

Board – CBSE

Class – 7

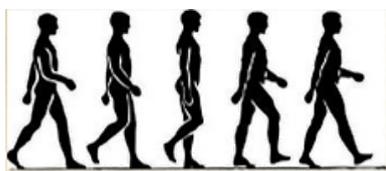
Topic – Motion and Time

- **What is Motion?**

If an object keeps on changing its position with time, it is moving or in **motion**.

Motion can be of different types:

- **Linear or straight** in which the object travels in a straight line.
- **Circular** in which the object travels along a circular path.
- **Curvilinear** in which the object moves along a curve.



A person's motion



A Bicycle's motion



A Car's motion



A Train's motion

Examples of Motion

- **Slow and Fast Motion**

- Suppose one object covers a particular distance in less time and another covers the same distance in more time. In that case, the first object is said to be moving slowly, while the second object is moving faster.

- **The speed of an object**

The distance travelled by an object in unit time is called its **speed**.

Types of Speed:

- **Uniform Speed –**

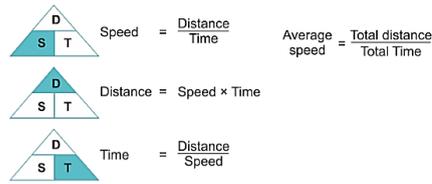
When the object travels a fixed distance same time gap, it is said to have a uniform speed.

- **Non-uniform Speed –**

When an object covers different distances in different time gaps, it is said to have a non-uniform speed.

- **Average Speed –**

The total distance travelled by an object divided by the total time taken by the object is called its average speed.



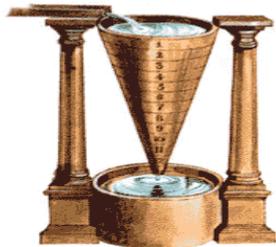
Finding Speed, Time and Distance

- Measuring Time

- ❖ **Morning** – The rising of the sun
- ❖ **Day and Night** – The time between the sunrise and sunset
- ❖ **Month** – The time between two new moons
- ❖ **Year** – The time the earth takes to complete its one revolution around the sun

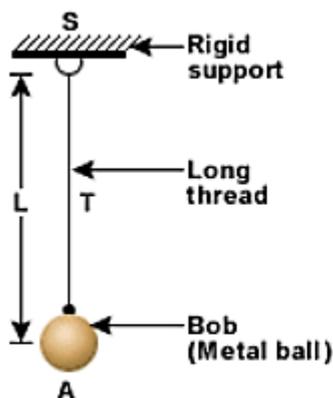
Time measuring devices or clocks –

- **Clocks** use the concept of **periodic motion** to measure time.
- It means that it uses a motion that repeats itself in equal amounts of time.
- There are different types of time measuring devices.

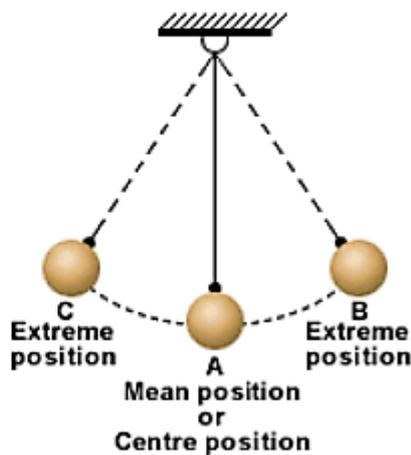
<p>Sundial :</p> <p>It uses the position of the sun to depict time</p>	
<p>Sand Clock (hourglass) :</p> <p>It uses sand to measure time</p>	
<p>Water Clock –</p> <p>It uses water to measure time</p>	

<p>Pendulum Clock –</p> <p>It uses a pendulum to measure time</p>	
<ul style="list-style-type: none"> • Quartz Clocks – <p>They have an electric circuit that works with the help of cells.</p> <p>They provide accurate time.</p>	

- **Periodic Motion of a Simple Pendulum**



(a) Simple pendulum



(b) Motion of a simple pendulum

Simple Pendulum

- ❖ A simple pendulum contains a **Bob**. It is a metallic ball or a stone that is suspended from a rigid stand with the help of a thread.
- ❖ **Oscillatory motion –**
- ❖ The to and fro motion of the pendulum is called **Oscillatory Motion**.
- ❖ The pendulum's bob does move from the centre (mean position) of the pendulum to its extreme positions on the other side.

- **Oscillation –**

When the bob moves from its centre (mean position) to its extreme ends, it is said to complete one oscillation.

- **Time Period of a pendulum –**

The time taken by the pendulum bob to complete one oscillation is called its **Time Period**.

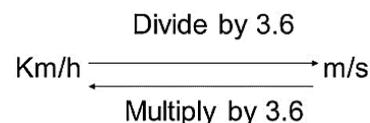
- **Units to Measure Time Speed**

Time	Second (s)
	Minutes (min)
	Hours (h)
Speed = Distance/time	Meter/Second (m/s)
	Meter/minute (m/min)
	Kilometre/hour (km/h)

Conversion between km/hr and m/s

To convert between m/s and km/h

$$\frac{1\text{km}}{1\text{h}} = \frac{1000\text{m}}{1\text{h}} = \frac{1000\text{m}}{60\text{min}} = \frac{1000\text{m}}{3600\text{s}} = \frac{1}{3.6}$$



Speedometer –

It is a device that is used in vehicles such as cars and trucks which measure the speed in kilometre per hour.

Odometer –

It is a device that measures the distance travelled by a vehicle in meters or kilometres.



The dashboard of a car

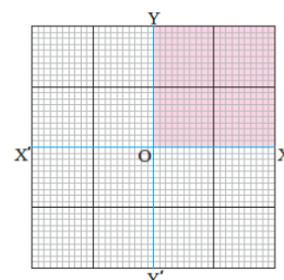
The measure of Distance and Speed of a car

- **Distance-time Graph**

A graph representing the distance travelled by an object with respect to time is called a distance-time graph.

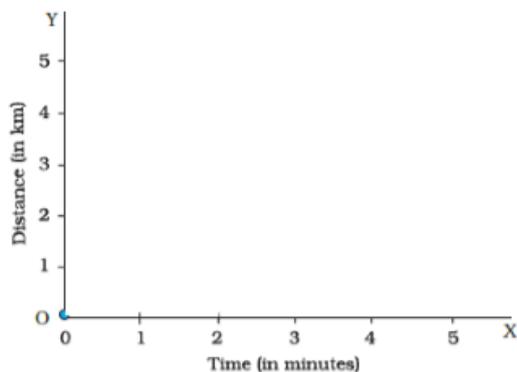
- **Making a distance-time graph:**

1. Mark the x-axis and y-axis and divide them into equal quantities.



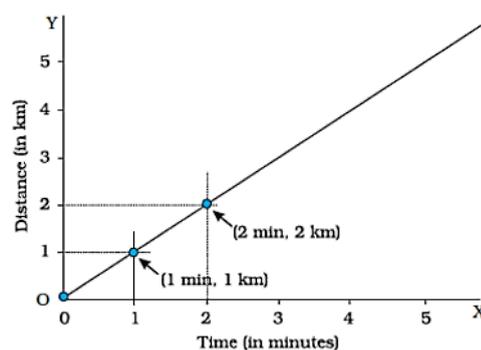
- **Take the first quadrant**

1. Choose one scale to represent the distance (for example, x-axis to represent the distance (1 km = 1 cm). The other represents time (for example, the y-axis represents 1 min = 1 cm).



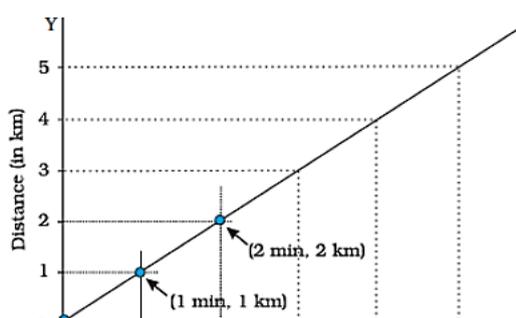
Choosing the scale

2. Mark the values of time and distance in the graph.
3. Mark the set of values of time taken and distance covered in that time by the object in the graph.
For example, if 1 km is covered in 1 minute, then mark 1 unit on both the x-axis and y-axis.



Marking the values for time and distance

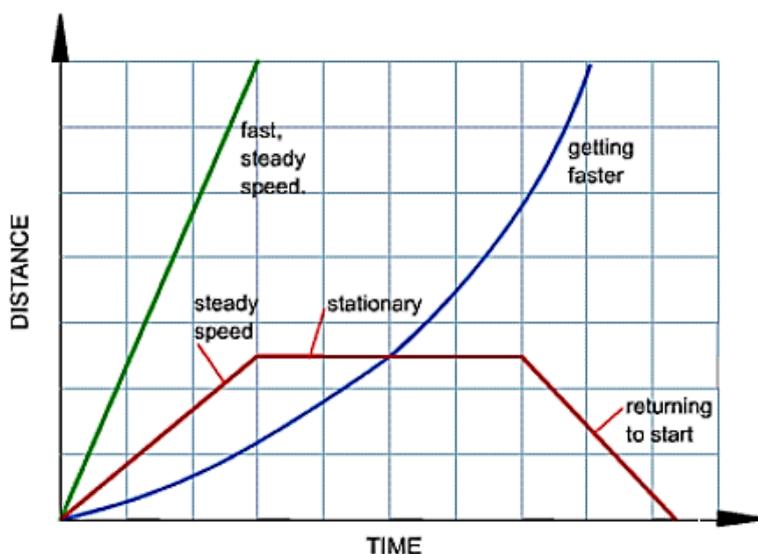
4. Now, draw lines parallel to the x-axis and y-axis at the points that you have marked.
5. Mark the points where these lines intersect on the graph. These points show the position of the moving object.
6. Now, join all the points of intersection and obtain a straight-line graph.
7. This is the distance-time graph of a moving object.



- **Obtaining a straight line graph**

- The shape of the distance-time graph can be the following:

Shape of Graph	Interpretation
Straight line	The object has a uniform or constant speed
Parallel to time-axis	It is a stationary object
Curve shape	The object has a non-uniform speed



Distance-time Graphs

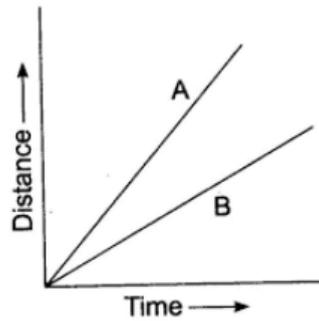
- **To find the speed of the distance-time graph**

$$\begin{aligned}
 \text{Speed} &= \frac{\text{distance}}{\text{time}} \\
 &= \frac{\text{final position of object} - \text{initial position of object}}{\text{time taken by object}}
 \end{aligned}$$

Also, the speed of the distance-time graph can be calculated by the **slope** of a graph.

The steeper the slope of the graph, the more is the speed of the object.

For example, in the graph given below, object A has a steeper slope. This means that object A is moving at a higher speed than object B.



Distance-time graph of two objects