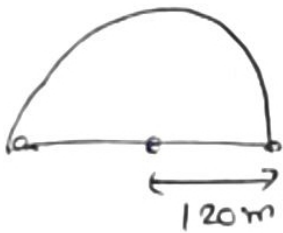


Task

① Given The ^{WS-4} cyclist is revolving in a circular path of radius $r = 120$

Time taken for half rotation = 1 min = 60 sec.

$$\therefore \text{Total displacement} = 2r \Rightarrow 2 \times 120 \Rightarrow 240 \text{ m}$$



$$\therefore \text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time}}$$

$$= \frac{240 \text{ m}}{60 \text{ sec}} = 4 \text{ m sec}^{-1}$$

⑧

Given that a motorist drives for north with

a speed = 85 kmph.

in Time = 35 min = $\frac{35}{60}$ hrs

∴ His displacement s_1 = speed $\times$ time

$$= 85 \times \frac{35}{60}$$

$$= 49.56 \text{ km.}$$

He then continued his journey towards north

covered a distance (d) = 130 km.

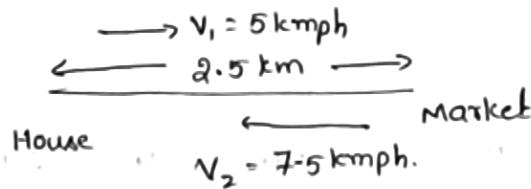
∴ Total displacement = $s_1 + d$

$$= 49.56 + 130$$

$$= 179.56 \text{ km}$$

$$\approx 179.6 \text{ km.}$$

(3)



clearly The person is covering first half of the distance [House-Market] with a speed v_1 and remaining half of the distance [Market-house] with a speed v_2

$$\begin{aligned} \therefore \langle \text{speed} \rangle &= \frac{2v_1 v_2}{v_1 + v_2} \\ &= \frac{2 \times 5 \times 7.5}{5 + 7.5} \\ &= 6 \text{ kmph} = 6 \times \frac{5}{18} \text{ m/s} = \frac{5}{3} \text{ m/s} \end{aligned}$$

(4)

Given displacement of the particle

$$x = 4t^3 - 3t + 2$$

$$\therefore \langle \text{velocity} \rangle = \frac{dx}{dt} = \frac{d}{dt} [4t^3 - 3t + 2]$$

$$= 4 \frac{d}{dt} t^3 - 3 \frac{d}{dt} t + \frac{d}{dt} (2)$$

$$\left[\because \frac{d}{dx} x^n = nx^{n-1} ; \frac{d}{dx} (\text{constant}) = 0 \right]$$

$$\begin{aligned} \therefore \langle \text{velocity} \rangle &= 4[3t^{3-1}] - 3 + 0 \\ &= 12t^2 - 3 \end{aligned}$$

$$\text{At } t = 3 \text{ sec} \Rightarrow \langle \text{velocity} \rangle = 12(3)^2 - 3$$

$$= 108 - 3 = 105 \text{ m/s}$$

⑥ Given in $t_1 = 4 \text{ sec} \rightarrow$ Distance travelled $d_1 = 16 \text{ m}$
 $t_2 = 2 \text{ sec} \rightarrow$ Distance travelled $d_2 = 16 \text{ m}$

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

$$= \frac{d_1 + d_2}{t_1 + t_2}$$

$$= \frac{16 + 16}{4 + 2} = \frac{32}{6} = 6.33 \text{ m/s.}$$

⑦

Total distance she swam = 180 m

Total time taken = 1 min = 60 sec

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

$$= \frac{180}{60} = 3 \text{ m/s.}$$

⑩

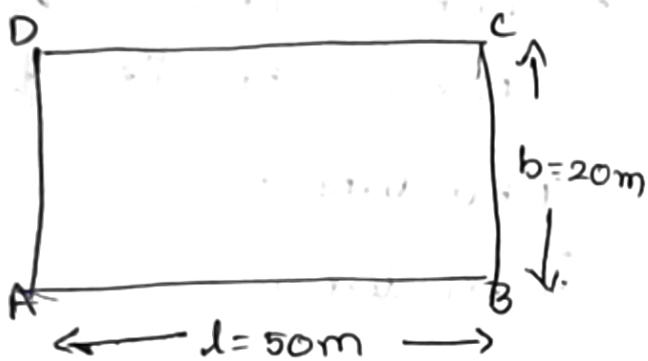
After a turns around a rectangular track
 The runner back to his starting point.

$\therefore$ Initial position = Final position

$$\Rightarrow \text{Displacement} = \text{Final position} - \text{Initial position} = 0$$

$$\therefore \langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}} = \frac{0}{100} = 0.$$

9



For one rotation

$$\begin{aligned}\text{Total distance} &= \text{Circumference} \\ &= 2(l+b) \\ &= 2(50+20) = 2 \times 70 \\ &= 140\text{m.}\end{aligned}$$

For two rotations

$$\begin{aligned}\text{Total distance} &= 2 \times 140 \\ &= 280\text{m.}\end{aligned}$$

$$\text{Total time} = 100\text{sec}$$

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

$$= \frac{280}{100} = 2.8\text{ m/s}$$

advanced

② Given for one revolution time taken = 4 sec

(i) Along AB

$$\text{Distance} = \frac{1}{4} \times \text{Circumference}$$

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

For $\frac{1}{4}$ th rotation time = 1 sec

$$\langle \text{speed} \rangle = \frac{T \cdot d}{T \cdot t} = \frac{\pi r}{2}$$

(ii) Along AC (half rotation)

$$\text{Distance} = \frac{1}{2} \times \text{Circumference}$$

$$= \frac{1}{2} \times 2\pi r = \pi r$$

$$\text{Time} = 2 \text{ sec}$$

$$\langle \text{speed} \rangle = \frac{T \cdot d}{T \cdot t} = \frac{\pi r}{2}$$

(iii)

For one complete rotation

$$\text{Distance} = \text{Circumference} = 2\pi r$$

$$\text{Time} = 4 \text{ sec}$$

$$\langle \text{speed} \rangle = \frac{T \cdot d}{T \cdot t} = \frac{2\pi r}{4} = \frac{\pi r}{2}$$

Qth continuation

For $\frac{1}{4}$ of rotation



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

$$\begin{aligned} \langle \text{velocity} \rangle &= \frac{\text{Total displacement}}{\text{Total time}} \\ &= \frac{\sqrt{2} R}{T} \end{aligned}$$

(8)

$$(i) \text{ speed of train} = \frac{\text{Distance}}{\text{time}} = \frac{240}{4} = 60 \text{ kmph}$$

$$(ii) \text{ speed of car} = \frac{120}{3} = 40 \text{ kmph}$$

$$(iii) \text{ speed of bus} = \frac{3 \text{ km}}{\frac{1}{2} \text{ hr}} = 6 \text{ kmph}$$

$$\begin{aligned} \text{Total distance travelled} &= 240 \text{ km} + 120 \text{ km} + 3 \text{ km} \\ &= 363 \text{ km} \end{aligned}$$

$$\text{Total time} = 4 \text{ hr} + 3 \text{ hr} + \frac{1}{2} \text{ hr} = 7.5 \text{ hr}$$

$$\langle \text{speed} \rangle = \frac{T \cdot d}{T \cdot t} = \frac{363}{7.5} = 48.4 \text{ kmph}$$

T boyk

(4)

According to given data

Nithin cover 300m in 15sec. where an Tathin
cover 600m in 1min $\rightarrow$ 60sec

$$\text{speed of Nithin} = \frac{300}{15} = 20 \text{ m/s}$$

$$\text{speed of Tathin} = \frac{600}{60} = 10 \text{ m/s}$$

$\therefore$ Nithin win race

(5)

(a) Given athlete speed = 10 m/s

(b) bicycle speed = 20 m/min = $\frac{20}{60} = \frac{1}{3} = 0.33 \text{ m/s}$

(c) scooter speed = 30 kmph = $30 \times \frac{5}{18} \text{ m/s} = 8.33 \text{ m/s}$

$$a > c > b.$$

7

For $x = x_1 \rightarrow v_1$ $x_2 \xrightarrow{\text{speed}} v_2$

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

$$\text{T.d} = x_1 + x_2 \quad ; \quad \text{Total time} = t_1 + t_2 = \frac{x_1}{v_1} + \frac{x_2}{v_2}$$

$$\langle \text{speed} \rangle = \frac{x_1 + x_2}{\frac{x_1}{v_1} + \frac{x_2}{v_2}}$$

(a) $x = 20\%$ $x_1 = \frac{20}{100}x = \frac{1}{5}x$ $x_2 = 100 - x = 80\% = \frac{4}{5}x$

$$\therefore \langle \text{speed} \rangle = \frac{\frac{x}{5} + \frac{4x}{5}}{\frac{x}{5v_1} + \frac{4x}{5v_2}} = \frac{5v_1v_2}{v_2 + 4v_1} = \frac{10v_1v_2}{2v_2 + 4v_1}$$

(b) $x = 30\%$ $\Rightarrow x_1 = \frac{30}{100}x = \frac{3}{10}x$; $x_2 = 100 - x = 70\%$
 $x_2 = \frac{70}{100}x = \frac{7}{10}x$

$$\langle \text{speed} \rangle = \frac{\frac{3x}{10} + \frac{7x}{10}}{\frac{3x}{10v_1} + \frac{7x}{10v_2}} \Rightarrow \frac{10v_1v_2}{3v_2 + 7v_1}$$

(c) $x = 40\%$ $\Rightarrow x_1 = \frac{40}{100}x = \frac{2}{5}x$; $x_2 = (100 - x)\% = \frac{60}{100}x = \frac{3}{5}x$

$$\langle \text{speed} \rangle = \frac{\frac{2x}{5} + \frac{3x}{5}}{\frac{2x}{5v_1} + \frac{3x}{5v_2}} = \frac{5v_1v_2}{2v_2 + 3v_1}$$

(d) $x = 50\%$ $\Rightarrow x_1 = 50\%x = \frac{1}{2}x$ $x_2 = (100 - 50)\% = \frac{x}{2}$

$$\langle \text{speed} \rangle = \frac{\frac{x}{2} + \frac{x}{2}}{\frac{x}{2v_1} + \frac{x}{2v_2}} = \frac{2v_1v_2}{v_2 + v_1}$$

$$\text{Time} = \frac{\text{Total distance}}{\text{Average speed}} = \frac{300 \text{ km}}{60} = \underline{\underline{5 \text{ hrs}}}$$

L Task

CUA's

⑥ The total distance covered by ant is $= 2 \text{ cm} + 1.5 \text{ cm} + 2.5 \text{ cm} + 3 \text{ cm}$
 $= 9 \text{ cm}$

The total time taken $= 1 + 1 + 1 + 1 = 4 \text{ sec.}$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{9}{4} = 2.25 \text{ cm/sec}$$

$$= 2.25 \times 10^{-2} \text{ m/s}$$

⑨ Given radius of circular path $= 200 \text{ m}$

Time taken for half revolution $= 5 \text{ min} = 5 \times 60 = 300 \text{ sec}$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{\pi r}{300}$$

$$= \frac{22}{7} \times \frac{200}{300} = \frac{44}{7 \times 3} = \frac{44}{21} \text{ m/s}$$

The distance covered for half rotation $= \frac{1}{2} (\text{circumference})$
 $= \frac{1}{2} \times 2\pi r = \underline{\underline{\pi r}}$

SAG's

①

Given in a time $t_1 = 2 \text{ sec}$, An object moves a

$$\langle \text{velocity} \rangle = \frac{S_1}{t_1} = \frac{10}{2} = 5 \text{ m/s} \quad \text{of } S_1 = 10 \text{ m}$$

in a time $t_2 = 8 \text{ sec}$, Distance covered $S_2 = 20 \text{ m}$.

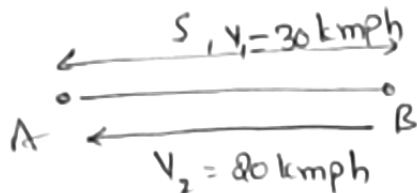
$$\langle \text{velocity} \rangle = \frac{S_2}{t_2} = \frac{20}{8} = 2.5 \text{ m/s}$$

$$\text{Total distance covered} = S_1 + S_2 = 10 + 20 = 30 \text{ m}$$

$$\text{Total time taken} = t_1 + t_2 = 2 + 8 = 10 \text{ sec}$$

$$\langle \text{velocity} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{30 \text{ m}}{10 \text{ sec}} = 3 \text{ m/s}$$

②

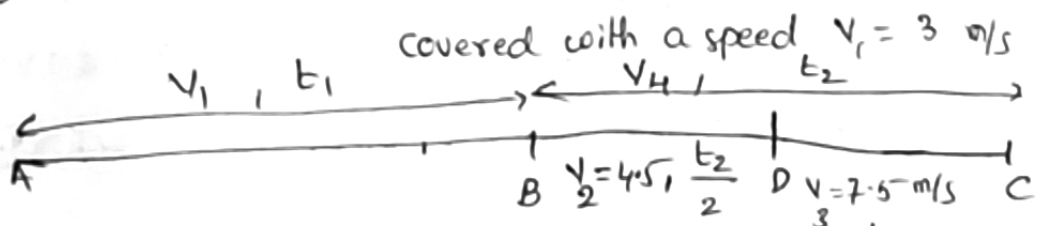


For the entire Journey of motor cyclist, 1st half $[A \rightarrow B]$ is covered with a speed v_1 , 2nd half $[B \rightarrow A]$ is covered with a speed v_2

$$\langle \text{speed} \rangle = \frac{2v_1v_2}{v_1 + v_2} = \frac{2 \times 30 \times 20}{30 + 20}$$

$$= \frac{2 \times 30 \times 20}{50} = 24 \text{ kmph}$$

③ Given that The first half of the distance is



For covering 2nd half, of the distance, the effective velocity becomes

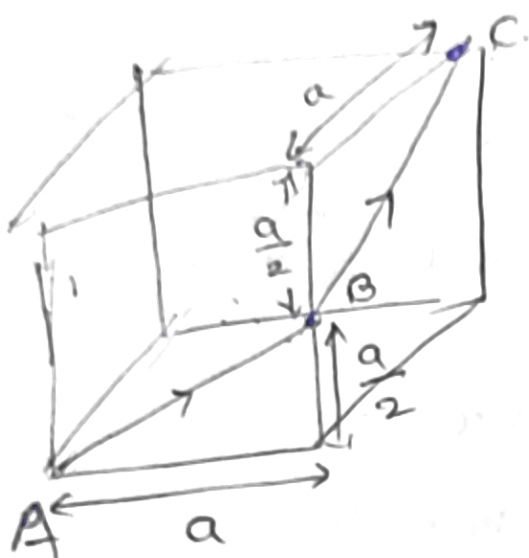
$$v_4 = \frac{v_2 + v_3}{2} = \frac{4.5 + 7.5}{2}$$

For Total Journey

$$v_4 = \frac{12}{2} = 6 \text{ m/s}$$

$$\therefore \langle \text{velocity} \rangle = \frac{2v_1v_4}{v_1 + v_4} = \frac{2 \times 3 \times 6}{3 + 6} = \frac{12 \times 2}{9} = \frac{8}{3} \text{ m/s}$$

(4)



The shortest distance (or) minimum distance covered by the ant to reach diagonally opposite corner is AC

From Fig $AC = AB + BC$

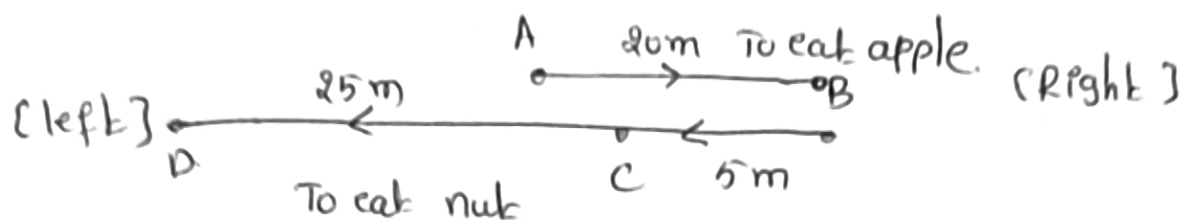
$$= \sqrt{a^2 + \left(\frac{a}{2}\right)^2} + \sqrt{a^2 + \left(\frac{a}{2}\right)^2}$$

$$= 2 \sqrt{a^2 + \left(\frac{a}{2}\right)^2} = 2 \sqrt{a^2 + \frac{a^2}{4}}$$

$$\Rightarrow 2 \sqrt{\frac{5a^2}{4}} = \frac{2\sqrt{5}a}{2} = \sqrt{5}a$$

5

Direction of motion of Pig



$$\begin{aligned}\text{Total distance travelled} &= 20 + 5 + 25 \\ &= 50 \text{ m}\end{aligned}$$

$$\text{Total time taken} = 300 \text{ sec}$$

$$\begin{aligned}\text{Total Displacement} &= \text{shortest distance} \\ &\text{between final and initial positions}\end{aligned}$$

$$= D - A$$

$$\Rightarrow 30 - 20$$

$$= 10 \text{ m}$$

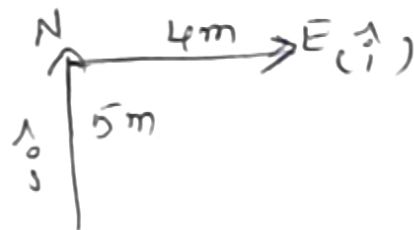
$$= 10 \text{ m}$$

$$\langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}} = \frac{10}{300} = 0.033 \text{ m/s}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{50}{300} = \frac{1}{6} \text{ m/s}$$

6

⑦ The directions of motion of a body are represented as shown below



$\therefore$ The displacement = vector form = $4\hat{i} + 5\hat{j}$ m

$$\therefore |\text{displacement}| = \sqrt{4^2 + 5^2} = \sqrt{41} = 6.4 \text{ m}$$

⑧

Total distance travelled = 100 m

Time taken = 14.4 sec.

$$\langle \text{velocity} \rangle = \frac{\text{Total distance}}{\text{Time taken}} = \frac{100}{14.4} = 6.94$$

⑨

Here, the body travels total distance = 2AB
The 1st half of the distance [A $\rightarrow$ B] is covered with speed 40 m/s and 2nd half of the distance [B $\rightarrow$ A] covered with a speed of 60 m/s

$$\begin{array}{c} \xrightarrow{v_1 = 40 \text{ m/s}} \\ A \quad \quad \quad B \\ \xleftarrow{v_2 = 60 \text{ m/s}} \end{array} \quad \langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}}$$

$$\langle \text{speed} \rangle = \frac{2v_1 v_2}{v_1 + v_2} = \frac{2 \times 40 \times 60}{40 + 60} = \frac{80 \times 60}{100} = 48 \text{ m/s}$$

Advanced

LTask

(1)

Total distance covered = $3 \text{ km} = 3 \times 10^3 \text{ m} = 3 \times 10^5 \text{ cm}$

$$\text{time} = 5 \text{ min} = 5 \times 60 = 300 \text{ sec}$$

$$\text{or } = \frac{5}{60} = \frac{1}{12} \text{ hr}$$

$$(a) \text{ speed} = \frac{d}{t} = \frac{3 \times 10^5 \text{ cm}}{300} = 1000 \text{ cm/sec}$$

$$(b) \text{ speed} = \frac{3000}{300} = 10 \text{ m/s} \quad (1 \text{ m/s} = \frac{18}{5} \text{ kmph})$$

$$(c) \text{ speed} = 10 \times \frac{18}{5} \text{ kmph} = 36 \text{ kmph}$$

(2)

$$v_{\text{car}} = 45 \text{ kmph} = \frac{45 \times 10^3}{60} \frac{\text{km}}{\text{min}}$$

$$(a) \quad t = 1 \text{ hr} \rightarrow \text{Distance} = v \times t = 45 \times 1 = 45 \text{ km}$$

$$(b) \quad t = 1 \text{ min} \rightarrow D = \frac{45 \times 10^3}{60} = 750 \text{ m/min}$$

$$(c) \quad 45 \text{ kmph} = 45 \times \frac{5}{18} \text{ m/s} = 12.5 \text{ m/s}$$

③

$$r = 7 \text{ m} \quad ; \quad \text{time} = 2 \text{ sec.}$$

$$\begin{aligned} \text{half rotation} \quad \text{Distance} &= \frac{1}{2} (2\pi r) \\ &= \frac{22}{7} \times 7 = 22 \text{ m} \end{aligned}$$

$$\text{Displacement} = 2r = 2 \times 7 = 14 \text{ m}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{22}{2} = 11 \text{ m/s}$$

$$\text{velocity} = \frac{\text{Displacement}}{\text{time}} = \frac{14}{2} = 7 \text{ m/s}$$

⑦

Given car takes T sec. to complete $\frac{1}{4}$ rotation

For Full rotation = $4T$ sec

For half rotation = $2T$ sec.

For one rotation: Displacement = 0

$$\langle \text{velocity} \rangle = \frac{\text{Displacement}}{\text{time}} = \frac{0}{T} = 0$$

Total distance = Circumference of a circle
= $2\pi R$.

$$\langle \text{speed} \rangle = \frac{2\pi R}{4T} = \frac{\pi R}{2T}$$

For half rotation Displacement = $2R$

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