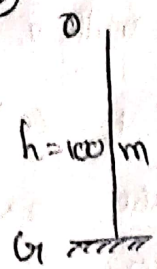
7th foundation
WS-3

Tbank

① WS2 - 14, 15, 16, 17 T bank
4, 5, 6, 7, 8 → L bank

①, ②



Total time of journey = 10sec

Total distance = GO + OG
= 100m + 100m
= 200m

Total displacement = Final position - Initial position
= G - G
= 0

$$\langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}} = \frac{0}{10} = 0$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{200}{10} = 20 \text{ m/s}$$

③

$V_1 = 30$ kmph $\rightarrow$ $t_1 = 30$ min $= \frac{1}{2}$ hr.

$V_2 = 40$ kmph $\rightarrow$ $t_2 = 40$ min $= \frac{2}{3}$ hr.

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{V_1 t_1 + V_2 t_2}{t_1 + t_2}$$

$$= \frac{30 \times \frac{1}{2} + 40 \times \frac{2}{3}}{\frac{1}{2} + \frac{2}{3}} = \frac{15 + 26.66}{\frac{7}{6}} = \frac{41.66 \times 6}{7}$$

$$= 35.71 \text{ kmph}$$

④

From given question Total distance = 60 km

so 1st half of the distance covered with $v_1 = 30$ kmph

and 2nd half of the distance with $v_2 = 60$ kmph

$$\langle \text{speed} \rangle = \frac{2v_1v_2}{v_1+v_2} = \frac{2\times 30\times 60}{60+30} = \frac{2\times 30\times 60^{20}}{90_3} = 40 \text{ kmph}$$

⑤

During start of motion $x_1 = 1272$ km

After $t = 50$ min $= \frac{5}{6}$ hrs $\rightarrow x_2 = 1352$ km

$\therefore$ Displacement of the car $= x_2 - x_1 = 1352 - 1272$

$= 80$ km

$$\langle \text{velocity} \rangle = \frac{\text{Displacement}}{\text{Time}} = \frac{80}{\frac{5}{6}} = \frac{80\times 6}{5} = 96 \text{ kmph}$$

⑥

$u =$ Speed $= 400$ kmls, $t = 10$ sec. $V = 600$ km/s

From $a = \frac{V-u}{t} = \frac{600-400}{10} = \frac{200}{10} = 20$ km/s^2

From $S = ut + \frac{1}{2}at^2$ For 10 sec

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

$$= 4000 + 1000 = 5000 \text{ km}$$

For next 50 sec $S_2 = vt = 600\times 50 = 30{,}000$ km

Total distance in one min $= S_1 + S_2 = 5000 + 30{,}000 = 35{,}000$ km

(7)

initial speed $u = 30$ m/s ; Final speed $= 50$ m/s

$t = 4$ sec

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

(8)

initial velocity $u = 15$ m/s ; Final velocity $v = 5$ m/s

$t = 2$ sec.

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

(9)

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

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

(10)

$v = 0$; $u = 20$ m/s.

$t_2 = 20$ sec ; $t_1 = 10$ sec.

$$\text{acceleration } a = \frac{v-u}{t_2-t_1} = \frac{0-20}{20-10} = \frac{-20}{10} = -2 \text{ m/s}^2$$

(14), (15), (16)

house $\xrightarrow{9 \text{ km}}$ school

$\rightarrow v_1 = 18$ kmph

$\leftarrow v_2 = 15$ kmph

To reach school $t_1 = \frac{\text{distance}}{v_1} = \frac{9}{18} = \frac{1}{2}$ hr

To reach house $t_2 = \frac{\text{distance}}{v_2} = \frac{9}{15} = \frac{3}{5}$ hrs

Total time $= t_1 + t_2 = \frac{1}{2} + \frac{3}{5} = \frac{6+5}{10} = \frac{11}{10}$ hrs

(17)

Distance moved $x_1 = 7m \rightarrow t_1 = 4$ sec

$x_2 = 18m \rightarrow t_2 = 6$ sec

$$\langle \text{velocity} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{x_1 + x_2}{t_1 + t_2}$$

$$= \frac{7+18}{4+6} = \frac{25}{10} = 2.5 \text{ m/s}$$

(18)

Initial speed $u = 45$ m/s : Final velocity $V = 3$ m/s

$t = 105$ sec

$$\text{Acceleration } a = \frac{V-u}{t} = \frac{3-45}{105} = \frac{-42}{105} = -2.8 \text{ m/s}^2$$

(19)

Initial velocity $u_1 = 10$ m/s for $t_1 = 5$ sec.

$V_2 = 20$ m/s for $t_2 = 4$ sec $\therefore V_3 = 15$ m/s $\rightarrow t_3 = 8$ sec

$$\langle \text{Acceleration} \rangle = \frac{\text{Total velocity}}{\text{Total time}} = \frac{V_1 + V_2 + V_3}{t_1 + t_2 + t_3}$$

$$= \frac{10+20+15}{5+4+8} = \frac{45}{17} = 2.65 \text{ m/s}^2$$

L Task

SAQ's

(1)

For $x_1 = 50$ km → speed $v_1 = 25$ kmph

$x_2 = 60$ km → speed $v_2 = 20$ kmph

Total time $= \frac{x_1}{v_1} + \frac{x_2}{v_2} = \frac{50}{25} + \frac{60}{20}$

$= 2 + 3 = 5$ hrs

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{x_1 + x_2}{5} = \frac{50\text{ km} + 60\text{ km}}{5}$$

$$= \frac{110}{5} = 22 \text{ kmph}$$

(2)

$t_1 = 2$ hrs →

A ← 200 km → B

← $t_2 = 3$ hrs

Here Total displacement

= Final position − initial position

= A − A

= 0

Total distance = AB + BA

= 200 km + 200 km

= 400 km

Total time = $t_1 + t_2$

= 2 hrs + 3 hr

= 5 hrs

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

= 80 kmph

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

$$= \frac{0}{5} = 0$$

(3)

distance = 70 km ; time = 2 hrs.

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

(4)

distance = 20 km ∴ t = 4 hrs

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

(5)

Initial speed $u = 5$ m/s ; Final speed $v = 15$ m/s

time = 5 sec.

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

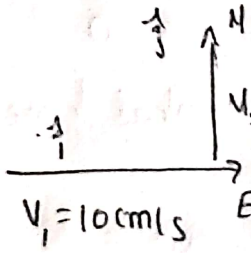
(6)

If the body was moving with uniform velocity

change in velocity $dv = 0$.

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time}} = \frac{0}{t} = 0$$

(7)



$$\text{Velocity} = 10\hat{i} + 10\hat{j}$$

$$|\text{velocity}| = \sqrt{10^2+10^2} = 10\sqrt{2} \text{ m/s}$$

$$\text{Acceleration} = \frac{|\text{velocity}|}{\text{time}} = \frac{10\sqrt{2}}{10} = \sqrt{2} \text{ cm/s}^2$$

(8)

Time = 0.46 sec. ∴ distance = 18.4 m.

$$\langle \text{speed} \rangle = \frac{\text{Distance}}{\text{time}} = \frac{18.4}{0.46} = 40 \text{ m/s}$$

speed is always +ve.

(9)

Speed = 1.4 m/s ; distance = 205 m.

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{205}{1.4} = 146 \text{ sec}$$

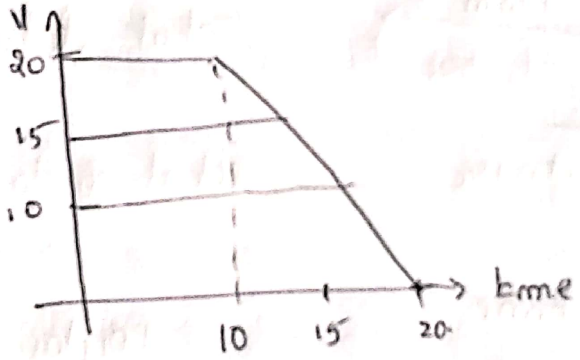
(10)

Time = 0.25 h ; displacement = 16 km. $= 16(-\hat{j})$ km

$$\langle \text{velocity} \rangle = \frac{\text{displacement}}{\text{Time}} = \frac{16}{0.25} = 64 \text{ kmph south}$$

$-\hat{j}$ → unit vector along South.

(14), (15), (16)



since From 0 → 10 sec the cheetah moving with uniform velocity → change in velocity = 0 ⇒ acceleration = 0

From 15 → 25 sec change in velocity = $V - U = 15 - 20 = -5$

$$\text{Acceleration} = \frac{dv}{dt} = \frac{-5}{25-15} = \frac{-5}{10} = -0.5$$

From 5 → 15 sec. → change in velocity = $V - U = 10 - 20 = -10$

$$\text{Acceleration} = \frac{dv}{dt} = \frac{-10}{15-5} = \frac{-10}{10} = -1 \text{ m/s}^2$$

(17)

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

$$\text{Retardation} = \frac{v-u}{t} = \frac{10-25}{5} = \frac{-15}{5} = -3\ m/s^2.$$

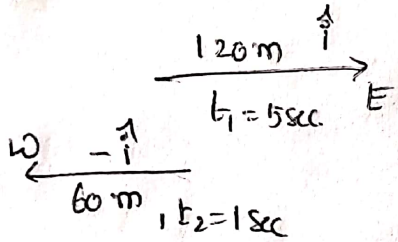
(18)

$u = 0 \quad ; \quad v = 36\ kmph = 36 \times \frac{5}{18} = 10\ m/s$

$$time = 10\ sec$$

$$\text{Acceleration} = \frac{v-u}{t} = \frac{10-0}{10} = \frac{10}{10} = 1\ m/s^2$$

(20)



Total distance = 120m + 60m

= 180m

Total displacement = $120\hat{i} + 60(-\hat{i})$

$= 60\hat{i}$

$|\text{Displacement}| = |60\hat{i}| = 60\ m$

Total time

$T = t_1 + t_2 = 5 + 1 = 6\ sec$

$$\langle speed \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{120}{6} = 20\ m/s$$

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

(21)

$u = 30\ m/s \quad ; \quad v = 10\ m/s \quad \rightarrow \quad time = 8\ sec$

$$\langle acceleration \rangle = \frac{v-u}{t} = \frac{0-30}{8} = \frac{-20}{8} = -2.5\ m/s^2$$