GRAVITY CLASSES

"Come Gravity Feel Success"

11th & 12th BOARD (NEET & JEE)

5th - 10th (All Subject)

NOTES PHYSICS

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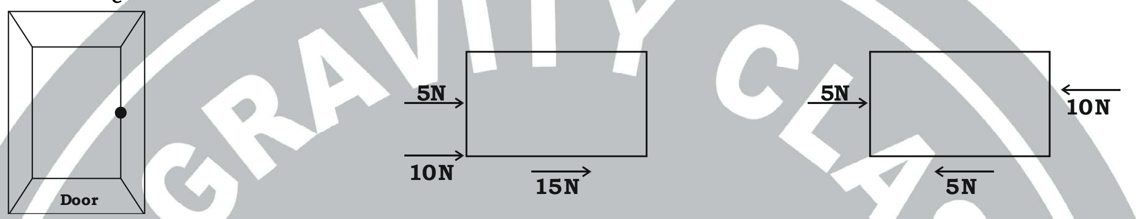
MOTION

- **Motion:-** The phenomenon of change of position of an object w.r.t. time and w.r.t observer.
- **Physics:-** It is a branch of science that deals with study of natural Phenomenon.
- **Physical Quantity:-** All those quantity which can be measured. ex. Time, Speed, Temp., Weight, Force, Pressure etc.
  Light X, Light Intensity
  Sound X, Sound Frequency wavelength.

(i) Scalar Quantity:- A quantity that has only magnitude is called a Scalar Quantity.
All those quantity which can be completely described by magnitude alone. Ex. length, weight, temp., time etc.

(ii) Vector Quantity:- A quantity that has magnitude as well as direction and that follows the same rules of addition as displacements do is called a Vector Quantity.
Those quantities which need both magnitude and direction for there complete description they are called V.Q. Ex. Force

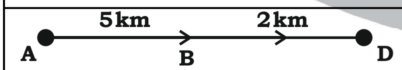
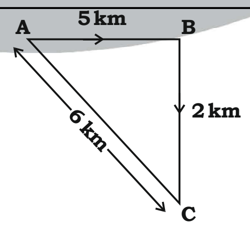


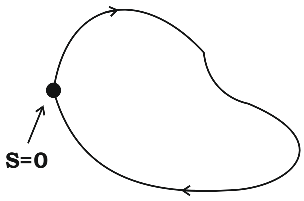
Indication: $\vec{S}, \vec{T}, \vec{D}$

- **Unit:-** It is a reference standard in term of which any Physical Quantity can be measured.
  ex. kg, g, mg → Mass.
  km, m, cm, mm → Length.
- **S.I. Unit:-** International System of Unit.

Length	**Mass**	**Time**	
Meter (m)	Kilogram (Kg)	Second (s)	
Meter	Kilogram	Second	M K S
Centimeter	Gram	Second	C G S
Foot	Pound	Second	F P S

- **Mechanics:-** It is a branch of physics in which deals with study of motion.

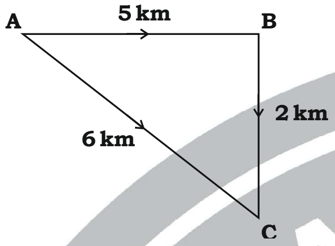
Distance	**Displacement**
can never be –ve.	can be –ve value.
Total actual path covered by the body.	The shortest separation between initial and final.
Representation → 'D'	Representation → 'S'
S.I. unit 'm' (Scalar)	S.I. unit 'm' (Vector)
 Distance = 7 km Displacement = 7 km	 Mag. Same but direction change. Distance = 7 km Displacement = 6 km



- Displacement can be zero but distance can't be zero.

→ Distance is not depending upon direction, so distance is an Scaler Quantity.

→ Displacement is a direction dependent on changes direction, length changes.



Displ. = 6 km.

So, it is Vector Quantity

- **Speed (v):-** The speed of an object that is moving is a quantity that tells us how fast it is moving.

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

S.I unit of speed is Scalar.

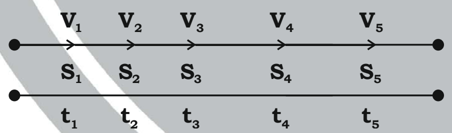
$$\text{Speed} = \frac{m}{s} \rightarrow m/s = ms^{-1}$$

- **Velocity** $\left(\vec{v}\right)$ **:-** The velocity of an object is a quantity that gives the speed of the object as well as its direction of motion.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time}}$$

S.I. unit of velocity is Vector Quantity.

$$\vec{v} = \frac{\text{Disp.}}{\text{Time}} = \frac{m}{s} = \frac{\text{Vector}}{\text{Scalar}} = \text{Vector}$$



- **Average Speed:-** The speed of an object that is moving is a quantity that tells us how fast it is moving.

$$\text{Av. Speed} = \frac{\text{Total dist. covered}}{\text{Total time taken}}$$

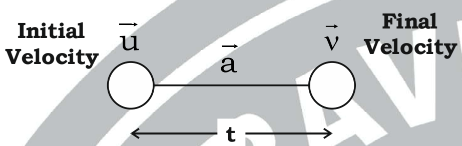
$$= \frac{s_1 + s_2 + s_3 + s_4 + s_5 + \ldots..}{t_1 + t_2 + t_3 + t_4 + t_5 + \ldots.}$$

- **Average Velocity:-** The average velocity of an object is its total displacement divided by the total time taken. In other words, it is rate at which an object changes its position from one place to another.

$$\text{Av. Velocity} = \frac{v_1 + v_2 + v_3 + v_4 + v_5}{5}$$

Uniform Motion	**Non-Uniform Motion**
Speed = Constant	Speed = Variable
If an object covers equal distances in equal interval of time the motion is said to be Uniform Motion.	If an object is covering unequal distance in unequal interval of time is said to be Non-uniform Motion.

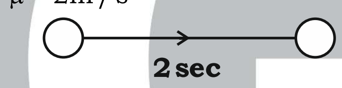
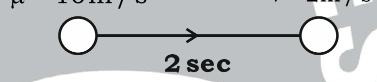
- **Acceleration** $\left(\vec{a}\right)$ **[Non-Uniform Motion]:-** The rate of change of velocity. The average speed of an object in a time interval is equal to the distance traversed divided by the time interval.
- **Retardation:-** If the acceleration's direction is opposite to that of the velocity, the object will decelerate.



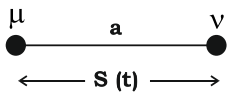
$\boxed{\vec{a} = \frac{\vec{v} - \vec{\mu}}{t}}$ $\frac{\rightarrow \text{ Vector}}{\rightarrow \text{ Scaler}}$

→ S.I unit of Acceleration is $\frac{m/s}{s} = m/s^2 = \frac{m}{s^2} = ms^{-2}$

→ Acceleration is vector quantity.

 $\mu = 2m/s$, $v = 10m/s$, **2 sec**	 $\mu = 10m/s$, $v = 2m/s$, **2 sec**
$a = \frac{v-\mu}{t} = \frac{10-2}{2}$	$a = \frac{v-\mu}{s} = \frac{2-10}{2}$
$= \frac{8}{2} = 4m/s^2$ ↑↓	$a = -4m/s^2$ ↓
	–ve Sign Retardation → When speed decreases → Brake are applied

Motion	
Uniform Motion	Non-Uniform Motion
(Speed → Cont.)	Speed ≠ Const.
a = 0	a ≠ 0 ↑↓
$\boxed{\text{Speed} = \frac{\text{Dist.}}{\text{Time}}}$	$v = \mu + at$
	$s = \mu t + \frac{1}{2}at^2$
	$v^2 = \mu^2 = 2as$



Where

μ = Initial Velocity

ν = Final Velocity

a = Acceleration

s = Displacement

t = Time

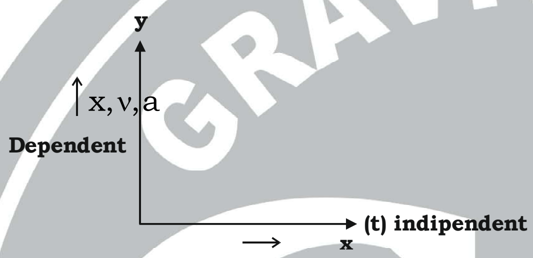
- **Understanding Graph:-**

  There are 3 types of Graph.

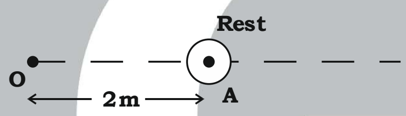
i. Position-Time Graph $(x-t)$.

ii. Velocity-Time Graph $(\nu-t)$

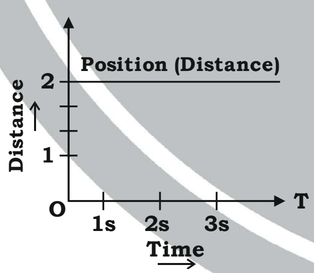
iii. Acceleration-Time Graph $(a-t)$.

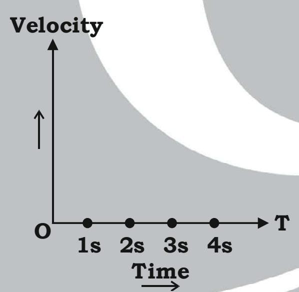


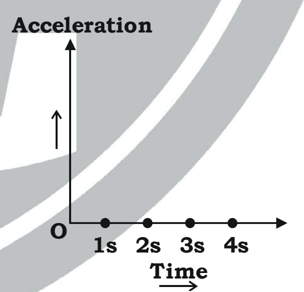
I. Rest (Stationary):-



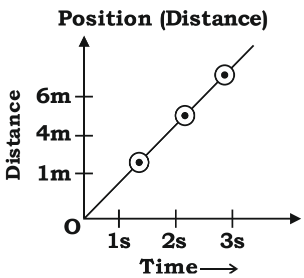
t = 0	2 m
t = 1s	2 m
t = 2s	2 m
t = 3s	2 m

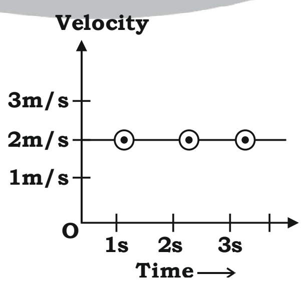


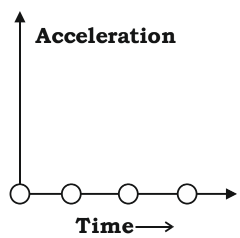




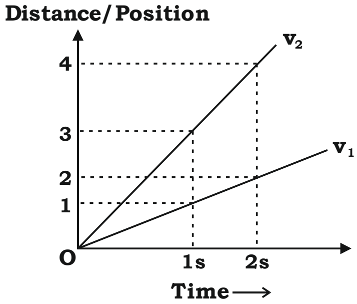
II. Uniform Motion (Speed → Const.):-







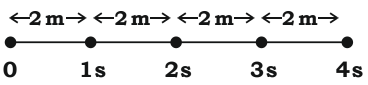
$$a = \frac{v-u}{t} = 0$$



More the slope more will be 'accel'

Less the slope less will be 'accel'

$v = 2m/s$



III. Uniform Acceleration (Const. Acceleration):-

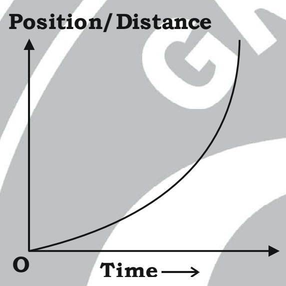
Ex. Means in every second adding (+) 2 m/s

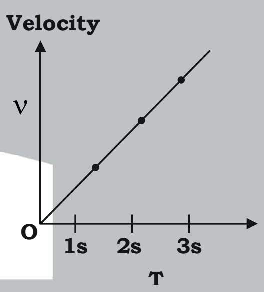
0 s → 0 m/s

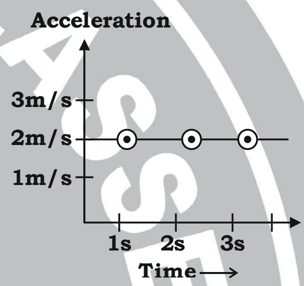
1 s → 2 m/s

2 s → 4 m/s

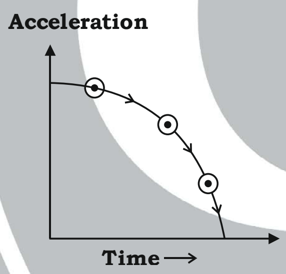
3 s → 6 m/s

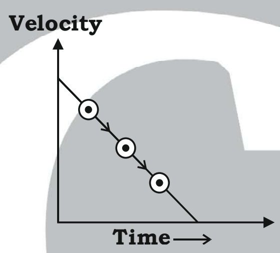






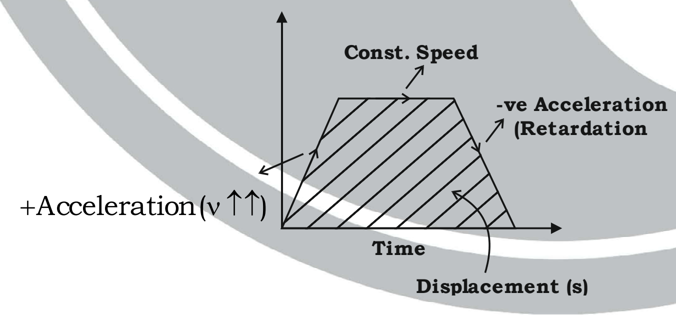
IV. Uniformily Retardation:- $v\downarrow\downarrow$ **(Negative Acceleration)**



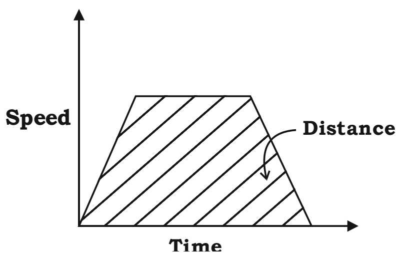


Note:- N (Normal Analysis)

Only in vt-Graph

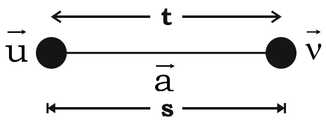


Let



- **Kinematical Equation (K.E):-**

Three K.E. are:-



$\nu = \mu + at$
$s = \mu t + \frac{1}{2}at^2$
$\nu^2 = \mu^2 = 2as$

Where,

ν = Final Velocity
μ = Initial Velocity
a = Acceleration
s = Displacement
t = Time

i. $\nu = \mu + at$

Difference of Acceleration
We know,

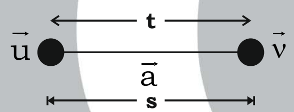
$$a = \frac{\nu - \mu}{t}$$

$$at = \nu - \mu$$

$$at + \mu = \nu$$

$$\boxed{\nu = \mu + at} \quad ....(i)$$

ii. $s = \mu t + \frac{1}{2}at^2$



As we know velocity

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

$$\frac{\mu + \nu}{2} = \frac{s}{t}$$ [$\because$ we are taking Average Velocity because there is two velocity i.e. μ & ν]

$$\left(\frac{\mu + \nu}{2}\right) \times t = s$$

$$\left[\frac{\mu + (\mu + at)}{2}\right] \times t = s$$

$$\left[\frac{\mu t + \mu t + at^2}{2}\right] = s$$

$$s = \frac{2\mu t + at^2}{2}$$

$$= \frac{\cancel{2}\mu t}{\cancel{2}} + \frac{at^2}{2}$$

$$\boxed{s = \mu t + \frac{at^2}{2}}$$

iii. $v^2 - \mu^2 = 2as$

$$\left(\frac{\mu + v}{2}\right) \times t = s \quad \text{[From above equation]}$$

We know that Acceleration

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

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

So, our equation becomes

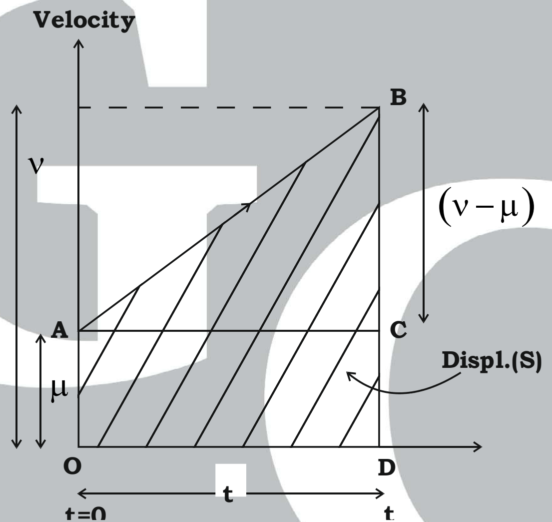
$$\left(\frac{\mu + v}{2}\right)\left(\frac{v - \mu}{a}\right) = s$$

$$(\mu + v)(v - \mu) = 2as$$

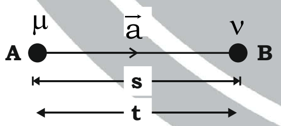
$$\boxed{v^2 - \mu^2 = 2as}$$

➢ **Kinematical Equations (Graphically):-**

$\boxed{v = \mu + at}$ $\boxed{s = \mu t + \frac{1}{2}at^2}$ $\boxed{v^2 - \mu^2 = 2as}$



i. By Definition of Acceleration



So, $\text{Acceleration} = \frac{\text{Change in Velocity}}{\text{Time}}$

$$a = \frac{BD - OA}{OD} \quad (\because \text{ Final Vel.} - \text{Init. Vel.})$$

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

$$at = v - \mu$$

$\boxed{v = \mu + at}$ ....(i)

ii. As we know Displacement (s) means shaded area, so

$$S = A(\square ABDO) \quad \text{[i.e. Area of Trapezium } \square \text{]}$$

$$S = A(\triangle ABC) + A(\square ABDO)$$

$$S = \left[\frac{1}{2}(AC \times BC) + (AC \times DC)\right]$$

$$S = \frac{1}{2} \times t \times (\nu - \mu) + (t \times \mu)$$

$$= \frac{t}{2}(\nu - \mu) + \mu t$$

$$= \frac{t}{2}(at) + \mu t \quad \left[\because a = \frac{\nu - \mu}{t} \quad \text{so, } \boxed{\nu - \mu = at}\right]$$

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

iii. Displacement

S = Area of Trapezium.

$$= A(\square ABDO)$$

$$S = \frac{1}{2}(AO + BD) \times OD \quad [\because \text{ Sum of H side} \times \text{Height of } \square]$$

$$S = \frac{1}{2}(\mu + \nu) \times t$$

We know from acceleration

$$a = \frac{\nu - \mu}{t}$$

so, $\boxed{\frac{\nu - \mu}{a} = t}$

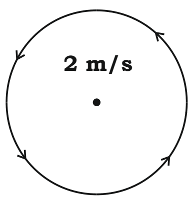
we use this in above equation

$$S = \frac{1}{2}(\nu + \mu)\left(\frac{\nu - \mu}{a}\right)$$

$$2aS = (\nu + \mu)(\nu - \mu)$$

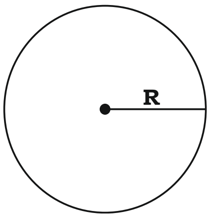
$$\boxed{2aS = \nu^2 - \mu^2}$$

- **Circular Motion:-** An object moving along circular path.



- **Uniform Circular Motino:-** (Speed is Const.)

→ An object moving along circular path with constant speed.



In completing 1 circle.

→ Circumference (D) → [Distance] $= 2\pi R$

→ 1 revolution/Time period = T

So, $\text{Speed} = \dfrac{\text{Distance}}{\text{Time}}$

$\therefore \boxed{\text{Speed} = \dfrac{2\pi R}{T}}$

Note:-Speed can be constant in both cases. But velocity can't be Constant because velocity is a Vector Quantity.

→ But here in this circular motion case Direction is continuously changing.