DPP-5

SOLUTION

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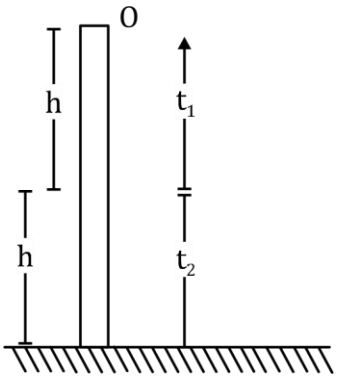
1. Let total height is 2 h.



$$h = \frac{1}{2}gt_1^2$$

$$t_1 = \sqrt{\frac{2h}{g}}$$

$$h + h = \frac{1}{2}g(t_1 + t_2)^2$$

$$t_1 + t_2 = \sqrt{\frac{4h}{g}}$$

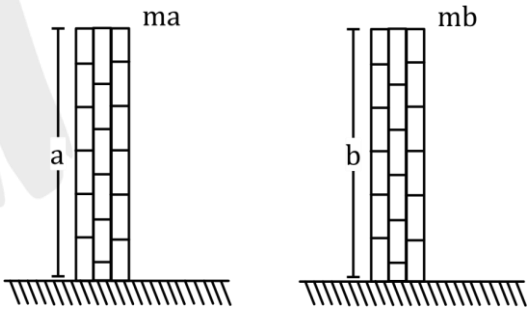
$$t_2 = \sqrt{2}t_1 - t_1$$

$$t_1 = \frac{t_2}{(\sqrt{2}-1)}$$

$$t_1 = \frac{t_2(\sqrt{2}+1)}{(\sqrt{2}-1)\cdot(\sqrt{2}+1)} = 2.414t_2$$

$$t_1 = 2 \cdot 414t_2$$

2.



$$a = \frac{1}{2}gt_a^2$$

$$b = \frac{1}{2}gt_b^2$$

$$\frac{t_a}{t_b} = \sqrt{\frac{a}{b}}$$

$$t_a : t_b = \sqrt{a} : \sqrt{b}$$

3. At maximum height

velocity is zero but acceleration always act downward direction. due to gravity.

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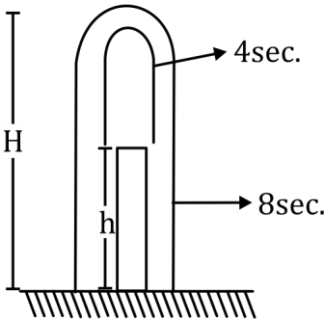
4. $H = \frac{1}{2}g \times 4^2$

$H - h = \frac{1}{2}g \times 2^2 \qquad = \frac{1}{2} \times 10 \times 16$

$H - h = 20\ m \qquad = 8 \times 10 = 80\ m$

$h = 60\ m$ option (C)



5. 6m/s ↑ ↓ g

$v = u - 10t$

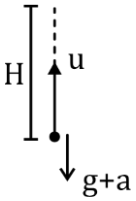
$v = 6 - 10 \times \frac{1}{2} = 1\ m/s$

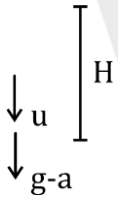
6. Let the retardation produced by resistance is a.

time of ascent = ta

time of descent = td

If the particle rises upto a height h





$H = \frac{1}{2}(g + a)t_a^2$

$t_a = \sqrt{\frac{2H}{g+a}} \qquad t_b = \sqrt{\frac{2H}{g-a}}$

$\frac{t_a}{t_d} = \sqrt{\frac{g-a}{g+a}} = \sqrt{\frac{10-6}{10+6}} = \frac{1}{2}$

$\frac{t_d}{t_a} = \frac{2}{1}$

7. $\frac{t_a}{t_d} = \sqrt{\frac{g-a}{g+a}} = \sqrt{\frac{10-2}{10+2}} = \sqrt{\frac{8}{12}}$

$\frac{t_a}{t_d} = \sqrt{\frac{2}{3}}$

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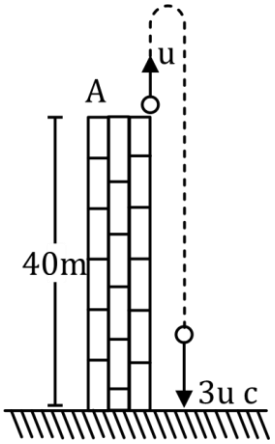
8. using 3rd equation b/w A to C.



$v_y^2 = uy^2 + 2ays$

$9u^2 = u^2 - 2g \times 40$

$8u^2 = 800$

$u^2 = 100$

$u = 10m/s$

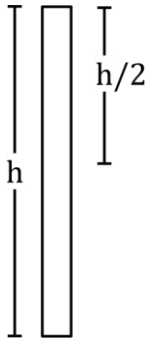
using first equation

$-3u = u - 10t$

$-30 - 10 = -10t$

$t = 4sec.$

9. In last second travel half distance $= \frac{h}{2}$



Let total time is t

$$h = \frac{1}{2}gt^2 \Rightarrow t = \sqrt{\frac{2h}{g}}$$

time, travelled the distance h/2 from dropping point $= t - 1$

$$\frac{h}{2} = \frac{1}{2}g(t-1)^2$$

$$t - 1 = \sqrt{\frac{h}{g}}$$

$t - 1 = \frac{t}{\sqrt{2}} \Rightarrow$ $\quad$ $t - \frac{t}{\sqrt{2}} = 1$

$$t\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right) = 1$$

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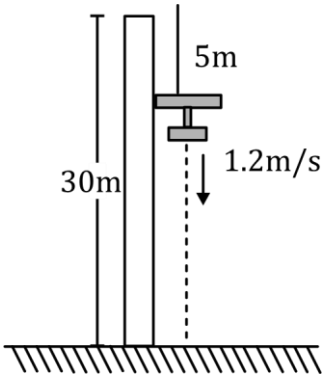
$$t = \left(\frac{\sqrt{2}}{\sqrt{2}-1}\right) = \frac{\sqrt{2}(\sqrt{2}+1)}{1}$$

$t = (2+\sqrt{2})\text{sec}$

$t = 3.414\text{sec}$



11. time taken by parachute to reach ground $= 1 + \frac{25}{1.2} = 1 + 20.8 =$ 21.8sec

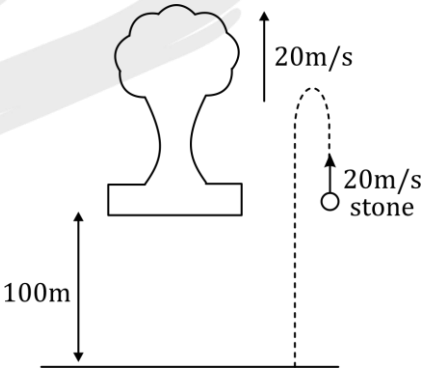
time taken by stone to reach the ground

$H = \frac{1}{2}gt^2$

$\frac{30 \times 2}{10} = t^2$

$t = \sqrt{6} = 2.449 = 2.4\text{sec}$

Ans – No



12. time taken by stone reach to ground

$sy = 2yt + \frac{1}{2}ayt^2$

$-100 = 20t - 5t^2$

$t^2 - 4t - 20 = 0$

$t = \frac{4 \pm \sqrt{16 - 4 \times 1 \times (-20)}}{2 \times 1}$

$t = \frac{4 \pm \sqrt{16+80}}{2} = \frac{4+\sqrt{96}}{2} = \frac{4+9.8}{2}$

$t = 6.9\text{sec}$

Height of parachute from ground

$= 100 + 20 \times 6.9$

$= 100 + 69 \times 2 = 100 + 138$

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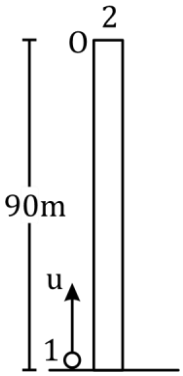
$= 238$ m

13. first we find speed u



$u^2 = 2gH$

$u = \sqrt{2 \times 10 \times 90} = 30\sqrt{2}$ m/s

Let Collision time t.

distance travelled by particle in time

$hy_1 = 30\sqrt{3}t - \frac{1}{2}g \cdot t^2$

distance travelled by particle 2 in time $(t - 2)$ sec.

$hy_2 = \frac{1}{2} \times g(t-2)^2$

$hy_1 + hy_2 = 90$ m

$30\sqrt{3}t - 5t^2 + 5(t-2)^2 = 90$ m