WS-8 - Integrated 8th class

(1)

Trask

(1)

Area under a-t curve given change in velocity

From $0 \to 2$ sec. velocity $= -10 \times 2 = -20$ m/s

$\Delta V_1 = V_2 - V_0 = -20$ m/s. [-ve, velocity is in negative direction]

From $2 \to 4$ sec velocity ΔV_3 $V_3 = 10 \times 2 = 20$ m/s

$\Rightarrow \Delta V_2 = V_3 - V_2 = 20 - 20 = 0$.

$\therefore$ clearly at $t = 2$ sec the body has max velocity

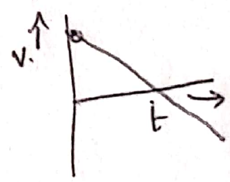
(20 m/s)

(2)

Graph (iii) shows various values of velocity at same point of time (the vertical line at the end) that is not realistic. A, B, and D are possible

(3)

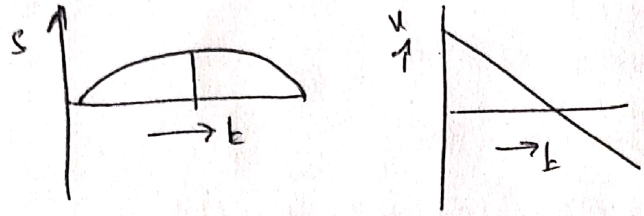
option 'c' correct



Think of the slope of the given s-t graph at different points and you could arrive at the correct answere. As the time increases slope of the graph positively decreases and reaches to zero. After that it again increases but with Negative values.

3rd continuation

So we can conclude that as the time increases velocity decreases in a particular direction and reaches to zero. After that it will again increase in opposite as shown in fig below.



(4)

option B

Area of a-t graph = velocity.

From 0→14 sec.

Area = Area from 0→12 sec − Area under 12→14 sec

⇒ ~~$\frac{1}{2}$~~ Area of trapezium − Area of triangle.

$= \frac{1}{2} \times b(h_1 + h_2) - \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 4 \times (12+6) - \frac{1}{2} \times 2 \times 2$

$\Rightarrow 36 - 2 = 34 \text{ m/s}$

(5)

Area under v-t graph = displacement.

$\Delta x = A_1 - A_2$

0→7 sec.

= Area of trapezium − Area of triangle

$= \frac{1}{2} b_1(h_1 + h_2) + (l_2 \times b_2) + \frac{1}{2} b_3 \times h_3 - \frac{1}{2} b_4 h_4$

$= \frac{1}{2} \times 1(2+6) + (1 \times 4) + \frac{1}{2} \times 4 \times 1 - \frac{1}{2} \times 3 \times 4$

$= 10 - 6 = 4\text{m}$

(6)

$<\text{velocity}>_{AB}$ is & instantaneous velocity at B are in same direction.

y-cordinate of A is $\rightarrow$ 30 cm

x coordinate of B is nearest to 30

it is in between 20 & 30 but close to 30

(7)

Area under v-t graph is = distance or displacement

$0 \rightarrow 6$ sec $= v_1 t_1 + v_2 t_2 + v_3 t_3$

$= 4 \times 2 + 2 \times 2 + 2 \times 2$

$= 8 - 4 + 4 = 8\,m$

Distance $= 8 + 4 + 4 = 16\,m$ [No direction]

(8)

As the ball bounces from horizontal surface velocity decreases with time gradually. After reaching maximum height it falls down and velocity starts increasing with time. gradually

But change in velocity w.r.t time is constant. [for perfect elastic collision]

clearly Graph - 1 $\rightarrow$ velocity

Graph - II $\rightarrow$ Acceleration

(9)

Area under v-t graph = Displacement

From 0→8 sec $= \frac{1}{2}b_1h_1 + b_2h_2 + b_3h_3 + \frac{1}{2}\times b_4 \times h_4 + \frac{1}{2}b_4h_4$

$+ \frac{1}{2}b_5 \times h_5 + b_6 \times h_6 + b_7 \times h_7$

$= \frac{1}{2}\times 1\times 2 + 1\times 2 + 1\times 2 + \frac{1}{2}\times 1\times 6 + \frac{1}{2}\times 1\times 6 - \frac{1}{2}\times 1\times 6$

$+ 1\times(-6) + 6\times 2$

$= 1 + 2 + 2 + 3 + 3 - 3 - 6 + 10.8$

$= 9m$

(10)

From graph

initial position $r_1 = 0$

Final position $r_2 = 20m$

Displacement $= r_2 - r_1 = 20 - 0 = 20m$

$t = 20sec$

$\langle velocity \rangle = \frac{Displacement}{time} = \frac{20}{20} = 1\ m/sec$

(17) (18)

$V_{AB} = \sqrt{V_A^2 + V_B^2 - 2V_AV_B\cos\theta}$

$\theta = 180°$ $\quad |\vec{V_A} - \vec{V_B}| = \sqrt{V_A^2 + V_B^2 - 2V_AV_B\cos 180°} = \sqrt{V_A^2 + V_B^2 - 2V_AV_B(-1)}$

$= \sqrt{V_A^2 + V_B^2 + 2V_AV_B} = \sqrt{(V_A + V_B)^2} = V_A + V_B$

$\theta = 90°$ $\quad |\vec{V_B} - \vec{V_A}| = \sqrt{V_A^2 + V_B^2 - 2V_AV_B\cos 90°} = \sqrt{V_A^2 + V_B^2}$

when two stones are in air, they have same acceleration (g), thus their relative speed remain same.

$\therefore$ From $v^2-u^2=2as$.

Both stones have initial speed ($u=20m/s$), displacement (h) and acceleration (g) are same respectively. Their final speed also same.

mass is same $\Rightarrow$ K.E also same.

time taken by I^{st} stone to reach ground

$$H = -20t_1 + \frac{1}{2}gt_1^2 \rightarrow ① \quad [h = -ut + \frac{1}{2}gt^2]$$

For second stone $\quad H = +20t_2 + \frac{1}{2}gt_2^2 \rightarrow ②$

① - ② given $\quad H - H = -20t_1 + \frac{1}{2}gt_1^2 - 20t_2 - \frac{1}{2}gt_2^2$

$$0 \Rightarrow -(20t_1 + 20t_2) + \frac{1}{2}g(t_1^2 - t_2^2)$$

$$\Rightarrow \overset{4}{\cancel{20}}(t_1+t_2) = \frac{1}{\cancel{2}}\overset{5}{\cancel{g}}(t_1^2 - t_2^2)$$

$$\Rightarrow 4(\cancel{t_1+t_2}) = (t_1-t_2)\cancel{(t_1+t_2)}$$

$$\Rightarrow t_1 - t_2 = 4 \quad \text{Not 2 sec.}$$

option (D) all are correct

⑯

$$V_{AB} = \sqrt{V_A^2 + V_B^2 - 2V_AV_B\cos\theta}$$

For $\theta = 0°$ $\quad V_A - V_B = \sqrt{V_A^2+V_B^2-2V_AV_B\cos 0} = \sqrt{V_A^2+V_B^2-2V_AV_B}$

$$= \sqrt{(V_A-V_B)^{\cancel{2}}} = V_A - V_B$$

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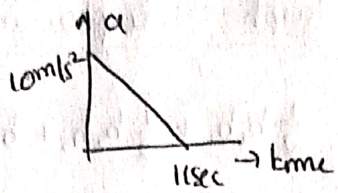

Area under a-t graph
= velocity
$= \frac{1}{2} \times b \times h$
$= \frac{1}{2} \times 11 \times \cancel{10}\ 5$
$= 55\ m/s^2$

LTask

Jee mains level

11

In Portion OA, slope of x-t graph is decreasing
∴ velocity is decreasing.
⇒ Acceleration is −ve.

In portion AB, displacement is constant due to which $v = 0$ ⇒ Acceleration = 0

In Portion BC, slope x-t graph is increasing
∴ velocity is increasing.
⇒ Acceleration is +ve.

In portion CD, slope is 0 due to which $v = 0$
⇒ Acceleration = 0

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option B correct. we know slope of v-t graph is acceleration.

Here Acceleration is −ve and constant for first half, it is +ve and constant over next half.

(13)

Area under v-t graph = displacement

∴ displacement $= \frac{1}{2}b_1h_1 + \frac{1}{2}b_2h_2 + b_3h_3 + \frac{1}{2}b_4h_4 + b_5h_5 + \frac{1}{2}b_6h_6$

$= \frac{1}{2}(2.5)(5) + \frac{1}{2}(2.5)\times 5 + 2.5\times 5 + \frac{1}{2}\times 2.5\times 10$

$+ 2.5\times 15 + \frac{1}{2}\times 2.5\times 10$

$\cancel{7.5 + 9.375 + 46.875\ 37.5} + 12.5$

$\simeq 7.5 + 12.5 + 37.5 + \frac{1}{2}\times 2.5\times 15$

$\simeq 75\,m$

(14)

height = Area under v-t graph

= Area of trapezium

$= \frac{1}{2}\times$ sum of the parallel sides × Distance b/w them

$= \frac{1}{2}(12+8)\times 3.6 = 36\,m$

(15)

$\langle velocity \rangle = \frac{\text{Total distance}}{\text{Total time}}$

Total distance from $O \to A = \frac{1}{2}\times OA \times AC = \frac{1}{2}$

Total distance from $A \to B = \frac{1}{2}\times AB \times AC$

$\tan 60^\circ = \frac{AC}{OA}$

$OA = AC \times \cot 60$

$\tan 30 = \frac{AC}{AB}$

$AB = AC\cot 30$

15 th continues:

$$\frac{\text{Total distance}}{OA} = \frac{1}{2} AC \Rightarrow \langle velocity \rangle \text{ for } OAC$$

and $$\frac{\text{Total distance}}{AB} = \frac{1}{2} AC. = \langle velocity \rangle \text{ for } ABC$$

∴ Ratio of ⟨velocities⟩ same

16

In case of vertically Projected body as time increases velocity decreases during upward motion At maximum height $V=0$. and then the body falls from max height w.r.t time velocity increases but direction is reversed ∴ it reaches the ground with same velocity of projection

option D - correct

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For vertically Projected body

$y = ut - \frac{1}{2}gt^2$ → which is equation of

parabola $y \Rightarrow$ vertical distance or Displacement

20 Take 16 th solution