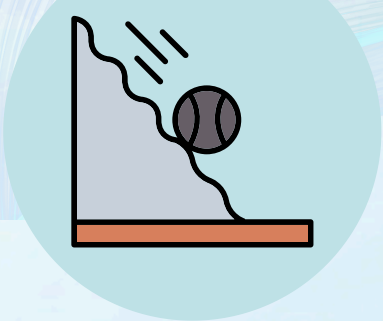
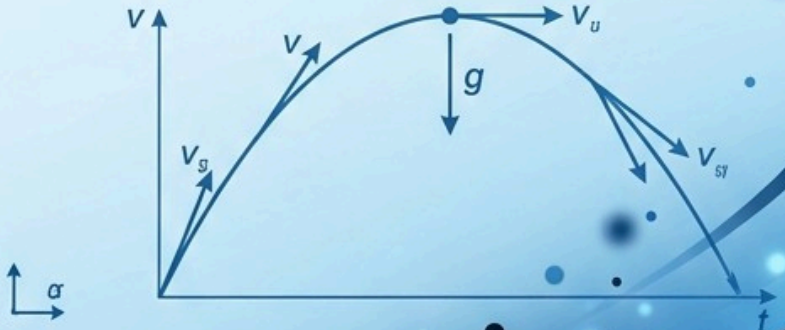
PARMAR SSC

MOTION

Lecture - 1





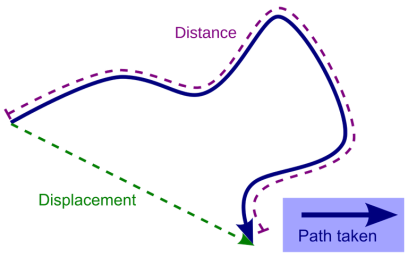




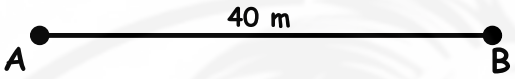
BY PARMAR SIR

MOTION

- A relative change in the position of an object with respect to a reference point is called motion.
- **Opposite of motion:** Rest (When the body is still and not moving).
- **Distance:** It refers to the total length of the path an object travels, regardless of direction and is a scalar quantity.
- **Displacement:** It is the shortest path between the initial and final positions (not the total distance) and is a vector quantity.



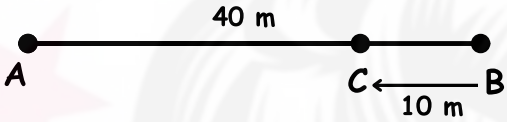
Case- 1



Distance = 40m
Displacement = 40m

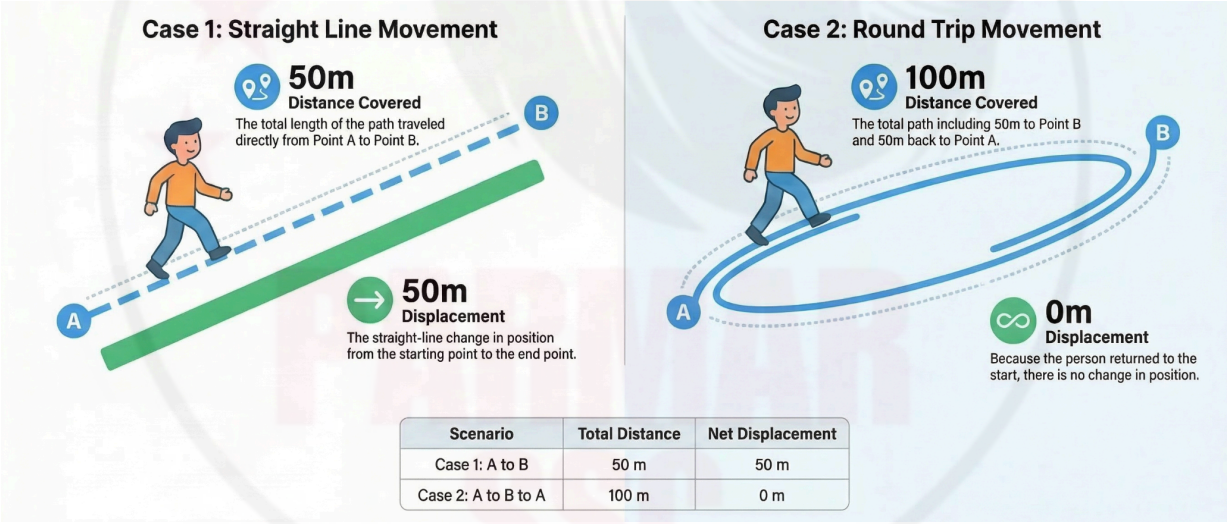
Distance = Displacement

Case- 2



Distance = 50m
Displacement = 30m

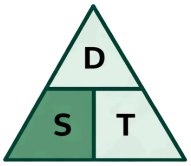
Distance ≥ Displacement



Scenario	Total Distance	Net Displacement
Case 1: A to B	50 m	50 m
Case 2: A to B to A	100 m	0 m

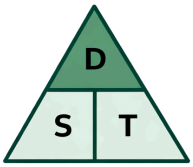
Scalar Quantity	Vector Quantity
It only represents numerical value (magnitude)	It represents both numerical value (magnitude) and direction
E.g. Distance, Speed, Time.	E.g. Displacement, Velocity.

Speed



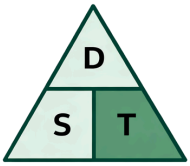
$S = \frac{D}{T}$

Distance



$D = S \times T$

Time



$T = \frac{D}{S}$

km/hr × 5/18 = m/s
m/s × 18/5 = km/hr

Speed

- It is the rate at which an object's position changes with time, regardless of the direction of motion.
- Its S.I. unit is meters per second → (m/s) and is a scalar quantity.

Average Speed

- The average speed is the ratio of total distance traveled by the object to the total time taken to cover that distance.
- It is a scalar quantity.

$$Average\ Speed = \frac{Total\ Distance\ Covered}{Total\ Time\ Taken}$$

Types of Motion

1. **Uniform Motion** एकसमान गति
2. **Non- Uniform Motion** असमान गति

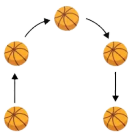
Uniform Motion

- Uniform motion is characterized by an object moving in a straight line with a constant velocity, which means that it covers equal distances in equal intervals of time, resulting in zero acceleration.
- **E.g.** If the speed of a car is 10 m/s, it means that the car covers 10 meters in one second. The speed is constant every second.

Linear (Rectilinear) Motion	Circular Motion	Rotational Motion
An object moving in a straight line at a constant speed (constant velocity).  A train traveling on a straight track with uniform speed.	An object moving along a circular path at a constant speed (constant angular velocity). 	An object rotating around a fixed axis at a constant angular speed. 

Non-Uniform Motion

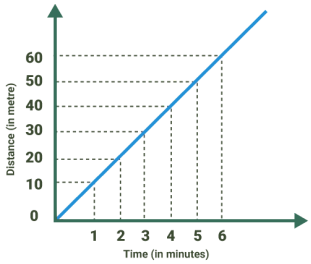
- Non-uniform motion is when an object's speed or direction changes over time, so it doesn't cover equal distances in equal time intervals.
- **E.g.** If a car covers 10 meters in the first two seconds and 15 meters in the next two seconds.


A ball thrown vertically upward (its speed keeps changing).

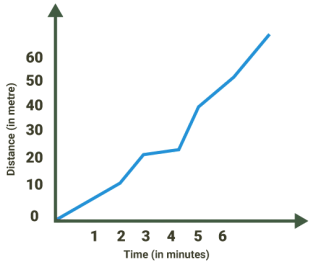

A roller coaster moving along its track.

Linear (Rectilinear) Motion	Circular Motion	Rotational Motion
An object moving in a straight line with changing speed (acceleration).	An object moving along a circular path with changing speed (acceleration).	An object rotating around a fixed axis with changing angular speed (angular acceleration).

Uniform Motion



Non- Uniform Motion



Velocity

- Velocity is the rate at which an object changes its position in a specific direction. Unlike speed, velocity is a vector quantity, which means it has both magnitude and direction.
- The S.I. unit of velocity is m/s.

$$Speed + Direction = Velocity$$

$$Velocity = \frac{Displacement}{Time}$$

$$v = \frac{d}{t} \qquad t = \frac{d}{v} \qquad d = v \times t$$

Speed is simply
how fast you are travelling



This car is travelling at a speed of 20 m/s

Velocity is
speed in a given direction



This car is travelling at a velocity of 20 m/s east

Acceleration

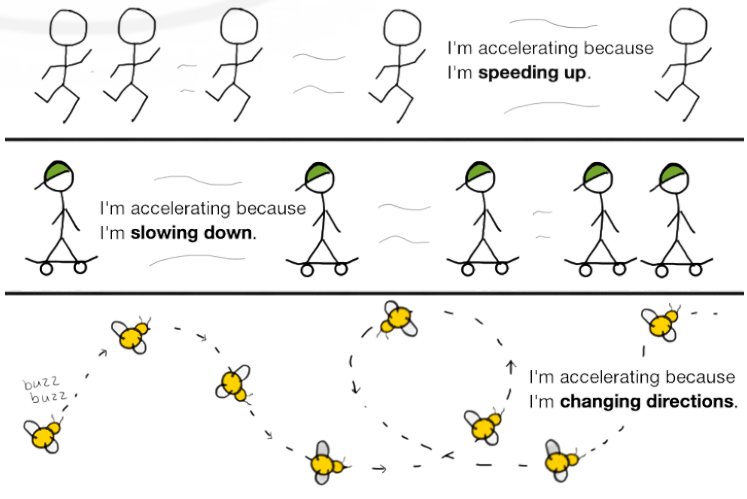
- Acceleration is defined as the rate of change of velocity with respect to time. It essentially describes how quickly an object's speed or direction (or both) is changing.
- The S.I. unit of acceleration is m/s^2

$$Acceleration = a_c$$

$$a_c = \frac{Change\ in\ Velocity}{Time\ (\Delta t)}$$

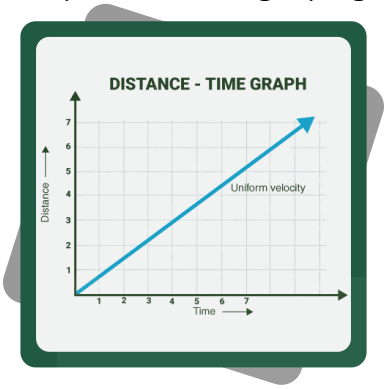
$$\frac{Final\ Velocity - Initial\ Velocity}{Time\ (\Delta t)}$$

$$\frac{v - u}{\Delta t}$$



Distance - Time Graph

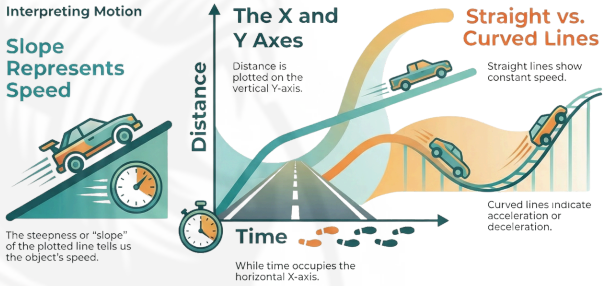
- Disptance-Time graph gives Speed.



A distance time graph shows how far an object has travelled over a period of time. Distance is plotted on the Y-axis and time is plotted on the X-axis.

What it tells us

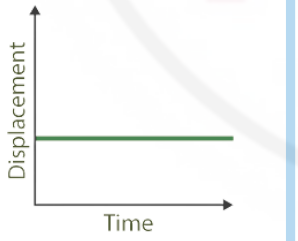
- The slope of the graph gives the speed of the object.
- A straight line with a constant slope means the object is moving at a constant speed.
- A curved line indicates that the speed is changing, which may mean acceleration or deceleration.



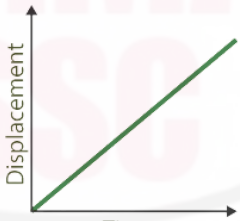
Displacement -Time Graph

- Displacement-Time graph gives Velocity.

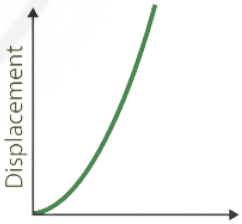
1. For Stationary Body (Body at rest)



2. For Uniform Motion

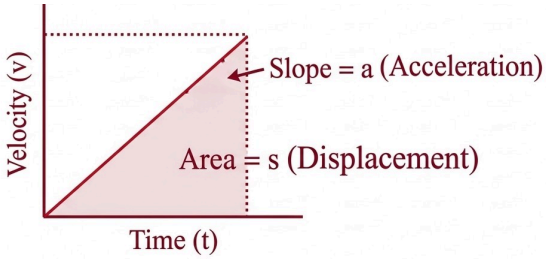


3. For Non-Uniform Motion (speed increases)



Velocity -Time Graph

- Velocity-Time graph gives Acceleration.



1. Acceleration = Slope
2. Displacement = Area

Numerical of Motion in a straight line: The "UTSAV" Concept

- In case of uniform acceleration, there are three equations of motion that describe the motion of an object with constant acceleration.

$$v = u + at$$

$$s = ut + 1/2\ at^2$$

$$v^2 - u^2 = 2\ as$$

u: Initial velocity
t: Time
s: Distance
a: Acceleration
v: Final velocity

When an object starts from a stationary position or starts to free fall, its initial velocity (u) is 0 m/s.
Deceleration, also known as negative acceleration or retardation, refers to a decrease in an object's speed or velocity, which is the opposite of acceleration (increasing speed or velocity).

Motion Under Gravity

- Motion under gravity (also known as free-fall motion) refers to the movement of an object solely influenced by the force of gravity, resulting in a constant downward acceleration **(approximately 9.8 m/s²)**.

$$v = u + gt$$

$$s = ut + 1/2\ gt^2$$

$$v^2 - u^2 = 2\ gh$$

a = g → Acceleration due to gravity
Free fall → u = 0 (initial speed)

Upward Motion (against the gravity)

$$v = u - gt$$

$$s = ut - 1/2\ gt^2$$

$$v^2 - u^2 = -2\ gh$$

a = -g, final velocity at highest point = 0

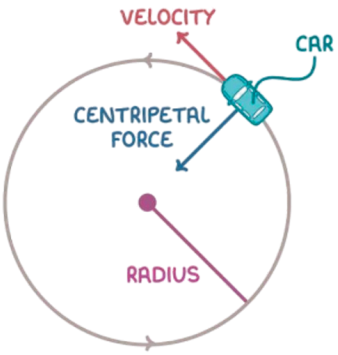
UNIFORM CIRCULAR MOTION

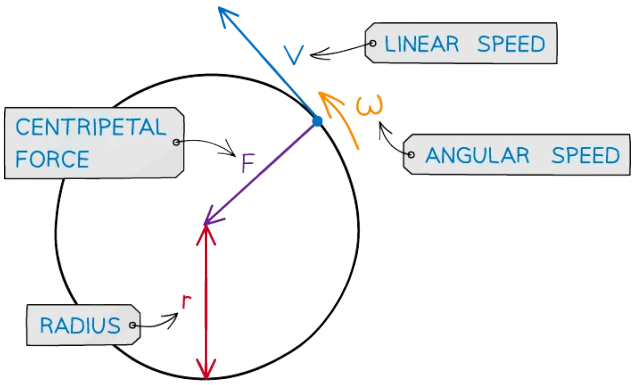
- The motion of a body moving with a constant speed along a circular path is called Uniform Circular Motion.

$$a_c = \frac{v^2}{r}$$

a(c) : Centripetal acceleration (acceleration towards the centre in circular path)

The motion of a body moving with a constant speed along a circular path is called For a body moving in uniform circular motion the speed attained by the object will remain constant not the velocity as velocity depends on the direction of motion, and in circular motion the direction of the object changes at every point. This continuous change in velocity results in an acceleration, even though the speed is constant.





Centripetal force is the force acting on a body in a circular path. It points towards the center around which the body is moving.



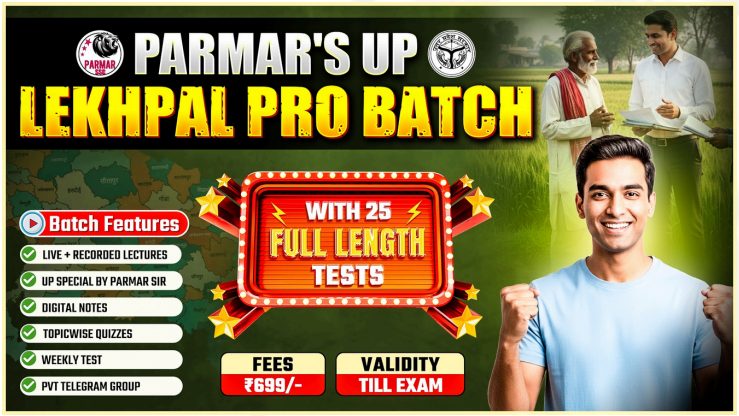


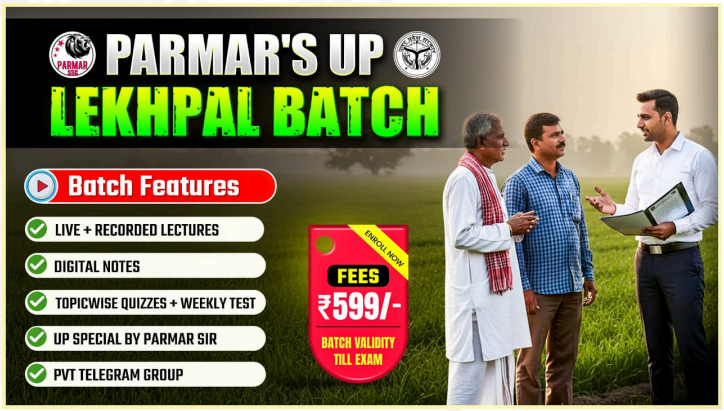
Join Now – Start Your Smart Preparation Today!

CLICK HERE

Join Now – Start Your Smart Preparation Today!

CLICK HERE





Join Now – Start Your Smart Preparation Today!

CLICK HERE

Join Now – Start Your Smart Preparation Today!

CLICK HERE



Join Now – Start Your Smart Preparation Today!

CLICK HERE

