Chapter-8 (Motion)

Excercise questions (Page number: 119 -121)

Q.NO.1: Soln, Given. diameter = 200m

radius = 100m i,e $\frac{200m}{2} = 100m$

Time of one rotation = 40s

Time after 2 min 20s = 2×60 +20

= 140s

Distance after 140s = ?

Displacement after 140s = ?

Circular track with diameter of 200m we know,

velocity along a circular path = $\frac{\text{circumference}}{\text{time}}$

$$V = \frac{2\pi r}{40s}$$

$$V = \frac{2 \times 3.14 \times 100m}{40s}$$

$$V = 15.7\ m/s$$

Distance after 140s = velocity x time

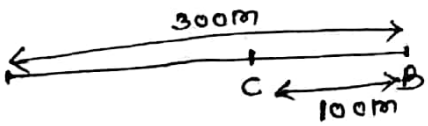
= 15.7 m/s × 140s

$$= \frac{157\ m}{10\ s} \times 140s$$

= 2198 m

Displacement after 140s = 200m

Q.NO.2: Soln, Given, Distance from Point A to B = 300m



Time taken = 2 min 30s

= (2×60 +30)s

= (120 +30)s = 150s

Distance from Point B to C = 100m

Time taken = 1 min = 60s

(a) Average speed = $\frac{\text{Total distance}}{\text{Time taken}} = \frac{300\ m}{150s}$ = 2 m/s

= 2m/s east

(b) Average speed = $\frac{100\ m}{60s}$ = 1.66 m/s

Therefore average velocity = 1.66 m/s west

Q.NO.3: Soln, Let the distance of the school = s km

Let time to reach the school in first trip = t_1

Let time to reach the school in second trip $= t_2$

Average speed in first trip $= \frac{s}{t_1}$

$$20 \text{ kg/h} = \frac{s}{t_1}$$

$$t_1 = \frac{s}{20} \text{ h}$$

Average speed in second trip $= \frac{s}{t_2}$

$$30 \text{ kg/h} = \frac{s}{t_2}$$

$$t_2 = \frac{s}{30} \text{ h}$$

Total time $= (t_1 + t_2)$

$$= \frac{s}{20} + \frac{s}{30}$$

$$= \frac{3s + 2s}{60} = \frac{5s}{60} = \frac{1s}{12}$$

i.e $\frac{s}{12}$

Average speed while both of trip $= \frac{\text{Total distance covered}}{\text{Total time taken}}$

$$= \frac{2s}{\frac{s}{12}} \text{ Km/h}$$

$$= \frac{12 \times 2s}{s}$$

$$= 24 \text{ Km/h}$$

Q. NO.4; Soln, Given, Initial velocity, $u = 0$

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

time, $t = 8 \text{ s}$

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

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

$$= 0 + \frac{1}{2} \times \frac{3 \text{ m}}{\text{s}^2} \times 8^4 \times 8 \text{ s}^2$$

$$= 96 \text{ m}$$

Q. NO.5: Soln, For first driver, Initial velocity, $u = 52 \text{ km/h}$

$$= \frac{52 \times 1000 \text{ m}}{60 \times 60 \text{ s}}$$

$$= \frac{520 \text{ m}}{36 \text{ s}}$$

Q.NO.6: Answers: (a) B is travelling fastest.
(b) NO, all three will never meet at same point on the road.
(c) When B passes A, C is at a distance approximately 8 Km from origin.
(d) By the time B passes C, it has travelled 5'5 km.

Q.NO.7: Soln, Given, $s = 20m$
$u = 0$
$a = 10m/s^2$
$t = ?$

$\therefore v = u + at = 0 + 10 \times 2 = 20m/s$

Again, we have $s = ut + \frac{1}{2}at^2$

$20m = 0 \times t + \frac{1}{2}(10m/s^2)t^2$

$20 = \frac{1}{2} \times 10^5 \times t^2$

$5t^2 = 20$

$t^2 = \frac{20}{5}$

$t^2 = 4$

$t = 2$

Q.NO.8: Answers: (a) Distance travelled by car in the first 4 s is 12 m approximately. (Area shaded)
(b) Uniform motion of the car is shown after 5'5 s.

Q.NO.9: Answer: When we throw a ball upward, it will go up and comes back downward after sometime. The motion of the ball at its top most point, the velocity is zero and when it comes down, it will have non-zero acceleration.

Q.NO.10: Ans: (i) Displacement is the distance between final and initial position.
$\therefore$ Displacement in this case is 0.

(ii) Average velocity $= \frac{\text{Total displacement}}{\text{Time taken}} = \frac{0}{1} = 0$

$= 14.4 \text{ m/s}$

$t = 5\text{s}$

Final velocity, $v = 0$

For second driver, Initial velocity, $u = 3 \text{ km/h}$

$= \frac{3 \times 1000 \text{ m}}{60 \times 60 \text{ s}}$

$= \frac{30 \text{ m}}{36 \text{ s}}$

$= 0.833 \text{ m/s}$

$t = 10\text{s}$

Final velocity, $v = 0$

Distance travelled by first car = Area of $\triangle OAB$

$= \frac{1}{2} \times OA \times OB$

$= \frac{1}{2} \times 14.4 \text{m/s} \times 5\text{s}$

$= 36 \text{ m}$

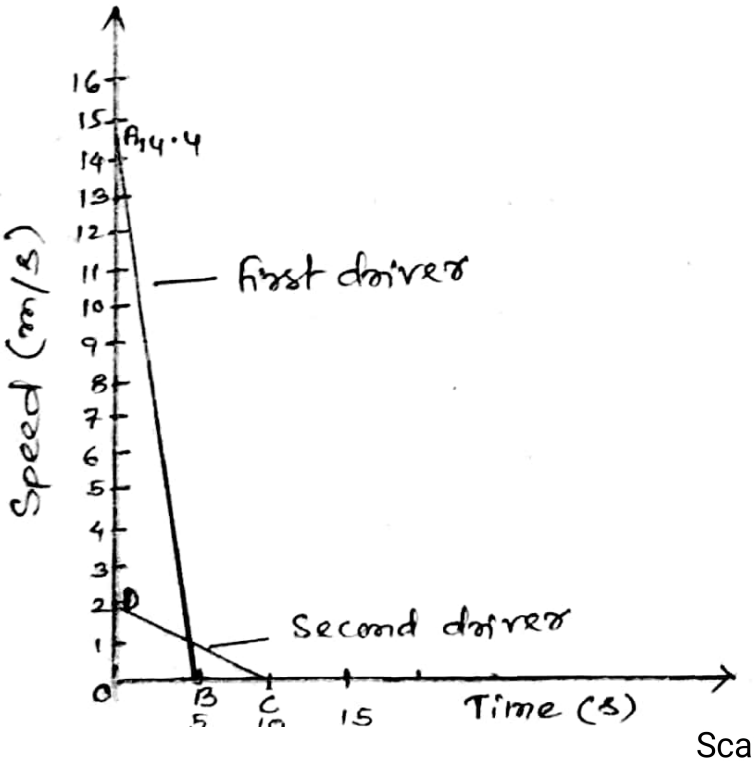
Distance travelled by second car = Area of $\triangle OCD$

$= \frac{1}{2} \times OD \times OC$

$= \frac{1}{2} \times 0.833 \times 10\text{s}$

$= 4.165 \text{ m}$

Hence, distance travelled by first car is more.



Q.NO.11 : Soln, Given, Initial velocity, $u = 0$
final velocity $v = 27\ m/s$
Time, $t = 9\ s$

Average acceleration $= \frac{v-u}{t}$

$= \frac{27-0}{9}$

$= 3\ m/s^2$

Q.NO.12 : Soln, Given, Initial velocity, $u = 50\ m/s$
final velocity, $v = 0$
$t = 0.4\ s$

(a) Acceleration, $a = \frac{v-u}{t} = \frac{0-50}{0.4}$

$= \frac{-50 \times 10}{4}$

$= \frac{-500}{4} = -125\ m/s^2$

(b) Distance travelled by car,

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

$= 50 \times 0.4 + \frac{1}{2} \times (-125\ m/s^2) \times (0.4)^2$

$= 50 \times \frac{4}{10} + \frac{-125 \times 4 \times 4}{2 \times 10 \times 10}$

$= 20 - \frac{100}{100}$

$= 20 - 10 = 10\ m$

Q.NO.13 :
Answers, (a) Freefall due to gravity.
(b) object moving in a circular path.

Q.NO.14, Soln, Given, Radius of circular orbit $= 42250\ km$
$= 42250 \times 1000\ m$

Time taken for 1 revolution $= 24\ h$
$= 24 \times 60 \times 60\ s$

Speed of the artificial satellite $= \frac{\text{distance}}{\text{Time}}$

$= \frac{42250 \times 1000\ m}{24 \times 60 \times 60\ s}$

$= 3073.74\ m/s$

Tick the correct option:

1.(i), 2.(ii) 3.(iii) 4.(iv) 5.(i)

In-text questions page-107:

1. Ans: Yes, an object moving in a circular path completing one revolution has zero displacement.

2. Soln; Total distance = 40 m in 40 sec

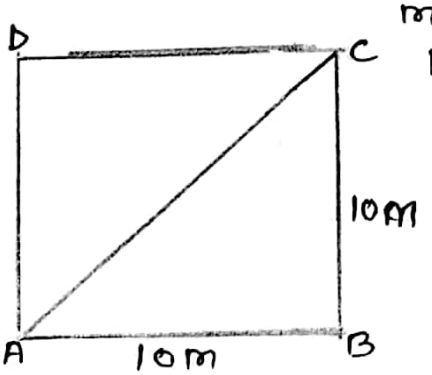
Total time taken by the farmer = 2 min 20 sec

$= 2 \times 60 + 20$

$= 120 + 20$

$= 140$ sec

Total rounds completed $= \frac{140}{40} = 3.5$ rounds. It means if the farmer starts from point A of the square field, he reaches point C. Therefore displacement = AC



Assume ABC is a right angled $\triangle$

$AC^2 = AB^2 + BC^2$

$AC^2 = (10)^2 + (10)^2$

$= 100 + 100$

$= \sqrt{200} = \sqrt{2 \times 100}$

$= 10\sqrt{2}$ m

3. Answers: (a) False

(b) False

In-text questions Page -109

1. Ans: The speed of an object is the distance covered per unit time.

The velocity is the displacement per unit time.

2. Ans: When a body moves in a straight line without reversing its direction i,e when a body is moving either in uniform motion or at constant acceleration.

3. Ans: Odometer measures the distance travelled by a vehicle.

4. Ans: The path is a straight line.

5. Soln: Given, $t = 5$ min $= 300$ s

speed of light, $v = 3 \times 10^8$ m/s

we have, $v = \frac{\text{Distance, } s}{\text{Time, } t}$

$s = v \times t = 3 \times 10^8$ m/s $\times$ 300 s

$= 9 \times 10^{10}$ m

i.e $s = 3 \times 10^{10}$ m

In-text questions Page-110

1. Answers: (i) If a body travels in a straight line and its velocity changes by equal amounts in equal intervals of time however small or large these time intervals may be, then the body is said to be uniform acceleration.

(ii) If the velocity of a body changes by unequal amounts in equal intervals of time, then the body is said to be non-uniform acceleration.

2. Soln; Given, Initial speed, $u = 80$ km/h

$= \frac{80 \times 1000 \text{ m}}{3600 \text{ s}} = \frac{800}{36}$ m/s

$t = 5$ s

Final speed, $v = 60$ km/h

$= \frac{60 \times 1000 \text{ m}}{3600 \text{ s}} = \frac{600}{36}$ m/s

using acceleration, $a = \frac{v - u}{t}$

$= \frac{\frac{600}{36} - \frac{800}{36}}{5}$

$= \frac{\frac{600 - 800}{36}}{5}$

$= \frac{-\overset{40}{\cancel{200}}}{36 \times \cancel{5}}$

$= -1.11$ m/

3. Soln: Given, $u = 0$ m/s

$v = 40$ km/h $= \frac{40 \times 1000 \text{ m}}{3600 \text{ s}} = \frac{\overset{100}{\cancel{400}}}{\cancel{369}}$ m/s

$t = 10 \text{ min} = 600s$

Using acceleration, $a = \frac{v-u}{t} = \frac{\frac{100}{9} - 0}{600}$

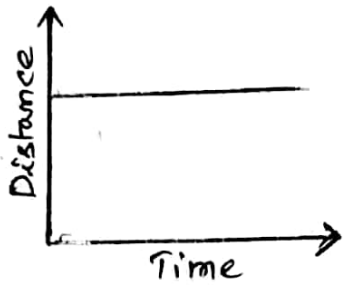
$= \frac{100}{9 \times 600} = \frac{1}{54}$

$= 0.018 m/s^2$

In-text questions Page - 114

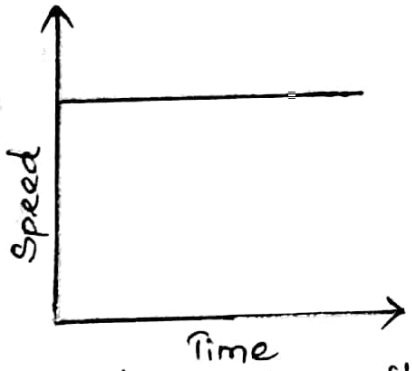
1. Ans: For uniform motion, distance-time graph is a straight line.
For non-uniform motion, distance-time graph is a curved line.

2. Ans:



The object is at rest.

3. Ans:



The object is moving with a uniform speed and zero acceleration.

4. Ans: It gives magnitude of displacement.

In-text questions Page - 116, 117

1. Soln: Given, $a = 0.1 m/s^2$, $t = 2 \text{ min} = 2 \times 60s = 120s$

Initial speed, $u = 0$

we have, $v = u + at$

$= 0 + 0.1 m/s^2 \times 120s$

$= \frac{1m}{10 s^2} \times 120s = 12 m/s$

2. Soln: Given, $v = 0$, [illegible], $a = -0.5\ m/s^2$

$u = 90\ km/h$

$= \frac{90 \times 1000\ m}{60 \times 60\ s}$

$= \frac{900\ m}{36\ s} = 25\ m/s$

we have, $v^2 = u^2 + 2as$

$(0)^2 = (25\ m/s)^2 + 2 \times (-0.5\ m/s^2) \times s$

$0 = 625 - 2 \times \frac{5}{10} \times s$

$s = 625\ m$

3. Soln: Given $a = 2\ cm/s^2$, $t = 3\ s$

we have, $v = u + at$

$= 0 + 2\ cm/s^2 \times 3\ s$

$= 6\ cm/s$

$= \frac{6}{100}\ m/s$

$= 0.06\ m/s$

4. Soln: Given, $a = 4\ m/s^2$, $u = 0$

$t = 10\ s$

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

$= 0 \times 10\ s + \frac{1}{2} \times \frac{4\ m}{s^2} \times 10 \times 10\ s^2$

$= 200\ m$

5. Soln: Given, $u = 5\ m/s$

$v = 0\ m/s$

$a = -10\ m/s^2$

(Since the given acceleration is in downward direction i.e the velocity of the stone is decreasing.)

Height i,e, distance, $s = ?$

Time taken to reach the height $= ?$

we have, $v^2 = u^2 + 2as$

$(0)^2 = (5\ m/s)^2 + 2 \times (-10\ m/s^2) \times s$

$0 = 25\ m^2/s^2 - \frac{20\ m}{s^2} \times s$

$$\Rightarrow \frac{20\,m}{s} \times S = \frac{25\,m^2}{s^2}$$

$$\Rightarrow 20\,m \times S = 25\,m$$

$$\Rightarrow S = \frac{25}{20}\,m = 1.25\,m$$

Again, $v = u + at$

$$0 = 5\,m/s + (-10\,m/s^2) \times t$$

$$0 = \frac{5m}{s} - \frac{10m}{s^2} \times t$$

$$\Rightarrow \frac{10m}{s^2} \times t = \frac{5\,m}{s}$$

$$\Rightarrow \frac{10 \times t}{s} = 5$$

$$\Rightarrow t = \frac{5}{10}\,s$$

$$\Rightarrow t = 0.5\,s$$