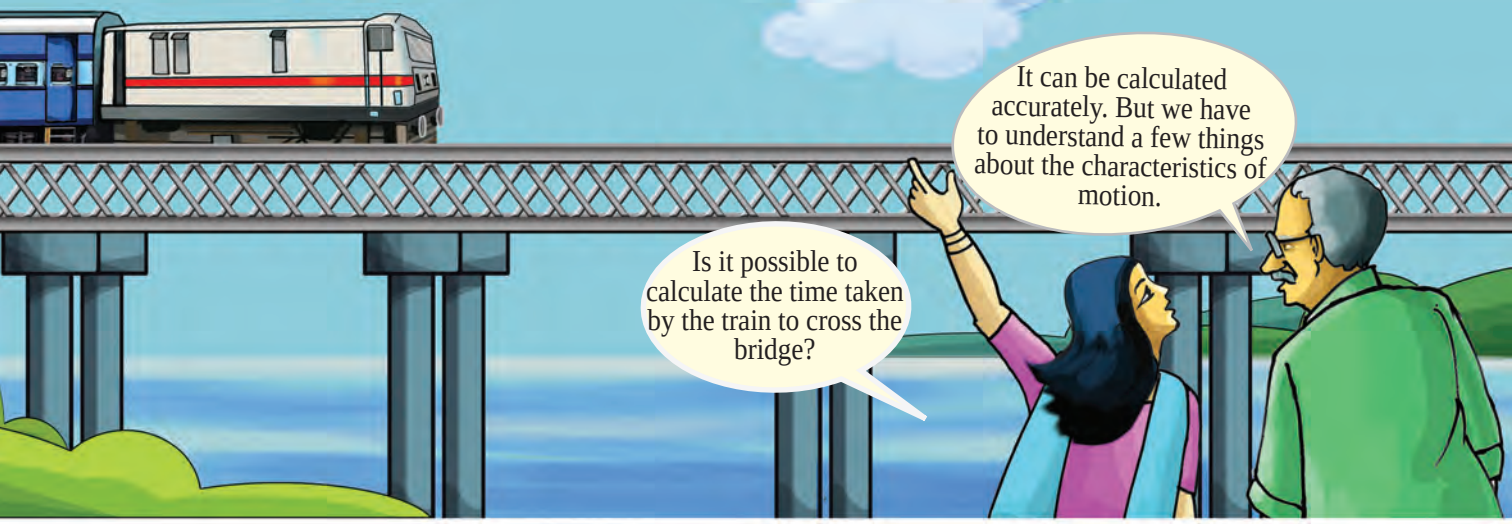
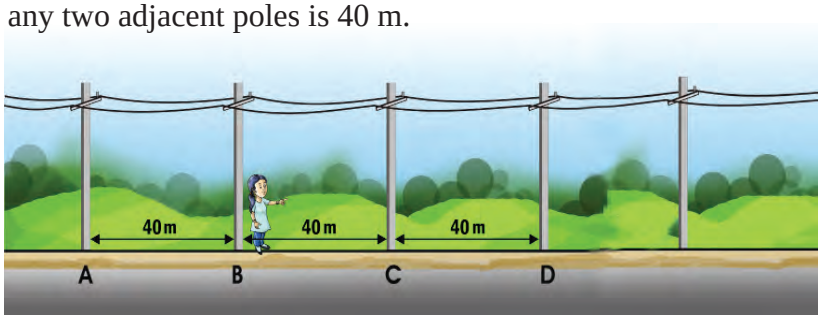
2 Equations of Motion



Observe the figure.

Did you ever have such a doubt like the one raised by the child? Let's try to find the answer.

A, B, C and D are four electric poles erected on the side of the road. The distance between any two adjacent poles is 40 m.



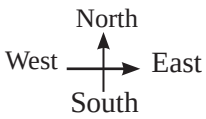


Fig 2.1

A child starts walking from pole B, passes C and reaches D. After that, the child returns from D and reaches the pole C.

- What is the total distance travelled by the child?
- What is the distance between the current position C and the initial position B of the child?
- If the child travels 40 m from B, which are the possible positions of the child?
- In which direction should the child travel 40 m to reach C from B?

(towards the east /towards the west)

The distance between the initial position B of the child and the current position C is the measure of the change in the position of the child. If the child travels 40 m from B in the eastward direction, the child can reach C. Here 40 m eastward from B to C is the displacement of the child.

Displacement

Displacement is the straight line distance between the initial position and the final position in a definite direction. Displacement is denoted by the symbol s. Unit of displacement is metre (m) which is also the unit of distance.

Vector quantities are the physical quantities having direction specified with magnitude. Vector quantities have both magnitude and direction. Quantities that do not require direction are scalar quantities.

- Is displacement a vector or a scalar?

Let's consider another situation.

- If the child travels 40 m in the westward direction from B, the current position of the child is .....

If the displacement from B in the forward direction (towards the east) is considered as positive, the displacement in the backward direction (towards the west) should be considered as negative. (These can also be considered in the reverse order). Once the direction is determined, the positive and negative directions should not be changed thereafter. Here, B is the initial position and A is the final position. Hence the displacement is negative.

Complete Table 2.1 based on the child's travel.

Stages of path covered by the child	Distance covered	Displacement
Directly from B to C	40 m	
Starts from B, reaches D and returns to C		40 m (from B to C)
Starts from B and reaches D	80 m	80 m (from B to D)
From B to A		− 40 m (from B to A)
Starts from B, reaches A and returns to B		Zero

Table 2.1

- The child moved from A to D and returned to A. What is the distance covered? What is the displacement? Aren't the initial position and final position the same?

  Isn't it clear from the table that the magnitude of displacement of an object can be zero or equal to or less than the distance covered?

- Write down the situations in which the distance covered and displacement are equal.

Two different paths taken by a child to move from position P through Q are depicted.

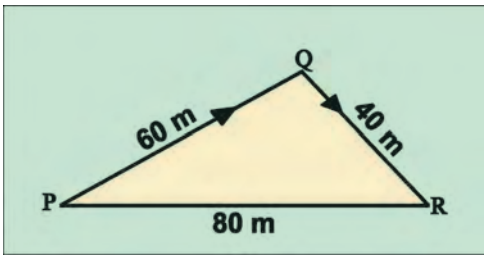


Fig 2.2 (a)

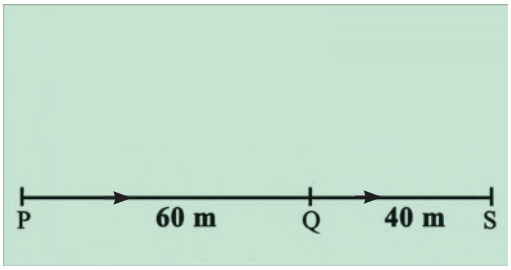


Fig 2.2 (b)

a) What is the distance covered in figure 2.2(a)? What is the displacement?

b) What is the distance covered as per the motion in figure 2.2(b)? What is the displacement?

c) In which situation is the magnitude of the distance and displacement equal?

Magnitude of displacement and distance covered are equal only when an object is moving along a straight line in the same direction.

Tabulate the differences between distance and displacement related to the path traversed by a person in Table 2.2.

Distance	Displacement
Length of the path covered	
	Can be zero
Scalar	

Table 2.2

The classrooms and some other locations of a school are depicted.

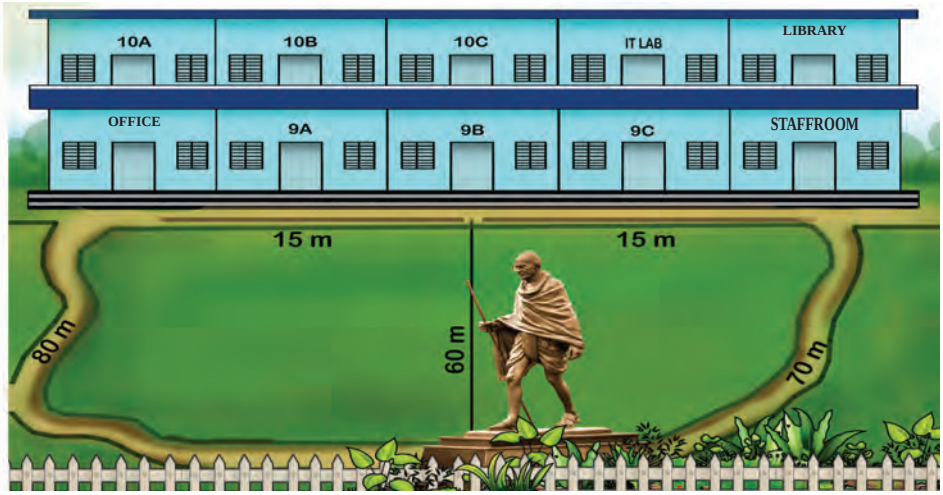


Fig. 2.3

During the interval, a student from Class 9B went to the staff room. The child then proceeded to the statue of the Father of the Nation in the school garden and returned to the class via the school office.

Complete Table 2.3 based on the path followed by the child.

Child's path	Distance (m)	Displacement (m)
When the child reaches the corridor in front of the staff room from Class 9B		
When the child reaches the garden near the statue of the Father of the Nation from 9B via the staff room		
When the child returns to Class 9B		

Table 2.3

Velocity

An illustration of a child's path is given in the figure. A child travels from P and reaches R through Q in 18 s.

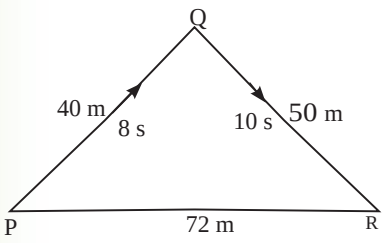


Fig 2.4

- What is the total distance covered by the child to reach R from P through Q?
- What is the speed of the child when the child travels from P to R through Q?
- What is the displacement of the child?

- Isn't the child's displacement of 72 m taking place in 18 s?

  Let's find out the displacement in one second.

$$\text{Displacement in one second} = \frac{\text{Displacement}}{\text{Time}}$$

$$= \frac{72\ \text{m}}{18\ \text{s}}$$

$$= 4\ \text{m/s}$$

The displacement in unit time is the velocity.

- What is its direction? (P $\rightarrow$ R / R $\rightarrow$ P / P $\rightarrow$ Q $\rightarrow$ R)

Didn't you understand that the direction of displacement and velocity are the same?

$$\text{Velocity } \mathbf{(v)} = \frac{\text{.....}}{\text{.....}} \quad ; \quad \text{That is, } \mathbf{v = \frac{s}{t}}$$

$$\text{Unit of velocity} = \frac{\text{Unit of displacement}}{\text{Unit of time}}$$

$$= \frac{\text{.....}}{\text{.....}} = \text{..... /.....}$$

Velocity is the displacement of an object in unit time.

Velocity is a vector quantity. The direction of velocity and displacement are the same. The unit of velocity is m/s.

The displacement of an object does not depend on the path of the object. But to calculate velocity, the total time taken to cover the actual distance should be considered.

Now, let's consider the doubt raised by the child at the beginning of this lesson. A train of length 200 m travels with a velocity of 20 m/s. What is the time taken by this train to cross a straight bridge of length 800 m?

Displacement = Length of the bridge + Length of the train

s = 800 m + 200 m

= 1000 m

Velocity (v) = 20 m/s

Time (t) = ?

$t = \frac{s}{v} = \frac{1000\ m}{20\ m/s}$

Time = 50 s

Calculate the speed and velocity of the child from P to Q in figure 2.4. What inferences can you draw from this?

A vehicle travels along a straight line with a velocity of 25 m/s and covers a distance of 400 m. Calculate the time taken for this.

What is the displacement of an object moving with a velocity of 36 m/s in one minute?

Uniform Velocity and Non uniform Velocity

Information related to the journey of three cars, each travelling a distance of 200 m is given. Observe their characteristics of motion and answer the questions.

A

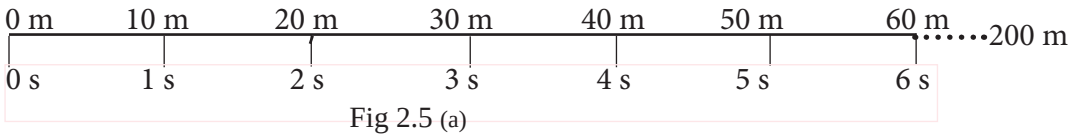


Fig 2.5 (a)

B

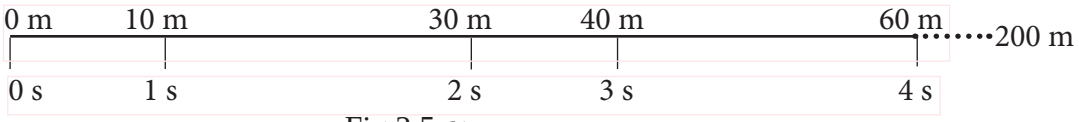


Fig 2.5 (b)

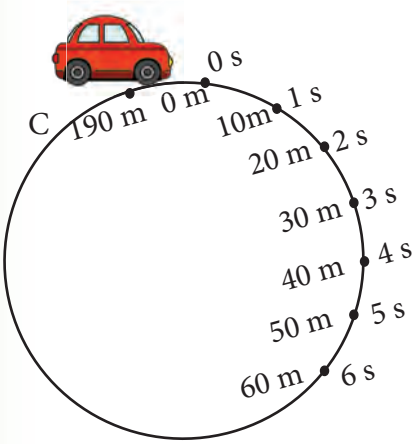


Fig 2.5 (c)

- Is the velocity of Car A always the same? Why?
- What about the velocity of Car B? Why?
- Haven't you noticed the mud sticking to the tyres of vehicles being thrown off when they rotate? Does the mud splash in the same direction every time?

  Isn't the direction of motion of an object moving along a circular path always changing?

  If the direction of motion of an object changes, the velocity of the object will also change.

- Is the velocity of Car C the same every second? Does the velocity change? Even though the magnitude of the speed does not change, the velocity changes because the direction changes.

An object moving in the same direction is in uniform velocity, if the magnitude of the displacement is equal at equal intervals of time.

If speed and direction change, velocity will also change. Even if any one of these changes, the velocity will vary. If the velocity of an object changes, then it will be in Non uniform velocity.

Complete the table based on the information in figures 2.5 (a), (b), (c).

Vehicle	Uniform velocity	Non uniform velocity	Reason
Car A	✓		Neither the magnitude nor the direction of the velocity changes.
Car B			
Car C			Magnitude of velocity does not change. Direction changes.

Table 2.4

You have understood what uniform velocity and non uniform velocity are.

Classify the situations given below, as uniform velocity and non uniform velocity. Record it in the science diary.

- Motion of a stone dropped from a height
- When light travels through vacuum
- A bus starts from a bus stop and is moving forward
- A train travelling at a uniform speed in the same direction
- Swinging on a swing

Uniform velocity	Non uniform velocity
•	• Motion of a stone dropped from a height •

Table 2.5

The velocity of a bus starting from a bus stop keeps changing. Will the change in velocity be the same in each second?

Accelerator is a mechanism in vehicles to increase their velocity.

Fig.2.6

Acceleration

Imagine that you are sitting in a bus. When the bus starts and moves forward in a straight line, doesn't the velocity change?

The data related to the straight line motion of the bus is given below. Analyse the information and answer the questions.

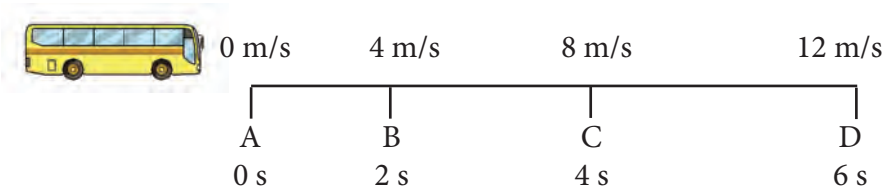


Fig.2.7

- When the bus travels from A to B, the velocity at A is..... (initial velocity / final velocity)
- The velocity at B is.....

  (initial velocity / final velocity)
- While considering the motion from B to C, velocity at B is.....

Complete the table using the data of the motion of the bus.

Path travelled by the bus	In each stage		Change in velocity (v - u) m/s	Time taken for change in velocity (t) s	Rate of change of velocity $\left(\frac{v-u}{t}\right)$ m/s^2
	Initial velocity (u) m/s	Final velocity (v) m/s			
From A to B	0	4	4	2	$\frac{4\ m/s}{2\ s} = 2\ m/s^2$
From B to C					
From C to D					

Table 2.6

Acceleration is the change in velocity of an object in unit time, or the rate of change of velocity.

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time}} \quad ; \quad a = \frac{v - u}{t}$$

Acceleration is a vector quantity.

You have calculated the change in velocity of the bus in each second or the rate of change of velocity. This is the acceleration of the bus.

$$\text{Unit of acceleration} = \frac{\text{Unit of change in velocity}}{\text{Unit of time}}$$

$$= \frac{\text{.....}}{\text{.....}}$$

$$= \text{.....}$$

A car is moving along a straight road with a velocity of 10 m/s. It is given an acceleration of 5 m/s^2. Calculate the velocity of the car after 2 s.

Initial velocity u = 10 m/s

acceleration a = 5 m/s^2

time t = 2 s

Final velocity v = ?

$$a = \frac{v - u}{t}$$

$$v - u = at$$

$$v = u + at = 10 + 5 \times 2$$

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

To calculate the final velocity, we can use the equation **v = u + at**

? The velocity of an object changes from 4 m/s to 28 m/s in 4 s. Calculate the acceleration.

? Have a look at the scene in an amusement park. List the instances in which acceleration occurs.

- **Motion of a giant wheel**
-

Fig. 2.8

Find instances of acceleration in your daily life and record them in the science diary.

- **Motion of a coconut falling from a coconut tree**
-

Can you think of some instances in everyday life where the velocity decreases? Expand the list by giving more examples.

- **Train arriving at a station**
- **The upward motion of a stone thrown upwards**
-

Is there an acceleration when the speed decreases?

Observe the figure.

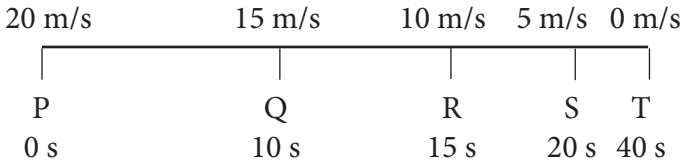


Fig. 2.9

The information related to the motion of a motorbike is given in the figure.

Complete the table by analysing the figure 2.9

Stages of motion	In each stage		Change in velocity (v - u) m/s	Time taken for change in velocity t (s)	Rate of change of velocity (Acceleration) $\left(a = \frac{v-u}{t}\right)$ m/s^2
	Initial velocity (u) m/s	Final velocity (v) m/s			
From P to Q	20	15	-5	10	$\frac{-5}{10} = -0.5$
From Q to R					
From R to S					
From S to T					

Table 2.7

It is seen that velocity is decreasing here.

The rate of decrease in velocity is negative acceleration or retardation.

Its unit is also m/s^2.

Should negative sign be given while writing the value of retardation?

An object starts from rest and attains a velocity of 10 m/s in 5 s.

a) What is its acceleration?

b) What is the acceleration if it comes to rest in 5 s? What is the retardation?

A vehicle travelling at a speed of 5 m/s is brought to rest in 2 s by applying brakes. Calculate the retardation of the vehicle.

If the velocity of an object in the 2nd second is 40 m/s and 30 m/s in the 4th second, what is its acceleration? What is its retardation? What is its velocity at the 8th second?

Uniform Acceleration, Non uniform Acceleration

- Was the acceleration obtained as per Table 2.6 the same on each occasion?
- What about the acceleration obtained as per Table 2.7?

An object is in uniform acceleration if the rate of change of velocity is equal at equal intervals of time. But if the rate of change of velocity of an object varies differently at equal intervals of time, then it is in non uniform acceleration.

You have acquired some ideas about speed, velocity and acceleration. Over speeding of vehicles cause accidents. We must strictly follow traffic rules to reduce accidents. Are accidents caused only by overspeeding of vehicles? Shouldn't pedestrians also follow the traffic rules?

Which are the traffic rules for pedestrians to follow?

- Pedestrians should walk along the right side of the road.
- Cross the road only at the zebra crossing, obeying the traffic signal.
-

Road signs and road markings have been implemented to reduce road accidents and to ensure safety.

Road signs can be broadly classified into three categories.

Haven't you noticed sign boards erected on roadsides? Some of them are in circular, triangular or rectangular shapes. It is important to note the characteristics of each of them.

Mandatory signs Signs indicating mandatory compliance	Cautionary signs Warning signs	Informatory signs Basic information indicators
		

Fig 2.10 (a)

Note the examples for mandatory, cautionary and informatory signs.

i. Mandatory Signs

These signs are warning signs that must compulsorily be followed.


No Parking


No Bicycles


No Horn

Fig 2.10 (b)

ii. Cautionary Signs

These signs are meant to warn about the road conditions in the journey ahead.


Hump


Narrow bridge


School ahead

Fig 2.10 (c)

iii. Informatory Signs

These signs provide information about the direction in which the driver has to go, the distance to various places and the availability of other facilities.


Petrol pump

Police station


Hospital

Fig 2.10 (d)

In addition to the signs mentioned above, collect more symbols for each category, prepare separate posters and display them on the school bulletin board.

Road Marking

Where vehicles are allowed to cross in a controlled manner

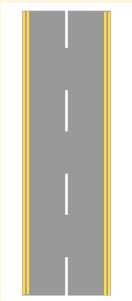


Fig 2.11 (a)

Where vehicles are not allowed to cross

Fig 2.11 (b)

Zebra crossing

Fig 2.11 (c)

Do accidents occur only because traffic rules are disobeyed?

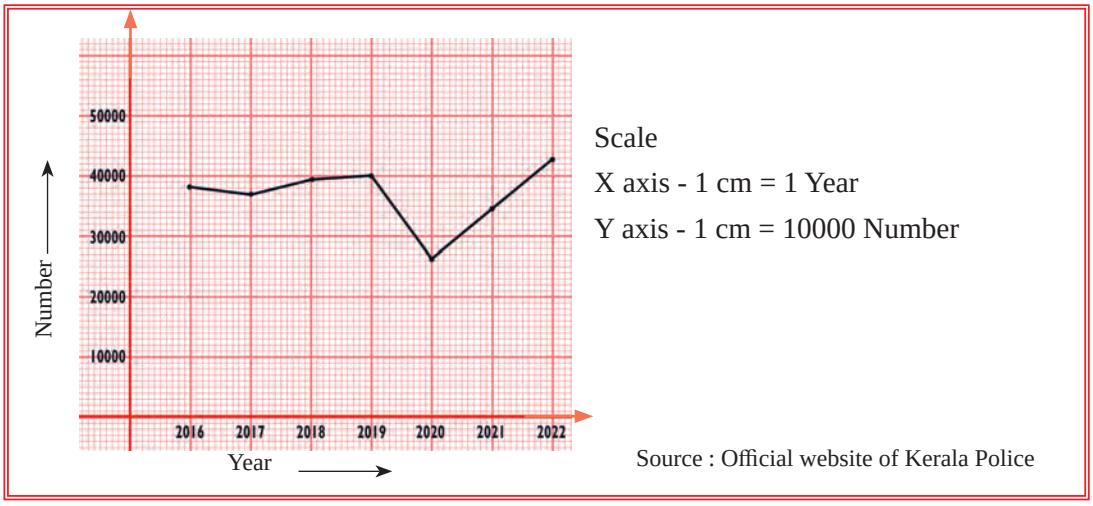
In dim light, drivers may not be able to see pedestrians walking along the side of the road or crossing the road wearing dark clothes. It invites accidents. Isn't it advisable to wear light coloured clothes during these times?

Prepare and present a seminar paper on the topic 'Students and Road Safety'.

Hints :

- Crossing the road
- Moving in groups along the road
- Playing near the road
- Driving a motor vehicle before obtaining a license
- Safe cycling
- Road signals
-

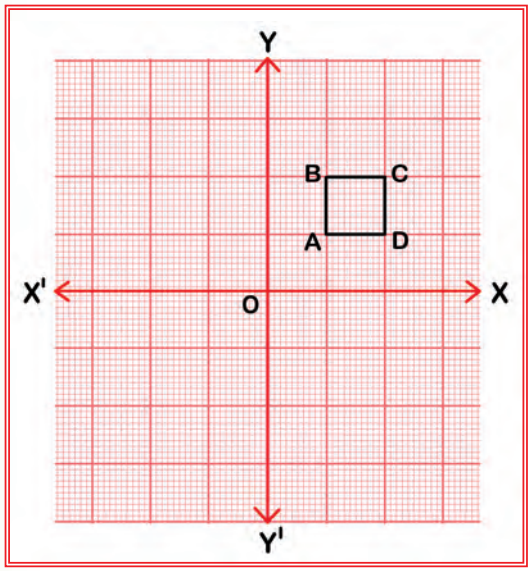
A graph showing the number of road accidents in Kerala from 2016 to 2022 is given below.



Graph 2.1

- What information can be gathered from the above graph?
- List down your findings.

Graphical Representation of Motion



Graph 2.2

A graph is a two-dimensional diagram. In a graph the horizontal line XX′ is the X axis and the vertical line YY′ is the Y axis. The point where the axes meet is the origin O.

OX is the positive axis (towards the right from the origin) and OX′ is the negative axis (towards the left from the origin). Similarly OY is considered as positive and OY′ is considered as negative. Axes are number lines.

There are several segments of length 1cm and breadth 1cm in a graph. The area of the segment ABCD is $1cm^2$. A graph is named by the quantities expressed in the Y and X axes respectively.

A graph can be used to understand and illustrate the relation between quantities and to formulate equations based on them. Mathematical calculations, real time information, formulation of conclusions etc., are also possible through graphs.

Check the graph 2.1 and answer the questions given below.

- In which year is the number of accidents the least?
- How many accidents occurred in 2019?

ExpEYES → Distance Measurement using SR04 Echo Module Plotting Graphs

Position - Time Graph

Information regarding the motion of an object is given in the table below. How can we draw a graph using these measurements? Choose an appropriate scale.

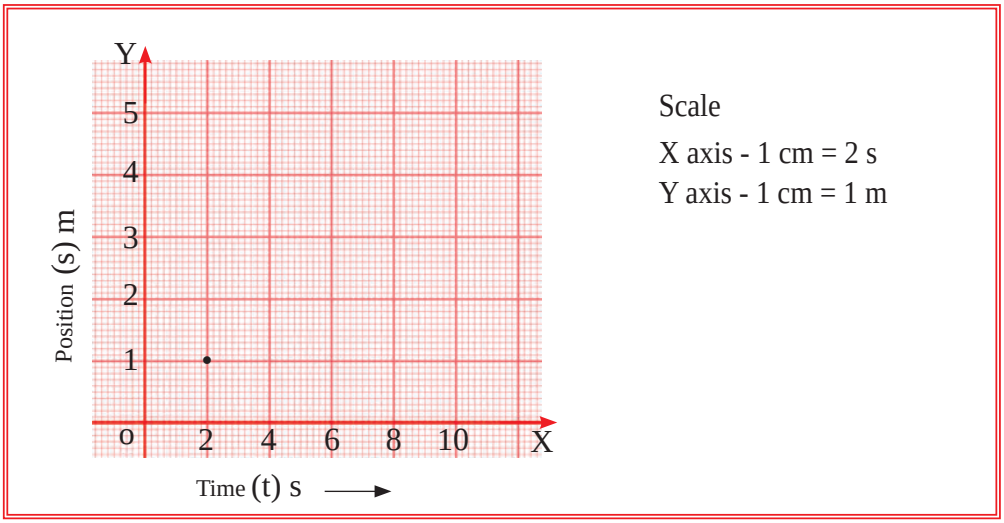
Look at the given example.

X axis - Time (s)	2	4	6	8	10
Y axis – Position (m)	1	2	3	4	5

Table 2.8

Draw the axes X′OX and Y′OY on the given graph paper. Mark O at the point of intersection of the axes. Determine the appropriate scale and plot position on the Y-axis and time on the X-axis according to the scale. Mark the co-ordinates given in the table as points on the graph paper.

Example : (2, 1) When the time is 2 s and the position is 1m, mark the point which lies above 2 in the X axis and against 1 in the Y axis. Mark the other points in the same way and join the points obtained.



Graph 2.3

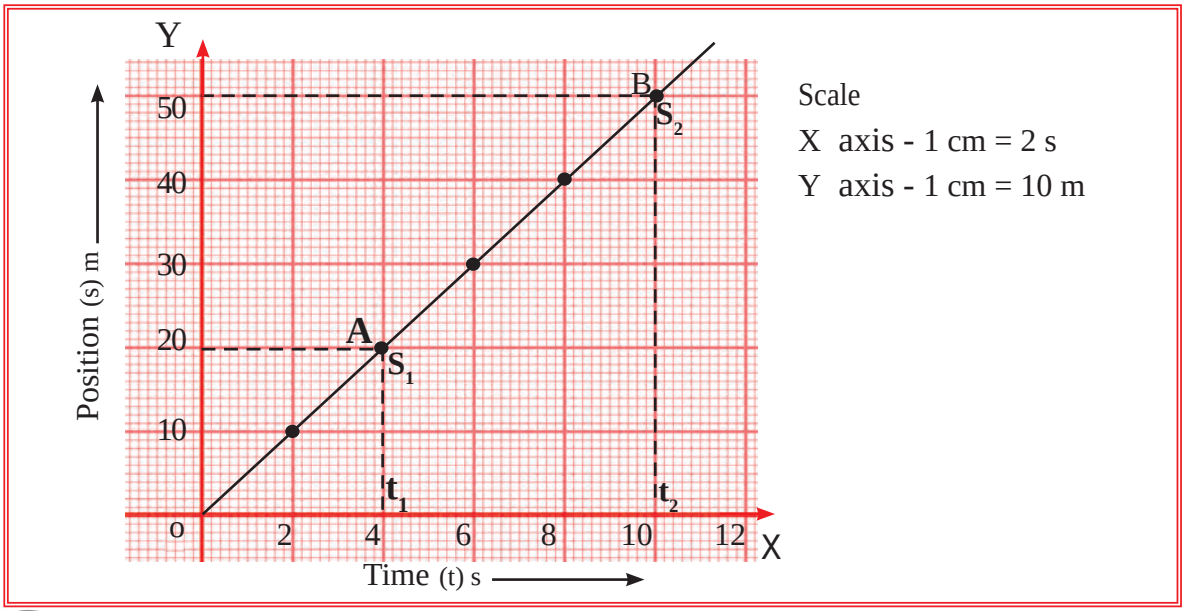
- What is the nature of the graph obtained?

  (a horizontal straight line / an inclined straight line /a curved line)
- By what name is this graph known?
- From the shape of the graph obtained, what is the nature of the velocity of the object?

  (uniform velocity/non uniform velocity)
- What is the displacement of the object in 5 s?
- What is the time taken to travel 1.5 m?

Let's consider another situation.

Position-time graph of the motion of a car is given.



Graph 2.4

How can we find the velocity of the car from A to B from Graph 2.4?

- What is the displacement of the car from A to B in the graph?
- What is the time taken by the car to travel from A to B?

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}} = \frac{s_2 - s_1}{t_2 - t_1} = \text{------} = \text{------}$$

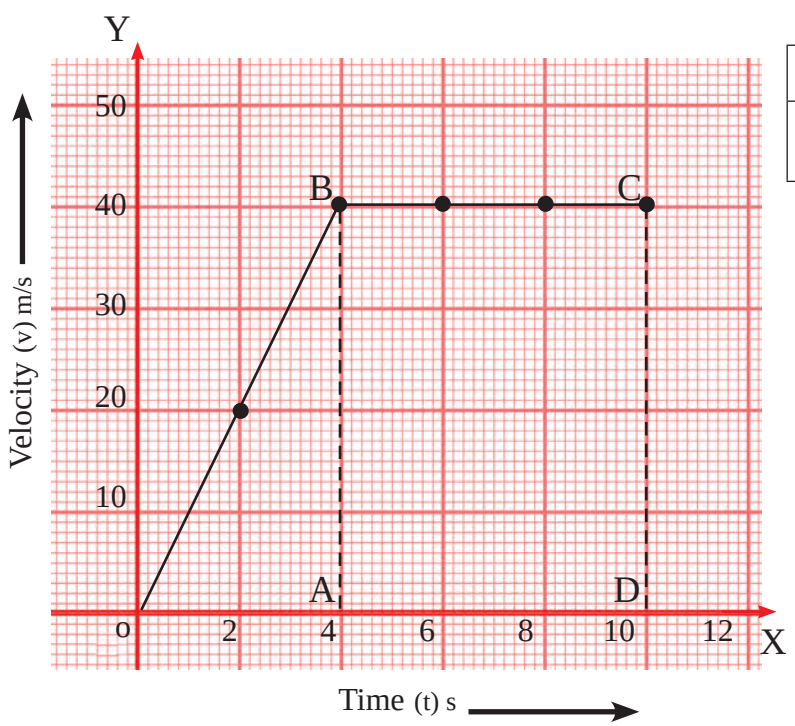
- What is the position of the car at the sixth second in the graph?
- Which type of velocity does this car have?

  (uniform velocity / non uniform velocity)
- Find out the velocity of the car between 6 s and 8 s from the graph.

A suitable scale has to be taken to limit the data of the graph to the size of the graph paper. As the scale increases, the size of the graph decreases. But the value of the physical quantity indicated by the graph does not change.

Velocity - Time Graph

Observe the given table and velocity-time graph related to the motion of a vehicle.



Time (s)	0	2	4	6	8	10
Velocity (m/s)	0	20	40	40	40	40

Scale

X axis - 1 cm = 2 s

Y axis - 1 cm = 10 m/s

Graph 2.5

A velocity-time graph is a graph that plots velocity on the Y-axis and time on the X-axis.

- From the graph, find the displacement of the vehicle between the fourth and tenth second.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

- Then, displacement = velocity × time

On the graph, it will be equal to AB × AD (Equal to the area of the rectangle ABCD)

- Isn't this equal to the area of the portion below BC on the graph?

  s = 40 m/s × 6 s = 240 m

On a velocity-time graph, displacement of an object within a definite time interval is equal to the area of the portion under the graph at that interval.

- Find the displacement during the first 4 s from Graph 2.5.
- What is the change in velocity in the first 4 s? What is the acceleration?
- What is the acceleration of this vehicle between 4 s and 10 s?

We have learned that displacement, velocity, time, acceleration etc., can be found out from the velocity - time graph.

Graphs can also be used to formulate equations.

Equations of Motion

The notations given below are commonly used to formulate equations of motion.

For an object moving with uniform acceleration -

Initial velocity u Final velocity v

Displacement s Acceleration a

Time taken for the change in velocity t

We can use the equation $\mathbf{v = u + at}$ to understand the relation between velocity and time.

We can use the equation $\mathbf{s = ut + \frac{1}{2} at^2}$ to find the relation between displacement and time.

The relation between displacement and velocity can be found using the equation $v^2 = u^2+2as$. These three equations are the equations of motion.

Equations of Motion

$v = u + at$

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

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

These equations are applicable only for objects in uniform acceleration.

A body starts from rest and acquires a velocity of 20 m/s in 2 s and 40 m/s in 6 s. What is the displacement of the object during this time interval?

Initial velocity, u = 20 m/s **Time $t = t_2 - t_1 = 6\text{ s} - 2\text{ s} = 4\text{ s}$**

Final velocity, v = 40 m/s

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

$= \frac{40\text{ m/s} - 20\text{ m/s}}{4\text{ s}}$

$= \frac{20\text{ m/s}}{4\text{ s}}$

$= 5\text{ m/s}^2$

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

$= (20\text{ m/s} \times 4\text{ s}) + \left[\frac{1}{2} \times 5\text{ m/s}^2 (4\text{ s})^2\right]$

$= 80\text{ m} + 40\text{ m}$

$= 120\text{ m}$

If the velocity of a car increases from 6 m/s to 16 m/s in 10 s,

a) calculate the acceleration of the car.

b) what is the displacement of the car during this time?

a) $u = 6\text{ m/s}$

$v = 16\text{ m/s}$

$t = 10\text{ s}$

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

$= \frac{16\text{ m/s} - 6\text{ m/s}}{10\text{ s}}$

$= \frac{10\text{ m/s}}{10\text{ s}}$

$= 1\text{ m/s}^2$

b) Displacement, $s = ut + \frac{1}{2}at^2$

$= (6\ m/s \times 10\ s) + \left[\frac{1}{2} \times 1\ m/s^2 \times (10\ s)^2\right]$

$= 60\ m + 50\ m$

$= 110\ m$

The velocity of a train that started from a railway station becomes 90 km/h in 10 minutes. Calculate the acceleration of the train.

$u = 0$

$v = 90\ km/h$

$= \frac{90 \times 5\ m/s}{18}$

$= 25\ m/s$

$t = 10$ minute

$= 600\ s$

$1\ km/h = \frac{1000\ m}{3600\ s}$

$= \frac{5}{18}\ m/s$

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

$= \frac{25\ m/s - 0\ m/s}{600\ s}$

$= \frac{1}{24}\ m/s^2$

An object falls down from rest and moves with an acceleration 10 m/s^2, hits the groundwith a velocity 20 m/s. From what height does the object fall?

$u = 0$

$a = 10\ m/s^2$

$v = 20\ m/s$

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

$(20\ m/s)^2 = 0^2 + 2 \times 10 \times s$

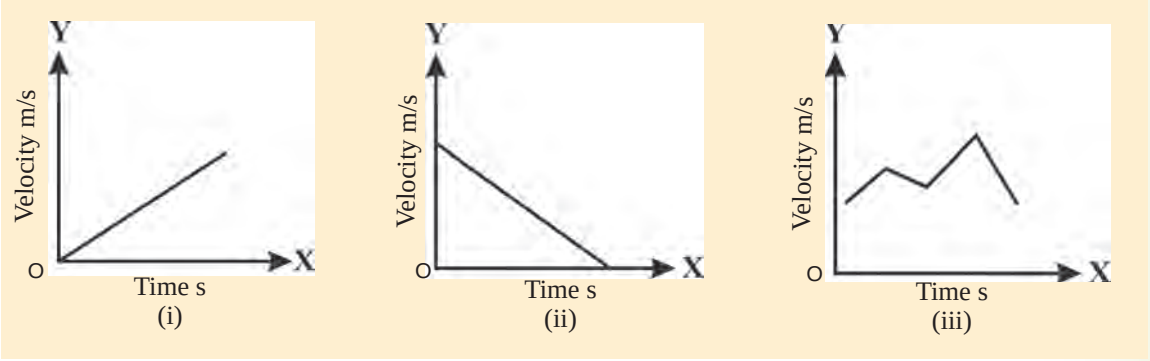
$400 = 20 \times s$

$s = \frac{400}{20}$

$= 20\ m$

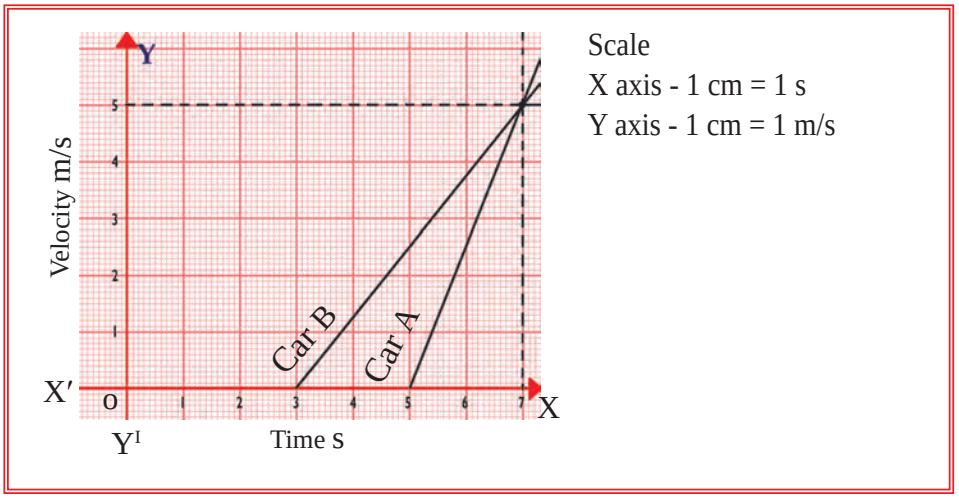
Let's Assess

1. A car starts from rest and moves with uniform acceleration. Calculate the acceleration of the car if it covers a distance of 200 m in 20 s.
2. If an object starts from rest and moves with an acceleration of 2 m/s^2, what will be the velocity of the object after 10 s?
3. Three different graphs related to the motion of a vehicle are given below. Analyse the graphs and find the characteristics of the motion.



Graph 2.6

4. Graph related to the motion of Car A and Car B is given.
   a) Which car has more acceleration? Why?
   b) Redraw the graph by changing the scale and compare the graphs.



Graph 2.7

5. Observe the figure.

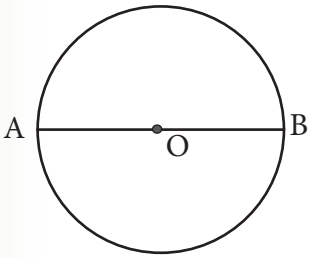


Fig. 2.12

A child runs along a circular path of circumference 440 m at a constant speed. The radius of the circular path is 70 m. The time taken to run from A and reach A in clockwise direction through B is 80 s. Find the distance, displacement, speed and velocity in each case in the table.

Situation	Distance	Displacement	Speed	Velocity
When it reaches B				
When it reaches A				

Table 2.9

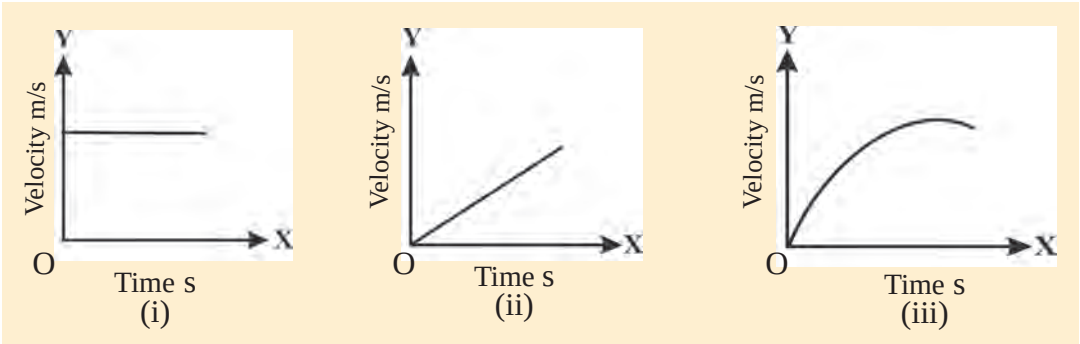
6. A train starts from rest and attains a speed of 72 km/h in 5 minute. Find the acceleration and displacement of the train.
7. Analyse Table 2.10 and draw the velocity-time graph.

X Time (s)	0	2	4	6	8	10
Y Velocity (m/s)	10	15	20	20	20	15

Table 2.10

a) From the graph, find the time interval during which there is no acceleration.
b) Find the time interval during which deceleration occurs.
c) Find the displacement between the fourth second and the eighth second.

8. Observe the graphs.



Graph 2.8

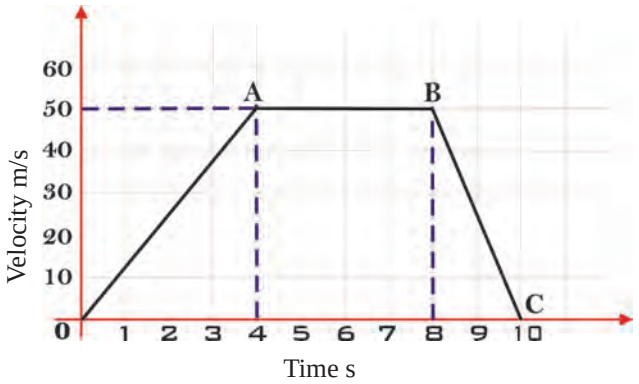
In which graph,

a) does the object have uniform acceleration?

b) does the object have uniform velocity?

c) does the object have acceleration and deceleration?

9. The velocity-time graph of an object in straight line motion is given.



Graph 2.9

Identify the regions of the graph where the object is moving with :

a) acceleration.

b) uniform velocity.

c) deceleration.

10. It is not safe for pedestrians to wear dark coloured clothes at night and in conditions with dim light. The school authorities decided to choose a dark coloured uniform for your school. Record your response to the decision. Justify the answer with respect to road safety.

11. In the figure given below, a child travels from P to S through Q and R and comes back straight to P.

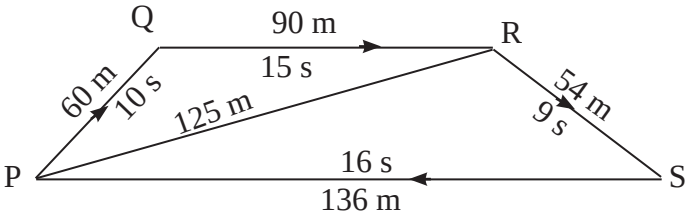


Fig 2.13

Analyse the figure and complete the table given below.

Starting from P	Speed	Velocity
On reaching Q		
On reaching R		
On reaching S		
While returning to P		

Table 2.11

12. A stone is thrown vertically upwards with a velocity of 20 m/s. ($a = -10\ m/s^2$)
    a) What is the maximum height that the stone has reached?
    b) How far will this stone travel in 3 s after it is thrown?
    c) How high will the stone be from the ground, 3 s after it is released?

13. An object is moving with a speed of 40 m/s. If it is given a deceleration of 8 m/s^2,
    a) how long will it take to come to rest?
    b) what is the displacement of the object in this time?

14. An object is moving with a velocity of 20 m/s. This object is given an acceleration of 5 m/s^2. What is the velocity when the displacement is 120 m?

15. A bullet travelling with a velocity of 60 m/s comes to rest after penetrating 2 cm into a wooden block. What is the acceleration of this bullet? How much is its deceleration?

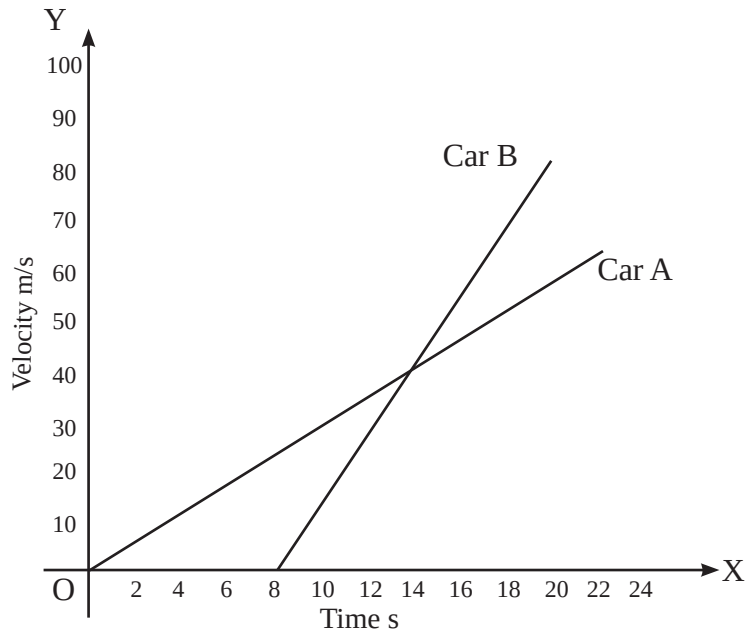
16. Observe the table illustrating the motion of an object, select an appropriate scale and draw the graph. Interpret the graph and write down the answers to the questions given below.

Time s	0	5	10	15	20	25	30
Velocity m/s	20	25	30	30	30	25	20

Table 2.12

    a) Which is the time interval with no acceleration?
    b) Which is the time interval with deceleration?
    c) Calculate the displacement of this object in 30 s.

17. The velocity- time graph of the motion of Car A and Car B is given below.



Graph 2.10

a) Which car started first?

b) How much time did each car take to attain the same speed?

c) Which car possesses more acceleration?

d) Which car has more displacement?

Extended Activities

1. The Science Club organises an awareness class on 'Road accidents due to overspeeding.' Prepare the necessary slides for the presentation.

   (Hints : traffic rules, signboards, traffic rules to be followed by pedestrians, etc.)

2. An object is thrown upwards with a velocity of 30 m/s. It returns to the same position after some time. Draw the velocity-time graph of this object and display it in the class (Consider the deceleration as 10 m/s^2).

3. Prepare a project on whether the safety measures implemented in your area are adequate to reduce road accidents.

- Project planning can be done with the help of your teacher.
- Bring relevant findings to the attention of the Road Safety Authority.

(For more information, the services of the National Transportation Planning and Research Centre (NATPAC) and the Motor Vehicles Department can be availed.

The report should include:

- Introduction
- Hypothesis
- Objectives
- Methodology
- Analysis
- Results
- Conclusion
- Suggestions