C.W

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Ch-8

Motion

Rest → When a body does not change its position the body is said to be in rest.

Motion → When a body changes its position with respect to time the body is said to be in motion.

Origin → To describe the position of an object we need to specify a reference point called the origin.

Distance → The actual path-length covered by a body is said to be distance covered by that body.

Note (i) The SI or standard unit of distance is metre, represented by 'm'

ii) Distance depends on path. It means by changing path between the two fixed point, the distance will change between the two points.
There may be infinite path between two points

iii) Distance is a scalar quantity.

iv) Distance never be negative.

Displacement → Displacement between two points can be define as the shortest distance covered in certain direction.

NOTE i) The SI unit of displacement is metre, represented by 'm'

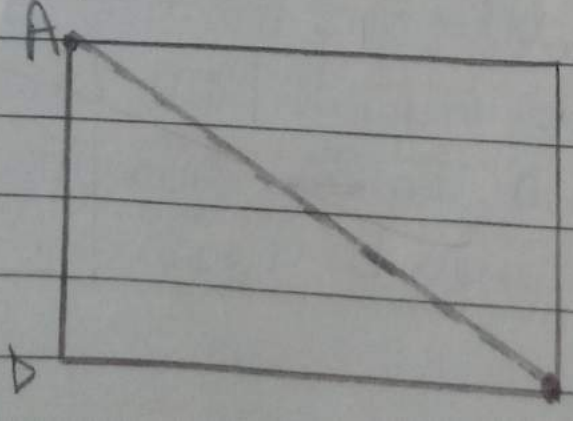
ii) Displacement does not depends on path. Displacement only depends on initial position and final position.

iii) Displacement is a vector quantity. The direction of displacement always from initial position to final position.

iv) Displacement may be negative, positive or zero.

Question 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 from his initial position?



1 round =
= 40 sec
= 2 min 20 sec
= 140 sec
initial point = A
final point = C
Displacement = A to C
By ~~by thagorus theorm~~,
$= \sqrt{10^2 + 10^2}$
$= \sqrt{2 \times 100}$
$= 10\sqrt{2}$
$\therefore$ ~~Total no. of rounds~~
$= 140$
Ans
Farmer completed ~~round~~ in 40 sec.
$\therefore$ Total ~~no.~~ of rounds by Farmer $= \frac{140}{40} = \frac{7}{2} = 3.5$ m

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

⇒ Yes, it have zero displacement.

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Q. Write the difference between distance and displacement.

Distance	Displacement
1. The actual path covered by a body.	1. It is the shortest path covered by a body in certain direction.
2. It is a scalar quantity.	2. It is a vector quantity.
3. It is always positive.	3. It may be negative, positive or zero.
4. It depends on path.	4. It does not depend on path.

Note:

When a body moves in a straight line, the magnitude of displacement = the distance covered by the body. In other cases, magnitude of displacement will be lesser than the distance.

Q. Give one-one example of uniform and non-uniform motion.

Uniform motion - a car moving with constant velocity.

Non-uniform motion - The velocity of a vehicle moving on a crowded road. ~~It's~~

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Q-1

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

2. What does the odometre of an automobile measure?

3. Write any three differences b/w distance and displacement.

Answer

1. yes, it have a zero displacement.
For example, a person jogs in a circular park and completes one round. His initial and final position are same.

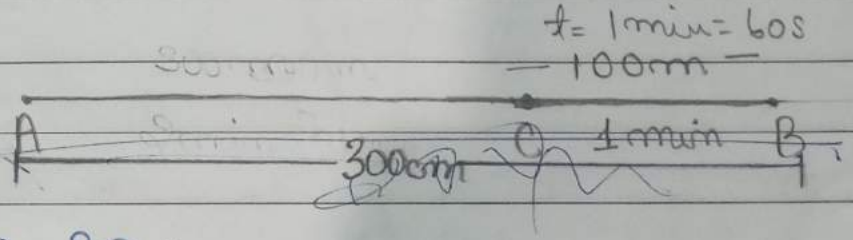
3. Distance	Displacement
• The actual path length covered by a body is said to be distance covered by that body.	• The displacement b/w two points can be defined as the shortest dis. covered in certain direction.

• It is a scalar quantity.	• It is a vector quantity.
• It is always positive.	• It may be negative, positive or zero.

2. Odometre of an automobile measure the distance cover by the body.

Exercise-

2.



2min 30 sec.

2×60 + 30 sec. = 150 sec

A to B

Average Speed from A to B = $\frac{\text{Dis.}}{\text{time}}$

$= \frac{300}{150}$

$= 2 m/s$

Velocity from A to B = $\frac{\text{Displacement}}{\text{time}}$

$= \frac{300}{150}$

$= 2 m/s$

A to C

Average speed $= \frac{AB + BC}{t_1 + t_2}$

$= \frac{400}{210}$ m/s

Velocity $= \frac{200 \text{ m}}{210 \text{ s}}$

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Acceleration (a)

The rate of change of velocity is called acceleration.

i.e. acceleration = $\frac{\text{final velocity} - \text{initial velocity}}{\text{time taken to change in velocity}}$

$\Rightarrow \quad a = \frac{V-u}{t}$

NOTE:

i) The SI unit of acceleration is m/s^2 or ms^{-2}

ii) It is a vector quantity.

iii) When 'a' is positive, the velocity of the body will increase with time.

iv) When 'a' is negative, the velocity of the body will decrease with time.

Q. A car starting from rest and acquire a velocity 90 Km/hr in 6 sec, find the acceleration of the car?

⇒ Given:

$u = 0$

$V = 90 \text{ Km/hr} = \frac{90 \times 5}{18} = 25 \text{ m/s}$

$t = 6 \text{ s}$

$a = ?$

$$a = \frac{v-u}{t} = \frac{25\ m/s - 0}{6s} = \frac{25}{6}\ m/s^2$$

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Q. What is the SI unit of acceleration?

⇒ SI unit of acceleration is m/s^2 or. ms^{-2}.

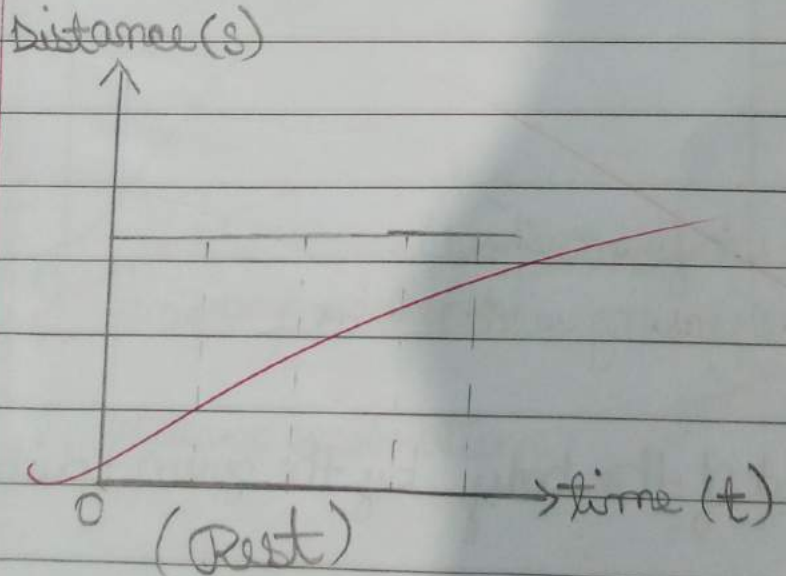
2. Is acceleration a vector quantity.

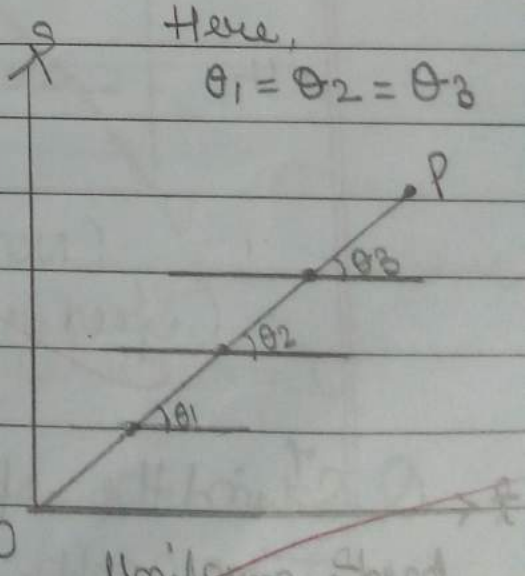
⇒ Yes, acceleration is a vector quantity.

3. Is speed a vector quantity.

⇒ No, speed is a scalar quantity.

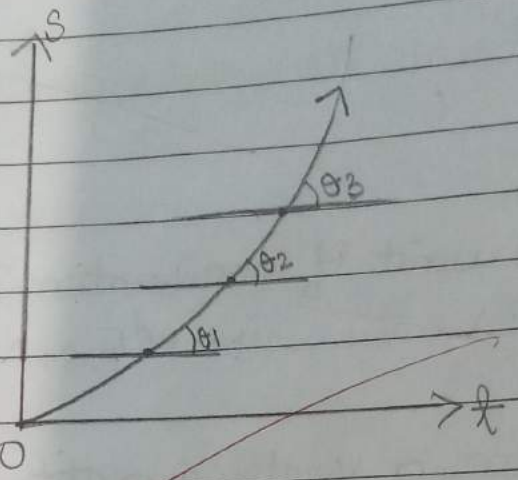
4. Distance-Time Graph





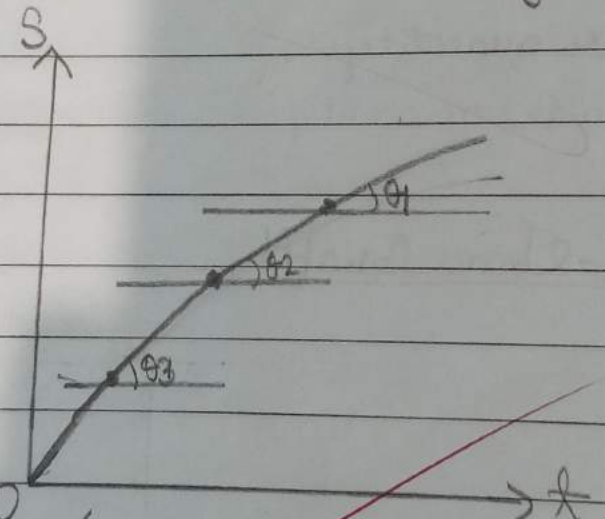
Uniform Speed

the speed remain constant



Here,
$\theta_3 > \theta_2 > \theta_1$

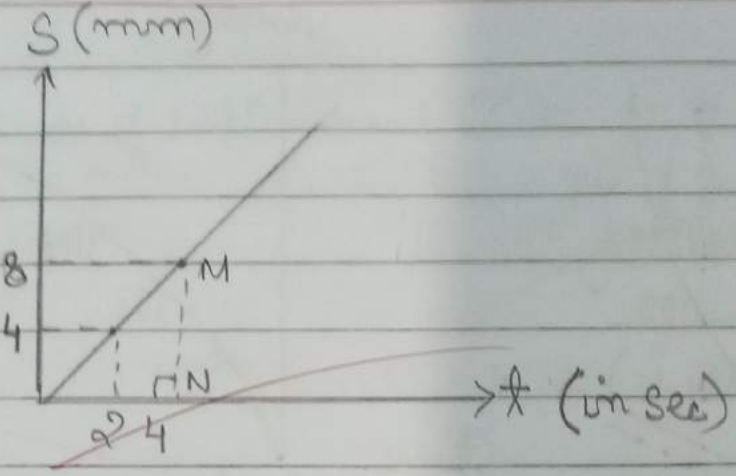
(Non-uniform)
(Speed is increasing with time)



Here,
$\theta_1 > \theta_2 > \theta_3$

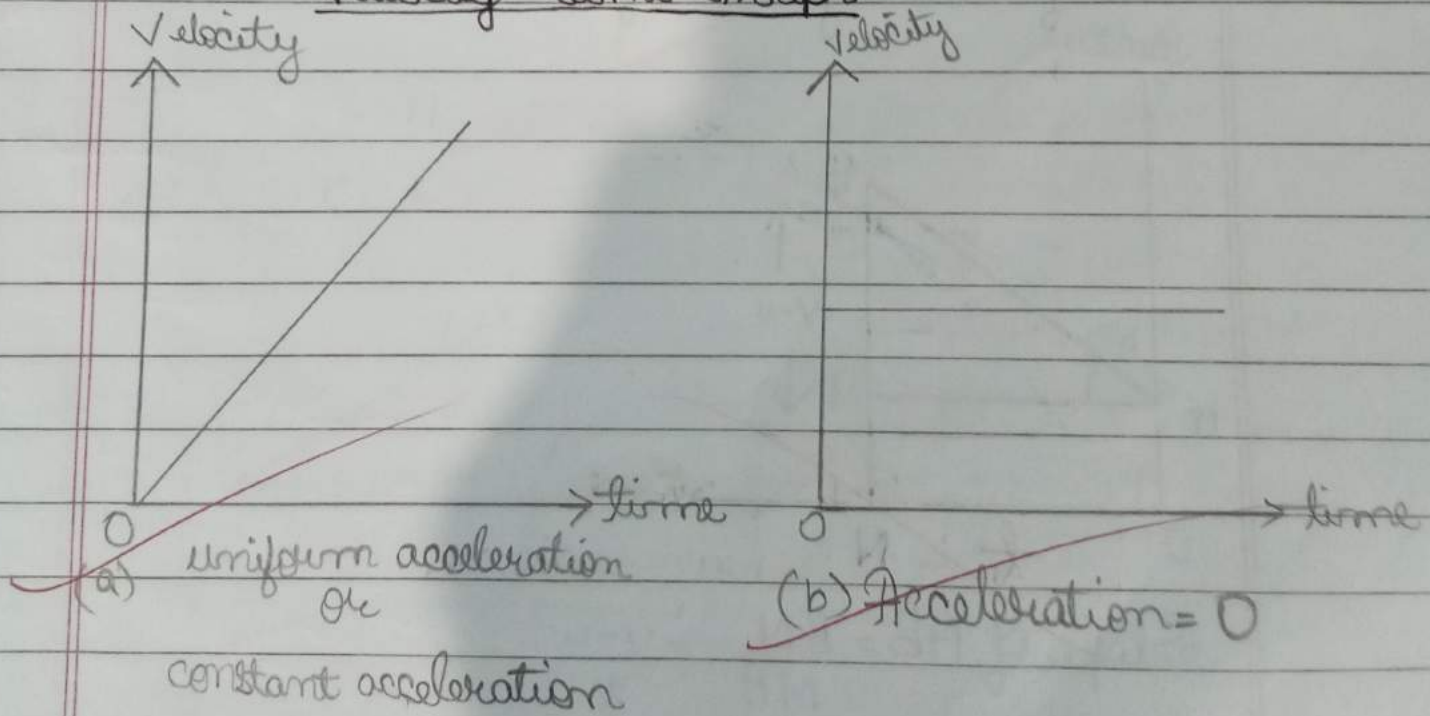
(Non-uniform speed)
(Speed is decreasing with time)

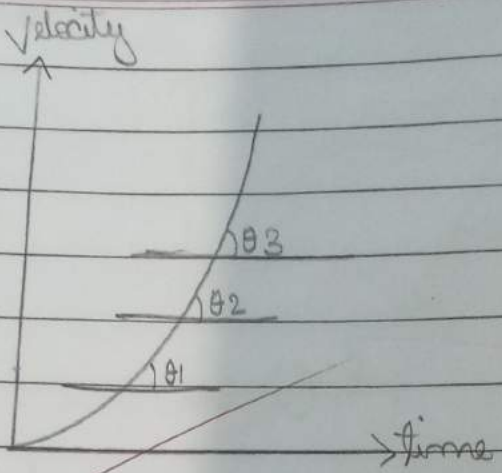
Q. Find the speed of the body by the given distance-Time Graph.



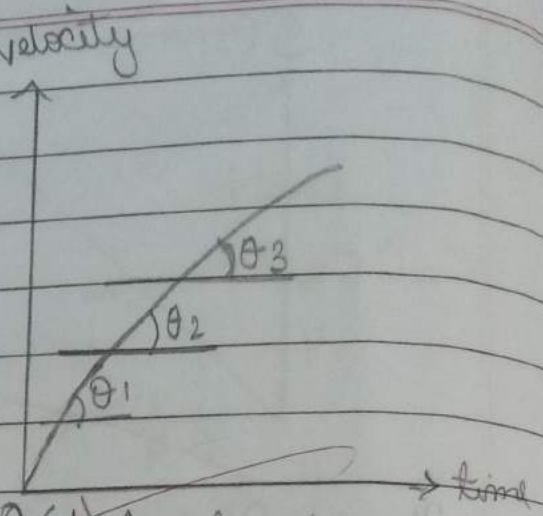
$$\text{Speed} = \text{Slope of OP} = \frac{MN}{ON} = \frac{8\text{ m}}{4\text{ s}} = 2\text{ m/s}$$

Velocity - Time Graph



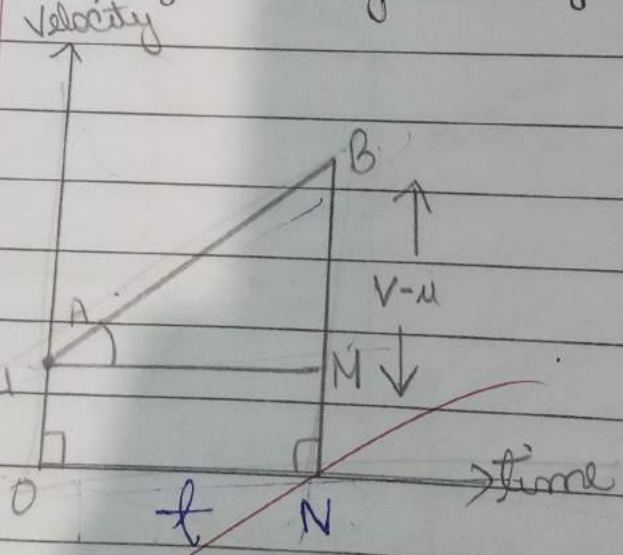


(c) Acceleration is increasing with time



(d) Acceleration is decreasing with time

Use of velocity-time graph



Slope of $AB = \frac{BN}{MA} = \frac{v-u}{t}$

$\Rightarrow a = \frac{v-u}{t}$

$\Rightarrow at = v-u$

$\Rightarrow \boxed{u + at = v}$

Magnitude of displacement (S) = Ar. of trap. ABNO

S = Ar. of $\triangle ABM$ + Ar. of $\square AMNO$

$S = \frac{1}{2} \times AM \times BM + MN \times ON$

$S = \frac{1}{2} \times t \times (v-u) + ut$

$= \frac{1}{2} \times t(ut + at - u) + ut$

$$\boxed{S = ut + \frac{1}{2}at^2}$$