① Diameter of Circular track, d = 200m

Radius = $\frac{d}{2} = \frac{200}{2} = 100m$

Circumference = $2\pi r = 2\pi(100) = 200\pi m$

In 40s, the given athelete covers a distant of $200\pi m$

In 1s, the athelete covers a destant = $\frac{200\pi}{40} m$

The athelete runs for 2mins 20s = 140s

∴ Total destance covered in 140s = $\frac{200 \times 22}{40 \times 7} \times 140 = 7200m$

Displacement = 200m

②(a) Distance covered while jogging AtoB = 300m

Time taken = 150s

Avg. Speed = $\frac{\text{Total Distance Covered}}{\text{Total Time Taken}}$

$= \frac{300}{150} = 2m/s$

Avg velocity = $\frac{\text{Displacement}}{\text{Time Interval}}$

$= \frac{300}{150} = 2m/s$

(b) From A to C

Total distance covered = 300 + 100

Total Time = 150 + 60 = 210 s

Avg speed = $\frac{400}{210}$ = 1.90 m/s

Avg Velocity = $\frac{\text{Displacement}}{\text{Time Interval}}$

$\Rightarrow \frac{200}{210}$ = 0.95 m/s

(3) Case - I - Home to School

Avg speed = 20 Km/h

Avg Speed = $\frac{\text{Total Distance}}{\text{Total Time Taken}}$ =

Let total distance = d

Let total time = t_1

$\therefore 20 = \frac{d}{t_1}$ = $t_1 = \frac{d}{20}$ ... (i)

Case - II - Returning from school

Total distance = d

Time taken = t_2

$30 = \frac{d}{t_2}$

$t_2 = \frac{d}{30}$ —— (ii)

Avg speed of trip = $\frac{\text{Total distance covered}}{\text{Time taken}}$

$\Rightarrow \frac{2d}{t_1+t_2} = \frac{2d}{\frac{d}{20}+\frac{d}{30}} = \frac{2}{\frac{3+2}{60}} = \frac{120}{5} = 24$ km/h

④ $u = 0$

$a = 3 m/s^2$

$t = 8s$

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

$s = 0 + \frac{1}{3} \times 3 \times (8)^2 = 96 m$

⑤ Case - (I)

$u_1 = 52$ km/h $= 14.4$ m/s

$t_1 = 5s$

$v = 0$ (after brakes)

Case - (II)

$u_2 = 3$ km/h $= 0.833$ m/s ≈ 0.83 m/s

Time taken $t_2 = 10s$ $v = 0$

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S in Case - (1)

$S_1 = \frac{1}{2} \times u_1 \times t_1 = \frac{1}{2} \times 14.4 \times 5 = 36m$

S in Case (2)

$S_2 = \frac{1}{2} \times u_2 \times t_2 = \frac{1}{2} \times 0.83 \times 10 = 4.15m$

So, 'S' in Case (1) is higher

(6) (a) Object B

(b) No

(c) 5.714 km

(d) 5.143 km

(7) $S = 20m$

$a = 10 m/s^2$

$u = 0$

$v = ?$

$v^2 = u^2 + 2as$

$v^2 = 0 + 2(10)(20)$

$v = 20 m/s$

$v = u + at \Rightarrow 20 = 0 + 10(t) \Rightarrow t = 2s$

(a) Shaded Area equals to $\frac{1}{2} \times 4 \times 6 = 12m$ in 1st 4s.

(b) 8s to 10s represents uniform motion of the car.