed{v = 9.8\, m/s}$$

$$h = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2}(4.9)(2)^2$$

$$\boxed{h = 9.8\, m}$$



$$v = u + at$$

$$0 = 9.8 - 9.8t$$

$$t = 1\ sec$$

$$d = ut + \frac{1}{2}at^2 = 9.8(1) - \frac{1}{2}(9.8)(1)^2$$

$$d = 9.8 - 4.9 = 4.9\, m$$

$$H = h + d = 9.8 + 4.9$$

$$\boxed{H = 14.7\, m}$$

ANS : a

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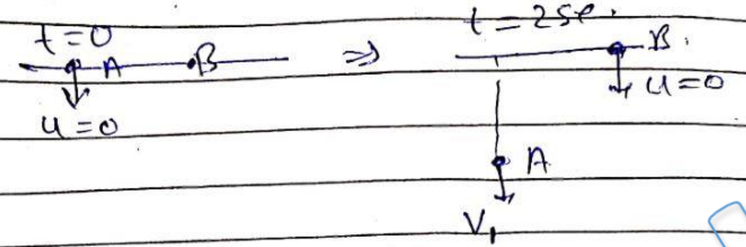
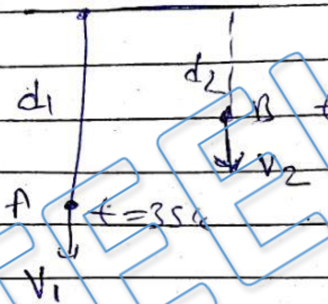
SOLUTION : 12



at $t = t$



$v_1 = 0 + gt$; $V_2 = g(t-2)$

$v_1 = 30\,m/s$

$30 = gt$ — (1)

$t = \frac{30}{10}$

$t = 3\,m/s$

$d_1 = \frac{1}{2} g (3)^2$ $\quad$ $d_2 = \frac{1}{2} g (1)^2$

$d_1 = 45\,m$ $\quad$ $d_2 = 5\,m$

$\Delta d = 40\,m$.

ANS : d

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