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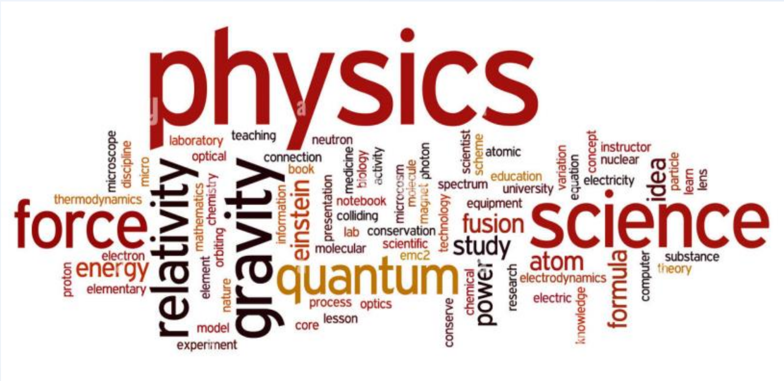
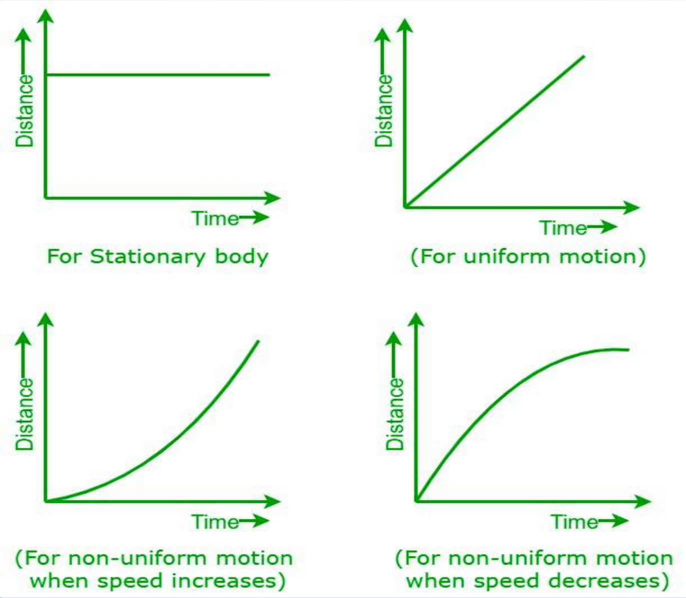
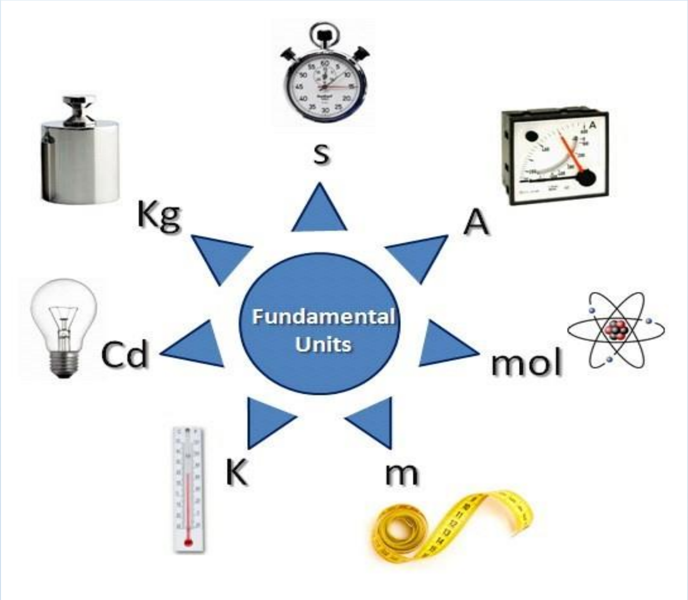


MODULE-1 CLASS-2

KINEMATICS

PRESENTED BY- DEPT. OF PHYSICS





TODAY'S LESSON

- Distance & Displacement.
- Speed & Velocity
- Acceleration & Retardation.
- Equation in kinematics.

DISTANCE V/S DISPLACEMENT

① $\left.\begin{array}{l}\text{Distance} = 0 \\ \text{Displacement} = 0\end{array}\right\} \Rightarrow$ Rest object

initial & final Position Same

after motion

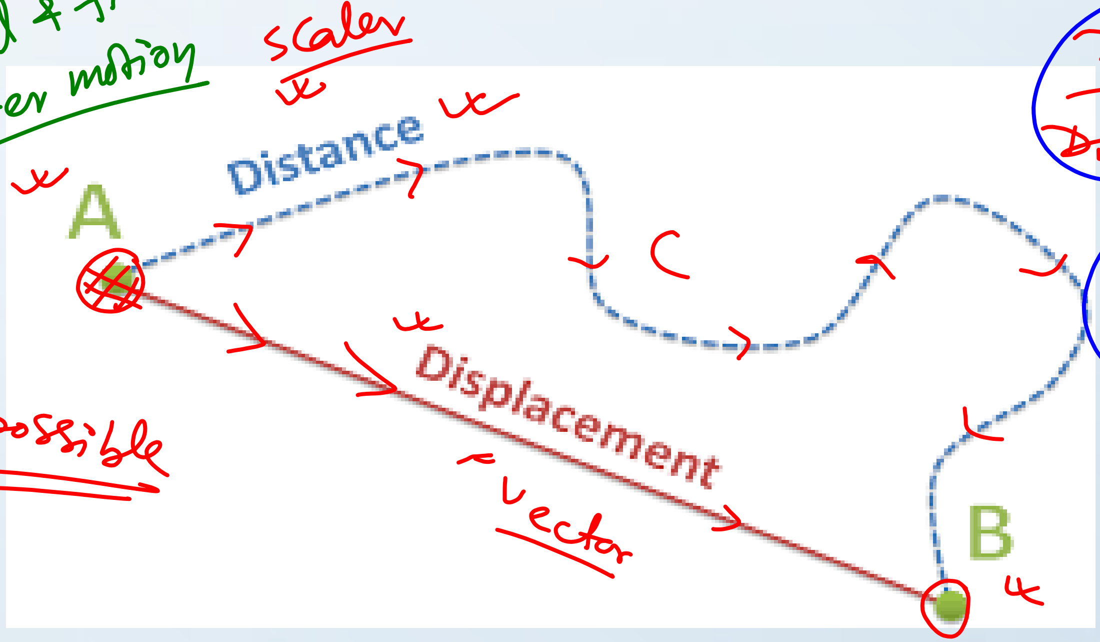
② $\left.\begin{array}{l}\text{Distance} \neq 0 \\ \text{Displacement} = 0\end{array}\right\} \Rightarrow$

③ $\left.\begin{array}{l}\cancel{\text{Distance} = 0} \\ \cancel{\text{Displacement} \neq 0}\end{array}\right\}$ Impossible

Distance $\geq$ |Displacement|

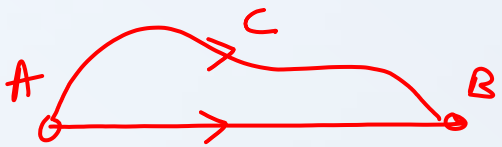
$$\frac{\text{Distance}}{\text{Displacement}} \geq 1$$

$$\frac{\text{Displacement}}{\text{Distance}} \leq 1$$



DISTANCE V/S DISPLACEMENT

Distance	Displacement
1. Distance is the length of the path actually travelled by a body in any direction.	Displacement is the shortest distance between the initial and the final positions of a body in the direction of the point of the final position.
2. Distance between two given points depends upon the path chosen.	Displacement between two points is measured by the straight path between the points. opposite direction
3. Distance is always positive.	Displacement may be positive as well as 0. +ve , −ve =
4. Distance is a scalar quantity.	Displacement is a vector quantity.
5. Distance will never decrease.	5. Displacement may decrease.



time = t

speed $\geq$ |velocity|

VELOCITY $\Rightarrow$ $V = \frac{AB}{t}$

$\frac{\text{velocity}}{\text{speed}} \leq 1$

SPEED $\Rightarrow$ $\frac{ACB}{t} = V_1$

- Rate of change of **displacement** is called velocity.
- Unit- metre/sec (SI system), cm/sec (CGS system) ft/sec
- Dimension – [LT^{-1}]
- It is vector quantity.

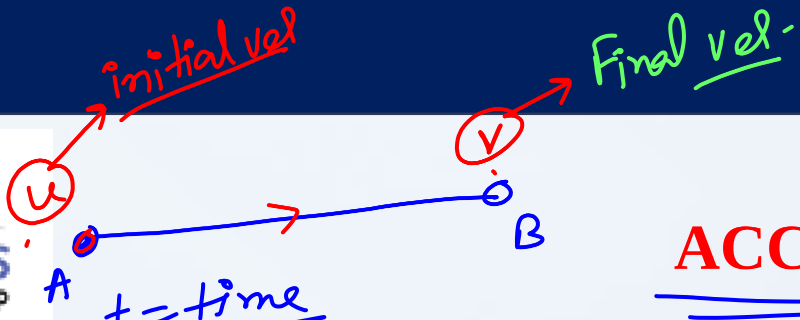
- Rate of change of **distance** is called speed.
- Unit- metre/sec (SI system), cm/sec (CGS system) ft/sec
- Dimension – [LT^{-1}]
- It is scaler quantity.

Avarage velocity (V_{av})

i) $V_{av} = \frac{V_1 + V_2}{2}$

ii) $V_{av} = \frac{\text{Total disp.}}{\text{total time}} = \frac{S_{total}}{t_{(total)}}$

Constant velocity / Uniform velocity



t = time

ACCELERATION

If $(v > u)$

$(v-u)$

- The change in velocity per unit of time is known as acceleration.
- it is a vector quantity and must have a direction.
- Acceleration ‘a’ = $\frac{v-u}{\Delta t}$ $\Rightarrow$ $\boxed{v = u + a \cdot t}$

[v= final velocity, u= initial velocity, Δt = time interval]

$\frac{m/sec}{sec}$

- SI unit is m/s^2 , CGS unit is cm/s^2 . # Dimension $\Rightarrow [LT^{-2}]$
- Retardation is negative acceleration.

$\boxed{a' = -a}$

Retardation (a')

If $u > v$

Change of vel. $= (u - v)$

$\boxed{a' = \frac{u-v}{t}} \Rightarrow$

$\boxed{v = u - a't}$

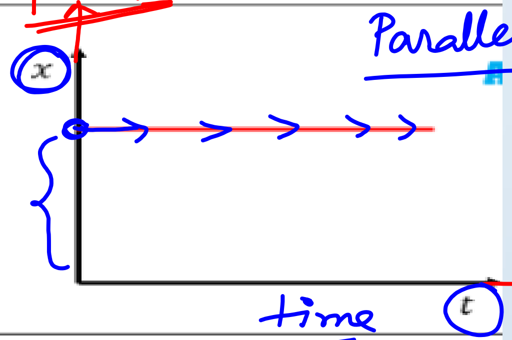
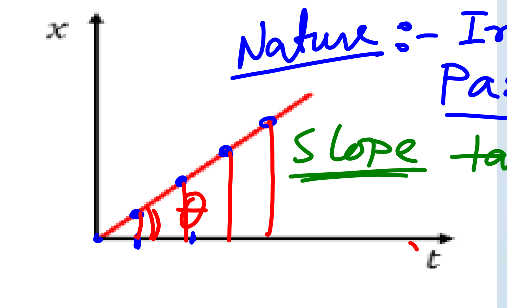
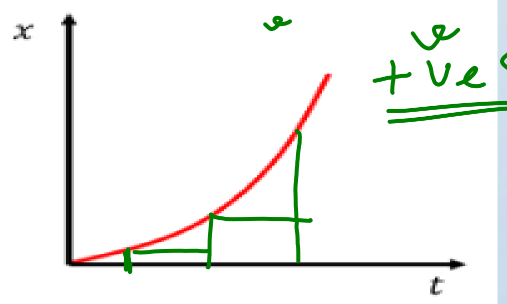
DISPLACEMENT - TIME GRAPH

Slope of distance-time graph ⇒ Speed

$t=0$

5m 5m 5 m

$s=0$

1) At rest: i.e. the slope of $x-t$ (velocity) initial disp x_0 $= \tan 0° = 0$ $\Rightarrow v = 0$	
2) For uniform motion: (velocity v = constant) $x = kt$, k is a positive constant Slope $= \frac{dx}{dt} = \frac{d}{dt}(kt) = k$ i.e. velocity is constant.	
3) Uniformly accelerated motion (Acceleration a is constant) $x = \frac{1}{2}at^2$ Acceleration $= \frac{d^2x}{dt^2} = a$ (Constant)	

Parallel to time axis

Nature :- Inclined straight line Passing through origin

Slope $\tan\theta = \frac{\text{Disp.}}{\text{time}}$ = velocity

+ve slope

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VELOCITY - TIME GRAPH

Area of Speed-time graph ⇒ Distance.

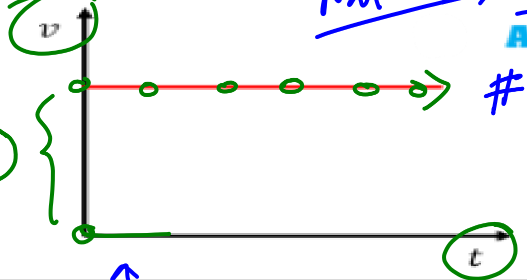
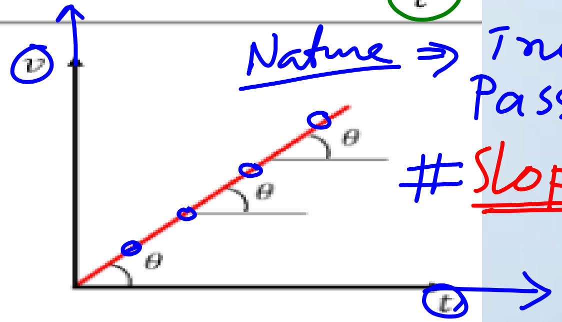
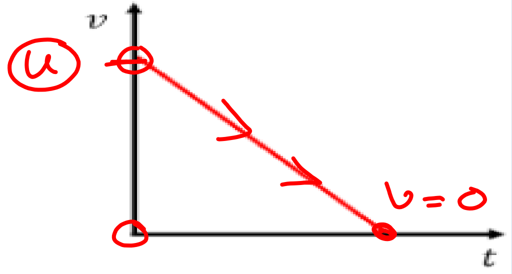
Nature ⇒ Parallel to time-axis

Area of v-t graph = Displacement

Nature ⇒ Inclined straight line Passing through origine

Slope

$\tan\theta = \frac{\Delta v}{\Delta t} = Acc^n$ -

Uniform motion (v = constant, a = 0)	
Uniformly accelerated motion (a = constant) Slope = $+ve$	
Retardation - Uniformly decelerated motion (a = $-ve$) Slope = $-ve$	

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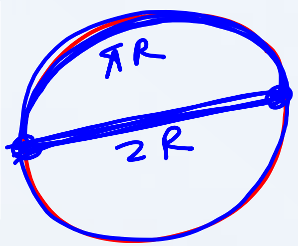


$V_{av} = \left(\frac{u+v}{2}\right)$

$a = \left(\frac{v-u}{t}\right)$

EQUATION IN KINEMATICS

S = Displacement
V = Final vel
u = initial vel
t = time
$+a$ = Accelaration
$-a$ = Retardation.

$V_{av} = 20$ m/sec

$V = 25$ m/sec

$= \left(\frac{u+v}{2}\right) t$

$S \propto t$

1. $S = v_{av} \times t$ [for uniform motion]

100 m

2. $V = u \pm at$ [for uniform acceleration / retardation]

time $(t) = \frac{100}{20} = 5$ sec

3. $V^2 = u^2 \pm 2as$ [for uniform acceleration / retardation]

$V_{av} = \frac{u+v}{2}$

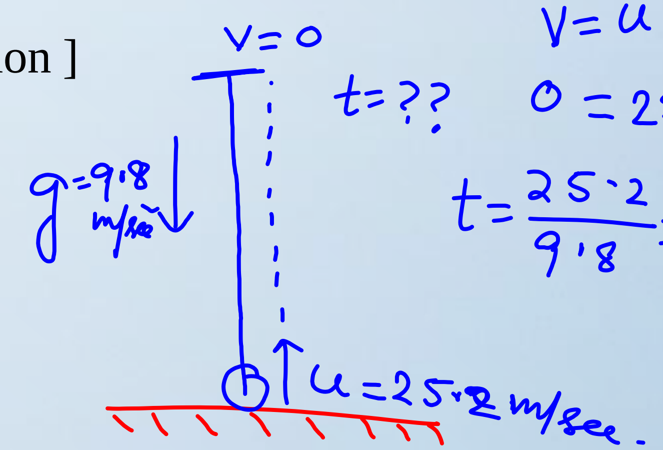
4. $S = ut \pm \frac{1}{2}at^2$ [for uniform acceleration / retardation]

$h = ut \pm \frac{1}{2}gt^2$

$20 = \frac{u+25}{2}$

$u = 40 - 25 = 15$ m/sec

$a = \frac{v-u}{t} = \frac{25-15}{5} = 2$ m/sec^2

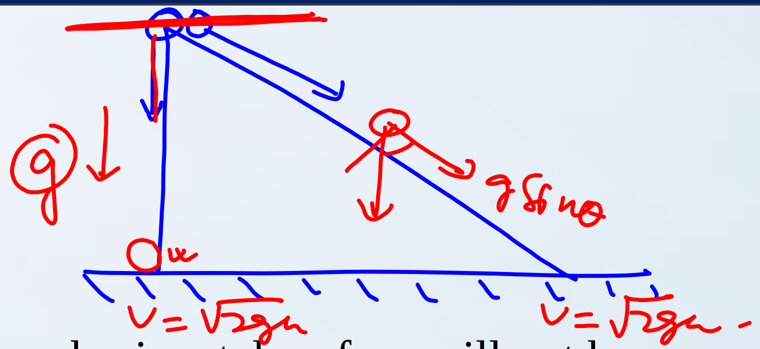


$V = u - gt$

$0 = 25.2 - g \cdot t$

$t = \frac{25.2}{9.8} = 2.57$ sec

PYQ



Q1. An object moving with a constant speed on a horizontal surface will not have—

a) Velocity b) Momentum c) Kinetic energy ***d) Acceleration***

Q2. A person is sitting in a moving train and facing the engine. He tosses up a coin and the coin falls behind him. It can be concluded that the train is moving-

a) forward and losing speed ***b) forward and gaining speed***

c) forward and uniform speed d) backward with uniform speed

Q3. An example of a scalar quantity is—

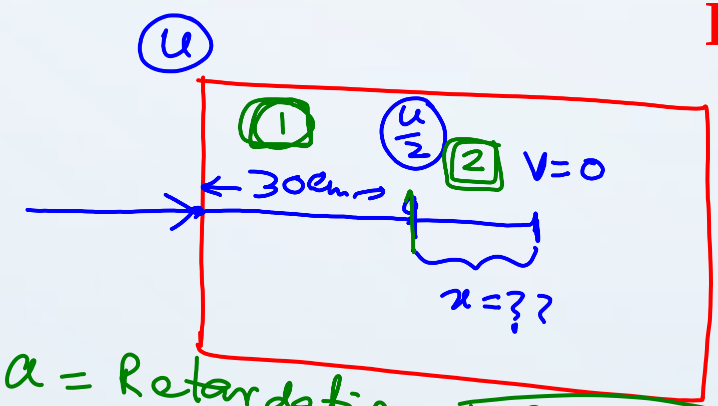
a) Velocity b) Force c) Momentum ***d) Energy***

Q4. Identify the vector quantity from the following—

a) Heat ***b) Angular momentum*** c) Time d) Work

WBCS main

LIBRARY REFERENCE BOOK



- CHAYA PHYSICS(11+12)
- GENERAL SCIENCE ENCYCLOPEDIA(ARIHANT)

a = Retardation

$\boxed{v^2 = u^2 - 2as}$

$\boxed{1st}$

$$\left(\frac{u}{2}\right)^2 = u^2 - 2a\cdot 30$$

$$\frac{u^2}{4} = u^2 - 60a$$

$$60a = u^2 - \frac{u^2}{4} = \frac{3u^2}{4}$$

$$a = \frac{\cancel{3}u^2}{4\times\cancel{60}_{20}} = \frac{u^2}{80}$$

$\boxed{2nd}$

$$0^2 = \left(\frac{u}{2}\right)^2 - \cancel{2}\cdot\frac{u^2}{\cancel{80}_{40}}\cdot x$$

$$\frac{\cancel{u^2}x}{\cancel{40}_{10}} = \frac{\cancel{u^2}}{\cancel{4}}$$

$$\boxed{x = 10\,cm}$$