7th cws-5 – Advanced

Thank

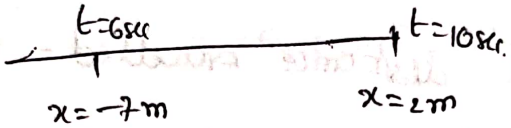
(1)

Given speed = 144 kmph = $144 \times \frac{5}{18}$ = 40 m/s

time = 5 sec.

distance = speed × time = 40 × 5 = 200 m → A

(2)



Total distance = 9 m.

Total time = 4 sec.

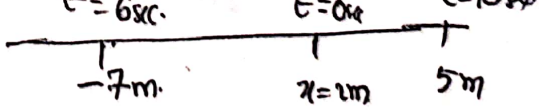
$\langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}}$

$= \frac{9}{4} = 2.25$ m/s → B

(3)

at $t_1 = 0$ sec → $x = 5$ m

$t_3 = 10$ sec. $x = 2$ m.



Total displacement = $-5 + 2 = -3$ m.

Total time = 10 sec

$\langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}} = \frac{3}{10} = 0.3$ m/s → C.

Scanned with OKEN Scanner

④

Given $u = 70$ m/s ; $v = 80$ m/s

$$\langle \text{velocity} \rangle = \frac{v+u}{2} = \frac{70+80}{2} = \frac{150}{2} = 75 \text{ m/s} \rightarrow$$

⑤

$d_1 = 6$ km $\rightarrow t_1 = 18$ min

$d_2 = 3$ km $\rightarrow t_2 = 12$ min

$d_3 = 1$ km $\rightarrow t_3 = 10$ min

Total distance travelled $= d_1 + d_2 + d_3$

$= 6\text{km} + 3\text{km} + 1\text{km}$

$= 10$ km.

Total time $= t_1 + t_2 + t_3 = 18 + 12 + 10 = 40$ min

$$\langle \text{velocity} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{10}{40} = 0.25 \text{ km per min}$$

$\rightarrow D$

⑥

$u = 0 \rightarrow v = 72$ km ph $= 72 \times \frac{5}{18} = 20$ m/s ; $s = 40$ m

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

$\Rightarrow 20^2 - 0^2 = 2(a)(40)$

$\Rightarrow \frac{400}{10} = 2 \times 40\ a$

$\Rightarrow a = \frac{10}{2} = 5 \text{ m/s}^2 \rightarrow A$

Scanned with OKEN Scanner

(6)

Given $u = 54$ kmph ; $a = -2\ m/s^2$

$v = 86$ kmph.

$\Rightarrow u = 54 \times \frac{5}{18}\ m/s = 15\ m/s$; $v = 86 \times \frac{5}{18} = 10 m/s$

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

$\Rightarrow (v+u)(v-u) = 2as$

$\Rightarrow (54+86)\times\frac{5}{18}\,(86-54)\times\frac{5}{18} = 2 \times (-2) \times s$

$\Rightarrow 140 \times \frac{25}{18 \times 18} \times 32 = 4s$

$\Rightarrow s = \frac{50 \times 140}{81}\ m =$

(7)

Given

$u = 54$ kmph

$= 54 \times \frac{5}{18} = 3 \times 5$

$= 15\ m/s$

$v = 36$ kmph

$= 36 \times \frac{5}{18}$

$= 10\ m/s$

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

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

$\Rightarrow (10^2 - 15)^2 = 2(-2)s$

$\Rightarrow -125 = -4s$

$s = \frac{125}{4} = 31.25 m \rightarrow A$

Scanned with OKEN Scanner

(8)

$u = 72$ kmph $\Rightarrow v = 0$; $t = 3$ sec.

$\Rightarrow 72 \times \frac{5}{18}$

$\Rightarrow 20$ m/s

From $v = u + at$

$\Rightarrow 0 = 20 + 3a$

$\Rightarrow a = -\frac{20}{3} = -6.67 \text{ m/s}^2$. $\rightarrow c$

(9)

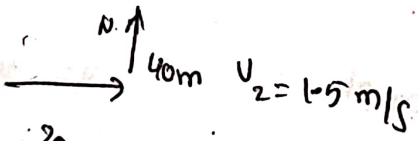
$d = 800$m ; $u = 0$; $a = 8 \text{ m/s}^2$

From $v^2 = 2as$

$\Rightarrow u^2 = 2 \times 8 \times 800$

$\Rightarrow u = 80\sqrt{2}$ m/s $\rightarrow D$

(10)



$t_1 = \frac{d}{v_1} = \frac{30}{2} = 15$ sec

$t_2 = \frac{d}{v_2} = \frac{40}{1.5} = \frac{400}{15} = 26.67$ sec

$|\text{velocity}| = \frac{\text{Total distance}}{\text{Total time}} = \frac{30\hat{i} + 40\hat{j}}{15 + 26.67}$

$\Rightarrow \frac{\sqrt{30^2 + 40^2}}{41.67} = \frac{50}{41.67} = 1.19 \simeq 1.2 \simeq \frac{6}{5}$ m/s

Scanned with OKEN Scanner

(14) (13)

In one hour the minute hand completes one rotation

$\therefore$ displacement = 0

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

$= 0$

(15)

$s_1 = 29\,m \rightarrow t_1 = 5\,sec.$

$s_2 = 55\,m \rightarrow t_2 = 14\,sec.$

$\langle \text{velocity} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{29+55}{5+14} = \frac{84}{19} = 4.42\ m/s$

If $u = 0$

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

$\Rightarrow 29 = 0 \times 5 + \frac{1}{2}a(5)^2$

$\Rightarrow 29 = \frac{25}{2}a \Rightarrow a = \frac{58}{25} = 2.32\ m/s^2$

(16)

Given

$u_1 = 50$ kmph $\rightarrow s_1 = 6m \rightarrow v = 0.$

$u_2 = 100$ kmph $\rightarrow s_2 = ?$

From $s \propto u^2$

$\Rightarrow \frac{s_2}{s_1} = \left[\frac{u_1}{u_2}\right]^2 \Rightarrow \frac{6}{s_2} = \frac{1}{4}$

$\Rightarrow \frac{s_1}{s_2} = \left[\frac{50}{100}\right]^2 \Rightarrow s_2 = 24m$

Scanned with OKEN Scanner

(17)

$u=0 \rightarrow v = 108$ kmph $\rightarrow t = 15$ sec

$= 108 \times \frac{5}{18}$

$= 30$ m/s

From $v = u + at \rightarrow 30 = 0 + a \times 15$

$\rightarrow 30 = 15a$

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

(18)

Given $u = 24$ m/s ; $a = 0.5 \text{ m/s}^2$; $t = 4$ sec.

From $s = ut + \frac{1}{2}at^2 = 24 \times 4 + \frac{1}{2} \times 0.5 \times 4^2$

$= 96 + \frac{1}{2} \times 0.5 \times 16 = 96 + 4 = 100$m

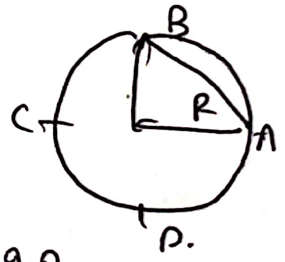
(19)

Given $t = 4$ sec.

(a)

Average velocity for $\frac{1}{2}$ rotation

$= \frac{\text{Displacement}}{\text{time}} = \frac{2R}{2} = R \rightarrow g$



(b)

$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{time}} = \frac{\pi R}{2} \rightarrow h.$

(c)

Acceleration $= \frac{\langle \text{velocity} \rangle}{\text{time}} = \frac{R}{2} \rightarrow f$

(b)

Acceleration $= \frac{\sqrt{2}R}{1} = \sqrt{2}R \rightarrow h$ [For $\frac{1}{4}^{th}$ rotation

Velocity = Displacement

CTask

CUQ

(2)

Total distance covered = 2cm + 1.5cm + 2.5cm + 3cm

= 10cm.

Total time = 4 sec

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{10}{4} = 2.5 \text{ cm/sec}$$

(3)

Given $d_1 = 40\text{km} \rightarrow t_1 = 1\text{hr}$

$d_2 = 10\text{km} \rightarrow t_2 = 15\text{min} = \frac{15}{60}\text{hr} = \frac{1}{4}\text{hr}$

$$v_1 = \frac{d_1}{t_1} = \frac{40}{1} = 40\text{kmph} \quad ; \quad v_2 = \frac{10}{\frac{1}{4}} = 40\text{kmph}$$

Since $v_1 = v_2$ then the body is in uniform motion

(4)

Given $R = 200$; $t = 5\text{min} = 5 \times 60 = 300\text{sec}$.

Total distance for half revolution = πR

$$= \frac{22}{7} \times 200$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{\frac{22}{7} \times 200}{300} =$$

$$= \frac{44}{21} \text{ m/s}$$

Scanned with OKEN Scanner

SAQ's

(1)

$u_1 = 60$ kmph $\rightarrow s_1 = 20$ m.

$u_2 = 120$ kmph $\rightarrow s_2 = ?$

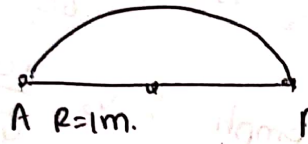
From $s = \frac{v^2}{2a} \Rightarrow s \propto v^2$

$\Rightarrow \frac{s_1}{s_2} = \left[\frac{u_1}{u_2}\right]^2$

$\Rightarrow \frac{20}{s_2} = \left[\frac{60}{120}\right]^2 = \left[\frac{1}{2}\right]^2$

$\Rightarrow \frac{20}{s_2} = \frac{1}{4} \Rightarrow s_2 = 80$ m $\rightarrow$ D

(2)



$t = 1$ sec.

Displacement $= 2r = 2(1) = 2$ m.

$\langle$ velocity $\rangle = \frac{\text{Displacement}}{\text{time}} = \frac{2}{1} = 2$ m/s

(3)

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

Distance covered by the body $s = ut + \frac{1}{2}at^2$

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

$= 0 + 20 = 20$ m

(4)

$u_1 = 24$ m/s ; $u_2 = 36$ m/s.

$s \propto u^2$

$\Rightarrow \frac{s_1}{s_2} = \left[\frac{u_1}{u_2}\right]^2 = \frac{s_1}{s_2} = \left[\frac{24}{36}\right]^2 = \left[\frac{2}{3}\right]^2 = \frac{4}{9}$.

Scanned with OKEN Scanner

(5)

$u = 10 m/s$; $t = 5 sec$ $v = 20 m/s$

3 sec earlier velocity $v' = u + a \times t'$ $(t' = 3 sec)$ → (1)

From $v - u = at$ for 5 sec

$\Rightarrow 20 - 10 = 5a$

$\Rightarrow a = \frac{10}{5} = 2 m/s^2$

From (1) $v' = 10 + 2 \times 3 = 10 + 6 = 16 m/s$

(6)

Given $u_A = 0 \rightarrow a_1$ $t_1 = 2 sec$.

$u_B = 0 \rightarrow a_2$.

Given displacement of A & B in 5^{th} sec is same.

$S_A = S_B$

$\Rightarrow u_A + \frac{a_A}{2}(2n-1) = u_B + \frac{a_B}{2}(2n-1)$

$\Rightarrow \frac{a_A}{2}(2(5)-1) = \frac{a_B}{2}(2(5)-1)$

$\Rightarrow a_A = a_B \Rightarrow \frac{a_A}{a_B} = \frac{1}{1}$

(7)

From $A \rightarrow B \rightarrow C$.

Displacement = length of diagonal

$= \sqrt{2} \times side = \sqrt{2}\, l$

$\langle velocity \rangle = \frac{\text{Total displacement}}{\text{time}} = \frac{\sqrt{2}\, l}{t}$.

Scanned with OKEN Scanner

(8)

$V_1 = 20$ kmph ; $V_2 = 40$ kmph ; $V_3 = 80$ kmph

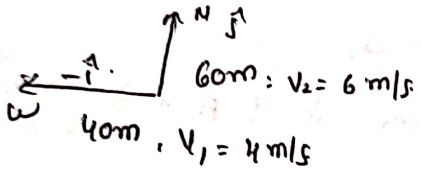
$$\langle \text{speed} \rangle = \frac{3 V_1 V_2 V_3}{V_1 V_2 + V_2 V_3 + V_3 V_1}$$

$$= \frac{3 \times 20 \times 40 \times 80}{20 \times 40 + 40 \times 80 + 80 \times 20}$$

$$= \frac{3 \times 800 \times 80}{800 + 3200 + 1600} = \frac{3 \times 800 \times 80}{5600/7}$$

$$= \frac{240}{7} = 34 \text{ kmph}$$

(9)



Total time $= \frac{S_1}{V_1} + \frac{S_2}{V_2}$.

$= \frac{40}{4} + \frac{60}{6} = 20$ sec

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

$= \frac{60\hat{i} + (-40\hat{j})}{20} = \frac{100}{20} = 5$ m/s.

(10)

Given $S = 1.5t - 4.8t^2$.

Initial velocity at $t = 0$ $\quad u = \frac{ds}{dt} = \frac{d}{dt}[1.5t - 4.8t^2]$

$= 1.5 - 4.8 \frac{d}{dt}(t^2)$

$= 1.5 - 4.8[2t] = 1.5 - 9.6t$

$= 1.5 - 9.6(0)$

$= 1.5$ m/s.

Scanned with OKEN Scanner

$$u = 1.5 - 9.6t$$

Acceleration $= \frac{du}{dt} = \frac{d}{dt}[1.5 - 9.6t]$

$$= \frac{d}{dt}(1.5) - 9.6\frac{dt}{dt}$$

$$= 0 - 9.6 = -9.6 \text{ m/s}^2.$$

(15)

Given $u = 0$ $\therefore a = 2 \text{ m/s}^2$ $\therefore v = 72 \text{ kmph} = 72 \times \frac{5}{18} = 20 \text{ m/s}$

From $v = u + at$

$$\Rightarrow 20 = 0 + 2t \Rightarrow 2t = 20 \Rightarrow t = 10 \text{ sec}.$$

Velocity at the end of 7th sec

$$v = u + at = 0 + 2 \times 7 = 14 \text{ m/s}.$$

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

$$\Rightarrow (20)^2 - 0^2 = 2 \times 2 \times s$$

$$\Rightarrow 400 = 4s \Rightarrow s = 100 \text{ m}$$

(16)

Given ~~u=0~~ $u = 6 \text{ m/sec}$. $\therefore a = 3 \text{ m/s}^2$ $\therefore n = 4^{th} \text{ sec}$

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

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

$$= 6 + \frac{3}{2} \times 7$$

$$= 6 + \frac{21}{2} = 6 + 10.5 = 16.5 \text{ m}$$

Scanned with OKEN Scanner

(17)

Given $v_1 = 30$ m/sec ; $v_2 = 50$ m/sec

If a body covers $\frac{1}{3}$rd of distance with v_1 & $\frac{2}{3}$rd of distance with speed v_2

$$\text{speed} = \frac{3v_1v_2}{2v_1 + v_2} = \frac{3 \times 30 \times 50}{2 \times 30 + 50}$$

$$= \frac{90 \times 50}{60 + 50} = \frac{90 + 50}{110} = \frac{450}{11}$$

$$= 40.98 \text{ m/s}$$

(18)

Given

$u = 0$; $v = 10$ m/s ; $t = 4$ sec

(a) initial velocity $u = 0$.

(b) acceleration $a = \frac{v-u}{t} = \frac{10-0}{4} = \frac{10}{4} = 2.5 \text{ m/s}^2$

(c) $S_n = u + \frac{a}{2}(2n-1) = 0 + \frac{2.5}{2}(2(3)-1) = 0 + \frac{2.5 \times 5}{2}$

$$S_n = 6.25 \text{ m}$$

(d) distance travelled $s = ut + \frac{1}{2}at^2 = 0 \times 4 + \frac{1}{2} \times 2.5 \times 4^2$

$$= 0 + \frac{1}{2} \times 2.5 \times 16$$

$$= 2.5 \times 8$$

$$= 20 \text{ m}$$

Scanned with OKEN Scanner