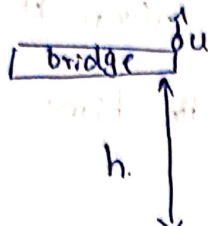


8th advanced

①

WS-6

①



Here the Velocity of Projection

$$u = 3 \text{ m/s}$$

time taken to reach ground = 2s.

$\therefore$ Height of bridge

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

$$h = -(3)(2) + \frac{1}{2} \times 10 \times 2^2$$

$$= -6 + 10 \times 2$$

$$= -6 + 20$$

$$h = 14 \text{ m}$$

②

Let u be the velocity with which stone was

Projected (i.e) Given $u = v$

The velocity with which the stone reach ground $v = 2v$.

From $v^2 - u^2 = 2as$ Here $a = g$; $s = h$

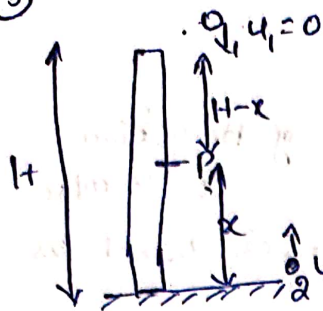
$$\Rightarrow (2v)^2 - v^2 = 2gh$$

$$\Rightarrow 4v^2 - v^2 = 2gh$$

$$\Rightarrow 3v^2 = 2gh$$

$$\Rightarrow h = \frac{3v^2}{2g}$$

③



Let P is meeting point, whose position is x from the ground. Given $H = 300 \text{ m}$

Let t be the time after which

2 bodies are meet at P .

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

1 stone (or) body

Freely Falling

$$u_1 = 0; a_1 = g; s_1 = H - x$$

2nd body

Vertically Projectile

$$u_2 = 100 \text{ m/s}; a_2 = -g; s_2 = x$$

$$\therefore H - x = u_1 t + \frac{1}{2} g t^2$$

$$\Rightarrow H - x = 0 \times t + \frac{1}{2} g t^2$$

$$\Rightarrow H - x = \frac{1}{2} g t^2 \rightarrow \text{①}$$

$$x = u_2 t + \frac{1}{2} (-g) t^2$$

$$\Rightarrow x = 100t - \frac{1}{2} g t^2 \rightarrow \text{②}$$

From ① & ② we get

$$\therefore H - (100t - \frac{1}{2} g t^2) = \frac{1}{2} g t^2$$

$$\Rightarrow 300 - 100t + \frac{1}{2} g t^2 = \frac{1}{2} g t^2$$

$$\Rightarrow 300 - 100t = 0 \Rightarrow 100t = 300$$

$$\Rightarrow t = 3 \text{ sec.}$$

$\therefore$ From

$$\text{①} \quad H - x = \frac{1}{2} g t^2$$

$$\Rightarrow 300 - x = \frac{1}{2} \times 10 \times 3^2$$

$$\Rightarrow 300 - x = 5 \times 9$$

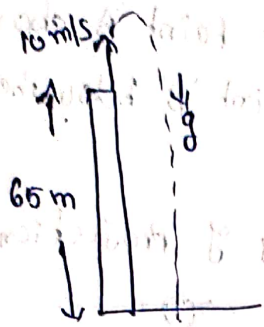
$$\Rightarrow 300 - x = 45 \Rightarrow x = 300 - 45$$

$$\Rightarrow x = 255 \text{ m}$$

Both bodies meet after '3' sec of their start at a height 255m from ground.

(2)

(4)



Let the velocity of projection $u = 10 \text{ m/s}$

Height of cliff $= h = 65 \text{ m}$

The velocity of the stone just before reaching the ground is calculated from

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

$$\Rightarrow v^2 - 10^2 = 2 \times g \times h$$

$$\Rightarrow v^2 - 100 = 2 \times 10 \times 65$$

$$\Rightarrow v^2 - 100 = 1300$$

$$\Rightarrow v^2 = 1400$$

$$\Rightarrow v = \sqrt{1400} \approx 37 \text{ m/s}$$

(5)

Here Given that helicopter is ascending with a

speed $u = 8 \text{ m/s}$

At the time of chopping

the speed of food packet is same as that of helicopter.

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

$$\Rightarrow 12 = -8t + \frac{1}{2} \times 10 \times t^2$$

$$\Rightarrow 12 = -8t + 5t^2$$

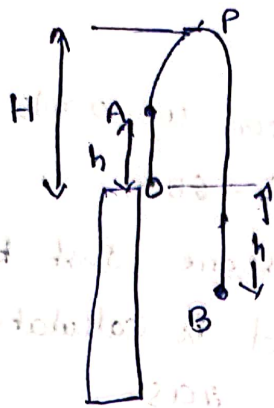
$$\Rightarrow 5t^2 - 8t - 12 = 0$$

Then the roots for 't' can be calculated

$$\text{by using } t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(5)(-12)}}{2 \times 5}$$

$$t = \frac{8 \pm \sqrt{64 + 2400}}{10} = 2.54 \text{ sec}$$

⑥



Let H = height reached by a ball from O
 h = height of the point A above Top
 and the point B below the top of
 a tower.

u be the velocity of Projection

From

$$v^2 - u^2 = 2as \rightarrow (1)$$

For B

$$v_B^2 - u^2 = 2gh \quad [\text{Ball is in downward Journey}]$$

For A

$$v_A^2 - u^2 = 2(-g)h \quad [\text{Ball is moving up}]$$

$$\Rightarrow v_A^2 - u^2 = -2gh$$

In the Question given

$$v_B = 2v_A$$

$$\Rightarrow v_B^2 = 4v_A^2$$

$$\Rightarrow [u^2 + 2gh] = 4[u^2 - 2gh]$$

$$\Rightarrow u^2 + 2gh = 4u^2 - 8gh$$

$$\Rightarrow u^2 - 4u^2 = -2gh - 8gh$$

$$\Rightarrow -3u^2 = -10gh$$

$$\Rightarrow u^2 = \frac{10gh}{3} \rightarrow (2)$$

As the ball moving from $O \rightarrow P$ then from (1)

$$v_P^2 - u^2 = 2(-g)H \quad \text{but at highest point } p \quad v_P = 0$$

$$\Rightarrow 0^2 - u^2 = -2gH$$

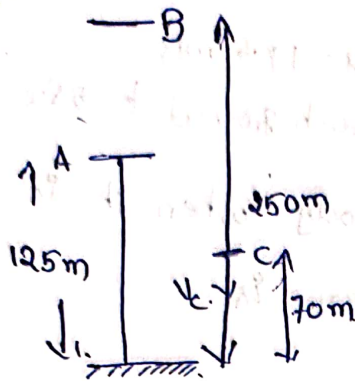
$$\Rightarrow u^2 = 2gH$$

$$\Rightarrow 5 \frac{10gh}{3} = 2gH \quad [\text{From 2}]$$

$$\Rightarrow H = \frac{5h}{3}$$

(3)

(7)



let 'B' be the highest point reached by the body.

For the journey A $\rightarrow$ B:

Initial velocity = u .

Displacement $s = 250 - 125$
 $= 125 \text{ m.}$

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

Final velocity $v_B = 0$

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

$$\Rightarrow 0^2 - u^2 = 2(-10)(125)$$

$$\Rightarrow -u^2 = -2500$$

$$\Rightarrow u = \sqrt{2500} = 50 \text{ m/s}$$

Now for A $\rightarrow$ C:

$$u = 50 \text{ m/s}; \quad v_c = v_c$$

$$\text{Displacement} = s_{Ac} = -(125 - 70) \\ = -55 \text{ m.}$$

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

$$\therefore \text{From } v^2 - u^2 = 2as$$

$$\Rightarrow v_c^2 - (50)^2 = 2(-10)(-55)$$

$$\Rightarrow v_c^2 - 2500 = 1100$$

$$\Rightarrow v_c^2 = 3600 \Rightarrow v_c = \sqrt{3600} = 60 \text{ m/s}$$

⑧

Let the velocity of projection, $u = 19.6 \text{ m/s}$

Time taken by the body to reach ground $t = 5 \text{ Sec}$

∴ The displacement of the body when it is projected from top of a tower is

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

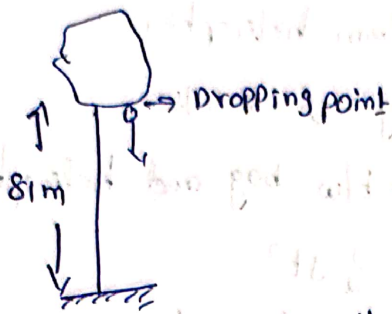
$$\Rightarrow h = -19.6(5) + \frac{1}{2}(9.8)(5)^2$$

$$\Rightarrow h = -98.0 + 122.5$$

$$= 24.5 \text{ m}$$

⑨

(10)



At the time of dropping

$$v_{\text{body}} = v_{\text{balloon}} = 12 \text{ m/s}$$

The displacement of the body =

Height from which it is dropped

 $\therefore$ the height can be calculated by using

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

$$81 = -12t + \frac{1}{2} \times 10 t^2$$

$$81 = -12t + 5t^2$$

$$5t^2 - 12t - 81 = 0$$

This is in the form of quadratic equation $ax^2 + bx + c = 0$

$$\therefore \text{Roots for } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \text{ Here } x = t$$

$$= \frac{-(-12) \pm \sqrt{(-12)^2 - 4(5)(-81)}}{2 \times 5}$$

$$= \frac{12 \pm \sqrt{144 + 1620}}{10}$$

$$= \frac{12 \pm \sqrt{1764}}{10} = \frac{12 \pm 42}{10}$$

$$= \frac{12+42}{10}$$

$$\text{or } \frac{12-42}{10}$$

$$= \frac{54}{10}$$

There is no 've'

value for time.

$$t = 5.4 \text{ sec}$$

(15)

For (i) (ii)

Here the bag is dropped from helicopter.

So the velocity of bag $u = 2 \text{ m/s}$.

Then the separation b/w bag and helicopter after 2 sec is

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

$$= 2 \times 2 - \frac{1}{2}(9.8)2^2$$

$$= 4 - (9.8)2$$

$$= 4 - 19.6 \text{ m}$$

$$= -15.6 \text{ m}$$

Because the bag is moving in downward direction its displacement is -ve.

The velocity of bag after 2 sec

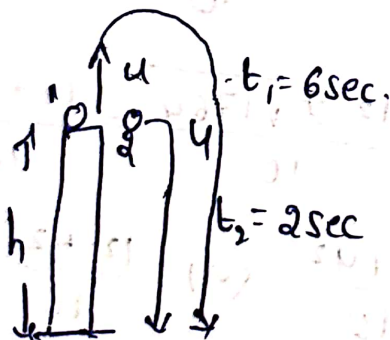
$$v = u - gt$$

$$= 2 - (9.8) \times 2$$

$$= 2 - 19.6$$

$$= -17.6 \text{ m/s}$$

(16)



For 1st body $h = -ut_1 + \frac{1}{2}gt_1^2$

$$\Rightarrow h = -6u + \frac{g}{2}(6)^2$$

$$h = -6u + 18g \rightarrow (1)$$

For 2nd stone $h = ut_2 + \frac{1}{2}gt_2^2$

$$\Rightarrow h = 2u + \frac{1}{2}g(2)^2$$

$$\Rightarrow h = 2u + 2g \rightarrow (2)$$

(5)

From ① and ② we get

$$\Rightarrow 2u + 2g = -6u + 18g$$

$$\Rightarrow 8u = 16g$$

$$\Rightarrow u = 2g$$

sub 'u' value in ② we get

$$\Rightarrow h = 2(2g) + 2g$$

$$= 4g + 2g$$

$$= 6g$$

$$h = 60 \text{ m}$$

(17)

Given balloon starts from rest i.e. $u = 0$

Its acceleration $a = \frac{g}{8}$, After 8 sec from start

The velocity of balloon is $v = u + at$

$$v = 0 + \frac{g}{8} \times 8$$

$$\Rightarrow v = g \text{ m/s}$$

The height to which balloon was risen is 'h'. From

this height the stone was released from balloon.

$$\therefore h = ut + \frac{1}{2}at^2 \Rightarrow h = 0 \times 8 + \frac{1}{2} \times \frac{g}{8} (8)^2$$

$$\Rightarrow h = \frac{1}{2} \times \frac{g}{8} \times 64 \times 4$$

$$\Rightarrow h = 4g$$

$\therefore$ For stone $h = -ut + \frac{1}{2}gt^2$ [Here $u = v$]

$$4g = -gt + \frac{1}{2}gt^2$$

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

$$\Rightarrow t^2 - 2t = 8$$

$$\Rightarrow t^2 - 2t - 8 = 0$$

$$\Rightarrow t^2 - 4t + 2t - 8 = 0$$

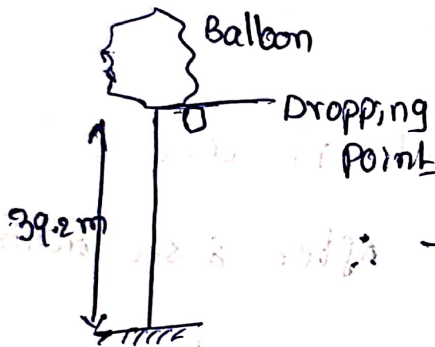
$$\Rightarrow (t-4)(t+2) = 0$$

i.e. $t = 4$ (or) -2 but No $\geq$ ve' values for time

So correct ans is $t = 4$ Sec.

1 Task SAG

①



The velocity of the packet = velocity of Balloon at the time of dropping.

The displacement of package = Height from which it was dropped. It can be.

calculated by using $h = -ut + \frac{1}{2} g t^2$

$$\Rightarrow 39.2 = -9.8t + \frac{1}{2} (9.8) t^2$$

$$\Rightarrow 39.2 = -9.8t + 4.9t^2$$

$$\Rightarrow 8 = -2t + t^2$$

$$\Rightarrow t^2 - 2t - 8 = 0$$

$$\Rightarrow t^2 - 4t + 2t - 8 = 0$$

$$\Rightarrow t(t-4) + 2(t-4) = 0$$

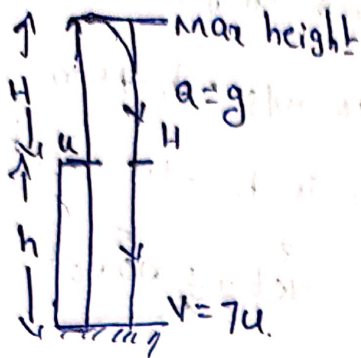
$$\Rightarrow (t-4)(t+2) = 0$$

$$\Rightarrow t = 4 \text{ (or) } -2 \text{ sec}$$

No $\geq$ ve' values for time so 4s is correct

(6)

(2)



Here H = maximum height reached by the body from top of tower

$$\Rightarrow H = \frac{u^2}{2g}$$

The displacement of the body = h , this can be calculated by using $v^2 - u^2 = 2as$

$$\Rightarrow (7u)^2 - u^2 = 2gh$$

$$\Rightarrow 49u^2 - u^2 = 2gh$$

$$\Rightarrow 48u^2 = 2gh$$

$$\Rightarrow h = \frac{48}{2g} u^2$$

$\therefore$ The total distance travelled by the body

$$= H + H + h$$

$$= \frac{u^2}{2g} + \frac{u^2}{2g} + \frac{48}{2g} u^2$$

$$= \frac{50}{2g} u^2 = 25 \frac{u^2}{g}$$

(3)

Given initial velocity $u = 20 \text{ m/s}$

$$h = 80 \text{ m}; a = g = 10 \text{ m/s}^2$$

The speed with which the stone reach the ground is

calculated by using $v^2 - u^2 = 2as$

$$\Rightarrow v^2 - (20)^2 = 2(10)(80)$$

$$\Rightarrow v^2 - 400 = 1600$$

$$\Rightarrow v^2 = 2000 \Rightarrow v = \sqrt{2000}$$

$$\Rightarrow v = 20\sqrt{5} \text{ m/s}$$

④ Here the balloon is moving with uniform velocity

The velocity of stone = 10 m/s ; $h = 75 \text{ m}$

The displacement of stone is $h = -ut + \frac{1}{2}gt^2$

$$\Rightarrow 75 = -10t + \frac{1}{2} \times 10 \times t^2$$

$$\Rightarrow 15 = -2t + t^2$$

$$\Rightarrow t^2 - 2t - 15 = 0$$

$$\Rightarrow t^2 - 5t + 3t - 15 = 0$$

$$\Rightarrow t(t-5) + 3(t-5) = 0$$

$$\Rightarrow (t-5)(t+3) = 0$$

$$\Rightarrow t = 5 \text{ sec or } -3 \text{ sec.}$$

No -ve values for time, so time is 5 sec correct.

⑤

The velocity of helicopter = velocity of food packet = 2 m/s

After 2 sec velocity of food packet = $v = u - gt$

$$= 2 - 9.8 \times 2$$

$$= 2 - 19.6$$

$$= -17.6 \text{ m/s}$$

-ve sign shows the direction of motion is downwards.

⑥

Here Given Acceleration of balloon is $a = \frac{g}{8}$

$$u = 0$$

$\therefore$ The time taken by the stone to reach ground can be

calculated by using

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

$$\Rightarrow h = -0 \times t + \frac{1}{2} \times \frac{g}{8} t^2 \Rightarrow h = \frac{g}{16} t^2$$

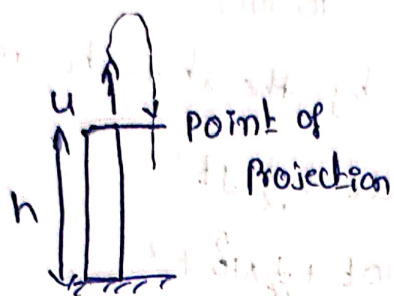
$$\Rightarrow t^2 = \frac{16h}{g} \Rightarrow t = 4\sqrt{\frac{h}{g}}$$



(7)

Here the body was projected up with a velocity

$$u = 19.6 \text{ m/s}$$



The body crosses point of projection

After time of flight

$$\text{i.e. } T = \frac{2u}{g} = \frac{2 \times 19.6}{9.8} = 4 \text{ sec}$$

(8)

After an object was dropped, the distance

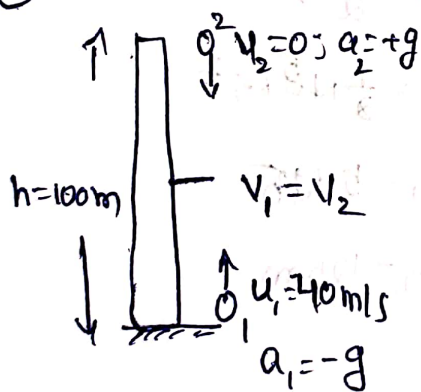
between balloon and object after 2 sec is

$$= \frac{1}{2} g t^2$$

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

$$= 10 \times 2 = 20 \text{ m}$$

(9)



$$\text{Here } g = 10 \text{ m/s}^2$$

For Vertically Projected body
velocity after 't' sec is $v_1 = u + at$

$$\Rightarrow v_1 = u_1 + a_1 t$$

$$\Rightarrow v_1 = 40 - gt \quad \text{--- (1)}$$

For Freely Falling body $v_2 = u_2 + a_2 t$

$$\Rightarrow v_2 = 0 + gt$$

$$\Rightarrow v_2 = gt \quad \text{--- (2)}$$

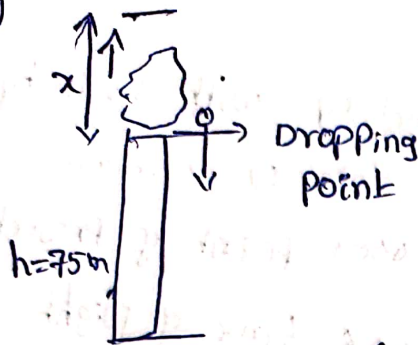
$$\text{Given } v_1 = v_2 \Rightarrow gt = 40 - gt$$

$$\Rightarrow 2gt = 40$$

$$\Rightarrow t = \frac{40}{2g} = 2 \text{ sec.}$$



(10)



The velocity of stone = velocity of balloon
- at the time of dropping

$$u = 10 \text{ m/s}$$

Time taken by the stone to reach ground

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

$$\Rightarrow 75 = -10t + \frac{1}{2} \times 10 t^2$$

$$\Rightarrow 15 = -2t + t^2$$

$$\Rightarrow 15 = -2t + t^2 \Rightarrow t^2 - 2t - 15 = 0$$

$$\Rightarrow t^2 - 5t + 3t - 15 = 0$$

$$\Rightarrow t(t-5) + 3(t-5) = 0$$

$$\Rightarrow (t-5)(t+3) = 0 \quad (\text{i.e. } t = 5 \text{ (or) } -3 \text{ sec})$$

No -ve values for time. so $t = 5 \text{ sec}$

∴ The height of the balloon from ground when stone

reaches the ground is $h = \frac{1}{2}gt^2$

$$\Rightarrow h = \frac{1}{2} \times 10 \times 5^2$$

$$\Rightarrow h = 5 \times 25$$

$$h = 125 \text{ m}$$

(16)

① For a Freely falling body $u=0$; $a=g$

$\therefore$ The ratio of distance travelled by the body in successive sec is $= 1:3:5: \dots (2n-1)$

(ii)

Given $x =$ distance travelled in n^{th} sec.

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

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

In $(n+1)^{\text{th}}$ sec let s be the distance travelled by a freely falling body.

$$\therefore s = u + \frac{g}{2} (2(n+1)-1) \quad [u=0]$$

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

$$\Rightarrow s = \frac{g}{2} (2n+1) \rightarrow \text{②}$$

$$\Rightarrow s = ng + \frac{g}{2}$$

$$\text{From ① } x = \frac{g}{2} (2n) - \frac{g}{2} \Rightarrow x = ng - \frac{g}{2}$$

$$\Rightarrow x + \frac{g}{2} = ng$$

From ② By sub'ing value we get

$$\Rightarrow s = x + \frac{g}{2} + \frac{g}{2}$$

$$\Rightarrow \boxed{s = x + g}$$

$\Rightarrow$ &

(iii) let 'x' be the distance travelled by a FFB in n^{th} sec

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

Here $u=0$; $a=g$

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

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

$$\Rightarrow x = ng - \frac{g}{2} \rightarrow (2) \Rightarrow x + \frac{g}{2} = ng$$

let 's' be distance travelled in $(n-1)^{\text{th}}$ sec

$\therefore$ From (1) $s = 0 + \frac{g}{2} [2(n-1)-1]$

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

$$\Rightarrow s = \frac{g}{2} (2n-3)$$

$$\Rightarrow s = ng - \frac{3g}{2} \rightarrow (3)$$

sub 'ng' value in (3) we get

$$\Rightarrow s = x + \frac{g}{2} - \frac{3g}{2}$$

$$\Rightarrow s = x - \frac{2g}{2}$$

$$\Rightarrow \boxed{s = x - g}$$

$$\boxed{b + x = c}$$