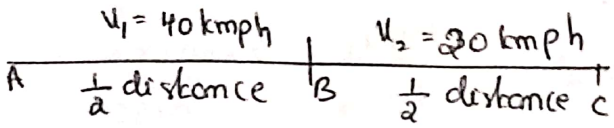
(1)

Total distance = 60 km



$$\langle \text{speed} \rangle = \frac{2v_1v_2}{v_1+v_2} = \frac{2\times40\times30}{40+30} = \frac{2\times40\times60}{3\cancel{70}} = 266 \text{ kmph}$$

(2)

$v_1 = 50$ kmph : $t_1 = 0.22$ h

$v_2 = 30$ kmph : $t_2 = 0.24$ h

$v_3 = 80$ kmph

$t_3 = 0.12$ hr

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{v_1t_1 + v_2t_2 + v_3t_3}{t_1+t_2+t_3}$$

$$= \frac{50\times0.22 + 30\times0.24 + 80\times0.12}{0.22+0.24+0.12}$$

$$= \frac{11.0 + 7.2 + 9.6}{0.58} = \frac{16.8+11}{0.58} = 47.93 \text{ kmph}$$

(3)

first half of the

Total distance = 20m + 40m + 55m

= 115m

Total time = 1 + 1 + 1 = 3 sec

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{115}{3} = 35 \text{ m/s}$$

(4)

$v_1 = 60$ kmph ; $s_1 = 250$ km [half of total distance]

$v_2 = 80$ kmph ; $s_2 = 250$ km [next half of total distance]

$$\therefore \langle \text{speed} \rangle = \frac{2v_1v_2}{v_1+v_2} = \frac{2\times 60\times 80}{60+80}$$

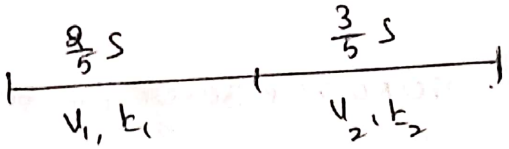
$$= \frac{2\times 60\times 80}{140} = \frac{60\times 8}{7} = 68.57 \text{ kmph}$$

(5)

distance = 455 m ; $t = 5$ sec.

$$\langle \text{velocity} \rangle = \frac{\text{distance}}{\text{time}} = \frac{455}{5} = 91 \text{ m/s}$$

(6)



Total distance = s

Total time $= t_1 + t_2 = \frac{2s}{5v_1} + \frac{3s}{5v_2} = \frac{s}{5}\left[\frac{2v_2+3v_1}{v_1v_2}\right]$

$$\therefore \langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{s}{\frac{s}{5}\left[\frac{2v_2+3v_1}{v_1v_2}\right]}$$

$$= \frac{5v_1v_2}{2v_2+3v_1}$$

(7)

$v = 0$; $t = 8$ sec ; $u = 50$ kmph $= 50\times\frac{5}{18} = \frac{125}{9}$ m/s

From defination of $a = \frac{v-u}{t} = \frac{0-\frac{125}{9}}{8} = -\frac{125}{9\times 8}$

$$a = -1.74 \text{ m/s}^2$$

(8)

$u = 0$; $t = 20$ sec $\quad v = 72$ kmph $= 72 \times \frac{5}{18} = 20$ m/s.

From defination of acceleration $a = \frac{v-u}{t}$

$\Rightarrow a = \frac{20-0}{20} = \frac{20}{20} = 1 \text{ m/s}^2$

(9)

$u = 54$ kmph : $v = 108$ kmph : $t = 15$ sec

$\therefore dv = v - u = 108 - 54 = 54$ kmph $= 54 \times \frac{5}{18} = 15$ m/s

From defination of $a = \frac{v-u}{t} = \frac{15}{15} = 1 \text{ m/s}^2$.

(10)

$u = 10$ m/s : $a = 50 \text{ m/s}^2$; $t = 3$ sec

From defination of $a = \frac{v-u}{t}$

$\Rightarrow v = u + at = 10 + 50 \times 3$

$\Rightarrow v = 10 + 150 = 160$ m/s

Advanced

(1)

$\langle \text{speed} \rangle = \frac{2v_1v_2}{v_1+v_2} = \frac{\text{Total distance}}{\text{Total time}}$

$= \frac{200 \text{ km} + 200 \text{ km}}{5 \text{ hr} + 5 \text{ hr}} = \frac{400 \text{ km}}{10 \text{ hrs}} = 40$ kmph

Total time $= 5 \text{ hr} + 5 \text{ hr} = 10$ hrs

$\langle \text{velocity} \rangle = 0$ because the car come back to Delhi After 10 hrs (ie) Displacement $= 0$

(2)

$S_{Nithin} = 300\,m$; $t_{Nithin} = 15$ sec.

$$V_{Nithin} = \frac{S_{nithin}}{t_{nithin}} = \frac{300}{15} = 20\ m/s$$

$S_{Jathin} = 600\,m$; $t_{Jathin} = 1\,min = 60$ sec

$$V_{Jathin} = \frac{S_{Jathin}}{t_{Jathin}} = \frac{600}{60} = 10\ m/s$$

Nithin will win the race.

(3)

$V_{athlete} = 10\ m/s$

$V_{bicycle} = 20\ m/min = \frac{20\ m}{60\ sec} = \frac{1}{3}\ m/s$

$V_{scooter} = 30\ kmph = 30 \times \frac{5}{18} = \frac{25}{3} = 8.33\ m/s$

b, c, a.

(6)

(i) $u = 18$ kmph ; $v = 72$ kmph ; $t = 30$ sec $= \frac{30}{3600}$ hrs

$v - u = 72 - 18 = 54$ kmph

$$a = \frac{v-u}{t} = \frac{54 \times 120}{3600} = 54 \times 120 = 6480\ kmh^{-2}$$

(ii)

Given $dv = 54$ kmph $\quad t = 1\,min = \frac{1}{60}$ hr

$$a = \frac{dv}{t} = \frac{54}{\frac{1}{60}} = 54 \times 60 = 3240\ kmph^2$$

(iii)

$u = 108$ kmph ; $v = 36$ kmph ; $t = 4$ s

$dv = v - u = -72$ kmph $= -72 \times \frac{5}{18} = -20\ m/s$

$$a = \frac{dv}{dt} = \frac{-20}{4} = -5\ m/s^2$$

(7)

(a) $u = 10\,m/s$; $v = 0\,m/s$; $t = 1\,sec$ $\rightarrow a = \frac{v-u}{t} = \frac{0-10}{1} = -10\,m/s^2$

(b) $u = 5\,m/s$; $v = 5\,m/s$; $t = 5\,sec$ $\rightarrow a = \frac{v-u}{t} = \frac{5-5}{5} = 0\,m/s^2$

(c) $u = 0\,m/s$; $v = 10\,m/s$; $t = 5\,sec$ $\rightarrow a = \frac{v-u}{t} = \frac{10-0}{5} = 2\,m/s^2$

(d) $u = 2\,m/s$; $v = 1\,m/s$; $t = 2\,sec$ $\rightarrow a = \frac{v-u}{t} = \frac{1-2}{2} = -0.5\,m/s^2$

(8)

$u = 108\,kmph$; $v = 36\,kmph$; $t = 10\,sec$

$\Rightarrow v-u = 36-108 = -72\,kmph = -72 \times \frac{5}{18} = -20\,m/s^2$

$acceleration = \frac{v-u}{t} = \frac{-20}{10} = -2\,m/s^2$

(9)

$t = 2\,min$; $r = 120\,m$

half revolution $= \frac{1}{2} \times$ Circumference

$= \frac{1}{2} \times 2\pi r = \pi r = \frac{22}{7} \times 120$

$\langle speed \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{\frac{22}{7} \times 120}{2 \times 60}$

$= \frac{22}{7} = 3.14\,m/s$

LTask CUQ's

(8)

Total distance $= 2cm + 1.5cm + 2.5cm + 3cm = 9cm$

Total time $= 4\,sec$

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

$= 2.25 \times 10^{-2}\,m/sec$

(9)

$t_1 = 1\ hr$, $d_1 = 40\ km$

$$Speed_1 = \frac{d_1}{t_1} = \frac{40}{1} = 40\ kmph$$

$t_2 = 15\ min = \frac{1}{4}\ hr$, $d_2 = 10\ km$

$$Speed_2 = \frac{d_2}{t_2} = \frac{10}{\frac{1}{4}} = 40\ kmph$$

$\therefore Speed_1 = Speed_2$ → uniform speed.

(10)

$r = 200\ m$; $t = 5\ min = 5 \times 60\ sec$

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

$$= \frac{\frac{1}{2} \times 2\pi r}{t} = \frac{2 \times \frac{22}{7} \times 200 \times \frac{1}{2}}{5 \times 60} = \frac{44}{21}$$

$$= \frac{44}{21}\ m/s$$

Jee mains level

(1)

$V_1 = 30\ kmph$; $V_2 = 50\ kmph$

$$\langle speed \rangle = \frac{2V_1V_2}{V_1 + V_2} = \frac{2 \times 30 \times 50}{30 + 50}$$

$$= \frac{2 \times 1500}{80} = \frac{150}{4} = 37.5\ kmph$$

(2)

$V_1 = 80$ kmph, $V_2 = 40$ kmph

If a body covers $\frac{1}{2}$ of time with a speed V_1 and remaining $\frac{1}{2}$ of time with a speed V_2.

$$\langle \text{speed} \rangle = \frac{V_1 + V_2}{2} = \frac{80+40}{2} = \frac{120}{2} = 60 \text{ kmph}$$

option → A.

(3)

$V_1 = 20$ kmph, $V_2 = 60$ kmph

If the car cover first $\frac{1}{3}$ of distance with V_1 and $\frac{2}{3}$ of distance with V_2 $\langle \text{speed} \rangle = \frac{3V_1V_2}{V_2 + 2V_1}$

$$\langle \text{speed} \rangle = \frac{3 \times 20 \times 60}{60 + 2 \times 20} = \frac{60 \times 60}{60+40} = \frac{3600}{100} = 36 \text{ kmph}$$

(4)

(5)

$u = 4\ m/s \quad ; \quad a = -2\ m/s^2$

$$a = \frac{v-u}{t} \Rightarrow -2 = \frac{0-4}{t}$$

$$\Rightarrow -2 = \frac{-4}{t}$$

$$\Rightarrow t = 2\ sec$$

(6)

$u = 5\ m/s$ to $v = 8\ m/s$ in $t = 2\ sec.$

$$a = \frac{v-u}{t} = \frac{8-5}{2} = \frac{3}{2} = 1.5\ m/s^2$$

(7)

$v_1 = 20\ kmph \quad ; \quad v_2 = 40\ kmph$

$$\langle speed \rangle = \frac{2v_1v_2}{v_1+v_2} = \frac{2\times 20\times 40}{20+40}$$

$$= \frac{40\times \overset{2}{\cancel{40}}}{\cancel{60}} = \frac{80}{3}\ kmph$$

(8)

$t_1 = 10\ min \quad v_1 = 20(+\hat{j})\ m/s \quad ; \quad v_2 = 40(\hat{j})\ m/s$

$t_2 = 20\ min \ , \ t_3 = 5\ min$

$$\langle velocity \rangle = \frac{v_1t_1 + v_2t_2}{t_1+t_2+t_3} = \frac{+20\hat{j}\times 10 + 40\hat{j}\times 20}{10+20+5}$$

$$= \frac{+200\hat{j}+800\hat{j}}{35} = \frac{1000}{35}\hat{j}\ m/s$$

$$= 28.57\ m/s.$$

(9)

$v_c^2 - v_A^2 = 2as_1$; $v_B^2 - v_c^2 = 2as_2$

$\Rightarrow v_c^2 - v_A^2 = 2a\frac{d}{2} \rightarrow (1)$; $v_B^2 - v_c^2 = 2a\frac{d}{2} \rightarrow (2)$

From (1) and (2)

$\Rightarrow v_c^2 - v_A^2 = v_B^2 - v_c^2$

$\Rightarrow v_c^2 + v_c^2 = v_A^2 + v_B^2$

$\Rightarrow 2v_c^2 = v_A^2 + v_B^2$

$\Rightarrow v_c = \frac{1}{\sqrt{2}}\sqrt{v_A^2 + v_B^2} = \frac{1}{\sqrt{2}}\sqrt{10^2 + 20^2}$

$= 5\sqrt{10}$ m/s

(10)

u = 36 kmph ; v = 108 kmph $t = \frac{1}{2}$ min = 30 sec.

$v - u$ = 108 - 36 = 72 kmph $= 72 \times \frac{5}{18} = 20$ m/s

Acceleration $= \frac{v-u}{t} = \frac{20}{30} = 0.66$ m/s^2

(4)

Distance between the home and market = 2.5 km

Total time = 40 min

Speed = 5 kmph and 7.5 kmph

home → market time $t_1 = \frac{d}{v} = \frac{2.5}{5} = \frac{1}{2}$ hr = 30 min

He returns back with a speed 7.5 kmph in rest of time that is 10 min. [out of 40 min, 30 min for home ~~Distance~~ to market]

Distance = speed × time = $7.5 \times \frac{10}{60} = 1.25$ km

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

$$\Rightarrow \frac{2.5 + 1.25}{\left[\frac{40}{60}\right] hr} = \frac{45}{8} = 5.625 \text{ kmPh}$$

option 'D' correct

Advanced

(2)

$u = 0$; $v = 75$ kmph $= 75 \times \frac{5}{18}$; $t = 5$ min $= 5 \times 60 = 300$ sec

Acceleration $= \frac{v-u}{t} = \frac{75 \times \frac{5}{18} - 0}{300} = \frac{125}{6 \times 300} = \frac{5}{72}$ m/s²

Distance $= v \times t = \frac{25}{75} \times \frac{5}{18} \times 300 \Rightarrow 6250$

$= 75 \times 5$ min

$= 75 \times \frac{5}{60}$ km $= \frac{25}{4}$ km.

(5), (6), (7)

$u = 0$; $a = 0.5\ m/s^2$; $v = 54$ kmph

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

Time taken to reach ground is calculated

from $v = u + at$

$\Rightarrow 15 = 0 + 0.5\ t$

$\Rightarrow 15 = \frac{1}{2} t \Rightarrow t = 30$ sec

From $v = u + at$ after '5' sec

$\Rightarrow v = 0 + 0.5 \times 5$

$\Rightarrow v = 0 + 2.5 = 2.5\ m/s$

From $v = u + at$

$\Rightarrow v = 0 + at$

$\Rightarrow v = at$

$$\frac{v_{21}}{v_7} = \frac{a \times 21}{a \times 7} = \frac{3}{1}$$

(8)

$u = 30$ m/sec ; $v = 10$ m/sec ; $t = 4$ sec.

From $v = u + at$

$\Rightarrow 10 = 30 + a \times 4 \Rightarrow 4a = -20$

$\Rightarrow a = -5\ m/s^2$

(9)

$t_1 = 1\frac{1}{2}\ hr = \frac{3}{2}\ hr \qquad x_1 = 0.25$ miles

$t_2 = \frac{1}{2}\ hr \rightarrow \qquad x_2 = 0.2$ miles

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

$$= \frac{0.25 + 0.2}{\frac{3}{2} + \frac{1}{2}} = \frac{0.45}{\frac{4}{2}} = \frac{0.45}{2}$$

$$= 0.45 \text{ mph.}$$