

C-9 PHYSICS WK-6

NOTE- COMPLETE YOUR COPY ALONG WITH THE NOTES PROVIDED. ALL THE DERIVATIONS AND RELATED NUMERICALS. ALL THE GRAPHS DISTANCE-TIME AND VELOCITY – TIME GRAPH.NCERT ANSWERS.DRAW THE GRAPHS NEATLY WITH THE PENCIL.

(Chapter – 8) (Motion)

(Class – IX)

$$s = \frac{v^2 - u^2}{2a} = \frac{0^2 - 25^2}{2(-0.5)} = 625 \text{ m}$$

Therefore, train will go 625 m before it brought to rest.

Question 3:

A trolley, while going down an inclined plane, has an acceleration of 2 cm/s^2 . What will be its velocity 3 s after the start?

Answer 3:

Here we have,

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

Acceleration (a) = $2 \text{ cm/s}^2 = 0.02 \text{ m/s}^2$

Time (t) = 3 s

Final velocity, $v = ?$

We know that, $v = u + at$

Therefore, $v = 0 + 0.02 \times 3 \text{ m/s}$

$\Rightarrow v = 0.06 \text{ m/s}$

Therefore the final velocity of trolley will be 0.06 m/s after start.

Question 4:

A racing car has a uniform acceleration of 4 m/s^2 . What distance will it cover in 10 s after start?

Answer 4:

Here we have,

Acceleration, $a = 4 \text{ m/s}^2$

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

Time, $t = 10 \text{ s}$

Distance covered (s) = ?

We know that, $s = ut + \frac{1}{2}at^2$

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

$\Rightarrow s = 2 \times 100 \text{ m}$

$\Rightarrow s = 200 \text{ m}$

Thus, racing car will cover a distance of 200 m after start in 10 s with given acceleration.

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Question 1:

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

Answer 1:

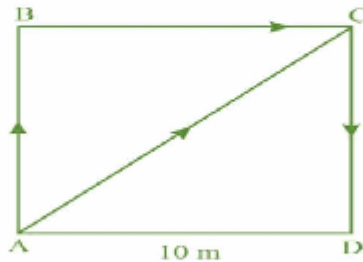
Yes, zero displacement is possible if an object has moved through a distance.

Suppose a body is moving in a circular path and starts moving from point A and it returns back at same point A after completing one revolution, then the distance will be equal to its circumference while displacement will be zero.

Question 2:

A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds from his initial position?

Answer 2:



Given, side of the square field = 10 m

Therefore, perimeter = $10 \text{ m} \times 4 = 40 \text{ m}$

Farmer moves along the boundary in 40 s

Time = 2 minutes 20 s = $2 \times 60 \text{ s} + 20 \text{ s} = 140 \text{ s}$

since, in 40 s farmer moves 40 m

Therefore, in 1s distance covered by farmer = $40 \div 40 = 1 \text{ m}$.

Therefore, in 140s distance covered by farmer = $1 \times 140 \text{ m} = 140 \text{ m}$

Now, number of rotation to cover 140 along the boundary = $\frac{\text{Total distance}}{\text{Perimeter}}$

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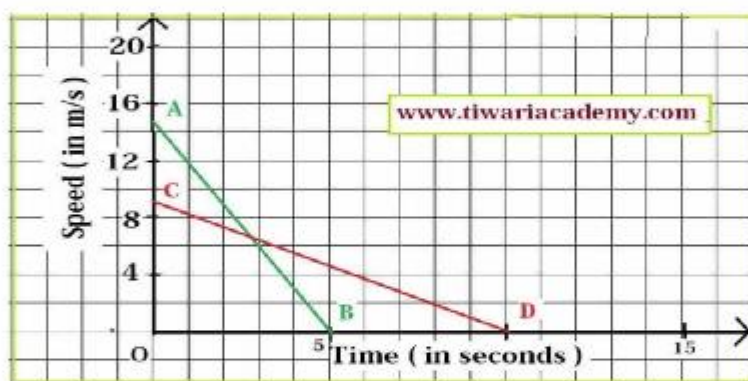
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Question 5:

A driver of a car travelling at 52 kmh^{-1} applies the brakes and accelerates uniformly in the opposite direction. The car stops after 5 s. Another driver going at 34 kmh^{-1} in another car applies his brakes slowly and stops in 10 s. On the same graph paper, plot the speed versus time graphs for two cars. Which of the two cars travelled farther after the brakes were applied?

Answer 5:

In the following graph, AB and CD are the time graphs for the two cars whose initial speeds are 52 km/h (14.4 m/s) and 34 km/h (8.9 m/s), respectively.



Distance covered by the first car before coming to rest

= Area of triangle AOB

= $\frac{1}{2} \times AO \times BO$

= $\frac{1}{2} \times 52 \text{ kmh}^{-1} \times 5 \text{ s}$

= $\frac{1}{2} \times (52 \times 1000 \times 1/3600) \text{ ms}^{-1} \times 5 \text{ s} = 36.1 \text{ m}$

Distance covered by the second car before coming to rest

= Area of triangle COD

= $\frac{1}{2} \times CO \times DO$

= $\frac{1}{2} \times 34 \text{ km h}^{-1} \times 10 \text{ s}$

= $\frac{1}{2} \times (34 \times 1000 \times 1/3600) \text{ ms}^{-1} \times 10 \text{ s} = 47.2 \text{ m}$

Thus, the second car travels farther than the first car after they applied the brakes.

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$$= 140 \text{ m} \div 40 \text{ m} = 3.5 \text{ round}$$

Thus after 3.5 round farmer will at point C (diagonally opposite to his initial position) of the field.

$$\text{Therefore, Displacement AC} = \sqrt{10^2 + 10^2} = \sqrt{200} = 10\sqrt{2} \text{ m}$$

Thus, after 2 minute 20 second the displacement of farmer will be equal to $10\sqrt{2}$ m north east from initial position.

Question 3:

Which of the following is true for displacement?

- (a) It cannot be zero.
- (b) Its magnitude is greater than the distance travelled by the object.

Answer 3:

None of (a) and (b) are true.



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Question 1:

What is the nature of the distance – time graphs for uniform and non-uniform motion of an object?

Answer 1:

- The slope of the distance-time graph for an object in uniform motion is straight line.
- The slope of the distance-time graph for an object in non-uniform motion is not a straight line.

Question 2:

What can you say about the motion of an object whose distance-time graph is a straight line parallel to the time axis?

Answer 2:

When the slope of distance-time graph is a straight line parallel to time axis, the object is stationary.

Question 3:

What can you say about the motion of an object if its speed-time graph is a straight line parallel to the time axis?

Answer 3:

When the graph of a speed time graph is a straight line parallel to the time axis, the object is moving with constant speed.

Question 4:

What is the quantity which is measured by the area occupied below the velocity-time graph?

Answer 4:

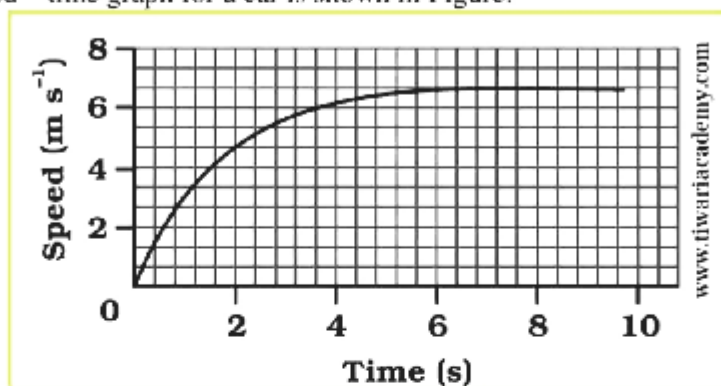
The quantity of distance is measured by the area occupied below the velocity time graph.

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Question 8:

The speed – time graph for a car is shown in Figure:



(a) Find how far does the car travel in the first 4 seconds. Shade the area on the graph that represents the distance travelled by the car during the period.

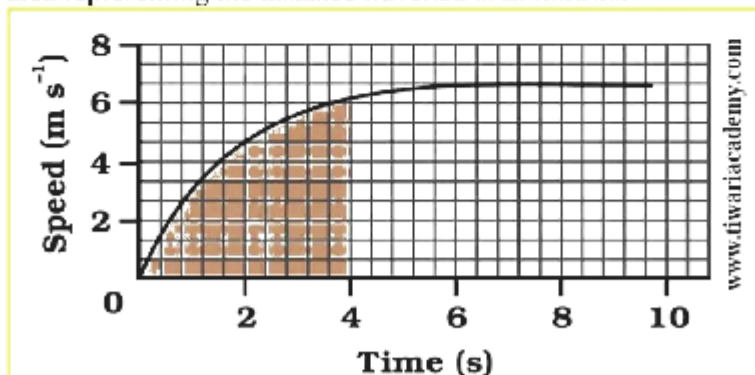
(b) Which part of the graph represents uniform motion of the car?

Answer 8:

(a) Distance covered = area under speed – time

$$\Rightarrow \text{Distance} = \frac{1}{2} \times 4 \times 6 = 12 \text{ m}$$

Shaded area representing the distance travelled is as follows:



(b) After 6 seconds the car moves in uniform motion (at a speed of 6 m/s).

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Question 9:

State which of the following situations are possible and give an example of each of the following:

- (a) an object with a constant acceleration but with zero velocity,
- (b) an object moving in a certain direction with an acceleration in the perpendicular direction.

Answer 9:

(a) Yes, a body can have acceleration even when its velocity is zero. When a body is thrown up, at highest point its velocity is zero but it has acceleration equal to acceleration due to gravity.

(b) Yes, an acceleration moving horizontally is acted upon by acceleration due to gravity that acts vertically downwards.

Question 10:

An artificial satellite is moving in a circular orbit of radius 42250 km. Calculate its speed if it takes 24 hrs to revolve around the earth.

Answer 10:

Here,

$$r = 42250 \text{ km} = 42250000 \text{ m}$$

$$T = 24 \text{ h} = 24 \times 60 \times 60 \text{ s}$$



Using Speed, $v = \frac{2\pi r}{T}$

$$v = \frac{(2 \times 3.14 \times 42250000)}{(24 \times 60 \times 60)} \text{ m/s}$$

$$= 3070.9 \text{ m/s} = 3.07 \text{ km/s}$$

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Question 5:

A stone is thrown in a vertically upward direction with a velocity of 5 m/s. If the acceleration of the stone during its motion is 10 m/s^2 in the downward direction, what will be the height attained by the stone and how much time will it take to reach there?

Answer 5:

Here we have,

Initial velocity (u) = 5 m/s

Final velocity (v) = 0 m/s

Acceleration (a) = -10 m/s^2

Height, i.e. Distance, s = ?

Time (t) taken to reach the height = ?

We know that, $v^2 = u^2 + 2as$

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

$$\Rightarrow 0 = 25 - 20s$$

$$\Rightarrow s = 25/20 \text{ m}$$

$$\Rightarrow s = 1.25 \text{ m}$$

Now, we know that, $v = u + at$

$$\Rightarrow 0 = 5 + (-10) \times t$$

$$\Rightarrow 0 = 5 - 10t$$

$$\Rightarrow t = 5/10 \text{ s}$$

$$\Rightarrow t = 0.5 \text{ s}$$

Thus, stone will attain a height of 1.25 m and time taken to attain the height is 0.5 s.

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Exercises

Question 1:

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

Answer 1:

Time taken = 2 min 20 sec = 140 sec.

Radius, $r = 100$ m.

In 40 sec the athlete complete one round.

So, in 140 sec the athlete will complete = $140 \div 40 = 3.5$ round.

\Rightarrow Distance covered in 140 sec = $2\pi r \times 3.5 = 2 \times \frac{22}{7} \times 100 \times 3.5 = 2200$ m.

At the end of his motion, the athlete will be in the diametrically opposite position.

\Rightarrow Displacement = diameter = 200 m.

Question 2:

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

Answer 2:

(a) For motion from A to B:

Distance covered = 300 m

Displacement = 300 m.

Time taken = 150 sec.

We know that, Average speed = Total distance covered \div Total time taken
 $= 300 \text{ m} \div 150 \text{ sec} = 2 \text{ ms}^{-1}$

Average velocity = Net displacement \div time taken
 $= 300 \text{ m} \div 150 \text{ sec} = 2 \text{ ms}^{-1}$

(b) For motion from A to C:

Distance covered = $300 + 100 = 400$ m.

Displacement = $AB - CB = 300 - 100 = 200$ m.

Time taken = $2.5 \text{ min} + 1 \text{ min} = 3.5 \text{ min} = 210 \text{ sec}$.

Therefore, Average speed = Total distance covered \div Total time taken
 $= 400 \div 210 = 1.90 \text{ ms}^{-1}$.

Average velocity = Net displacement \div time taken
 $= 200 \text{ m} \div 210 \text{ sec} = 0.952 \text{ ms}^{-1}$.

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Question 3:

Abdul, while driving to school, computes the average speed for his trip to be 20 kmh^{-1} . On his return trip along the same route, there is less traffic and the average speed is 30 kmh^{-1} . What is the average speed of Abdul's trip?

Answer 3:

Let one side distance = $x \text{ km}$.

Time taken for forward trip at a speed of 20 km/h = Distance / Speed = $x/20 \text{ h}$.

Time taken in return trip at a speed of 30 km/h = $x/30 \text{ h}$.

$$\text{Total time for the whole trip} = \frac{x}{20} + \frac{x}{30} = \frac{3x+2x}{60} = \frac{5x}{60} \text{ h.}$$

Total distance covered = $2x \text{ km}$.

$$\begin{aligned} \text{We know, Average speed} &= \text{Total distance} \div \text{Total time} \\ &= 2x \div (5x/60) = 24 \text{ kmh}^{-1}. \end{aligned}$$

Question 4:

A motor boat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 ms^{-2} for 8.0 s . How far does the boat travel during this time?

Answer 4:

$$\begin{aligned} \text{Here, } u &= 0 \text{ m/s} \\ a &= 3 \text{ ms}^{-2} \\ t &= 8 \text{ s} \end{aligned}$$

$$\begin{aligned} \text{Using, } s &= ut + \frac{1}{2} at^2 \\ s &= 0 \times 8 + \frac{1}{2} \times 3 \times 8^2 = 96 \text{ m.} \end{aligned}$$

