WS-3. 7th Foundation Motion in a straight line

Thank

①

Given speed $v = \frac{120}{2}\ m/s = 60\ m/s$

Time for 240 m $= \frac{\text{Distance}}{\text{speed}}$

$= \frac{240}{60} = 4\ sec$

[Given train covers 120m in 2 sec initially

so its speed $= \frac{\text{distance}}{\text{time}} = \frac{120}{2} = 60\ m/s$]

②

We know Distance = speed × time.

Given speed = 65 kmph ∴ time = 3 hrs

∴ Distance $= 65 \times 3 = 195$ km

③

From data the body goes up 100m and then comes back down 100m to the same position.

∴ Total distance = 100m(up) + 100(down)

$= 200\ m$

Total time = 5s(up) + 5s(down) = 10s

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

$= \frac{200}{10} = 20\ m/s$

(4)

we know Displacement is the change in position from the start to the end.

The body returns back to original position after 10sec.

$\therefore$ Displacement $= 0$

$$\langle \text{velocity} \rangle = \frac{\text{Displacement}}{\text{Time}} = \frac{0}{10} = 0 \text{ m/s}$$

(5)

Given $t_1 = 30 \text{ min} = 0.5 \text{ hrs} = \frac{1}{2} \text{ hrs}$

$t_2 = 40 \text{ min} = \frac{40}{60} = \frac{2}{3} \text{ hrs}$

Distance covered in 30 min $d_1 = v_1 t_1$

$= 30 \times \frac{1}{2}$

$= 15 \text{ km}$

Distance covered in 40 min $d_2 = v_2 t_2$

$= 40 \times \frac{2}{3}$

$= 26.67 \text{ km}$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{15 + 26.67}{\frac{1}{2} + \frac{2}{3}}$$

$= 35.7 \text{ kmph}$

(6)

Given $d_1 = 30\,km$; $V_1 = 30\,kmph$

$d_2 = 30\,km$; $V_2 = 60\,kmph$

clearly the car is covering two equal halfs of the distance with different velocities.

$$\therefore \langle speed \rangle = \frac{2V_1V_2}{V_1+V_2} = \frac{2\times30\times60}{30+60}$$

$$= \frac{2\times30\times60}{90} = 40\,kmph$$

(7)

From given data

Distance travelled = Final − Initial Reading

$= 1352 - 1272$

$= 80\,km$

Time taken $= 50\,min = \frac{50}{60} = \frac{5}{6}\,hrs$

$$\langle speed \rangle = \frac{Distance}{Time} = \frac{80}{\frac{5}{6}} = 96\,kmph$$

(9)

Given initial velocity $u = 30\,m/s$

Final velocity $v = 50\,m/s$

$t = 4\,sec$

$$acceleration = \frac{v-u}{t} = \frac{50-30}{4} = \frac{20}{4} = 5\,m/s^2$$

(8)

Given $u = 400$ km/s ; $v = 600$ km/s

$t_1 = 10$ sec Total time = 1 min = 60 sec

case (i)

$$a = \frac{v-u}{t} = \frac{600-400}{10} = 20 \text{ km/s}^2$$

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

$= 400 \times 10 + \frac{1}{2}(20)(10)^2$

$= 5000$ km

Next 50 sec velocity of the space ship is 600 km/s.

∴ Distance travelled $s_2 = 600 \times 50$

$= 30,000$ km

∴ Total distance $= 30,000 + 5000$

$= 35,000$ km

(10)

Given $u = 15$ m/s ; $v = 5$ m/s ; $t = 2$ s

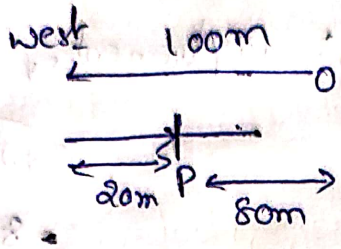
$$\text{acceleration} = \frac{v-u}{t} = \frac{5-15}{2} = \frac{-10}{2} = -5 \text{ m/s}^2$$

(11)

Given $u = 0$; $v = 12$ m/s ; $t = 6$ sec.

$$\text{Acceleration} = \frac{v-u}{t} = \frac{12-0}{6} = 2 \text{ m/s}^2.$$

(12)



Total distance = 100 + 20
= 120m

Here 'O' is starting point
P is final reaching point

Displacement = shortest distance between O and P
= 80m

(13)

For one rotation

Distance = length of the track
= 1600m.

Displacement = 0 Because the body come back to it's original position for one rotation.

(14)

Given $V_1 = 30$ kmph ; $t_1 = 30$ min
$= \frac{30}{60} = 0.5$ hrs

$V_2 = 60$ kmph ; $t_2 = 30$ min $= 0.5$ hrs

Total distance travelled $= V_1 t_1 + V_2 t_2$

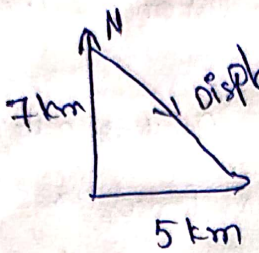
$= 30 \times 0.5 + 60 \times 0.5$

$= 15 + 30$

$= 45$ km

Advanced

(17)



$\therefore$ Displacement $= \sqrt{5^2+7^2}$

$= \sqrt{25+49}$

$= 8.6$ km

Total distance $= 7+5 = 12$ km

Finally he can moving towards east

only a, b are correct.

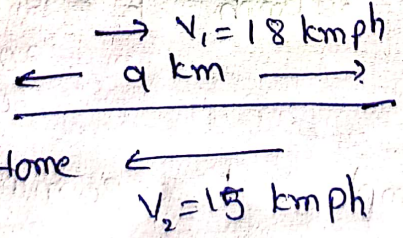
(18)

(a) 76 kmph $= 76 \times \frac{5}{18} = 20$ m/sec.

(b) 5 m/sec $= 5 \times \frac{18}{5} = 18$ kmph

(c) 1 km/min $= \frac{1000}{60} = \frac{50}{3} = 16.66$ m/sec.

(19), (20), (21)



Time taken to reach school $= \frac{d}{V_1} = \frac{9}{18} = \frac{1}{2}$ hrs.

Time taken to reach house $= \frac{d}{V_2} = \frac{9}{15} = \frac{3}{5}$ hrs

Total time of journey $= \frac{1}{2} + \frac{3}{5} = \frac{5+6}{10}$

$= \frac{11}{10}$ hrs

(22)

Given $t = 0.2$ sec ; speed $= 30$ km ph.

distance = speed × time $= 30 \times \frac{0.2}{360}$ hr.

$= \frac{0.2}{120}$ hr $= \frac{0.2}{120} \times$ km

$= \frac{1}{600}$ km $= \frac{1000}{600}$ km

$= \frac{10}{6}$ km $= 1.6$ km

(23)

Given distance $= 100$ m ; time $= 10$ sec

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{100}{10} = 10 \text{ m/s}$$

$$\text{Velocity} = \text{distance/time} = \frac{100}{10} = 10 \text{ due east}$$

(24)

Given $u = 45$ m/s ; $v = 3$ m/s ; $t = 1.5$ sec

$$a = \frac{v-u}{t} = \frac{3-45}{105} = \frac{-42}{105} = -28 \text{ m/s}^2$$

(25)

Given $v_1 = 10$ m/s ; $t_1 = 5$ sec

$v_2 = 20$ m/s $t_2 = 4$ sec $v_3 = 15$ m/s ; $t_3 = 8$ sec

Final velocity $= 15$ m/sec time taken $= 5+4+8 = 17$ sec

$$\langle \text{acceleration} \rangle = \frac{v_f - u}{\text{Total time}} = \frac{15-10}{17} = 0.294 \text{ m/s}^2$$

(26).

a → 1 m/sec = 100 cm/s.

b) 20 cm/sec = 20×10^{-2} m/s = 0.2 m/s

c) 3 m/s = $\frac{3}{1} \times \frac{5}{18}$ kmph = $\frac{5}{6}$ kmph = 0.8 kmph

d). 18 kmph = $18 \times \frac{5}{18} = 5$ m/s

LTask

(1)

Given distance = 60 km ; time = 3 hrs.

$\therefore$ velocity = $\frac{\text{Displacement}}{\text{time}} = \frac{60}{3} = 20$ kmph. → B

(2)

Given speed = 12 m/s ; time = 25 min

$= \frac{25}{60}$ hr

$= 12 \times 10^{-3}$ km / 3600 hr

$= 12 \times \frac{18}{5}$ kmph

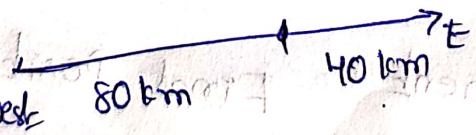
distance = speed × time

$= 12 \times \frac{18}{5} \times \frac{25}{60}$

= 18 kmph — c

(3)

Given



Displacement = 80 − 40

= 40 km →

Time = 2 hr.

$\langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Time}} = \frac{40}{2} = 20$ kmph → D

Here Displacement = +40 km − 80 km

East considered as +ve ; west considered as −ve.

④

Given time = 50 min speed = 24 km/s

$= \frac{50}{60}$ hrs

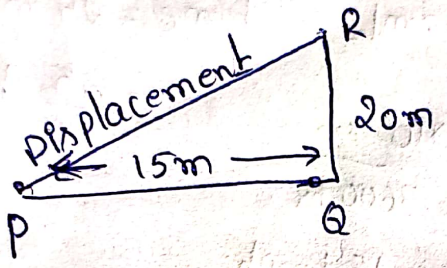
(or) 50×60 sec.

∴ Distance travelled = vt

$= 24 \times 50 \times 60$

$= 72{,}000 = 72$ km → C

⑤

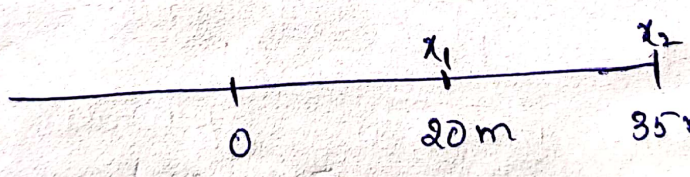


∴ Displacement = length of PR = $\sqrt{15^2+20^2}$

$= \sqrt{225+400}$

$= \sqrt{625} = 25$m → D

⑥

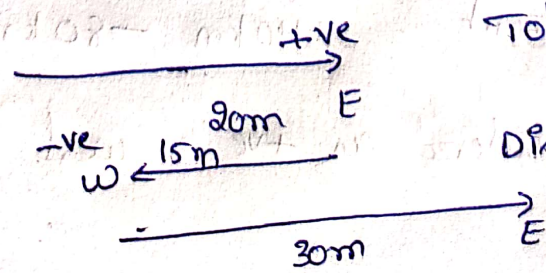


Displacement = Final position − initial position

$= x_2 - x_1$

$= 35 - 20 = 15$m → A

⑦



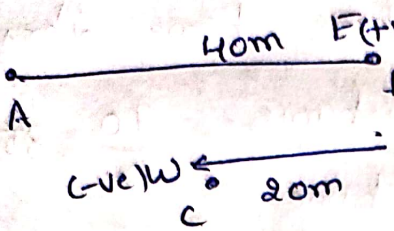
Total distance = 20 + 15 + 30

= 65m

Displacement = +20 − 15 + 30

= 35m East

(8)



Total distance = 40 + 20 = 60m

Displacement = +40 − 20

= +20m East

(9)

Given $d_1 = 50$ km ; $v_1 = 25$ kmph we know time = $\frac{\text{distance}}{\text{speed}}$

$d_2 = 60$ km ; $v_2 = 20$ kmph

Time taken by the car for covering total distance

$$= \frac{d_1}{v_1} + \frac{d_2}{v_2}$$

$$= \frac{50}{25} + \frac{60}{20} \Rightarrow 2 + 3 = 5 \text{ hrs}$$

$$\therefore \langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{50+60}{5}$$

$$= \frac{110}{2} = 22 \text{ kmph} \rightarrow A$$

(10)

Here Distance covered by train = AB + BA

= 200 + 200

= 400 km

Total time = 2 + 3 = 5 hrs

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{400}{5} = 80 \text{ kmph}$$

$$\langle \text{velocity} \rangle = \frac{\text{Displacement}}{\text{time}} = \frac{0}{5} = 0$$

[Because the train come back to it's original point A]

Displacement = 0

(11)

Given distance = 70 km; time = 2 hrs

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{70}{2} = 35 \text{ kmph}$$

(12)

distance = 20 km; time = 4 hrs

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{20}{4} = 5 \text{ kmph}$$

(13)

Given $u = 5 \text{ m/s}$; $v = 15 \text{ m/s}$; $t = 5 \text{ sec}$

We know acceleration $a = \frac{v-u}{t} = \frac{-15+5}{5} = \frac{-10}{5} = -2 \text{ m/s}^2$

(14)

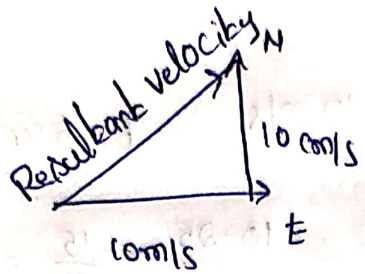
Since the body is moving with uniform velocity ie $v = \text{constant}$.

$\therefore$ change in velocity $= 0$

$\therefore$ acceleration $= \frac{\text{change in velocity}}{\text{time}}$

$$= \frac{0}{t} = 0 \text{ m/s}^2$$

(15)



$\therefore$ change in velocity = Resultant velocity

$= \sqrt{10^2+10^2} = 10\sqrt{2}$ cm/sec

Time = 10 sec

$\therefore$ acceleration = $\frac{\text{change in velocity}}{\text{time}} = \frac{10\sqrt{2}}{10} = \sqrt{2}\ cm/s^2$

Advanced level

(20), (21), (22)

For first $\frac{1}{5}$ sec the velocity is maintained constant

change in velocity = 0

acceleration = 0

From 15 to 25 sec $a = \frac{v-u}{t} = \frac{0-20}{25-15} = \frac{-20}{10} = -0.2\ m/s$

From 5 to 15 sec. $= \frac{20-10}{15-5} = \frac{10}{10} = 1\ m/s$.

(23)

Given $u = 25\ m/s$; $v = 10\ m/s$; $t = 5\ sec$

we know $a = \frac{v-u}{t} = \frac{10-25}{5} = \frac{-15}{5} = -3\ m/s^2$

(24)

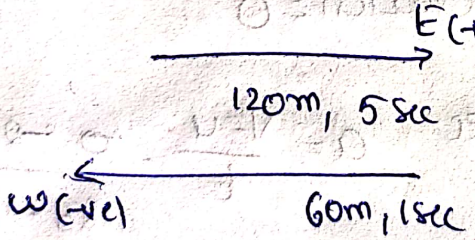
Given $u = 0$; $v = 36\ kmph$; $t = 10\ sec$

$= 36 \times \frac{5}{18}\ m/s$

$= 10\ m/s$

$\therefore$ acceleration $a = \frac{v-u}{t} = \frac{10-0}{10} = 1\ m/s^2$

(25)



Total distance $= 120 + 60$

$= 180\ m$

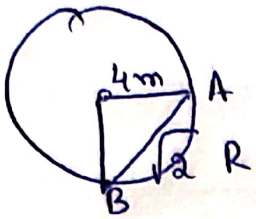
Total time $= 5 + 1 = 6\ sec$

$\langle speed \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{180}{6} = 30\ m/s$

Displacement $= +120\ m - 60\ m = +60\ m$

$\langle velocity \rangle = \frac{\text{Displacement}}{\text{time}} = \frac{60}{6} = 10\ m/s$

(26)



For $\frac{3}{4}^{th}$ of rotation

Distance travelled = $\frac{3}{4}$ × circumference of a circle

$= \frac{3}{4_2} \times 2\pi r$

$= \frac{3}{2} \times \frac{22}{7} \times 4_2$

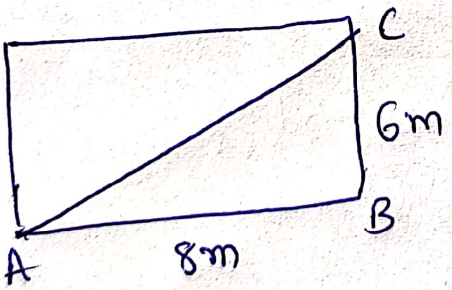
$\Rightarrow 6 \times 3.14 = 18.84$ m

(or) 6π m

Displacement = $\sqrt{2}$ R

$= 4\sqrt{2}$ m.

(27)



A → B → C

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

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

$= \sqrt{64 + 36} = 10$ m

From D → A

Displacement = 6m ; time = 2 sec

velocity = $\frac{\text{Displacement}}{\text{time}} = \frac{6\text{m}}{2\text{ sec}} = 3$ m/sec