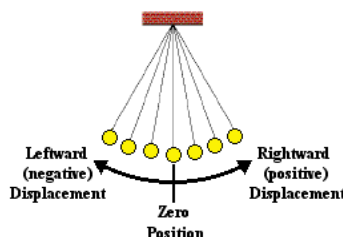


## Chapter – 10: Motion and Measurement of Distances

- Tree, house, school – fixed at one place – stationary
- Man, animal, bird, vehicle – move from place to place
- Movement of objects – motion – change position with time
  - Position of car – changes with time
  - Time A – in front of house – car present
  - Time B – house still in position – car moves away
- House – not moving – stationary – at rest
- Car – moving – in motion
- Some objects move faster – observed easily
- Other objects – move fairly slow – motion cannot be observed
- Wrist watch –
  - Second hand moves fastest – observed easily
  - Minute hand moves slower – observed with difficulty
  - Hour hand moves slowest – observed with most difficulty

### Types of Motion

- Rectilinear motion –
  - Motion in straight line
  - Movement of bullet from gun
  - Motion of cyclist on straight road
  - Motion of vehicle, train, falling stone, ball rolling on ground
  - Fixed direction
- Circular motion –
  - Motion in circles
  - Moon around earth, motion of artificial satellites
  - Motion of different planets
  - Motion of tip of hands of watch, point on the blade of fan, child on a merry-go-round
  - Athlete running in a circular track, bull tied to rope, clothes spun in washing machine
- Periodic motion –
  - Motion repeats after regular intervals of time
  - Motion of seconds' hand – repeats every minute
  - Revolution of earth (other planets too) around sun
  - Swinging of pendulum, vibrations of drum membrane, rotation of earth on its axis, child on a swing
  - Pendulum – long string – heavy metal bob (ball) at the end – swing it – show periodic motion



- Stretched strings on string instruments – show vibrations

- Stretched membrane of drums – show vibrations – piece of paper placed on it bounces when its struck
- Rotational motion –
  - Object turns around a fixed axis
  - Spinning of top, earth rotating on its axis
  - Blades of fan, wind-mill, potter's wheel, hands of watch
  - Difference between rotational and circular motion –
    - Circular motion – whole object travels as whole
    - Rotational motion – object spins on its axis

### **Objects having more than one motion**

- Earth –
  - Moves around sun – circular motion
  - Repeats motion around sun every year – periodic motion
  - Rotates on its axis – rotational motion
- Merry-go-round –
  - Merry-go-round as a whole – rotational motion
  - Children sitting on it – circular motion
- Bicycle –
  - Cycle moving on straight line – rectilinear motion
  - Wheel of cycle rotating on axle – rotational motion
- Ball –
  - Moving on ground – rectilinear motion
  - Rolling on ground – rotational motion
- Sewing machine –
  - Wheel rotating on axis – rotational motion
  - Needle moves up and down – periodic motion

### **The Story of Transport**

- Carry people and goods – one place to another – transport
- Early days – no means of transport
- Ancient people – travel on horse backs, camel backs – carry goods on these animals
- Initially – logs of wood – used as boats on water routes – later on – logs joined together – streamlined boats
- Invention of wheel – great change
- Bullock carts, horse carts, camel carts – used wheels
- Also led to invention of bicycle – popular mode of transport
- Beginning 19<sup>th</sup> century – invention of steam engine – used coal as fuel – new source of power
- Trains – increased carrying capacity, speed of travel
- Also used to run ships
- Steam engine – external combustion engine – fuel (coal) burnt outside the engine
- Invention of internal combustion engine – second half of 19<sup>th</sup> century – automobiles (cars, buses, trucks, scooters) – motorized boats and ships also developed
- Aeroplanes developed – faster means of transport

- Lots of other means of transport – helicopters, electric trains, monorail, supersonic planes (faster than speed of sound), rockets

## **Distances**

- Length of space between 2 points – distance
- Delhi and Agra – 200 kms
- 2 points – close enough – distance between them – small
- 2 points – far apart – distance between them – greater

## **Measurement**

- Compare object – standard unit of measurement
- Buying cloth – in metres – tailor – uses inch tape – measure body dimensions correctly

## **Need of standard units of measurement**

- Daily life – many objects – units of measurement – forearm length, hand-span
- These units – different for different people – can disrupt (change) the measurement
- Standard unit required – does not change from person to person, place to place
- Metre – standard unit of length – does not change for different persons

## **Every measurement consists of a number and a unit**

- Every measurement – 2 parts –
  - Numerical part – number – magnitude of measurement
  - Unit part – name of unit of measurement
- Length of table – 2 metres
  - 2 – numerical part
  - Metres – unit part
- Measurement cannot exist – in a single part
- Measurement not complete unless both parts available

## **SI unit of length**

- Uniformity in measurement of physical quantities – scientists adopted ‘International System of Units’
- Called SI units – Systeme International d’ Unites
- SI unit of length – metre (m)
- Sample of standard metre – present in National Physical Laboratory, New Delhi
- SI unit of weight – kilogram (kg)
- SI unit of time – second (s)

## **Prefixes used with SI units**

- Prefix – used before SI unit – make it bigger or smaller
  - Kilo –
    - Means 1000
    - Kilo added to meter – multiply by 1000
    - 1 kilometre = 1000 metre
  - Centi –
    - Means 1/100<sup>th</sup>
    - Centi added to meter – multiply by 1/100

- 1 centimetre = 1/100 metre
- Milli –
  - Means 1/1000<sup>th</sup>
  - Milli added to metre – multiply by 1/1000
  - 1 millimetre = 1/1000 metre

## Measurement of Length

- Length – distance between 2 points
- Metre – standard unit – measure length
- Measured using metre scale – divided into 100 cms – further divided into 10 mm

### Use of proper units of length

- Type of unit – depend on magnitude of length
  - Metre – measure length and breadth of table, room, playground, height of building
  - Centimetre – measure smaller lengths – pencil, note-book, etc
  - Millimetre – measure much smaller lengths – thickness of a coin
  - Kilometre – larger distances than few metre – distance between 2 cities

### Length measuring devices

- Various devices – measure length – metre scale, measuring tape
  - Object – straight – either metre scale or measuring tape
  - Object – round (curved) – measuring tape – flexible – bend easily
- Full metre scale – very long – inconvenient for smaller lengths
- Smaller lengths – measured by rulers – short scales – 30 cms or 15 cms – made of plastic, metal, wood

### How to measure the length of an object

- Measured using scale
- Place the ruler along the length – 0 mark on scale should coincide with left end of object – read the mark coinciding with right end of object

### Precautions to be taken while using a scale

- Precautions – avoid error in measurement
  - Scale – place it parallel to the length to be measured
    - When scale is not parallel – wrong measurements can be recorded
  - While reading – place eye vertically above the scale mark
    - Eye – placed slightly left or right – wrong measurement can be recorded
  - Scale – damaged 0 mark – use 1 cm mark as starting point
    - Coincide 1 cm mark with left end of object – read the mark coinciding with right end of object – subtract 1 from it – obtain the accurate measurement

### To measure the length of a curved line

- Coincide the starting point of thread with starting of line – mark the point on thread coinciding with the end point of line
- Measure the length of thread using a scale – thread can be straightened out (stretched to make it straight)