WS-1 7th class Integrated

Task

(1) Here · The total distance = Path length covered.

= 5 + 3

= 8 m

(2) Given that distance = 40 m

Displacement = 20 m East.

∴ Distance > Displacement → here the body is moving in a st. line

(3) For one rotation the car come back to it's original position.

i.e initial position = Final position.

∴ Displacement = Final position − initial position

= 0

(4) Given that speed = 10 m/s

Time = 30 sec.

∴ Total distance covered = speed × time

= 10 × 30

= 300 m

(5) North and south are represented by a unit vectors $\hat{j}$ & $-\hat{j}$

∴ Displacement = $15(-\hat{j}) + 20(\hat{j})$

= $5\hat{j}$ towards North

(5) In General North and South are represented by a unit vectors $\hat{j}$ & $-\hat{j}$

$\therefore$ The displacement $= 15(-\hat{j}) + 20(\hat{j})$

$= -15\hat{j} + 20\hat{j}$

$= 5\hat{j}$

$= 5$ km North.

(6) Given Distance traveled by the cyclist = 30m

Time = 10 sec

$\therefore$ Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{30}{10}$

$= 3$ m/s.

Given that the cyclist maintains constant speed

$\therefore$ Magnitude of velocity = Speed = constant

$= 3$ m/s

(8) Given

Speed of train = 60 kmph

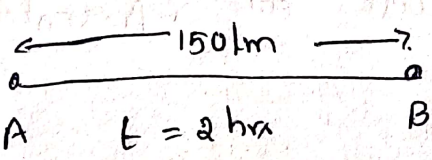
Time = 3 hrs

Total distance covered by the train = speed x time

$= 60 \times 3$

$= 180$ km.

(7)



Total distance = 150 km

Time = 2 hrs

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

$$= \frac{150}{2}$$

$$= 75 \text{ kmph.}$$

Suppose if the displacement from A to B is 120 km east

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

$$= \frac{120}{2} = 60 \text{ kmph east}$$

The direction of velocity is in the direction of change in position

(9)

We know that east and west are represented by the unit vectors $\hat{i}$ & $-\hat{i}$.

$\therefore$ Total displacement $= 200(\hat{i}) + 150(-\hat{i})$

$= 200\hat{i} - 150\hat{i} \Rightarrow 50\hat{i}$

Total time $= 20 + 15 = 35$ sec

(9)

we know that east and west are represented by unit vectors $\hat{i}$ & $-\hat{i}$

$\therefore$ Displacement $= 200\hat{i} + 150(-\hat{i})$

$= 200\hat{i} - 150\hat{i}$

$= 50\hat{i}$

change in time = 20 − 15 = 5 sec.

$\therefore$ velocity $= \frac{|\text{Displacement}|}{\text{change in time}} = \frac{|50\hat{i}|}{5} = \frac{50}{5} = 10 \text{ m/s}$

(10)

Speed of the cyclist = 25 kmph

Time = 2 hrs.

$\therefore$ Distance covered = speed × Time

= 25 × 2

= 50 km.

(13)

North is denoted by a unit vector $\hat{j}$

East is denoted by a unit vector $\hat{i}$

$\therefore$ Net displacement of Rakesh = $5\hat{i} + 7\hat{j}$

$\therefore$ $|\text{displacement}| = \sqrt{5^2 + 7^2} = \sqrt{25+49}$

$= \sqrt{74} = 8.6$ km

Total distance traveled = 7 km + 5 km = 12 km

(14)

we know that $1\ \text{kmph} = \frac{5}{18}\ \text{m/s}$

$1\ \text{m/sec} = \frac{18}{5}\ \text{kmph}$.

$\therefore \quad 36\ \text{kmph} = {}^{2}\cancel{36} \times \frac{5}{\cancel{18}}\ \text{m/s} = 2 \times 5 = 10\ \text{m/s}$

$15\ \text{m/sec} = {}^{3}\cancel{15} \times \frac{18}{\cancel{5}}\ \text{kmph} = 54\ \text{kmph}$

$1\ \text{km/min} = \frac{1000\ \text{m}}{60\ \text{sec}} = \frac{100}{6} = 16.66\ \text{m/sec}.$

(15)

Given radius of circular track = 70 m

For 1 revolution Distance covered = Path length covered

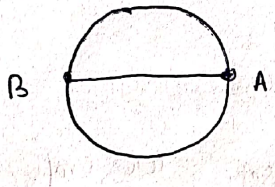
= Circumference of Circle

$= 2\pi r$

$= 2 \times \frac{22}{\cancel{7}} \times {}^{10}\cancel{70}$

$= 44 \times 10$

$= 440\ \text{m}$



For half revolution, Athlet reaches exactly diametrically opposite point [A → B]

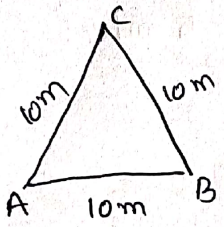
$\therefore$ Displacement = Diameter

$= 2r$

$= 2 \times 70$

$= 140\ \text{m}.$

(16)



Acc to given data

Distance = Circumference = AB + BC + CA

= 10m + 10m + 10m

= 30m.

Since the body reaches to it's starting point [F.P = I.P]

Displacement = F.P − I.P = 0

(17)

we know that $\text{speed} = \frac{\text{distance}}{\text{time}}$.

(i.e) $\text{speed} \propto \frac{1}{\text{time}}$

$\Rightarrow \frac{\text{speed}_1}{\text{speed}_2} = \frac{\text{time}_2}{\text{time}_1}$.

Given in $\text{time}_1 = 60 \text{ min} \rightarrow \text{speed}_1 = 60 \text{ kmph}$

$\text{time}_2 = 40 \text{ min} \rightarrow \text{speed}_2 = ?$

$\therefore \Rightarrow \frac{60}{\text{speed}_2} = \frac{40}{60}$

$\Rightarrow \frac{60^{1}5}{\text{speed}_2} = \frac{4}{6} \Rightarrow \text{speed}_2 = 15 \times 6$

$= 90 \text{ kmph}$

(18)

we know that $1 \text{ m/sec} = 100 \text{ cm/sec}$

(or) $1 \text{ cm/sec} = \frac{1}{100} \text{ m/sec} = 10^{-2} \text{ m/sec}$

$1 \text{ kmph} = \frac{5}{18} \text{ m/sec}$

$\Rightarrow 1 \text{ m/sec} = \frac{18}{5} \text{ kmph}$

(a) $1 \text{ m/sec} = 100 \text{ cm/sec}$.

(b.) $20 \text{ cm/sec} = 20 \times 10^{-2} \text{ m/sec} = 0.2 \text{ m/sec}$

(c) $3 \text{ m/sec} = 3 \times \frac{18}{5} \text{ kmph} = 10.8 \text{ kmph}$

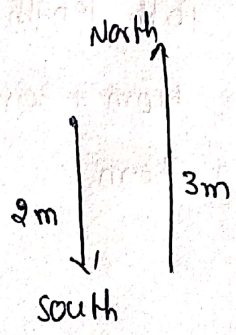
(d) $18 \text{ kmph} = 18 \times \frac{5}{18} \text{ m/sec} = 5 \text{ m/sec}$.

L Task

CUQ

(10) We know that north is represented by a unit vector $\hat{j}$

south is represented by $-\hat{j}$



Distance = Total path length covered

= 2m + 3m

= 5m

Displacement = shortest distance covered

$= 2(-\hat{j}) + 3(\hat{j})$

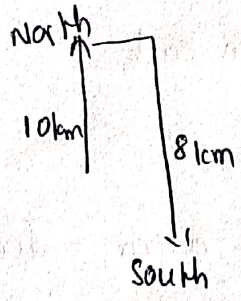
$= -2\hat{j} + 3\hat{j}$

$= 1\hat{j}$

|Displacement| = 1 m

JEE Main level

(1)



Total distance covered = path length covered

= 10 km + 8 km

= 18 km.

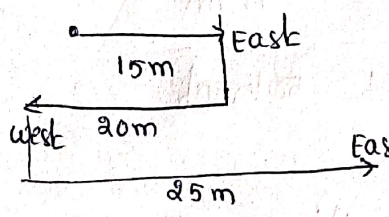
(2) We know that East and west are denoted by the unit vectors $\hat{i}$ & $-\hat{i}$

Total displacement = shortest distance covered

$= 15(\hat{i}) + 20(-\hat{i}) + 25(\hat{i})$

$= 40\hat{i} - 20\hat{i}$

$= 20\hat{i}$



Displacement = 20m towards east

(3)

Given car moves 40m north & 30m south.

while we are calculating distance directions are not considered.

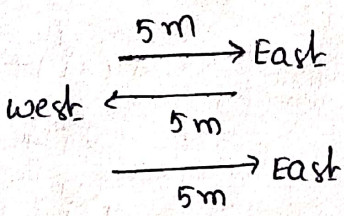
$\therefore$ distance = Path length covered

= 40m + 30m

= 70m.

(4)

Acc to Given data



East is denoted by a unit vector $\hat{i}$

West is denoted by a unit vector $-\hat{i}$

$\therefore$ Displacement = shortest distance covered

$= 5\hat{i} + 5(-\hat{j}) + 5\hat{i}$

$= 5\hat{i} - 5\hat{j} + 5\hat{i}$

$= 5\hat{i}$

Displacement = 5m east

(5)

Distance covered by a car = 200 km

Time = 4 hrs

$$\text{<speed>} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{200 \text{ km}}{4 \text{ hrs}}$$

$$= 50 \text{ kmph.}$$

(6)

Total distance covered = 150 km

Time = 2 hrs.

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

$$= \frac{150}{2}$$

$$= 75 \text{ kmph.}$$

(7)

Given

Displacement = 40 m

Time = 10 sec.

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

$$= \frac{40 \text{ m}}{10 \text{ sec}}$$

$$= 4 \text{ m/s}$$

(9)

we know that when a body is in uniform motion

speed = velocity.

Given speed of cyclist = 20 m/s.

∴ velocity of cyclist = 20 m/s

(10)

Given speed of cyclist = 15 m/s

Time = 2 min = 2×60 sec

∴ Distance = speed × time

= 15×2×60 = 1800 m.

(13)

Given Velocity = 45 kmph = $45 \times \frac{5}{18}$ m/sec

(a) In a time 1 hr ; Distance = velocity × time

= 45 × 1

= 45 km

(b) In a time 1 min ; Distance = velocity × time

$= \cancel{45}^{15} \times \frac{5}{\cancel{18}_{6}} \times 1 \times \cancel{60}^{10}$

= 750 m

(c) In a time 1 sec ; Distance = velocity × time

$= 45 \times \frac{5}{18} \times 1$

= 12.5 m

(14)

Given Distance = 1566 m

(or) [1 m = 10^2 cm]

= 1566×10^2 cm

(or) [1 m = 10^{-3} km]

= 1.566 km

(15)

Given length l = 8m ; breadth = 6m

(i) As ant travelling from A → B → C → D

Initial position = A ; Final position = D

∴ Displacement = Final position − Initial position

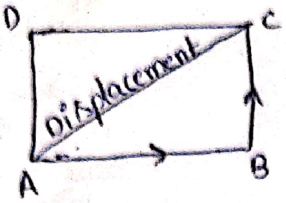
= D − A

= breadth

= 6 m.

(ii) As the ant reaches to C from A in a time 5 sec

Displacement = shortest distance b/w A & C



= length of the diagonal

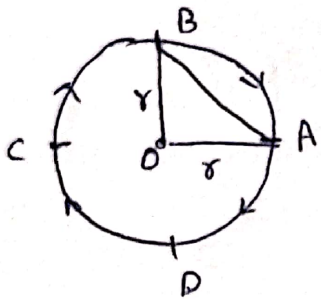
$= \sqrt{l^2 + b^2}$

$= \sqrt{8^2+6^2} = \sqrt{64+36} = \sqrt{100}$

$= 10\,m$

$\therefore$ Velocity $= \frac{\text{Displacement}}{\text{time}} = \frac{10\,m}{5\,sec} = 2\ m/s$

(6)



As the body completes $\frac{3}{4}^{th}$ of rotation body reaches to B from A

$\therefore$ Displacement = shortest distance [AB]

$= \sqrt{(OA)^2 + (OB)^2}$

$= \sqrt{r^2 + r^2}$

$= \sqrt{2r^2} = \sqrt{2}\,r$

Distance = path length covered

$= \frac{3}{4}^{th}$ of circumference of a circle

$= \frac{3}{4} \times 2\pi r$

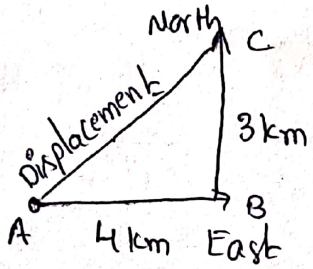
$= \frac{3}{2}\pi r$

$\therefore$ Distance : Displacement $= \frac{3}{2}\pi r : \sqrt{2}\,r$

$= \frac{3\pi}{2} : \sqrt{2}$

$= 3\pi : 2\sqrt{2}$

(17) The direction of motion of a body is shown in fig



Time taken = 2 sec

$\therefore$ Velocity = $\frac{\text{Displacement}}{\text{Time}}$

$= \frac{5}{2} = 2.5 \text{ km/sec}$

$\because$ Displacement = shortest distance covered [AC]

$= \sqrt{AB^2 + BC^2}$

$= \sqrt{4^2 + 3^2}$

$= \sqrt{16 + 9}$

$= \sqrt{25}$

$= 5 \text{ km}$