Lakhmir Singh Solutions Class 9 Physics Chapter 1 Motion

Question 1:

Is displacement a scalar quantity?

ANSWER:

No, displacement is a vector quantity because it has magnitude as well as direction.

Question 2:

State whether distance is a scalar or a vector quantity.

ANSWER:

Distance is a scalar quantity; it has magnitude but no specific direction.

Question 3:

Change the speed of 6 m/s into km/h.

ANSWER:

We have to convert 6 m/s into km/h. So,
$6\ m/s = \frac{(6)(3600)}{1000} km/h = 21.6\ km/hr$6 m/s=(6)(3600)1000km/h=21.6 km/hr

Question 4:

What name is given to the speed in a specified direction?

ANSWER:

Velocity is the name given to the speed of a body in a particular direction.

Question 5:

Aakash Institute

Give two examples of bodies having non-uniform motion.

ANSWER:

Two examples of non-uniform motion:
(a) Motion of a bus on a curved road
(b) Motion of a bee flying randomly in air.

Question 6:

Name the physical quantity obtained by dividing 'Distance travelled' by 'Time taken' to travel that distance.

ANSWER:

Speed is obtained by dividing 'distance travelled' by 'time taken' to travel that distance.

Question 7:

What do the following measure in a car?

(a) Speedometer
(b) Odometer

ANSWER:

(a) Speedometer of a car is used to measure the instantaneous speed of the car.
(b) Odometer of a car is used to record and measure the overall distance travelled by the car.

Question 21:

What type of motion, uniform or non-uniform, is exhibited by a freely falling body? Give reason for you answer.

ANSWER:

Aakash Institute

A freely falling body exhibits non-uniform motion. Its velocity increases at a constant rate, so it shows uniformly accelerated motion.

Question 22:

State whether speed is a scalar or a vector quantity. Give reason for your choice.

ANSWER:

Speed is a scalar quantity. This is because it has magnitude, but it does not specify direction. It is the distance travelled by a body per unit time.

Question 23:

Bus X travels a distance of 360 km in 5 hours whereas bus Y travels a distance of 476 km in hours. Which bus travels faster?

ANSWER:

We should first consider Bus X.
Distance travelled (d_1) = 360 km
Time taken (d_1) = 5 hr
So, we can calculate the speed as:
$\text{Speed} = \text{Distance Time}$Speed = Distance Time
Thus, the speed of Bus X is 72 km/h.
Similarly,
For Bus Y:
Distance travelled
Time taken (t_2) = 7 hr
So, we can calculate the speed as:
$\text{Speed} = \text{Distance Time}$Speed = Distance Time
Thus, the speed of Bus Y is 68 km/h.
Speed of Bus X is more than that of Bus Y. Hence, Bus X travels faster.

Question 24:

Arrange the following speeds in increasing order (keeping the least speed first):

Akash Institute

(i) An athlete running with a speed of 10 m/s.
(ii) A bicycle moving with a speed of 200 m/min.
(iii) A scooter moving with a speed of 30 km/h.

ANSWER:

We have three different moving bodies. To compare their speeds, we need to express them in similar S.I. units.
(i) An athlete running with a speed of 10 m/s.
(ii) A bicycle moving with a speed of 200 m/min. Converting into S.I. units, the speed will be:
$=\frac{200}{60}=3.33\ m/s$=20060=3.33 m/s
(iii) A scooter moving with a speed of 30 km/h. Converting into S.I. units, the speed will be:
$=\frac{(30)(1000)}{3600}=8.33\ m/s$=(30)(1000)3600=8.33 m/s
On arranging the speeds in ascending order, we get:
(ii) < (iii) < (i)

Question 25:

(a) Write the formula for acceleration. Give the meaning of each symbol which occurs in it.
(b) A train starting from Railway Station attains a speed of 21 m/s in one minute. Find its acceleration.

ANSWER:

(a) Acceleration is the change in velocity per unit time; it is a vector quantity.
$\text{Acceleration}=\frac{\text{Change in velocity}}{\text{Time taken}}$Acceleration=Change in velocityTime taken
The above expression can also be written as:
$a=\frac{v-u}{t}$a=v-ut
Where,
a = Acceleration
v = Final velocity
u = Initial velocity
t = Time taken

(b) We will find the value of uniform acceleration.
Initial velocity (*u*) 0 m/s
Final velocity (*v*) = 21 m/s
Time taken (*t*) = 60 s
Acceleration:
$a=\frac{v-u}{t}$a=v-ut
Putting the values in the above equation, we get:
$a=\frac{21-0}{60}=0.35\ m/s^2$ a=21-060=0.35 m/s2

Aakash Institute

Question 26:

(a) What term is used to denote the change of velocity with time?
(b) Give one word which means the same as 'moving with a negative acceleration'.
(c) The displacement of a moving object in a given interval of time is zero. Would the distance travelled by the object also be zero? Give reason for your answer.

ANSWER:

(a) Acceleration is used to denote the change in velocity with time.
(b) Retardation is the same as ‘moving with a negative acceleration'.
(c) Displacement is a vector quantity, so it can be zero for two reasons:
1. When the body doesn't move at all: In this case, the distance travelled will also be zero.
2. When the body comes back to its initial position: In this case, the distance travelled is non-zero, but the displacement is zero.

Question 27:

A snail covers a distance of 100 metres in 50 hours. Calculate the average speed of snail in km/h.

Figure

ANSWER:

Distance (d) = 1000 m = 0.1 km
Time (t) = 50 hr
So, we can calculate the speed as:
Average speed=Total distance travelledTimeAverage speed=Total distance travelledTime
Average speed for the entire journey:
=0.150=0.002 km/hr=0.150=0.002 km/hr

Question 8:

Name the physical quantity which gives us an idea of how slow or fast a body is moving.

ANSWER:

Speed is the physical quantity that gives the idea of how slow or fast a body is moving.

Aakash Institute

Question 9:

Under what conditions can a body travel a certain distance and yet its resultant displacement be zero?

ANSWER:

When the body comes back to its starting point, its resultant displacement is zero. It is because it has covered a certain distance in due course of time; however, there is no difference between the initial and final positions.

Question 10:

In addition to speed, what else should we know to predict the position of a moving body?

ANSWER:

Besides speed, we should know the direction to predict the position of a moving body.

Question 11:

When is a body said to have uniform velocity?

ANSWER:

When a body covers equal distances in equal intervals of time in a particular direction, it is said to have uniform velocity.

Question 12:

Under which condition is the magnitude of average velocity equal to average speed?

ANSWER:

The magnitude of average velocity is equal to average speed when an object covers equal distances in equal intervals of time in a particular direction.

Aakash Institute

Question 13:

Which of the two can be zero under certain conditions : average speed of a moving body or average velocity of a moving body?

ANSWER:

Average velocity of a moving body can be zero. This is because the net displacement for a given time interval can be zero.

Question 14:

Give one example of a situation in which a body has a certain average speed but its average velocity is zero.

ANSWER:

Motion of a boy from his home to shop and back to home is an example of a situation in which a body has a certain average speed but its average velocity is zero.

Question 15:

What is the acceleration of a body moving with uniform velocity?

ANSWER:

The acceleration of a body moving with uniform velocity is zero.

Question 16:

What is the other name of negative acceleration?

ANSWER:

Retardation is the other name for negative acceleration.

Question 17:

Aakash Institute

Name the physical quantity whose SI unit is :

(a) m/s
(b) m/s^2

ANSWER:

(a) Speed or velocity is expressed in m/s.
(b) Acceleration or retardation is expressed in m/s^2.

Question 18:

What type of motion is exhibited by a freely falling body?

ANSWER:

A freely falling body exhibits uniform accelerated motion.

Question 19:

What is the SI unit of retardation?

ANSWER:

The S.I. unit of retardation is m/s^2.

Question 20:

(a) Displacement is a _____ quantity, whereas distance is a _____ quantity.
(b) The physical quantity that includes both the speed and direction of the motion of a body is called its _____.
(c) A motorcycle has a steady _____ of 3 m/s^2. This means that each _____ its _____ increases by _____.
(d) Velocity is the rate of change of _____. It is measured in _____.
(e) Acceleration is the rate of change of _____. It is measured in _____.

ANSWER:

(a) Displacement is a vector quantity, whereas distance is a scalar quantity.
(b) The physical quantity that includes both the speed and direction of the motion of a body

Aakash Institute

is called its velocity.
(c) A motorcycle has a steady acceleration of 3 m/s^2. This means that each second its velocity increases by 3 m/s.
(d) Velocity is the rate of change of displacement. It is measured in m/s.
(e) Acceleration is the rate of change of velocity. It is measured in m/s^2.

Question 28:

A tortoise moves a distance of 100 metres in 15 minutes. What is the average speed of tortoise in km/h?

ANSWER:

Distance (*d*) = 0.1 km
Time (t) $=\frac{1}{560}$hr $=0.25$ hrTime (t) =1560hr =0.25 hr
So, we can calculate the speed as:
Average speed = Total distance travelledTimeAverage speed = Total distance travelledTime
Average speed for the entire journey:
$=\frac{0.1}{0.25}=0.4$ km/hr=0.10.25=0.4 km/hr

Question 29:

If a sprinter runs a distance of 100 metres in 9.83 seconds, calculate his average speed in km/h.

ANSWER:

Distance (*d*) = 100 m
Time (*t*) = 9.83 s
So, we can calculate the speed as:
Average speed =Total distance travelledTimeAverage speed =Total distance travelledTime
Average speed for the entire journey:
$=\frac{100}{9.83}=10.173$ m/s=1009.83=10.173 m/s
Now, we can convert it in km/h as:
$=\frac{(10.173)(3600)}{1000}=36.62$ km/hr=(10.173)(3600)1000=36.62 km/hr

Aakash Institute

Question 30:

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

ANSWER:

We have to find the average velocity of the entire journey. For this, we have the following information:
Speed from A to B = (v_1) = 30 m/s
Let the distance from A to B be (d).
Also, let the time taken to travel from A to B be (t_1).
$\text{Time} = \frac{\text{Distance travelled}}{\text{Speed}}$Time =Distance travelledSpeed
We have:
$t_1 = \frac{d}{30}$t1=d30
Speed from B to A (v_2) = 20 m/s
Let the time taken to travel from B to A be(t_2).
Thus, we have:
$t_2 = \frac{d}{20}$Total time of journey:=$t_1 + t_2 = \frac{d}{30} + \frac{d}{20} = \frac{d}{12}$t2=d20Total time of journey:=t1+t2=d30+d20=d12
Total distance travelled is 2d.
Therefore,
$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Time}}$Average speed=Total distance travelledTime
On putting the values to obtain the average speed of the motorcyclist, we get:
$= \frac{(2d)}{12d} = 24 \text{ km/hr}$=(2d)12d=24 km/hr

Question 31:

A motorcyclist starts from rest and reaches a speed of 6 m/s after travelling with uniform acceleration for 3 s. What is his acceleration?

ANSWER:

We have to find the value of uniform acceleration.
Initial velocity (u) = 0 m/s
Final velocity (v) = 6 m/s
Time taken (t) = 3s
Acceleration:
$a = \frac{v - u}{t}$a=v-ut

Aakash Institute

Put the values in the above equation to obtain the value of acceleration.
$a = \frac{6-0}{3} = 2\ m/s^2$a=6-03=2 m/s2

Question 32:

An aircraft travelling at 600 km/h accelerates steadily at 10 km/h per second. Taking the speed of sound as 1100 km/h at the aircraft's altitude, how long will it take to reach the 'sound barrier'?

ANSWER:

Final velocity, v = 1100 km/h = 1100 × 5/18 = 305.55 m/s
Initial velocity, u = 600 km/h = 600 × 5/18 = 166.66 m/s
Acceleration = 10 km/h per second = 10 × 5/18 = 2.77 m/s^2
Time taken by body,
v = u + at
t = (v - u)/a
t = (305.55 -166.66)/2.77
t = 50.14 sec
$t \simeq 50$ sec

Question 33:

If a bus travelling at 20 m/s is subjected to a steady deceleration of 5 m/s^2, how long will it take to come to rest?

ANSWER:

We have to find the time taken to reach the given final velocity.
We have:
Initial velocity (*u*) = 20 m/s
Final velocity (*v*) = 0 m/s
Acceleration for the entire journey (*a*) = –5 ms^2.
Let the time taken be (*t*).
We can calculate the time taken using the first equation of motion.
$t = \frac{v-u}{a}$t=v-ua
Time taken by the bus to come to rest:
$= \frac{0-20}{-5} = 4\ s$=0-20-5=4 s

Aakash Institute

Question 34:

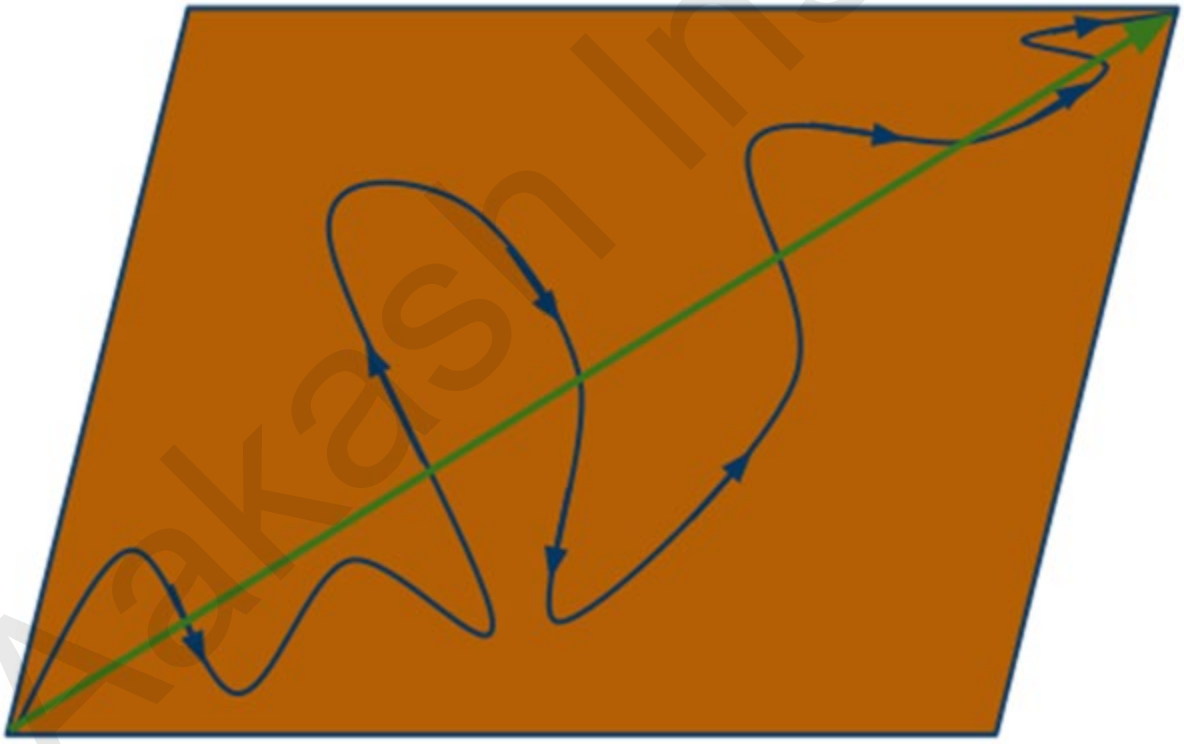
(a) What is the difference between 'distance travelled' by a body and its 'displacement'? Explain with the help of diagram.
(b) An ant travels a distance of 8 cm from P to Q and then moves a distance of 6 cm at right angles to PQ. Find its resultant displacement.

ANSWER:

(a)

Distance		Displacement	
1.	Distance has only magnitude, with no specified direction.	1.	Displacement has magnitude as well as direction.
2.	It is a scalar quantity.	2.	It is a vector quantity.
3.	Two different distances can be added directly.	3.	We have to follow the vector addition method to add displacements.

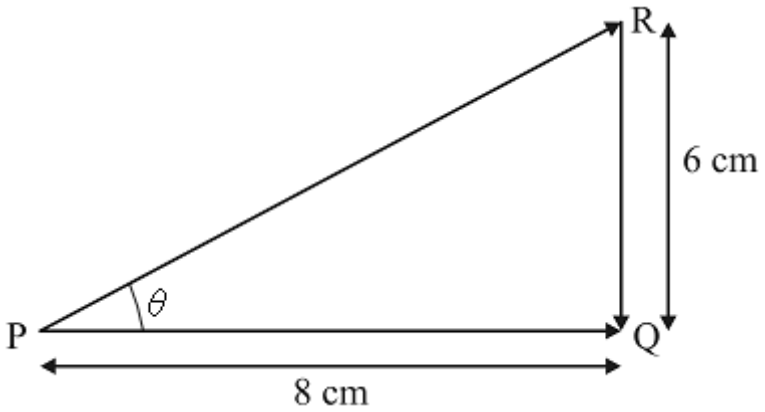
One difference in diagrammatic form is as follows:



Here the curved line is the distance traveled and the straight line is the magnitude of the displacement.

(b) We have to find the resultant displacement from the given diagram:

Akash Institute



We have:
PQ = 8 cm and *QR* = 6 cm
Resultant displacement:
PR = PQ^2+QR^2−−−−−−−−−−−√=64+36−−−−−−−√=100−−−√=10 cmPR = PQ2+QR2=64+36=100=10 cm
The direction of this displacement is from P to R. If θ is the angle made by PR with PQ then,'

This is the angle made by the resultant with PQ.

Question 35:

Define motion. What do you understand by the terms 'uniform motion' and 'non-uniform motion'? Explain with examples.

ANSWER:

A body is said to be in motion when its position changes continuously with respect to a stationary point taken as the reference point.

Uniform motion: A body is said to be in uniform motion if it travels equal distances in equal intervals of time in a particular direction, no matter how small these time intervals are.
For example, a car running at a constant speed of 10 m/s towards east will cover the equal distance of 10 m every second towards east, so its motion will be uniform.

Non-uniform motion: A body is said to be in non-uniform motion if it travels unequal distances in equal intervals of time.
For example, motion of a freely falling ball from the roof of a tall building.

Aakash Institute

Question 36:

(a) Define speed. What is the SI unit of speed?
(b) What is meant by (i) average speed, and (ii) uniform speed?

ANSWER:

(a) Speed of a body is the distance travelled by it per unit time. The S.I. unit of speed is m/s.
(b) (i) Average speed of a body is the total distance travelled by it divided by the total time taken by it to cover the given distance.

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

Average speed =Total distance travel ledTotal time taken

(ii) A body has a uniform speed if it travels equal distance in equal intervals of time, no matter how small these time intervals are.

Question 37:

(a) Define velocity. What is the SI unit of velocity?
(b) What is the difference between speed and velocity?
(c) Convert a speed of 54 km/h into m/s.

ANSWER:

(a) Velocity of a body is the distance travelled by it per unit time in a given direction. The S.I. unit of velocity is m/s. It is a vector quantity.

(b) (i) Speed is a scalar quantity, whereas velocity is a vector quantity.
(ii) Speed of a body is the distance travelled by it per unit time, whereas the velocity of a body is the distance travelled by it per unit time in a given direction.
(iii) Speed is always positive, while velocity can be both positive and negative, depending upon the direction.

(c) We have to convert 54 km/h into m/s.

$$54 \text{ km/hr} = \frac{(54)(1000)}{3600} \text{m/s} = 15 \text{ m/s}$$

54 km/hr=(54)(1000)3600m/s =15 m/s54 km/hr=(54)(1000)3600m/s = 15 m/s

Question 38:

Aakash Institute

(a) What is meant by the term 'acceleration'? State the SI unit of acceleration.
(b) Define the term 'uniform acceleration'. Give one example of a uniformly accelerated motion.

ANSWER:

(a) Acceleration of a body is defined as the rate of change of its velocity with respect to time. It is a vector quantity. The S.I. unit of acceleration is (m/s^2) .
(b) A body has uniform acceleration if it travels in a straight line and its velocity increases by equal amounts in equal intervals of time.
For example, a freely falling body has uniform acceleration.

Question 39:

The distance between Delhi and Agra is 200 km. A train travels the first 100 km at a speed of 50 km/h. How fast must the train travel the next 100 km, so as to average 70 km/h for the whole journey?

ANSWER:

We have the following data to find the speed for the second part of the journey:
Total distance to be travelled by train (D) = 200 km
Average speed required (v_{avg}) = 70 km/hr
Time required for the entire journey (T):
$\text{Time}=\text{Total distance}\text{Average speed} \quad =\frac{200}{70}\text{hr} \quad T=\frac{20}{7}\text{hr}$Time=Total distanceAverage speed =20070hr T=207hr
For the first part of the trip:
Distance covered (d_1) = 100 km
Speed for this part of journey (v_1) = 50 km/hr
Time taken for the first part of journey:
$\text{Time} =\text{Distance travelled}\text{Speed}\text{So},t_1=\frac{100}{50}\text{hr}= 2 \text{ hr}$Time =Distance travelledSpeedSo,t1=10050hr= 2 hr
For the second part of the trip,
Distance covered (d_2) = 100 km
Time taken for the second part of journey:
$t_2=T-t_1 \quad =(\frac{20}{7}-2)\text{hr} \quad =\frac{6}{7}\text{hr}$t2=T-t1 =207-2hr =67hr
Speed of the train for the second part of the journey:
$=\frac{\text{distance travelled}}{\text{Time}}=\frac{(100)(7)}{6}=116.67 \text{ km/hr}$=distance travelledTime=(100)(7)6=116.67 km/hr

Akash Institute

Question 40:

A train travels the first 15 km at a uniform speed of 30 km/h; the next 75 km at a uniform speed of 50 km/h; and the last 10 km at a uniform speed of 20 km/h. Calculate the average speed for the entire train journey.

ANSWER:

(i) In the first case, the train travels at a speed of 30 km/h for a distance of 15 km.
We can find the time as:
$\text{Time}=\frac{\text{Distance travelled}}{\text{Speed}}\text{So},t_1=\frac{15}{30}\text{hr} \quad =0.5 \text{ hr}$Time=Distance travelledSpeedSo,t1=1530hr =0.5 hr

(ii) In the second case, the train travels at a speed of 50 km/h for a distance of 75 km.
We can find the time as:
$\text{Time}=\frac{\text{Distance travelled}}{\text{Speed}}\text{So},t_2=\frac{75}{50}\text{hr} \quad =1.5 \text{ hr}$Time=Distance travelledSpeedSo,t2=7550hr =1.5 hr

(iii) In the third case, the train travels at a speed of 20 km/h for a distance of 10 km.
We can find the time as:
$\text{Time}=\frac{\text{Distance travelled}}{\text{Speed}}\text{So},t3=\frac{10}{20}\text{hr} \quad =0.5 \text{ hr}$Time=Distance travelledSpeedSo,t3=1020hr =0.5 hr

Total distance covered:
= (15 + 75 + 10) km
= 100 km
Total time taken = (0.5 + 1.5 + 0.5) km
= 2.5
Therefore, $\text{Average speed}=\frac{\text{Total distance travelled}}{\text{Time}}$Average speed=Total distance travelledTime
Now, put the values to get the average speed.
$=\frac{100}{2.5}=40 \text{ km/hr}$=1002.5=40 km/hr

Question 41:

A car is moving along a straight road at a steady speed. It travels 150 m in 5 seconds:

(a) What is its average speed?
(b) How far does it travel in 1 second?
(c) How far does it travel in 6 seconds?
(d) How long does it take to travel 240 m?

Aakash Institute

ANSWER:

(a) We have:
Distance (d) = 150 m
Time (t) = 5s
So, we can calculate average the speed as:
$\text{Average speed} = \text{Total distance travelled} \text{Time}$Average speed=Total distance travelledTime
Average speed for the entire journey:
$= \frac{150}{5} = 30 \text{ m/s}$=1505=30 m/s

(b) We have to calculate the distance travelled in 1s.
Distance = (Speed) (Time)
Distance travelled in one second:
=(30) (1) m
$= 30 \text{ m}$=30 m

(c) We have to calculate the distance travelled in 6 s.
Distance = (Speed) (Time)
Distance travelled in one second:
= (30) (6) m
$= 180 \text{ m}$=180 m

(d) We have:
Distance (d) = 240 m
Speed (v) = 30 m/s
We can find the time as:
$\text{Time} = \text{Distance travelled} \text{Speed} \text{So}, t = \frac{240}{30} \text{s} = 8 \text{s}$Time=Distance travelledSpeedSo,t=24030s=8s

Question 42:

A particle is moving in a circular path of radius r. The displacement after half a circle would be:

(a) 0
(b) πr
(c) $2r$
(d) $2\pi r$

ANSWER:

Aakash Institute

(c) Displacement is the difference between the final and initial position of a body. It is a vector quantity and is independent of the path taken. So, for the movement of half of a circle, the displacement is 2*r*, where *r* is the radius of the circular path.

Question 43:

The numerical ratio of displacement to distance for a moving object is :

(a) always less than 1
(b) equal to 1 or more than 1
(c) always more than 1
(d) equal to 1 or less than 1

ANSWER:

(d), i.e., Equal to 1 or less than 1.
Displacement is always smaller than or equal to displacement.

Question 44:

A boy is sitting on a merry-go-round which is moving with a constant speed of 10 m s^{-1}. This means that the boy is :

(a) at rest
(b) moving with no acceleration
(c) in accelerated motion
(d) moving with uniform velocity

ANSWER:

(c) Acceleration is the rate of change of velocity, and the velocity of the merry-go-round is changing with respect to time. Thus, it will move in an accelerated motion.

Question 45:

In which of the following cases of motion, the distance moved and the magnitude of displacement are equal?

Aakash Institute

(a) if the car is moving on straight road
(b) if the car is moving on circular road
(c) if the pendulum is moving to and fro
(d) if a planet is moving around the sun

ANSWER:

(a) The magnitude of displacement is equal to the distance travelled by a body when it travels in a straight line.

Question 46:

The speed of a moving object is determined to be 0.06 m/s. This speed is equal to :

(a) 2.16 km/h
(b) 1.08 km/h
(c) 0.216 km/h
(d) 0.0216 km/h

ANSWER:

(c) We can convert 0.06 m/s as:
$=0.06\ (3600)1000 \text{km/hr} = 0.216\ \text{km/hr} = 0.06\ (3600)1000 \text{km/hr} = 0.216\ \text{km/hr}$
So, the answer is 0.216 km/h.

Question 47:

A freely falling object travels 4.9 m in 1st second, 14.7 m in 2 nd second, 24.5 m in 3rd second, and so on. This data shows that the motion of a freely falling object is a case of :

(a) uniform motion
(b) uniform acceleration
(c) no acceleration
(d) uniform velocity

ANSWER:

Aakash Institute

(b) The displacement of the body in equal interval of time is unequal, but acceleration is constant. The acceleration will thus be uniform, so the answer is (b).

Question 48:

When a car runs on a circular track with a uniform speed, its velocity is said to be changing. This is because :

(a) the car has a uniform acceleration
(b) the direction of car varies continuously
(c) the car travels unequal time intervals.
(d) the car travels equal distances in unequal time intervals

ANSWER:

(d) When a car runs on a circular track, its velocity changes continuously, as its direction keeps changing.

Question 49:

Which of the following statement is correct regarding velocity and speed of a moving body?

(a) velocity of a moving body is always higher than its speed
(b) speed of a moving body is always higher than its velocity
(c) speed of a moving body is its velocity in a given direction
(d) velocity of a moving body is its speed in a given direction

ANSWER:

(d) Velocity is a vector quantity having a magnitude and a specific direction. So, velocity is nothing but speed in a particular direction.

Question 50:

Which of the following can sometimes be 'zero' for a moving body?

(i) average velocity
(a) only (i)

Aakash Institute

(ii) distance travelled
(b) (i) and (ii)

(iii) average speed
(c) (i) and (iv)

(iv) displacement
(d) only (iv)

ANSWER:

(c) Distance is the length of the actual path covered by a moving body. This implies that the distance travelled by a moving body and also its average speed can never be zero at any point of time. However, it is possible for the displacement as well as average velocity for the body to be zero at an instance during the motion of the particle.

Question 51:

When a car driver travelling at a speed of 10 m/s applies brakes and brings the car to rest in 20 s, then retardation will be:

(a) + 2 m/s^2
(b) − 2 m/s^2
(c) − 0.5 m/s^2
(d) + 0.5 m/s^2

ANSWER:

(d) The term “retardation” means negative acceleration.
Initial velocity = 10 m/s
Final velocity = 0 m/s
Time taken = 20 s
$\text{Acceleration} = \frac{0-10}{20} \Rightarrow \text{Acceleration} = -0.5\ m/s^2 \Rightarrow \text{Retardation} = 0.5\ m/s^2$Acceleration =0-1020⇒Acceleration =-0.5 m/s2⇒Retardation =0.5 m/s2

Question 52:

Which of the following could not be a unit of speed?

Akash Institute

(a) km/h
(b) s/m
(c) m/s
(d) mm s^{-1}

ANSWER:

(b) Speed is the distance travelled by a moving body per unit time.

Question 53:

One of the following is not a vector quantity. This one is :

(a) displacement
(b) speed
(c) acceleration
(d) velocity

ANSWER:

(b) Vector quantities have magnitude as well as direction, and they obey the laws of vector addition.

Question 54:

Which of the following could not be a unit of acceleration?

(a) km/s^2
(b) cm s^{-2}
(c) km/s
(d) m/s^2

ANSWER:

(c) Acceleration is defined as the rate of change of velocity.

Question 55:

Aakash Institute

A body is moving along a circular path of radius R. What will be the distance travelled and displacement of the body when it completes half a revolution?

ANSWER:

We have to analyse the distance and displacement of a body that has covered half the perimeter of a circle.
Distance travelled in half a rotation of a circular path is equal to the circumference of semi-circle.
Distance travelled = πR
Displacement is calculated from the initial and final positions of a body. It is independent of the path covered. So, displacement is the diameter of the semi-circle.
Hence, displacement is $2R$, where R is the radius of the circular path.

Question 56:

If on a round trip you travel 6 km and then arrive back home :

(a) What distance have you travelled?
(b) What is your final displacement?

ANSWER:

(a) Distance travelled is the actual path covered.
Total distance covered in this case due to going and coming back:
$2d$ = 6 km
d is the distance of one-side journey.

(b) Displacement is calculated from the initial and final positions of a body. It is independent of the path covered. So, displacement in this case is 0 because the initial and final positions are the same.

Question 57:

A body travels a distance of 3 km towards East, then 4 km towards North and finally 9 km towards East.
(i) What is the total distance travelled?
(ii) What is the resultant displacement?

ANSWER:

Aakash Institute

1-22-57
(i) Distance travelled is the actual path covered.
Total distance travelled:
= (3 + 4 + 9) km
= 16 km

(ii) The body travels a total distance of 12 km east, which means towards the x-axis, on a Cartesian plane. It travels a distance of 4 km in north direction, which means towards *y*-axis.
Resultant displacement:
12^2+4^2−−−−−−−−√=144+16−−−−−−−−√=160−−−√=12.65 km 122+42=144+16=160= 12.65 km

Question 58:

A boy walks from his classroom to the bookshop along a straight corridor towards North. He covers a distance of 20 m in 25 seconds to reach the bookshop. After buying a book, he travels the same distance in the same time to reach back in the classroom. Find (a) average speed, and (b) average velocity, of the boy.

ANSWER:

(a) Distance travelled is the length of the actual path covered.
Total distance covered in going and coming back:
= (20 + 20) m
= 40 m
Total time taken, = (25 + 25) s
= 50 s
So, we can calculate average speed as:
Average speed=Total distance travelled TimeAverage speed=Total distance travelled Time
Average speed for the entire journey:
=4050=0.8 m/s=4050=0.8 m/s

(b) Average velocity is zero, as displacement is zero because the boy arrives at the initial point.

Question 59:

Aakash Institute

A car travels 100 km at a speed of 60 km/h and returns with a speed of 40 km/h. Calculate the average speed for the whole journey.

ANSWER:

In the first case, the car travels at a speed of 60 km/h for a distance of 100 km.
Thus,
$\text{Time}=\frac{\text{Distance travelled}}{\text{Speed}}$So, $t_1=\frac{100}{60}$hr $=\frac{5}{3}$hrTime=Distance travelledSpeedSo, t1=1 0060hr =53hr

In the second case, the car travels at a speed of 40 km/h for a distance of 100 km.
Thus,
$\text{Time}=\frac{\text{Distance travelled}}{\text{Speed}}$So, $t_2=\frac{100}{40}$hr $=\frac{5}{2}$hrTime=Distance travelledSpeedSo, t2=1 0040hr =52hr

Total time taken:
$=t_1+t_2=\frac{5}{3}+\frac{5}{2}hr=\frac{25}{6}$hr=t1+t2=53+52hr=256hr

Total distance travelled = 200 km
We can calculate average speed as:
$\text{Average speed}=\frac{\text{Total distance travelled}}{\text{Time}}$Average speed=Total distance travelledTime
Average speed for the entire journey:
$=\frac{(200)}{(6)25}=48$ km/hr=(200) (6)25=48 km/hr

Question 60:

A ball hits a wall horizontally at 6.0 m s^{-1}. It rebounds horizontally at 4.4 m s^{-1}. The ball is in contact with the wall for 0.040 s. What is the acceleration of the ball?

ANSWER:

We have to find the value of uniform acceleration.
We have:
Initial velocity (u) = 6 m/s
Final velocity is in opposite direction to that of initial velocity (v) = –4.4 m/s
Time taken (t) = 0.04 s
Acceleration:
$a=\frac{v-u}{t}$a=v-ut
Put the values in the above equation to get the value of acceleration.
$a=\frac{-4.4-60.04}{} =\frac{10.40.04}{} =-260$ m/s2a=-4.4-60.04 =10.40.04 =-260 m/s2

Aakash Institute

Question 1:

(a) What remains constant in uniform circular motion?
(b) What changes continuously in uniform circular motion?

ANSWER:

(a) Speed remains constant in uniform circular motion.
(b) Direction of motion changes continuously in uniform circular motion.

Question 2:

State whether the following statement is true or false :
Earth moves round the sun with uniform velocity.

ANSWER:

The statement “Earth moves around the sun in uniform velocity” is false as the direction of motion while travelling in a circular path is always changing and velocity being a vector quantity also changes.

Question 3:

A body goes round the sun with constant speed in a circular orbit. Is the motion uniform or accelerated?

ANSWER:

The motion is accelerated one. Here the direction of motion of the body changes every instant.

Question 4:

Aakash Institute

What conclusion can you draw about the velocity of a body from the displacement-time graph shown below:

Figure

ANSWER:

It represents uniform velocity. In this type of motion, body covers equal distance in equal interval of time in a specific direction.

Question 5:

Name the quantity which is measured by the area occupied under the velocity-time graph.

ANSWER:

Displacement is the quantity which is measured by the area occupied under the velocity-time graph.

Question 6:

What does the slope of a speed-time graph indicate?

ANSWER:

The slope of a speed-time graph indicates acceleration.

Question 7:

What does the slope of a distance-time graph indicate?

ANSWER:

The slope of a distance-time graph indicates speed.

Question 8:

Aakash Institute

Give one example of a motion where an object does not change its speed but its direction of motion changes continuously.

ANSWER:

The motion of an artificial satellite around the earth is an example of a motion (uniform circular motion) where an object does not change its speed but its direction of motion changes continuously.

Question 9:

Name the type of motion in which a body has a constant speed but not constant velocity.

ANSWER:

Uniform circular motion is the type of motion in which a body has a constant speed but not constant velocity.

Question 10:

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

ANSWER:

If the speed-time graph is a straight line parallel to the time axis then the body is moving with a constant speed.

Question 11:

What conclusion can you draw about the speed of a body from the following distance-time graph?

Figure

ANSWER:

Aakash Institute

The body has a uniform speed because the body covers equal distance in equal interval of time.

Question 12:

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

ANSWER:

The body is not moving because it is not changing its position with respect to any stationary object.

Question 13:

What conclusion can you draw about the acceleration of a body from the speed-time graph shown below?

Figure

ANSWER:

It represents non-uniform acceleration. In this kind of motion, speed doesn't vary linearly with time.

Question 14:

A satellite goes round the earth in a circular orbit with constant speed. Is the motion uniform or accelerated?

Figure

ANSWER:

It is an example of accelerated motion, as direction of motion is changing continuously.

Question 15:

Aakash Institute

What type of motion is represented by the tip of the 'seconds' hand' of a watch? Is it uniform or accelerated?

ANSWER:

'Seconds' hand 'of a watch represents uniform circular motion because the speed of the second-hand is always constant and its tip covers a circular path.

Question 16:

Fill in the following blanks with suitable words :
(a) If a body moves with uniform velocity, its acceleration is _____.
(b) The slope of a distance-time graph indicates _____ of a moving object.
(c) The slope of a speed-time graph of a moving body gives its _____.
(d) In a speed-time graph, the area enclosed by the speed-time curve and the time axis gives the_____ by the body.
(e) It is possible for something to accelerate but not change its speed if it moves in a _____.

ANSWER:

(a) If a body moves with uniform velocity, its acceleration is zero.
(b) The slope of a distance-time graph indicates speed of a moving object.
(c) The slope of a speed-time graph of a moving body gives its acceleration.
(d) In a speed-time graph, the area enclosed by the speed-time curve and the time axis gives the distance traveled by the body.
(e) It is possible for something to accelerate but not change its speed if it moves in a circular path.

Question 17:

Is the uniform circular motion accelerated? Give reasons for your answer.

ANSWER:

Yes, the uniform circular motion is accelerated because the velocity changes due to continuous change in the direction.

Aakash Institute

Question 18:

Write the formula to calculate the speed of a body moving along a circular path. Give the meaning of each symbol which occurs in it.

ANSWER:

The speed of a body moving along a circular path is given by the formula:
$v = 2\pi r T$ v=2πrT
Where,
(v) - Speed of the object in circular path.
(π) - It is a constant having value close to 3.14
(r) - Radius of circular path
(T) - Time taken for one round of circular path.

Question 19:

Explain why, the motion of a body which is moving with constant speed in a circular path is said to be accelerated.

ANSWER:

The motion of a body is said to be an accelerated one if the velocity of the body changes with time. In uniform circular motion the magnitude of velocity remains constant but the direction of motion changes at every instant. So, the motion is an accelerated one.

Question 20:

What is the difference between uniform linear motion and uniform circular motion? Explain with examples.

ANSWER:

In uniform linear motion, the speed and direction of motion is fixed and so, it is not accelerated. Example- A car running on a straight road.
In uniform circular motion, the speed is constant but the direction of motion changes continuously and hence, it is accelerated.
Example- Motion of earth around the sun.

Aakash Institute

Question 21:

State an important characteristics of uniform circular motion. Name the force which brings about uniform circular motion.

ANSWER:

An important characteristic of uniform circular motion is that the speed remains constant while the direction of motion changes continuously with time, so it is accelerated. Centripetal force brings about uniform circular motion. This force is always directed towards the center of the circular path and it is along the radius of the circular path.

Question 22:

Find the initial velocity of a car which is stopped in 10 seconds by applying brakes. The retardation due to brakes is 2.5 m/s^2.

ANSWER:

We have to find the initial velocity.
Final velocity as the car stops after some time, (v) = 0 m/s
Acceleration for the entire journey, (a) = –2.5 m/s^2
Time taken is (t) = 10 s
Let the initial velocity be (u)
We can calculate initial velocity using 1st equation of motion as, $u = v - at$
So initial velocity,
$u = 0 - (-2.5)(10)$
$\Rightarrow u = 25$ m/s

Question 23:

Describe the motion of a body which is accelerating at a constant rate of 10 $m\ s^{-2}$. If the body starts from rest, how much distance will it cover in 2 s?

ANSWER:

We have to find the distance travelled by the body. We have the following information given,
So, Initial velocity, (u) = 0 m/s
Acceleration, (a) = 10 m/s^2

Aakash Institute

Time taken, (t) = 2 s
We can calculate the distance travelled by using the 2nd equation of motion,
$s=ut+\frac{1}{2}at^2$s=ut+12at2
Put the values in above equation to find the distance travelled by the body,
$(s) = 0(2)+\frac{1}{2}(10)(2)^2 \quad =20$ m(s) = 0(2)+12(10)(2)2 =20 m

Question 24:

A motorcycle moving with a speed of 5 m/s is subjected to an acceleration of 0.2 m/s^2. Calculate the speed of the motorcycle after 10 seconds, an the distance travelled in this time.

ANSWER:

We have to find the distance travelled and final velocity of the body. We have the following information given,
Initial velocity, (u) = 5 m/s
Acceleration, (a) = 0.2 m/s^2
Time taken, (t) = 10 s
So, we can find the final velocity using the relation,
$v = u + at$
So, final velocity,
v = 5 + (0.2)(10)
= 7 m/s
We can calculate the distance travelled by using the 2nd equation of motion,
$s=ut+\frac{1}{2}at^2$s=ut+12at2
Put the values in above equation to find the distance travelled by the motorcycle,
$(s)=5(10)+\frac{1}{2}(0.2)(10)^2 \quad =(50 + 10)$ m =60 m(s)=5(10)+12(0.2)(10)2 =(50 + 10) m
=60 m

Question 25:

A bus running at a speed of 18 km/h is stopped in 2.5 seconds by applying brakes. Calculate the retardation produced.

ANSWER:

We have to find the value of retardation. So,
Initial velocity,
$(u)=18$ km/hr $=\frac{18(1000)}{3600}$m/s =5 m/su=18 km/hr =18(1000)3600m/s =5 m/

Aakash Institute

s
Final velocity, (v) = 0 m/s
Acceleration, $a=v-ut$a=v-ut
Put the values in the above equation to get the value of acceleration
$a=0-52.5 = -2\ m/s2$a=0-52.5 =-2 m/s2
Thus, the retardation is 2 m/s^2.

Question 26:

A train starting from rest moves with a uniform acceleration of 0.2 m/s^2 for 5 minutes. Calculate the speed acquired and the distance travelled in this time.

ANSWER:

We have to find the distance travelled as well as final velocity of the train. We have the following information given,
Initial velocity, (u) = 0 m/s
Acceleration for the entire journey, (a) = 0.2 m/s^2
Time taken,
(t) = (5) (60) s
= 300 s
So, we can find the final velocity using the relation,
$v = u + at$
Therefore, final velocity of the train is,
v = 0 + (0.2)(300)
= 60 m/s
We can calculate the distance travelled by the train, using the 2nd equation of motion,
$s=ut+12at2$s=ut+12at2
Put the values in above equation to find the distance travelled,
$(s)=0(300)+12(0.2)(300)2 =(9000)\ m =9\ km$(s)=0(300)+12(0.2)(300)2 =(9000) m
=9 km

Question 27:

Name the two quantities, the slope of whose graph gives :

(a) speed, and
(b) acceleration

ANSWER:

Aakash Institute

(a) The slope of the graph of distance v/s time gives speed.
(b) The slope of the graph of velocity v/s time gives acceleration.

Question 28:

A cheetah starts from rest, and accelerates at 2 m/s^2 for 10 seconds. Calculate :

(a) the final velocity
(b) the distance travelled.

ANSWER:

We have to find the distance travelled by the cheetah. We have the following information given,
So, initial velocity, (u) = 0 m/s
Acceleration, (a) = 2 m/s^2
Time taken, (t) = 10 s
(a) So, we can find the final velocity using the relation, $v = u + at$
Final velocity,
$v = 0 + (2)\ (10)$
$= 20$ m/s

(b) We can calculate the distance travelled by cheetah using the 2nd equation of motion, $s = ut + \frac{1}{2}at^2$s = ut + 12at2
Put the values in above equation to find the distance travelled,
$(s)=0(10)+\frac{1}{2}(2)(10)^2 \quad =100$ m(s)=0(10)+12(2)(10)2 =100 m

Question 29:

A train travelling at 20 $m\ s^{-1}$ accelerates at 0.5 $m\ s^{-2}$ for 30 s. How far will it travel in this time?

ANSWER:

We have to find the distance travelled by the train. We have the following information given,
So, initial velocity, (u) = 20 m/s
Acceleration, (a) = 0.5 m/s^2
Time taken, (t) = 30 s
We can calculate the distance travelled by using the 2nd equation of motion,
$s=ut+\frac{1}{2}at^2$s=ut+12at2

Aakash Institute

Put the values in above equation to find the distance travelled by the train,
$(s)=20(30)+12(0.5)(30)2 \quad =(600+225)\ m \quad =825\ m$(s)=20(30)+12(0.5)(30)2 =(600+225) m =825 m

Question 30:

A cyclist is travelling at 15 m s^{-1}. She applies brakes so that she does not collide with a wall 18 m away. What deceleration must she have?

ANSWER:

We have to find the deceleration. We have the following information given,
Initial velocity, (u) = 15 m/s
Final velocity, (v) = 0 m/s
Distance travelled, (s) = 18 m
Let the acceleration be (a)
We can calculate acceleration by using the 3rd equation of motion,
$a=v2-u22s$a=v2-u22s
Put the values in above equation to find the deceleration,
a = (0 – 225)/(36)
$\Rightarrow a$ = –6.25 m/s^2
Thus, the deceleration is 6.25 m/s^2.

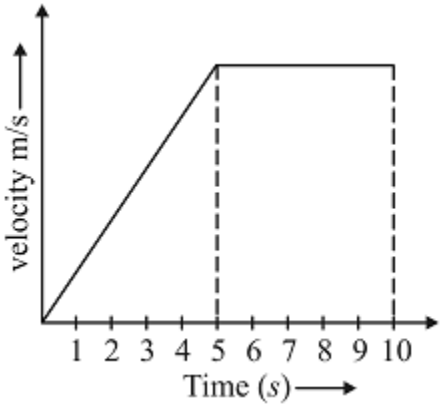
Question 31:

Draw a velocity-time graph to show the following motion :
A car accelerates uniformly from rest for 5 s; then it travels at a steady velocity for 5 s.

ANSWER:

Aakash Institute

We have to draw a velocity verses time curve for a moving body.



Question 32:

The velocity-time graph for part of a train journey is a horizontal straight line. What does this tell you about (a) the train's velocity, and (b) about its acceleration.

ANSWER:

(a) The train has a uniform velocity. This is because neither speed nor the direction of moving object is changing.
(b) There is no acceleration as the object is moving with uniform velocity.

Question 33:

(a) Explain the meaning of the following equation of motion :
$v = u + at$
where symbols have their usual meanings

(b) A body starting from rest travels with uniform acceleration. If it travels 100 m in 5 s, what is the value of acceleration?

ANSWER:

(a) The given equation is the first equation of motion i.e.,
$v = u + at$
Where,
(a) - Acceleration
(v) - Final velocity
(u) - Initial velocity

Aakash Institute

(*t*) - Time taken
It gives the velocity acquired by a body in time *t* provided initial velocity and acceleration is known.

(b) We have to find the acceleration of the body. We have the following information given,
Initial velocity,
Let the acceleration be (*a*)
Time taken,(*t*) = 5 s
Distance travelled, (*s*) = 100 m
We can calculate the distance travelled by using the 2nd equation of motion,
$s=ut+\frac{1}{2}at^2$s=ut+12at2
Put the values in above equation to find the acceleration of the body,
$100=0(5)+\frac{1}{2}(a)(5^2)$100=0(5)+12(a)(52)
On further simplification,
$25a^2=100$25a2=100
Therefore,
$a=\frac{100}{25}=8\ m/s^2$a=20025 =8 m/s2

Question 34:

(a) Derive the formula : *v* = *u* + *at,* where the symbols have usual meanings.
(b) A bus was moving with a speed of 54 km/h. On applying brakes it stopped in 8 seconds. Calculate the acceleration.

ANSWER:

(a)
Consider a body has initial velocity (*u*) . Suppose it is subjected to a uniform acceleration (*a*) such that after time (*t*) its final velocity becomes (*v*). Now, from the definition of acceleration we know that:
$\text{Acceleration}=\frac{\text{Change in velocity}}{\text{Time taken}}$Acceleration=Change in velocityTime taken
The above expression can also be written as,
$a=\frac{v-u}{t}$a=v-ut
On further simplification, we get the 1st equation of motion,
v = *u* + *at*
Where,
(*a*) - Acceleration
(*v*) - Final velocity
(*u*) - Initial velocity
(*t*) - Time taken

Aakash Institute

The equation $v = u + at$ is called the first equation of motion and is used to calculate the velocity 'v' acquired by a body in time 't'.

(b) We have to find the value of uniform acceleration. So,
Initial velocity
(u) = 54 km/hr $=54(1000)3600 m/s$ $=15$ m/s(u) = 54 km/hr =54(1000)3600m/s =15 m/s
Final velocity (v) = 0 m/s
Time taken(t) = 8 s
So acceleration, $a=v-ut$a=v-ut
Put the values in the above equation to get the value of acceleration
$a=0-158$ $=-1.875$ m/s2a=0-158 =-1.875 m/s2

Question 35:

(a) Derive the formula : $s=ut+12at2$s=ut+12at2, where the symbols have usual meanings.
(b) A train starting from stationary position and moving with uniform acceleration attains a speed of 36 km per hour in 10 minutes. Find its acceleration.
ANSWER:

(a) Consider a body in motion starts with an initial velocity (u) and uniform acceleration (a) and achieves a final velocity (v) in time (t) covering a distance 's'. Then distance 's' traveled by a moving body can be calculated by considering its average velocity for time (t). Since, the average velocity is sum average of initial velocity (u) and final velocity is (v) of the body, i.e.
Average velocity=Initial velocity + Final velocity2So, Average velocity = v+u2Average velocity=Initial velocity + Final velocity2So, Average velocity = v+u2
Also we know that,
Distance travelled = (Average velocity) (Time)
Using this relationship in equation (1),
$s=(u+v2)ts=u+v2t$
Now using the 1st equation of motion $v = u + at$ in the above,
$s=(2u+at2)ts=2u+at2t$
On further simplification we get the 2nd equation of motion as,
$s=ut+12at2$s=ut+12at2
Where,
(s) - Displacement
(u) - Initial velocity
(a) - Acceleration
(t) - Time

Akash Institute

(b) We have to find the value of uniform acceleration. So,
Initial velocity (*u*) = 0 m/s
Final velocity
$(v) = 36 \text{ km/hr} = 36(1000)3600 \text{m/s} = 10 \text{ m/s}$Time taken,$(t) = (10)(60) \text{ s} = 600$(v)= 36 k m/hr =36(1000)3600m/s =10 m/sTime taken,(t) =(10)(60) s = 600
So acceleration,
$a = v - ut$a=v-ut
Put the values in the above equation to get the value of acceleration
$a = 10 - 0600 = 0.0167 \text{ m/s}2$a=10-0600 =0.0167 m/s2

Question 36:

(a) Write the three equations of uniformly accelerated motion. Give the meaning of each symbol which occurs in them.
(b) A car acquires a velocity of 72 km per hour in 10 seconds starting from rest. Find (i) the acceleration, (ii) the average velocity, and (iii) the distance travelled in this time.

ANSWER:

(a) The first equation of motion is-
$v = u + at$v=u+at
Second equation of motion is-
$s = ut + 12at2$s=ut+12at2
Third equation of motion is-
$v2 = u2 + 2as$v2=u2+2as
Where,
(*s*) - Displacement
(*u*) - Initial velocity
(*a*) - Acceleration
(*v*) - Final velocity
(*t*) - Time taken

(b) We have the following information,
Initial velocity, (*u*) = 0 m/s
Final velocity
$(v) = 72 \text{ km/hr} = 72(1000)3600 \text{m/s} = 20 \text{ m/s}$Time taken, $(t) = (10) \text{ s}$(v)= 72 km/hr =72(1000)3600m/s =20 m/sTime taken, (t) =(10) s

(i) So acceleration,
$a = v - ut$a=v-ut
Put the values in the above equation to get the value of acceleration

Aakash Institute

$a = \frac{20-0}{10} = 2\ m/s^2$a=20-010 =2 m/s2

(ii) We have to find the average velocity. We will use the following relation,
$\text{Average velocity} = \frac{\text{Initial velocity + Final velocity}}{2}$So, $\text{Average velocity} = \frac{v+u}{2}$Average velocity=Initial velocity + Final velocity2So, Average velocity = v+u2

Therefore putting the value in the above to get the average velocity,

$\text{Average velocity} = \frac{20+0}{2} m/s = 10\ m/s$Average velocity =20+02m/s =10 m/s

(iii) We have to calculate the distance travelled. We will use the relation,
Distance travelled = (Average velocity) (Time)
So distance travelled is,
$= (10)(10)\ m = 100\ m$=(10)(10) m=100 m

Question 37:

(a) What is meant by uniform circular motion? Give two examples of uniform circular motion.
(b) The tip of seconds' hand of a clock takes 60 seconds to move once on the circular dial of the clock. If the radius of the dial of the clock be 10.5 cm, calculate the speed of the tip of the seconds' hand of the clock. $(\text{Given } \pi = \frac{22}{7})$Given π=227
ANSWER:

(a) When a body moves in a circular path with uniform speed (constant speed), its motion is called uniform circular motion.
Examples-
(i) Artificial satellites move in uniform circular motion around the earth.
(ii) Motion of a cyclist on a circular track.

(b) We have the following information,
Time, (T) = 60 s
Radius of circular path, (r = 0.105)
The speed of a body moving along a circular path is given by the formula:
$v = \frac{2\pi rT}{V} = \frac{2(22)(0.105)(60)}{(7)} m/s = (4.62420) m/s = 0.01\ m/s$v=2πrTV=2(22)(0.105)(60)(7)m/s =(4.62420)m/s =0.01 m/s

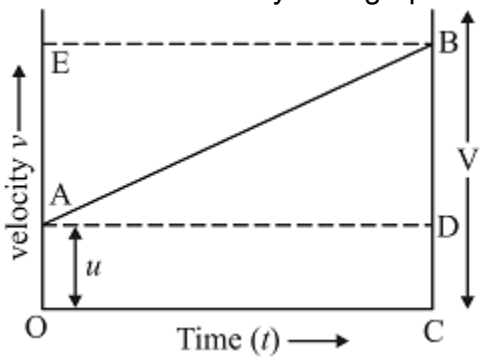
Akash Institute

Question 38:

Show by means of graphical method that : $v = u + at$ where the symbols have their usual meanings.

ANSWER:

Consider the velocity-time graph of a body shown in figure.



The body has an initial velocity (u) at a point A and then, its velocity changes at a uniform rate from A to B in time, (t). In other words, there is a uniform acceleration (a) from A to B, and after time (t) its final velocity becomes (v) which is equal to BC in the graph. The time (t) is represented by OC. To complete the figure, we draw the perpendicular CB from point C, and draw AD parallel to OC. BE is the perpendicular from point B to OE.

Now, initial velocity of the body, (u) =
OA .....(1)
And, final velocity of the body, (v) = BC ……
(2)
But from the graph BC = BD + DC
Therefore, v = BD + DC ……(3)
Again DC = OA
So, v = BD + OA
Now, from equation (1),
So, v = BD + u .....(4)
We should find out the value of the slope of a velocity-time graph which is equal to the acceleration,
Thus, Acceleration,
$a=\frac{BD}{AD}$a=BDAD
But AD = OC = t, so putting t in place of AD in the above relation, we get,
$a=\frac{BD}{t}$a=BDt
So, BD = at
Now, putting this value of BD in equation (4), we get the 1st equation of motion-:
$v=u+at$v=u+at

Akash Institute

where,
(a) - Acceleration
(v) - Final velocity
(u) - Initial velocity
(t) - Time taken

Question 39:

Show by using the graphical method that : $s=ut+\frac{1}{2}at^2$s=ut+12at2 where the symbols have their usual meanings.

ANSWER:

Suppose the body travels a distance (s) in time (t).

In the figure, the distance travelled by the body is given by the area of the space between the velocity-time graph AB and the time axis OC, which is equal to the area of the figure OABC.
Thus: Distance travelled = Area of the trapezium OABC
But, Area of the figure OABC = Area of rectangle OADC + Area of triangle ABD
= Area of rectangle OADC + area of triangle ABD
Now, find out the area of rectangle OADC and area of triangle ABD.
(i) Area of rectangle OADC
= (OA) (OC)
= (u) (t)
(ii) Area of triangle ABD,
= (1/2)(AD)(BD)
= (1/2)(t)(at)
= $(1/2)at^2$

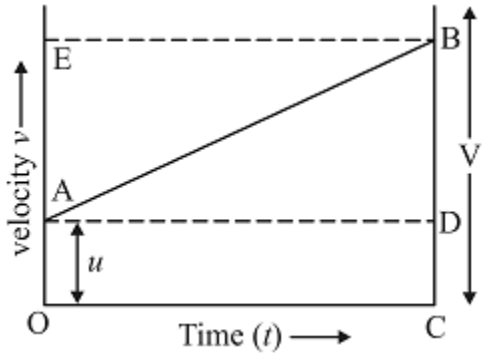
Distance travelled (s) is,
So, s = Area of rectangle OADC + Area of triangle ABD
$s=ut+\frac{1}{2}at^2$s=ut+12at2
This is the second equation of motion.
Where
(s) - Displacement
(u) - Initial velocity
(a) - Acceleration
(t) - Time

Akash Institute

Question 40:

Derive the following equation of motion by the graphical method : $v^2 = u^2 + 2as$ where the symbols have their usual meanings.

ANSWER:



In the given figure, the distance travelled (s) by a body in time (t) is given by the area of the figure OABC which is a trapezium.

Distance travelld = Area of the trapezium OABC

So, Area of trapezium OABC,

=(Sum of parallel sides)(Height)2=(OA+CB)(OC)2=(Sum of parallel sides)(Height)2=(OA+CB)(OC)2

Now, (OA + CB) = $u + v$ and (OC) = t.

Putting these values in the above relation, we get:

s=(u+v2)t ...(1)s=u+v2t ...(1)

Eliminate t from the above equation. This can be done by obtaining the value of t from the first equation of motion.

$v = u + at$

So,

t=v−uat=v-ua

Now, put this value of t in equation (1), we get:

s=((u+v)(v−u)2a)s=(u+v)(v-u)2a

On further simplification,

$2as = v^2 – u^2$

Finally the third equation of motion.

v2=u2+2asv2=u2+2as

where

(s) - Displacement

(u) - Initial velocity

(a) - Acceleration

(v) - Final velocity

(t) - Time taken

Aakash Institute

Question 41:

A bus increases its speed from 36 km/h to 72 km/h in 10 seconds. Its acceleration is :

(a) 5 m/s^2
(b) 2 m/s^2
(c) 3.6 m/s^2
(d) 1 m/s^2

ANSWER:

Final velocity is = 72 km/h = 20 m/s
Initial velocity is = 36 km/h = 10 m/s
Time taken is 10 sec. so,
$\text{Acceleration} = \frac{20-10}{10} = 1\ m/s^2$ Acceleration=20-1010 =1 m/s2
So, the answer is
(d) 1 m/s^2

Question 42:

A bus moving along a straight line at 20 m/s undergoes an acceleration of 4 m/s^2. After 2 seconds, its speed will be:

(a) 8 m/s
(b) 12 m/s
(c) 16 m/s
(d) 28 m/s

ANSWER:

Acceleration of the moving object is 4 m/s^2
Initial velocity is 20 m/s.
Time taken is 2 sec.
By applying 1st equation of motion we get,
$v = u + at$
$= 20 + 2(4)$
$= 28$ m/s
So, the answer is
(d) 28 m/s

Aakash Institute

Question 43:

The slope of a speed-time graph gives:

(a) distance travelled
(b) velocity
(c) acceleration
(d) displacement

ANSWER:

The rate of change of speed per unit time is termed as acceleration. So, the answer is
(c) Acceleration

Question 44:

The area under a speed-time graph represents a physical quantity which has the unit of :

(a) m
(b) m^2
(c) m s^{-1}
(d) m s^{-2}

ANSWER:

The area under the speed time graph gives us the distance. So, the answer is
(a) m

Question 45:

If the displacement of an object is proportional to the square of time, then the object is moving with :

(a) uniform velocity
(b) uniform acceleration
(c) increasing acceleration
(d) decreasing acceleration

ANSWER:

Aakash Institute

We are given with the relationship that,
$x = kt^2$
Differentiating it twice we get,
$v = 2kt$
$a = 2k$
Where,
v - velocity
a - acceleration
So, the answer is
(b) Uniform acceleration

Question 46:

Four cars A, B, C and D are moving on a levelled, straight road. Their distance-time graphs are shown in the given figure. Which of the following is the correct statement regarding the motion of these cars?

Figure

(a) car A is faster than car D
(b) car B is the slowest
(c) car D is faster than the car C
(d) car C is the slowest

ANSWER:

The slope of distance time graph gives the speed or the measure of rate of change of distance per unit time. So, the answer is,
(b) Car B is the slowest

Question 47:

A car of mass 1000 kg is moving with a velocity of 10 m s^{-1}. If the velocity-time graph for this car is a horizontal line parallel to the time axis, then the velocity of car at the end of 25 s will be :

(a) 25 m s^{-1}
(b) 40 m s^{-1}
(c) 10 m s^{-1}
(d) 250 m s^{-1}

Aakash Institute

ANSWER:

It is given that the velocity time curve is parallel to *x* axis hence velocity is constant with time and acceleration is 0. So, the answer is
(c) 10 m/s

Question 48:

A motorcycle is being driven at a speed of 20 m/s when brakes are applied to bring it to rest in five seconds. The deceleration produced in this case will be :

(a) + 4 m/s^2
(b) − 4 m/s^2
(c) + 0.25 m/s^2
(d) −0.25 m/s^2

ANSWER:

We have,
Initial velocity = 20 m/s
Final velocity = 0 m/s
Time taken = 5 sec.
So,
Deceleration = – Acceleration
= –(0 – 20)/5
= 4 m/s^2
So, the answer is
(a) 4 m/s^2

Question 49:

A sprinter is running along the circumference of a big sports stadium with constant speed. Which of the following do you think is changing in this case?

(a) magnitude of acceleration being produced
(b) distance covered by the sprinter per second
(c) direction in which the sprinter is running
(d) centripetal force acting on the sprinter

ANSWER:

Aakash Institute

The sprinter is having a uniform circular motion in which the direction of motion continuously changes. So, the answer is
(c) direction in which sprinter is running

Question 50:

In the speed-time graph for a moving object shown here, the part which indicates uniform deceleration of the object is :

Figure

(a) ST
(b) QR
(c) RS
(d) PQ

ANSWER:

For a speed time graph to show uniform deceleration, the slope should be negative and constant for that time interval. So, the answer is
(c) RS

Question 51:

A student draws a distance-time graph for a moving scooter and finds that a section of the graph is horizontal line parallel to the time axis. Which of the following conclusion is correct about this section of the graph?

(a) the scooter has uniform by scooter is the maximum in this section
(b) the distance travelled by scooter is the maximum in this section
(c) the distance travelled by scooter is the minimum in this section
(d) the distance travelled by the scooter is zero in this section

ANSWER:

If distance time graph is parallel to the time axis then the object has not travelled any distance. So, the answer is
(d) Distance travelled by the scooter is zero in this section.

Aakash Institute

Question 52:

Which one of the following is most likely not a case of uniform circular motion?

(a) motion of the earth around the sun
(b) motion of a toy train on a circular track
(c) motion of a racing car on a circular track
(d) motion of hours' hand on the dial of a clock

ANSWER:

For a body to move in uniform circular motion its speed must be constant. So, the answer is (c) Motion of a racing car in a circular track.
A racing car do not travel at constant speed in a circular track.

Question 53:

The graph given alongside shows the positions of a body at different times. Calculate the speed of the body as it moves from :

Figure

(i) A to B,
(ii) B to C, and
(iii) C to D

ANSWER:

(i) The distance covered from A to B,
= 3 – 0
= 3 cm
Time taken to cover the distance from A to B
= 5 – 2
= 3 s
Hence speed,
=DistanceTime=33cm/s=1 cm/s=DistanceTime=33cm/s=1 cm/s

Aakash Institute

(ii) The speed of the body as it moves from B to C is zero because the distance travelled is zero.
(iii) The distance covered from C to D,
= 7 – 3
= 4 cm
Time taken to cover the distance from C to D,
= 9 – 7
= 2 s
Hence speed,
$=\text{DistanceTime}=42\text{cm/s}=2\ \text{cm/s}$=DistanceTime=42cm/s=2 cm/s

Question 54:

What can you say about the motion of a body if :

(a) its displacement-time graph is a straight line?
(b) its velocity-time graph is a straight line?

ANSWER:

(a) The body has uniform velocity if its displacement –time graph is a straight line. If the straight line is parallel to the time axis then the magnitude of uniform velocity is zero.
(b) The body has a uniform acceleration if its velocity-time graph is a straight line. If the straight line is parallel to the time axis then the magnitude of uniform acceleration is zero.

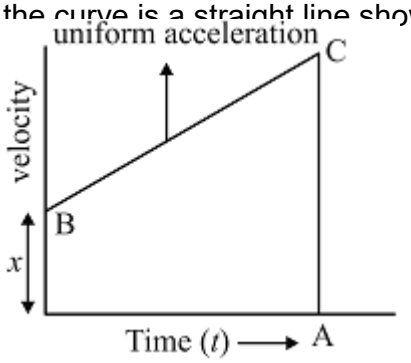
Question 55:

A body with an initial velocity *x* moves with a uniform acceleration *y*. Plot its velocity-time graph.

ANSWER:

Aakash Institute

We have to plot a graph between velocity and time. From the graph we can conclude that the curve is a straight line showing uniform acceleration.



Question 56:

Given alongside is the velocity-tine graph for a moving body :

Figure

Find : (i) Velocity of the body at point C.
(ii) Acceleration acting on the body between A and B.
(iii) Acceleration acting on the body between B and C.

ANSWER:

(i) BC represents uniform velocity. So velocity of the body at point C is $40\ \mathrm{km}$40 km
(ii) Acceleration = Slope of line AB
$=(40-20)(3-0)\mathrm{km/hr}^2=6.66\ \mathrm{km/hr}^2$=(40-20)(3-0)km/hr2=6.66 km/hr2
(iii) BC represents uniform velocity, so, acceleration acting on the body is zero.

Question 57:

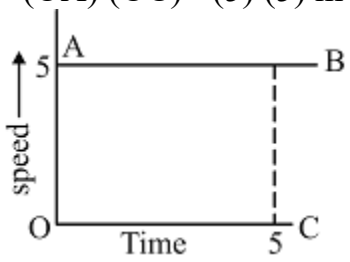
A body is moving uniformly in a straight line with a velocity of 5 m/s. Find graphically the distance covered by it in 5 seconds.

ANSWER:

We have to calculate the distance travelled by the moving body whose speed time graph is given to us.
Distance travelled = Area of rectangle OABC
So, distance travelled,

Aakash Institute

=(OA) (OC)= (5) (5) m=25 m=(OA) (OC)= (5) (5) m=25 m



Question 58:

The speed-time graph of an ascending passenger lift is given alongside.
What is the acceleration of the lift :

(i) during the first two seconds?
(ii) between second and tenth second?
(iii) during the last two seconds?

ANSWER:

(i) We have to find the acceleration from the given graph.
Acceleration = slope of line AB
$=\frac{(4.6-0)}{(2-0)} m/s^2 = 2.3\ m/s^2$=(4.6-0)(2-0)m/s2=2.3 m/s2
(ii) Between second and tenth second, it represents uniform speed, so, acceleration acting on the lift is zero.
(iii) During the last two seconds, it represents retardation of the lift, so its acceleration is (–2.3 m/s^2).

Question 59:

A car is moving on a straight road with uniform acceleration. The speed of the car varies with time as follows :

Figure

Time (s)	:	0	2	4	6	8	10
Speed (m/s)	:	4	8	12	16	20	24

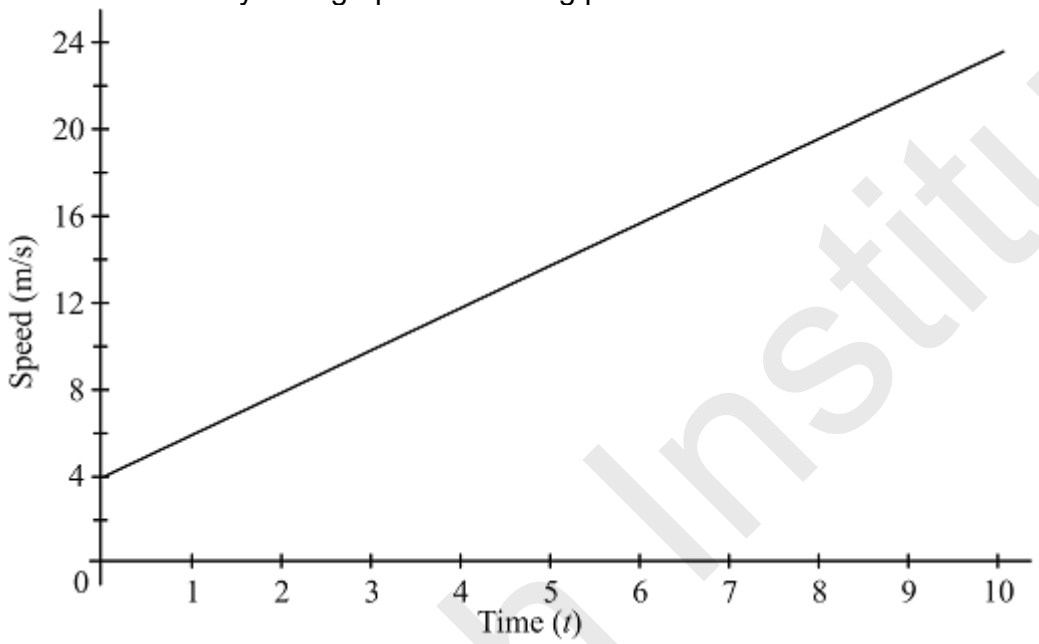
Aakash Institute

Draw the speed-time graph by choosing a convenient scale. From this graph :

(i) Calculate the acceleration of the car.
(ii) Calculate the distance travelled by the car in 10 seconds.

ANSWER:

We have a velocity-time graph of a moving particle.



(i) We have to find the acceleration from the given graph.
Acceleration = slope of line
$=\frac{(12-4)}{(4-0)}\text{m/s}$=(12-4)(4-0)m/s^2 =2 m/s2
(ii) Distance travelled by the car is given by the area enclosed by the curve.
s=(Sum of parallel sides)(Height)2 =(4+24)(10)2m =140 ms=(Sum of parallel sides)(Height)2 =(4+24)(10)2m =140 m

Question 60:

The graph given alongside shows how the speed of a car changes with time :

Figure

(i) What is the initial speed of the car?
(ii) What is the maximum speed attained by the car?
(iii) Which part of the graph shows zero acceleration

Aakash Institute

(iv) Which part of the graph shows varying retardation?
(v) Find the distance travelled in first 8 hours.

ANSWER:

(i) Initial speed of the car is 10 km/h
(ii) Maximum speed attained by the car is 35km/h
(iii) BC represents zero acceleration.
(iv) CD represents varying retardation.
(v) Distance travelled is given by the area enclosed within the curve. So,
Distance travelled = Area or trapezium + Area of rectangle
So distance travelled,
= (1/2)(8+5)(25) + (8)(10)
= 242.5 km

Question 61:

Three speed-time graphs are given below :

Figure

Which graph represents the case of :
(i) a cricket ball thrown vertically upwards and returning to the hands of the thrower?
(ii) a trolley decelerating to a constant speed and then accelerating uniformly?

ANSWER:

(i) Graph (c) represents a cricket ball thrown vertically upwards and returning to the hands of the thrower.
(ii) Graph (a) represents a trolley decelerating to a constant speed and then accelerating uniformly.

Question 62:

Study the speed-time graph of a car given alongside and answer the following questions :

Figure

Aakash Institute

(i) What type of motion is represented by OA?
(ii) What type of motion is represented by AB?
(iii) What type of motion is represented by BC?
(iv) What is the acceleration of car from O to A?
(v) What is the acceleration of car from A to B?
(vi) What is the retardation of car from B to C?

ANSWER:

(i) OA represents uniform acceleration.
(ii) AB represents constant speed.
(iii) BC represents uniform retardation.
(iv)Acceleration of car from O to A = slope of line OA
$a=\frac{(40-0)}{(10-0)} m/s^2 = 4\ m/s^2$a=40-010-0m/s2 =4 m/s2
(v) Acceleration of car from A to B is zero as it has uniform speed.
(vi)Retardation of car from B to C = slope of line BC
$a=\frac{(40-0)}{(50-30)} m/s^2 = 2\ m/s^2$a=40-050-30m/s2 =2 m/s2

Question 63:

What type of motion is represented by each one of the following graphs?

Figure

ANSWER:

(i) Graph (a) represents uniformly accelerating motion as it has a constant slope.
(ii) Graph (b) represents a motion of constant speed.
(iii) Graph (c) represents uniformly retarding motion as it has a constant negative slope.
(iv) Graph (d) represents non-uniformly retarding as it has a varying slope.

Question 64:

A car is travelling along the road at 8 m s^{-1}. It accelerates at 1 m s^{-2} for a distance of 18 m. How fast is it then travelling?

ANSWER:

We have to find the final velocity of the moving object. And we have the following information

Aakash Institute

Initial velocity, (*u*) = 8 m/s
Acceleration, (*a*) = 1 m/s^2
Distance, (*s*) = 18 m
So applying 3rd equation of motion to calculate the final velocity,
$v=u^2+2as$−−−−−−−−√v=u2+2as
Where,
(*a*) - Acceleration
(v) - Final velocity
(*u*) - Initial velocity
(*s*) - Distance
Put the values in the above equation to get the value of final velocity,
$v=64+36$−−−−−−−√$m/s\ =100$−−−√$m/s\ =10\ m/s$v=64+36m/s =100m/s =10 m/s

Question 65:

A car is travelling at 20 m/s along a road. A child runs out into the road 50 m ahead and the car driver steps on the brake pedal. What must the car's deceleration be if the car is to stop just before it reaches the child?

ANSWER:

We have to find the deceleration. We have the following information given,
Initial velocity, (*u*) = 20 m/s
Final velocity, (*v*) = 0 m/s
Distance travelled, (*s*) = 50 m
Let the deceleration for the entire journey be (*a*)
We can calculate acceleration by using the 3rd equation of motion,
$a=v^2-u^22s$a=v2-u22s
Where,
(*s*) - Displacement
(*u*) - Initial velocity
(*a*) - Acceleration
(*v*) - Final velocity
Put the values in above equation to find the deceleration,
$a=[0-4002(50)]m/s^2\ =(-400100)m/s^2\ =-4\ m/s^2$a=0-4002(50)m/s2 =-400100m/s2 =-4 m/s2
Hence, deceleration is 4 m/s^2.

Akash Institute