Q.S-6 7th Foundation +

Thank

(4)

Given $s = 2t - \frac{1}{2} 3t^2$

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

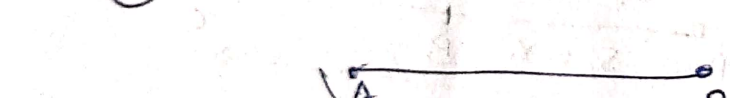
By comparing with $a = -3 \text{ m/s}^2$

(5)

By comparing Given equation with $s = ut + \frac{1}{2} at^2$

clearly $u = 0$

(6)



(6)

$u_A = 15\ m/s$ $\quad v_P = ?$ $\quad a_P = a_Q =$

$u_Q = 20\ m/s$ $\quad v_Q = 30\ m/s$

From $\quad v = u + at$

For P | For Q

$\Rightarrow v_P = 15 + a_P t$

$\therefore v_P = 15 - 10$

$= 5\ m/s$

$v_Q = u_Q + a_Q t$

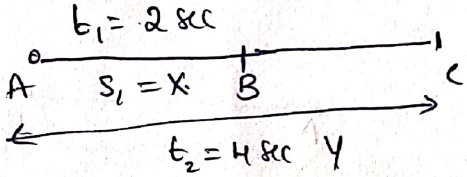
$\Rightarrow 30 = 20 + (a_Q)\, t$

$\Rightarrow 30 = 20 + a_Q t$

$\Rightarrow at = -10\ m/s$

(7)

initial velocity $u = 0$



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

For AB $\Rightarrow$ $\quad x = 0 \times 2 + \frac{1}{2}a(2)^2$

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

$x = 2a.$

For AC

$y = 0 \times 4 + \frac{1}{2}a(4)^2$

$\Rightarrow y = \frac{1}{2}a \times 16 = 8a$

$\Rightarrow y = 2a + 6a$

$\Rightarrow y = x + x$

$y = 4(2a)$

$= 4x$

(8)

Given initial velocity $u = 10$ m/s in time $= 5$ sec

velocity $v = 30$ m/s at what time t'

$v' = 60$ m/s

From $v = u + at$

$\Rightarrow 30 = 10 + a \times 5$

$\Rightarrow 5a = 20$

$\Rightarrow a = 4 \text{ m/s}^2$

$v' = v + at'$

$\Rightarrow 60 = 30 + 4t'$

$\Rightarrow 30 = 4t'$

$\Rightarrow t' = \frac{30}{4} = 7.5$ sec

(9)

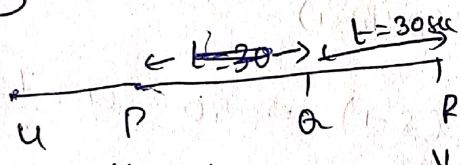
velocity $u = 6$ m/s : $v = 0$; $a = ?$: $s = 3$m

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

$\Rightarrow 0^2 - 6^2 = 2 \times a \times 3$

$\Rightarrow -6^2 = 6a \Rightarrow a = -6 \text{ m/s}^2$

(10)



$V_P = 5$ m/s

$V_R = 40$ m/s

$a = 0.5 \text{ m/s}^2$

From $v = u + at$ For QR

$\Rightarrow V_R = V_Q + 0.5 \times 30$

$\Rightarrow 40 = V_Q + 15 \Rightarrow V_Q = 25$ m/s

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

$\Rightarrow V_Q^2 - u_P^2 = 2(0.5)\,s$

$\Rightarrow (25)^2 - (5)^2 = s$

$\Rightarrow 30 \times 20 = s$

$\Rightarrow s = 600$ m

For R → Q V_Q $S = ut + \frac{1}{2}at^2$

$S = 5 \times 30 + \frac{1}{2} \times 0.5 (30)^2$

$= 150 + \frac{1}{2} \times 0.5 \times 900$

$= 150 + 225$

RQ $= 375$ m

(12)

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

For $n=2$ $\quad S_2 = u + \frac{a}{2}(2(2)-1)$

$S_2 = u + \frac{a}{2}(4-1) \Rightarrow S_2 = u + \frac{3a}{2}$

For $n=1$ $\quad S_1 = u + \frac{a}{2}(2(1)-1)$

$= u + \frac{a}{2}(2-1) \Rightarrow u + \frac{a}{2}$.

(14), (15), (16)

$n_1 = 2 \rightarrow S_1 = 10\ m$. let u be the initial velocity

$n_2 = 4^{th} \rightarrow S_2 = 20\ m$ a be the acceleration.

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

For $n_1=2 \rightarrow 10 = u + \frac{a}{2}(2(2)-1) \Rightarrow 10 = u + \frac{a}{2}(4-1)$

$\Rightarrow 10 = u + \frac{3}{2}a \rightarrow (1)$

For $n_2 = 4$ $\quad 20 = u + \frac{a}{2}(2(4)-1)$

$\Rightarrow 20 = u + \frac{a}{2}(8-1) \Rightarrow 20 = u + \frac{7}{2}a \rightarrow (2)$

By solving (1) & (2) we get $\quad 10 = u + \frac{3a}{2}$

$20 = u + \frac{7a}{2}$

$\Rightarrow -10 = -\frac{4a}{2} \Rightarrow 2a = 10$

$\Rightarrow a = 5\ m/s^2$

sub 'a' value in (1) we get

$10 = u + \frac{3}{2} \times 5$

$\Rightarrow 10 = u + 7.5 \Rightarrow u = 10 - 7.5$

$= 2.5\ m/s$

For $n=5^{th}$

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

$$\Rightarrow S = 2.5 + \frac{5}{2}(2(5)-1)$$

$$= 2.5 + \frac{5}{2} \times 9$$

$$= 2.5 + (2.5) \times 9$$

$$\Rightarrow 25 \text{ m}$$

(17)

Given $u = 2$ m/s ; acceleration $a = 2$ m/s^2

time $t = 5$ sec

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

$$\Rightarrow S = 2 \times 5 + \frac{1}{2} \times 2 \times 5^2$$

$$= 10 + 25 = 35 \text{ m}$$

(18)

initial velocity $u = 15$ m/s

Final velocity $v = 5$ m/s ; Displacement $= 10$m

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

$$\Rightarrow 5^2 - 15^2 = 2 \times a \times 10$$

$$\Rightarrow (5+15)(5-15) = 20a$$

$$\Rightarrow 20 \times (-10) = 20a$$

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

(19)

Let the initial velocity $u = 0$

Final velocity $v = 72$ kmph

$= 72^{4} \times \frac{5}{18} = 4 \times 5 = 20$ m/s

Time $= 5$ min $= 5 \times 60$ sec.

(or) $5 \times \frac{1}{60} = \frac{1}{12}$ hrs.

$\therefore$ From $s = ut + \frac{1}{2} a t^2$

$\Rightarrow s = 0 \times \frac{1}{12} + \frac{1}{2} \times 72 \times \left(\frac{1}{12}\right)^2 (12)$

From $v = u + at$ $\Rightarrow s = \frac{1}{2} \times \frac{72^{6}}{12} = 3$ km

$\Rightarrow 72 = 0 + a \times \frac{1}{12}$

$\Rightarrow a = 72 \times 12$

(20)

Initial velocity $u = 72$ kmph ; final velocity $v = 18$ kmph

distance $s = 20$ m $\quad u = 5$ m/s

(a) $u = 72^{4} \times \frac{5}{18}$

$= 20$ m/sec.

(d) Acceleration $= \frac{v^2 - u^2}{2s} = \frac{5^2 - 20^2}{2 \times 20} = \frac{5}{25 \times (-15)}$

$= -\frac{75}{8} = -9.375$ m/s^2

(b) Time $= \frac{v - u}{a} = \frac{5 - 20}{\left(-\frac{75}{8}\right)} = \frac{-15 \times 8}{-75} = \frac{8}{5} = 1.6$ sec

(c) From $v^2 - u^2 = 2as \Rightarrow 0^2 - (20)^2 = 2\left(-\frac{75}{8}\right) \times s$

$\Rightarrow +400 = +\frac{150}{8} \times s \Rightarrow s = \frac{64}{3}$

$= 21.33$ m.

L Task

Jee mains level

(1)

Given $V = 5 + 8t$

After 5 sec $V = 5 + 8 \times 5$

$\Rightarrow V = 5 + 40 = 45$ m/s

(2)

Initial velocity $u = 25$ m/s

Final velocity $V = 0$ ∴ distance $S = 80$m

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

$\Rightarrow 0^2 - (25)^2 = 2 \times a \times 80$

$\Rightarrow -625 = 2 \times 80 \times a \Rightarrow a = -\frac{625}{160} = -\frac{62.5}{16} = -3.9$ m/s^2

(3)

Initial velocity $u = 300$ cm/s $= 3$ m/s

Acceleration $a = 300$ cm/s^2 $= 3$ m/s^2

Time $t = 3$ sec.

∴ From $S = ut + \frac{1}{2}at^2$

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

$= 9 + \frac{3}{2} \times 9$

$= 9 + 13.5$

$= 22.5$ m.

(4)

initial speed $u = 15$ m/s

$V = 0$

distance $s = 3$ m

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

$\Rightarrow 0^2 - (15)^2 = 2 \times a \times 3$

$\Rightarrow -15 \times 15 = 2 \times 3 \times a$

$\Rightarrow a = \frac{-75}{2} = -37.5$ m/s^2

(5)

Particle is starting from rest $u = 0$

For $n = 1$

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

$$\Rightarrow S_1 = 0 + \frac{a}{2}(2(1)-1)$$

$$\Rightarrow S_1 = \frac{a}{2}(2-1) = \frac{a}{2}$$

For $n = 3$

$$S_3 = 0 + \frac{a}{2}(2(3)-1)$$

$$= \frac{a}{2}(6-1)$$

$$\Rightarrow S_3 = 5\frac{a}{2}$$

$$\therefore \frac{S_1}{S_3} = \frac{\frac{a}{2}}{\frac{5a}{2}} = \frac{1}{5}$$

(6)

Given $u = 36$ kmph $= 36 \times \frac{5}{18} = 10$ m/s ; $V = 0$; $a = -4$ m/s^2.

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

$\Rightarrow 0^2 - 10^2 = 2(-4)s$

$\Rightarrow -100 = -8s$

$\Rightarrow s = \frac{100}{8} = 12.5$ m

⑦

$u = 10\ m/s$; $a = 10\ m/s^2$; $s = 3\ m$.

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

$\Rightarrow v^2 - 10^2 = 2 \times 10 \times 3$

$\Rightarrow v^2 - 100 = 60 \Rightarrow v = \sqrt{160} = 12.64\ m/s$

⑧

$u = 54\ kmph = 54 \times \frac{5}{18}$; $a = -0.4\ m/s^2$

$= 15\ m/s$ $v = 0$; $s = ?$

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

$\Rightarrow 0^2 - (15)^2 = 2(-0.4)s$

$\Rightarrow +225 = +0.8\ s \Rightarrow s = \frac{225}{0.8} = \frac{2250}{8} = 281.25\ m$

⑨

Given average velocity $\langle v \rangle = \frac{v+u}{2} = 0.34\ m/s$

change in velocity $v - u = 0.18\ m/s$.

distance $s = 0.06\ m$.

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

$\Rightarrow (v+u)(v-u) = 2 \times a \times s \Rightarrow a = \frac{(v+u)}{2} \frac{(v-u)}{s}$

$= 0.34 \times \frac{0.18}{0.06} = 1.02\ m/s^2$

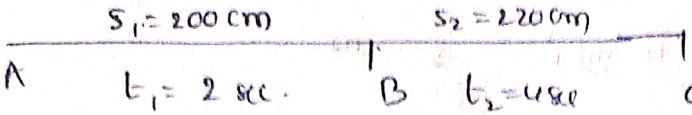
⑩

$u = 4\ m/s$; $a = 6\ m/s^2$, $n = 10$ sec

$s = u + \frac{a}{2}(2n-1)$ $\Rightarrow s = 4 + 3(19)$

$s = 4 + \frac{6}{2}(2(10)-1)$ $s = 61\ m$

(14), (15), (16)



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

For AB

$S_1 = 2u + \frac{1}{2}a(2)^2$

$\Rightarrow 200 = 2u + 2a$

$\Rightarrow a + u = 100 \rightarrow (1)$

For AC

$S_1 + S_2 = u(6) + \frac{1}{2}a(6)^2$

$\Rightarrow 420 = 6u + \frac{1}{2}a \times 36$

$\Rightarrow 70 = u + 3a. \rightarrow (2)$

By solving (1) & (2) we get

$$\begin{array}{r} u + a = 100 \\ u + 3a = 70 \\ \hline -2a = 30 \end{array}$$

$\Rightarrow a = -15 m/s^2$

From (1)

$-15 + u = 100$

$\Rightarrow u = 115$ cm/sec.

Velocity at the end of 7th sec

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

$$= 115 + \frac{(-15)}{2}(2(7)-1)$$

$$= 115 - \frac{15}{2} \times 13$$

$$\simeq 10m$$

(17)

$u = 0$; $a = 4 m/s^2$; $t = 10$ sec.

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

$= 0 \times 10 + \frac{1}{2} \times 4 \times 10^2$

$= 0 + 2 \times 100$

$S = 200 m$

(18) $a = 2 m/s^2$, $u = 10 m/s$, $t = 4$ sec

$V = u + at$

$V = 10 + 2 \times 4$

$= 18$ m/s.