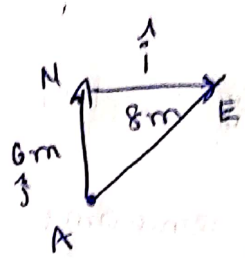
9th foundation

WS-1

Task

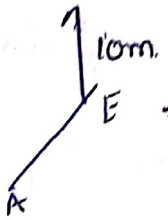
① The body first moves 6m north, 8m east



$\Rightarrow$ Displacement $= 6\hat{j} + 8\hat{i}$

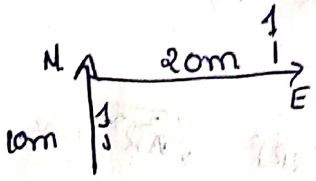
$|\text{Displacement}| = \sqrt{6^2+8^2} = 10\text{m}$

$=$



$\Rightarrow$ displacement $= \sqrt{10^2+10^2} = 10\sqrt{2}\text{ m}$

②



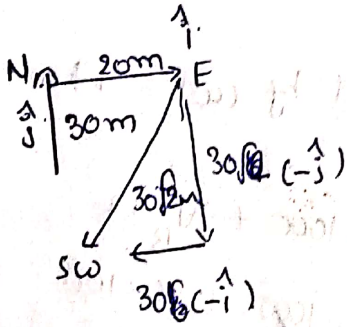
Displacement $= 20\hat{i} + 10\hat{j}$

$= \sqrt{20^2+10^2} = \sqrt{400+100}$

$= \sqrt{500} = 10\sqrt{5} = 10 \times 2.25$

$= 22.5\text{m}$

③



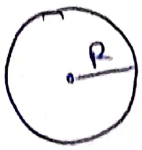
Displacement $= 30\hat{j} + 20\hat{i} - 30\hat{j} - 30\hat{i}$

$= -10\hat{i}$

$|\text{Displacement}| = 10\text{m}$

$(-\hat{i})$ indicates direction is along west

(4)



time = 40 sec

At the end of 2 min 20 sec means $2 \times 60 + 20$

$= 120 + 20$

$= 140$ sec.

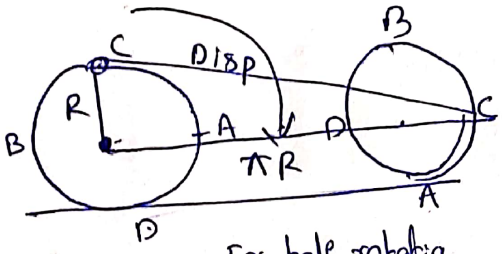
For every 40 sec the body completes one rotation

In 120 sec 3 rotations, remaining 20 sec. half rotation

completed But $\therefore$ Displacement = Diameter = $2R$

$=$

(5)



For half rotation

For half rotation the contact point (D) has a displacement $= 2R$

Net displacement $= \sqrt{(\pi R)^2 + (2R)^2} = \sqrt{\pi^2 R^2 + 4R^2} = R\sqrt{\pi^2 + 4}$

$R = 1$ m

Net displacement $= \sqrt{\pi^2 + 4}$.

(6)

$V_B = 10$ m/s. , $t = 100$ sec. $\therefore a_B = 0$

Distance travelled by car = 1 km + Distance travelled by bus

$\Rightarrow V_c \times t = 1000 + V_B \times t$

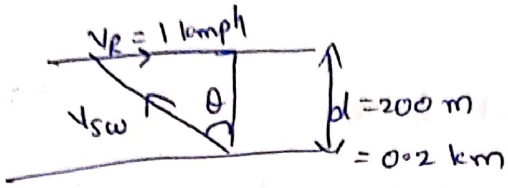
$\Rightarrow V_c \times 100 = 1000 + 10 \times 100$

$\Rightarrow V_c = 10 + 10 = 20$ m/s

(7)

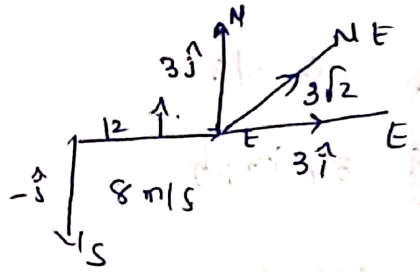
$d = 200\ m$

$V_R = 1$ kmph ; $V_{SW} = 2$ kmph



$$t = \frac{d}{\sqrt{V_{SW}^2 - V_R^2}} = \frac{0.2}{\sqrt{2^2 - 1^2}} = \frac{0.2}{\sqrt{3}} = 0.178 \text{ hrs.}$$

(8)



Resultant velocity

$= 8.(-\hat{j}) + 12\hat{i} + 3\hat{i} + 3\hat{j}$

$= -8\hat{j} + 15\hat{i} + 3\hat{j}$

$= -5\hat{j} + 15\hat{i}$

$|\text{velocity}| = \sqrt{(-5)^2 + (15)^2} = \sqrt{25 + 225} = \sqrt{250} = 15.78$ m/s

(9)

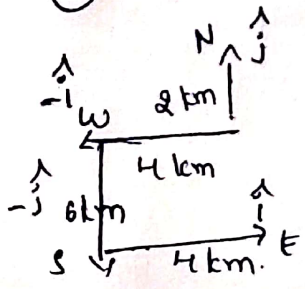
Given $R = 1.5$ cm.

Distance travelled $= 2\pi r = 2 \times \frac{22}{7} \times 1.5$

$= \frac{66}{7}$

$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{\frac{66}{7}}{60} = \frac{11}{7} = 1.57 \times 10^{-3}$ m/s

(10)



Total distance = 2 km + 4 km + 6 km + 4 km = 16 km

Displacement $= 2\hat{j} + 4(-\hat{i}) - 6\hat{j} + 4\hat{i}$

$= -4\hat{j}$

$|\text{Displacement}| = 4$ km.

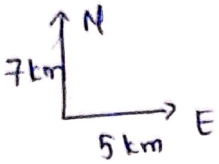
(11)

For 1 day the displacement of Earth is 0.

because Earth completes one rotation.

(16)

(13)



Total distance = 7 + 5 = 12 km.

his displacement $= \sqrt{7^2+5^2}$

$= \sqrt{49+25} = \sqrt{74}$

$= 8.6$ km

(14)

(a)

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

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

1 km/min $= \frac{1000}{60} = 16.66$ m/s

(15)

$r = 70$m

For one rotation Distance $= 2\pi r$ = circumference

$= 2 \times \frac{22}{7} \times 70^{10} = 440$ m

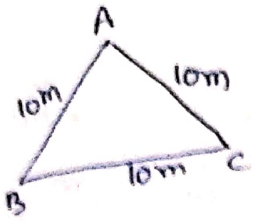
For half revolution Displacement = Diameter

$= 2 \times r$

$= 2 \times 70$

$= 140$ m

(16)



According to given question, the body completes one rotation.

Distance = Perimeter

= 3 × side length

= 3 × 10 = 30cm

Displacement = 0 because the body back to same corner from where it started.

(17)

In both cases distance covered is same.

$$V_1 t_1 = V_2 t_2$$

$$\Rightarrow 60 \times 60 = V_2 \times 40$$

$$\Rightarrow 360 = 4 V_2$$

$$\Rightarrow V_2 = 90 \text{ kmph}$$

(18)

(a) $1 \text{ m/sec} = \frac{18}{18} \text{ kmph} = \frac{18}{5} \text{ kmph} = 3.6 \text{ kmph}$

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

$20 \text{ cm/sec} = 20 \times 10^{-2} \text{ m/s} = 0.2 \text{ m/s}$

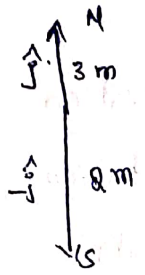
$1 \text{ m/sec} = 100 \text{ cm/sec}.$

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

L Task

CUQ

(10)



Distance = $2\hat{j} + 3\hat{j} = 5\hat{j}$

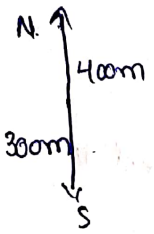
$= 2m + 3m = 5\ m$

Displacement = $2\hat{j} - 3\hat{j} = -\hat{j}$.

$|\text{Displacement}| = |-\hat{j}| = 1\ m$.

SAQ's

(1)



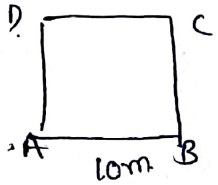
Displacement = $400\hat{j} + 300(-\hat{j}) = 100\hat{j}$

$|\text{Displacement}| = 100\ m$.

If flies 1200 m upwards Displacement = $100 + 1200$

$= 1300\ m$

(2)



For complete rotation, time = 40 sec.

Distance = 10 m.

At the end of 2 min 20 sec. [$2 \times 60 + 20 = 140$ sec]

The body makes 3 rotations completely and half rotation in remaining 20 sec. So the body reaches diagonally opposite corner in 20 sec.

Displacement = $\sqrt{\text{side}^2 + \text{side}^2} = \sqrt{10^2 + 10^2} = 10\sqrt{2}\ m$

$= 10 \times 1.414$

$= 14.14\ m$

④ ⑥

$r = 10$ cm.

if the min hand moves from 10 am to 10:14 Am

time = 14 min

distance covered for 14 min

$= \frac{1}{4} \times$ circumference of a circle

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

$= \frac{1}{4} \times \frac{22}{7} \times 10 \times 10^{-2}$

$= \frac{110}{7} \times 10^{-2} = \frac{1.01}{7} =$ ~~0.01~~ m

$= 0.157$ m (or) 15.7 cm

Speed = distance / time

$= \frac{15.7}{14 \times 60}$

⑤

In east direction displacement $x_1 = v\,t$

$= 60 \times 1 = 60\hat{i}$ km

In south direction displacement $x_2 = v\,t(-\hat{j})$

$= 60 \times 30 \text{ min } (-\hat{j})$

$= 60 \times \frac{30}{60} \text{ hr } (-\hat{j})$

$= -30\hat{j}$ km

Net displacement $= \sqrt{60^2 + (-30)^2} = 30\sqrt{2^2+1} = 30\sqrt{5}$ km

(7)

time = 0.46 s ∴ s = 18.4 m.

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{18.4}{0.46} = \frac{1840}{46} = 40 \text{ m/s}$$

(8)

speed = 1.4 m/s

distance = 205 m

$$\text{time} = \frac{\text{distance}}{\text{velocity}} = \frac{205}{1.4} = 146.42 \text{ sec}$$

(9)

time = 0.25 h = $\frac{1}{4}$ hr ∴ displacement = 16 km

$$\text{velocity} = \frac{\text{displacement}}{\text{time}} = \frac{16}{\frac{1}{4}} = 64 \text{ kmph south.}$$

(10)

$s_1 = 428$ m → west

<velocity> = 1.7 m/s.

$$\text{time} = \frac{\text{distance}}{\text{velocity}} = \frac{428}{1.7} = 251.76 \text{ sec}$$

(13)

(a) velocity = 45 kmph

t = 1 hr

distance = v t

= 45 × 1

= 45 km

(b) V = 45 × 1000 kmph

$= 45 \times \frac{250}{60}$ m/min

= 750 m/min

d = v × t

= 750 × 1 = 750 m

(c) V = 45 kmph

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

$= \frac{25}{2} = 12.5$ m

d = v × t

= 12.5 × 1

= 12.5 m.

Given (15)

(15)

Given $l = 8m$, $b = 6m$

From $A \to B \to C \to D$ Displacement = $D - A$

$= 6m$

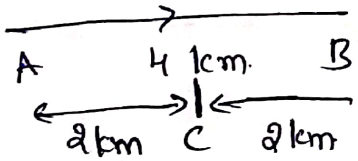
From $A \to C$ Displacement = $\sqrt{l^2 + b^2}$

$= \sqrt{8^2 + 6^2} = 10m$

time = 5 sec velocity = $\frac{\text{Displacement}}{\text{time}}$

$= \frac{10}{5} = 2 m/s$.

(16)



Distance = AB + BC

= 4 km + 2 km

= 6 km

Displacement = shortest distance blw A and C.

= 2 km

(17)

Diameter = 200 m ⇒ radius = 100 m.

- For one rotation Distance = Circumference = $2\pi r$

$= 2 \times \frac{22}{7} \times 100 = \frac{4400}{7}$.

$t = 5$ sec

speed = $\frac{\text{Distance}}{\text{time}} = \frac{\frac{4400}{7}}{5} = \frac{880}{7} = 126 m/s$