SCIENTIFIC REASONS / SHORT QUESTIONS

CHAPTER # 1
SCOPE OF PHYSICS

Q1. What is physics? What are its main branches?

Ans. Physics: The branch of the physical sciences which deals with interaction of matter and energy and their relationship. It explains the natural phenomena with help of fundamental laws and principles. Main branches of physics are:
Electronics, Bio-physics, Nuclear physics, electrical physics, Plasma physics, e.t.c.

Q2. Name some of the household applications in your home which are based on the principle of physics.

Ans. Radio, Television, Telephone, Electric fans, Washing Machine, Electric Iron, Bulb, Fluorescent Tube, Heater, Toaster, Grinder, Refrigerator, Sewing Machine, Electric Bell.

Q3. What type of natural phenomena could serve as alternative time standard?

Ans. Any phenomenon that repeats itself can be used as a measure of time: the measurement consists of counting the repetitions.

Q4. Are the radians and steradian the basic units of SI?

Ans. Are radians and steradians are two supplementary basic units of SI. Radian is used for the plane angles and steradian for solid angles.

Q5. Express the following quantities using the prefixes.

(a) 3×10^{-4} m. (b) 5×10^{-5} s. (c) 72×10^{2} g.

Ans.

(a) 3×10^{-1}m = 0.3×10^{-3} = 0.3 mm
(b) 5×10^{-5}s = 50×10^{-6}s = 50 μs
(c) 72×10^{2}g = 7.2×10^{3}g= 7.2 Kg

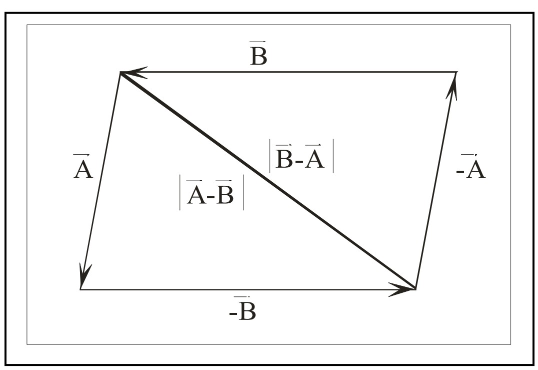
CHAPTER # 2
SCALAR & VECTOR

Q1. Can the magnitude of the resultant of two vectors is greater then the magnitude of sum of the individual vectors?

Ans. **No**, the magnitude of the resultant of two vectors can be equal to or less than the sum of the magnitude of the individual vector.

Q2. Can the magnitude of $\vec{A} - \vec{B}$ be the

Ans. **Yes**, If two vectors $\vec{A}$ **and** $\vec{B}$ represent two adjacent sides of a parallelogram as shown in figure then from figure we can write:



$$\left|\vec{A} - \vec{B}\right| = \mathbf{OP} \text{ ....Eq. (i)}$$

$$\left|\vec{B} - \vec{A}\right| = \mathbf{OP} \text{ ....Eq. (ii)}$$

By comparing Eq. (i) and (ii) we get

$$\boxed{\left|\vec{A}-\vec{B}\right| = \left|\vec{B}-\vec{A}\right|}$$ **.........Proved**

Q3. **If $\vec{C}$ is the vector sum of $\vec{A}$ and $\vec{B}$ does $\vec{C}$ have to lie the same plane of $\vec{A}$ and $\vec{B}$?**

Ans. **Yes**, if $\vec{C} = \vec{A} + \vec{B}$ then $\vec{C}$ lies in the same plane of $\vec{A}$ and $\vec{B}$.

Q4. **Can a scalar product of two vectors be negative?**

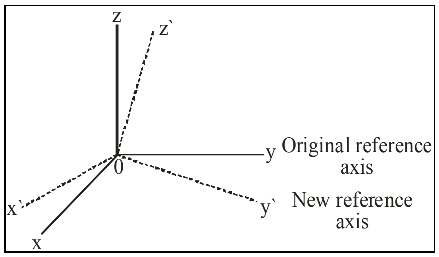
Ans. **Yes**, If the angle between two vectors is 180°.

Q5. **Is it possible that the magnitude of the resultant of two equal vector be equal to the magnitude of either vector.**

Ans. **Yes**, it is possible if the angle between two given vector is 120°.

Q6. **Will the value of a vector quantity change if it's reference axis are changed. Explain?**

Ans. **No,** since the vector depends upon only magnitude and direction and independent to the reference axis, so the vector remains unchanged if it's reference axis are changed.



Q7. **Show that scalar product holds commutative law of multiplication.**

Proof:

Consider two vector A and B having angle ‘θ’ between them. (as shown in Fig1) Scalar product means the product of the magnitudes of those vectors that have same directions.

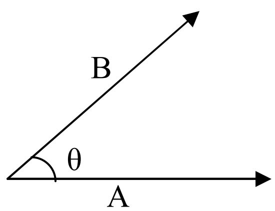
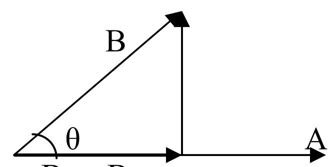


Fig1



$B_x = B_x$

Fig 2

From Fig 2.

$A \bullet B = |A|\, B_A = |A|\, B_x$

But $B_x = |B| \cos\theta$

$A \bullet B = |A||B| \cos\theta$ (1)

From Fig 3

$B \bullet A = |B|\, A_B = |B|\, A_x$

But $A_x = |A| \cos\theta$

$B \bullet A = = |B|\,|A| \cos\theta$

$B \bullet A = |A|\,|B| \cos\theta$ (2)

Combining (1) & (2)

$$\boxed{\mathbf{A \bullet B = B \bullet A}}$$

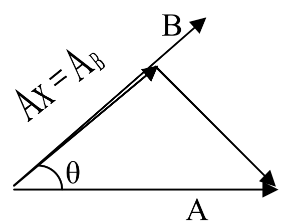


Fig 3.

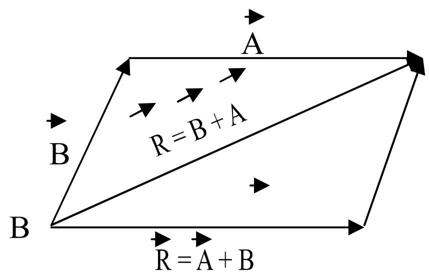
This is the required expression and it shows that “If the order of the addition of two vectors is changed then resultant remains unchanged.”

Q8. State and verify the law of parallelogram.

Consider two vectors A and B which represent the two adjacent sides of a parallelogram. If these vectors are added graphically by head and tail rules, the resultant vector is obtained as,

$\vec{R} = \vec{A} + B$

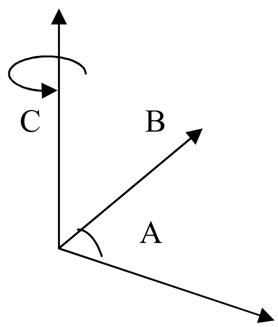
or $\vec{R} = \vec{B} + A$



This property is called law of parallelogram and it states that
'If the two adjacent sides of the parallelogram are represented by two vectors then the diagonal of the parallelogram gives the resultant vector.'

Q9. State 'right hand rule' for the direction of the vector product.

The direction of the product can be determined by using right hand rule which is given as "If the curl of the figures of right hand gives the direction of the plane of the multiplied vectors then the direction of thumb which is perpendicular on the finger gives the direction of the product vectors."



Q10. Define unit vector.

Ans. A vector having magnitude on e and used to indicate only the direction of the vector is called unit vector.

OR

'The ratio of a vector with its magnitude is called unit vector.
Mathematical Form:
A unit vector can be determined just by dividing a vector with its magnitude.

i.e. $a = \frac{A}{|A|}$

Q11. Define rectangular components. Give its different types.

Ans. The components of a vector that are perpendicular on each other and can be form the side of the rectangular are called rectangular components of a vector. There are two types of rectangular components.

(i) Horizontal component or x-component. (ii) Vertical component or y-component

Q12. Define product of two vectors. Give its types.

The multiplication of two vectors with each other is called product of the vector.
There are two types of the product of the vectors.

I. Scalar product or dot product.
II. Vector product or cross product.

Q13. Give the mathematical form of scalar product.

consider two vectors A and B having angle 'θ' between them.
(as shown in Fig 1)
Scalar product means the product of the magnitudes of those vectors that are acting in the same direction.

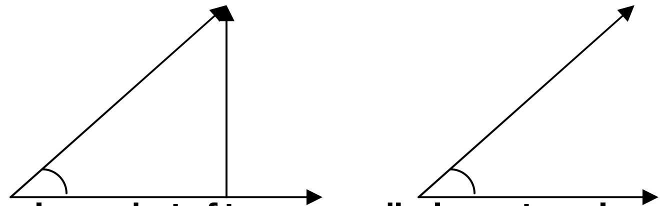
From Fig 2.

$A \bullet B = |A|\ B_A = B_{xs}$

But $B_x = B_A = |B| \cos\theta$

$A \bullet B = |A||B| \cos\theta$

This is the required mathematical form for the scalar product. It is also called dot product because of sign of dot (•) is used between the multiplied vectors.



Q14. Show that the scalar product of two perpendicular vectors always be zero.

Scalar product of two vectors that are equal in magnitude and are perpendiculars to each other is equal to zero.

A • B = IAI IBI cosθ
IAI = IBI ; Equal in magnitudes
θ = 90 ; Perpendicular vector
A • B = IAI IAI cos90
A • B = IAI^2 (0) cos90=0
A • B = (0)
A • B = IBI IBI cos90
A • B = IBI^2 (0) cos90=0
A • B = (0)

Scalar product of two vectors that are not equal in magnitude and are perpendicular to each other is equal to zero.

A • B = IAI IBI cosθ
IAI $\cancel{=}$ IBI ; not equal in magnitudes
θ = 90 ; Perpendicular vectors
A • B = IAI IBI cos90
A • B = IAI IBI (0) cos90=0
A • B = (0)

Q15. Show the scalar product of two equal and parallel vectors is equal to square of magnitude of any of them.

Scalar product of two vectors that are equal in magnitude and are parallel to each other is equal to the square of magnitude of any of them.

A • B = IAI IBI cosθ
IAI = IBI ; Equal in magnitude
θ = 0 ; Parallel vectors
A • B = IAI IAI cosθ
= IAI^2 (1) = IAI^2
A • B = IAI IBI cosθ cosθ=1.
= = IBI^2 (1) = IBI^2

Q16. Show the scalar product of two unequal and parallel vectors is equal to product of their magnitudes.

Ans. Scalar product of two vectors that are not equal in magnitude and are acting n the same direction is equal to the product of their magnitudes.

A • B = IAI IBI cosθ
IAI $\cancel{=}$ IBI ; not equal in magnitudes
θ = 0 ; acting in the same directions
A • B = IAI IBI cosθ
A • B = IAI IBI (1) cosθ=1.
A • B = IAI IBI

Q17. Show that i . i = j . j = k . k = 1

î•î = j•j = k•k = 1
A • B = IAI IBI cosθ
Î • î = 1 x 1 x cosθ
= 1 x 1x 1
= 1

Similarly j•j = k•k = 1

Q18. Show that i . j = j . k = k . i = 0

î•j = j•k = k•î = 0
A • B = IAIIBI cos90
Î • j = 1x1x cos90
Î • j = 1x1x0
Î • j = 0

Similarly j•k = k•î = 0

Q19. Show that j . i = k . i = i . k = 0

î•j = k•j = î•k = 0
A • B = IAI IBI cosθ

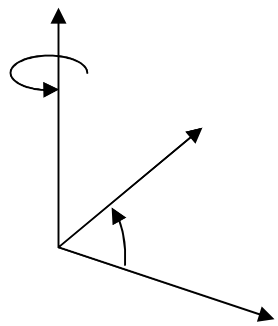
$\hat{j} \bullet \hat{i} = 1x1x \cos 90$
$\hat{j} \bullet \hat{i} = 1x1x0$
$\hat{j} \bullet \hat{i} = 0$
Similarly $\hat{j} \bullet k = k \bullet \hat{i} = 0$

Q20. Give the mathematical form of vector product.

Ans. Mathematical From:
Consider two vectors A and B having angle ‘θ’ between them. Mathematically, vector product of A and B is given as

$A \times B = C$
$A \times B = |A|\,|B| \cos\theta\, \hat{n}$

Where IAI & IBI are the magnitudes of the multiplied vector and ñ is the normal unit vector.



Q21. Show that the vector product of two parallel vectors always be zero.

Ans. The magnitude of the vector product of two vector products of two vectors that are equal in magnitude and are parallel to each other is equal to zero.

$A \times B = |A||B| \sin\theta\, \hat{n}$
$|A \times B| = |A||B| \sin\theta$
$|A| = |B|$; Equal in magnitudes.
$\theta = 0$; parallel vectors.
$|A \times B| = |B||B| \sin 90$
$= |B|^2 (0) = 0$
$\sin 0 = 0$
$|A \times B| = |A||B| \sin 0^0$
$|A \times B| = |A||B| (0) = 0$

Q22. Show the vector product of two equal and perpendicular vectors is equal to square of magnitude of any of them.

Ans. The magnitude product of two vectors that are equal in magnitude and are perpendicular to each other is equal to the square of magnitude of any of them.

$A \times B = |A||B| \sin\theta\, \hat{n}$
$|A \times B| = |B||B| \sin\theta$
$|A| = |B|$; Equal in magnitudes.
$\theta = 90$; Perpendicular vectors.
$|A \times B| = |A||A| \sin 90$
$= |A|^2 (1) = |A|^2$

OR $|A \times B| = |B||B| \sin 90^0$ $\sin 90 = 1$
$= |B|^2 (1) = |B|^2$

Q23. Show the scalar product of two unequal and perpendicular vectors is equal to product of their magnitudes.

Ans. The magnitude of the vector product of two vectors that not equal in magnitude and are perpendicular to each other is equal to the product of their magnitudes.

$A \times B = |A||B| \sin\theta\, \hat{n}$
$|A \times B| = |A||B| \sin\theta$
$|A| \neq |B|$; not Equal in magnitudes.
$\theta = 90$; Perpendicular vectors.
$|A \times B| = |A||B| \sin 90$
$= |A||B| (1)$ $\sin 90 = 1$
$|A \times B| = |A||B|$

Q24. Show that i x i = j x j = k x k = 0

$\hat{i} \bullet \hat{i} = \hat{j} \bullet \hat{j} = k \bullet k = 0$
$A \times B = |A||B| \sin\theta\, \hat{n}$
$i \times i = 1x1x \sin 0 \times \hat{n}$

$i \times i = 1 \times 1 \times 0 = 0$

similarly $j \bullet j = k \bullet k = 0$

CHAPTER # 3 "MOTION"

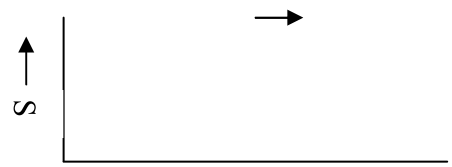
Q1. Under what condition instantaneous velocity becomes equal to average velocity.

Ans. When object is in a state of uniform motion i.e., moving with the uniform velocity.

Q2. How the velocity can be determined from displacement-time graph.

Ans. When body moves with uniform velocity, it travels equal displacement in equal interval of time. The graph between the displacement and the time will be straight line as shown in Fig (1)
If we take any point A on the graph and draw a perpendicular AB on the time axis, It is clear that AB represents the displacement and OB represents the time taken.

$$Velocity = \frac{Displacement}{Time}$$
$$V = \frac{AB}{OB}$$



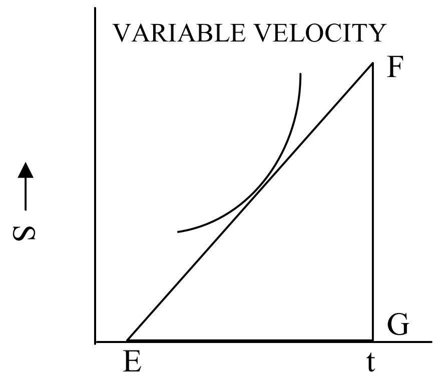
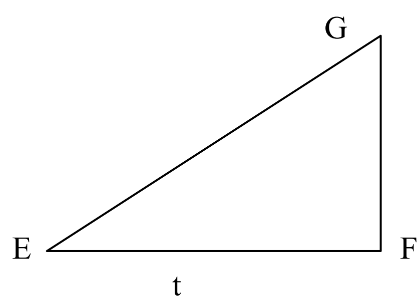


Fig (2)

When body moves with variable velocity, then graph between displacement and time will not be curve as shown in Fig (2)

The velocity of a body at any point A can be found by drawing a tangent EG on the curve at point A. Now draw a perpendicular GF on the time axis. The velocity of a body at A is given as

$$Velocity\ at\ A = \frac{Displacement}{Time}$$
$$V_A = \frac{Displacemetn}{Time} = \frac{GF}{EF}$$



Q3. How the acceleration can be determined from velocity-time graph.

Ans. When a body moves with uniform acceleration the graph between its velocity and time will be straight line, as shown in Fig (1)

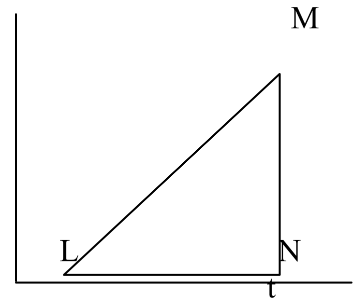
From Fig, acceleration of a body is given as,

$$Acceleration = \frac{Change\ in\ velocity}{Time}$$
$$\vec{a} = \frac{\overrightarrow{PQ}}{\overrightarrow{OQ}}$$

If the acceleration of a body is variable then graph will not be straight line. It will be curve as shown in Fig (2)

The acceleration at any point 'P' is given as acceleration at

Fig (2)



$P = \frac{Change\ in\ Velocity}{Time}$

$\vec{a} = \frac{\overline{MN}}{\overline{LN}}$

VARAIBLE ACCELERATION

Q4. Show that force is equal to the rate of change of momentum.

Ans. Let mass of a body = m

Initial velocity of a body = v_i

Initial momentum of a body = mv_i

Final velocity of a body = v_f

Final momentum of a body = mv_f

Change in momentum of a body = $mv_f - mv_i$

Rate of change of a body $= \frac{mV_f - mV_i}{t}$

Rate of change of a body $= \frac{m(V_f - V_i)}{t}$

But $a = \frac{V_f - V_i}{t}$

Rate of change of a body = ma

According to Newton's second law of motion.

F = ma

Rate of change of a body = F

It shows that " Rate of change of momentum is equal to force"

Q5. Show that 1 Kg ms^{-1} = 1 Ns.

Ans.

P = mv

In MKS system P = kg m/s

Multiply and divide by s

P = $kg\frac{m}{s} \times \frac{s}{s}$

P = Kg $\frac{m}{s^2} \times s$ ----------------(i)

F = ma

N = kg$\frac{m}{s^2}$ ________________ (ii)

Using (ii) in (i)

P = NS ________________ (iii)

Equating (i) and (iii)

Kg ms^{-1} = Ns.

1 Kg ms^{-1} = 1 Ns.

Q6. Define tension in the string.

Ans. A reaction form acts along the string upward due to the suspended weight of the body is called tension in the string. It is denoted by T.

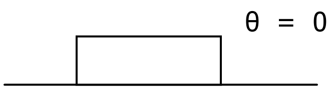
Q7. What is the main cause of force of friction?

Ans. It is due the roughness of the surface. When body surface slides over any surface then projection and depression between body and the surface interlock into one another. This interlocking causes the force of friction.

Q8. Under acceleration will be maximum and minimum on the inclined plane.

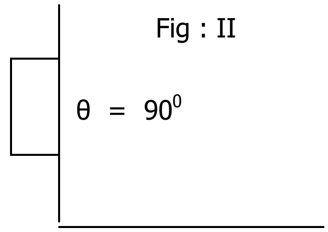
Ans. Minimum Acceleration :

Fig : I



Maximum Acceleration :

Fig : II



$a = g \sin\theta$
$a = g \sin\theta$
From Fig (i)
From Fig (ii)
$a = g \sin(0)$
$a = g \sin(90)$
$\sin(0) = 1$
$\sin(90) = 1$
$a = 0$
$a = g$

Result: When angle of Inclination is '0' then block does not move.	Result: When angle of Inclination is '90' then block falls freely under the action of gravity.

Q9. State the condition for block remains at rest on the inclined plane.

Ans. Form vector diagram for Block to be rest

$R - W_x = 0$
$R = W_x$
$R = w \cos\theta$ $\quad$ $A_x = A\cos\theta$
$R = w\, mg \cos\theta$ (I) $\quad$ $W = mg$

Also
$f - W_y = 0$
$f = W_y$
$f = W \sin\theta$ $\quad$ $A_y = A \sin\theta$
$f = mg \sin\theta$ $\quad$ (II) $\quad$ $w = mg$

If conditions (I) & (II) are satisfied the block remains at rest on an inclined plane.

Q10. State the condition for block slides downward on the inclined plane.

Ans. The block to be slides downwards:

$W_y > f$
$W \sin\theta > f$
$Mg \sin\theta > f$

If above condition is satisfied then block slides down ward on the inclined plane.

Q11. Describe the final velocities when two bodies of same velocities collide with each other.

Ans.

$$V_1 = \frac{(m_1 - m_2)U_1}{(m_1 + m_2)} + \frac{2m_2U_2}{(m_1 + m_2)}$$

Let $m_1 = m_2 = m$

$$V_1 = \frac{(m - m)U_1}{(m + m)} + \frac{2mU_2}{(m + m)}$$

$$V_1 = \frac{(0)U_1}{2m} + \frac{2mU_2}{2m}$$

$$\boxed{\mathbf{V_1 = U_2}}$$

$$V_2 = \frac{2m_1U_1}{(m_1 + m_2)} + \frac{(m_2 - m_1)U_2}{(m_1 + m_2)}$$

Let $m_2 = m_1 = m$

$$V_2 = \frac{2mU_1}{(m + m)} + \frac{(m - m)U_2}{(m + m)}$$

$$V_2 = \frac{2mU_1}{2m} + \frac{(0)U_2}{2m}$$

$$\boxed{\mathbf{V_2 = U_1}}$$

Result:
When two bodies of same masses collide with each other elastically, then after collision they interchange their velocities.

Q12. Describe the final velocities when two bodies of same velocities collide with each other such that target is at rest.

Ans.

$$V_1 = \frac{(m_1 - m_2)U_1}{(m_1 + m_2)} + \frac{2m_2U_2}{(m_1 + m_2)}$$

Let $m_1 = m_2 = m$

$$V_1 = \frac{(m - m)U_1}{(m + m)} + \frac{2m(0)}{(m + m)}$$

$$V_1 = \underline{(0)U_1} + 0$$

$$V_2 = \frac{2m_1U_1}{(m_1 + m_2)} + \frac{(m_2 - m_1)U_2}{(m_1 + m_2)}$$

Let $m_2 = m_1 = m$

$$V_2 = \frac{2mU_1}{(m + m)} + \frac{(m - m)(0)}{(m + m)}$$

$$V_2 = \underline{2mU_1} + 0$$

$$\text{2m} \quad \boxed{V_1 = 0} \qquad\qquad \text{2m} \quad \boxed{V_2 = U_1}$$

Result:
When two bodies of same masses collide with each other in such a way that body 2 in initially at rest then after collision body 1 comes to rest while body 2 starts its motion with the initial velocity of body 1.

Q13. Describe the final velocities when heavy body collides with the light body, which is initially at rest.

$$V_1 = \frac{(m_1 - m_2)U_1}{(m_1 + m_2)} + \frac{2m_2U_2}{(m_1 + m_2)}$$

Let $m_1 >> m_2$

$m_2 \approx 0$

$$V_1 = \frac{(m_1 - 0)U_1}{(m_1 + 0)} + \frac{2(0)(0)}{(m_1 + 0)}$$

$$V_1 = \frac{m_1U_1}{m_1} + 0$$

$$\boxed{V_1 = U_1}$$

$$V_1 = \frac{2m_1U_1}{(m_1 + m_2)} + \frac{(m_2 - m_1)U_2}{(m_1 + m_2)}$$

Let $m_1 >> m_2$

$m_2 \approx 0$

$$V_1 = \frac{2m_1U_1}{(m_1 + 0)} + \frac{(0 - m_1)(0)}{(m_1 + 0)}$$

$$V_1 = \frac{2m_1U_1}{2m_1} + 0$$

$$\boxed{V_1 = 2U_1}$$

Result:
When heavy body collide with light body which is initially at rest then after collision comes body 1 continue its motion with same speed while body 2 starts its motion with the twice of the initial velocity of the body 1.

Q14. Describe the final velocities when light body collides with the heavy body, which is initially at rest.
Ans.

$$V_1 = \frac{(m_1 - m_2)U_1}{(m_1 + m_2)} + \frac{2m_2U_2}{(m_1 + m_2)}$$

Let $m_1 << m_2$

$m_1 \approx 0$

$$V_1 = \frac{(0 - m_2U_1}{(0 + m_2)} + \frac{2(0)U_1}{(0 + m_2)}$$

$$V_1 = \frac{m_2U_1}{m_2} + 0$$

$$\boxed{V_1 = U_1}$$

$$V_1 = \frac{2m_1U_1}{(m_1 + m_2)} + \frac{(m_2 - m_1)U_2}{(m_1 + m_2)}$$

Let $m_1 << m_2$

$m_1 \approx 0$

$$V_1 = \frac{2(0)U_1}{(0 + m_2)} + \frac{(0 - m_1)(0)}{(0 + m_2)}$$

$$V_1 = 0 + 0$$

$$\boxed{V_1 = 0}$$

Result:
When light body collide with heavy body which is initially at rest then after collision comes body 1 reflect back with same speed while body remains at rest.

CHAPTER # 4 "MOTION IN TWO DIMENSIONS"

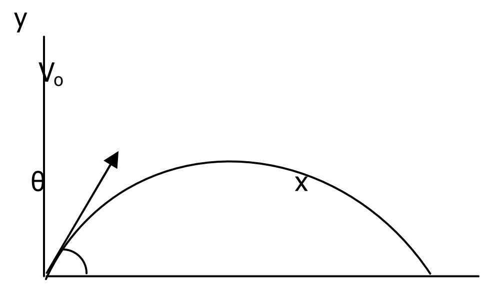
PROJECTILE MOTION:

Q1. Define projectile motion.

Ans. The motion of an object in the curved path with constant horizontal velocity and variable vertical velocity is called projectile motion**."**

OR

When an object is projected with certain angle θ ($0 < \theta < 90^0$) called angle of projection, with certain velocity called velocity of projection then its moves in the curved path called parabolic path with constant horizontal velocity, variable vertical velocity and under the action of gravity. Such object is called projectile and its motion is called projectile motion.



Q2. Under what condition horizontal range will maximum.

Ans. When the projectile is projected with 45^0

Q3. Show that when a projectile is projected is 45^0, its range will maximum.

Ans. Horizontal Range is given as,

$$R = \frac{V_o^2 \sin 2\theta}{g}$$

Above expression shows that, for constant velocity of projection (V_0) and gravitational acceleration (g), horizontal range depends on the factor sin2θ and it will be maximum at the maximum value of sin2θ. The maximum value of sin is 1.

$$\text{Sin } 2\theta = 1$$
$$2\theta = \sin^{-1}(1)$$
$$2\theta = 90^0$$
$$\theta = \frac{90}{2}$$
$$\theta = 45^0$$

It shows that, "when a projectile is projected with 45^0, its horizontal range will be maximum."

Q4. Under what condition horizontal range will be equal to the maximum height.

Ans. When the projectile is projected with 76^0

Q5. Show that when a projectile is projected with 76^0, its horizontal range will be equal to the maximum height.

Ans. Proof: when horizontal range becomes equal to maximum height.

$$h_{max} = R$$
$$\frac{V_0{}^2 sin^2\theta}{2g} = \frac{V_0{}^2 sin2\theta}{g}$$
$$\frac{sin^2\theta}{2} = sin2\theta$$
$$\frac{sin^2\theta}{2} = 2sin\theta cos\theta$$
$$\frac{sin^2\theta}{sin\theta cos\theta} = 2 \times 2$$
$$\frac{sin\theta}{cos\theta} = 4$$
$$tan\theta = 4$$
$$\theta = tan^{-1}(4)$$
$$\boxed{\theta = 76^0}$$

When projectile is projected with 76^0, horizontal range becomes equal to maximum height.

Q6. At what position, projectile has maximum velocities during its motion.

Ans. Projectile has maximum velocities at the point of projection and just before striking the ground.

Q7. At what position, projectile has minimum velocity during its motion.

Ans. Projectile has minimum velocity at its maximum height and it is equal to the horizontal component of the velocity.

Q8. What is the value of the horizontal acceleration during projectile motion?

Ans. During projectile motion horizontal velocity always be zero because through out the projectile motion horizontal velocity always remains constant.

Q9. What are the values of the vertical acceleration during projectile motion?

Ans. As projectile motion occurs under the influence of gravity therefore vertical acceleration is equal to the gravitational acceleration. For upward motion it is equal to "+ g" and for downward motion it is equal to "- g"

Q10. Define the trajectory of projectile motion. Give its mathematical form.

Ans. The curved path followed by the projectile during its motion is called trajectory of projectile motion.

For upward motion

$$Y = tan\theta - \frac{1}{2}\frac{g}{{V_0}^2}\ sec^2\theta x^2$$

For downward motion

$$Y = tan\theta - \frac{1}{2}\frac{g}{{V_0}^2}\ sec^2\theta x^2$$

Q11. Show that projectile performs its motion in the parabolic path.

Ans. Considering

$$Y = tan\theta x - \frac{1}{2}\frac{g}{{V_0}^2}\ sec^2\theta x^2$$

Let $tan\ \theta x = a$ and $b = \frac{g}{{V_0}^2}\ sec^2\theta$

$$\boxed{Y = ax - \frac{bx^2}{2}}$$

This is the general form for parabola hence if is proved that projectile performs its motion in the parabolic path.

CIRCULAR MOTION:

Q1. Differentiate circular motion and uniform circular motion.

Ans. During circular motion object moves in the circular orbit with any speed where as in uniform circular motion object moves in the circular orbit with uniform speed.

Q2. Why during circular motion velocity can never be uniform.

Ans. During circular motion velocity can never be uniform because the direction of velocity which is tangent on the circle changes at every point.

Q3. Derive the relation between linear and angular velocities.

Ans. Supposed Δs is the linear distance and Δθ is the angular distance in a circle of radius r.

Then $\Delta S = r\Delta\theta$

But ΔS and Δθ are covered in the same time Δt. Dividing both sides of above equation by Δt we get,

$$\frac{\Delta S}{\Delta t} = \frac{r\Delta\theta}{\Delta t}$$

Ration $\frac{\Delta S}{\Delta t}$ gives the average linear speed whereas the ratio $\frac{\Delta\theta}{\Delta t}$ gives the average angular speed. If

The time Δt is so small that it approaches zero. Then these ratios will give the instantaneous values of linear and angular speed i.e.

$$\lim_{\Delta t \to 0} \frac{\Delta S}{\Delta t} = \lim_{\Delta t \to 0} \frac{r\Delta\theta}{\Delta t}$$

$$V = r\omega$$

In the form of cross product, the above equation is written as

v = ω r

Q4. Derive the relation between linear and angular accelerations.

Ans. Suppose a body is revolving in a circle of radius r. Its linear and angular speeds change by Δv and Δw in time Δt. Then

$$\Delta v = r\ \Delta w$$

Dividing both sides by Δt we get

$$\frac{\Delta V}{\Delta t} = \frac{r\Delta W}{\Delta t}$$

$\frac{\Delta V}{\Delta t}$ is the average linear acceleration a and $\frac{\Delta V}{\Delta t}$ is the average angular acceleration α.

If time Δt 0 then we get the instantaneous values of these accelerations i.e.

$$\lim_{\Delta t \to 0} \frac{\Delta V}{\Delta t} = \lim_{\Delta t \to 0} \frac{r\Delta W}{\Delta t}$$

$$\boxed{a = r\ \alpha}$$

Q5. Express centripetal acceleration in terms of time period.

Ans. Considering $a_c = \frac{V^2}{r}$ --------- (i)

Suppose T is the time taken to complete one rotation. Distance covered in one rotation is given by 2πr where r is the radius of the circle. Then speed v is given by,

$$V = \frac{S}{T}$$

$$V = \frac{2\pi r}{T}$$

Put this value in equation (i)

$$a_c = \frac{\left(\frac{2\pi r}{T}\right)^2}{r}$$

$$a_c = \frac{4\pi^2 r^2}{T^2}\frac{1}{r}$$

$$a_c = \frac{4\pi^2 r}{T^2}$$

Q6. Express centripetal acceleration in terms of frequency.

Ans. Considering

$$a_c = \frac{4\pi^2 r}{T^2}$$

It can also be written as

$$a_c = 4\pi^2 r \times \frac{1}{T^2}$$

But $f = \frac{1}{T}$

$$a_c = 4\pi^2 r f^2.$$

CHAPTER # 5
"TORQUE, EQUILBRIUM & ANGULAR MOMENTUM"

Q1. Define moment arm.

Ans. The perpendicular distance from the point of application and the axis of rotation is called moment arm. It is denoted by $\vec{r}$.

Q2. Express torque in terms of vector product.

Ans. Vector Form of Torque is given a.

$$\tau = r\,F\,\text{Sin}\,\theta\,\tilde{n}$$

Where n is the normal unit vector vector used to indicate the direction.

A x B = AB Sin θ ñ Torque can also be written as

$$\vec{\tau} = \vec{\tau} \times \vec{F}$$

It show that," the vector product of moment arm and force is called Torque."

Q3. Which component of force is responsible to produce torque?

Ans. The perpendicular component of force is responsible to produce torque.

Q4. How the direction of torque be determined.

Ans. The direction of Torque is always perpendicular on both moment arm and force and can be determined by using right hand rule which is stated as,

"*If the figures of the right hand represent the direction of moment arm and applied force, then the direction of thumb which is perpendicular to the figures gives the direction of torque."*

Q5. Define equilibrium and its types.

Ans. ***DEFINITION:*** 'If an object is in a state of rest or in a state of uniform motion, then it is said to be in a state of equilibrium.

TYPES OF EQUILIBRIUM: There are two type of equilibrium.

1. Static equilibrium.
2. Dynamic equilibrium

1. **Static equilibrium**: If an object is in a state of rest than it is said to be in a state of static equilibrium.
2. **Dynamic equilibrium**: If an object in a state of uniform motion, them if is said to be in a state of dynamic.

There are two types of dynamic equilibrium

i) Translational equilibrium
ii) Rotational equilibrium

i) ***Translational dynamic equilibrium**:* If an object is moving in a straight line with uniform velocity, them it is said to be in a state of translational equilibrium.

ii) ***Rotational dynamic equilibrium:*** If an object is moving in a circular orbit with uniform speed, then it is said to be in a state of rotational equilibrium.

Q6. Define angular momentum.

Ans. "The momentum of an object τ revolving gin a circular orbit is called angular momentum

OR

"The vector product of moment arm and linear momentum is called momentum.'

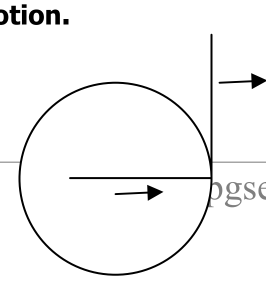
Q7. Derive the expression of angular momentum for the circular motion.

Ans. *Angular momentum during Circular motion.*

Angular momentum is given as

L = mvr Sin θ

During circular motion: $\theta = 90^0$



$L = mvr \ \ \text{Sin } 90^0$ $\qquad$ $\text{Sin } 90^0 = 1$

$L = mvr \ (1)$

$\boxed{L = mvr}$

Q8. Show that torque is equal to rate of change of angular momentum.

Ans. Angular momentum is given as

$\vec{L} = \vec{r} \times \vec{P}$

Diff. w.r.t. to 't'

$\frac{d\vec{L}}{dt} = \frac{d}{dt}(\vec{r} \times \vec{P})$

$\frac{d\vec{L}}{dt} = \vec{r} \times \frac{d}{dt}\vec{P} + \vec{P}\frac{d}{dt}\vec{r}$

But $\vec{F} = \frac{d}{dt}\vec{P}$ Rate of change of momentum

And $\vec{V} = \frac{d}{dt}\vec{r}$ Rate of change of moment arm (Displacement)

$\frac{d\vec{L}}{dt} = \vec{r} \times \vec{F} + \vec{P} \times \vec{V}$

But $\vec{\tau} = \vec{r} \times \vec{F}$ (Torque) and $\vec{P} = m\vec{V}$ (Momentum)

$\frac{d\vec{L}}{dt} = \vec{\tau} + \vec{P} \times \vec{V}$

$\frac{d\vec{L}}{dt} = \vec{\tau} + m\vec{V} \times \vec{V}$

$\frac{d\vec{L}}{dt} = \vec{\tau} + m(0)$

$\frac{d\vec{L}}{dt} = \vec{r}$

It show that, *"The rate of change of angular momentum is equals to torque."*

Q9. Show that 1 Kg m s^{-1} = 1 J s.

Ans. Angular momentum is given as L = m v r

In MKS system $\qquad$ L = kg m/s x m

L = kg m^2/s ________________ (i)

Multiply and divide by s

$L = kg\frac{m^2}{s} \times \frac{s}{s}.$

$L = kg\frac{m^2}{s^2} \times s.$

$L = kg\frac{m}{s^2} \times m \times s.$ ________________ (ii)

But $N = kg\frac{m}{s^2}$

Using (iii) in (ii)

L = N x m x s

But J = N x m

L = J x s ___________________ (iv)

Equating (i) and (iv)

Kg m^2 s^{-1} = J s.

$\boxed{1 \text{ Kg } m^2 s^{-1} = 1 \text{ J s.}}$

Q10. Derive the angular mathematical form for the angular momentum.

Ans. Angular momentum is given as

$L = mvr \ \text{Sin } \theta$

But $\quad v = r\omega$

$L = m(r\omega) r \sin\theta$

$\boxed{L = m r^2 \omega \sin\theta}$

Which is the required angular form of angular momentum.

Q11. What is required condition for the law of conservation of angular momentum?

Ans. The object must be in rotational equilibrium i.e., the sum of all torques acting on the object equals to zero.

Q12. State the law of conservation of angular momentum.

Ans. ***Statement:***

"When ever an object is in rotational equilibrium, its total angular momentum always remains constant."

OR

"During uniform circular motion total angular momentum always remains constant."

Mathematical Form:

Mathematically it is given as

$$\boxed{\vec{L} = \text{Constant}}$$

CHAPTER # 6 "GRAVITATION"

Q1. Define gravitation.

Ans. Gravitation means attraction. It is the property due bodies attracts each other. It depends on the mass and the density of the body.

Q2. Show that gravitational force is a mutual force.

Ans. Gravitational force is mutual force. It exists between two bodies and in th e absence of any body gravitational force will be zero.

Q3. Show that two bodies exert equal and opposite forces on each other.

Ans. Vector form of gravitational force can be expressed as,

$$\vec{F} = G\frac{m_1 m_2}{r^2} \cdot \hat{r}$$

Where r is a unit vector used to indicate the direction of unit vector.

Force on Body 1 due to Body 2 is given as,

$$\vec{F}_{21} = G\frac{m_1 m_2}{r^2} \cdot \hat{r}_{12}$$

Force on body 2 due to Body 1 is given as

$$\vec{F}_{12} = G\frac{m_1 m_2}{r^2} \cdot \hat{r}_{21}$$

Both bodies exert same force on each other but in opposite direction.

$$F_{12} = - F_{21}$$

It shows that "two bodies exert and opposite forces on each other."

Q4. What happen with gravitational force if the masses are doubled?

Ans. Gravitational force becomes 4 times i.e. it becomes 4F.

Q5. What happen with the gravitational force if the distance between the bodies is doubled?

Ans. Gravitational force is decreased by 4 time i.e., it becomes ¼ F.

Q6. What happen with the gravitational force if the masses as well as the distance between the bodies are doubled?

Ans. Gravitational force remains same.

Q7. Calculate the value of the mass of earth.

Ans. Considering an object of mass 'm' radius 'r' placed at the surface of Earth having mass 'M_E' and radius 'R_E.

Let Mass of Earth = M_E

mass of body = m

Radius of body = r'

Radius of Earth = R_E

Body is at the surface of earth

Mean Distance between Centers of Earth and body = $r = r' + R_E$

A/c to Newton's Law of Gravitational

$$F = G\frac{m_1 m_2}{r^2}$$

$$F = G\frac{M_E m}{(r' + R_E)^2}$$

$r' <<< R_E$ therefore r' is so small as compared $r' \approx 0$ to R_E that it can be neglected.

$$F = G\frac{M_E m}{{R_E}^2}$$

It is the force with which Earth attracts the body towards its centre and by definition it is equal to the weight of the body

F = w

Substituting values,

$$G\frac{M_E m}{{R_E}^2} = mg$$

$$\boxed{M_E = \frac{g{R_E}^2}{G}}$$

This is the required expression for the mass of Earth.

We have $g = 9.8\ m/s^2$

R_E = Radius of Earth; $6.4 \times 10^6 m$

G = Grav. Const. $6.67 \times 10^{-11}\ N.m^2/kg^2$

On the substitution of values, mass of Earth is found to be 5.98×10^{24} kg.

Q8. Calculate the value of the density of earth.

Ans. "The ration of mass of the object with its volume is called Density of the object."

By definition, density is given as

$$P = \frac{m}{V}$$

For Earth: $\rho_E = \frac{M_E}{V_E}$ ------------------(1)

Using relation for the mass of Earth.

$$M_E = \frac{g{R_E}^2}{G} \quad \text{------------------(2)}$$

Earth is considered as a spherical body.

Volume of earth cab be given as

$$V_E = \frac{4}{3}\pi {R_E}^3 \quad \text{------------------(3)}$$

Substituting (2) & (3) in (1)

$$\rho_E = \frac{\frac{g{R_E}^2}{G}}{\frac{4}{3}\pi {R_E}^3}$$

$$\rho_E = \frac{g{R_E}^2}{G} \times \frac{3}{4\pi {R_E}^3}$$

$$\rho_E = \frac{3g}{4\pi G R_E}$$

This is the required expression for the density of Earth.

We have

$g = 9.8\ m/s^2$

$\pi = 3.142$

$G = 6.67 \times 10^{-11}\ N\text{-}m^2/kg^2$

$R_E = 6.4 \times 10^6$ m

On the substitution of values, Density of Earth is found to be $5.5 \times 10^3\ kg/m^3$.

Q9. What is effect of altitude on "g"?

Ans. The value of g decreases because it is inversely proportional to the square of the distance away from the centre of the earth.

Q10. What is effect of depth on "g"?

Ans. The value of g decreases because it has inverse effect with the depth.

Q11. What is artificial gravity and how it is produced?

Ans. The gravity which is developed due to rotation of the object in order of balance the gravitation of the earth is called artificial gravity.

Q12. What is meant by weightlessness in satellite?

Ans. ***See notes***

Q13. Differentiate between real and apparent weight.

Ans. ***As discuss in the class***

Q14. Calculate the apparent weight of a body lift is at rest.

Ans. When lift is at rest the acceleration is zero. The apparent weight W indicated by the spring is the tension T.

Therefore $W' = T = mg$

Result:- The apparent weight is equal to the actual weight.

Q15. Calculate the apparent weight of a body lift moves upward or downward with uniform velocity.

Ans. When lift is moving upward or downward with uniform velocity.

The acceleration is zero

$$T - W = 0$$

$$T = W$$

$$\text{But } T = F_w$$

$$F_w = W$$

Result:- The apparent weight is equal to the actual weight.

Q16. Calculate the apparent weight of a body lift moves upward with uniform acceleration.

Ans. When elevator move upward with uniform acceleration than tension in string is greater than its weight

$$T > W$$

Net force/weight with which it moves up

$$F = T - W$$

A/c to Newton's 2nd Law

$F = ma$

$ma = T - W$

But $T = F_w$

$ma = F_w - w$

$ma = F_w - mg$

$F_w = ma + mg$

$F_w = m(a + g)$

Result: When elevator moves upward uniform velocity it apparent weight is greater than actual weight.

Q17. Calculate the apparent weight of a body lift moves downward with uniform acceleration.

Ans. When elevator moving downward with uniform acceleration than tension in string is lesser than its weight.

$W > T$

Net force with which it moves down

$F = W - T$

A/c to Newton's 2nd Law

$F = ma$

$W - T = ma$

$W - ma = T$

$T = W - ma$

$T = mg - ma$

$T = m(a - g)$

Result:- The apparent weight is lesser than the actual weight

Q18. Show during free fall motion apparent weight of a body becomes zero.

Ans. When body falls freely under the action of gravity it is in a state of downward accelerated motion.

CHAPTER # 7 "WORK, ENERGY & POWER"

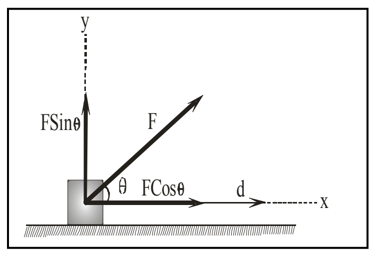
Q1. Show that work is the scalar product of force and displacement.

Ans. If a force **F** acts on the body by making an angle θ with horizontal then force of a body can be resolved in to two rectangular components **FCosθ** and **FSinθ**. Where **FSinθ** can not perform any work therefore work done by the force is given by:

Work = (FCosθ)(d)

Work = FdCosθ

Work = $\vec{F} \cdot \vec{d}$



So work can also be defined as:

"Work is the dotproduct of force and displacement"

Q2. State the condition for which work will be maximum.

Ans. Work is said to be maximum or positive if force and displacement are in the same direction.

Q3. State the condition for which work will be minimum.

Ans. Work is said to be minimum or zero if force and displacement are perpendicular to each other.

Q4. Under what condition work will be negative.

Ans. Work is said to be negative if force and displacement are opposite to each other.

Q5. Show that power is the scalar product of force and velocity.

Ans. Power is the amount of work done by a body in unit time. Mathematically it can be expressed as:

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

$$P = \frac{\vec{F} \cdot \vec{d}}{t}$$

$$P = \vec{F} \cdot \frac{\vec{d}}{t}$$

$$P = \vec{F} \cdot \vec{V}$$

With the help of above equation power can also be defined as:

"Power is the dot product of force and velocity."

Q6. State the conditions of conservative field.

Ans. Such a field in which work done is independent of the path followed by the body.

OR

Such a field in which the total work done in a moving body along a closed path is equal to zero.

Q7. Why gravitational field is said to be conservative field.

Ans. Gravitational field is said to be conservative field because it satisfy the following required condition of conservative field.

i) Work done is independent of the path followed and only depends on the displacement between initial and final positions.

ii) The total work done in a moving body along a closed path is equal to zero.

Q8. What is absolute gravitational potential energy?

Ans. The amount of work required to displace an object against the gravitational field to an infinite point stored in the object in the form of absolute gravitational energy.

Q9. State the law of conservation of energy.

Ans. "Energy can neither be created nor can it be destroyed. It can only be transformed from one form to another."

Q10. When an object is dropped from certain height, why its potential energy is not completely converted into kinetic energy.

Ans. Its potential energy is not completely converted into kinetic energy because certain amount of energy is utilized to overcome the air friction.

CHAPTER # 8 "WAVE MOTION AND SOUND"

Q1. State the basic conditions of simple harmonic motion.

Ans. Basic conditions for AHM. The basic condition for a system to execute simple harmonic motion is:-

(i) There must be an elastic restoring forc acting on the system

(ii) The system must have inertia.

(iii) The acceleration of the system should be proportional to its displacement (from the main position) but opposite in direction.

Q2. Give some examples of simple harmonic motion.

Ans. Examples of SHM.

I) The motion of the bob of a simple pendulum.

II) The motion of a stretched string when it is plucked to disturb it from the mean position.

III) The motion of a body (i.e. heavy mass particle) attached to the end of an a\elastic spring hanging vertically.

IV) The motion of the projection of a particle moving round a circle with uniform speed.

V) The motion of an elastic metallic strip, held vertically in a rigid support with a heavy mass attached to its free end.

Q3. A certain simple pendulum has an iron bob. Would its behavior change if we replace the iron bob with a lead bob of the same size?

Ans. Change in behaviour of a simple pendulum with bobs of different materials. There time period of a simple pendulum is given but the relations.

$$T = 2\Pi\sqrt{\frac{l}{g}}$$

Where l = length of the pendulum, and
g = acceleration due to gravity.
The above relation shows that the time period of a simple pendulum only depends upon its length and value of 'g' at a certain place and its is independent of the mass of the bob. Therefore, if we replace the iron bob with a lead bob, only the mass of the bob will change but h behavior of he pendulum will not be affected. It means that the time period and the frequency of the pendulum, having a certain length, will remain unchanged with the change of bobs.

Q4. Will the period of a vibrating spring increase, decrease or remain constant by addition of more weight?

Ans. Period of vibrating spring is given by

$$T = 2\Pi\sqrt{\frac{m}{k}}$$

where m = mass attached to the free end of the spring, and K = spring constant.
Above relation shows that the period of a vibrating spring is directly proportional to the mass attached to its free end i.e. $T\alpha\sqrt{m}$ period increases with the addition of mass. Thus with the addition of more weight (mg), mass m will increase and the period of the vibrating spring will also increase.

Q5. What happen to the time period if the length of the pendulum is changed?

Ans.

Q6. What happen to the time period of the pendulum if the mass its bob is changed?

Ans.

Q7. Would you keep the amplitude of a simple pendulum small or large? Why?

Ans. Amplitude of a simple pendulum. We should keep the amplitude of simple pendulum small because in deriving the relation for its time period.

$$(T = 2\Pi\sqrt{\frac{l}{g}})$$

the distance through a which pendulum is displaced, son small that sinθ =θ, 'θ' carr only be small, if amplitude is small.

Q8. What is the frequency of the second pendulum.

Ans. Frequency of a second's pendulum. A second's pendulum is that pendulum whose time period is 2 seconds i.e.

T = 2 seconds

But relation between the frequency and time period is given by

$$F = \frac{1}{T}$$

Therefore the frequency of a second's pendulum is given by

f = ½ = 0.5 vibration/second

Q9. Differentiate transverse wave and longitudinal wave.

Ans. **DIFFERENCE BETWEEN TRANSVERSE & LONGITUDINAL WAVE:**

Transverse Waves	Longitudinal Waves
1. Wave in which particles of the medium vibrates perpendicular to the direction of propagation is called transverse wave.	1. Wave is which particle of the medium vibrates along the direction of propagation is called longitudinal waves.
2. Transference of energy through perpendicular vibration of the particle of eh medium.	2. Transference of energy through parallel vibration of the particles of the medium.
3. Crest and trough form due to perpendicular vibration.	3. Compression and rarefaction form due to parallel vibration.
4. Light waves, electromagnetic waves are some examples of transverse waves	4. Wave in stretched string, spring waves are some examples of longitudinal waves.

Q10. Is it possible for two identical waves traveling in the same direction along a string to give rise to a standing wave?

Ans. It is not possible for two identical waves traveling in the same direction along a string to given rise to a standing wave. Two identical waves moving along the same string can only reduce standing waves when they are moving in the opposite directions.

Q11. Define the terms: crest, trough, compression, rarefaction node and antinode.

Ans. **Crest**:-The highest portion of the wave above the mean position is called crest.

Trough:-The lowest portion of the wave below the mean position is called trough.

Compression:-The portion of the wave in which particles of the medium close to each other is called compression.

Refractions:-The portion of the wave in which particle of the medium are away from each other is called rarefaction.

Node:-The point of standing wave which lies on the mean position having minimum displacement is called node.

Anti Node:- The point of standing wave where displacement is maximum is called antinodes.

Q12. How the speed of a transverse in the string will change if its tension is made four times.

Ans. The speed of a transverse wave in a string is given by

$$v = \sqrt{\frac{TxL}{m}}$$

if the tension is made four times, then the speed of the wave will become

$$v' = \sqrt{\frac{4TxL}{m}}$$

or $$v' = 2\sqrt{\frac{TxL}{m}} = 2v$$

Thus the speed of the transverse wave will be doubled if the tension is made four times.

Q13. Why does sounds travel faster in solids than in gases.

Ans. Sound travels faster in solids than in gases

The speed of sound is given by the formula

$$v = \sqrt{\frac{E}{\rho}}$$

Where E = elasticity of the medium, and
ρ = density of the medium through which sound travels.

It is true that the density of solids is larger than that for gases but the elasticity of the solids is much larger than gases, so the ratio E/ Speed of transverse becomes four times. Is much larger for solids is much larger than gases. That is why the sound travels faster in solids than is gases.

Q14. Why does the speed of a sound wave in gas change with temperature?

Ans. Speed of sound changes with the change in the temperature of a gas.
The speed of sound in a gas is given by

$$v = \sqrt{\frac{\gamma p}{\rho}}$$

here P=pressure of the gas.
When the temperature of a gas rises its pressure increases and its density decreases, therefore the speed of sound increases. On the other hand with the decrease of temperature, the pressure of a gas decreases and factor P/ ρ become less thus decreasing the speed of sound.

Q15. How are beats useful in tuning musical instrument?

Ans. We know that the number of beats produced per second is equal to the differences between the frequencies of two sounding bodies. If we know that frequency of standard instruments, we can tune the other instruments to the desired frequency by counting the number of beats as compared to the standard instrument. In this way beats are useful for tuning a musical instrument.

Q16. What is meant by the quality of the sound?

Ans. It is the characteristics by which two sound waves of same pitch and possibly of the same intensity, given out by two different sources may be distinguished from each other .It is the internal characteristics of eh vibrating body depending on the nature of body. the quality of sound waves also depends on the shape of wave form produced b it, in turn it depends upon the number and type of Harmonics occurring in the sound.

Q17. How the intensity of sound related with loudness.

Ans. *Relation between intensity and loudness*:- (Weber-Fechner law)
Statement: 'loudness of a sound wave is directly proportional to the logarithm of intensity."
Mathematical form:- Mathematically, it is given as \

$$L \propto \text{Log } I$$
$$L = k \log I$$

Q18. Differentiate between musical sound and noise.

Ans. **<u>Musical sound</u>**: Sound which produces pleasant effect in our ear in called musical sound.

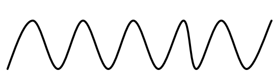
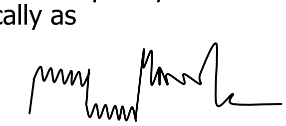
Or

Sound in which there is uniform change in frequency is called sound waves.

<u>Noise:</u>
Sound which produce unpleasant effect tin our ear is called Noise

Or

Sound in which there is a rapid change in the frequency is called Noise.
Following are the point of distinguish between a musical sound and a Noise.

	MUSICAL SOUND		NOISE
1	It produce pleasant situation upon the ear.	1	It do not produce pleasant situation upon the ear.
2	It is smooth and agreeable	2	It is jarring and disagreeable.
3	If has periodicity i.e, waves follow each other at regular interval.	3	Wave do not follow each other with regular interval
4	All the waves are similar & there is no sudden change of loudness or frequency	4	All the wave are not similar and there is sudden change in Loudness
5	Change in frequency can be represented by the curve. 	5	Change on frequency can be represented graphically as 

CHAPTER # 9 "NATURE OF LIGHT"

Q1. What is the necessary condition on the path difference between two waves interfere (a)

constructively (b) destructively.

Ans. Condition for constructive interference:- For constructive Interference path difference between the two waves coming from different source should be integral multiple of the wave length.

i.e., path diff. = 0, λ, 2λ,3λ,4λ,5λ……….nλ.

Where m = 0,1,2,3…….

Condition for destructive interference:- For destructive interference path difference between two waves coming from different source should be odd integral multiple of the wave length.

I.e., Path difference $=\frac{0\lambda}{2},\frac{2\lambda}{2},\frac{3\lambda}{2},\frac{4\lambda}{2},\frac{5\lambda}{2}.\ .\ .\ .\ (m+1)\frac{\lambda}{2}$

Where m = 0,1,2,3,………

Q2. Why we do not find interference in ordinary light?

Ans. Interference of light needs coherent waves from monochromatic sources. Ordinary light beams are not coherent.

Q3. Why the distant flash lights will not produce an interference pattern.

Ans. Two light beams which are coherent when they are closer to the source, at large distance they do not remain coherent thus distant flash lights are unable to produce an interference pattern.

Q4. Although we can hear but can not see around corners. How can you explain this in view of the fact that sound and light are both waves?

Ans. The wavelength of sound waves in very large, of the order of several feet, or meters therefore they can diffract about corners and we can hear them.

But the wavelength of light wave is much smaller, of the order of 10^3 m, therefore they can not diffract about large corners and we can not see light.

Q5. Explain, why it is said that the light wave fronts from sun are plane wave fronts.

Ans. The sun is at a large distance, wave fronts from sun when reach to earth, are spheres of large radii. Only a small portion is found plane, thus these wave fronts are called plane wave front.

Q6. Why central ring in the Newton's ring always be dark.

Ans. The interference pattern formed at center of the rings is due to path difference equal to zero, but in thin film an additional phase inversion occurs, it givers destructive interference. Hence central point in Newton's ring is always dark.

Q7. What are the Newton's rings?

Ans. When a monochromatic ray of light incident on a Plano convex lens, which placed on a glass surface, then circular dark and bright consecutive circles, will be obtained, these rings are called Newton's rings

Q8. What is the main cause of Newton's rings.

Ans. Air in between Plano convex lens and a flat glass surface behave like air wedge film. The thickness of air wedge film is zero at the contact if such a film is illuminated by a monochromatic light then dark bands is obtained at its centre. As we go away from the centre then the thickness changes gradually due to which alternative bright and dark rings are obtained.

Q9. Give the condition for the bright Newton's ring.

Ans. For nth Bright Ring: m = N-1

$$\gamma m = \sqrt{(N-1+\frac{1}{2})R\lambda}$$

$$\gamma m = \sqrt{(N-\frac{1}{2})R\lambda}$$

this is the required expression for the radius of bright rings.

Q10. Give the condition for the dark Newton's ring.

Ans. For First dark ring: m=1 $\gamma_1 = \sqrt{1.R\lambda}$

For Second dark ring; 2 $\gamma_{21} = \sqrt{2.R\lambda}$

For nth dark ring: m = N $\gamma_{N1} = \sqrt{N.R\lambda}$

This is the required expression for the radius of the Nth dark ring.

Q11. Why the central point on the screen in Young's double slit arrangement is always bright?

Ans. The path difference for interference pattern at centre is zero then interference is constructive and image is bright.

Q12. Give the condition for the formation of bright fringes in the Michelson's interferometer.

Ans. For constructive interference i.e., for the bright fringes the distance moved by moveable mirror is:

P = m λ / 2

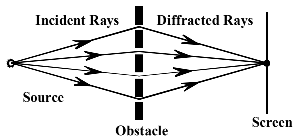
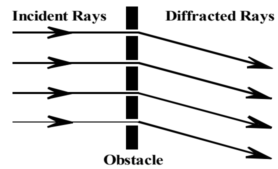
Q13. Give the condition for the formation of dark fringes in the Michelson's interferometer.

Ans. For destructive interference i.e., for the dark fringes the distance moved by moveable mirror is:

P = m λ / 4

Q14. What is the use of compensator in the Michelson's interferometer?
Ans. Compensator is used to avoid difference of the time interval produced in the two light waves coming from the two mirrors.

Q15. Differentiate Fresnel diffraction and Frunhoffer diffraction.
Ans.

FRESNEL DIFFRACTION	**FRAUNHOFER DIFFRACTION**
In Fresnel Diffraction the source of light and the screen where diffraction is formed are kept at finite distance from the diffracting obstacle 	In Fraunhofer Diffraction the source of light and the screen where diffraction is formed are kept at infinite distance from the diffracting obstacle. 
In Fresnel Diffraction the wave fronts falling and leaving the obstacle are not plane.	In Fraunhofer Diffraction the wave fronts falling and leaving the obstacle are plane.
In Fresnel Diffraction the corresponding rays are not parallel	In Fraunhofer Diffraction the corresponding rays are parallel to each other.

Q16. State Bragg's Law.
Ans. "To determine the structure of crystal those light can be used having wave length comparable to the distance between atomic planes."
Q17. What aspect of light is produced by the phenomena of polarization?
Ans. The process of polarization proves that light is a transverse wave.
Q18. Why diffraction is called special type of interference?
Ans. Diffraction of light is due to the formation of source (spherical wave front) on the edge of the obstacle. Now the secondary waves interfere them selves in obstructed portion in a special way that is only on one side.

CHAPTER # 10 "GEOMETRICAL OPTICS"

Q1. What is the effect on the image if half of converging lens is covered?
Ans. The image will remain unchanged, only the intensity of light passing thought the lens will be halved causing less brightness.
Q2. Define power of the lens. Give its units.
Ans. *Definition:* the reciprocal of the focal length is called power of the lens.

Mathematical Form: $Power = \frac{1}{Focal\ Length}$

$P = \frac{1}{f}$

Unit: It unit is diopter. The unit of power of the lens is diopter if focal length is taken in meter.
Q3. Define linear magnification.
Ans. *Definition # 01:* The ratio between the height of image and the height of object is called linear magnification.
i.e. $Magnification = \frac{Image\ height}{object\ height} = \frac{h_i}{h_o}$
Definition # 02: The ratio between the image distance and the object distance is called linear magnification.
i.e. $Magnification = \frac{Image\ distance}{object\ distance} = \frac{q}{p}$

Q4. Define angular magnification.
Ans. Definition: "The ratio between the angles formed by the image at the eye when it is viewed through instrument to the angle formed by the object when it is viewed without instrument is called angular magnification."
Magnification $= \frac{\text{Angle formed at the eye when it is viewed with instrument}}{\text{Angle formed at the eye when it is viewed without instrument}}$

Or $M = \frac{\beta}{\alpha}$

When β: Angle formed at the eye with instrument.
α: Angle formed at the eye without instrument.

Q5. Give the sign convention used in the lens formula.

Ans. The image seen in lens have coloured by edges. Why?

1. **What is best position to see any object?**
   The best position to observe any object is the least distance of distinct vision.
2. **What is meant by least distance of distinct vision?**
   It is the minimum distance from to observe any object clearly. For normal human eye it is 25 cm or 250 mm.
3. **How a convex lens is used as a magnifier?**
4. **State the principle used for the construction of magnifying glass.**
   It is based on the principal that" if object is placed within the focal length of the lens then virtual and magnified image is formed on the same side of the lens."
5. **State the principle used for the construction of compound microscope.**
   It is based on the principal that" if object is placed within the focal length of the lens then virtual and magnified image is formed on the same side of the lens."
6. **Why would be advantageous to use blue light with a compound microscope?**
7. **Why Objective of short focal length is preferred in microscope?**
8. **State the principle used for the construction of astronomical telescope.**
   It is based on the principal that" if object is at infinite distance then parallel rays enter into lens and form image will be formed at the principal focus of the lens."
9. **What is length of astronomical telescope?**
   The sum of the focal lengths of objective and image distances. i.e.,
   $$L = f_o + f_e$$