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Ch-7 Motion

1) Rest :- A body is said to be in ~~rest~~ a state of rest when its position doesn't change with respect to a reference point.

2) Motion :- A body is said to be in a motion when its position changes with respect to a reference point.

3) Motion are three types :-
i) linear motion
ii) Oxcillatory motion.
iii) Circullatory motion.

3) Physical quantity :- It is a physical property of material that can be measure,

It has two types.
i) Scallere quantity
ii) Vectore quantity.

Scallere quntity.

It is a physical quantity having only magnitude not direction
Ex:- Speed, Distance

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ii) vectore quantity :

It is a physical quantity having magnitude with direction.
Ex: velocity, excellieration, displacement, momentom

Physical quantity of motion.

4) Distance - The actual path length travelled by an object is called Distance.

(a) It is a scaller quantity.
(b) Its always positive, and cannot be zero.
(c) Its SI unit is meter.

5) Displacement -

The shortest between initial point and final point is called displacement

(a) It is a vectore quantity.
(b) It can positive, negative and zero.
(c) Its SI unit is meter.

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⑥

Speed	Velocity
i) The distance travell by a body per unit time	i) The distance travell by a body per unit time in given direction
ii) Speed = $\frac{\text{Distance}}{\text{Time}}$	ii) It is speed with direction.
iii) It is a scaller quantity.	iii) Velocity = $\frac{\text{Displacement}}{\text{Time}}$
iv) It always positive	iv) It is vector quantity
v) Its SI unit is m/s	v) It can be positive negative and zero.

7) Average Speed -

Average speed = $\frac{\text{Total distance}}{\text{Total Time}}$.

8) Average velocity -

Average velocity = $\frac{\text{Initial velocity} + \text{Final v}}{2}$

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(a) Types of motion

i) Uniform Motion

When a body travells equal distance in equal interval of time.

ii) Non-Uniform motion

When a body travells unequal distance in equal interval of time

(b) Excelleration :-

The rate of change of velocity of an object with respect to time is called excelleration.

(a) It is a vector quantity.

(b) Initial velocity = U
(c) final velocity = V
(d) Time = T
(e) $a = \frac{V - U}{T}$
(f) Its may be positive and negative.
(g) Negative excelleration is also known as retardation or deexelleration

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h) Its SI unit m/s^2

11) Positive excellaration :-

When initial velocity lower than final velocity.

$$a = \frac{V - U}{T} = \frac{50 - 20}{5} = 6 m/s^2$$

Here $U = 20 m/s$
$V = 50 m/s$
$T = 5$ second.

12) Negative excelleration

When initial velocity higher then final velocity

$$a = \frac{V - U}{T} = \frac{60 - 100}{4} = 10 m/s^2$$

Here $U = 100 m/s$
$V = 60 m/s$
$T = 4$ second.

13) Graphical representation of Motion

Distance, time, Graph.

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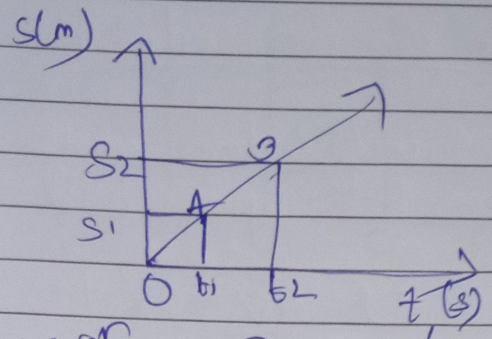
Distance time Graph



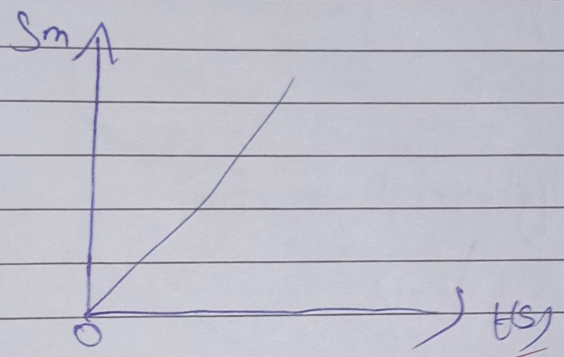
S = Distance
t = time
V = velocity / speed

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

$V = \frac{S_2 - S_1}{t_2 - t_1}$

Uniform Speed / velocity.

Velocity time graph



non- uniform speed

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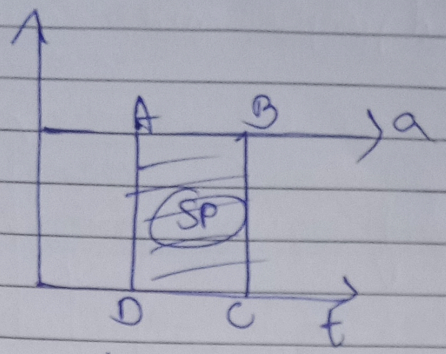
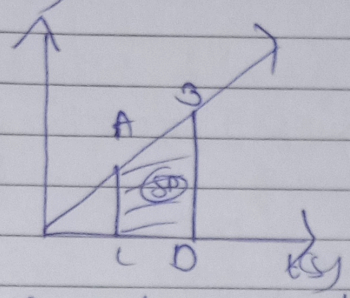
Graph

(14)



uniform

v (m/s)



(Non- uniform)

Equation of motion by Graphical method.

(a) $v = u + at$ (velocity - Time)

(b) $S = ut + \frac{1}{2}at^2$ (Position - Time)

I (c) $2as = v^2 - u^2$ (Position - velocity relation)

(a) Equation of velocity time relation

Slope $= \frac{\text{Rise}}{\text{Run}}$

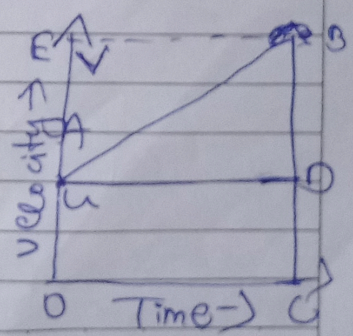
$AB = \frac{BD}{AD}$

$BC = BD + CD$

$BC - CD = BD$

$AB = \frac{BC - CD}{AD}$

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



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$at = v - u$

$at + u = v$

$\boxed{v = u + at}$

II Second Equation

(b) Equation of position-time relation.

Area under slope = Displacement = area of OABC

Area of OABC = Area of rectangle AOCD + Δ ABD

$S = OC \times OA + \frac{1}{2} \times AD \times BD$

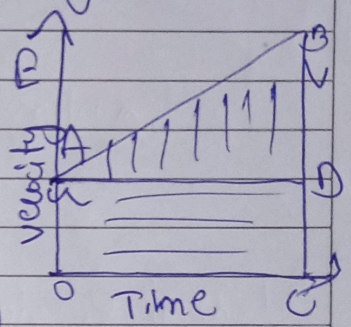
$S = OC \times OA + \frac{1}{2} AD \times (BC - CD)$

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

$S = ut + \frac{1}{2} t (at)$

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

$\left(\begin{array}{l} BC = BD + CD \\ BC - CD = BD \\ v = u + at \\ v - u = at \end{array} \right)$



III

(c) Equation of positive-velocity relation

Area under slope = Displacement = area of OABC

Area of trapezium OABC

$\Rightarrow \frac{1}{2} \times (BC + OA) \times OC$

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

by 1st equation of motion

$S = \frac{1}{2} \times (v + u) \times \left(\frac{v - u}{a}\right)$ $\left(\begin{array}{l} v = u + at \\ \frac{v-u}{a} = t \end{array} \right)$

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$$S = \frac{(v+u)(v-u)}{2a}$$

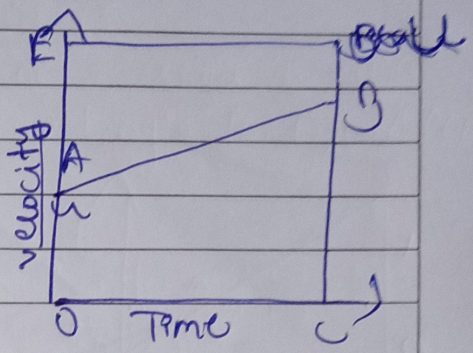
$2ag = v^2 - u^2$

$v^2 - u^2 = 2ag$

$[a^2 - b^2 = (a+b)(a-b)]$

Dist on speed of a circular path

~~$v^2 - u^2 = 2ag$~~



$D = 2\pi r$

$S = \frac{2\pi r}{t}$ $\left(\pi = \frac{22}{7}\right)$

$S = \frac{\pi r}{t}$

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