WS-6 7th advanced

EFB

Thank

①

(1)

Given stone in freely falling body

Given $t_d = \sqrt{\frac{2h}{g}}$

$\Rightarrow 4.2 = \sqrt{\frac{2h}{\cancel{9.8}\ 4.9}}$

$\Rightarrow (4.2)^2 = \frac{h}{4.9} \Rightarrow h = (4.2)^2 \times 4.9$

$\Rightarrow h = 86.44\,m$

(2)

Given $h = 65\,m$, Given body is a Freely falling body

$t_d = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times 65}{9.8}} = \sqrt{13.3} = 3.64$ sec

(3)

$h = 65\,m$

velocity of a freely falling body to reach ground

$v = \sqrt{2gh} = \sqrt{2\times 10 \times 65} = \sqrt{1300} = 36$ m/sec

(4)

$\frac{t_{d_1}}{t_{d_2}} = \frac{1}{2}$; we know that $t_d = \sqrt{\frac{2h}{g}}$

$t_d^2 \propto h$ $\rightarrow \frac{h_1}{h_2} = \left(\frac{t_{d_1}}{t_{d_2}}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

(5)

Given body is FFB ; $u=0$; $g=9.8\ m/s^2$; $n=6^{th}$

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

$$\Rightarrow S_n = 0 + \frac{g}{2}(2(6)-1)$$

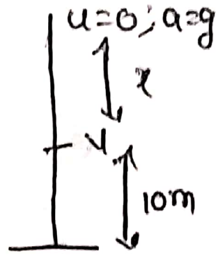
$$= 0 + \frac{9.8}{2}(12-1) = 4.9 \times 11 = 53.9\,m$$

(6)

Given

$S = 10m$ in $t = 0.4$ sec ; $a = g = 9.8$

$\therefore$ From $S = ut + \frac{1}{2}at^2$



$$10 = u(0.4) + \frac{1}{2}9.8(0.4)^2$$

$$\Rightarrow 10 = u(0.4) + 4.9 \times 0.16$$

$$\Rightarrow 10 = u \times 0.4 + 0.784$$

$$\Rightarrow u \times 0.4 = 9.2 = 23.04\ m/s$$

From $v^2 - u^2 = 2gx$

$$\Rightarrow (23.04)^2 - 0^2 = 2 \times 9.8 \times x$$

$$\Rightarrow (23.04 \times 23.04 = 19.6\,x$$

$$\Rightarrow x = \frac{23.04 \times 23.04}{19.6} = 27.08\,m$$

Total height $= x + 10 = 27.08 + 10 = 37.08\,m$

Time of descent $t_d = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 39.08}{9.8}}$

$$t_d = 2.8\ sec.$$

(7)

let the required time be t.

For freely falling body we have $S_1 = \frac{1}{2}gt^2$

$= \frac{1}{2} \times 10 \times t^2$

$= 5t^2$.

For a body thrown downward with 1 m/s

$S_2 = ut + \frac{1}{2}gt^2$

$= 1t + \frac{1}{2} \times 10 t^2$

$= t + 5t^2$

Now $S_2 - S_1 = 18$

$t + \cancel{5t^2} - \cancel{5t^2} = 18$

$\Rightarrow t = 18$ sec

(8)

let $u = 0$: $a = g$

Given v = displacement. For a FFB displacement $= h$

$\Rightarrow \sqrt{2gh} = h$

By squaring on both sides

$\Rightarrow 2gh = h^2 \Rightarrow h = 2g$ m.

$\therefore$ velocity aquired $v = \sqrt{2gh} = \sqrt{2g \times 2g} = 2g$

$v = 2 \times 9.8 = 19.6$ m/s

(9)

Given time of descent $t_d = 4$ sec

$\Rightarrow \sqrt{\frac{2h}{g}} = 4$

$\sqrt{\frac{\cancel{2}h}{\cancel{9.8}\,4.9}} = 4$

$\Rightarrow h = 4^2 \times 4.9$

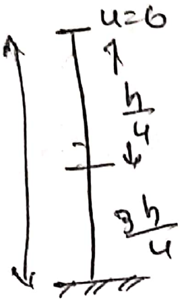
$= 16 \times 4.9$

$= 78.4$ m

(10)

We know that $t_d = \sqrt{\frac{2h}{g}}$

$t_d \propto \sqrt{h} \Rightarrow \frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$ $\qquad t_2 = \frac{t_1}{2}$



$\Rightarrow \frac{t_1}{\frac{t_1}{2}} = \sqrt{\frac{h}{h_2}} \Rightarrow 2 = \sqrt{\frac{h}{h_2}}$

on squaring both sides

$\Rightarrow 4 = \frac{h}{h_2} \Rightarrow h_2 = \frac{h}{4}$

In $\frac{t}{2}$ sec the body covers a distance $\frac{h}{4}$ from top

$\therefore$ the body is at a height of $\frac{3h}{4}$ from ground.

(11)

Given $u=0$

$S_n = 25m$ in last sec

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

$\Rightarrow 25 = \frac{g}{2}(2n-1) \rightarrow (1)$

$\Rightarrow 50 = 10(2n-1) \Rightarrow 2n-1 = 5 \Rightarrow n = 3$ sec.

$\therefore$ height of fall $= h = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times 3^2 = 5 \times 9$

$= 45m$

(14), (15), (16)

Given $h = 49m$

$t_d = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 49}{9.8}} = \sqrt{\frac{2 \times 49 \times 0}{98}} = \sqrt{10}$ sec

velocity $v = \sqrt{2gh} = \sqrt{2 \times 10 \times 49} = 7\sqrt{20} = 31$ m/sec

We know $t_d \propto \sqrt{h}$

$\Rightarrow \frac{t_{d_1}}{t_{d_2}} = \sqrt{\frac{h_1}{h_2}} \Rightarrow \frac{\sqrt{10}}{t_{d_2}} = \sqrt{\frac{h}{\frac{h}{2}}} \Rightarrow \frac{\sqrt{10}}{t_{d_2}} = \sqrt{2} \Rightarrow t_{d_2} = \sqrt{5}$ sec

~~Task~~

(17)

In 2 sec distance travelled by ~~first~~ 2nd ball

$h_2 = \frac{1}{2} g t_1^2$

$= \frac{1}{2} \times 10 (2)^2$

$= 20m$

After 2 more sec. means 4 sec. distance travelled by Ist ball

$h_1 = \frac{1}{2} g (t_2)^2 = \frac{1}{2} \times 10 (4)^2$

$= \frac{1}{2} \times 10 \times 16$

$= 80m$

Seperation b/w them $= h_1 - h_2 = 80 - 20 = 60m$

(18)

$h = 100m$

Time of fall $= \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 100}{10}} = \sqrt{20} = 2\sqrt{5}$ sec.

L Task

CUQ's

(7)

In Ist sec $S_1 = \frac{g}{2}(2n-1) = \frac{g}{2}(2(1)-1) = \frac{g}{2}$

2nd sec $S_2 = \frac{g}{2}(2(2)-1) = \frac{g}{2}(4-1) = \frac{3g}{2}$

3rd sec $S_3 = \frac{g}{2}(2(3)-1) = \frac{g}{2}(6-1) = \frac{5g}{2}$

$S_1 : S_2 : S_3 = \frac{g}{2} : \frac{3g}{2} : \frac{5g}{2} = 1 : 3 : 5$

(9)

In I^{th} sec $s = 5m$; $v = gt = v = g$

In 4 sec. distance travelled by the body

$$s' = ut + \frac{1}{2}gt^2$$

$$\Rightarrow s' = \cancel{g(4)} + \frac{1}{2}g(4)^2$$

$$= \cancel{4g} + \frac{1}{\cancel{2}} g \times \cancel{16}8$$

$$= \cancel{12}8g = 8 \times 10 = 80m$$

(8)

distance travelled by a freely falling body in 3rd sec

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

$$S_n = 0 + \frac{g}{2}(2(3)-1)$$

$$S_n = 5(5) = 25 \text{ m (or) } 24.5m \; [\text{if } g = 9.8 \, m/s^2]$$

<u>Jee mains level</u>

(7)

Given $t = 5$ sec

Distance travelled by freely falling body

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

$$= \frac{1}{\cancel{2}} \times \cancel{10}^{5} (5)^2$$

$$= 5 \times 25$$

$$= 125m.$$

(2)

Given $n=4$; The body is a freely falling body

so $u=0$; $a=g$

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

$= 0 + \frac{10}{2}(2(4)-1)$

$\Rightarrow 5(8-1) = 35$ m (or) 34.3 m for $g = 9.8\ m/s^2$

(3)

Given the body is a freely falling body : Total time of descent = $t_d = n$ $a=g$; $u=0$; $S_n = 2450$ cm $= 24.5$ m.

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

$\Rightarrow 24.5 = 0 + \frac{g}{2}(2n-1)$

$\Rightarrow \overset{5}{\cancel{24.5}} = \frac{\overset{4.9}{\cancel{9.8}}}{\cancel{2}}(2n-1)$ $\Rightarrow 2n-1 = 5 \Rightarrow 2n = 6 \Rightarrow n = 3$ sec

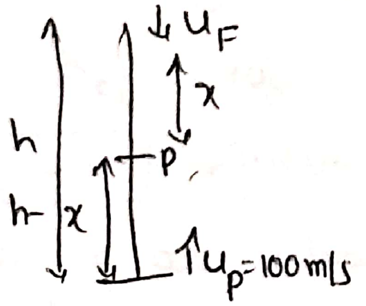
$\therefore$ The height from which the body dropped $h = \frac{1}{2}gt^2$

$\Rightarrow h = \frac{1}{2}(9.8) \times 3^2 = 4.9 \times 9 = 44.1$ m

$= 4410$ cm

(4)

Given $h = 400$ m ; $u = 100$ m/s



P is meeting point

$a=g$ From FFB $S = ut + \frac{1}{2}at^2$ VPB ; $a=-g$

$\Rightarrow x = \frac{1}{2}gt^2 \rightarrow (1)$

$h - x = 100t - \frac{1}{2}gt^2 \rightarrow (2)$

From (1) & (2)

$\Rightarrow h - \cancel{\frac{1}{2}gt^2} = 100t - \cancel{\frac{1}{2}gt^2}$

$\Rightarrow 400 = 100t \Rightarrow t = \underline{4 \text{ sec}}$

(5)

Here the stone is a freely falling body so

$u=0;\ a=g.$

let 'n' be the time of descent.

Given Total distance travelled by it in last second is equal to distance covered by it in 5 sec

$\therefore\ S_n = S_5$

$\Rightarrow u+\frac{a}{2}(2n-1) = ut+\frac{1}{2}at^2$

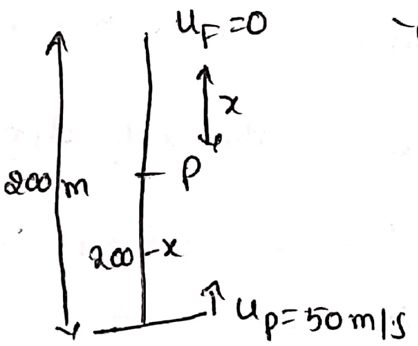
$\Rightarrow 0+\frac{g}{2}(2n-1) = 0\times5+\frac{1}{2}g5^2$

$\Rightarrow \cancel{\frac{g}{2}}(2n-1) = \cancel{\frac{g}{2}}\times25 \Rightarrow 2n-1 = 25$

$\Rightarrow 2n = 26 \Rightarrow n = 13$ sec

$\therefore$ The stone remains in air for 13 sec

(6)



'P' is meeting point

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

FFB: $a=g;\ u=0$; $S=x$

VPB: $a=-g;\ S=200-x$; $u=50$

$\therefore\ x = 0\times t+\frac{1}{2}gt^2$

$\Rightarrow x = \frac{1}{2}gt^2 \rightarrow (1)$

$\Rightarrow 200-x = 50t-\frac{1}{2}gt^2 \rightarrow (2)$

From (1) & (2)

$\Rightarrow 200-\frac{1}{2}\cancel{gt^2} = 50t-\frac{1}{2}\cancel{gt^2}$

$\Rightarrow 200 = 50t \Rightarrow \boxed{t = 4\text{ sec}}$

The meeting point from ground $= 200-x = 200-\frac{1}{2}gt^2$

$= 200-\frac{1}{\cancel{2}}\times\cancel{10}^{5}\times4^2$

$= 200-80 = 120m$

From TOP $= x = \frac{1}{2}gt^2 = \frac{1}{2}\times10\times16 = 80m$

(7)

we know for a freely falling body $u=0$; $a=g$

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

For $n=1$ $S_1 = 0 + \frac{g}{2}(2(1)-1) = \frac{g}{2}$

For $n=2$ $S_2 = 0 + \frac{g}{2}(2(2)-1) = \frac{g}{2}(4-1) = \frac{3g}{2}$

For $n=3$ $S_3 = 0 + \frac{g}{2}(2(3)-1) = \frac{g}{2}(6-1) = \frac{5g}{2}$

$\therefore S_1 : S_2 : S_3 = \frac{g}{2} : \frac{3g}{2} : \frac{5g}{2} = 1:3:5$

(8)

Given $h = 490m$. Total time of fall $= t_d = \sqrt{\frac{2h}{g}}$

$\Rightarrow t_d = \sqrt{\frac{2\times490}{9.8}} = \sqrt{100} = 10$ sec

In last second means 10^{th} sec.

$S_n = u + \frac{g}{2}(2n-1) = 0 + \frac{g}{2}(2(10)-1)$

$S_n = \frac{9.8}{2}(20-1) = 4.9\times19 = 93.1\ m$

(9)

we know for a freely falling body

distance travelled in 't' sec $S = \frac{1}{2}gt^2$

For successive sec means $t = 1, 2, 3, 4$ ---

$S_1 \propto \frac{1}{2}g(1)^2$; $S_2 \propto \frac{1}{2}g(2)^2$; $S_3 \propto \frac{1}{2}g(3)^2$

$\Rightarrow S_1 : S_2 : S_3 = \frac{g}{2}(1)^2 : \frac{g}{2}(2)^2 : \frac{g}{2}(3)^2$

$\Rightarrow 1:4:9$

(10)

For a Freely falling body distance travelled

$S_n = x$ in n^{th} sec

$\therefore S_n = \frac{g}{2}(2n-1) \Rightarrow x = \frac{g}{2}(2n-1) \rightarrow (1)$

The distance travelled in $(n+1)^{th}$ sec

$$S_{n+1} = \frac{g}{2}(2(n+1)-1) = \frac{g}{2}(2n+2-1)$$

$$S_{n+1} = \frac{g}{2}(2n+1)$$

$$\Rightarrow S_{n+1} = \frac{g}{2}(2n+1) - g + g$$

$$\Rightarrow \frac{g}{2}(2n) + \frac{g}{2} - g + g$$

$$\Rightarrow \frac{g}{2}(2n) - \frac{g}{2} + g \Rightarrow \frac{g}{2}(2n-1) + g$$

$$S_{n+1} \Rightarrow \underline{x+g}$$

(14)

Given $h = 20m$

Time taken by I^{th} stone to reach ground

$$t_1 = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times20}{10}} = \sqrt{4} = 2 sec.$$

Here both stones are reaching ground at a time.

$\therefore$ ~~$t_{d_2} = 2 sec = \frac{u}{g}$~~ $\Rightarrow$ ~~$u = 2g = 2\times10 = 20m/s$~~

~~From $s = ut + \frac{1}{2}at^2$~~ $\quad 20 = 34 + 5\times9$

$\Rightarrow$ ~~$20 = 2u + \frac{1}{2}\times10\times2^2$~~ $\quad 34 = -2r$

$\Rightarrow$ ~~$20 = 2u + 20$~~ 10 $\quad 10 \qquad t_d = \frac{3}{} = \frac{u}{g}$

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

14th continuation

time of descent for 2nd stone = 1sec

From $h = ut + \frac{1}{2}gt^2$

$\Rightarrow 20 = u \times 1 + \frac{1}{2} \times 10(1)^2$

$\Rightarrow 20 = u + 5 \Rightarrow u = 15\,m/s$

(15)

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

$v = 2v \;; u = v$

$\Rightarrow (2v)^2 - v^2 = 2(g)x.$

For a Freely falling body

$s = h$

$v^2 = 2gh$

$\Rightarrow 3v^2 = 2gx$

$\Rightarrow 3(2gh) = 2gx$

$x = 3h$

(16)

Given body is a Freely falling body $u = 0 \;; a = g$

Given displacement in last second = displacement in 3sec

$\Rightarrow u + \frac{a}{2}(2n-1) = ut + \frac{1}{2}at^2$

$\Rightarrow 0 + \frac{g}{2}(2n-1) = 0 \times 3 + \frac{1}{2}g(3)^2$

$\Rightarrow \cancel{\frac{g}{2}}(2n-1) = \cancel{\frac{g}{2}} \times 9$

$\Rightarrow 2n-1 = 9$

$\Rightarrow 2n = 10$

$\Rightarrow n = 5sec$