NCERT Most Important Questions For Class-9 Science Chapter-7 Motion

1.Give an example of a body which may appear to be moving for one person and stationary for the other.

Answer

The passengers in a moving bus observe that the trees, buildings as well as the people on the roadside appear to be moving backwards. Similarly, a person standing on the roadside observes that the bus (along with its passengers) is moving in forward direction. But, at the same time, each passenger in a moving bus or train observes, his fellow passengers sitting and not moving. Thus, we can tell that motion is relative.

2.How can we describe the location of an object?

Answer

To describe the position of an object we need to specify a reference point called the origin. For example, suppose that a library in a city is 2 km north of the railway station. We have specified the position of the library with respect to the railway station i.e., in this case, the railway station acts as the reference point.

3.What do you mean by average speed? What are its units?

Answer

Average speed is defined as the average distance travelled per unit time and is obtained by dividing the total distance travelled by the total time taken. The unit of average speed is the same as that of the speed, that is, ms^{-1}.

4.What is the difference between uniform velocity and non-uniform velocity?

Answer

Uniform velocity: An object with uniform velocity covers equal distances in equal intervals of time in a specified direction, e.g., an object moving with speed of 40km h^{-1} towards west has uniform velocity.
Non-uniform velocity: When an object covers unequal distances in equal intervals of time in a specified direction, or if the direction of motion changes, it is said to be moving with a non-uniform or variable velocity, e.g., revolving fan at a constant speed has variable velocity.

5.Differentiate between distance and displacement.

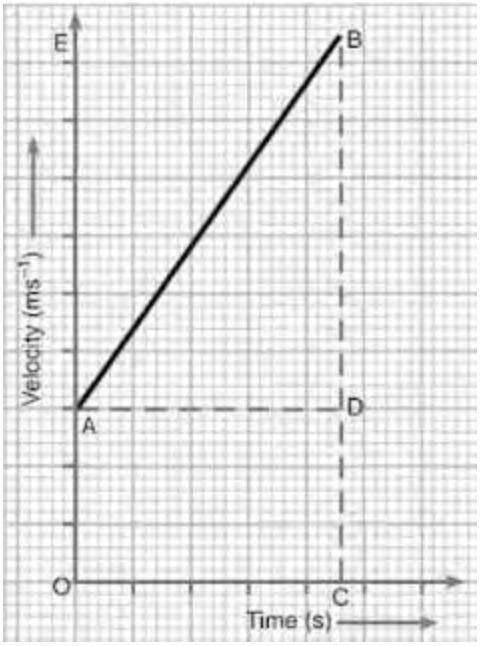
Answer

Distance	Displacement
It is the length of the actual path covered by an object, irrespective of its dirction of motion.	Displacement is the shortest distance between the initial and final positions of an object in a given direction.
Distance is a scalar quantity	Displacement is a vector quantity. Displacement may be positive negative or zero.
Distance between two given points may be same or different for different path chosen.	Displacement between two given points is always the same.
Distance covered can never be negative. It is always positive or zero.	Displacement between two given points is always the same.

6.With the help of a graph, derive the relation v = u + at.

Answer

Consider the velocity-time graph of an object that moves under uniform acceleration as shown in the figure (u≠0).



From this graph, we can see that initial velocity of the object (at point A) is u and then it increases to v (at point B) in time t. The velocity changes at uniform rate a. As shown in the figure, the lines BC and BE are drawn from point B on the time and the velocity axes respectively.

The initial velocity is represented by OA.
The final velocity is represented by BC.
The time interval t is represented by OC.

BD = BC – CD, represents the change in velocity in time interval t.

If we draw AD parallel to OC, we observe that BC = BD + DC = BD + OA

Substituting, BC with v and OA with u, we get

v = BD + u
or, BD = v – u — (i)

Thus, from the given velocity-time graph, the acceleration of the object is given by Change in velocity
a = (Change in velocity)/(Time Taken)= BD/AD= BD/OC
Substituting OC with t, we get
a = BD/t ⇒ BD = at — (ii2)

From equations (1) and (2), we have
v-u = at or v =u + at

7.Suppose a ball is thrown vertically upwards from a position P above the ground. It rises to the highest point Q and returns to the same point P. What is the net displacement and distance travelled by the ball?
Answer
Displacement is zero. Distance is twice the distance between position P and Q.

8.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 × 4 = 40 m
Farmer moves along the boundary in 40s.
Displacement after 2 m 20 s = 2 × 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 m. Now, 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.

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

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

9.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.

10.What does the odometer of an automobile measure?

Answer

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

11. 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

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

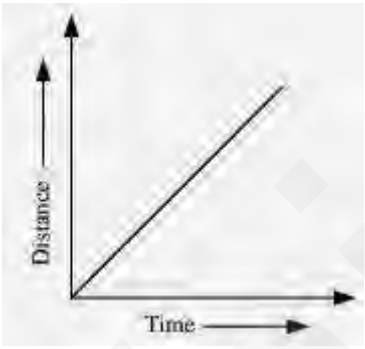
Answer

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.

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

Answer

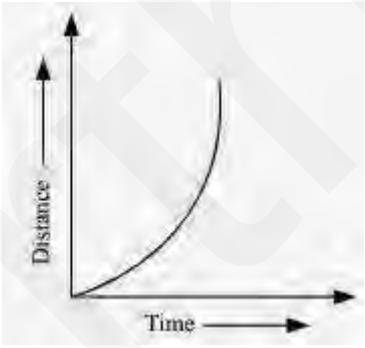
If distance time graph is a straight line parallel to the time axis, the body is at rest.



14.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.

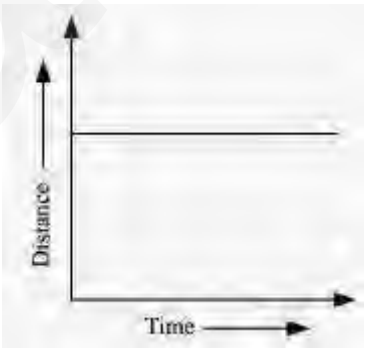
Answer

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.

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

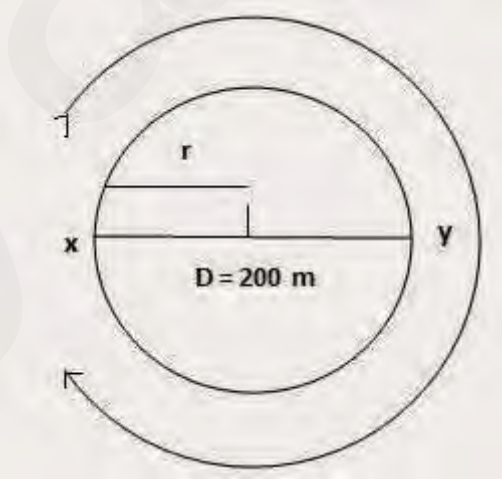
Answer

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

16.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 × (22 / 7) × 100
Speed of the athlete (v) = Distance / Time
= (2 × 2200) / (7 × 40)
= 4400 / 7 × 40
Therefore, **Distance covered in 140 s = Speed (s) × Time(t)**
= 4400 / (7 × 40) × (2 × 60 + 20)
= 4400 / (7 × 40) × 140
= 4400 × 140 /7 × 40
= 2200 m

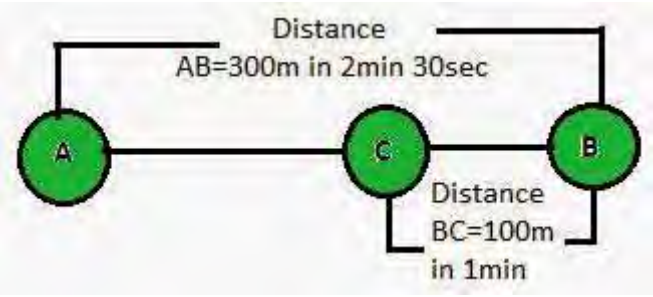
Number of round in 40 s =1 round
Number of round in 140 s =140/40
$=3\ ^{1}/_{2}$
After taking start from position X,the athlete will be at postion Y after $3\ ^{1}/_{2}$ rounds as shown in figure
Hence, **Displacement of the athlete** with respect to initial position at x= xy
= Diameter of circular track
= 200 m



17.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 × 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 × 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}

18.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

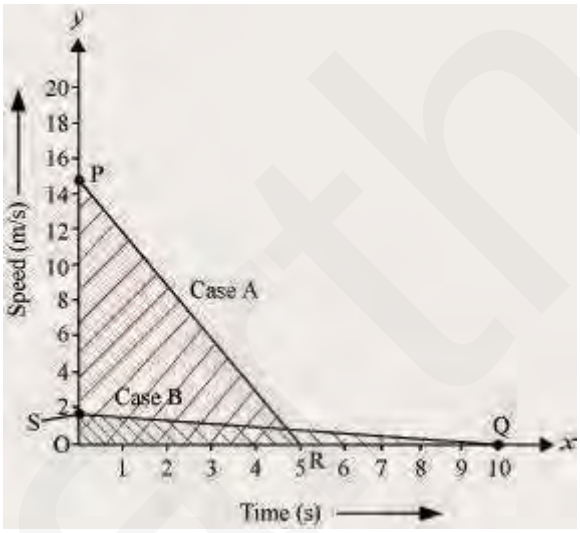
The distance Abdul commutes while driving from Home to School = S
Let us assume time taken by Abdul to commutes this distance = t_1
Distance Abdul commutes while driving from School to Home = S
Let us assume time taken by Abdul to commutes this distance = t_2
Average speed from home to school v_{1av} = 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 Distance/Total Time
= 2S / (S/20 +S/30)
= 2S / [(30S+20S)/600]
= 1200S / 50S
= 24 kmh^{-1}

19.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 △ OPR

= (1/2) × OR × OP

= (1/2) × 5s × 52 kmh^{-1}

= (1/2) × 5 × (52 × 1000) / 3600) m

= (1/2) × 5 × (130 / 9) m

= 325 / 9 m

= 36.11 m

Distance Travelled by second car before coming to rest =Area of △ OSQ

= (1/2) × OQ × OS

= (1/2) × 10 s × 3 kmh^{-1}

= (1/2) × 10 × (3 × 1000) / 3600) m

= (1/2) × 10 x (5/6) m

= 5 × (5/6) m

= 25/6 m

= 4.16 m