9
Chapter

Motion and Time

We'll cover the following key points:

- Time
- Types of Motion
- Speed
- Distance-Time Graph

Hi, I'm EeeBee

Do you Remember:

Fundamental concept in previous class.

In class 6th we learnt
- Measurement of Length
- Motion and its Types

Still curious? Talk to me by scanning the QR code.

Learning Outcomes

By the end of this chapter, students will be able to:

- Students will understand the concept of time and its importance in measuring motion.
- They will be able to distinguish between different types of motion, such as uniform and non-uniform motion.
- Students will learn how to calculate speed and interpret distance-time graphs.
- They will gain insights into how these concepts are applied in real-life scenarios, such as travel and sports.

Guidelines for Teachers

To introduce the chapter, the teacher can begin by asking students how they measure time and observe motion in everyday life, such as the movement of vehicles or athletes running a race. This can lead into a discussion about types of motion and how time plays a critical role in describing it. Using visual aids like stopwatches, pendulums, or animations of objects in motion can help students grasp the concept better. Demonstrating a simple activity, like rolling a ball and measuring its speed using distance and time, will make the topic relatable.

For distance-time graphs, the teacher can use graph paper or software to plot real-time data collected from a moving object, making the learning experience interactive.

NCF Curricular Goals and Competencies

This chapter addresses the following curricular goals and competencies:

- **CG-7 (C-7.1):** Students communicate their own questions, observations, and conclusions related to science.
- **CG-7 (C-7.2):** Explains processes related to motion, time, and graphical representation.

Mind Map

MOTION AND TIME

Slow or fast

The distance moved by objects in a given interval of time can help us to determine the fast or slow motion.

Measurement of time

Day : Time between sunrise and the sunset.

Month : One new moon to the next.

Year : Fixed time taken by the earth to complete on revolution of the sun.

Clocks or Watchers : Measure hour, minute and second.

Units

Time : Measured by

Clock ⟶ Second

Speed : Measured by

Speedometre ⟶ m/s^{-1}

Distance : Measured by

Odometer ⟶ metre

Speed

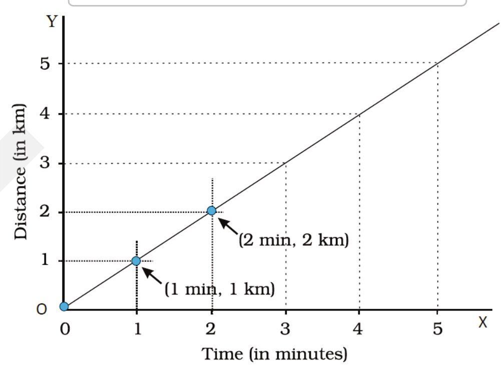
Distance covered by an object in a unit time

$$\text{Speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

Type of motion

- The action or process of moving or being moved.
- **Uniform motion :** Object moving along a straight line with a constant speed.
- **Non - Uniform motion :** Speed of an object moving along a straight line keeps changing.

Distance-time graph



Based on NCERT*

Time

The teacher is holding a stopwatch and a pendulum.

Time is the duration in which things occur. The knowledge of time is essential for carrying on our daily life activities. For example, our school starts at a particular 'time'. We use our wrist watch to know the time so that we may reach the school on time. Similarly, we need to know the time to catch a bus, a train or an aeroplane for making a journey. We also have to know the time to listen to a particular radio programme or to watch a favourite television programme. We measure time with the help of clocks and watches.

In History...

- **Galileo Galilei:** Studied motion and time using pendulums and inclined planes.
- **Isaac Newton:** Established the three laws of motion, which are fundamental to understanding motion and speed.
- **Christian Huygens:** Invented the pendulum clock to measure time accurately.
- **Albert Einstein:** Revolutionized the understanding of time and motion through his **theory of relativity**.
- **Marie Curie:** Applied principles of motion in her research on **radioactive decay**.

KEYWORDS

Theory of Relativity: Einstein's theory explains the interrelation between space, time, and gravity, revolutionizing our understanding of the universe.

Radioactive Decay: A natural process where unstable atomic nuclei emit radiation, transforming into more stable forms over time.

Measurement of Time in Ancient Times

Long, long ago, people did not have clocks or watches for measuring time. But people realised the importance of time. Our **ancestors** used some natural events which repeated regularly after definite intervals of time to measure the time.

For example,

- The time taken between one sunrise to the next sunrise was called 'day'.
- The time taken between one new moon to the next new moon was called 'month'.
- The time taken by the earth to complete **one revolution** of the Sun was called a 'year'.

Some of the important time measuring devices used in ancient times were: sundial, sand clock and water clock.


Sand Clock

Sundial


Water clock

1. Sundial : Sundial is one of the earliest devices used to measuring time. A sundial measures time by the position of the **shadow** cast by the Sun. The sundial has a triangular blade which is fixed vertically on a dial marked with hours of the day. The Sun casts a shadow of this vertical blade on the dial.

As the position of Sun changes in the sky, the position of the shadow of the blade on the dial also changes. The position of the shadow of the vertical blade on the dial gives the time of the day.


Jaipur's Jantar Mantar

KEYWORDS

Ancestors: Our ancestors laid the foundation of our existence by passing down knowledge, culture, and traditions. Understanding our ancestors helps us connect with our roots and appreciate our heritage.

One Revolution: One revolution of Earth around the Sun takes approximately 365.25 days, defining a year. The Moon's revolution around the Earth causes the phases of the Moon, influencing tides and calendars.

Shadow: A shadow is formed when an object blocks the path of light, creating a dark shape behind it. Shadows can change size and direction depending on the position of the light source.

2. Water Clock : Water clock was yet another time measuring device used in ancient times. A water clock uses the rate at which water drips from one vessel to another to measure time intervals. Water was allowed to drip from one vessel to another vessel kept at a lower level. The time taken by the entire water to dip from the upper vessel to the lower vessel was used for measuring time intervals. Every time the upper vessel is filled with water, its water takes exactly the same time to drip into the lower vessel.

3. Sand Clock : Another early device for measuring time was the sand clock. Sand clock is also known as sand-glass or hour-glass. The sand clock uses the flow of sand to measure time. The length of time taken by the sand to pass from one bulb of the sand clock to other, gives a constant time, interval.

A sand clock consists of two glass bulbs joined together through a narrow tube. Some sand is filled in one of the glass bulbs. The two glass bulbs are close at the outer ends.

4. Candle Clock : It uses a candle with nails inserted into it at fixed gaps. The candle is kept on a metal plate. When the candle burns to the point where the nail is fixed; the nail falls on the metal plate, producing a sound. This happens at regular intervals.

All these instruments were not able to give accurate time. The need for accurate time measurement, therefore, led to the invention of mechanical clocks.

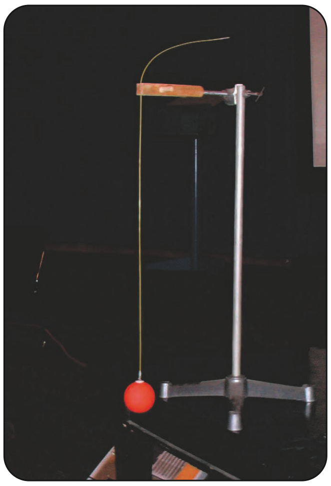
Mechanical clocks were built in tall towers as the weights needed space to fall or move downwards. These clocks worked for a short period of time only (maximum for two hours). In 1656, Christiaan Hugens, a Dutch mathematician and physicist, invented the first pendulum clock which measured time using the periodic motion.

Did you know?

Galileo was the first to experiment with pendulums and find out their unique characteristics that could be used to measure time.

Simple Pendulum

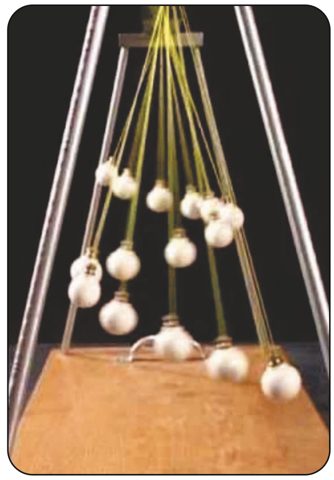
Let us learn some more about a simple pendulum. It contains a small mass, called bob, suspended from a fixed point through a long string or rod. The mass moves freely under gravity. The motion of a pendulum is called oscillatory motion. When the bob of the pendulum moves from one point, goes on the opposite side and the comes back to its original position, it is said to complete on oscillation.



Simple Pendulum

The time taken by the pendulum to complete one oscillation is called its time period. It is interesting to know that for small displacements the time period of a simple pendulum remains constant. The time period is independent of the mass of the bob. The time period of a pendulum depends upon the length of the string from which the bob is suspended. Longer the string, greater is the time period.

Earlier, clocks were based on the oscillation and constant time period of a simple pendulum.



Galileo Simple Pendulum

Now, we define certain terms related to the study of a simple pendulum.

- **Length of the pendulum :** The length of the string (thread) from the point of suspension to the centre of the bob is called the length of the pendulum.
- **Mean position of the bob :** The position of the bob when it is at rest is called its mean position.
- **Extreme positions of the bob :** The positions where the bob is the maximum distance from the mean position are called the extreme positions.
- **Oscillation of the pendulum :** The motion of the bob of a pendulum from one extreme position to the other extreme position and back is called an oscillation of the pendulum. For example, in the motion of the bob from its extreme position to another extreme position and back to the previous extreme position, is called an oscillation.
- **Amplitude of pendulum:** As the pendulum oscillates to-and-fro, the maximum displacement of the bob from its mean position on either side is called the amplitude of pendulum.
- **Time period of the pendulum:** The time taken by the bob of a pendulum to complete one oscillation is called the time period of the pendulum.

Activity

Aim : to determine the time period of a pendulum.

Materials Required : A metal ball (bob), a string of length one metre, an iron stand, a stopwatch.

Method:

- Set up a simple pendulum as shown in with a string or thread of length one metre carrying the bob at lower end and tied at its upper end from a rigid support (like iron stand).
- Switch off the nearby fans.

- Let the bob of the pendulum come to rest at its mean position. Mark the position of the bob on the floor below it.
- To set the pendulum in motion, hold the bob gently and move it slightly to one side.
- Now, release the bob from its displaced position gently. Do not push the bob while releasing it. Ensure that the bob does not spin on its axis while oscillating.
- Start the stop watch when the bob is at one of the extreme positions. Keep on counting the number of oscillations made by the pendulum bob.
- Measure the time taken by the pendulum bob to make 20 complete oscillations. Divide the time taken for 20 oscillations by 20. This will give us the time taken by pendulum for making one oscillation. It is the time period of the pendulum.

Calculations : Time taken for 20 oscillations = 48 seconds

∴ Time taken for 1 oscillations = 2.4 seconds

∴ Time period of this pendulum is 2.4 seconds.

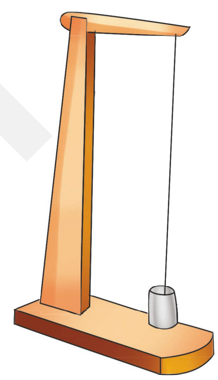
Numerical: A simple pendulum takes 32 seconds to complete 20 oscillations. What is the time period of this pendulum?

Solution:

Time taken for 20 oscillations = 32s

So, time taken for 1 oscillations = 1.6s

Thus, the time period of this pendulum is 1.6 seconds.



Time Period Of Pendulum

Latest Trend in Measurement of Time

Quartz is a hard mineral consisting of silica. These days, most of us use quartz clocks and watches. These watches measure time accurately. So, most of the accurate clocks and watches these days use quartz, crystals for measuring time. The clocks and watches which uses quartz crystal for their working are called quartz clocks and quartz watches.

Quartz has a unique property of oscillating when subjected to a small amount of electric current. In these, watches, an electric cell and a quatz crystal are placed in an electric circuit.

For measuring short interval of time, a stop watch is used. It can be made to start or stop with the help of a push-button and is used to measure timings at sports events. It can measure one-tenth of a second.

Unit of Time

The standard unit of measuring time is second, and is written as ‘s’. The large units of time are minutes and hours written as ‘min.’ and ‘h’.

Some units and their conversions are as follows:

60 seconds = 1 minute

60 minutes = 1 hour

24 hours	= 1 day
30 days	= 1 month
12 months	= 1 year
10 years	= 1 decade
100 years (or 10 decades)	= 1 century
1000 years (or 10 centuries)	= 1 millennium

Let's recall what we know

SCAN TO ACCESS

Take a Task

Watch Remedial

Apply Concept in Context

Apply

- Why is time an important factor in understanding motion? Provide examples of situations where accurate time measurement is essential.
- How has the invention of clocks and timers improved our understanding of motion and speed?

Skills Covered: Critical thinking, Applicative thinking, Brainstorming

Examine Further

Analyse

What will happen if the measurement of time is inaccurate in activities such as sports, transportation, or scientific experiments?

Skills Covered: Critical thinking, Analytical thinking, Brainstorming, Research, Investigation

Self-Assessment Questions

Evaluate

- What is time, and how is it measured?
- How do tools like stopwatches and clocks help in measuring time?
- What is the role of time in understanding motion?
- How has the concept of time evolved with technological advancements?

Skills Covered: Research, Observation, Recall

Creative Insight

Create

Time measurement is fundamental to understanding motion. By observing events over a period and recording their duration, we can describe and predict motion patterns.

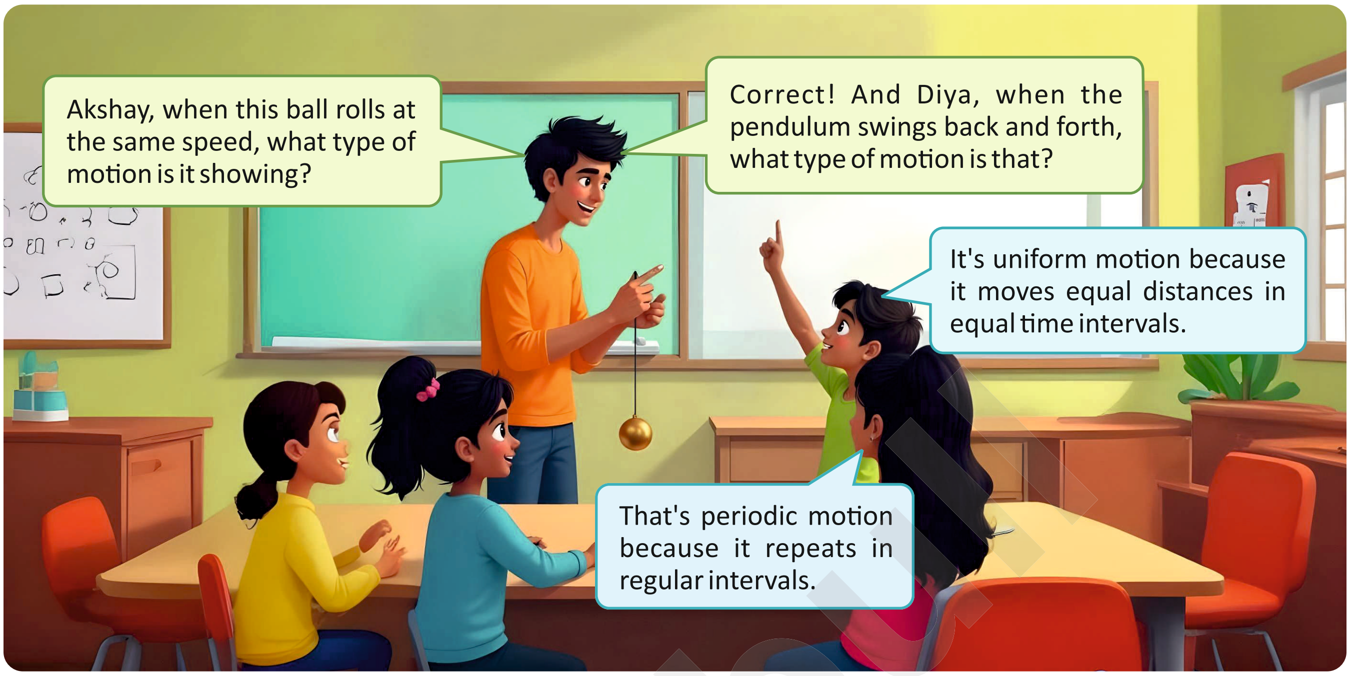
Task: Create a timeline showing the evolution of time measurement tools, from sundials to atomic clocks, and explain how each contributed to advancements in science.

Skills Covered: Research, Creativity, Observation, Brainstorming

Bloom's Taxonomy

Types of Motion

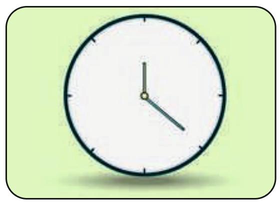
The teacher is holding a rolling ball and a pendulum.



An object is said to be moving, if it changes its position with respect to a fixed point or object with time. Also, an object is said to be at rest, if it does not change its position with respect to a fixed object or a fixed point with time. Motion and rest are relative terms.

- **Rectilinear Motion :** Motion in a straight line is called rectilinear motion. The motion of a bicycle moving on a straight road is rectilinear motion or motion along a straight line.

- **Rotational Motion :** When an object turns (or spins) about a fixed axis, it is called rotational motion. The earth turns round and round on its axis like a spinning top, so the spinning of earth on its axis is an example of rotational motion.



- **Circular Motion :** A round path having the shape of a circle is called circular path. When an object moves along a circular path, it is called circular motion. For example, the earth moves around the Sun in a circular path (or circular orbit), so the motion of the earth around the Sun is a circular motion.

- **Periodic motion :** The motion which repeats itself after regular intervals of time, is called periodic motion. Periodic motion is also called oscillatory motion. The swinging of a pendulum is an example of periodic motion. Some other examples of periodic motion are motion of a swing, motion of hands of an athlete while running a race, motion of a child on a see-saw.

Uniform and Non Uniform Motion

Suppose, an object say a car or a bike keeps on moving only one way along a straight line path. If it keeps on covering equal distances in equal interval of time, its speed remains constant. We call the motion of such an object a uniform motion. Thus, an object moving along a straight line path is said to have a uniform motion, if its speed remains constant. But this may not actually be possible in day-to-day situations due to heavy traffic, bad roads, etc. Thus, in real situation, we hardly find bodies moving at uniform motion.

An object moving along a straight line path is said to have non-uniform motion if its speed keeps changing (it does not remain constant). An object having non-uniform motion travels 'unequal distances' in equal intervals of time, or 'equal distances' in unequal intervals of time. If we calculate the speed of the train for various distances, we will realise that the train has not travelled at the same speed. So, the motion of the train is called Non-uniform motion.

Let's recall what we know

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

Apply Concept in Context

Apply

- How can we identify whether an object is in rotational or circular motion? Provide examples.
- Why are different types of motion observed in nature and technology?

Skills Covered: Critical thinking, Applicative thinking, Brainstorming

Examine Further

Analyse

What will happen if a vehicle switches from uniform to non-uniform motion frequently during a journey? How would it affect time and distance calculations?

Skills Covered: Critical thinking, Analytical thinking, Brainstorming, Research, Investigation

Self-Assessment Questions

Evaluate

- What are the main types of motion?
- How does periodic motion differ from circular motion?
- Provide examples of uniform and non-uniform motion from daily life.

Skills Covered: Research, Observation, Recall

Creative Insight

Create

Motion can be uniform, non-uniform or periodic. Each type serves a purpose in different scenarios, from machines to natural phenomena.

Task: Create a flowchart or mind map showing the types of motion, their definitions, and examples from daily life.

Skills Covered: Research, Creativity, Observation, Brainstorming

Speed

The teacher rolls two toy cars on a table at different speeds.

Slow moving fan is less effective on a summer evening while a fast moving fan is able to circulate more air in a room. If you have to travel to a distant city as quickly as possible, you will definitely prefer an aeroplane than a train or a car, for a simple reason that the aeroplane than a train or a car, for a simple reason that the aeroplane travels faster than a train or a car. Slow moving air is called a **breeze** and is pleasant to feel, while fast moving air causes **storms** and **tornados**, which are disastrous.

This example clearly indicates that to know precisely how fast or slow an object is moving, we need to measure the:

- Distance travelled by the body.
- Time taken to travel this distance.

Suppose a car travels distance of 100 kilometres in 4 hours. The speed of this car is given by:

This example clearly indicates that to know precisely how fast or slow an object is moving, we need to measure the:

- Distance travelled by the body.
- Time taken to travel this distance.

$$\text{Speed} = \frac{\text{100 kilometres}}{\text{4 hours}}$$

Suppose a car travels distance of 100 kilometres in 4 hours. The speed of this car is given by:

Note that m/s is the SI unit of speed. The speed of an object is usually not constant and the distance travelled divided by time gives us the average speed during that time. When the road is straight, flat and free, the speed may be much more than 25 km per hour but on bends, hills or in a crowded area, the speed may fall well below this average value.

We have just studied that the formula for calculating the speed of a moving object is:

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

We can rearrange this formula and get two other relations for calculating the 'Distance travelled' and 'Time taken' as follows:

- One relation obtained by rearranging the speed formula is:

  Distance travelled = speed × time taken

- Another relation obtained by rearranging the speed formula is:

$$\text{Time taken} = \frac{\text{Distance travelled}}{\text{Speed}}$$

Units of Speed

- The standard unit of distance is metre (m) and that of time is the second (s). So, the standard unit of speed is metre per second or m/s.
- Another unit of speed is metres per minute (metres/minutes) which is written in short form as m/min.

Speedometer and Odometer

An instrument on a vehicle's dashboard which indicated the speed of the vehicle when it is running, is called speedometer.

The speedometer has the symbol 'km/h' written on its dial. Most of the vehicles have needle type speedometers but these days vehicles are also coming with digital speedometes. In a vehicle, there is also an instrument called odometer. Odometer is an instrument of measuring the distance travelled by a vehicle. Odometer records the distance travelled by a vehicle in kilometres. The meter fitted on the top of the handles of scooters and motorcycles have in built speedometer and odometer.

Speedometer

KEYWORDS

Breeze: A gentle and light movement of air, typically caused by the uneven heating of the Earth's surface.

Tornadoes: A rapidly spinning column of air extending from a thunderstorm to the ground, caused by strong atmospheric pressure differences and wind shear.

Storms: A violent atmospheric disturbance involving strong winds, often accompanied by rain, thunder, lightning, or snow, caused by the rapid upward movement of air.

Numerical 1: Roma walked a distance of 270 meters from her home to a park in 3 minutes. What was her speed during this walk?

Odometer + speedmeter

Sol : Distance (s) = 270 m

Time (t) = 3 min.

= $3 \times 60\,s = 180\,s$

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

$\therefore$ v = $\frac{270}{180}$

$\therefore$ v = 1.5m/s

Numerical 2: Pooja walked a distance of 600 meters from her home to a park in 5 minutes. What was her speed during this walk?

Sol : Distance (s) = 600 m

Time (t) = 5 min.

= $5 \times 60\,s = 300\,s$

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

$\therefore$ v = $\frac{600}{300}$

$\therefore$ v = 2m/s

Let's recall what we know

Apply Concept in Context

Apply

- Why is speed an important concept in transportation? Give examples.
- How would you calculate the speed of an athlete running a 100-meter race in 12 seconds?

Skills Covered: Analytical thinking, Problem-solving

Examine Further

Analyse

If a vehicle's speed changes frequently during a journey, how will that affect the total time taken and the average speed?

Skills Covered: Critical thinking, Analytical thinking, Research

SCAN TO ACCESS

Take a Task

Watch Remedial

Self-Assessment Questions

Evaluate

- What is speed, and how is it calculated?
- Differentiate between average speed and instantaneous speed.
- Provide examples of situations where speed measurement is crucial.
- How do speedometers in vehicles measure speed?

Skills Covered: Research, Recall, Application

Creative Insight

Create

Speed connects distance and time, and understanding it can improve efficiency in travel and work.

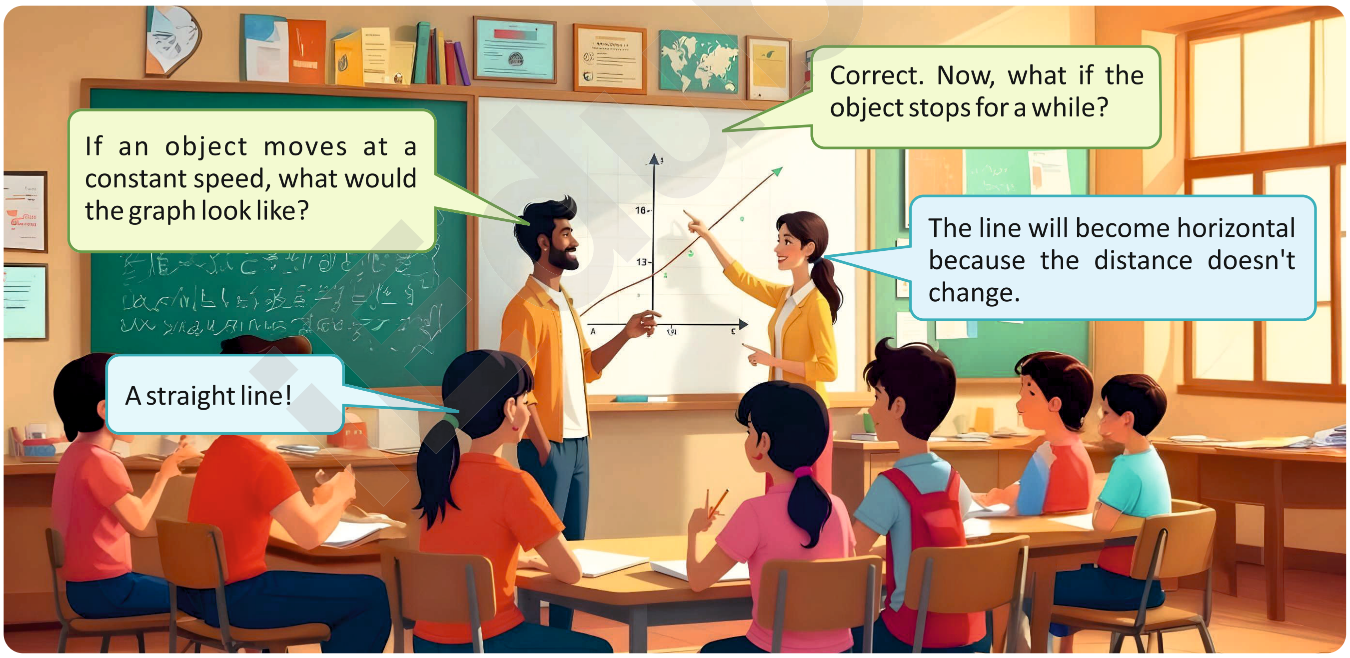
Task: Design an experiment to measure the speed of a rolling ball. Record the distance covered and the time taken, and calculate the speed.

Skills Covered: Experimentation, Observation, Problem-solving

Bloom's Taxonomy

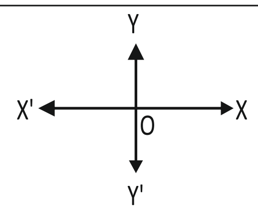
Distance-Time Graph

The teacher draws a distance-time graph on the board.



A graph is a diagrammatic representation, depicting an interrelation between two quantities.

A graph consists of two perpendicular lines meeting at a common point. The common meeting point O is known as the origin of the graph, while the perpendicular lines are known as the axis of the graph.



Axis of a graph

As shown in the figure, the horizontal line X‘OX is commonly known as the X-axis and the vertical line YOY’ is known as the Y-axis of the graph. The value of two interrelated quantities are represented on one of the two axes respectively. An appropriate scale is chosen to represent the values of the two given quantities. The values of two given quantities presented in a tabular form are known as data.

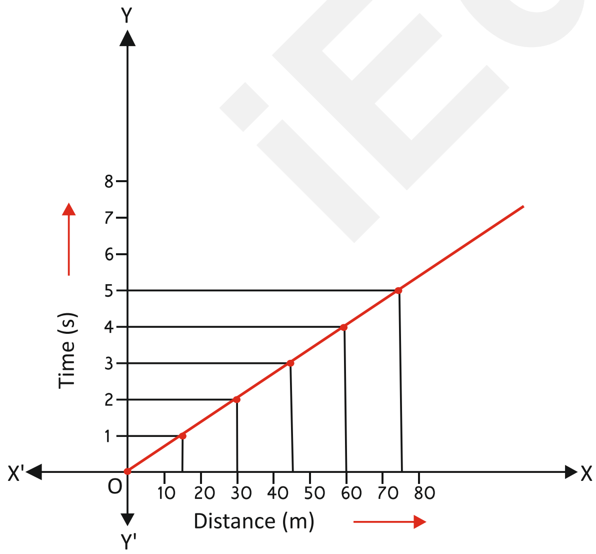
Time taken	Distance travelled
0 s	0 m
1 s	15 m
2 s	30 m
3 s	45 m
4 s	60 m
5 s	75 m

Time taken	Distance travelled
0 min	0 m
1 min	2 m
2 min	3.5 m
3 min	4 m
4 min	6.5 m
5 min	9 m

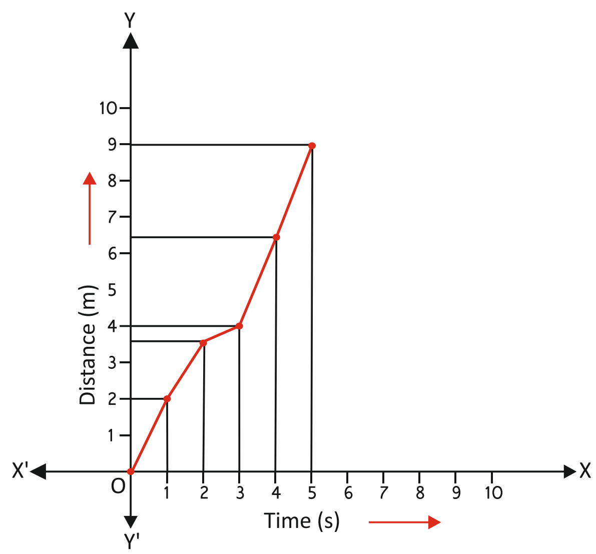
The graph obtained for this example is a straight line. If you study the above table of observations, you will find that the distance covered by the motorcyclist is equal (15m) in every second. This also indicates that the motorcyclist did not change its speed during his journey. Such a motion is called uniform motion.

If an object covers equal distances in equal intervals of time, the object is said to be in a uniform motion.

The distance-time graph for a body moving with uniform motion is a sloping straight line.



Graph showing the data given in the table



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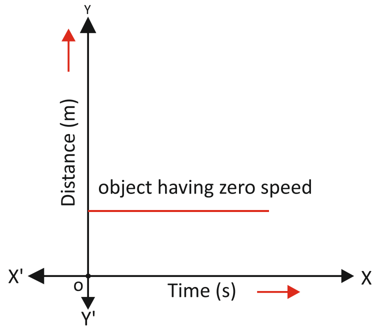


Graph for zero-speed object

The distance-time graph for an object with non uniform motion is a curved line.

For a body with zero speed, the distance-time graph is shown as a horizontal line, parallel to the time axis.

Let's recall what we know

Apply Concept in Context

Apply

- Why are distance-time graphs important for analyzing motion?
- How would you describe the motion of an object if its graph shows a curved line?

Skills Covered: Analytical thinking, Graph interpretation

Examine Further

Analyse

What do the slope and shape of a distance-time graph indicate about an object's motion?

Skills Covered: Critical thinking, Graphical analysis

Self-Assessment Questions

Evaluate

- What information can you derive from a distance-time graph?
- How does the slope of the graph relate to the speed of the object?
- Sketch a distance-time graph for the following scenario: A car starts,stops for 5 minutes, and then moves again at a faster speed.

Skills Covered: Recall, Application, Creativity

Creative Insight

Create

Distance-time graphs visually represent motion, helping us predict and analyze patterns.

Task: Observe and record the motion of a bicycle on a road. Plot the data on a graph and describe its motion.

Skills Covered: Observation, Experimentation, Graphical representation

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

SUMMARY

Time

Definition: Time is a measurable period during which events occur in a sequence. It is a fundamental aspect of understanding motion and is measured in seconds, minutes, hours, etc.

Key Characteristics:

- Measured using instruments like clocks and stopwatches.
- Essential for determining speed, acceleration, and other aspects of motion.
- The SI unit of time is the second (s).

Examples:

- Observing the time taken for a pendulum to complete one swing.
- Measuring the duration of a car journey.

Types of Motion

Motion is the change in the position of an object with respect to time.

- **Rectilinear Motion:** Movement in a straight line (e.g., a car moving on a straight road).
- **Circular Motion:** Movement along a circular path (e.g., hands of a clock, motion of the Earth around the Sun).
- **Periodic Motion:** Motion that repeats at regular intervals (e.g., a pendulum, a vibrating string).
- **Rotational Motion:** Spinning motion of an object about its axis (e.g., rotation of a top).

Speed

Speed is the distance traveled by an object per unit of time. It is a scalar quantity and does not indicate direction.

Formula:

Speed = Distance /Time

Key Characteristics:

- Measured in meters per second (m/s) in the SI system.
- Can be uniform (constant speed) or non-uniform (varying speed).
- Speedometers measure the instantaneous speed of vehicles.

Examples:

- A cyclist covering 20 km in one hour has a speed of 20 km/h.
- An airplane traveling at a constant speed of 900 km/h.

Distance-Time Graph

A graph that represents the motion of an object, showing how distance changes with time.

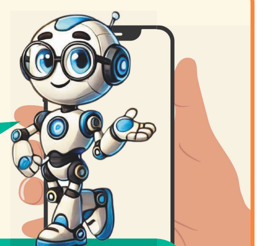
Key Characteristics:

- The x-axis represents time, while the y-axis represents distance.
- A straight line indicates uniform motion.
- A curved line indicates non-uniform motion.
- A horizontal line represents an object at rest.

EeeBee: Your AI Buddy

Explore! Motion and Time with EeeBee AI Buddy.

Hi Friend! Use prompts to ask me questions about the chapter we just finished! eeee, lets go!



Start by Scanning this QR Code:

Gap Analyzer™
Take a Test

EXERCISE

That turn curiosity into confidence—let's begin!

A. Choose the correct answer.

1. What is the SI unit of time?
   (a) Hour ☐ (b) Minute ☐
   (c) Second ☐ (d) Day ☐
2. Which of the following represents circular motion?
   (a) A car moving on a straight road ☐ (b) The hands of a clock ☐
   (c) A person running on a track ☐ (d) A ball rolling down a slope ☐
3. The speed of an object is determined by the formula:
   (a) Distance × Time ☐ (b) Time ÷ Distance ☐
   (c) Distance ÷ Time ☐ (d) Speed × Distance ☐
4. A horizontal line on a distance-time graph indicates:
   (a) Uniform motion ☐ (b) Non-uniform motion ☐
   (c) No motion ☐ (d) Accelerated motion ☐
5. Which of the following is an example of periodic motion?
   (a) A bird flying in the sky ☐ (b) A pendulum swinging ☐
   (c) A car moving in a straight line ☐ (d) A person walking on a road ☐

B. Fill in the blanks.

1. The SI unit of speed is ________ per second.
2. Motion in a straight line is called ________ motion.
3. A clock measures the ________ taken for an event to occur.
4. A pendulum shows ________ motion as it repeats its movement.
5. The slope of a distance-time graph represents the ________ of an object.

C. Write True or False.

1. Speed is equal to Time/Distance. ________
2. Circular motion is always non-uniform. ________
3. A distance-time graph with a steep slope indicates high speed. ________
4. The S.I. unit of time is second. ________
5. Periodic motion occurs at irregular intervals. ________

D. Define the following terms.

1. Time
2. Motion
3. Speed
4. Distance-Time Graph
5. Periodic Motion

E. Match the columns.

Column A	Column B
1. Time	(a) Change in position over time
2. Rectilinear Motion	(b) Movement in a straight line
3. Circular Motion	(c) Motion along a circular path
4. Speed	(d) Distance ÷ Time
5. Distance-Time Graph	(e) Graph showing motion

F. Give reasons for the following statements.

1. A pendulum is an example of periodic motion.
2. A distance-time graph helps analyze the motion of an object.
3. Measuring time accurately is essential for studying motion.
4. Speed is a better measure of motion than distance.
5. Uniform motion creates a straight line on a distance-time graph.

G. Answer in brief.

1. What is uniform motion? Give an example.
2. How is speed calculated?
3. Differentiate between circular and rotational motion.
4. Why is a clock important in the study of motion?
5. What information can we gather from a distance-time graph?

H. Answer in detail.

1. Describe the different types of motion with suitable examples.
2. Explain the concept of speed, including its calculation and units.
3. Discuss the importance of distance-time graphs in understanding motion.
4. Describe the role of time measurement in studying motion.
5. Compare periodic and non-periodic motion with examples.

NEP Corner Know about NEP 2020

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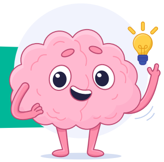
Assessments are now competency-based, focusing on your actual understanding, problem-solving skills, and critical thinking.

Skill-based Activity



Measuring Speed

STEM

Perform the given activity to understand how speed is calculated.

You will need a toy car, a stopwatch, and a ruler.

1. Mark a straight track of 1 meter.
2. Use the stopwatch to measure the time taken by the car to travel the distance.
3. Calculate the speed using the formula:

   Speed = Distance / Time

4. Repeat with different distances and times.

Now, answer the following questions:

1. What is speed? How is it measured?
2. How does time taken affect the speed of an object?
3. How is this activity useful in real-life situations?

Skills Covered: Observation, Analytical thinking, Logical thinking, Brainstorming

Types of Motion Model

Art

Create a 3D model representing different types of motion using craft materials:

- Use materials like clay and wires to show examples of rectilinear, circular, periodic, and rotational motion.
- Label each motion type and provide real-life examples.
- Present your model and explain the characteristics of each motion type.

Skills Covered: Creativity, Analytical thinking, Organization, Brainstorming

Distance-Time Graph Exploration

Group Activity

1. Collect data on the movement of different objects (e.g., walking, cycling).
2. Plot the distance-time graph for each object.
3. Analyze the graphs to identify uniform and non-uniform motion.

Skills Covered: Critical thinking, Logical thinking, Brainstorming, Collaboration

Factors Influencing Speed

Case to Investigate

Investigate how different factors affect the speed of a moving object:

Factors	Data Collected
Surface type	
Weight	
Slope	

Compile your findings and present them in a report.

Skills Covered: Critical thinking, Research, Investigation, Communication

Understanding Motion and Speed (Physics in Action)

Aligning with SDGs

Research a program or initiative that focuses on innovations in transportation or mechanics to optimize motion and speed. Highlight its key features and how it contributes to advancements in physics and technology. Present your findings to the class.

Aligned with: SDG 4 – Quality Education, SDG 9 – Industry, Innovation, and Infrastructure

Skills Covered: Critical and logical thinking, Brainstorming, Research, Problem-solving, Analytical reasoning

Skills Covered: Global awareness, Critical thinking, Research, Analytical thinking, Problem-based thinking

Designing a Speed Tracking System

Integrated Learning

Use your knowledge of motion and speed to design a system for tracking the speed of a moving object (e.g., a bike or car):

1. Identify tools (e.g., sensors, timers).
2. Create a sketch of your system and label its components.
3. Explain how your design could be used in real-world applications.

Skills Covered: Applicative thinking, Critical thinking, Research, Problem-solving