# **Chapter: Motion (Class 9 Science)**

### ♦ What is Motion?

Motion is the change in the position of an object with respect to time and a reference point.

Example: A moving car, a falling ball, or a flying bird – all are in motion.

## ♦ Types of Motion

- 1. **Translational Motion** When an object moves from one point to another.
- E.g., a car moving on a road.
  2. Circular Motion When an object moves in a circular path.
  - E.g., motion of a fan blade.
- 3. Rotational Motion The object rotates about an axis.
   o E.g., Earth rotating on its axis.
- 4. **Periodic Motion** Repeated motion after equal intervals of time.
  - E.g., motion of a pendulum.

#### ♦ Important Terms

Term	Definition	Unit
Distance	Total path travelled	meter (m)
Displacement	Shortest distance from initial to final position	meter (m)
Speed	Distance covered per unit time	m/s
Velocity	Displacement per unit time (includes direction)	m/s
Acceleration	Change in velocity per unit time	m/s²

#### ♦ Difference Between Distance and Displacement

Distance	Displacement
Scalar quantity	Vector quantity
Total path covered	Shortest straight-line path
Always positive	Can be positive, negative, or zero

#### ◆ Uniform and Non-uniform Motion

- Uniform Motion: Equal distance in equal intervals of time *E.g., car moving at 60 km/h constantly*
- Non-uniform Motion: Unequal distances in equal intervals of time *E.g., car in traffic, speeding up or slowing down*

#### ◆ Equations of Motion (For Uniform Acceleration)

- 1.  $\mathbf{v} = \mathbf{u} + \mathbf{at}$
- 2.  $s = ut + \frac{1}{2}at^2$
- 3.  $v^2 = u^2 + 2as$

Where:

- u = initial velocity
- v = final velocity
- a = acceleration
- t = time
- *s* = displacement

#### ♦ Graphical Representation of Motion

#### 1. Distance-Time Graph

- $\circ$  Slope = Speed
- Straight line = Uniform motion
- 2. Velocity-Time Graph
  - $\circ$  Slope = Acceleration
  - Area under graph = Displacement

#### ♦ Acceleration Types

- **Positive Acceleration** Speed increases (e.g., car speeding up)
- Negative Acceleration (Retardation) Speed decreases (e.g., brakes applied)