

Task

①

Given

$$\text{distance} = 20 \text{ km} \quad \text{time} = 4 \text{ hrs}$$

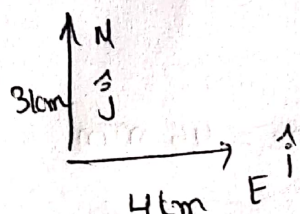
$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{20}{4} = 5 \text{ kmph}$$

②

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

$$\begin{aligned} \therefore \text{displacement} &= \text{Final position} - \text{Initial position} \\ &= \text{Ground} - \text{Ground} \\ &= 0 \end{aligned}$$

③



$$\therefore \text{displacement} = 4\hat{i} + 3\hat{j}$$

$$\begin{aligned} |\text{displacement}| &= \sqrt{4^2 + 3^2} \\ &= \sqrt{16 + 9} \\ &= \sqrt{25} = 5 \text{ km NE} \end{aligned}$$

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

④

$$\text{displacement} = 12\hat{i} + 9\hat{j} + 6\hat{k}$$

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

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

5)

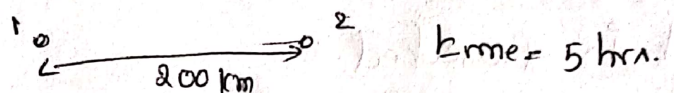
$$u = 10 \text{ m/sec} \quad ; \quad a = 1 \text{ m/s}^2 \quad ; \quad t = 10 \text{ sec}$$

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

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

$$= 150 \text{ m}$$

6)



$$\text{odometer reading} = \text{distance travelled} = 350 \text{ km}$$

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

7)

$$\text{distance} = k \quad ; \quad \text{time} = 45 \text{ min}$$

8)

Because the two buses are travelling in opposite direction

first bus covers k km due south

second bus covers k km due North.

7)

$$l_{\text{train}} = 100 \text{ m} \quad ; \quad l_{\text{bridge}} = 500 \quad ; \quad \text{velocity} = 5 \text{ kmph}$$

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

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

$$\text{time} = \frac{\text{distance}}{\text{velocity}} = \frac{600 \times 18}{25} = 36 \times 18 = 648 \text{ sec}$$



①

$$\text{Total distance travelled} = 20 \text{ km} + 30 \text{ km} + 10 \text{ km} \\ = 60 \text{ km}$$

$$\text{Total time} = 1 \text{ hr} + 1 \text{ hr} + 1 \text{ hr} = 3 \text{ hr.}$$

$$\langle \text{speed} \rangle = \frac{\text{Total distance}}{\text{Total time}} = \frac{60 \text{ km}}{3 \text{ hr}} \\ = 20 \text{ kmph}$$

②

$$(u) \text{ initial speed} = 400 \text{ km/s} : t_1 = 10 \text{ sec}$$

$$\text{final speed } v = 600 \text{ km/s}$$

in first 10 sec.

$$\text{distance } s_1 = u \times t_1 + \frac{1}{2} a t_1^2 \\ = 400 \times 10 + \frac{1}{2} (20) (10)^2 \\ = 4000 \text{ km} + 1000 \text{ km} \\ = 5000 \text{ km}$$

in one minute, the remaining time is 50 sec.

It is fired with a velocity 600 km/s

$$\text{distance } s_2 = v \times t_2 = 600 \times 50 \\ = 30000 \text{ km}$$

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

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

$$\text{distance travelled } s_3 = u t + \frac{1}{2} a t^2 \\ = 400 \times 10 + \frac{1}{2} \times 20 \times (10)^2 \\ = 4000 + 1000 = 5000 \text{ km}$$

$$\text{Total distance} = s_2 + s_3 = 30000 + 5000 = 35000 \text{ km}$$

(14), (17)

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

$$d_2 = 69 \times 10^3 \text{ m}; t_2 = 45 \text{ min}$$

$$\text{speed of car} = \frac{d_{\text{car}}}{t_{\text{car}}} = \frac{420 \text{ m}}{60 \text{ sec}} = 7 \text{ m/sec}$$

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

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

$$\therefore v_{\text{car}} = 7 \times \frac{18}{5} = 25.2 \text{ kmph}$$

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

(15)

$$d_{\text{Bus}} = 69 \text{ km}; t_{\text{bus}} = 45 \text{ min} \\ = \frac{45}{60} \text{ hr.}$$

$$\therefore \text{speed of bus} = \frac{d_{\text{Bus}}}{t_{\text{Bus}}} = \frac{69 \times 60}{45} \\ = 92 \text{ kmph}$$

(16)

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

$$\text{Speed of Bus} = 92 \text{ kmph.}$$

$$\therefore \frac{v_{\text{car}}}{v_{\text{Bus}}} = \frac{7 \times \frac{18}{5}}{92} = \frac{63}{230}$$

(8)

$$\text{Speed} = 480 \text{ kmph}$$

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

$$\text{distance} = \text{Speed} \times \text{time}$$

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

(19)

$$\text{distance} = 210 \text{ km} \quad ; \quad v = 70 \text{ kmph}$$

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

L Task

Jee mains level

(1)

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

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

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

(2)

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

$$(v) \text{ Rebounding velocity} = -20 \text{ m/s}$$

$$\text{change in velocity} = v - u = -20 - 20$$

$$= -40 \text{ m/s}$$



③

$$\text{Velocity} = 120 \text{ kmph} \quad ; \quad t = 30 \text{ sec}$$
$$= 120 \times \frac{5}{18} \text{ m/s}$$

$$\text{distance} = \text{velocity} \times \text{time}$$
$$= 120 \times \frac{5}{18} \times 30$$
$$= 1000 \text{ m}$$

④

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

At the end of 10 sec

$$\text{velocity } v = u + at$$
$$= 10 + 1 \times 10 = 20 \text{ m/s}$$

⑤

$$\text{time} = 0.2 \text{ sec} \quad \text{distance} = 30 \text{ m}$$

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

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

⑥

$$\text{Reading of odometer} = \text{distance} = 350 \text{ km}$$
$$\text{time} = 5 \text{ hrs}$$

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

distance travelled = 25 km

time = 2 hr.

Displacement = Final position - Initial position
= house - house
= 0.

(8)

$v_1 = 40 \text{ kmph}$, $v_2 = 60 \text{ kmph}$.

If a body covers first half of the distance with a speed v_1 , second half of the distance with a speed v_2

$$\langle \text{speed} \rangle = \frac{2v_1v_2}{v_1+v_2} = \frac{2 \times 40 \times 60}{40+60}$$

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

(9)

Total distance = ~~50~~ $v_1 t_1 + v_2 t_2$

$v_1 = 50 \text{ mph}$, $v_2 = 60 \text{ mph}$, $t_1 = 3 \text{ hr}$: $t_2 = 2 \text{ hr}$

$$S = 50 \times 3 + 60 \times 2 = 150 + 120$$
$$= 270 \text{ miles}$$

Total time = $t_1 + t_2 = 3 + 2 = 5 \text{ hr}$

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

$$= 54 \text{ mph.}$$

(10)

$$v_{\text{sound}} = 330 \text{ m/s} : \text{time} = 2 \text{ min.}$$

$$= 2 \times 60 \text{ sec.}$$

total distance travelled by sound = $2d$.

$$v_{\text{sound}} = \frac{2d}{t}$$

$$d = v_{\text{sound}} \times \text{time}$$

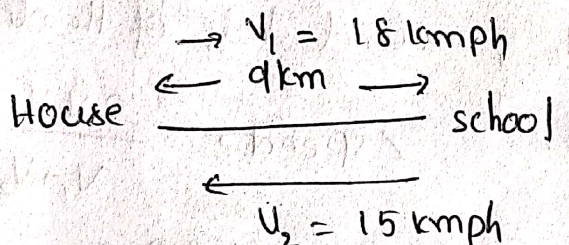
$$\Rightarrow \cancel{3300} \times \cancel{2} = \cancel{12000} \Rightarrow d = 60 \times 330 \times 2$$

$$= 19800 \times 2$$

$$= 39,600 \text{ m}$$

$$= 39.6 \text{ km}$$

(14) & (15)



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

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

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

(16)

total Time taken to cover 4 km is

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

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

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

(17)

$$u = 90 \text{ kmph} \quad ; \quad t = 10 \text{ sec} = \frac{10}{3600} \text{ hr}$$

$$\text{length} = \text{distance travelled} = u \times t \text{ km}$$

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

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

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

(18)

$$\text{distance}_1 = 60 \text{ km} \quad ; \quad t_1 = 30 \text{ min}$$

$$d_2 = 100 \text{ km} \quad ; \quad t_2 = ?$$

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

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

$$= 50 \text{ min}$$