

ws. 9. speed and velocity $\frac{2d}{\frac{d}{v_1} + \frac{d}{v_2}}$

Given

$$d_1 = 30 \text{ km}, v_1 = 40 \text{ kmph}$$

$$d_2 = 30 \text{ km}, v_2 = 20 \text{ kmph}$$

clearly the car is covering half of the distances with different velocities

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

$$= \frac{2 \times 800}{60} = 26.6 \text{ kmph} \rightarrow c$$

$$\text{Total time} \Rightarrow 0.52 + 0.24 + 0.71$$

$$\Rightarrow 0.76 + 0.71$$

$$\Rightarrow 1.47 \text{ h}$$

$$\text{also } v_1 = 60 \text{ kmph}, v_2 = 30 \text{ kmph}, v_3 = 70 \text{ kmph}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{v_1 t_1 + v_2 t_2 + v_3 t_3}{t_1 + t_2 + t_3}$$

$$\Rightarrow \frac{60 \times 0.52 + 0.24 \times 30 + 70 \times 0.71}{1.47}$$

$$= 59.9 \text{ kmph}$$

③

$$\text{Total time} = 3 \text{ sec}$$

$$\text{Total distance} = 15 \text{ m} + 25 \text{ m} + 35 \text{ m}$$

$$= 75 \text{ m}$$

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

$$= \frac{75}{3} = 25 \text{ m/s} \rightarrow \text{D}$$

④

Here clearly the train is covering equal half of the distances (Delhi - Agra and Agra - Delhi)

with speeds $v_1 = 50 \text{ kmph}$; $v_2 = 70 \text{ kmph}$

$$\therefore \langle \text{speed} \rangle = \frac{2v_1v_2}{v_1 + v_2} = \frac{2 \times 50 \times 70}{50 + 70}$$

$$= \frac{100 \times 70}{120} = 116.6 \text{ kmph}$$

⑤

For one complete rotation

$$\text{displacement} = 0$$

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

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

⑥

Let $S_1 = \frac{2}{5} S$ with speed V_1 ,

$S_2 = \frac{3}{5} S$ with speed V_2

where 'S' is the total distance covered by the body

Time taken to cover distance S_1 is

$$t_1 = \frac{S_1}{V_1} = \frac{2}{5} \frac{S}{V_1}$$

Time taken to cover distance $S_2 \rightarrow t_2 = \frac{S_2}{V_2}$

$$t_2 = \frac{3}{5} \frac{S}{V_2}$$

$$\therefore \text{speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{S}{t_1 + t_2}$$

$$= \frac{S}{\frac{2}{5} \frac{S}{V_1} + \frac{3}{5} \frac{S}{V_2}} = \frac{S \times 5 V_1 V_2}{S(2V_2 + 3V_1)}$$

$$= \frac{5 V_1 V_2}{3 V_1 + 2 V_2}$$

⑦

Given $V_1 = 20 \text{ kmph}$, $V_2 = 40 \text{ kmph}$, $V_3 = 60 \text{ kmph}$

$t_1 = 5 \text{ sec}$, $t_2 = 10 \text{ sec}$, $t_3 = 15 \text{ sec}$,

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

$$= \frac{V_1 t_1 + V_2 t_2 + V_3 t_3}{t_1 + t_2 + t_3}$$

(7)th continuation

$$\langle V \rangle = \frac{20 \times 5 + 40 \times 10 + 60 \times 15}{5 + 10 + 15}$$

$$= \frac{100 + 400 + 900}{25} = 46.6 \text{ kmph}$$

(8)

Total distance covered by the person

$$d = 4 + 2 + 1 = 7 \text{ km}$$

$$\begin{aligned} \text{Total time} &= 32 + 22 + 16 \\ &= 70 \text{ min} \end{aligned}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{7}{70} = \frac{1}{10}$$

$$= 0.1 \text{ km/min} \rightarrow C$$

(9)

$$\text{See distance} = 120 \text{ km}$$

$$\text{time} = 2 \frac{1}{2} \text{ hr} = \frac{5}{2} \text{ hr}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{120}{\frac{5}{2}}$$

$$= \frac{240}{5} = 48 \text{ kmph} \rightarrow B$$

(10)

$$\text{speed} = 600 \text{ kmph}; \text{ time} = 2.5 \text{ hr}$$

$$\text{distance} = \text{speed} \times \text{time} = 600 \times 2.5$$

$$= 1500 \text{ km} \rightarrow A$$



Advanced

①

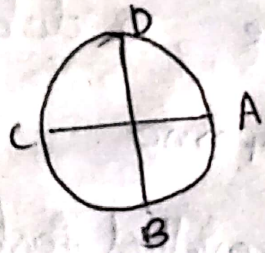
distance $d = 200 \text{ km}$; time $= 5 \text{ hrs}$.

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{200+200}{5+5}$$
$$= \frac{400}{10} = 40 \text{ kmph.}$$

Total time back to delhi $= 5+5=10 \text{ hrs}$

$\langle \text{velocity} \rangle = 0$ because displacement for whole journey is zero.

②



Time $= 4 \text{ sec}$

(i) Along AB distance $= \frac{1}{4} \times \text{Circumference}$

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

Time $= 1 \text{ sec}$

$$\therefore \langle \text{speed} \rangle = \frac{\text{distance}}{\text{time}} = \frac{\frac{\pi r}{2}}{\frac{1}{1}} = \frac{\pi r}{2}$$

(ii) For AC

distance $= \frac{1}{2} \times \text{Circumference}$

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

Time $= 2 \text{ sec}$

$$\therefore \langle \text{speed} \rangle = \frac{\text{distance}}{\text{time}} = \frac{\pi r}{2}$$

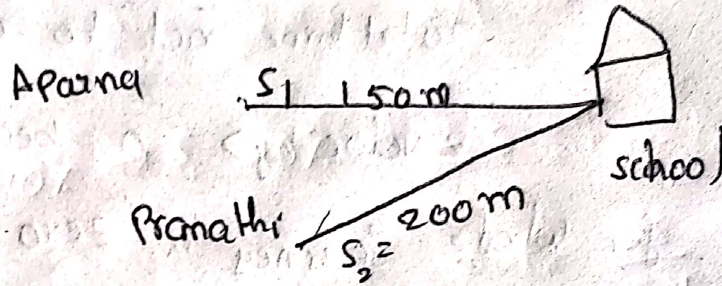
② (ii)

For one revolution distance = Circumference
 $= 2\pi r$

Time = 4 sec

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{2\pi r}{4} = \frac{\pi r}{2}$$

③



(i) ~~both~~ since both are reaching the school at same time, so distance covered by Pranathi > Aparna
 so Pranathi travelled farther?

(ii)

$$\text{Difference} = S_2 - S_1 = 200 - 150 = 50m$$

Aparna is nearer to school.

④

For Nithin

distance = 300m

time = 15 sec

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{300}{15} = 20 \text{ m/s}$$

For Jathin

distance = 600m

time = 60 sec

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{600}{60} = 10 \text{ m/s}$$



5

(a) speed = 10 m/s

(b) speed = 20 m/min = $\frac{20}{60} = \frac{1}{3}$ m/s

(c) 30 kmph = $30 \times \frac{5}{18} = \frac{25}{3}$ m/s

a > c > b $\rightarrow$ B

6

For Gaitman speed = $\frac{200 \text{ km}}{75 \text{ min}} = 2.67 \text{ km/min}$

For shabab? speed = $\frac{150}{60} = 2.5 \text{ km/min}$

For Rajdhan? speed = $\frac{280}{120} = 2.33 \text{ km/min}$

all a, b, c are correct $\rightarrow$ D

8

First distance covered $S_1 = x\%$

Remaining distance covered $S_2 = 100 - x\%$

(B) Total time = $\frac{S_1}{V_1} + \frac{S_2}{V_2}$

'S' is total distance

(a) $x = 20\% \rightarrow S_1 = 20\% \rightarrow S_1 = \frac{1}{5}S$

$S_2 = 80\% \rightarrow S_2 = \frac{4}{5}S$

Time = $\frac{S}{5V_1} + \frac{4S}{5V_2}$

∴ speed = $\frac{S_1 + S_2}{\Delta T} = \frac{S}{\frac{S}{5V_1} + \frac{4S}{5V_2}} = \frac{5V_1V_2}{V_1 + 4V_2}$



$$\textcircled{b} \quad x = 30\% \rightarrow S_1 = 30\% = \frac{3}{10} S ; \text{ time } t_1 = \frac{S_1}{V_1} = \frac{3S}{10V_1}$$

$$S_2 = 70\% \Rightarrow \frac{7}{10} S \Rightarrow t_2 = \frac{7S}{10V_2}$$

$$\therefore \langle v \rangle = \frac{S}{t_1 + t_2} = \frac{S}{\frac{3S}{10V_1} + \frac{7S}{10V_2}} = \frac{10V_1 V_2}{3V_2 + 7V_1}$$

$$\textcircled{c} \quad x = 40\% \rightarrow S_1 = 40\% \Rightarrow \frac{2}{5} S ; \text{ time } t_1 = \frac{S_1}{V_1}$$

$$\Rightarrow t_1 = \frac{2S}{5V_1}$$

$$S_2 = 60\% \Rightarrow \frac{3S}{5} ; \text{ time } t_2 = \frac{S_2}{V_2}$$

$$t_2 = \frac{3S}{5V_2}$$

$$\langle v \rangle = \frac{S}{t_1 + t_2} = \frac{S}{\frac{2S}{5V_1} + \frac{3S}{5V_2}} = \frac{5V_1 V_2}{2V_2 + 3V_1}$$

$$\textcircled{d} \quad x = 50\% \rightarrow S_1 = 50\% = \frac{1}{2} S \Rightarrow t_1 = \frac{S}{2V_1}$$

$$S_2 = \frac{1}{2} S \Rightarrow t_2 = \frac{S}{2V_2}$$

~~the body covers~~

$$\therefore \langle v \rangle = \frac{S}{t_1 + t_2} = \frac{S}{\frac{S}{2V_1} + \frac{S}{2V_2}} = \frac{2V_1 V_2}{V_2 + V_1}$$

LTASK
CUQA

④

$$\text{time} = 12 \text{ min} \Rightarrow \frac{12}{60} = \frac{1}{5} \text{ hr}$$

$$\text{speed} = 35 \text{ kmph} =$$

$$\text{distance} = \text{speed} \times \text{time} = 35 \times \frac{1}{5} = 7 \text{ km}$$

⑥

$$\text{Total distance} = 2 \text{ cm} + 1.5 \text{ cm} + 2.5 \text{ cm} + 3 \text{ cm}$$

$$= 11 \text{ cm}$$

$$\text{Total time} = 4 \text{ sec}$$

$$\text{Speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{11}{4} = 2.25 \text{ cm/s}$$
$$= 2.25 \times 10^{-2} \text{ m/s}$$

⑦

$$\text{Given } d_1 = 40 \text{ km}, t_1 = 1 \text{ hr}$$

$$\text{speed} = \frac{d_1}{t_1} = \frac{40}{1} = 40 \text{ kmph}$$

$$d_2 = 10 \text{ km}, t_2 = 15 \text{ min} \Rightarrow \text{speed} = \frac{d_2}{t_2}$$

$$\text{speed} = \frac{10}{15 \times \frac{1}{60}} = 40 \text{ kmph}$$

$\therefore$ uniform speed.

⑧

$$36 \text{ kmph} = \frac{36 \times 1000 \text{ m}}{60 \text{ min} \times 60 \text{ s}}$$

$$= 600 \text{ m/min}$$

⑨

$$\text{Distance} = 2\pi r = 2\pi \times 200 = 400\pi \text{ m}$$

$$\text{Time} = 5 \text{ min} = 5 \times 60 = 300 \text{ s}$$

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

$$= \frac{400 \times \pi}{300} = \frac{4 \times 22}{3 \times 7}$$

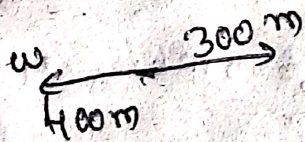
$$= \frac{88}{21} \text{ m/s}$$

$$= \frac{200 \times 22}{300 \times 7} = \frac{44}{21}$$

SAGAN

①

According to given data



$$\text{Total Time} = 18 \text{ s}$$

$$\text{Total distance} = 300 + 400 = 700 \text{ m}$$

$$\text{Total displacement} = 400 - 300 = 100 \text{ m}$$

$$\text{Speed} = \frac{700}{18}$$

$$= 38.88 \text{ m/s}$$

$$\text{Velocity} = \frac{100}{18} = 5.55 \text{ m/s}$$

(2)

$$\text{Total distance} = 30 + 45 = 75$$

$$\text{Total time} = 2 + 3 = 5 \text{ hrs}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{75}{5} = 15 \text{ mph}$$

(3)

$$\text{Total distance} = 30 + 30 = 60 \text{ m}$$

here the cover is covering every half of the distance with speeds $V_1 = 20 \text{ m/s}$; $V_2 = 12 \text{ m/s}$.

$$\therefore \langle \text{speed} \rangle = \frac{2V_1V_2}{V_1 + V_2} = \frac{2 \times 20 \times 12}{20 + 12}$$

$$\Rightarrow \frac{40 \times 12}{32} = 15 \text{ m/s}$$

(4)

$$\text{Here total time} = \frac{S_1}{V_1} + \frac{S_2}{V_2} = \frac{30}{60} + \frac{30}{40}$$

$$= \frac{1}{2} + \frac{3}{4} = \frac{10}{8} = \frac{5}{4} \text{ hrs}$$

$$= \frac{5}{4} \times 60 \text{ min} = 75 \text{ min}$$

$$\langle \text{speed} \rangle = \frac{2V_1V_2}{V_1 + V_2} = \frac{2 \times 60 \times 40}{60 + 40}$$

$$= \frac{2 \times 2400}{100} = 48 \text{ kmph}$$

⑤ initial velocity $u = 20 \text{ m/s}$

Final velocity $v = 50 \text{ m/s}$

$$\langle \text{velocity} \rangle = \frac{u+v}{2} = \frac{20+50}{2} = \frac{70}{2} = 35 \text{ m/s}$$

→ B

⑥

Distance covered $= 100 \text{ m}$

Time $= 10.48 \text{ sec}$

$$\langle \text{velocity} \rangle = \frac{\text{displacement}}{\text{time}} = \frac{100}{10.48}$$

$$= 9.54 \text{ m/s} \rightarrow A$$

⑦

Total distance $= 0.25 + 0.2 = 0.45 \text{ miles}$

Total time $= \frac{1}{2} + \frac{1}{2} = 1 \text{ hr}$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{0.45}{1} = 0.45 \text{ m/h}$$

→ A

⑧

Here

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

$$\left\{ \begin{array}{l} v_1 = 50 \text{ kmph} \\ v_2 = 30 \text{ kmph} \end{array} \right.$$

$$= \frac{2 \times 30 \times 50}{30+50}$$

$$= \frac{2 \times 1500}{80} = \frac{1500}{40} = \frac{150}{4} = 37.5 \text{ kmph}$$

9

Total distance = 60 kmph

Total time = 3 hrs

$$\text{Speed} = \frac{60}{3} = 20 \text{ kmph}$$

Speed for first 40 km is 16 kmph

$$\therefore \text{time taken} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{40}{16} = \frac{10}{4} \text{ hrs}$$

$$\text{Remaining time} = 3 - \frac{10}{4} = \frac{12-10}{4} = \frac{1}{2} \text{ hrs}$$

Remaining distance = 20 km

$$\text{Speed } v_2 = \frac{20}{\frac{1}{2}} = \frac{20}{\frac{1}{2}} = 40 \text{ kmph}$$

10

Here Total displacement = 15 - 5 = 10 m

Total time = 4 - 2 = 2 sec

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

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

Advanced

①

$$\text{distance} = 3 \text{ km} \quad \text{time} = 5 \text{ min} = 5 \times 60 \\ = 300 \text{ sec. (or)}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}} \quad \frac{5}{60} \text{ hr} = \frac{1}{12} \text{ hr}$$

$$= \frac{3 \text{ km}}{\frac{1}{12} \text{ hr}} = 36 \text{ kmph}$$

$$= 36 \times \frac{5}{18} \text{ m/s} = 10 \text{ m/s} \\ = 1000 \text{ cm/s}$$

→ D

②

$$\text{Given speed} = 45 \text{ kmph (or)} 45 \times \frac{5}{18} \text{ m/s}$$

$$\text{we know distance} = \text{speed} \times \text{time}$$

$$\text{a) } t = 1 \text{ hr} \rightarrow d_1 = 45 \times 1 = 45 \text{ km}$$

$$\text{b) } t = 1 \text{ min} \rightarrow d_2 = 45 \times \frac{1000}{60} \times 1 = 750 \text{ m/min}$$

$$\text{c) } t = 1 \text{ sec} \rightarrow d_3 = 45 \times \frac{5}{18} \times 1 = 12.5 \text{ m}$$

all, a, b, c are correct → D

③

$$\text{Given } r = 7 \text{ m} \quad t = 2 \text{ sec}$$

$$\text{a) distance} = \frac{1}{2} \times \text{circumference} = \frac{1}{2} \times 2\pi r = \frac{22}{7} \times 7 \\ = 22 \text{ m}$$

$$\text{b) displacement} = 2r = 2 \times 7 = 14 \text{ m}$$

$$\text{c) speed} = \text{distance} / \text{time} = \frac{22}{2} = 11 \text{ m/s}$$

$$\text{d) velocity} = \text{displacement} / \text{time} = \frac{14}{2} = 7 \text{ m/sec}$$

(14)

Given

length of second arm = $7 \text{ cm} = r_s$

length of min arm = $5 \text{ cm} = r_{\text{min}}$

length of hr arm = $3.5 \text{ cm} = r_{\text{hr}}$

where $r \rightarrow$ radius

(i) speed of second arm = $\frac{\text{distance}}{\text{time}}$

$$= \frac{2\pi r_s}{60} = \frac{2 \times \frac{22}{7} \times 7}{60 \times 60} = \frac{11}{15} \text{ cm/s}$$

(ii) speed of min arm = $\frac{\text{distance}}{\text{time}}$

$$= \frac{2\pi r_{\text{min}}}{60} = \frac{2 \times \frac{22}{7} \times 5}{3600}$$
$$= \frac{11 \times 5}{1800 \times 7} = \frac{11}{180 \times 7} = \frac{11}{1260}$$

(iii) speed of hour arm = $\frac{\text{distance}}{\text{time}}$

$$= \frac{2\pi r_{\text{hr}}}{60} = \frac{2 \times \frac{22}{7} \times 3.5}{12 \times 3600}$$
$$= \frac{11}{21600} \text{ cm/s}$$

③ In ~~1 hr~~ 1 hr, the minute hand completes one rotation, displacement is zero and hence velocity is zero

④

Given radius = R

For $\frac{1}{4}$ rotation time = T

For complete rotation time = $4T$

$$\begin{aligned} \text{⑤ For one rotation } \langle \text{speed} \rangle &= \frac{\text{Total distance}}{\text{Total time}} \\ &= \frac{2\pi R}{4T} = \frac{\pi R}{2T} \end{aligned}$$

$$\text{⑥ } \langle \text{velocity} \rangle = \frac{\text{Total displacement}}{\text{Total time}} = \frac{0}{4T} = 0$$

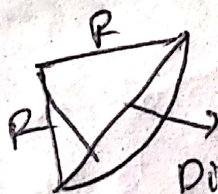
⑦

Displacement = $2R$, time = $2T$

$$\begin{aligned} \langle \text{velocity} \rangle &= \frac{\text{Total displacement}}{\text{Total time}} \\ &= \frac{2R}{2T} = \frac{R}{T} \end{aligned}$$

⑧

Displacement = $\sqrt{2} R$, time = T



Displacement

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

$$\langle \text{velocity} \rangle = \frac{\sqrt{2} R}{T}$$

(10)

For Train

$$\text{distance} = 240 \text{ km}; \text{ Time} = 4 \text{ hr}$$

$$\text{For car} \quad \text{distance} = 120 \text{ km}; \text{ time} = 3 \text{ hr}$$

$$\text{For cycle} \quad \text{distance} = 3 \text{ km}; \text{ time} = \frac{1}{2} \text{ hr.}$$

$$(i) \text{ speed of train} = \frac{240}{4} = 60 \text{ kmph}$$

$$(ii) \text{ speed of car} = \frac{120}{3} = 40 \text{ kmph}$$

$$(iii) \text{ speed of cycle} = \frac{3}{\frac{1}{2}} = 6 \text{ kmph}$$

$$\text{Total distance} = 240 + 120 + 3 = 363 \text{ km}$$

$$\text{Total time} = 4 + 3 + \frac{1}{2} = \frac{15}{2} = 7.5 \text{ hr}$$

$$\text{Speed} = \frac{\text{Total distance}}{\text{Total time}}$$

$$= \frac{363}{7.5}$$

$$= 48.4 \text{ kmph}$$

105-10

8th foundation

Acceleration

Task

①

Given initial speed $u = 36 \text{ kmph} = 36 \times \frac{5}{18}$

Final speed $v = 108 \text{ kmph} = 108 \times \frac{5}{18}$

Time $= \frac{1}{2} \text{ min} = 30 \text{ sec}$

From $a = \frac{v-u}{t} = \frac{(108 - 36) \times \frac{5}{18}}{30}$

$$\Rightarrow \frac{72 \times \frac{5}{18}}{30} = \frac{2}{3} = 0.66 \text{ m/s}^2 \rightarrow A$$

②

Given initial ~~speed~~ velocity $u = 50 \text{ kmph}$

$$= 50 \times \frac{5}{18} \text{ m/s}$$

Final speed $v = 0$

Time $= 8 \text{ sec}$

$$\therefore a = \frac{v-u}{t} = \frac{0 - \frac{50 \times 5}{18}}{8} = \frac{-250}{8 \times 18} = -1.74 \text{ m/s}^2 \rightarrow B$$

'-ve' shows it is in retardation

③

Given initial velocity $u = 0$ (start from rest)

Final velocity $v = 36 \text{ kmph} = 36 \times \frac{5}{18} \text{ m/s}$
 $= 10 \text{ m/s}$

Time $= 10 \text{ sec}$

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



(4)

Given initial speed $u = 36 \text{ kmph}$

Final speed $v = 72 \text{ kmph}$

$$\Delta v = v - u = 72 - 36 = 36 \text{ kmph} = 36 \times \frac{5}{18}$$

$$= 10 \text{ m/s}$$

time = 10 sec

$$\text{acceleration } a = \frac{v - u}{t} = \frac{10}{10} = 1 \text{ m/s}^2 \rightarrow D$$

(5)

Given initial speed = 10 m/s

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

$$\text{From } a = \frac{v - u}{t} \Rightarrow v - u = at$$

$$\Rightarrow v = u + at$$

$$= 10 + 50 \times 3$$

$$= 160 \text{ m/s} \rightarrow D$$

(6)

Given time $t = 2.5 \text{ s}$; acceleration

$$a = 108 \text{ m/s}^2$$

Final speed = 7.6 m/s = v

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

$$\Rightarrow at = v - u$$

$$\Rightarrow u = v - at = 7.6 - 108 \times 2.5$$

$$= 7.6 - 270$$

$$= -262.4 \text{ m/s} \rightarrow C$$



7

Given acceleration $a = 3.2 \text{ m/s}^2$

time = 32.8 sec

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

here $u = 0$

$$\therefore S = \frac{1}{2} at^2 = \frac{1}{2} \times 3.2 \times (32.8)^2$$

$$S = 1.6 \times 1075.84$$

$$= 1721 \text{ m} \rightarrow A$$

8

Given car starts from rest $u = 0$

time = 5.21 sec distance $S = 110 \text{ m}$

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

$$\Rightarrow 110 = 0 \times t + \frac{1}{2} a (5.21)^2$$

$$\Rightarrow 110 = \frac{a}{2} (5.21)^2$$

$$\Rightarrow 220 = a \times 27.144 \Rightarrow a = \frac{220}{27.14} = 8.1 \text{ m/s}^2$$

$\rightarrow C$

9

Given initial velocity $u = 18.5 \text{ m/s}$

Final velocity $v = 46.1 \text{ m/s}$

time = 2.47 sec

From $a = \frac{v - u}{t} = \frac{46.1 - 18.5}{2.47} = 11.17 \text{ m/s}^2$

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

$$= 18.5 \times 2.47 + \frac{1}{2} \times 11.17 \times (2.47)^2 = 79.8 \text{ m}$$

(10)

Given $v = 444 \text{ m/s}$ { Rocket starts
 $t = 1.83 \text{ sec}$ from rest
 $u = 0$ }

$$a = \frac{v}{t} = \frac{444}{1.83} \text{ m/s}^2$$

$$\text{From } S = \frac{1}{2} at^2$$

$$= \frac{1}{2} \times \frac{444^2}{1.83} (1.83)^2$$

$$= 222 \times 1.83$$

$$= 406 \text{ m}$$

Advanced

(1)

Given body starts from rest $u = 0$

initial velocity $u = 0$

acceleration = uniform = constant

$$= 5 \text{ m/s}^2$$

change in velocity = constant = 5 m/s

after $t = 5 \text{ sec}$

$$v = u + at = 0 + 5 \times 5 = 25 \text{ m/s}$$

after $t = 10 \text{ sec}$

$$v = u + at = 0 + 5 \times 10 = 50 \text{ m/s}$$

a, b, c, are correct

② Given initial speed $u = 20 \text{ m/s}$

Final speed $v = 60 \text{ m/s}$; time $= 4 \text{ sec}$

$$\text{Acceleration } a = \frac{v-u}{t} = \frac{60-20}{4} = \frac{40}{4} = 10 \text{ m/s}^2$$

velocity after 6 sec

$$v = u + at = 20 + 10 \times 6 = 80 \text{ m/s}$$
$$= 80 \times \frac{1.6}{5} = 256 \text{ kmph}$$

only a, b, c. $\rightarrow A$

④

If the velocity of a body is decreasing
final velocity is less than initial
velocity so the acceleration is negative

because $a = \frac{v-u}{t}$

That negative acceleration is called
retardation

⑤

(a)

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

(b)

$$a = \frac{v-u}{t} = \frac{5-5}{5} = 0$$

(c)

$$a = \frac{10-0}{5} = 2 \text{ m/s}^2$$

(d)

$$a = \frac{1-2}{2} = -\frac{1}{2} = -0.5 \text{ m/s}^2$$

⑥

Given

initial velocity $u = 18 \text{ kmph}$

Final velocity $v = 72 \text{ kmph}$

$$t = 30 \text{ sec} = \frac{30}{3600} = \frac{1}{120} \text{ hrs}$$

$$v - u = 72 - 18 = 54 \text{ kmph} = 54 \times \frac{5}{18} = 15 \text{ m/s}$$

$$a = \frac{v - u}{t} = \frac{15}{30} = \frac{1}{2} \text{ m/s}^2$$

$$(or) a = \frac{54}{\frac{1}{120}} = 54 \times 120 = 6480 \text{ kmph}^2 \rightarrow B$$

⑦

Given

change in velocity $= v - u = 54 \text{ kmph}$

$$\text{time} = 1 \text{ min} = \frac{1}{60} \text{ hrs}$$

$$a = \frac{v - u}{t} = \frac{54}{\frac{1}{60}} = 60 \times 54 = 3240 \text{ kmph}^2 \rightarrow B$$

⑧

change in velocity $= v - u = 36 - 18 = 18 \text{ kmph}$

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

~~time = 4 s~~

$$= -72 \text{ kmph} = -\frac{72 \times 5}{18}$$

$$= -20 \text{ m/s}$$

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

⑨ Given the body starts from rest $u=0$

$$v = 12 \text{ m/s}, t = 5 \text{ s}$$

$$\text{From } a = \frac{v-u}{t} = \frac{12-0}{5} = \frac{12}{5} = 2.4 \text{ m/s}^2$$

$$\text{From } s = ut + \frac{1}{2}at^2$$

$$\Rightarrow s = 0 \times 5 + \frac{1}{2} \times 2.4 \times 5^2$$

$$= 0 + 1.2 \times 25 = 30 \text{ m}$$

⑩

initial velocity $u = 50 \text{ kmph}$

stopping distance $s_1 = 6 \text{ m}$

if $u_2 = 100 \text{ kmph}$

$s_2 = ?$

here the car coming to rest i.e. $v=0$

$$\text{From } v^2 - u^2 = 2as$$

$$\Rightarrow 0^2 - u^2 = 2as \Rightarrow u^2 \propto s$$

$$\Rightarrow \frac{s_2}{s_1} = \left[\frac{u_2}{u_1} \right]^2$$

$$\Rightarrow \frac{s_2}{6} = \left[\frac{100}{50} \right]^2$$

$$\Rightarrow \frac{s_2}{6} = 2^2 \Rightarrow s_2 = 2^2 \times 6 = 24 \text{ m}$$

LTask

SAa's

①

Given initial velocity $u = 0$

Final velocity $v = 7.10 \text{ m/s}$

distance $s = 35.4 \text{ m}$

From $v^2 - u^2 = 2as$

$$\Rightarrow (7.1)^2 - 0^2 = 2a(35.4)$$

$$\Rightarrow 7.1 \times 7.1 = a \times 70.8$$

$$a = \frac{7.1 \times 7.1}{70.8} = 0.71 \text{ m/s}^2$$

$\rightarrow B$

②

Given

$$a = 3 \text{ m/s}^2$$

$v =$ Take off speed $= 65 \text{ m/s}$

$u = 0$ because the flight starts from rest

From $v^2 - u^2 = 2as$

$$\Rightarrow (65)^2 - 0^2 = 2 \times 3 \times s$$

$$\Rightarrow 65 \times 65 = 6s$$

$$\Rightarrow s = \frac{4225}{6} \approx 704 \text{ m} \rightarrow D$$

③

initial velocity $u = 22.4 \text{ m/s}$; $t = 2.55 \text{ s}$

Final velocity $v = 0$

$$\text{From } a = \frac{v - u}{t} = \frac{0 - 22.4}{2.55} = -\frac{22.4}{2.55}$$



$$S = 2.55 + 22.4 + \frac{1}{2} \left(-\frac{22.4}{2.55} \right) (2.55)^2$$

$$\therefore S = 2.55 + 22.4 \left[1 - \frac{1}{2} \right] = \frac{57.12}{2} = 28.56 \text{ m} \rightarrow D$$

(4)

distance travelled by kangaroo = 2.62 m

$$a = g = 9.8 \text{ m/s}^2$$

$$\text{From } v^2 - u^2 = 2as \text{ here } u = 0$$

$$\therefore 2.62 \quad v^2 - 0^2 = 2 \times 9.8 \times 2.62$$

$$\therefore v = \sqrt{51.352} = 7.2 \text{ m/s} \rightarrow B$$

kangaroo is starting from rest ($u=0$)

(5)

change in velocity of fly = ~~75~~ $v - u$

$$= 75 - 145$$

$$= -70 \text{ m/s}$$

$$\text{time} = 15 \text{ s}$$

$$\text{From } a = \frac{v - u}{t} = \frac{-70}{15} = -4.66 \text{ m/s}^2$$

$$\text{From } s = ut + \frac{1}{2} at^2$$

$$= 145 \times (15) + \frac{1}{2} \left(-\frac{70}{15} \right) (15)^2$$

$$\therefore 145 \times 15 - \frac{1}{2} \times 70 \times 15$$

$$\therefore 15 [145 - 35] = 15 \times 110$$

$$= 1650 \text{ m} \rightarrow A$$

⑥

initial velocity $u = 1.6 \text{ m/s}$

acceleration $a = 4 \text{ m/s}^2$; $t = 4 \text{ sec}$

From $s = ut + \frac{1}{2}at^2$

$$\Rightarrow s = 1.6 \times 4 + \frac{1}{2} \times 4 \times 4^2$$

$$= 6.4 + 2 \times 16 = 38.4 \text{ m} \rightarrow B$$

⑦

Given initial speed $u = 12 \text{ m/s}$

$a = -1.0 \text{ m/s}^2$; $t = 6 \text{ sec}$

From $s = ut + \frac{1}{2}at^2$

$$\Rightarrow s = 12 \times 6 + \frac{1}{2}(-1)(6)^2$$

$$= 72 - \frac{1}{2} \times 36 = 72 - 18 = 54 \text{ m} \rightarrow B$$

⑧

Given plane starts from rest so $u = 0$

$a = 5 \text{ m/s}^2$; distance $s = 500 \text{ m}$

From $v^2 - u^2 = 2as$

$$\Rightarrow v^2 - 0^2 = 2 \times 5 \times 500$$

$$\Rightarrow v = \sqrt{5000} \approx 71 \text{ m/s} \rightarrow B$$

⑨

Given

$a = -11 \text{ m/s}^2$; initial speed $u = 55 \text{ m/s}$

final speed $v = 0$

From $v^2 - u^2 = 2as$

$$\Rightarrow 0^2 - (55)^2 = 2(-11)s$$

$$\Rightarrow -55 \times 55 = -22s$$

$$\Rightarrow s = \frac{55 \times 55}{2}$$

$$\approx 1512.5 \text{ m} \rightarrow B$$



⑩

Given initial velocity $u = 4 \text{ m/s}$

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

Final velocity $v = 0$

From $v = u + at$

$$\Rightarrow 0 = 4 + (-2)t$$

$$\Rightarrow 4 = 2t \Rightarrow t = 2 \text{ sec} \rightarrow A$$

Advanced

②

Given

initial velocity $u = 0$

Final velocity $v = 75 \text{ kmph}$; $t = 5 \text{ min}$

$$= 75 \times \frac{5}{18} \text{ m/s} = \frac{5}{60} \text{ hr} = \frac{1}{12} \text{ hr}$$

$$a = \frac{v - u}{t} = \frac{75 - 0}{\frac{1}{12}} = 75 \times 12 \text{ kmph}^2$$

or)

$$\Rightarrow a = \frac{75 \times \frac{5}{18} - 0}{5 \times 60 \text{ sec}} = \frac{75 \times 5}{5 \times 18 \times 60} = \frac{5}{72} \text{ m/s}^2$$

distance $s = \frac{1}{2} at^2 = \frac{1}{2} \times \frac{5}{72} \times (5 \times 60)^2$

$$= \frac{1}{2} \times 75 \times 12 \times \left(\frac{1}{12}\right)^2 = \frac{75}{24}$$

$$= \frac{25}{8} \text{ km}$$

⑤ Given initial velocity $u=0$

$$a = 2 \text{ m/s}^2 \rightarrow t_{\text{me}} = \frac{1}{2} \text{ min} = 30 \text{ s}$$

$$\therefore s = ut + \frac{1}{2}at^2 = 0 \times 30 + \frac{1}{2} \times 2 \times 30^2$$

$$= \frac{1}{2} \times 2 \times 900$$

$$= 900 \text{ m}$$

After 30 sec velocity $v = u + at$
 $= 0 + 2 \times 30$

$$v_{\text{max}} = 60 \text{ m/s}$$

For next 30 sec (Total time 1 min)

Back at initial velocity { max velocity in entire journey }, Final velocity $v' = 0$

$$\text{From } v'^2 - u^2 = 2as$$

$$\Rightarrow v'^2 - v^2 = 2as$$

$$\Rightarrow 0 - 60^2 = 2(-2)s$$

$$\Rightarrow +3600 = 4s$$

$$\Rightarrow s = 900 \text{ m}$$

$$\text{Total distance} = 900 + 900 = 1800 = 1.8 \text{ km}$$

$$v_{\text{max}} = 60 \text{ m/s}$$

For $\frac{1}{2}$ of v_{max} let x be the position

$$v = \frac{1}{2} v_{\text{max}} \quad \text{From } v^2 - u^2 = 2as$$

$$= \frac{60}{2}$$

$$= 30 \text{ m/s}$$

$$\Rightarrow \left(\frac{1}{2} \times 60\right)^2 - 0^2 = 2(2)s$$

$$\Rightarrow 900 = 4s$$

$$\Rightarrow s = 225 \text{ m}$$



⑥ Given $u = 0$; $a = 0.5 \text{ m/s}^2$; $v = 54 \text{ kmph}$

(i) From $v = u + at$ $= 54 \times \frac{5}{18}$
 $= 15 \text{ m/s}$

$$\Rightarrow 15 = 0 + (0.5)t$$

$$\Rightarrow 15 = 0.5t$$

$$t = 30 \text{ s} \rightarrow A$$

(ii) after $t = 5 \text{ s}$

$$v = u + at = 0 + (0.5)(5)$$

$$= 2.5 \text{ m/s} \rightarrow B$$

(iii) From $v = u + at$

$$v = 0 + at \Rightarrow v = at$$

$$\therefore \frac{v_1}{v_2} = \frac{t_1}{t_2} = \frac{21}{7} = \frac{3}{1} \rightarrow C$$

(10)

(a)

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

(b)

$$u = 30 \text{ m/s}; v = 10 \text{ m/s}; a = \frac{v - u}{t} = \frac{10 - 30}{4} = -5 \text{ m/s}^2$$

(c) If the body is in uniform motion

$$\text{velocity} = v = \text{constant} \Rightarrow a = 0$$

(d)

$$u = 2 \text{ m/s}; v = 22 \text{ m/s}; t = 5 \text{ s}$$

$$a = \frac{v - u}{t} = \frac{22 - 2}{5} = \frac{20}{5} = 4 \text{ m/s}^2 \rightarrow C$$

(11)

Given The body starts from rest $u=0$

$$a = 10 \text{ m/s}^2, \quad t = 5 \text{ s}$$

$$\text{From } s = ut + \frac{1}{2}at^2$$

$$\Rightarrow s = 0 \times 5 + \frac{1}{2} \times 10 \times 5^2$$

$$= 0.5 \times 25 = 125 \text{ m}$$

(12)

Given initial speed $u_1 = 60 \text{ kmph}$.

distance $s_1 = 20 \text{ m}$

$$\text{if } u_2 = 120 \text{ m} \quad s_2 = ?$$

$$\text{we know } s \propto u^2 \Rightarrow \frac{s_2}{s_1} = \left[\frac{u_2}{u_1} \right]^2$$

$$\Rightarrow \frac{s_2}{20} = \left[\frac{120}{60} \right]^2 \Rightarrow \frac{s_2}{20} = 4$$

$$\Rightarrow s_2 = 80 \text{ m}$$