EVERWIN VIDHYASHRAM

STD: IX **PHYSICS NOL**

CHAPTER - 8 MOTION (APRIL & JUNE)

Motion:

An object said to be in motion when its position changes with time.

Distance:

The total path covered by an object, scalar quantity, SI unit is 'm' .

Displacement:

The shortest distance measured from the initial to the final position of an object, vector quantity, SI unit is 'm'.

Uniform motion:

When an object covers equal distance in equal intervals of time, it is said to be in uniform motion.

Non Uniform Motion:

When an object covers unequal distances in equal intervals of time.

Speed:

The distance travelled by an object in unit time.

- Scalar quantity
- SI unit – m/s

Average Speed:

For non-uniform motion, the average speed of an object is obtained b dividing the total distance travelled by an object by the total time taken.

$$\text{Average speed } (v) = \frac{\text{Total distance travelled } (s)}{\text{Total time taken } (t)}$$

Velocity:

- Velocity is the speed of an object moving in definite direction.
- SI unit – m/s
- Vector quantity.

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

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

u – Initial velocity; v – final velocity.

Acceleration:

- Change in velocity of an object per unit.
- $a = \frac{v-u}{t}$
- SI unit – m/s^2

Uniform Acceleration:

Velocity of an object increases or decreases of time.

Non-Uniform Acceleration:

Velocity of an object increases or decreases by unequal amounts in equal intervals of time.

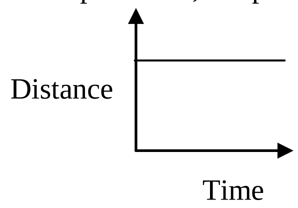
Graphical Representation:

Distance – time graph:

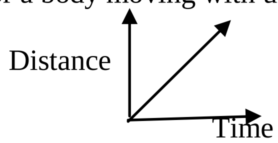
- Time is taken on x-axis and distance travelled is tken on y axis .
- Speed of a body = slope of graph
- For uniform speed, slope is inclined straight line.
- For non-uniform speed slope is a curved line.
- For a stationary body, slope is a straight line parallel to time axis.

For a body at rest.

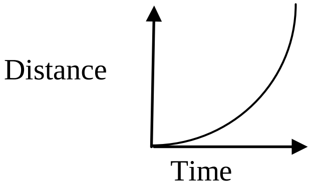
- As the slope is zero, so speed of the body is zero.



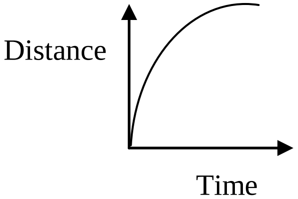
- For a body moving with uniform speed



- For non- uniform motion (accelerated motion) The slope of graph is increasing with time.

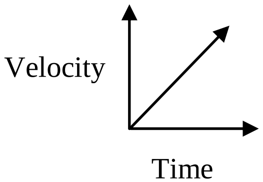


- For decelerated motion (speeding down)
- Slope of graph is decreasing with time.

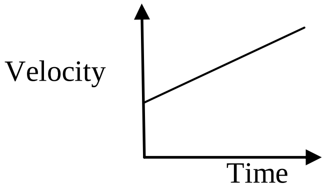


Velocity –Time graphs

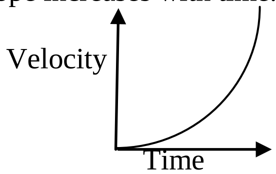
- When a body moving with a uniform velocity.
- The slope of AB indicates zero acceleration.



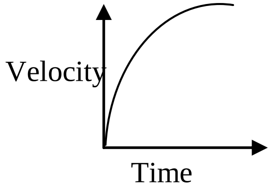
- When a body is moving with uniform acceleration and its initial velocity is not zero.



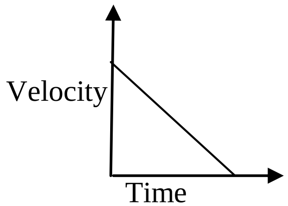
- When a body is moving with increasing acceleration.
- Slope increases with time.



- When a body is moving with decreasing acceleration.
- Slope decreases with time.



- When a body is moving with a uniform retardation & its initial velocity is not zero.



Velocity- time graph:

- Time is taken on x-axis and velocity is taken on y- axis

Velocity is taken on y-axis:

- Acceleration of body = slope of graph.
- Distance or displacement = Area under the curve.
- For uniform accelerated motion slope is a curved line.

Equations of motion.

I – $V = u + at$

II – $S = ut + \frac{1}{2} at^2$

III – $V^2 = u^2 + 2as$

Motion along circular path.

When moving in a circular path with uniform speed, it is said to be uniform circular motion.

- Direction changes continuously
- $V= \frac{2\lambda r}{t}$

CHAPTER – 9 FORCE AND LWAS OF MOTION (JULY)

Net Force:
The net force is when two or more forces are applied on the same object and at the same time. The applied force combined are called the net force.

- Force can make a stationary body in motion.
- Force can stop a moving object.
- Force can change the speed of a moving body.
- Force can change the shape and size of an object.

Balances forces:

- If the net forces of applied forces is equal to zero, it is called balanced force.
- Balanced forces are equal in magnitude and opposite in direction.

Unbalanced Forces:

- Net force of applied force is greater than zero.
- An object in rest can be moved because of applied unbalanced forces.

Newton's laws of motion:
A body is at rest will remains in rest and a body in motion will continue to be in motion in a straight line with uniform speed, unless it is compelled to change by an external force.

Inertia:

- Resistance to change.
- In ability of an object to change its state by itself.

Applications of Newton's I Law: (Types of Inertia)

- Inertia of rest – A passenger in a stationary bus has the tendency to be at rest, when the bus takes a sudden start, body of passenger will have a jerk.
- Inertia of motion – when the bus is baked suddenly, the man bends forward due to inertia of motion.
- Inertia of direction – A passengers in a moving bus has a tendency to move in a straight line, when the bus takes turn, towards left his body bends towards right.

Momentum:

- Product of mass and velocity
- P = m x v
- SI unit = $kgms^{-1}$

Change in momentum:

- Difference between final momentum (mv) and the initial momentum (mu).
- Change in momentum = mv-mu

Newton's II law:
The rate of change of momentum of a body is directly proportional to the applied force.

- Force = $\frac{\text{Change in momentum}}{\text{time taken}}$
- $F = \frac{mv-mu}{t}$
- $F = m[\frac{v-u}{t}]$
- F = m a
- SI unit – N
- One & unit of force (1N) is defined as the amount that produces an acceleration of $1ms^{-2}$ in an object of mass 1kg.

Application of Newton's II Law:

- When we stop the ball gradually we need to apply less force, this is easy and safe, if we stop the ball suddenly,

- We need to apply larger force which is difficult and can also injure our hand.

Newton's III law of motion.

To every action there is a equal and opposite reaction.

Applications of III law:

- Gun applies force on bullet due to which it moves ahead. By newton's III law bullet will also apply same force on gun in backward direction, This is called recoil of gun.
- Hose pipe applies large force on water due to which water moves ahead. By Newton's III law water applies the same force on pipe backwards. To stop it, many people need to hold it.
- Man pushes the boat backward and boat pushes man forward.
- In swimming man pushes water back (action), man moves ahead (reaction)

Conservation of momentum:

If two or more object apply force on each other with no external force, their final momentum remains same as initial momentum.

Total momentum before collision } = Total momentum after collision.

m1u1+m2u2=m1v1+m1v2

Practical examples of convervation of momentum.

- In rocket, fuel is burnt due to which gases are ejected downwards. For conservation of momentum, rocket moves up.
- Fuel in jet plane burns and ejects gases in backward direction, Plane moves ahead.

CHAPTER 10 – GRAVITATION **OCTOBER**

Newton's Universal law of gravitation:

- Every object in the universe attracts every other object with the force which is directly proportional to the square of distance between them.
- $F \propto \frac{Mm}{d^2}$
- $F = G \times \frac{Mm}{d^2}$
- G- Gravitational constant
- $G = 6.67 \times 10^{-11} Nm^2Kg^{-2}$

Relation between Newton's III law of motion and Newton's law of gravitation.

- According to Newton's III law, "Every object exerts equal and opposite force on other object but in opposite direction".
- According to Newton's law gravitation, "Every mass in the universe attracts the very other mass".
- In case of freely falling stone and earth, stone is attracted towards earth means.
- But according to Newton's III law, the stone should also attract the earth.
- It is true that stone also attracts the earth with the same force but due to very less mass of the stone and the acceleration is 9.8 m/s², the acceleration of earth.
- F = m x g----------②

  Substitute ② in ①

  $m \times g = \frac{G M_e m}{R^2}$

  $g - \frac{GM_e}{R^2}$

  $G = 6.67 \times 10^{-11} Nm^2Kg^{-2}$

  $M_e = 6 \times 10^{24}$ Kg

  $R = 6.37 \times 10^6$ m

  $g = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24}}{(6.37 \times 10^6)^2}$

  $g = 9.8 m/s^2$

Relationship between G and g:

$g = \frac{GM}{R^2}$

Mass and weight:

Mass	Weight
1.Quantity of matter contained in an object	1.Gravitational pull acting on an object
2. Remains constant at all the places	2.different at different places
3. Mass of the body cannot be zero	3. Weight of the object becomes zero if 'g' is zero.
4. Measure of inertia	4. measure of graviy
5. Scalar quantity	5. Vector quantity
6. SI unit – kg	6. SI unit - N

Factors affecting value of 'g'

- Earth is not a perfect sphere. The radius of the earth increases when we go from pole to equator, hence the value of 'g' maximum at the poles minimum at the equator.
- The value of 'g' decreasing with increasing height.
- The weight of an object on moon is one-sixth of the weight on earth.

Thrust and Press:

- The force acting on an object perpendicular to the surface is called thrust.
- The effect of thrust per unit area is called pressure.
- P= F/A
- SI unit – N/m^2 or Pascal (Pa)

Pressure depends on two factors

- Force applied
- Area of surface over which force acts.

Buoyancy:

- The upward force experienced by an object when it is immersed into a fluid is called force of buoyancy.
- It acts in upward direction.
- depends on density of the fluid
- When the force of gravitation lesser than the buoyant force, object floats.
- When the force of gravitation greater than the buoyant force, object sinks.
- This is the reason why pins sink and boat/ship floats.

Density:

- Mass per unit volume
- SI UNIT = Kg/m^2

Archimedes's Principle:

- When a body immersed fully or partially in a fluid, it experiences a upward force that is equal to the weight of the fluid displaced by it.

Applications of Archimedes's principle:

- Used in designing ships and submarines.

Submarines:

- Hydrometers and lactometers are mage on this principle.

Relative density:

- The ratio of the density of a substance to that of the density of water.
- Relative density = $\frac{\text{Density of substance}}{\text{Density of water}}$
- It has no unit.

CHAPTER 11 – WORK AND ENERGY NOVEMBER

Work:

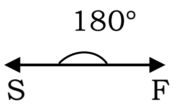
- Force acting upon an object to cause a displacement
- W = F x S
- SI unit – Nm or joule (J)
- SI joule is defined as the amount of work done by force 1N when displacement is 1m
- 1J = 1N x 1m

Sign Conventions for work done:

- When both the force and the displacement are in the same direction, positive work is done.
- W = F x S ___S F→ 0 = 0°

- When force acts in a direction opposite to the direction of displacement, the work done is negative.

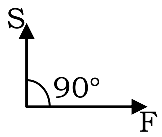
- W = - F x s

- 

W = Fs cos 0

W = Fs cos 180°

w = - Fs

- If force and displacement act at an angle 90° then work done is zero.
- 

W= F s cos 0

= F s cos 90°

W = 0

Necessary conditions for work to be done:

- Force should act on the object object must be displaced.

Energy:

The capacity of a body to do work is called the energy of the body.

SI unit – joule (J)

1000 J = 1 KJ

Forms of energy:

The various forms of energy are potential energy, kinetic energy, heat energy, chemical energy, electrical energy and light energy.

Kinetic energy:

It is the energy possessed by a body due to its motion.

Kinetic energy of an object increases with speed.

Kinetic energy of a body moving with a certain velocity.

Work done on it W = FxS---①

According to third equation of motion

$V^2 = u^2 + 2as$

$V^2 - u^2 = 2as$

$\frac{V^2 - u^2}{2a} = S$ ---------②

According to Newton's II Law of motion.

F = ma ------------③

Substitute ③ & ② in ①

$W = m\,a \times \frac{v^2 - u^2}{2a}$

$= \frac{mv^2}{2}$ Initial velocity u = 0

$E_k = \frac{1}{2} mv^2$

Potential energy:

Energy possessed by a body due to its position or shape.

Ex. Water stored in a dam, a stretched rubber band possess potential energy due to its distorted shape.

Types of potential energy:

On the basis of position and change in shape of object, Potential energy is of two types.

i) Gravitational potential energy : It is the energy possessed by a body due to its position above the ground.

ii) Elastic Potential energy: It is the energy possessed by a body due to its change in shape.

Expression for Potential energy:

- E_p = mgh
- SI unit – joule (J)

Law of Conservation of energy:

- Energy neither be created nor destroyed, but one form of energy can be transformed to another form.
- Total energy remains the same.

Power:

The rate of doing work.

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

Unit of Power:

- SI unit of Power – Js^{-1} or walt
- 1 walt is the power when 1J of work is done in 1s
- The bigger unit of power is kilo walt (KW)
- 1KW = 1000 W
- 1 Mega walt = 10^6 Walt
- 1 Horse power = 746 walt

Commercial unit of energy:

- The unit of energy is kilo Walt hour (kWh)
- The unit kilo Walt hour means one kilo walt of power supplied for one hour.
- 1 kwh = 1 kw x 1h
- = 1000 w x 60 x 60 s

= 1000 Js^{-1} x 3600 s

= 3.6 x 10^6 J

1 unit = 1 kilo walt hour = 3.6 x 10^6 J

CHAPTER 12 – SOUND DEC/JAN

Introduction:

- Sound is a mechanical energy which produces sensation of hearing.
- Sound is produces due to vibration of different objects.
- Sound wave propagates as compressions an rare fractions in the medium.
- Sound waves are longitudinal waves.
- sound waves are produces due to variations in pressure and density of the medium.

i) Compressions:

Compression is the part of wave in which particles of the medium are closer to one another forming the region of high pressure and density.

- Compressions are represented by the upper portion of the curve called crest.

ii) Rare fraction:

Rare fraction is a part of the wave where particles spread out to form a region of low pressure and density.

Rare fractions are represented by the lower position of the curve called trough.

iii) Amplitude (A):

The maximum displacement of each particular form its mean position.

SI unit –m

iv) Wavelength (A):

The distance between two adjacent crests or troughs of a wave is called its wavelength.

SI unit –m

v) Frequency (V):

The number of vibrations per second.

$V = \frac{1}{t}$

SI unit –Hz

vi) Velocity (V):

The distance travelled by a wave in one second.

SI unit – m/s

$$\text{Velocity} = \frac{\text{distance travelled}}{\text{time taken}}$$

$V = \frac{\lambda}{t}$

$V = \frac{1}{t} \times \lambda$ ∴ $V = \frac{1}{t}$

V = V λ is called wave equation.

vii) Time equation (t):

- Time taken to complete one vibration.
- SI unit is second (s)

Pitch and Loudness of Sound:

Pitch: It represents shrillness or flatness of sound.
It depends on frequency of vibration.
Higher the frequency higher will be pitch and vice-versa.

Loudness:

It is the measure of sound energy reaching the ear per second.

It depends on amplitude of the sound wave.

It is measured in decibel 'db'.

Audible Frequency:

The audible range of human ear between $20H_z$ and $20,000\ H_{z.}$

Range of frequencies:

Infrasonic has the frequency below $20H_z$

Reflection of second:

An Echo is the phenomenon of repetition of sound of a source by reflection from an obstacle.

Multiple echoes:

Multiples echoes are heard when sound is repeatedly reflected from a number of obstacles at suitable distance.

Megaphones, Stethoscope, hearing aid etc, are based on phenomenon of multiple reflection of sound.

Reverberation:

Reverberation is the phenomenon of persistence of audible sound after source has stopped emitting sound.

Reverberation is reduces by carpeting the floor, upholstering furniture and covering walls with some absorbing materials like curtains etc.,

Human Ear:

- Outer ear – collects the sound waves
- Middle ear – amplifies the sound waves.
- Inner ear – converts the amplified sound energy into electrical energy and conveys to the brain as nerve impulse for interpretation.