9th foundation — ws-2

Task

①

$u = 0$; $v = 144$ kmph ; $t = 5$ sec

$= 144 \times \frac{5}{18}$ m/s

$= 40$ m/s

∴ From $v = u + at$ $\Rightarrow 40 = 0 + 5a$

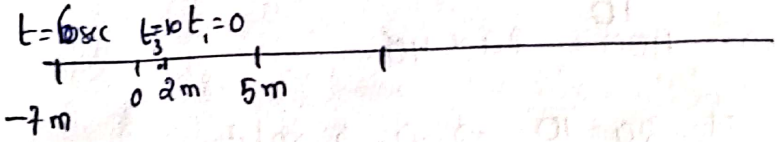
$\Rightarrow 40 = 5a \Rightarrow a = 8\ m/s^2$

∴ From $s = ut + \frac{1}{2}at^2$

$\Rightarrow s = 0 \times 5 + \frac{1}{2} \times 8 \times 5^2$

$\Rightarrow s = 0 + 4 \times 25 = 100$ m

②, ③



$\langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}} = \frac{2(-)(-7)}{4} = \frac{9}{4} = 2.25$ m/s

between 0 and 10 sec $\langle \text{velocity} \rangle = \frac{2-5}{10} = -\frac{3}{10} = -0.3$ m/s

④

initial velocity $u = 70$ m/s ; Final velocity $v = 80$ m/s

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

Scanned with OKEN Scanner

(5)

$S_1 = 6$ km, $t_1 = 18$ min ; $S_2 = 3$ km in $t_2 = 12$ min

$S_3 = 1$ km in $t_3 = 10$ min.

$$\therefore \quad \langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{S_1 + S_2 + S_3}{t_1 + t_2 + t_3}$$

$$= \frac{6+3+1}{18+12+10} = \frac{10}{40} = 0.25 \text{ m/s.}$$

(6)

Initial velocity $u = 0$ $\therefore v = 72 \times \frac{5}{18} = 20$ m/s.

$S = 40$ m.

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

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

$$\Rightarrow 400 = 2a \times 40$$

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

(7)

$u = 54$ kmph $\rightarrow v = 86$ kmph . $a = -2$ m/s^2.

$= 54 \times \frac{5}{18}$ $= 86 \times \frac{5}{18}$

$= 15$ m/s $= 4.6 \times 5$

$= 23$ m/s.

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

$$\Rightarrow (15)^2 - (23)^2 = 2(-2)S$$

$$\Rightarrow (15+23)(15-23) = -4S$$

$$\Rightarrow 38 \times (-8) = -4S$$

$$S = 76 \text{ m.}$$

Scanned with OKEN Scanner

(8)

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

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

$= 20$ m/s

From, $a = \frac{v-u}{t}$

$\Rightarrow a = \frac{0-20}{3} = -\frac{20}{3} = -6.67$ m/s^2

(9)

Given $u = 0 \quad ; S = 800$m

$a = 8$ m/s^2

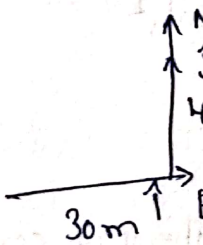
From $v^2 - u^2 = 2as$

$\Rightarrow v^2 - 0^2 = 2 \times 8 \times 800$

$\Rightarrow v^2 = 2 \times 6400$

$\Rightarrow v = \sqrt{2 \times 6400} = 80\sqrt{2}$ m/s.

(10)



$V_1 = 2$ m/sec

Total time $= \frac{30}{V_1} + \frac{40}{V_2}$

$\Rightarrow \frac{30}{2} + \frac{40}{1.5}$

$\Rightarrow \frac{30}{2} + \frac{80}{3}$

$= \frac{250}{6}$ sec.

<velocity> $=$ $\frac{\text{Total displacement}}{\text{Total time}}$

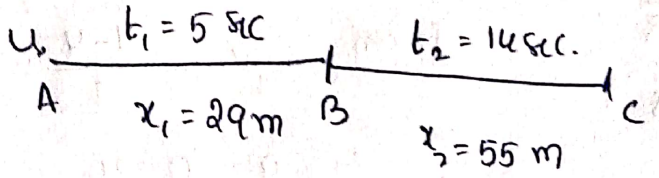
$= \frac{30\hat{i} + 40\hat{j}}{\frac{250}{6}} = \frac{\sqrt{(30)^2 + (40)^2}}{\frac{250}{6}}$

$= \frac{50}{250} \times 6 = \frac{6}{5}$ m/s

Scanned with OKEN Scanner

(15), (16)

let 'u' be the initial velocity



$$\text{<velocity>} = \frac{\text{Total displacement}}{\text{Total time.}} = \frac{29+55}{5+14}$$

$$= \frac{84}{19} = 4.42 \text{ m/sec.}$$

If the body starts from rest $u = 0$ in $t = 5$ sec.

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

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

$$\Rightarrow 29 = \frac{a}{2} \times 25$$

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

(16)

If $u_1 = 50$ kmph $\rightarrow s_1 = 6$ m

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

The car coming to stop (i.e) $v = 0$

From $v^2 - u^2 = 2as \Rightarrow 0^2 - u^2 = 2as$

$$\Rightarrow u^2 \propto s$$

$$\Rightarrow \left(\frac{u_1}{u_2}\right)^2 = \frac{s_1}{s_2} \Rightarrow \left[\frac{50}{100_2}\right]^2 = \frac{6}{s_2}$$

$$\Rightarrow \frac{1}{4} = \frac{6}{s_2}$$

$$\Rightarrow s_2 = 24 \text{ m.}$$

Scanned with OKEN Scanner

(17)

$u = 0$; $V = 108$ kmph ; $t = 15$ sec

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

$= 30$ m/sec

From $a = \frac{V-u}{t} = \frac{30-0}{15} = \frac{30}{15} = 2$ m/s^2

(18)

$u = 24$ m/s ; $a = 0.5$ m/s^2 ; $t = 4$ sec

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

$\Rightarrow s = 24 \times 4 + \frac{1}{2} \times 0.5 \times (4)^2$

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

$= 96 + 4 = 100$m

(19)

Total time $T = 4$ sec. ; Radius .

for Half rotation Distance = Path length $= \frac{1}{2} \times$ circumference

$= \frac{1}{2} \times 2\pi R = \pi R$.

Displacement = Diameter $= 2R$.

Time = 2sec.

$\langle$speed$\rangle = \frac{\text{Distance}}{\text{Time}} = \frac{\pi R}{2}$; $\langle$velocity$\rangle = \frac{\text{Displacement}}{\text{Time}}$

$= \frac{2R}{2} = R$.

Acceleration $= \frac{\text{velocity}}{\text{time}} = \frac{R}{2}$

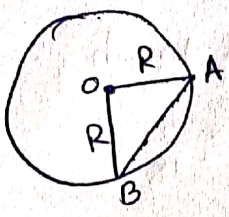
For $\frac{1}{4}^{th}$ rotation Distance

~~Displacement~~ $= \frac{1}{4} \times$ circumference

$= \frac{1}{4} \times 2\pi R = \frac{\pi R}{2}$

Scanned with OKEN Scanner

19th continuation



Displacement = $AB = \sqrt{R^2+R^2} = \sqrt{2}\,R$

$\langle velocity \rangle = \frac{\text{Displacement}}{\text{time}}$

$= \frac{\sqrt{2}\,R}{1}$.

Acceleration = $\frac{\text{velocity}}{\text{time}} = \frac{\sqrt{2}\,R}{1} = \sqrt{2}\,R$.

L Task

SAQ's

(1)

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

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

Here the car coming to rest (i-e) $V = 0$.

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

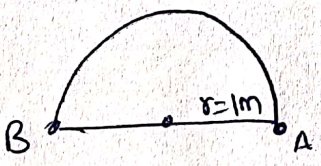
$\Rightarrow 0^2 - u^2 = 2as \Rightarrow -u^2 = 2as$

$\Rightarrow u^2 \propto s$

$\Rightarrow \frac{s_2}{s_1} = \left[\frac{u_2}{u_1}\right]^2 \Rightarrow \frac{s_2}{20} = \left[\frac{120}{60}2\right]^2$

$\Rightarrow \frac{s_2}{20} = 2^2 \Rightarrow s_2 = 20 \times 2^2 = 80$m

(2)



time = 1 sec

Displacement = Diameter = $2r$

$= 2$

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

$= 2$ m/sec.

Scanned with OKEN Scanner

③ $u=0 \;:\; a = 10\ m/s^2$

Given that distance (s) covered by the body in $t_1 = 2$ sec is equal to distance (s') covered in next sec.

From $s = ut_1 + \frac{1}{2}at_1^2$

$\Rightarrow s = 0 \times (2) + \frac{1}{2} \times 10 (2)^2$

$\Rightarrow s = 0 + 10 \times 2 = 20 + 0 = 20\ m.$

④

We know that $v^2 - u^2 = 2as$ when car coming to stop $v = 0$

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

$\Rightarrow -u^2 = 2as \Rightarrow s \propto u^2$

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

⑤

let initial velocity $u = 10\ m/s$.

After $t = 5$ sec velocity $v = 20\ m/s$.

velocity of a Particle before 3 sec means After 2 sec from starting

$v' = u + at$

$\Rightarrow v' = 10 + 2 \times 2$

$= 10 + 4$

$= 14\ m/sec$

in 5 sec $v = 20$

$v = u + at$

$\Rightarrow 20 = 10 + 5a$

$\Rightarrow 10 = 5a$

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

Scanned with OKEN Scanner

$$\therefore \quad u_A t_A + \frac{1}{2} a_A t_A^2 = u_B t_B + \frac{1}{2} a_B t_B^2$$

$$\Rightarrow \quad 0 \times 5 + \frac{1}{2} a_1 (5)^2 = 0 \times 3 + \frac{1}{2} a_2 (3)^2$$

$$\Rightarrow \quad \frac{a_1}{2}(25) = \frac{a_2}{2}(9)$$

(6) $u_A = u_B = 0$; Here B starts 2 sec later than A

Distance travelled in 5^{th} sec by A = Distance travelled by B in 3^{rd} sec

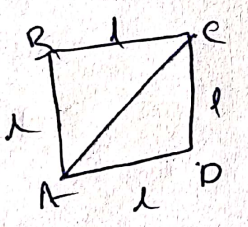
$$\therefore \quad u_A + \frac{a_1}{2}(2n_1 - 1) = u_B + \frac{a_2}{2}(2n_2 - 1)$$

$$\Rightarrow \quad 0 + \frac{a_1}{2}(2\times 5 - 1) = 0 + \frac{a_2}{2}(2\times 3 - 1)$$

$$\Rightarrow \quad \frac{a_1}{2}(10-1) = \frac{a_2}{2}(6-1)$$

$$\Rightarrow \quad a_1 \times 9 = a_2 \times 5 \quad \Rightarrow \quad \frac{a_1}{a_2} = \frac{5}{9}$$

(7)



From A → C Displacement = length of diagonal

$$= \sqrt{l^2 + l^2} = \sqrt{2}\, l$$

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

Scanned with OKEN Scanner

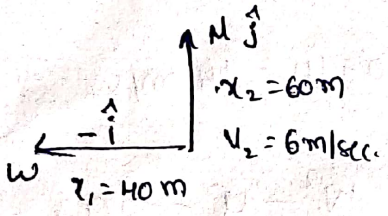
(8)

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

$$\langle \text{speed} \rangle = \frac{3V_1V_2V_3}{V_1V_2 + V_2V_3 + V_3V_1} = \frac{3 \times 20 \times 40 \times 80}{20 \times 40 + 40 \times 80 + 80 \times 20}$$

$$= \frac{60 \times 3200}{800 + 3200 + 1600} = \frac{60 \times \cancel{3200}^{\,4}}{\cancel{5600}^{\,7}} = \frac{240}{7} \simeq 34 \text{ kmph}$$

(9)



$$\text{Total time} = \frac{x_1}{V_1} + \frac{x_2}{V_2}$$

$$\Rightarrow \frac{40}{4} + \frac{60}{6} = 10 + 10 = 20 \text{ sec}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{60+40}{20} = \frac{100}{20}$$

$$= 5 \text{ m/s}$$

(10)

Distance travelled $s = 1.5t - 4.8t^2$

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

$u = 1.5$ m/s ; $\frac{a}{2} = -4.8$

$\Rightarrow a = -9.6$ m/s^2

Scanned with OKEN Scanner

(15)

$a = 2\ m/s^2$; $v = 72$ kmph $= 72 \times \frac{5}{18} = 20$ m/sec.

$u = 0$.

From $v = u + at$.

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

Velocity at the end of 7th sec.

$v = u + a \times t$

$v = 0 + 2 \times 7 = 0 + 14 = 14$ m/sec.

displacement $s =$? $v^2 - u^2 = 2as$

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

$\Rightarrow 400 - 0 = 4s$

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

(16)

Initial velocity $u = 6$ m/sec.

$a = 3\ m/s^2$; $n = 4$

$S_n = u + \frac{a}{2}(2n-1) = 6 + \frac{3}{2}(2(4)-1)$

$S_n = 6 + \frac{3}{2} \times 7 = 6 + 10.5 = 16.5$ m

(17)

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

$\text{<speed>} = \frac{3 v_1 v_2}{2v_1 + v_2} = \frac{3 \times 30 \times 50}{2 \times 30 + 50} = \frac{3 \times 1500}{60 + 50} = \frac{3 \times 1500}{110}$

$= \frac{450}{11} = 40.98$ m/sec.

Scanned with OKEN Scanner