

27/08/2021

Chapter - 3

MOTION IN A STRAIGHT LINE (L-1)

- Kinematic is the branch of mechanics which deals with the motion of an object without taking into account the cause of the motion.
- Dynamics is the branch of mechanics which deals with the motion of an object with taking into account the cause of the motion.
- If a body does not change its position as time passes with respect to the frame of reference, it is said to be at rest.
- If a body changes its position as time passes with respect to frame of reference, it is said to be in motion.

Frame of Reference - The coordinates (x, y, z) of an object describe the position of the object with respect to this coordinate system. This coordinate system along with a clock constitutes a frame of reference.

30/08/2021

(L-2)

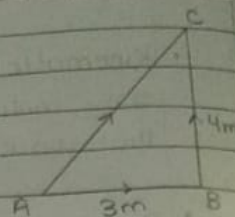
- Distance - It is the actual path length covered by a moving particle in a given interval of time.
 - ↳ It is a scalar quantity
 - ↳ The value is always positive.
 - ↳ SI unit = metre (m)
- Displacement - It is the shortest distance between the initial and final position of an object.
 - It is a vector quantity.
 - The value can be zero, positive or negative.
 - SI unit = metre (m)

Path - The line joining the successive position of a moving body is called its path.

Q. Find the distance and displacement.

Sol. Distance = $AB + BC$
 $= 3 + 4$
 $= 7\text{m}$

Displacement = AC
 $= \sqrt{AB^2 + BC^2}$
 $= \sqrt{3^2 + 4^2}$
 $= \sqrt{25}$
 $= 5\text{m}$

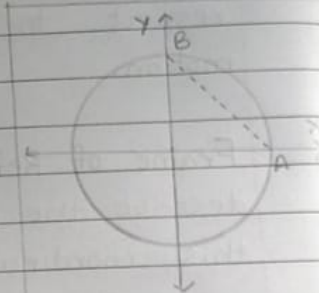


Q. A body moves over one-fourth of a circular arc in a circle of radius r . The magnitude of distance travelled and displacement will be respectively

- (a) $\frac{\pi r}{2}, r\sqrt{2}$ b) $\frac{\pi r}{4}, r$ c) $\pi r, \frac{r}{\sqrt{2}}$ d) $\pi r, r$

Sol. Distance = $\frac{1}{4} \times 2\pi r = \frac{\pi r}{2}$

Displacement = $\sqrt{r^2 + r^2}$
 $= \sqrt{2r^2}$
 $= r\sqrt{2}$



\therefore (a) $\frac{\pi r}{2}, r\sqrt{2}$

• Speed - Rate of distance with time is called speed.

↳ It is a scalar quantity

↳ Unit = metre/second (m/s)

Types:

a) Uniform Speed - Body covers equal distance in equal intervals of time.

b) Non-Uniform Speed - Body covers unequal distance in equal intervals of time.

c) Average Speed - The average speed of a particle is defined as the ratio of total distance travelled to the total time taken.

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

$$v_{av} = \frac{\Delta S}{\Delta t}$$



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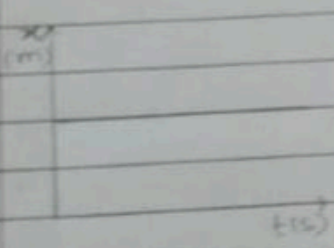
d) Instantaneous speed - It is the speed of a particle at particular instant.

Instantaneous speed, $v = \lim_{\Delta t \rightarrow 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}$

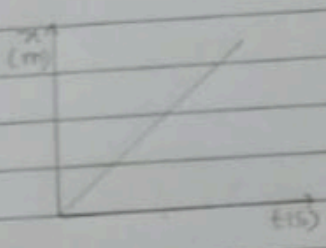
- Velocity - Rate of change of position i.e. rate of displacement with time is called velocity.
- ↳ It is a vector quantity
- ↳ Unit = metre/second (m/s)

Position - time Graph

1) At rest



2) Uniform motion



3) Non-Uniform motion

