2/10/21

ODM CONNECT HW

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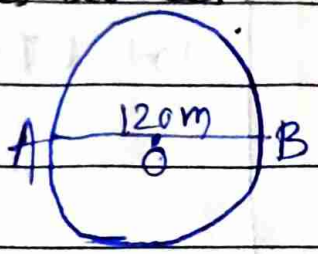
Exercises

1. An athlete completes one round of a circular track of diameter 200m in 40s. What will be the distance covered and the displacement at the end of 2 minutes 20 secs?



Ans) Given: Diameter (AB) = 200m, radius (r) = $\frac{200}{2}$ = 100m

Time taken to complete 1 round = 40s

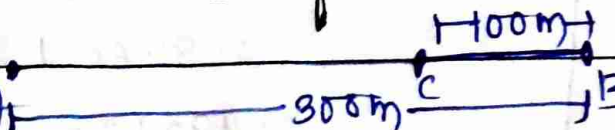
Total time taken = 2 minute 20 secs = 2×60+20 = 120+20 = 140s

No. of round = n = $\frac{\text{Total time}}{\text{Time for 1 round}}$ $\Rightarrow n = \frac{140}{40} = 3.5$

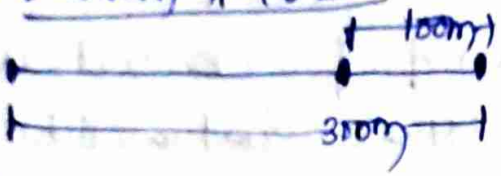
Distance (s) = 3.5 × 2πr = 7 × $\frac{22}{7}$ × 100 = 2200m,

Displacement (s) = AB = 200m

2. Joseph jogs from one end A to the other end B of a straight 300m road in 2 minutes 30 seconds and then turns around and jogs 100m back to point C in another 1 minute. What are Joseph's average speeds and velocities on jogging (a) from A to B and (b) from A to C?



(a) From A to B



Average speed

Total Distance = AB = 300m

Total time = 2 mins 30 secs

= 2 × 60 + 30 secs

= 120 + 30

= 150 secs

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

= $\frac{300}{150}$

= 2m/s

Average velocity

Total displacement = AB = 300m

Total Time = 2 mins 30 secs

= 2 × 60 + 30 secs

= 120 + 30

= 150 secs

Avg. velocity = $\frac{\text{Total displacement}}{\text{Total time}}$

= $\frac{300}{150}$

= 2m/s

b) From A to C

Average speed

Total distance = AB + BC

= 300 + 100m

= 400m

Total time = 2 min 30 secs + 1 min

= 3 min 30 secs

= 3 × 60 + 30 secs

= 180 + 30

= 210s

Average velocity

Total displacement = AC

= 300 − 100

= 200m

Total time = 2 min 30 secs + 1 min

= 3 min 30 secs

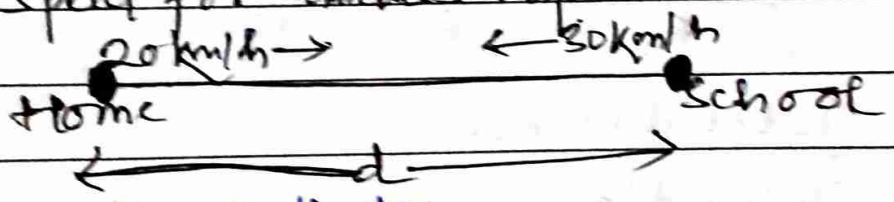
= 3 × 60 + 30 secs

= 180 + 30

= 210s

Avg. speed = $\frac{\text{Total distance}}{\text{Total time}}$	Avg. velocity = $\frac{\text{Total displacement}}{\text{Total time}}$
$= \frac{400}{210}$	$= \frac{200}{210}$
$= \frac{40}{21}$	$= \frac{80}{21}$ $= 0.95 m/s$
$= 1.90 m/s$	

3. Abdul, while driving to school, computes the average speed for his trip to be 20 km/h. On his return trip along the same route, there is less traffic and the average speed is 30 km/h. What is the average speed for Abdul's trip?



We know that

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

Let

Distance between Abdul's home and school be d.

Now,

Since he goes from home to school, and then back

Total Distance $= d + d = 2d$

To find Total time,

We find Time taken to go from Home to school, and from School to Home

Home to school

Distance = d

Speed = 20 km/h

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

$20 = \frac{d}{\text{time}}$

$\therefore \text{time} = \frac{d}{20}$

School to home

Distance = d

Speed = 30 km/h

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

$30 = \frac{d}{\text{time}}$

$\therefore \text{time} = \frac{d}{30}$

Total time taken $= \frac{d}{20} + \frac{d}{30}$

$= \frac{3d + 2d}{60} = \frac{5d}{60} + \frac{d}{12}$

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

$= \frac{2d}{d/12} = \frac{2d \times 12}{d} = 24 \text{ km/h}.$

4. A motorboat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 m/s for 8.0 s. How far does the aboat travel during this time?

Ans) Since Motorboat starts from rest,
Its Initial velocity well be 0

Therefore,

Initial velocity $= u = 0 \text{ m/s}$

Acceleration = $a = 3 m/s^2$

Time = $t = 8s$

We need to find (Distance)

$s = ut + \frac{1}{2}a(t)^2$

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

$= 0 + \frac{1}{2} \times 3 \times 64$

$= 3 \times 32 = 96m$

Thus, boat travels 96m

5. A driver of a car travelling at 52 km/h applies the brakes and accelerates uniformly in the opposite direction. The car stops in 5s. Another driver going at 3km/h in another car applies his brakes slowly and stops in 10s. On the same graph paper, plot the speed versus time graphs for the two cars. Which of the 2 cars travelled farther after the brakes were applied?

Car-1

$u = 52 km/h$

$= 52 \times \frac{5}{18} m/s$

$= \frac{130}{18} m/s$

$= 14.44 m/s$

$v = 0 m/s$

$t = 5 sec$

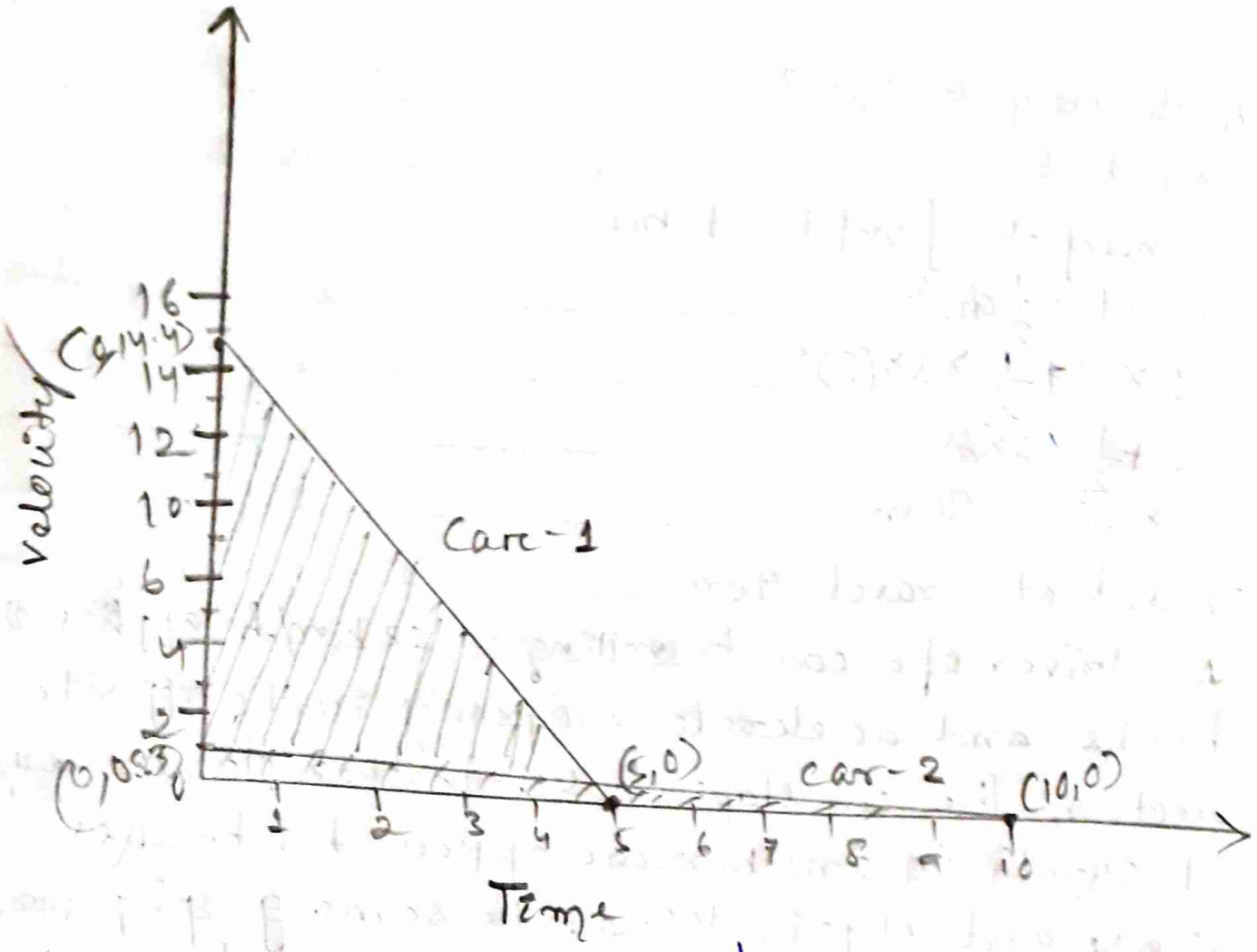
Car-2

$u = 3 km/h$

$= 3 \times \frac{5}{18} m/s = \frac{5}{6} m/s = 0.83 m/s$

$v = 0 m/s$

$t = 10 secs$



car 1

Distance travelled
= Area under v-t graph
$= \frac{1}{2} \times b \times h$
$= \frac{1}{2} \times 5 \times \frac{130}{9}$
$= 36.11 m$

Car 2

Distance travelled
= Area under v-t graph
$= \frac{1}{2} \times b \times h$
$= \frac{1}{2} \times 10 \times \frac{5}{6}$
$= 4.166 m$

So, car 1 travelled farther.

(8) Fig (in the book) shows the distance-time graph of 3 objects A, B and C. Study the graph and ans. the following questions:

(a) Speed = Distance / Time

from the graph, we see that,

A travels from 6 to 12 kms in 2 hours

B travels from 0 to 12 kms in 1.4 hours

C travels from 2 to 12 km in 1.6 hours

since B travels the most distance in the smallest time,

it is travelling the fastest.

(b) All the three objects A, B and C never meet at a single point.

Thus, all the three were never at the same point on the road.

(c) C has travelled 5.71 kms when B passes A.

7 small unit in Y-axis = 4 kms, 1 small units = $\frac{4}{7}$ kms

C has travelled 10 small unit = $10 \times \frac{4}{7} = \frac{40}{7} = 5.71$ km

(d) B has travelled by the time it passes C.

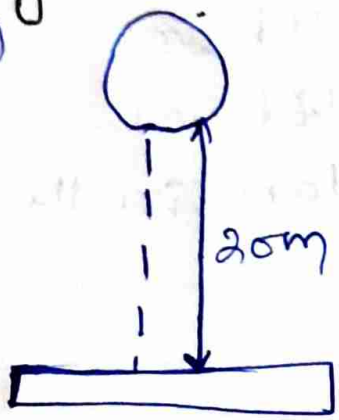
7 small units on Y-axis = 4 kms, 1 small unit = $\frac{4}{7}$ km

B has travelled 9 small unit = $9 \times \frac{4}{7} = \frac{36}{7} = 5.14$ km

(e) A ball is gently dropped from a height of 20m. If its velocity increases uniformly at the

rate of $10m/s^2$, with what velocity will it strike the ground? After what time will it strike the ground?

Ans)



$s = 20m$

$a = 10m/s^2$

Since the ball is dropped;

$u = 0$

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

$\Rightarrow v^2 - (0)^2 = 2 \times 10 \times 20$

$\Rightarrow v^2 = 400$

$\Rightarrow v = \sqrt{400}$

$\Rightarrow v = \pm 20 m/s$

As, $a = +$, So $v = +$

$\Rightarrow v = 20 m/s$

$\Rightarrow v = u + at$

$\Rightarrow 20 = 0 + (10)t$

$\Rightarrow 10t = 20$

$\Rightarrow t = \frac{20}{10}$

$\Rightarrow t = 2s$

(8) (a) The shaded area which is equal to $\frac{1}{2} \times 4 \times 6 = 12m$ represents the distance travelled by the car in the first 4 s.

(b) 6 s to 10 s represents uniform motion.