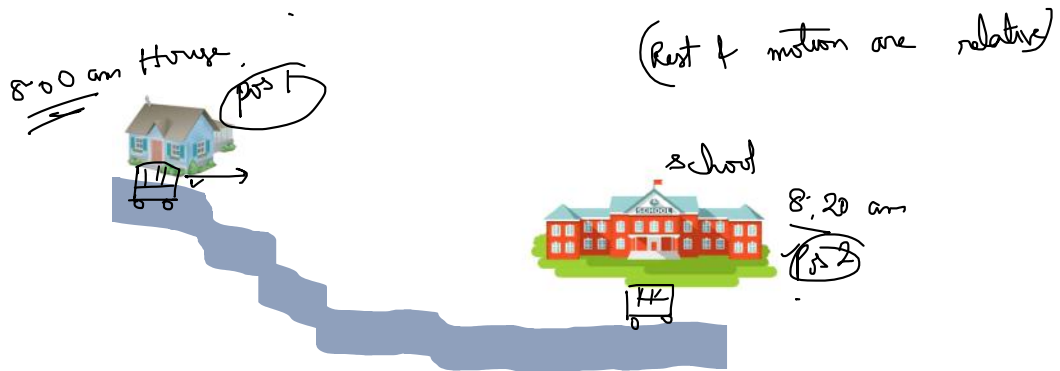
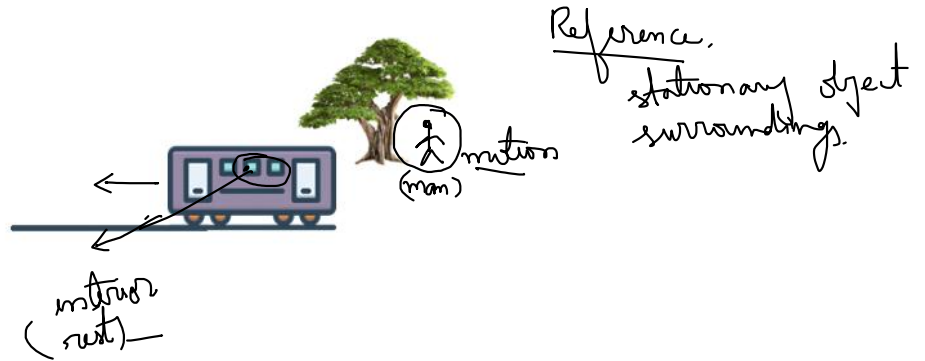


**Chapter 8: Motion**

Motion moving  
(vehicles, birds, wind)

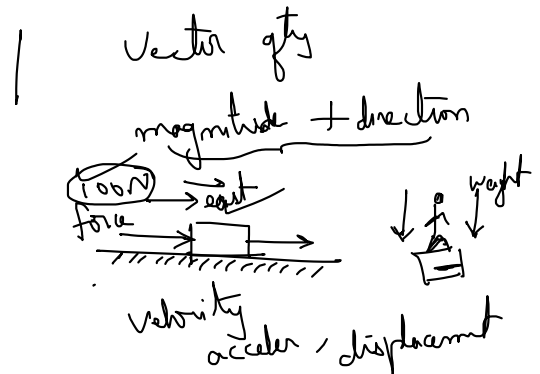
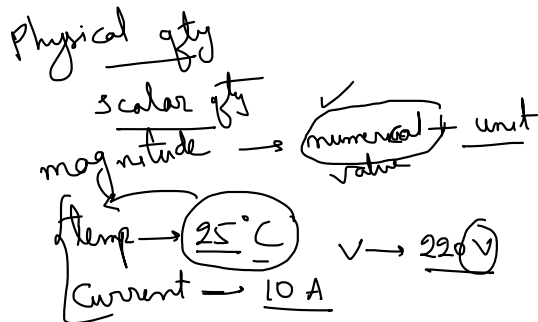
Rest (stationary)  
eg. rocks, building, trees.



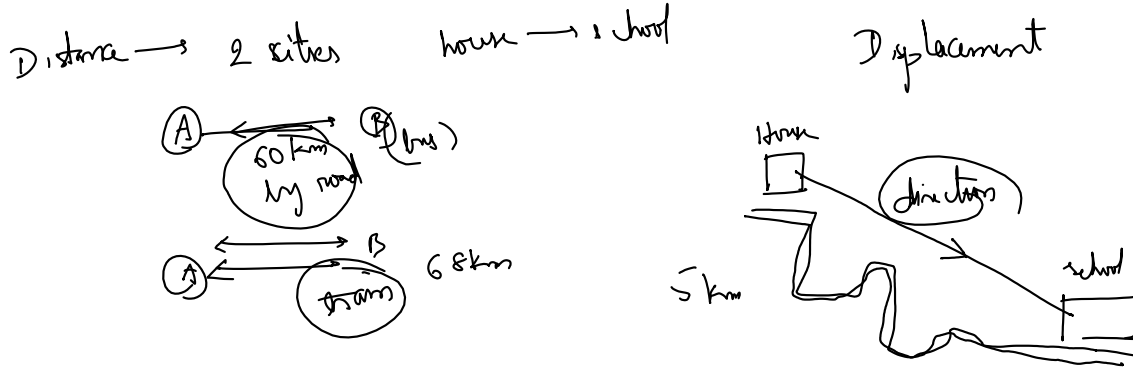
**Motion:** An object is said to be in motion if it changes its position with time with respect to its surroundings.

**Rest:** An object is said to be at rest if it does not change its position with time with respect to its surroundings.

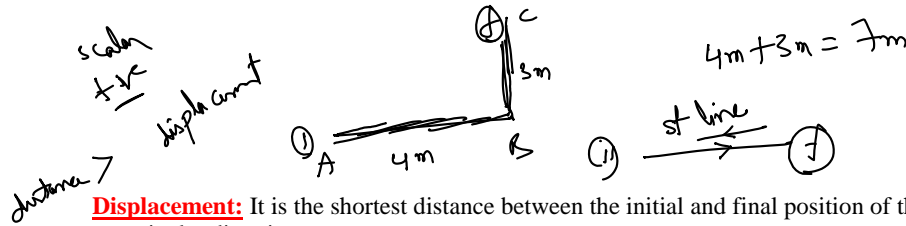
**Rest and motion are relative:** An object can be in motion with respect to one body while at the same time it can be at rest with respect to another body.



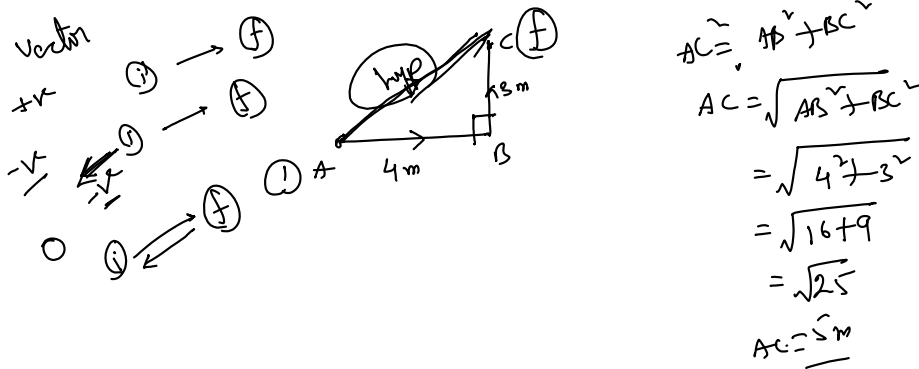
Scalar quantity	Vector quantity
A physical quantity which is completely defined by its magnitude alone is called a scalar quantity.	A physical quantity which is completely defined by its magnitude as well as direction is called a vector quantity.
Eg: time, temperature, work, energy, mass, speed etc	Eg: force, displacement, weight, torque, velocity, momentum etc



**Distance:** It is the actual length of the path travelled by the (moving) body.



**Displacement:** It is the shortest distance between the initial and final position of the moving body in a particular direction.



Distance	Displacement
1) It is the actual length of the path traversed by the body.	1) It is the shortest distance between the initial and final positions of the moving body in a particular direction.
2) It is a scalar quantity.	2) It is a vector quantity.
3) It is always positive.	3) It can be positive, negative or zero.
4) It is always greater than or equal to the displacement of the body.	4) It is always less than or equal to the distance travelled by the body.
5) SI unit is m (metre)	5) SI unit is m (metre)
6) It is denoted by S.	6) It is denoted by S.

1. An object has moved through a distance. Can it have zero displacement? If yes, support your answer with an example.

1. An object has moved through a distance. Can it have zero displacement? If yes, support your answer with an example.

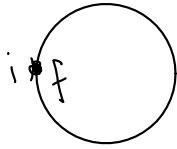
eg:



$$\text{distance} = h + h = 2h$$

$$\text{displacement} = 0$$

object returns to the same position when thrown upwards.

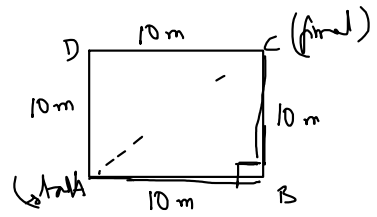


$$\text{distance} = 2\pi r$$

$$\text{displacement} = 0$$

man after completion of one round in a circular track.

2. A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds?



$$\text{Time taken for 1 round} = 40 \text{ s}$$

$$\text{for } 2 \text{ min } 20 \text{ s} = 120 \text{ s} + 20 \text{ s} = 140 \text{ s}$$

$$\text{no. of rounds for } 140 \text{ s} = \frac{140}{40} = 3.5$$

In  $\triangle ABC$ ,

$$AC = \sqrt{AB^2 + BC^2}$$

$$= \sqrt{10^2 + 10^2}$$

$$= \sqrt{200}$$

$$\text{(displacement) } AC = 10\sqrt{2} \text{ m}$$

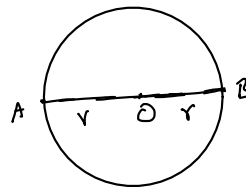
3. Which of the following is true for displacement?

- (a) It cannot be zero. *false*  
 (b) Its magnitude is greater than the distance travelled by the object. *false*

4. A body is moving along a circular path of radius  $r$ . What is the distance and the displacement of the body when it completes half a revolution?

$$\text{distance} = \frac{2\pi r}{2} = \pi r$$

$$\text{displacement} = r + r = 2r$$

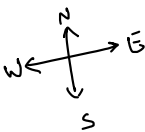
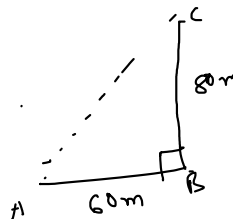


5. An object moves 60m due east and then 80m due north. Find the distance travelled and the magnitude of the displacement.

$$\text{distance} = AB + BC$$

$$= 60 + 80$$

$$= 140 \text{ m}$$



$$\text{displacement } AC = \sqrt{60^2 + 80^2}$$

displacement

$$AC = \sqrt{AB^2 + BC^2}$$

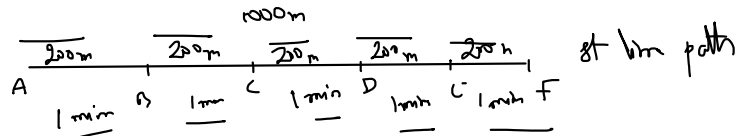
$$= \sqrt{60^2 + 80^2}$$

$$= \sqrt{3600 + 6400}$$

$$= \sqrt{10000}$$

$$AC = 100 \text{ m}$$

**Uniform motion:** An object is said to be in uniform motion if it covers equal distances in equal intervals of time, however small these intervals may be, in the same fixed direction.



**Non-Uniform motion:** An object is said to be in non-uniform motion if it covers unequal distances in equal intervals of time or equal distances in unequal intervals of time, however small these intervals may be.

eg Bus moving out of bus station, Train approaching the platform, motion of a car on a busy road.

**Speed:** The speed of a body is the distance travelled by it per unit time.

(or)

The rate of change of position of an object with time in any direction is called its speed.

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

$$v = \frac{S}{t}$$

Speed is a scalar quantity

SI unit of speed is (metre per second) m/s (or)  $\text{ms}^{-1}$

**Uniform speed:** An object is said to be moving with uniform speed if it covers equal distances in equal intervals of time, however small these intervals may be.

**Variable speed:** An object is said to be moving with variable speed if it covers unequal distances in equal intervals of time, however small these intervals may be.

**Average Speed:** The average speed of a moving body is the total distance travelled by the body divided by the total time taken to cover this distance, i.e.,

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

200 km  
4 h

50 km/h

$$\frac{200}{4} = \frac{50 \times 4}{4}$$

**Instantaneous speed:** The speed of an object at any particular instant of time is called the instantaneous speed of the object.

The speedometer of an automobile indicates its instantaneous speed at any instant.