CHAPTER 6
MOTION

SOLUTIONS

Try to answer the Questions

Q1. In what condition is the distance covered equal to the magnitude of the displacement of an object in motion?

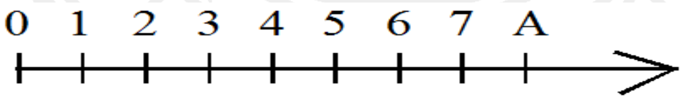
Ans: When an object travels along a straight-line the magnitude of displacement and distance travelled are always equal.

Q2. Can the distance travelled by an object be smaller than the magnitude of the displacement of the motion?

Ans: No

Q3. An object covers a distance. Can it have zero displacement? If yes, support your answer with an example.

Ans: Yes, the body can have zero displacement.



Let us consider the motion of an object moving along a straight path starting from O which is chosen as its reference point. At first the object reaches at A and moves back along the same path and reach the starting point O. Then the final position of the object coincides with the initial starting position. Hence, the displacement is zero.

Q4. State true or false

(1) Displacement cannot be zero

(2) Magnitude of displacement may be equal to the distance covered

(3) Magnitude of displacement is greater than the distance covered.

Ans:

(1) FALSE

(2) TRUE

(3) FALSE

Try to answer:

Q1. When is a motion said to be in
(i) Uniform acceleration

(ii) Non-uniform acceleration?

Ans:

(i) When the velocity of an object travelling along a straight line increases or decreases by equal amounts in equal intervals of time, then the acceleration of the object is said to be uniform.

(ii) If an object travelling along a straight line increases or decreases its velocity by unequal amounts in equal intervals of time, then the acceleration of the object is said to be non-uniform.

Q2. A particle is moving with a uniform velocity. What is its acceleration?

Ans: Its acceleration is zero.

Try to answer:

Q1. What can you understand about the motion of an object, if the distance-time graph is a straight line parallel to time axis?

Ans: The object is at rest.

Q2. What will be the nature of distance-time graphs for uniform and non-uniform motion of an object?

Ans: The nature of distance-time graph for uniform motion of an object will be a straight line i.e. linear.

The nature of distance-time graph for non-uniform motion of an object will be a curved line i.e. non-linear.

Q3. Which quantity is measured by the area occupied below the velocity-time graph of an object in motion?

Ans: Displacement covered by the object

EXERCISES

Q1. A boy while driving to his school covers at the average speed of 15 km/hr. On his return trip along the same route, covers at the average speed of 25km/hr due to less traffic. What is his average speed for the whole trip?

Ans:

Let distance covered while driving to school = S km

Distance covered for return trip = S km

Time taken while driving to school $t_1 = \frac{\text{S km}}{15 \text{ km/hr}} = \frac{\text{S}}{15}\text{hr}$

Time taken for return trip $t_2 = \frac{\text{S km}}{25\text{km/hr}} = \frac{\text{S}}{25}\text{hr}$

Average speed for the whole trip = $\frac{\text{total distance travelled}}{\text{total time}}$

$$= \frac{\text{S+S}}{\frac{\text{S}}{15}+\frac{\text{S}}{25}}$$

$$= \frac{2\text{S}}{\frac{5\text{S}+3\text{S}}{75}} = \frac{2\text{S}}{\frac{8\text{S}}{75}} = \frac{75\text{X}2}{8} = 18.75 \text{ km/hr}$$

Q2. A motor boat in Loktak Lake starting from rest accelerates along a straight path at a uniform rate of 2 ms^{-2} for 10.0s. How far does the boat travel during this time?

Ans:

Here, $u = 0\ m/s$

$a = 2.0 \text{ m/s}^2$

$t = 10.0\ s$

We have,

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

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

$$= 100\ m$$

Therefore, the distance travelled by the boat = 100 m

Q3. **The driver of a car travelling at 72km/hr applies the brakes and accelerates uniformly in the opposite direction at the rate of 5 m/s^2. How long the car will take to come to rest? How far will his car cover before coming to rest?**

Ans:

Here,

$$u = 72 \text{ km/hr} = \frac{72\text{X}1000\text{m}}{60\text{X}60 \text{ s}} = 20 \text{ m/s}$$
$$v = 0 \text{ km/hr} = 0 \text{ m/s}$$
$$a = -5\ m/s^2$$
$$t = ?$$
$$s = ?$$

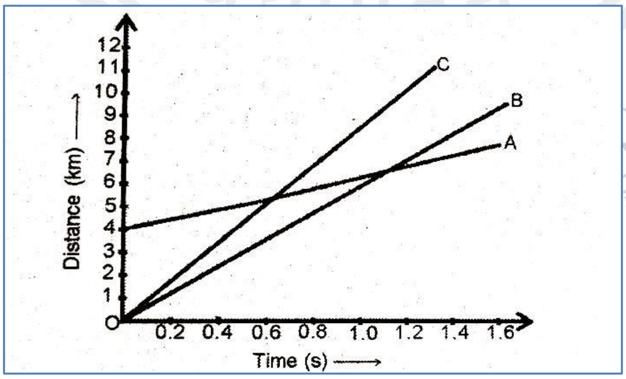
We have,

$$\boldsymbol{v = u + at}$$
$$\Rightarrow 0 = 20 + (-5) \times t$$
$$\Rightarrow t = \frac{20}{5} = 4\ s$$

Also,

$$\boldsymbol{s = ut + \frac{1}{2}at^2}$$
$$= 20 \times 4 + \frac{1}{2}(-5) \times 4^2$$
$$= 80 - (5 \times 8)$$
$$= 80 - 40 = 40m$$

Q4. **The figure below shows the distance – time graph of three motor-cyclist A, B and C. On the basis of this graph answer the following questions:**



(i) Which of them is travelling fastest?

(ii) Are all the three ever at the same point on the road?

(iii) When B passes A where is C?

(iv) How far did C travels when B meets A

Ans:

(i) For A,

Distance travelled = (8-4) km = 4km

Time = 1.6s

$$\boldsymbol{Speed} = \frac{\boldsymbol{distance}}{\boldsymbol{time}} = \frac{4\ km}{1.6\ s} = \frac{4\times 10}{16} = \frac{40}{16} = 2.5\ km/s$$

For B,

$$Distance\ covered = 10\ km$$

$$Time\ = 1.7s$$

$$Speed = \frac{10\ km}{1.7\ s} = \frac{10X10}{17} = \frac{100}{17} = 5.9\ km/s$$

For C,

$$Distancecovered = 12km$$

$$Time = 1.3s$$

$$Speed = \frac{12\ km}{1.3\ s} = \frac{12\times 10}{13} = \frac{120}{13} = 9.2\ km/s$$

Therefore, C is travelling fastest

(ii) No

(iii) C is at a distance of 12km from the starting point.

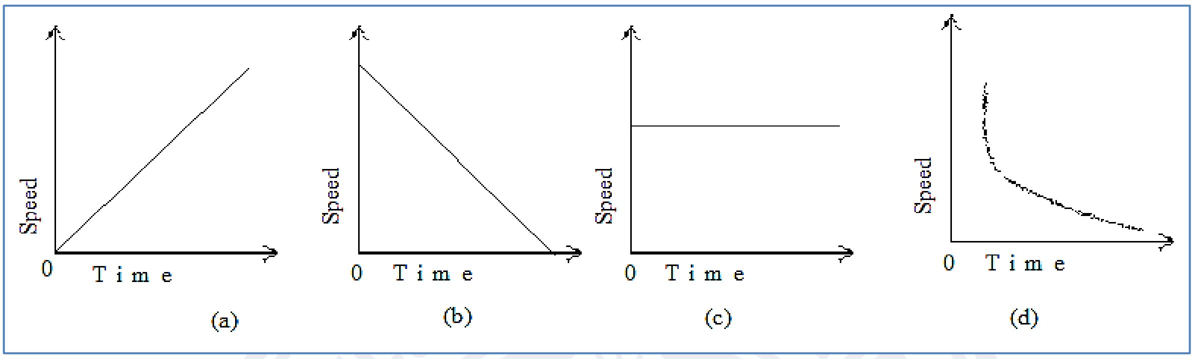
(iv) C travelled 10 km.

Or,

As is evident from the distance-time graphs of the three motor-cyclists A, B and C the slope of the graph C is the steepest Greater the slope, greater will be its speed and vice-versa. So, C travels the fastest.

Alternatively, a particular point on the time-axis could be chosen (say at t- 1.0 s) and corresponding points on the graphs A, B, and C could be marked to give the respective distance travelled by A, B and C. In all such cases, distance travelled by C will be more than that of A or B for the same time interval. Hence, C travelled the fastest.

Q5. **What type of motion is represented by each of the following graphs?**



Ans:

a) Uniformly accelerated motion (non-uniform motion)

b) Uniformly decelerated motion (non-uniform motion)

c) Uniform motion (with zero acceleration)

d) Non-uniform motion. (with non-uniform deceleration)

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