Measurement of Time and Motion

(From Class 7 – NCERT Curiosity)

Time helps us know how long something takes, and **motion** helps us know how things move.

Measurement of Time

Time is the duration between two events.

Units of Time

Second (s)	Minute (min)	Hour (h)	Day (day)	Week (week)
			365	7

Measuring Time

- Use a clock, watch or stopwatch.
- Measure longer durations in hours, days, weeks, months and years.
- 1 minute = 60 seconds
- 1 hour = 60 minutes = 3600 seconds
- 1 day = 24 hours

Measurement of Motion

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

Units of Motion

- **Speed** – how fast an object moves.
- **Velocity** – speed in a given direction.
- **Acceleration** – increase in velocity.

Measuring Motion

- Use a speedometer to measure speed in a vehicle.
- Speed = Distance ÷ Time
- Units: m/s, km/h

Key Points

- Time is measured in seconds, minutes, hours, etc.
- Motion is change in position.
- Speed = Distance ÷ Time
- Velocity includes direction.
- Acceleration is increase in speed.

In Everyday Life

We use clocks to know time.

Trains move with speed.

Cycling shows motion.

Cars move with high velocity.

Measurement of Time

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Chapter: Measurement of Time and Motion

1. How Did Humans Measure Time in Ancient Days?

Long ago, humans did not have clocks or watches. They observed **natural events** to keep track of time.



Important Observations:

- Rising and setting of the Sun.
- Phases of the Moon.
- Changing seasons.





- Repeated natural events helped humans understand the
- Calendars were developed to keep track of days and longer periods.

2. Sundial



How does it work?

A sundial measures time using the changing position of the shadow of an object cast by sunlight.

- Works using sunlight.
- The shadow changes its position during the day.
- The position of the shadow indicates the time.

3. Water Clock

Water clocks measure time using the flow of water into or out of a vessel.

1. Water Flowing-Out Type



- Water flows out of a vessel.
- Markings indicate the passage of time as the water level changes.

2. Floating Bowl Type



- A bowl with a small hole at the bottom floats on water.
- Water gradually enters through the hole.
- The bowl fills up and finally sinks.
- It is lifted and floated again.

4. Hourglass



How does it work?

- Measures time through the flow of sand.
- Sand flows from one bulb to another through a narrow opening.
- The time taken for the sand to flow indicates a fixed interval.

5. Candle Clock



How does it work?

- A candle is marked at regular intervals.
- As the candle burns, its length decreases.
- The markings indicate the passage of time.

6. Fascinating Fact

SAMRAT YANTRA – THE GIANT SUNDIAL

- Located at Jantar Mantar, Jaipur, Rajasthan.
- It is one of the world's largest stone sundials.
- It is an important astronomical instrument.



7. Quick Revision

Instrument	Principle
Sundial	Movement of shadow
Water Clock	Flow of water
Hourglass	Flow of sand
Candle Clock	Burning of candle

Remember:

Different instruments were developed by humans to measure different intervals of time before modern clocks and watches became common.

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SIMPLE PENDULUM & MEASUREMENT OF TIME

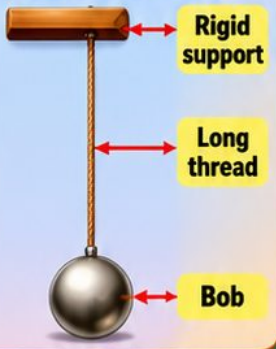
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Chapter: Measurement of Time and Motion

1. What is a Simple Pendulum?

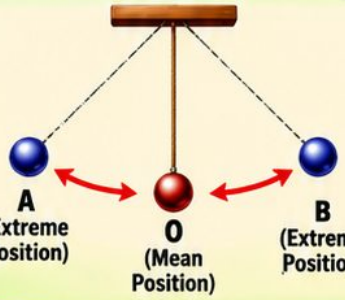
A simple pendulum consists of:

- A small metallic ball called the **BOB.**
- A long thread.
- A rigid support from which the thread is suspended.



2. How Does a Pendulum Move?

When the bob is moved slightly to one side and released, it starts moving to and fro.

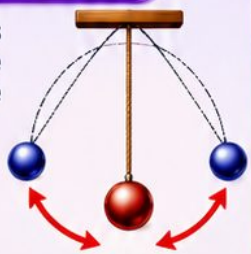


Oscillatory Motion: The repeated to-and-fro motion of an object about its mean position.

Periodic Motion: Motion that repeats itself after equal intervals of time.

3. What is One Oscillation?

One complete oscillation occurs when the bob moves from one position and returns to the same position in the same direction.



Example:

O → A → O → B → O

Also, A → B → A represents one oscillation.

4. Time Period of a Pendulum

The time taken by a pendulum to complete one oscillation is called its **TIME PERIOD.**

- **Symbol: T**
- **SI unit: Second (s)**



Time Period = Time Taken ÷ Number of Oscillations

5. What Affects the Time Period?

Experiment 1: Changing the Length



- The time period depends on the length of the pendulum.
- A longer pendulum takes more time.

Experiment 2: Changing the Mass of the Bob



- The time period does NOT depend on the mass of the bob.

IMPORTANT FACT:

At a given location, all simple pendulums of the same length have the same time period.

6. How Do Clocks Work?

All clocks, old or modern, are based on some process that repeats continuously.



7. Modern Clocks

Quartz Clocks

- Use vibrations of a quartz crystal.
- Help measure time accurately.



Atomic Clocks

- Use specific atomic processes.
- Are extremely accurate.



8. SI Unit of Time

The SI unit of time is the SECOND.

- Symbol of second : s
- Symbol of minute : min
- Symbol of hour : h

60 seconds = 1 minute
60 minutes = 1 hour
1 hour = 3600 seconds

Remember: Write s, not sec; h, not hrs; min, not mins.
Leave a space between the number and unit.

9. Fascianting Fact – Ghatika-Yantra

Ghatika-Yantra was an ancient water clock.

- A small hole in a bowl allowed water to enter.
- It took 24 minutes for the bowl to fill and sink.
- A 24-hour day was divided into 60 equal *Ghatikas*.



10. Quick Revision

- Simple pendulum = Bob + Thread + Support.
- Oscillation = One complete to-and-fro motion.
- Time period = Time for one oscillation.
- Depends on length, not mass.
- SI unit = Second (s).
- 1 min = 60 s, 1 h = 60 min.
- Quartz & Atomic clocks are accurate.

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SLOW OR FAST? UNDERSTANDING SPEED

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Chapter: Measurement of Time and Motion

1. What do we mean by Slow or Fast?

- Objects can move at different speeds.
- Some objects move faster, while others move slower.
- We compare the distances travelled by objects in a given interval of time to decide which is faster.
- An object that covers more distance in the same time is moving faster.



A runner who covers more distance in the same time is running faster.

2. How do we Compare Speed?

Example 1: Same Time, Different Distances



Car A	Car B
100 m in 10 s	150 m in 10 s

Car B is faster because it covers more distance in the same time.

Example 2: Same Distance, Different Times



Bicycle A	Bicycle B
100 m in 20 s	100 m in 10 s

Bicycle B is faster because it takes less time to cover the same distance.

3. What is Speed?

Speed is the distance covered by an object in a unit of time.

- Speed tells us how fast or slow an object moves.
- Greater speed means an object covers more distance in the same time.
- We calculate speed using distance and time.



4. Formula for Speed

$$\text{SPEED} = \frac{\text{TOTAL DISTANCE COVERED}}{\text{TOTAL TIME TAKEN}}$$

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

- **Distance** = How far an object travels.
- **Time** = How long the object takes.
- **Speed** = Distance travelled per unit time.

5. SI Unit of Speed

- SI unit of length = metre (m).
- SI unit of time = second (s).
- SI unit of speed = metre per second (m/s).

SI UNIT OF SPEED = m/s

Metre (m) + Second (s) = Metre per Second (m/s)

6. Other Units of Speed

Speed can also be expressed in kilometres per hour.

Kilometre per hour = km/h

Examples:

- Cars: km/h
- Bicycles: km/h
- Running: m/s
- Vehicles: speedometer readings in km/h



7. Real-Life Examples



Running	Cycling	Car	Train

Different objects can have different speeds.

8. Quick Eevision

- Faster objects cover more distance in the same time.
- Slower objects cover less distance in the same time.
- Speed tells us how fast an object moves.
- Speed = Distance ÷ Time.
- SI unit of speed = metre per second (m/s).
- Another common unit = km/h.



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Relationship Between Speed, Distance and Time

Class 7 – NCERT Curiosity Science

Chapter: Measurement of Time and Motion

1. What is Speed?

Speed is the distance covered by an object in a unit of time.



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

2. Relationship Between Speed, Distance and Time

We can calculate any one of these if the other two are known.



1. To Find Speed: $S = \frac{D}{T}$
2. To Find Distance: $D = S \times T$
3. To Find Time: $T = \frac{D}{S}$

3. Solved Example 1 – Finding Distance

Problem:

Raghav travels in a bus at a speed of 50 km/h. If it takes him 2 hours to reach his destination, how far has he travelled?



Solution:

Distance = Speed × Time

= 50 × 2 = 100 km

Answer: 100 km

4. Solved Example 2 – Finding Time

Problem:

A train is travelling at a speed of 90 km/h. How much time will it take to cover a distance of 360 km?



Solution:

Time = Distance ÷ Speed

= 360 ÷ 90 = 4 h

Answer: 4 hours

5. Speedometer and Odometer

Speedometer

Measures and displays the speed of a vehicle. Usually shows speed in km/h.



Odometer

Measures the total distance travelled.

Displays the distance in km.



6. Other Units of Speed

Speed can also be expressed in kilometres per hour.

Kilometre per hour = km/h



Examples:

- Cars: km/h
- Bicycles: km/h
- Running: m/s

7. Key Points to Remember

- Speed = Distance ÷ Time
- Distance = Speed × Time
- Time = Distance ÷ Speed
- Greater distance in the same time means higher speed.
- Speed is measured in m/s or km/h.



Quick Revision!

- Speed = Distance ÷ Time
- Distance = Speed × Time
- Time = Distance ÷ Speed
- SI Unit of Speed = m/s
- Another Unit = km/h

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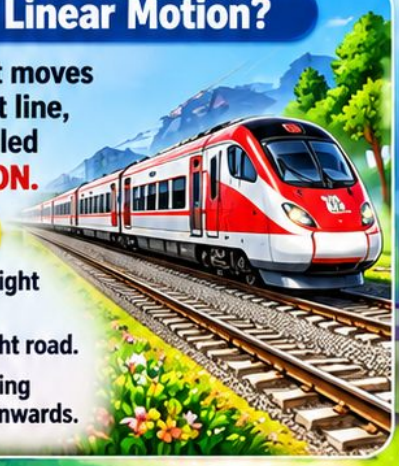
UNIFORM AND NON-UNIFORM LINEAR MOTION

Class 7 – NCERT Curiosity Science

Chapter: Measurement of Time and Motion

1. What is Linear Motion?

When an object moves along a straight line, its motion is called **LINEAR MOTION.**



Examples:

- A train on a straight railway track.
- A car on a straight road.
- An elevator moving upwards or downwards.

2. Uniform Linear Motion

An object moving along a straight line with constant speed is said to be in **UNIFORM LINEAR MOTION.**

Example: A train travels 20 km every 10 minutes.

Time	Distance covered
10:00 – 10:10	20 km
10:10 – 10:20	20 km
10:20 – 10:30	20 km
10:30 – 10:40	20 km
10:40 – 10:50	20 km
10:50 – 11:00	20 km

Key Features:

- Straight line motion
- Constant speed
- Equal distances in equal time intervals

Conclusion:
Equal distances in equal time intervals = **Uniform linear motion.**

3. Non-Uniform Linear Motion

When an object moves along a straight line but its speed changes, it is called **NON-UNIFORM LINEAR MOTION.**

Key Features:

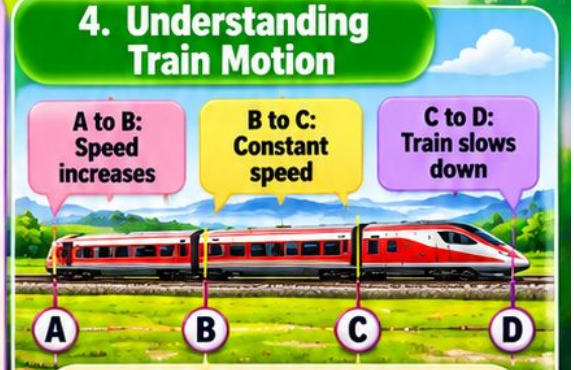
- Straight line motion
- Speed changes with time
- Unequal distances in equal time intervals

Example: A train travels different distances.

Time	Distance covered
10:00 – 10:10	20 km
10:10 – 10:20	15 km
10:20 – 10:30	15 km
10:30 – 10:40	25 km
10:40 – 10:50	20 km
10:50 – 11:00	25 km

Conclusion:
Unequal distances in equal time intervals = **Non-uniform linear motion.**

4. Understanding Train Motion



A to B – Non-uniform motion
B to C – Uniform motion
C to D – Non-uniform motion

5. Difference Between Uniform and Non-Uniform Motion

Uniform Linear Motion	Non-Uniform Linear Motion
Speed remains constant.	Speed changes.
Equal distances in equal time intervals.	Unequal distances in equal time intervals.
Straight-line motion.	Straight-line motion.
Example: Train moving at constant speed.	Example: Train accelerating or slowing down.

6. Real-Life Examples

Uniform Linear Motion

1. Train at constant speed on a track.



2. An object moving along a straight path.



Non-Uniform Linear Motion

1. A car speeding up on a straight road.



2. A train slowing down before a station.



7. Speedometer and Odometer

Speedometer
Measures and displays speed. Usually in km/h.



Odometer
Measures total distance travelled.



8. Quick Revision

- Linear motion = Motion along a straight line.
- Uniform linear motion = Equal distances in equal time intervals.
- Non-uniform linear motion = Unequal distances in equal time intervals.
- Uniform motion = Constant speed.
- Non-uniform motion = Changing speed.

Remember:
Both uniform and non-uniform linear motion take place along a straight line.

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Distance – Time Graph

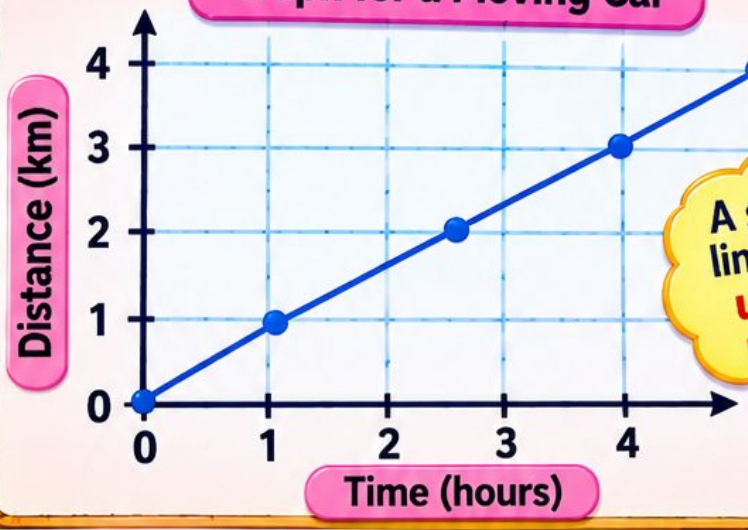
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What is a Distance–Time Graph?

A distance–time graph shows how the **distance** covered by an **object** changes with **time**.

It helps us understand whether the object is at rest, moving slowly or moving fast!

Graph for a Moving Car

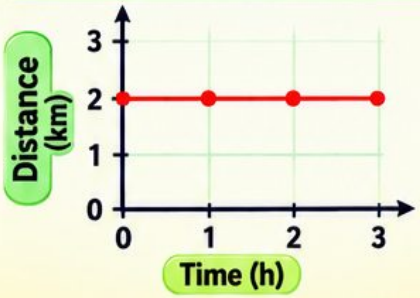


A straight line shows **uniform motion!**

Types of Distance–Time Graphs

1. Stationary Object

Distance does not change with time.

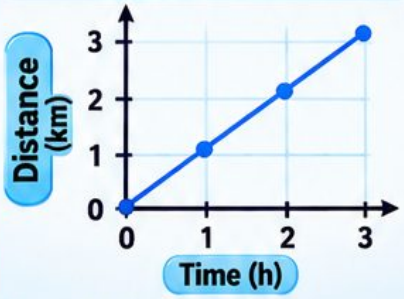


Example: A parked car. (Horizontal line)



2. Uniform Motion

Distance increases equally with time.

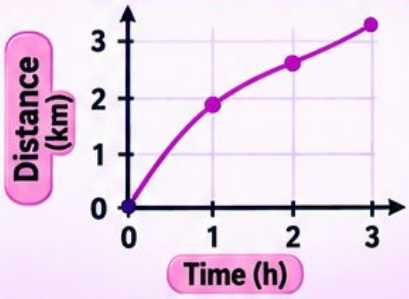


Example: A car moving at constant speed. (Straight line)



3. Non-Uniform Motion

Distance increases unequally with time.



Example: A car speeding up. (Curved line)



Key Takeaways

- A straight line = Uniform motion
- A horizontal line = At rest
- A curved line = Non-uniform motion
- The graph helps us understand the motion easily!



Distance–Time Graph = A Picture of Motion!

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Speed-Time Graph

Class 7 – NCERT Curiosity Science

Chapter: Measurement of Time and Motion

What is a Speed-Time Graph?

A speed-time graph shows how the **speed** of an object changes with **time**.



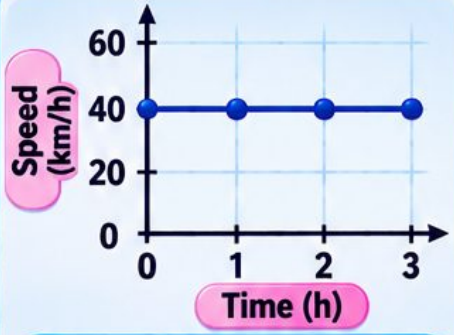
Axes of the Graph

Vertical axis (Y-axis) → Speed (in km/h or m/s)

Horizontal axis (X-axis) → Time (in seconds or hours)

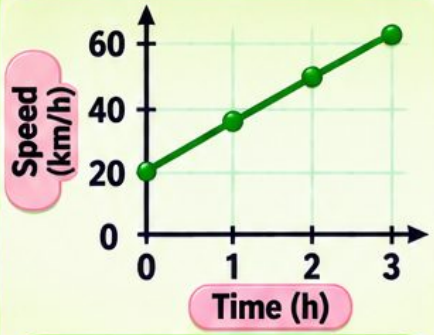
Types of Speed-Time Graphs

1. Constant Speed



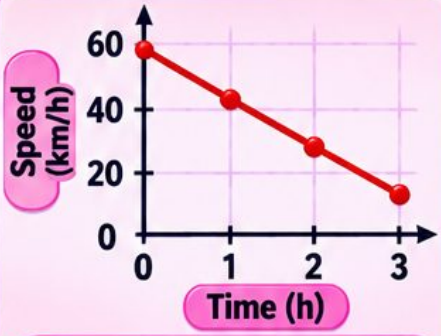
Speed remains constant.
Example: A car moving at 40 km/h.

2. Increasing Speed



Speed increases.
Example: A car speeding up.

3. Decreasing Speed



Speed decreases.
Example: A car slowing down.

Real-Life Examples


Racing Car


Cyclist


Train


Aeroplane

Key Takeaways

- A speed-time graph shows how **speed** changes with **time**.
- A horizontal line means **constant speed**.
- An upward line means speed is **increasing**.
- A downward line means speed is **decreasing**.



Remember!

Speed-Time Graph helps us understand how **speed** changes over **time**.

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