WS-7 6th foundation (speed & velocity)

Task.

(1)

Given distance = 20 km ; time = 4 hrs

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

(2)

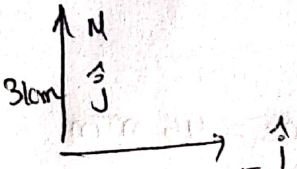
After 5 sec the stone reaches ground. From where it is projected.

∴ displacement = Final position − initial position

= Ground − Ground

= 0

(3)



$\hat{i}$, $\hat{j}$ are unit vectors along East and North.

∴ Displacement $= 4\hat{i} + 3\hat{j}$

$|\text{Displacement}| = \sqrt{4^2 + 3^2}$

$= \sqrt{16 + 9}$

$= \sqrt{25} = 5$ km NE

(4)

Displacement $= 12\hat{i} + 9\hat{j} + 6\hat{k}$.

where $\hat{i}$, $\hat{j}$, $\hat{k}$ are unit vectors along East, North and vertically upwards

$|\text{Disp}| = \sqrt{12^2 + 9^2 + 6^2} = \sqrt{144 + 81 + 36} = \sqrt{261} = 16.16$ approx cm

(5)

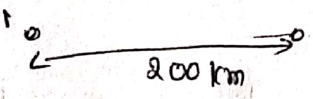
$u = 10 m/sec$; $a = 1 m/s^2$; $t = 10 sec$

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

$= 10 \times 10 + \frac{1}{2} 1 \times 10^2 = 100 + \frac{100}{2}$

$= 150m$

(6)



time = 5 hrs.

odometer reading = distance travelled = 350 km

$speed = \frac{distance}{time} = \frac{350}{5} = 70$

(9)

distance = k ; time = 45 min

(32)

Because the two buses are travelling in opposite directions

first bus covers k m due south

second bus covers km due North.

(7)

$l_{train} = 100m$; $l_{bridge} = 500$; Velocity = 5 kmph

velocity = $5 \times \frac{5}{18}$ m/s = $\frac{25}{18}$ m.

total distance travelled = $l_{train} + l_{bridge} = 100 + 500 = 600m$

time = $\frac{distance}{velocity} = \frac{600 \times 18}{25} = 24 \times 18 = 432 sec.$

(9)

Total distance travelled = 20 km + 30 km + 10 km

= 60 km

Total time = 1 hr + 1 hr + 1 hr = 3 hr.

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{60 \text{ km}}{3 \text{ hr}}$$

= 20 kmph

(10)

(a) Initial speed = 400 km/s : $t_1 = 10$ sec

final speed $v = 600$ km/s

In first 10 sec. distance $S_1 = u \times t_1 + \frac{1}{2} a t_1^2$

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

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

$= 5000$ km

In one minute, the remaining time is 50 sec.

It is fired with a velocity 600 km/s

distance $S_2 = v \times t_2 = 600 \times 50$

$= 30000$ km

Total distance travelled = After 10 sec $a = \frac{v-u}{t}$

$a = \frac{600-400}{10} = 20 \text{ m/s}^2$

distance travelled $S_3 = ut + \frac{1}{2} a t^2$

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

$= 4000 + 1000 = 5000$ km

Total distance $= S_2 + S_3 = 30000 + 5000 = 35000$ km

(14), (17)

$d_1 = 420\,m$; $t_1 = 1\,min = 60\,sec$; $d_2 = 420\,m$

$d_2 = 69 \times 10^3\,m$; $t_2 = 45\,mm$

Speed of Car $= \frac{d_{car}}{t_{car}} = \frac{420\,m}{60\,sec} = 7\,m/sec$

we know $1\,kmph = \frac{5}{18}\,m/s$

$\Rightarrow 1\,m/sec = \frac{18}{5}\,kmph$

$\therefore V_{car} = 7 \times \frac{18}{5} = 25.2\,kmph$

Total time of Journey $= 1\,min + 45\,min = 46\,min = \frac{46}{60} \simeq \frac{11}{15}\,hr$

(15)

$d_{Bus} = 69\,km$; $t_{bus} = 45\,min$

$= \frac{45}{60}\,hr.$

$\therefore$ speed of bus $= \frac{d_{Bus}}{t_{Bus}} = \frac{69}{45} \times 60$

$= 92\,kmph$

(16)

Speed of Car $= 7 \times \frac{18}{5}\,kmph$

Speed of Bus $= 92\,kmph.$

$\Rightarrow \frac{V_{car}}{V_{Bus}} = \frac{7 \times \frac{18}{5}}{92} = \frac{63}{230}$

(18)

Speed = 480 kmph $t = 36 \text{ min} = \frac{36}{60}$ hrs

distance = Speed × time

$= 480 \times \frac{36}{60} = 48$ km

(19)

distance = 210 km. ∴ V = 70 kmph

$$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{210}{70} = 3 \text{ hrs}$$

LTask

Jee mains level

(1)

distance = 450 m; time = 1 min = $\frac{1}{60}$ hrs. = 60 sec

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{450}{60} = \frac{15}{2} \text{ m/sec}$$

$= 3\frac{15}{2} \times \frac{18}{5}$ kmph = 27 kmph

(2)

(a) Initial velocity = 20 m/s

(b) Rebounding velocity = −20 m/s

Change in velocity = V − u = −20 − 20

= −40 m/s

(3)

Velocity = 120 kmph ; t = 30 sec

$= 120 \times \frac{5}{18}$ m/s

distance = velocity × time

$= \frac{\overset{40}{\cancel{120}}}{\underset{3}{\cancel{18}}} \times \cancel{30}\ 5$

$\Rightarrow$ 1000 m

(4)

$u_{car} = 10$ m/sec. ; $a_{car} = 1\ m/s^2$; $t = 10$ sec

At the end of 10 sec

velocity $v = u + at$

$= 10 + 1 \times 10 = 20$ m/s

(5)

time = 0.2 sec distance = 30 m

Velocity $= \frac{2d}{t} = 2 \times \frac{30}{0.2} = 2 \times \frac{300}{2} = 300$ m/s

Here the sound travels a distance from boy to cliff + echo from cliff to Boy.

(6)

Reading of odometer = distance = 350 km

time = 5 hrs

velocity = $\frac{\text{Distance}}{\text{time}} = \frac{350}{5} = 70$ kmph

distance travelled = 25 km

time = 2 hrs.

Displacement = Final position - initial position

= house - house

= 0.

(8)

$V_1 = 40$ kmph ; $V_2 = 60$ kmph.

If a body covers first half of the distance with a speed V_1, second half of the distance with a speed V_2

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

$$= \frac{4800}{100} = 48 \text{ kmph}$$

(9)

Total distance = $V_1t_1 + V_2t_2$

$V_1 = 50$ mph $V_2 = 60$ mph $t_1 = 3$ hr ; $t_2 = 2$ hrs

$S = 50\times 3 + 60\times 2 = 150 + 120$

$= 270$ miles

Total time = $t_1 + t_2 = 3 + 2 = 5$ hr.

$$\langle speed \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{270}{5}$$

$= 54$ mph.

(10)

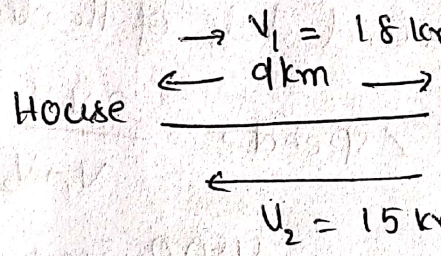
$v_{sound} = 330$ m/s ; time $= 2$ min
$= 2 \times 60$ sec.

Total distance travelled by sound $= 2d$.

$$v_{sound} = \frac{2d}{t} \qquad d = v_{sound} \times time$$

$$\Rightarrow 330 = \frac{2d}{120} \Rightarrow d = 60 \times 330 \times 2$$
$$= 19800 \times 2$$
$$= 39,600 \text{ m}$$
$$= 39.6 \text{ km}$$

(14) & (15)



Time taken to reach school $= \frac{d}{v_1}$

$= \frac{9}{18} = \frac{1}{2}$ hr

Time taken to reach house $= \frac{d}{v_2} = \frac{9}{15} = \frac{3}{5}$ hr.

(16)

Total Time taken to cover 4km is

$$t = \frac{\text{distance}}{\text{velocity}} = \frac{4}{6} \text{ hr}$$

To cover 4km he takes 3 time rest. For every rest 2 min so for 3 rest $= 6$ min $= \frac{6}{60}$ hr $= \frac{1}{10}$ hr.

$\therefore$ Total time $= \frac{4}{6} + \frac{1}{10} = \frac{46}{60}$ hrs $= 46$ min

(17)

$V = 90$ kmph $\quad : t = 10$ sec $= \frac{10}{3600}$ hr

length = distance travelled $= V \times t$ kms

$= 90 \times \frac{10}{3600}$ km

$= \frac{9}{36} = \frac{1}{4}$ km

$= \frac{1000}{4} = 250$ m

(18)

distance$_1 = 60$ km $\quad t_1 = 30$ min

$d_2 = 100$ km $\quad t_2 = ?$

$\Rightarrow \frac{d_1}{t_1} = \frac{d_2}{t_2} \Rightarrow t_2 = d_2 \times \frac{t_1}{d_1}$

$= \frac{50}{60} \times 30$

$= 50$ min