Assignments in Science Class IX (Term I)

8 Motion

IMPORTANT NOTES

1. **Rest :** When a body does not change its position with respect to time and its surroundings, the body is said to be at rest.
2. **Motion :** When a body continuously changes its position with respect to time and its surroundings, the body is said to be in motion.
3. **Locomotion :** The motion performed by living beings (animals and plants) is called locomotion.
4. **Characteristics (properties) of a moving body :**
   (i) There must be a reference point (a stationary object) to describe the position of a given body.
   (ii) The position of the given body must continuously change with time and with respect to reference point.
5. **Distance :** It is the actual length of the path travelled by a moving body, irrespective of the direction of motion of the body.
6. **Displacement :** The shortest distance of a moving body from the point of reference (initial position of the body) in a specified direction is called displacement.
7. **Uniform motion :** When a body covers equal distances in equal intervals of time, however small may be time intervals, the body is said to describe uniform motion.
8. **Non-uniform motion :** When a body covers unequal distances in equal intervals of time, it is said to be moving with non-uniform motion.
9. **Speed :** The rate of change of motion is called the speed.
10. **Mathematical expression for speed :** Speed = Distance ÷ Time. SI unit of speed is metre per second (ms^{-1} or m/s).
11. **Uniform speed :** When a body covers equal distances in equal intervals of time, however small may be the time intervals, the body is said to be moving with uniform speed.
12. **Variable speed :** When a body covers unequal distances in equal intervals of time, the body is said to be moving with variable speed.
13. **Average speed :** The average distance covered by a body per unit time, when the body is moving with a variable speed is called average speed.
14. **Velocity :** The distance covered by a body per unit time in a **specified direction** is called velocity. It is vector quantity and has same units as speed.
15. **Uniform velocity :** When a body covers equal distances in equal intervals of time (however small may be the time intervals) in a specified direction, the body is said to be moving with uniform velocity.
16. **Variable velocity or Non-uniform velocity :** When a body covers unequal distances in equal intervals of time in a specified direction or when a body covers equal distances in equal intervals of time, but its direction changes, then the body is said to be moving with a variable velocity.
17. **Acceleration :** The rate of change of velocity of a moving body is called acceleration. It is vector quantity and its unit is metre per square second (ms^{-2} or m/s^2).
18. **Positive acceleration :** The rate of change of velocity of a moving body, when the velocity is increasing is called positive acceleration.
19. **Negative acceleration :** The rate of change of velocity of a moving body, when the velocity is decreasing is called negative acceleration or retardation.
20. **Conclusions from a distance-time graph.**
   (i) If the graph is parallel to the time axis, then the body is stationary.
   (ii) If the graph is a straight line, but not parallel to time axis then the body is moving with a uniform speed.
   (iii) If the graph is a curve, it implies that body is moving with a variable speed and has accelerated motion.
21. **Conclusions from a velocity-time graph.**
   (a) **When the velocity-time graph is a straight line parallel to time axis.**
      (i) The body is moving with a uniform velocity and its acceleration is zero.

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(ii) The displacement of body can be calculated from the area under graph line.

(b) **When the velocity-time graph is a straight line, but not parallel to time axis.**

(i) The body is moving with a variable velocity, but uniform acceleration.

(ii) The uniform acceleration/deceleration can be calculated by finding slope of the graph. If the slope is positive then it is positive acceleration. If slope is negative then it is retardation.

(iii) The displacement of a body can be calculated by finding area under the velocity-time graph line.

22. If a body having initial velocity 'u' is acted upon an acceleration 'a' for the time 't' such that 'v' is its final velocity and s is distance covered then :

(i) $v = u + at$ (ii) $s = ut + \frac{1}{2}at^2$

(iii) $v^2 = u^2 + 2as$

23. Uniform circular motion : When a body moves in a circular path with uniform motion.

ASSIGNMENTS FOR SUMMATIVE ASSESSMENT

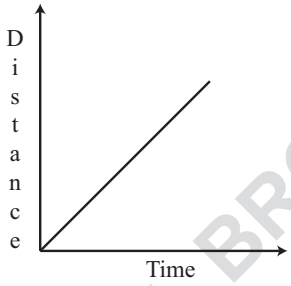
I. VERY SHORT ANSWER QUESTIONS (1 MARK)

PREVIOUS YEARS' QUESTIONS

1. State the meaning of uniform circular motion. **[2010 (T-I)]**

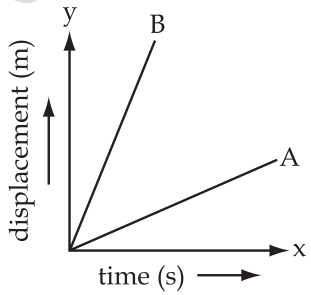
2. Why is the motion of an athlete moving along the circular path an accelerated motion ? **[2010 (T-I)]**

3. State the type of motion represented by the given graph. **[2010 (T-I)]**



4. If the acceleration of the particle is constant in magnitude but not in direction, what type of path does the particle follow ? **[2010 (T-I)]**

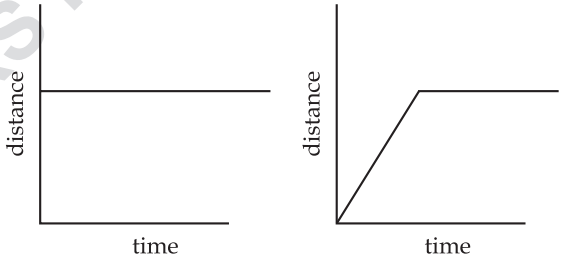
5. Two cars A and B have their displacement-time graph as given below. Which car has a greater velocity? **[2010 (T-I)]**



6. A particle is moving in a circle of diameter 5 m. What is its displacement when it completes $1^1/_2$ revolutions. **[2010 (T-I)]**

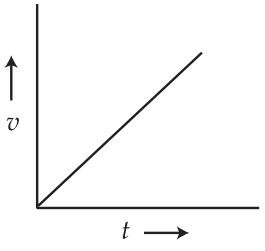
7. What kind of motion of a body is represented by the graphs given below? **[2010 (T-I)]**

(a) (b)



8. "The direction in which an object moves is given by the direction of velocity of the object and not by the direction of acceleration". Give an example to justify this statement. **[2010 (T-I)]**

9. Velocity-time graph for a moving body is shown in the diagram. What conclusion can be drawn about the type of motion? **[2010 (T-I)]**



10. Velocity of a particle moving along a straight line in a certain time interval is shown below. What is the distance travelled during acceleration?

[2010 (T-I)]

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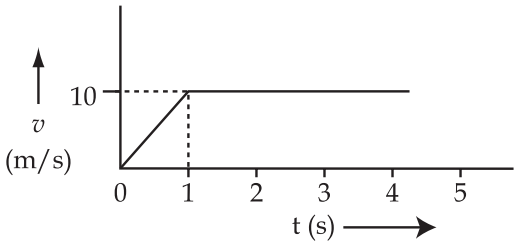

11. Name the quantity measured by the area occupied below the velocity - time graph. **[2010 (T-I)]**

12. Under what condition is the magnitude of distance and displacement equal? **[2010 (T-I)]**

13. An object starts with initial velocity u and attains a final velocity of v. The velocity of the object is changing at a uniform rate. **[2010 (T-I)]**

Write the formula for calculating the average velocity v_{av}.

14. A body thrown in the vertically upward direction rises up to a height 'h' and comes back to the position of start. Calculate.

(a) the total distance travelled by the body

(b) the displacement of the body. **[2010 (T-I)]**

OTHER IMPORTANT QUESTIONS

1. When is a body said to be at rest?

2. When is a body said to be in motion?

3. Give an example, when a body is at rest as well as in motion.

4. Give the name of a physical quantity that corresponds to the actual path travelled by a moving body.

5. Give the name of the physical quantity that corresponds to the shortest distance between the initial and the final position of a moving body.

6. Which amongst the following is a vector quantity and why? (i) Distance (ii) Displacement.

7. Are rest and motion relative terms or opposite terms?

8. What kind of bodies show locomotion in nature?

9. Give the name of the physical quantity that corresponds to the rate of change of motion and state its unit in SI system.

10. Does the motion of seconds hand of a watch represent uniform velocity or uniform speed?

11. Does the seconds hand of a watch represent uniform motion or accelerated motion?

12. A boy runs around a circular park of radius 7 m in 11 seconds. What is the speed of the boy?

13. Give the name of a physical quantity that corresponds to the rate of change of motion in a specified direction.

14. What do you understand by the term non-uniform motion? Give an example.

15. Amongst speed and velocity which is a scalar quantity and why?

16. A body is covering 4 m in every 1 second for 10 seconds towards east. What physical quantity does the body represent and state its magnitude?

17. A body covers a distance of 5 m in the first second, 10 m in the second second and 15 m in the third second, all distances being covered towards the west. What physical quantity does the body represent?

18. The velocity of a body increases by 10 m/s in every one second. What physical quantity does the body represent and what is its magnitude?

19. A train running at 20 ms^{-1} slows down at a rate of 1 ms^{-1} in every one second, till the train stops. Is the train acted upon by negative or positive acceleration and state its magnitude?

20. A cricket ball is projected vertically upwards. What kind of acceleration is acting on the ball?

21. The distance-time graph of a body is a straight line parallel to the time axis. What information does the graph convey regarding the motion of the body?

22. Which physical quantity can be calculated by finding the slope of a distance-time graph?

23. Area under the velocity-time graph line is 40 m. What physical quantity does this area represent?

24. How can you calculate acceleration from a velocity-time graph?

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II. SHORT ANSWER QUESTIONS – I (2 Marks)

PREVIOUS YEARS' QUESTIONS

1. A cyclist travels a distance of 4 km from P to Q and then moves a distance of 3 km at right angle to PQ. Find his resultant displacement graphically. **[2010 (T-I)]**

2. A bus decreases its speed from 80 km/h to 50 km/h in 4 s. Find the acceleration of the bus. **[2010 (T-I)]**

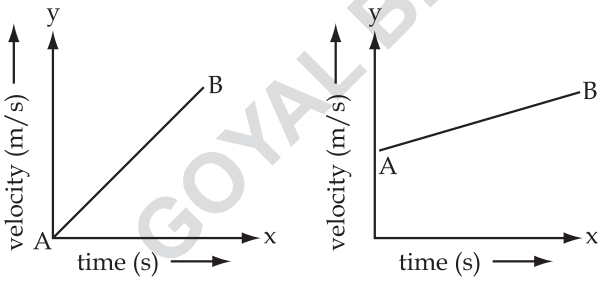
3. An electric train is moving with a velocity of 120 km/hr. How much distance will it cover in 30 s? **[2010 (T-I)]**

4. Giving one example each distinguish between uniform acceleration and non-uniform acceleration. **[2010 (T-I)]**

5. Represent the given data graphically. **[2010 (T-I)]**

TIME (IN SEC)	DISTANCE (M)
0	0
2	5
4	10
6	20

6. Explain the differences between the two graphs. **[2010 (T-I)]**

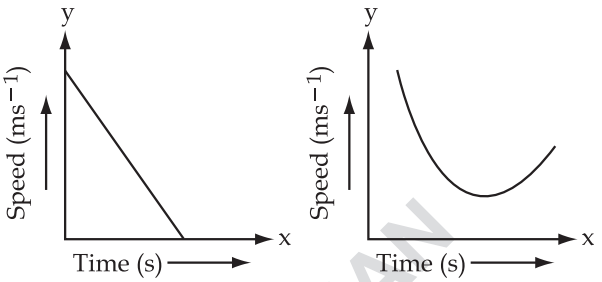


7. A particle moves 3 m north, then 4 m east and finally 6 m south. Calculate the displacement. **[2010 (T-I)]**

8. A body can have zero average velocity but not zero average speed. Justify. **[2010 (T-I)]**

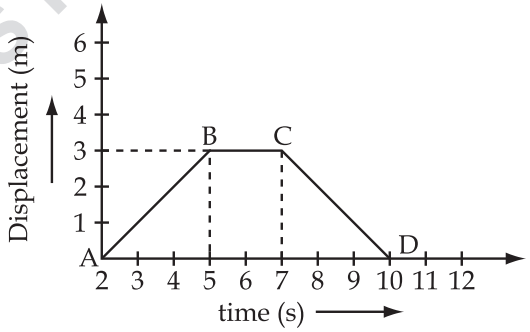
9. A train 100 m long is moving with a velocity of 60 kmh^{-1}. Find the time it takes to cross the bridge 1 km long. **[2010 (T-I)]**

10. What do the graphs shown below indicate : **[2010 (T-I)]**



11. On a 120 km track, a train travels the first 30 km at a uniform speed of 30 km/h. Calculate the speed with which the train should move rest of the track so as to get the average speed of 60 km/h for the entire trip? **[2010 (T-I)]**

12. The following displacement - time graph shows the positions of a body at different times. Calculate the velocity of the body as it moves from **[2010 (T-I)]**



(i) A - B

(ii) B - C

(iii) C - D

13. An athlete completes one round of a circular track of diameter 49 m in 20 s. Calculate the distance covered and displacement at the end of 30 s. **[2010 (T-I)]**

14. The graph given below is the distance - time graph of an object. **[2010 (T-I)]**

(i) Find the speed of the object during first four seconds of its journey

(ii) How long was it stationary?

(iii) Does it represents a real situation? Justify your answer.

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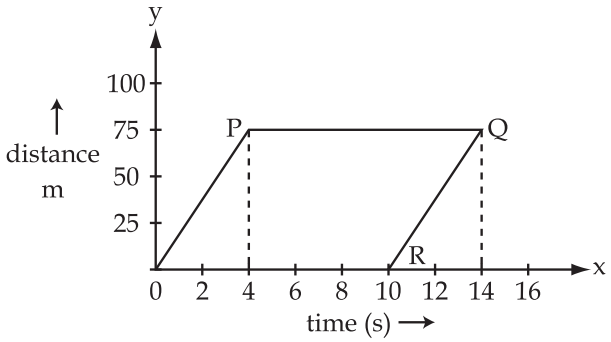


15. A car covers a distance x, while moving at 54 km/hr in 15 sec. The value of x is

(a) 2.25 km

(b) 5.40 km

(c) 0.225 km

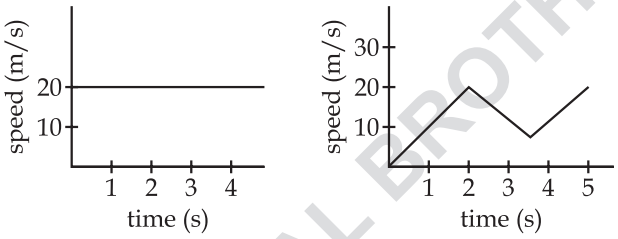
(d) 13.5 km

Choose the correct answer workout to arrive at the answer. **[2010 (T-I)]**

16. A marble rolling on a smooth floor has an initial velocity of 0.4 m/s. If the floor offers a retardation of 0.02 m/s^2, calculate the time it will take to come to rest. **[2010 (T-I)]**

17. (a) What does the odometer of an automobile measure? **[2010 (T-I)]**

(b) Two graphs for motion of objects moving along a straight line are shown. State how the speed is changing with time in both the cases.



18. A person travelling in a bus noted the timings and the corresponding distances as indicated on the km stones.

Time	Distance
8.00 am	10 km
8.15 am	20 km
8.30 am	30 km
8.45 am	40 km
9.00 am	50 km

(a) Name this type of table.

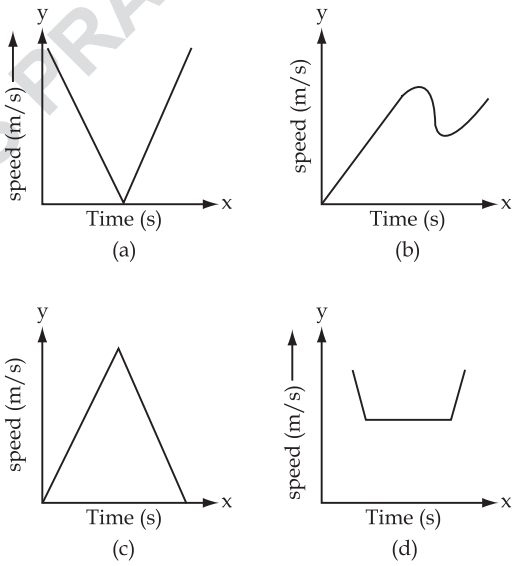
(b) What conclusion do you draw from this data? **[2010 (T-I)]**

19. Examine the data given below for motion of two different objects A and B carefully and state whether the motion of the objects is uniform or non uniform. Give reasons. **[2010 (T-I)]**

Time	Distance travelled by object A in m.	Distance travelled by object B in m.
9.30 a.m	10	12
9.45 a.m	20	19
10.00 a.m	30	23
10.15 a.m	40	35
10.30 a.m	50	37
10.45 a.m	60	41
11.00 a.m	70	44

20. A girl moves with the speed of 6 km/h for 2 h and with the speed of 4 km/h for the next 3 h. Find the average speed of the girl and the total distance moved. **[2010 (T-I)]**

21. Four speed - time graphs are shown below. **[2010 (T-I)]**



Which graph represents the following case?

(a) A ball thrown vertically upwards and returning to the hand of the thrower?

(b) A body decelerating to a constant speed and then accelerating.

Speed (m/s)	Time (s)
(a)	(b)
(c)	(d)

22. 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 min. 20 s? **[2010 (T-I)]**

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23. The minute hand of a wall clock is 10 cm long. Find its displacement and the distance covered from 10 a.m to 10.30 a.m. **[2010 (T-I)]**

24. A car starts with velocity 10 m/s and accelerates at rate 5 m/s^2. Find the final velocity when the car has travelled a distance 30 m. **[2010 (T-I)]**

25. A body covers a semicircle of radius 7 cm in 5 second. Find its velocity. **[2010 (T-I)]**

OTHER IMPORTANT QUESTIONS

1. State two differences between scalar and vector quantities.

2. State two differences between distance and displacement.

3. State two differences between speed and velocity.

4. A car moving along a circular path of radius 140 m, completes one round in 20 s. What is (i) the speed of the car (ii) the displacement of the car?

5. Give an example of a body moving with a uniform speed and uniform acceleration. Justify your answer.

6. (a) What do you understand by the term : (i) Distance (ii) Displacement? (b) State the SI units of distance and displacement.

7. A body is moving along a circular path of radius R. What will be the distance covered and the displacement of the body after half revolution?

8. A person starts from his house and travels a circular distance of 15 km around the walled city before returning back. What is (a) the distance covered by the person, (b) the displacement of the person?

9. Define the terms :

(i) speed and (ii) velocity.

10. Why is speed considered an incomplete physical quantity? Name a quantity akin to speed which describes the motion of a particle more accurately.

11. Name a physical quantity which corresponds to:

(a) rate of change of displacement

(b) rate of change of velocity

12. Arrange the following speeds in the increasing order :

(i) A scooter moving with a speed of 300 m per minute.

(ii) A car moving with a speed of 27 km per hour.

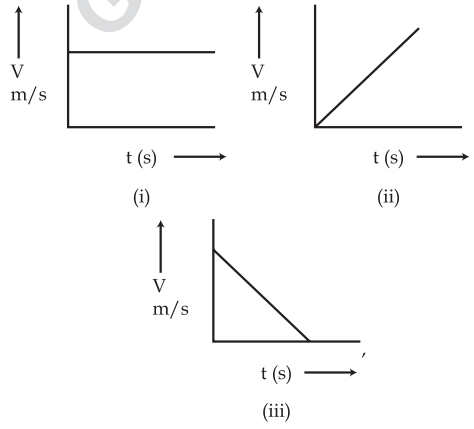
13. Draw a diagram to show the motion of a body whose speed remains constant, but the velocity changes continuously.

14. Draw a velocity versus time graph of a stone thrown vertically upwards and then coming downwards after attaining the maximum height.

III. SHORT ANSWER QUESTIONS – II (3 Marks)

PREVIOUS YEARS' QUESTIONS

1. What can you conclude about the motion of a body depicted by the velocity-time graphs (i), (ii) and (iii) given below : **[2010 (T-I)]**



2. Derive the equation $v^2 - u^2 = 2as$ graphically. **[2010 (T-I)]**

3. A bus travels at a distance of 120 km with a speed of 40 km/h and returns with a speed of 30 km/h. Calculate the average speed for the entire journey. **[2010 (T-I)]**

4. A bus accelerates uniformly from 54 km/h to 72 km/h in 10 s. Calculate : **[2010 (T-I)]**

(i) the acceleration

(ii) the distance covered by the bus in that time

5. (a) An object travels 16 m in 4 seconds and the next 16 m in 2 seconds. Calculate the average speed of the object.

(b) Give an example of an object moving under uniform circular motion. **[2010 (T-I)]**

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6. The driver of a train A travelling at a speed of 54 km/h applies brakes and retards the train uniformly. The train stops in 5 s. Another train B is travelling on the parallel track with a speed of 36 km/h. This driver also applies the brakes and the train retards uniformly. The train B stops in 10 s. Plot speed - time graph for both the trains on the same paper. Also calculate the distance travelled by each train after the brakes were applied. **[2010 (T-I)]**

7. (a) A car accelerates uniformly from 18 kmh^{-1} to 36 kmh^{-1} in 5 s. Calculate :

(i) acceleration

(ii) distance covered by the car in that time. **[2010 (T-I)]**

(b) The length of minute hand of a clock is 14 cm. Calculate the speed with which the tip of the minute hand moves.

8. A car is moving on a straight road with a uniform acceleration. The following table gives the speed of the car at various instants of time.

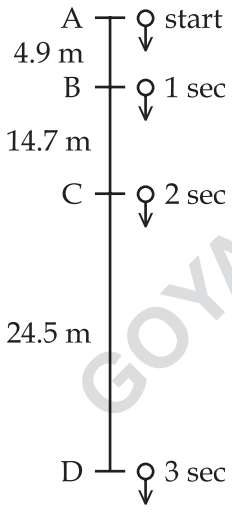
[2010 (T-I)]

Time (s)	0	10	20	30	40	50
Speed (ms^{-1})	5	10	15	20	25	30

(i) Draw the shape of speed - time graph representing the above sets of observations.

(ii) Find the acceleration of the car.

9. **[2010 (T-I)]**



From the given data find the value of 'a' (i) from A to B (ii) from B to C (iii) from C to D

10. Starting from a stationary position , Rehan paddles his bicycle to attain a velocity of 6 m/s in 30 s. Then he applies brakes such that the velocity of the bicycle comes down to 4 m/s in the next 5 s. Calculate the acceleration of the bicycle in both the cases. **[2010 (T-I)]**

11. Joseph jogs from one end A to the other end B of a straight 300 m road in 2 minutes 50 seconds and then turns around and jogs 100 m back of point C in another 1 minute. What are Joseph's average speeds and velocities in jogging?

(a) from A to B and (b) from A to C?

[2010 (T-I)]

12. Rajeev went from Delhi to Chandigarh on his motorbike. The odometer of the bike read 4200 km at the start of trip and 4460 km at the end of his trip. If Rajeev took 4 h 20 minutes to complete his trip, find the average speed in kmh^{-1} as well as ms^{-1}. **[2010 (T-I)]**

13. Draw a graph velocity versus time for a body starts to move with velocity '*u*' under a constant acceleration a for time *t*. Using this graph derive an expression for distance covered '*s*' in time '*t*'. **[2010 (T-I)]**

14. Ali 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 Ali's trip? **[2010 (T-I)]**

15. The brakes applied to a car produce an acceleration of 6 m/s^2 in the opposite direction to the motion. If the car takes two seconds to stop after the application of brakes, calculate the distance it travels during this time. **[2010 (T-I)]**

16. While driving Jayant travels 30 km with a speed of 40 km/h and next 30 km with a uniform speed of 20 km/h. Find his average speed. **[2010 (T-I)]**

17. A train accelerates uniformly from 36 km/hr to 54 km/hr in 10 seconds. Find

(a) the acceleration

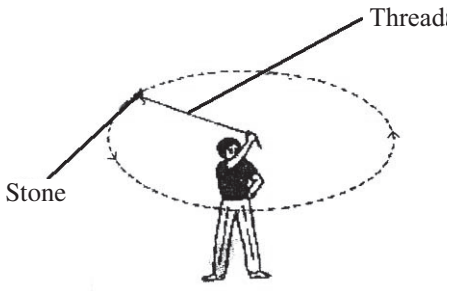
(b) the distance travelled by the car during this interval of time. **[2010 (T-I)]**

18. A van is accelerated uniformly from 36 km per hour to 90 km per hour in 3 seconds. Calculate: **[2010 (T-I)]**

(i) the acceleration

(ii) the distance covered by the van in that time

19.



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Look at the figure above :

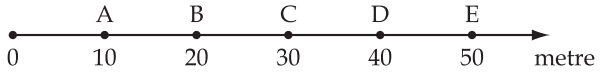
(a) Name the kind of motion of the stone.

(b) Is this an example of accelerated motion? Why?

(c) Name the force that keeps the stone in its path.

(d) What is the direction of this force? Draw it in your answer sheet. **[2010 (T-I)]**

20.



[2010 (T-I)]

Look at the figure above :

An object starts its journey from point 0. A, B, C, D and E represent position of the object at different instants. The object moves through A, B, C, D and E and then moves back to point C.

Calculate :

(a) the distance travelled by the object

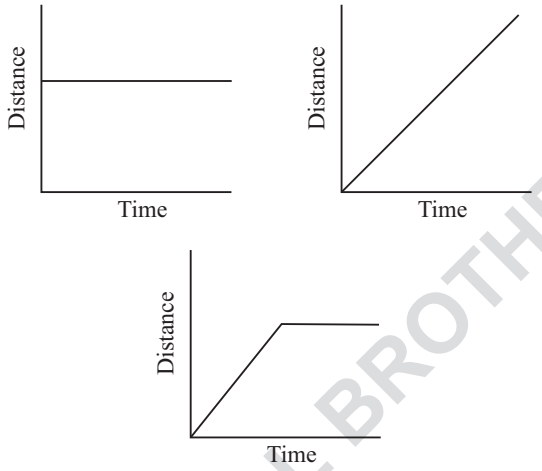
(b) the displacement of the object

(c) name the reference point in the diagram

OTHER IMPORTANT QUESTIONS

1. By giving one example each, define : (a) uniform velocity. (b) variable velocity and (c) average velocity.

2. Suggest what kind of motion of a body is represented by the graph given below :



3. Draw the distance-time graph for the following situations :

(a) When a body is stationary.

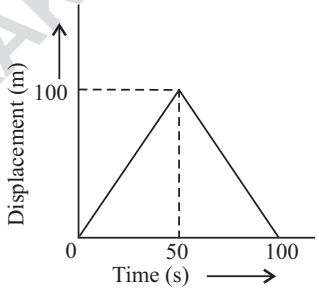
(b) When a body is moving with a uniform speed.

(c) When a body is moving with variable speed and uniform acceleration.

4. The displacement of a moving object in a given interval of time is zero. Would the distance travelled by the object also be zero? Justify your answer.

5. How will the equations of motion for an object moving with a uniform velocity change?

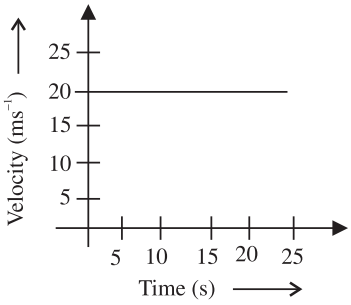
6. A girl walks along a straight path to drop a letter in the letter box and comes back to her initial position. Her displacement-time graph is shown in the figure. Plot a velocity-time graph for the same.



7. A car starts from rest and moves along the x-axis with a constant acceleration of 5 m s^{-2} for 8 seconds. If it then continues to move with a constant velocity, what distance will the car cover in 12 seconds since it started from rest?

8. A motorcyclist drives from A to B with a uniform speed of 30 km h^{-1} and returns back with a speed of 20 km h^{-1}. Find its average speed.

9. The velocity-time graph shows the motion of a cyclist. Find (i) its acceleration (ii) its velocity and (iii) the distance covered by the cyclist in 15 seconds.



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10. A car is running at a speed of 54 km h^{-1}. In the next second, its speed is 63 km h^{-1}. Calculate the distance covered by the car in m.

11. Draw velocity-time graphs for the following situations :

(a) When the body is moving with uniform velocity.

(b) When the body is moving with variable velocity and uniform acceleration.

(c) When the body is moving with variable velocity and uniform deceleration.

12. How can you calculate the following :

(a) Speed from distance-time graph.

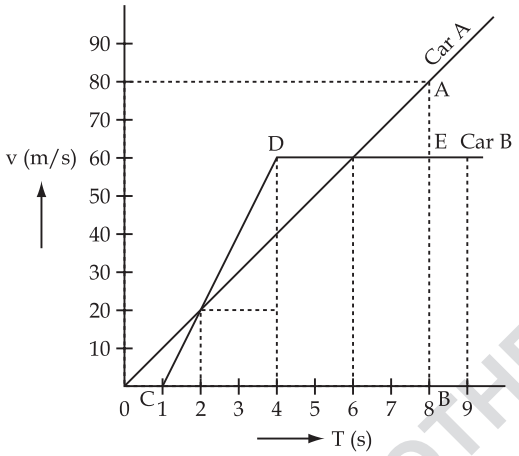
(b) Acceleration from velocity-time graph.

(c) Displacement from velocity-time graph.

IV. LONG ANSWER QUESTIONS (5 Marks)

PREVIOUS YEARS' QUESTIONS

1.



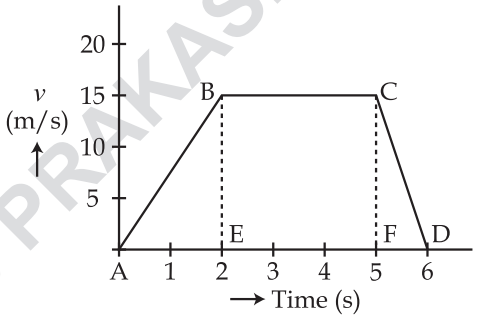
The *V-T* graph of cars A and B which start from the same place and move along a straight road in the same direction, is shown. Calculate (i) the acceleration of car A between 0 and 8 s. (ii) the acceleration of car B between 2 s and 4 s. (iii) the points of time at which both the cars have the same velocity (iv) which of the two cars is ahead after 8 sec. and by how much? **[2010 (T-I)]**

2. (a) The velocity-time graph of a car is given below. The car weighs 1000 kg. **[2010 (T-I)]**

(i) What is the distance travelled by the car in the first 2 seconds?

(ii) What is the braking force at the end of 5 seconds to bring the car to a stop within one second?

(b) Derive the equation $S = ut + \frac{1}{2} at^2$ using graphical method.



3. (a) Prove that $v = u + at$, using graphical method **[2010 (T-I)]**

(b) A train starting from rest attains a velocity of 72 km/h in 5 minutes. Assuming the acceleration is uniform. Find

(i) the acceleration

(ii) the distance travelled by the train for attaining this velocity.

4. The distance - time graph of two trains are given below. The trains start simultaneously in the same direction. **[2010 (T-I)]**

(i) How much ahead of A is B when the motion starts?

(ii) What is the speed of B?

(iii) When and where will A catch B?

(iv) What is the difference between the speeds of A and B?

(v) Is the speed of both the trains uniform or non-uniform? Justify your answer.

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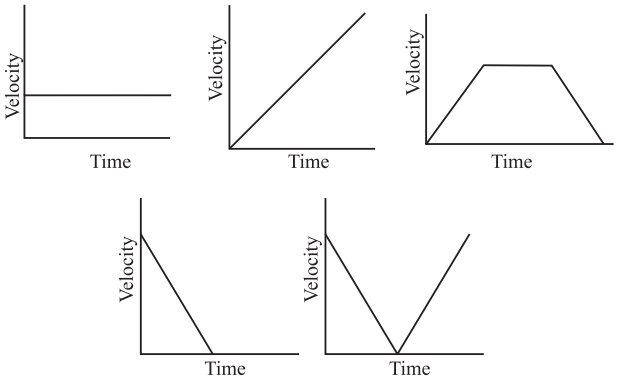
OTHER IMPORTANT QUESTIONS

1. Suggest real life examples where the motion of a body is similar to that represented by the following velocity-time graphs :



2. An object is dropped from rest at a height of 150 m and simultaneously another object is dropped from rest at a height 100 m. What is the difference in their heights after 2 s if both the objects drop with same acceleration? How does the difference in heights vary with time?

3. An object starting from rest travels 20 m in the first 2 s and 160 m in the next 4 s. What will be the velocity after 7 s from the start?

4. Using the following data, draw time-displacement graph for a moving object :

Time (s)	0	2	4	6	8	10	12	14	16
Displacement (m)	0	2	4	4	4	6	4	2	0

Use this graph to find average velocity for the first 4 s, for the next 4 s and for the last 6 s.

5. An electron moving with a velocity of 5×10^4 ms^{-1} enters into a uniform electric field and acquires a uniform acceleration of 10^4 ms^{-2} in the direction of its initial motion.

(i) Calculate the time in which the electron would acquire a velocity double of its initial velocity.

(ii) What distance would the electron cover in this time?

6. Two stones are thrown vertically upwards simultaneously with their initial velocities u_1 and u_2 respectively. Prove that the heights reached by them would be in the ratio of $u_1^2 : u_2^2$ (Assume upward acceleration to be –g and downward acceleration to be +g).

7. A train starting from rest, picks up a speed of 20 ms^{-1} in 200 s. It continues to move at the same speed for the next 500 s. It is then brought to rest in the next 100 s.

(i) Plot a speed time graph.

(ii) Calculate the rate of uniform acceleration.

(iii) Calculate the rate of uniform retardation.

(iv) Calculate the distance covered by the train during retardation.

(v) Calculate the average speed during retardation.

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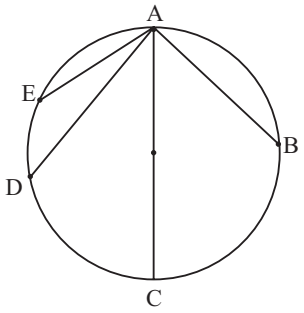
ASSIGNMENTS FOR FORMATIVE ASSESSMENT

A. Activities

1. Objective

To find the displacement of an object moving in a circular path.



Materials Required

A wooden peg, 2 m long string, a measuring tape (5 m), a sharp iron object or knife.

Procedure

1. Fix the wooden peg in the ground and tie to it 2 m long string.

2. On the other end of the string tie the sharp iron object. Holding the iron object straight and the string tight, sketch a circle in the ground.

3. Mark points A, B, C, D and E on the ground.

4. Measure displacement AE, AC, AD and AE with the help of a measuring tape and record it.

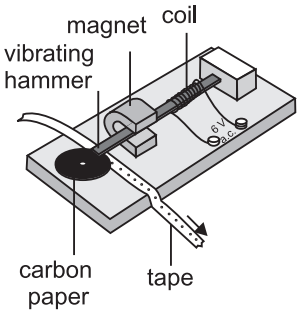
5. What are your conclusions, regarding displacement, when an object moves along a circular path.

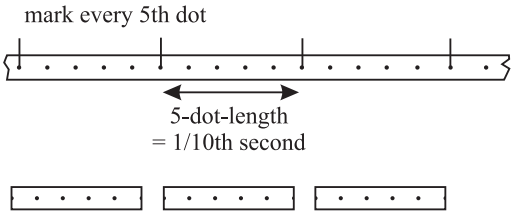
2. Objective

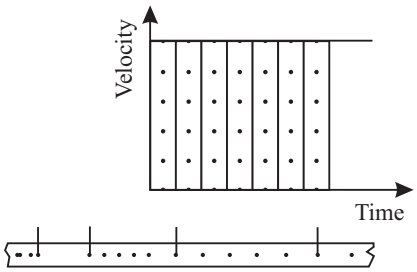
To prepare strip chart of : (i) Uniform velocity and time (ii) Variable velocity and time

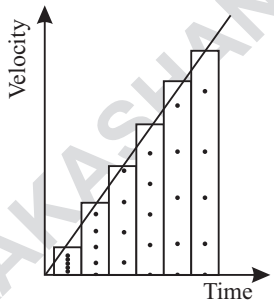
Materials Required :

10 m of paper tape (1 cm wide), a ticker timer, scissors, glue, pencil and scale.









Procedure :

1. Ticker timer is simply an electric vibrator that puts little black dots at a rate of 50 dots per second.
2. Fix the tape in the ticker timer, such that one end of the tape is held firmly in your hand.
3. Switch on the ticker timer and gently pull out the tape from it with uniform velocity such that you pull out about 50 cm of the tape.

   What do you notice about the spacing and dots?
4. Count along the tape, marking off every fifth point dot, knowing there are 50 dots in each second, 5 dots length is produced in $\frac{1}{10}$ th of a second.
5. Using scissors cut tape at each fifth mark.
6. Stick the 5 dot lengths side by side in the right order. You have made a strip chart of uniform velocity against time.
7. Repeat the activity, such that you pull tape with a jerk such that it accelerates.
8. Again cut strip after each 5 dots from the tape and stick them side by side. You have made a strip chart of variable velocity against acceleration.

B. Group Discussion

Discuss the motion of the earth with special reference to distance covered, displacement, speed, velocity and acceleration.

C. Classroom Quiz

1. Which of the two is either smaller or equal to amongst distance and displacement for a moving body.
2. A cockroach runs a distance of 4 m in 2 s randomly. State whether speed of the cockroach is 2 ms^{-1} or the velocity of the cockroach is 2 ms^{-1}.
3. The distance of an object is 0, 3, 6, 9, 12 and 15 centimetres from zero to 5 seconds.
   (i) Is the object moving with uniform speed?
   (ii) Is the object moving with uniform velocity?
   (iii) Is the motion of the object accelerated?
   (iv) If yes, what is the acceleration?
4. The acceleration due to gravity is 9.8 ms^{-2}. If the object is projected vertically upward, what is its acceleration.
5. Why does a body moving in a circular path have an accelerated motion?
6. A car is moving towards east with a velocity of 10 ms^{-1}. It turns towards north-east at the

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same speed. Will the velocity of the car change? Explain.

D. Experiments

1. To plot a distance-time (s – t) graph for a body moving with uniform speed from the data given below and hence calculate the speed of the object.

Distance (s) in (m)	Time (t) in (s)
0	0
4	1
8	2
12	3
16	4
20	5
24	6
28	7
32	8
36	9
40	10
44	11
48	12

Materials Required : A millimetre graph paper.

Procedure :

1. Count the mm available on x-axis, starting from origin on the lower left hand side of the graph. You will observe that there are 170 mm.

2. Count the number of points of time to be plotted on the x-axis. You will observe it is 12 s.

3. Divide the available length on the graph with the time *i.e.* 170 ÷ 12 = 14.1 mm.

4. Taking the most convenient scale, 10 mm to a second, plot time scale on x-axis.

5. Count the mm available on y-axis, starting from origin on lower left hand side of the graph. You will observe that there are 130 mm.

6. Count the distance to be plotted by substracting minimum distance from maximum distance. You will find it is (48-0) = 48 m.

7. Dividing the available length on y-axis with distance, i.e 130 ÷ 48 = 2.9.

8. Taking the most convenient scale, 2.5 mm = 1 m or 10 mm = 4 m, plot time scale on y-axis.

9. Now plot the values of distance and time on the graph.

10. Join all the points by a straight line.

Observations and Calculations

1. It observed that the graph is a straight line.

2. Calculate the speed as under.

(i) Select any two points on the graph line.

(ii) Read the ordinates of x-axis and y-axis. Say S_1 and S_2 are the ordinates of distance (y-axis) and t_1 and t_2 are the ordinates of time (x-axis) of the chosen points.

(iii) Record the ordinates and hence find $(S_2 - S_1)$ and $(t_2 - t_1)$.

(iv) Calculate the speed by the formula $\frac{S_2 - S_1}{t_2 - t_1}$.

(v) Repeat the calculations for four different points and tabulate them in the table shown below.

S.no	Value of time for first point t_1	Value of time for second point t_2	Value of distance for first point S_1	Value of distance for second point S_2	$t_2 - t_1$	$S_2 - S_1$	Speed = $\frac{S_2 - S_1}{t_2 - t_1}$
1.							
2.							
3.							
4.							
5.							

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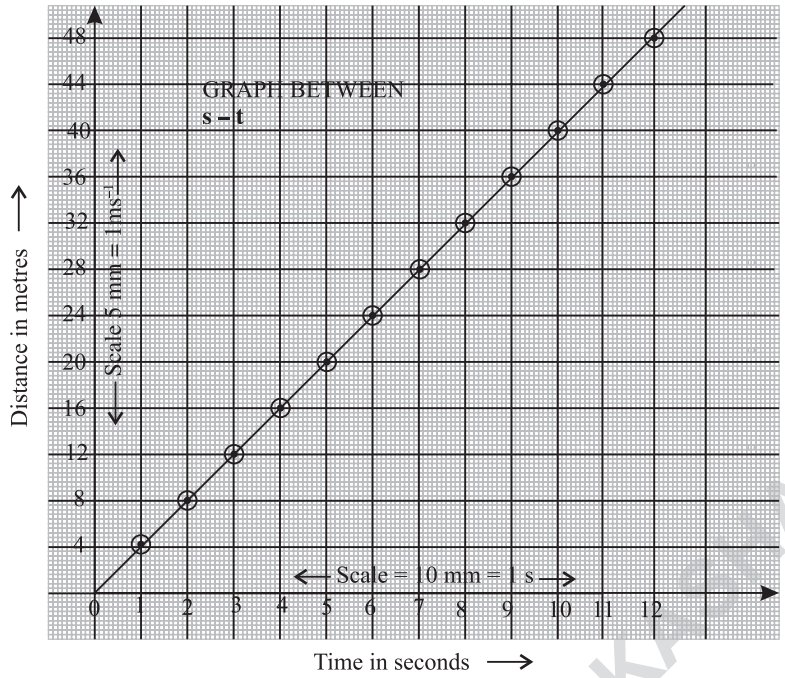

Conclusions

1. Speed of body is 4 ms^{-1}.
2. The body is moving with a uniform speed.
3. The graph of (s – t) is a straight line, if the body is moving with a uniform speed.

Applications

1. The slope of (s – t) graphs is the measure of speed of a moving object. Plot (s – t) graphs of different moving objects, the steepest slope shall have the highest speed. Such graphs are helpful in finding comparative speeds of different objects.
2. From s – t graph are we can find the speed of the moving object at a time which is not plotted on the graph, by extrapolating the graph.

Science Quiz

This quiz is regarding distance-time graph.

1. What is the shape of the distance-time graph of an object moving with uniform speed?
2. What physical quantity is represented by the slope of the graph?
3. What is the shape of the graph (s – t), if the body is at rest?
4. In a distance-time graph for an object, the graph line is parallel to the time axis. What is your conclusion regarding the motion of the object?
5. Can we have a distance-time graph parallel to the distance axis?
6. Give a reason for your answer in Question 6.
7. What kind of graph do you expect for a moving object moving a different speeds?

2. To plot a velocity-time (v – t) graph for an object moving with a uniform acceleration from the data given below and hence calculate (i) acceleration (ii) distance covered by the object.

Time in seconds	Velocity in ms^{-1}
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
10	20

Materials Required : A millimetre graph paper

Procedure

1. On the lower left hand side of the graph paper mark the origin and draw x-axis and y-axis.
2. Count the available number of divisions on the x-axis. Divide these divisions with the number

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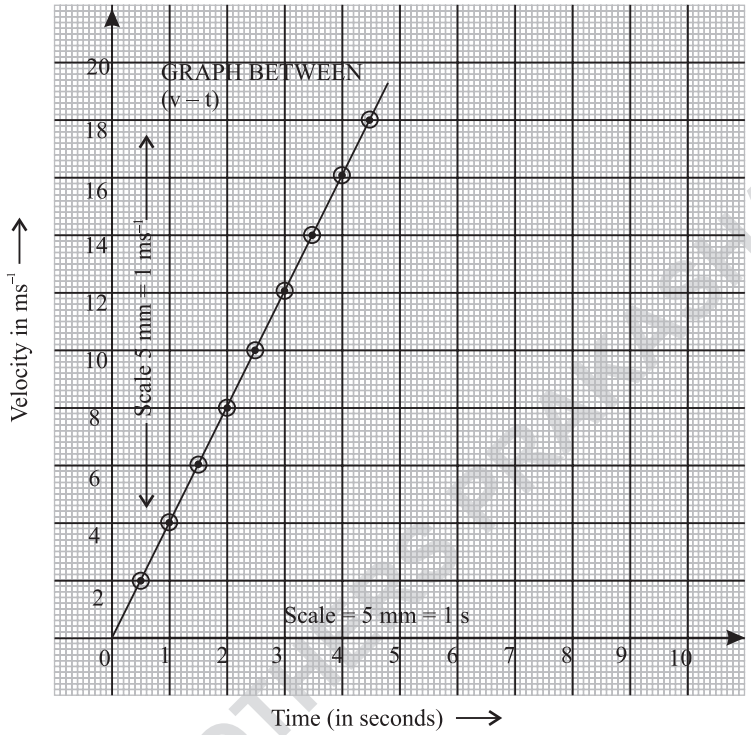
of seconds of time to be plotted and choose a convenient scale. In the present case, 5 mm to a 1 second is the most convenient scale.

3. Count the available number of divisions on the y-axis. Divide these divisions with the maximum velocity, to be plotted and choose a convenient scale. In the present case 5 mm to 1 ms^{-1} is the most convenient scale.
4. Mark the x-axis and y-axis according to the scale.
5. Plot the velocity time graph from the table above.
6. Join all the points of the graph by a straight line.



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Observations and Calculations

1. Velocity-time graph is a straight line.
2. **Calculation of acceleration**
   (i) Select any two points on the graph line.
   (ii) Read the ordinates of x-axis and y-axis. Say v_1 and v_2 are the ordinates of velocity (y-axis) and t_1 and t_2 are the ordinates of time (x-axis) of the chosen points.
   (iii) Record the ordinates and hence find $(v_2 - v_1)$ and $(t_2 - t_1)$.
   (iv) Calculate the acceleration by the formula $\frac{v_2 - v_1}{t_2 - t_1}$.
   (v) Repeat the calculations for four different points and calculate them in the table shown below.

Table for Calculation of Acceleration

S.no	Value of time from first point t_1	Value of time from second point t_2	Value of velocity from first point v_1	Value of velocity from second point v_2	$t_2 - t_1$	$v_2 - v_1$	Acceleration = $\frac{v_2 - v_1}{t_2 - t_1}$
1.							
2.							
3.							
4.							
5.							

3. Calculation of distance

Tabulate t_1, t_2, v_1 and v_2 as above. Calculate distance covered by the formula $s = \frac{1}{2}(v_1 + v_2) \times (t_2 - t_1)$.

S.no	Value of time from first point t_1	Value of time from second point t_2	$t_2 - t_1$	Value of velocity from first point v_1	Value of velocity from second point v_2	Distance (s) = $\frac{1}{2}(v_2 + v_1) \times (t_2 - t_1)$
1.						
2.						
3.						
4.						
5.						

Conclusions :

1. Acceleration of the object is 2 ms^{-2}.
2. The body is moving with variable velocity, but uniform acceleration.
3. The graph of ($v - t$) is a straight line, when an object moves with uniform acceleration.
4. The slope of ($v - t$) graph gives the acceleration of the body.
5. The area under the given points of ($v - t$) graph gives, the distance travelled in that time interval.

Applications :

1. If the ($v - t$) graph is a straight line, then an object moves with uniform acceleration and variable velocity.
2. The slope of $v - t$ graph is the measure of acceleration. More is the slope, higher is the acceleration of the object.
3. The area under ($v - t$) graph gives the measure of distance covered by a body. Larger the area under the ($v - t$) graph line, more is the distance covered.
4. By plotting two or more graphs of $v - t$ on the same graph paper, one can compare the acceleration and distances covered by two or more bodies.

Science Quiz :

This quiz is regarding the velocity-time graph.

1. What is the nature of ($v - t$) graph for an object moving with uniform acceleration?
2. What does the slope of a velocity-time graph represent?
3. What does the area under ($v - t$) graph represent?
4. What is the nature of ($v - t$) graph for an object, moving with uniform velocity?
5. What is the magnitude of slope of ($v - t$) graph for an object, moving with uniform velocity?
6. What conclusion can be drawn, if velocity time graph is parallel to the time axis?
7. Can velocity-time graph be parallel to velocity-axis.
8. Give a reason for your answer in question 7.
9. The velocity-time graphs for two cars A and B are placed on the same graph such that slope of car A is more than B. Which car is having more acceleration?
10. Two cars P and Q travel for the same time. The velocity-time graphs of both cars are plotted on the same graph paper. It is found that the area under the graph of Q is less than P. Which car travels through less distance?

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Motion

Page No: 100

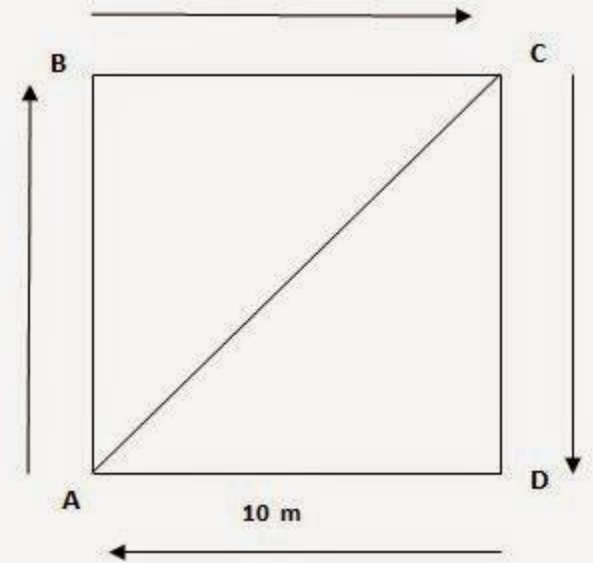
1. An object has moved through a distance. Can it have zero displacement? If yes, support your answer with an example.

Answer

Yes,an object can have zero displacement even when it has moved through a distance.This happens when final position of the object coincides with its initial position. For example,if a person moves around park and stands on place from where he started then here displacement will be zero.

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



Given, Side of the square field= 10m
Therefore, perimeter = 10 m x 4 = 40 m
Farmer moves along the boundary in 40s.
Displacement after 2 m 20 s = 2 x 60 s + 20 s = 140 s =?
Since in 40 s farmer moves 40 m

Therefore, in 1s distance covered by farmer = 40 / 40 m = 1m

Therefore, in 140s distance covered by farmer = 1 × 140 m = 140 mNow, number of rotation to cover 140 along the boundary= Total Distance / Perimeter
= 140 m / 40 m = 3.5 round
Thus, after 3.5 round farmer will at point C of the field.

Therefore. Displacement AC = $\sqrt{(10m)^2 + (10m)^2}$
= $\sqrt{100m^2 + 100m^2}$
= $\sqrt{200m^2}$
= $10\sqrt{2}$ m
= 10 x 1.414 = 14.14 m

Thus, after 2 min 20 seconds the displacement of farmer will be equal to 14.14 m north east from intial position.

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

None of the statement is true for displacement First statement is false because displacement can be zero. Second statement is also false because displacement is less than or equal to the distance travelled by the object.

Page No: 102

1. Distinguish between speed and velocity.

Answer

Speed	Velocity
Speed is the distance travelled by an object in a given interval of time.	Velocity is the displacement of an object in a given interval of time.
Speed = distance / time	Velocity = displacement / time
Speed is scalar quantity i.e. it has only magnitude.	Velocity is vector quantity i.e. it has both magnitude as well as direction.

2. Under what condition(s) is the magnitude of average velocity of an object equal to its average speed?

Answer

The magnitude of average velocity of an object is equal to its average speed, only when an object is moving in a straight line.

3. What does the odometer of an automobile measure?

Answer

The odometer of an automobile measures the distance covered by an automobile.

4. What does the path of an object look like when it is in uniform motion?

Answer

An object having uniform motion has a straight line path.

5. During an experiment, a signal from a spaceship reached the ground station in five minutes. What was the distance of the spaceship from the ground station? The signal travels at the speed of light, that is, 3×10^8 m s^{-1}.

Answer

Speed= 3×10^8 m s^{-1}
Time= 5 min = 5 x 60 = 300 secs. Distance= Speed x Time
Distance= 3×10^8 m s^{-1} x 300 secs. = 9×10^{10} m

Page No: 103

1. When will you say a body is in (i) uniform acceleration? (ii) non-uniform acceleration?

Answer

(i) A body is said to be in uniform acceleration if it travels in a straight line and its velocity increases or decreases by equal amounts in equal intervals of time.
(ii) A body is said to be in nonuniform acceleration if the rate of change of its velocity is not constant.

2. A bus decreases its speed from 80 km h^{-1} to 60 km h^{-1} in 5 s. Find the acceleration of the bus.

Answer

Initial speed of the bus, u= 80 km/h $= 80 \times \frac{5}{18} = 22.22$ m/s

Final speed of the bus, v= 60 km/h $= 60 \times \frac{5}{18} = 16.66$ m/s

Time take to decrease the speed, t= 5 s

Acceleration, $a = \frac{v-u}{t}$ $= \frac{16.66 - 22.22}{5} = -1.112$ m/s^2

3. A train starting from a railway station and moving with uniform acceleration attains a speed 40 km h^{-1} in 10 minutes. Find its acceleration.

Answer

Initial velocity of the train, $u = 0$

Final velocity of the train, $v = 40$ km/h $= 40 \times \frac{5}{18} = 11.11$ m/s

Time taken, $t = 10$ min $= 10 \times 60 = 600$ s

Acceleration, $a = \frac{v-u}{t} = \frac{11.11-0}{600} = 0.0185$ m/s^2

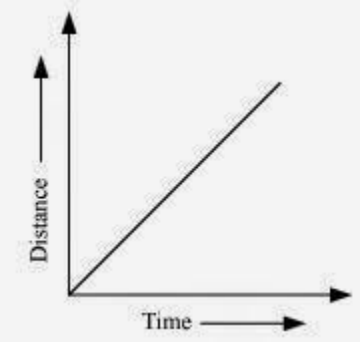
Hence, the acceleration of the train is 0.0185 m/s^2.

Page No: 107

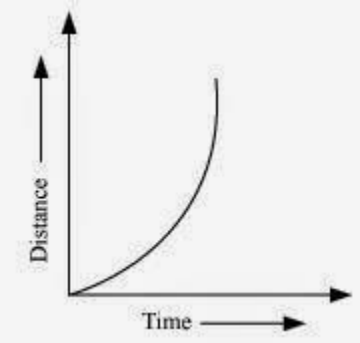
1. What is the nature of the distance - 'time graphs for uniform and non-uniform motion of an object?

Answer

When the motion is uniform,the distance time graph is a straight line with a slope.



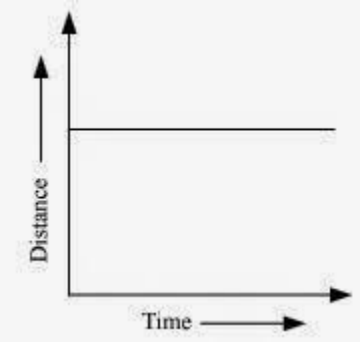
When the motion is non uniform, the distance time graph is not a straight line.It can be any curve.



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

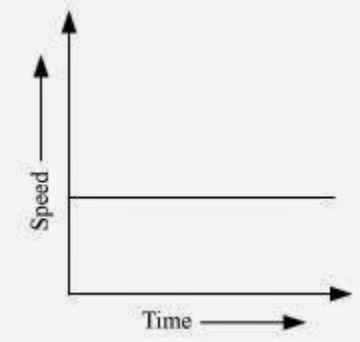
If distance time graph is a straight line parallel to the time axis, the body is at rest.



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

If speed time graph is a straight line parallel to the time axis, the object is moving uniformly.



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

Answer

The area below velocity-time graph gives the distance covered by the object.

Page No: 109

1. A bus starting from rest moves with a uniform acceleration of 0.1 m s^{-2} for 2 minutes. Find (a) the speed acquired, (b) the distance travelled.

Answer

Initial speed of the bus, u= 0

Acceleration, a = 0.1 m/s^2
Time taken, t = 2 minutes = 120 s

(a) v= u + at
v= 0 + 0×1 × 120
v= 12 ms^{-1}

(b) According to the third equation of motion:
$v^2 - u^2 = 2as$
Where, s is the distance covered by the bus
$(12)^2 - (0)^2 = 2(0.1)\ s$
s = 720 m

Speed acquired by the bus is 12 m/s.
Distance travelled by the bus is 720 m.

Page No: 110

2. A train is travelling at a speed of 90 km h^{-1}. Brakes are applied so as to produce a uniform acceleration of −0.5 m s^{-2}. Find how far the train will go before it is brought to rest.

Answer

Initial speed of the train, u= 90 km/h = 25 m/s
Final speed of the train, v = 0 (finally the train comes to rest)
Acceleration = - 0.5 m s^{-2}
According to third equation of motion:
$v^2 = u^2 + 2as$
$(0)^2 = (25)^2 + 2(-0.5)\ s$

Where, s is the distance covered by the train

$$s = \frac{25^2}{2(0.5)} = 625 \text{ m}$$

The train will cover a distance of 625 m before it comes to rest.

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

Initial Velocity of trolley, u= 0 cms^{-1}
Acceleration, a= 2 cm s^{-2}
Time, t= 3 s
We know that final velocity, v= u + at = 0 + 2 x 3 cms^{-1}
Therefore, The velocity of train after 3 seconds = 6 cms^{-1}

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

Answer

Initial Velocity of the car, u=0 ms^{-1}
Acceleration, a= 4 m s^{-2}
Time, t= 10 s
We know Distance, s= ut + (1/2)at^2
Therefore, Distance covered by car in 10 second= 0 × 10 + (1/2) × 4 × 102
= 0 + (1/2) × 4× 10 × 10 m
= (1/2)× 400 m
= 200 m

5. A stone is thrown in a vertically upward direction with a velocity of 5

m s^{-1}. 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

Given Initial velocity of stone, u=5 m s^{-1}
Downward of negative Acceleration, a= 10 m s^{-2}
We know that 2 as= v^2- u^2

Therefore, Height attained by the stone, s= $\frac{0^2}{5^2}$ x (-10) m

= $\frac{-25}{-20}$ m

= 1.25 m

Also we know that final velocity, v= u + at

or, Time, t= $\frac{v-u}{a}$

Therefore, Time, t taken by stone to attain the height, s= $\frac{0-5}{-10\ s}$

= 0.5 s

Page No: 112

Excercise

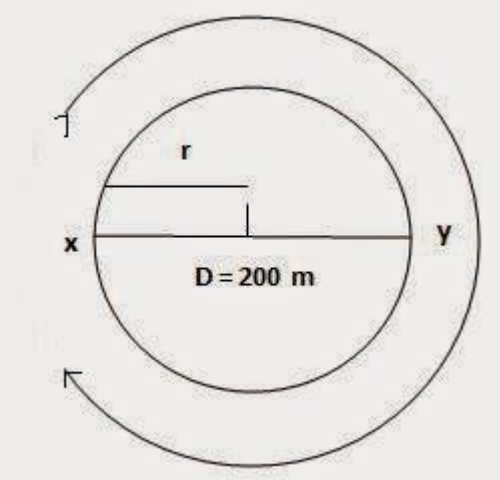
1. An athlete completes one round of a circular track of diameter 200 m in 40 s. What will be the distance covered and the displacement at the end of 2 minutes 20 s?

Answer

Diameter of circular track (D) = 200 m
Radius of circular track (r) = 200 / 2=100 m
Time taken by the athlete for one round (t) = 40 s
Distance covered by athlete in one round (s) = 2π r
= 2 x (22 / 7) x 100
Speed of the athlete (v) = Distance / Time
= (2 x 2200) / (7 x 40)
= 4400 / 7 × 40
Therefore, **Distance covered in 140 s = Speed (s) × Time(t)**
= 4400 / (7 x 40) x (2 x 60 + 20)
= 4400 / (7 x 40) x 140

= 4400 x 140 /7 x 40
= 2200 m

Number of round in 40 s =1 round
Number of round in 140 s =140/40
=3 $^{1}/_{2}$
After taking start from position X,the athlete will be at postion Y after 3 $^{1}/_{2}$ rounds as shown in figure



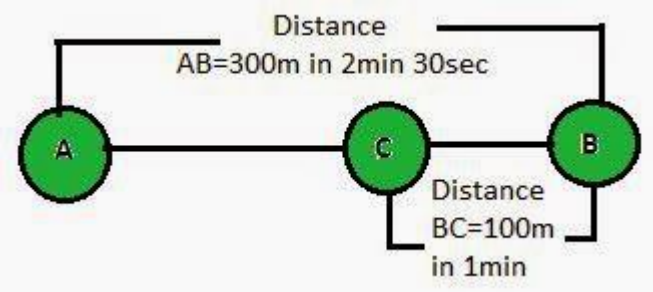
Hence, **Displacement of the athlete** with respect to initial position at x= xy

= Diameter of circular track
= 200 m

2. Joseph jogs from one end A to the other end B of a straight 300 m road in 2 minutes 30 seconds 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 and (b) from A to C?

Answer

Total Distance covered from AB = 300 m
Total time taken = 2 x 60 + 30 s
=150 s



Therefore, Average Speed from AB = Total Distance / Total Time
=300 / 150 m s^{-1}
=2 m s^{-1}
Therefore, Velocity from AB =Displacement AB / Time = 300 / 150 m s^{-1}
=2 m s^{-1}
Total Distance covered from AC =AB + BC
=300 + 200 m

Total time taken from A to C = Time taken for AB + Time taken for BC
= (2 x 60+30)+60 s
= 210 s
Therefore, Average Speed from AC = Total Distance /Total Time
= 400 /210 m s^{-1}
= 1.904 m s^{-1}

Displacement (S) from A to C = AB - BC
= 300-100 m
= 200 m

Time (t) taken for displacement from AC = 210 s

Therefore, Velocity from AC = Displacement (s) / Time(t)
= 200 / 210 m s^{-1}
= 0.952 m s^{-1}

3. Abdul, while driving to school, computes the average speed for his trip to be 20 km h^{-1}. On his return trip along the same route, there is less traffic and the average speed is 40 km h^{-1}. What is the average speed for Abdul's trip?

Answer

The distance Abdul commutes while driving from Home to School = S
Let us assume time taken by Abdul to commutes this distance = t_1
Distance Abdul commutes while driving from School to Home = S
Let us assume time taken by Abdul to commutes this distance = t_2
Average speed from home to school v_{1av} = 20 km h_{-1}
Average speed from school to home v_{2av} = 30 km h^{-1}
Also we know Time taken form Home to School t_1 =S / v_{1av}
Similarly Time taken form School to Home t_2 =S/v_{2av}
Total distance from home to school and backward = 2 S
Total time taken from home to school and backward (T) = S/20+ S/30
Therefore, Average speed (V_{av}) for covering total distance (2S) = Total Dostance/Total Time
= 2S / (S/20 +S/30)
= 2S / [(30S+20S)/600]
= 1200S / 50S
= 24 kmh^{-1}

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

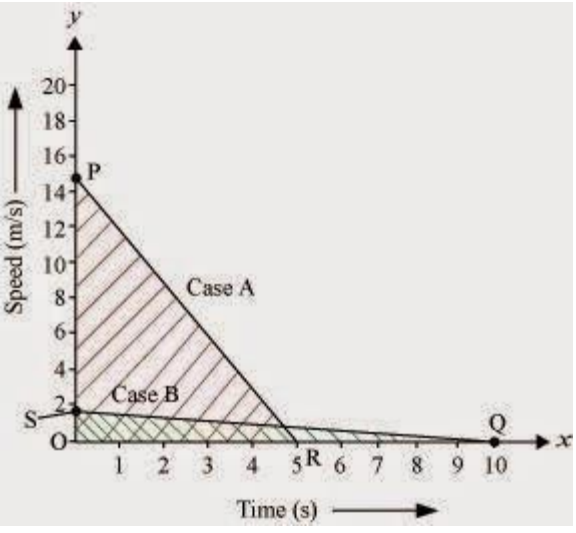
Answer

Given Initial velocity of motorboat, u = 0
Acceleration of motorboat, a = 3.0 m s^{-2}
Time under consideration, t = 8.0 s
We know that Distance, $s = ut + (1/2)at^2$
Therefore, The distance travel by motorboat = 0 x 8 + (1/2)3.0 x 8 2
= (1/2) x 3 x 8 x 8 m
= 96 m

5. A driver of a car travelling at 52 km h^{-1} applies the brakes and accelerates uniformly in the opposite direction. The car stops in 5 s. Another driver going at 3 km h^{-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 the two cars. Which of the two cars travelled farther after the brakes were applied?

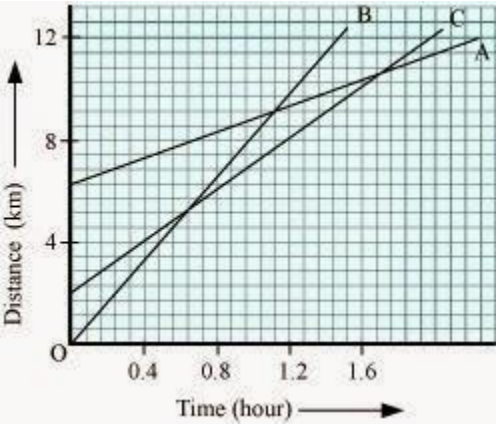
Answer

As given in the figure below PR and SQ are the Speed-time graph for given two cars with initial speeds 52 kmh-1 and 3 kmh-1 respectively.



Distance Travelled by first car before coming to rest =Area of Δ OPR
= (1/2) x OR x OP
= (1/2) x 5 s x 52 kmh-1
= (1/2) x 5 x (52 x 1000) / 3600) m
= (1/2) x 5x (130 / 9) m
= 325 / 9 m
= 36.11 m
Distance Travelled by second car before coming to rest =Area of Δ OSQ
= (1/2) x OQ x OS
= (1/2) x 10 s x 3 kmh-1
= (1/2) x 10 x (3 x 1000) / 3600) m
= (1/2) x 10 x (5/6) m
= 5 x (5/6) m
= 25/6 m
= 4.16 m

6. Fig 8.11 shows the distance-time graph of three objects A, B and C. Study the graph and answer the following questions:



(a) Which of the three is travelling the fastest?
(b) Are all three ever at the same point on the road?

(c) How far has C travelled when B passes A? (d)How far has B travelled by the time it passes C?

Answer

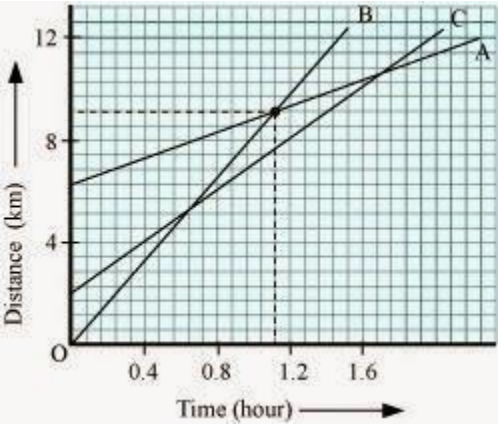
(a) Object B
(b) No
(c) 5.714 km
(d) 5.143 km

(a) $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$\text{Slope of graph} = \frac{y-\text{axis}}{x-\text{axis}} = \frac{\text{Distance}}{\text{Time}}$

Therefore, Speed = slope of the graph
Since slope of object B is greater than objects A and C, it is travelling the fastest.

(b) All three objects A, B and C never meet at a single point. Thus, they were never at the same point on road.



On the distance axis:
7 small boxes = 4 km
Therefore,1 small box = 4 / 7 Km
Initially, object C is 4 blocks away from the origin.
Therefore, Initial distance of object C from origin = 16 / 7 Km
Distance of object C from origin when B passes A = 8 km

Distance covered by C

Page No: 113

7. A ball is gently dropped from a height of 20 m. If its velocity increases uniformly at the rate of 10 m s^{-2}, with what velocity will it strike the ground? After what time will it strike the ground?

Answer

Let us assume, the final velocity with which ball will strike the ground be 'v' and time it takes to strike the ground be 't'
Initial Velocity of ball, u =0
Distance or height of fall, s =20 m
Downward acceleration, a =10 m s^{-2}

As we know, $2as = v^2 - u^2$

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

$= 2 \times 10 \times 20 + 0$

$= 400$

∴ Final velocity of ball, $v = 20\ ms^{-1}$

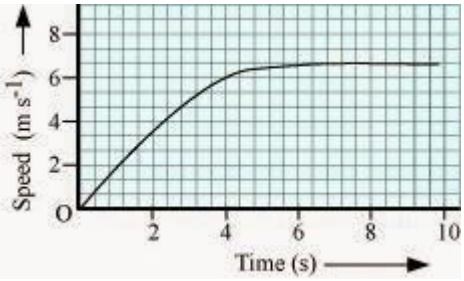
$t = (v-u)/a$

∴Time taken by the ball to strike = (20-0)/10

= 20/10

= 2 seconds

8. The speed-time graph for a car is shown is Fig. 8.12.

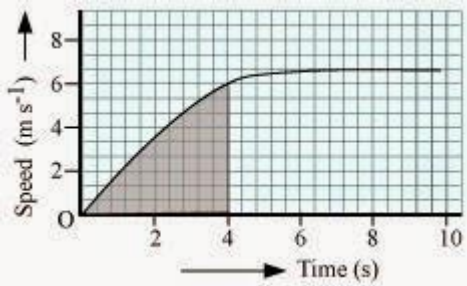


(a) Find out how far the car travels in the first 4 seconds. Shade the area on the graph that represents the distance travelled by the car during the period.

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

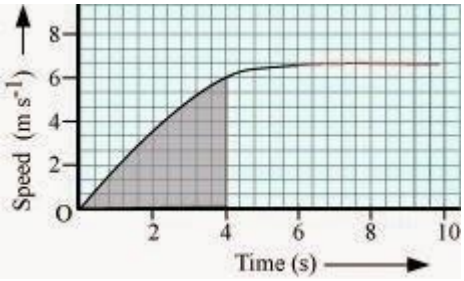
Answer

(a)



The shaded area which is equal to 1 / 2 x 4 x 6 = 12 m represents the distance travelled by the car in the first 4 s.

(b)



The part of the graph in red colour between time 6 s to 10 s represents uniform motion of the car.

10. State which of the following situations are possible and give an example for each of these:
(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

(a) Possible
When a ball is thrown up at maximum height, it has zero velocity, although it will have constant acceleration due to gravity, which is equal to 9.8 m/s2.

(b) Possible
When a car is moving in a circular track, its acceleration is perpendicular to its direction.

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

Answer

Radius of the circular orbit, r= 42250 km

Time taken to revolve around the earth, t= 24 h

Speed of a circular moving object, $v= (2\pi r)/t$

$=[2\times (22/7)\times 42250 \times 1000] / (24 \times 60 \times 60)$

$=(2\times 22\times 42250\times 1000) / (7 \times 24 \times 60 \times 60)$ m s^{-1}

$=3073.74$ m s^{-1}