Class IX Physics Motion Lecture 1

# Fundamentals of Motion

* Motion & Rest are relative concepts

**Motion**

↓

**Change of position of an object**

**Distance**

↓

**total path covered**

distance b/w A — D

AB + BC + CD + DA

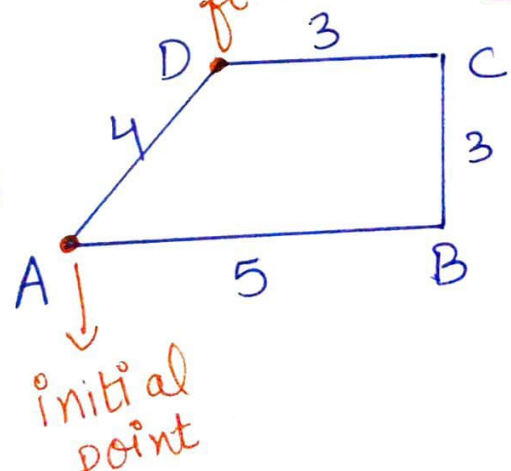
5 + 3 + 3 + 4

= 15 units

(It can be positive only)

**Displacement**

**shortest distance between two points**




Displacement between A - D

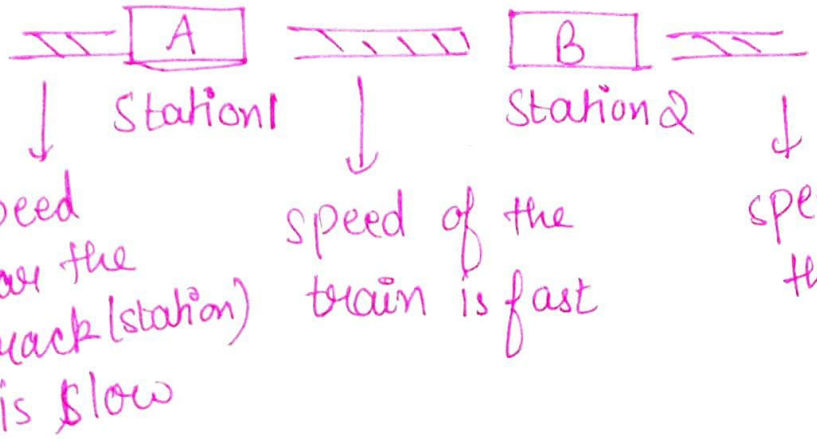
AD = 4 units

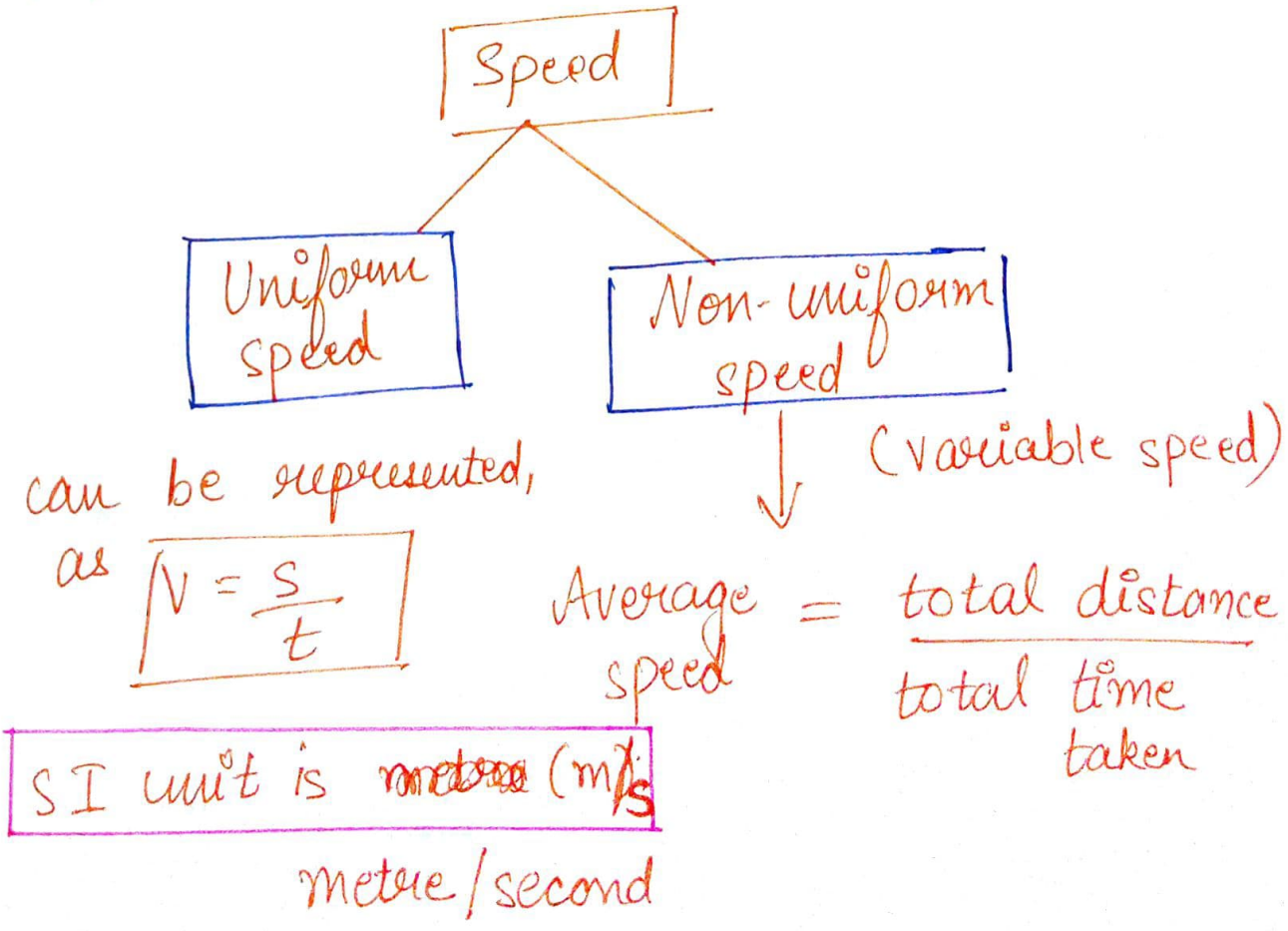
(It could be zero, negative (direction) and positive)

Uniform Motion — When an object travels equal distances in equal intervals of time, however small the interval may be, — **the motion is said to be uniform**

* When an object travels unequal distances in equal intervals of time, howsoever small the interval may be, — the motion is said to be non-uniform.

examples → A train starting from one station and stopping at the other has non-uniform motion.



Class IX
Physics

# Motion Lecture 2

## Equations of Motion & Acceleration

**Velocity (Speed)**

- **Magnitude**
- **Direction**

★ Velocity will change with the change in **one of these factors** or **both**

★ We calculate average velocity, when velocity is changing at a uniform rate over a period of time.

⇓

Change of rate of velocity → **Acceleration**

★ Unit of time occurs twice in the unit of acceleration

$$a = \frac{\text{Change in velocity}}{\text{time}} = \frac{v-u}{t}$$

$$a = \frac{\text{metre/sec}}{\text{sec}} \Rightarrow m/sec^2$$

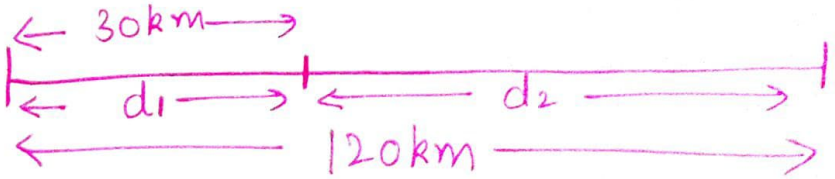
★ Acceleration, as same as velocity is a **vector quantity**

★ Negative acceleration is called as retardation

★ Negative sign in the answer show the direction (direction opp. to the direction of motion)

Q On a 120 km track, a train travels the first 30 km at a uniform speed of 30 km/hr. How fast must the train travel the next 90 km so as to average 60 km/h for the entire trip?

⇒




$V_1$ = speed of first 30 km = 30 km/hr (1 km/hr)

$d_1 = 30$ km, $d_2 = 120 - 30 = 90$ km

$V_2 = ?$ ; Avg. speed = $\frac{\text{total distance}}{\text{total time}}$

total time = $\frac{\text{total dis.}}{\text{avg. speed}}$

$t = \frac{120}{60} = \boxed{2 \text{ hr}}$

time req. to cover $d_1$ (30 km) = $\frac{30}{30} = \boxed{1 \text{ hr}}$

time to cover $d_2$ (90 km) = $\frac{90}{V_2}$

$1 = \frac{90}{V_2} \Rightarrow V_2 = \frac{90}{1} = \boxed{90 \text{ km/hr}}$

# Motion Lecture 3

## Equations of Motion

### ⓐ Graphical Representation

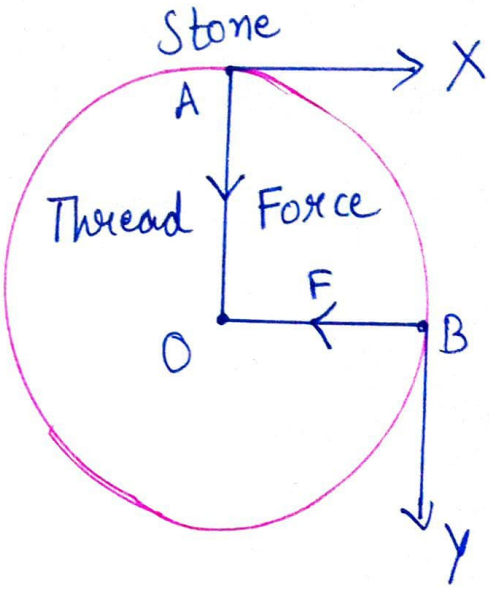
① **Distance - time** → change in position with time → speed/velocity

- Rest → Position will not change w.r.t time
- Uniform motion → equal distance in equal interval of time → Uniform speed
- Non-uniform motion → (change in velocity) → Accelerated motion

② **Velocity - time** → variation of velocity with time → Acceleration

- uniform velocity → velocity will remain same at all instant of time
- uniform acceleration → velocity changes by equal amount in equal interval of time
- non-uniform acceleration → Variable acc. (not a st. line)

# Uniform Circular Motion




If the thread breaks at A, the stone would fly along AX (tangent)

If the thread breaks at B, the stone would fly along BY

The direction of motion at any instant of time is along the tangent to the circular path at that instant

Distance travelled by the body in one complete revolution = Circumference of the circle

$$S = 2\pi r$$

$$V = \frac{2\pi r}{t}$$