1. Nature of Phsycial world and Measurement

2 mark questions

1. What is scientific method?

   The scientific method is a step-by-step approach in studying natural phenomena and establishing laws which govern these phenomena.

2. What are the general features of scientific method?
   - ➢ Systematic observation
   - ➢ Controlled experimentation
   - ➢ Qualitative and quantitative reasoning
   - ➢ Mathematical modeling
   - ➢ Prediction and verification or falsification of theories.

3. What is measurement?

   The comparision of any physical quantity with its standard unit is known as measurement.

4. What is physical quantity? Give example.
   - Quantities that can be measured, and in terms of which, laws of physics are described are called physical quantities.
   - Eg: length, mass, time, etc.

5. What are fundamental or base quantities? Give example.
   - Fundamental quantities are quantities which cannot be expressed in terms of any other physical quantities.
   - Ex: length, mass, time, electric current, temperature, luminous intensity and amount of substance.

6. What are derived quantities? Give example.
   - Quantities that can be expressed in terms of fundamental quantities are called derived quantities.
   - Example: area, volume.

7. What is unit?

   An arbitrarily chosen standard of measurement of a quantity, which is accepted internationally is called unit of the quantity.

8. What are fundamental units?
   - The units in which the fundamental quantities are measured are called fundamental quantities.
   - Example: metre, kilogram

9. What are derived units?
   - The units of physical quantities which can be obtained by a suitable multiplication or division of powers of fundamental units are called derived units.

   Example: $m\ s^{-1}, N\ m^{-1}$

10. What are the advantages of SI system?
    - ☆ It is a rational system of units.
    - ☆ It is a coherent system of units.
    - ☆ It is a metric system.
    - ☆ In this system, multiples and submultiples can be expressed as powers of 10.

11. Define SI standard of length or one metre.

    One metre is the length og the parth travelled by light in vacuum in $\frac{1}{299,792,458}$ of a second.

12. Define SI standard of mass or one kilogram.

    One kilogram is the mass of the prototype cylinder of platinum iridium alloy, preserved at the International Bureau of Weights and Measures at Serves, near Paris, France.

13. Define SI standard of time or one second.

    One second is the duration of 9,192,631,770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of Cesium-133 atom.

14. Define SI standard of temperature or one kelvin.

    One Kelvin is the fraction of $\frac{1}{273.16}$ of the thermodynamic temperature of the triple point of the water.

15. Define SI standard of electric current or one ampere.

    One ampere is the constant current, which when maintained in each of the two straight parallel conductors of infinite length and negligible cross section, held one metre apart in vacuum shall produce s force per unit length of $\mathbf{2\ x\ 10^{-7}\ N\ m^{-1}}$ between them.

16. Define SI standard of amount of substance or one mole.

    One mole is the amount of substance which contains as many elementary entities as there are atoms in 0.012 kg of pure carbon-12.

17. Define SI standard of lumimous intensity or one candela.

    One candela is the luminous intensity in a given direction, of a source that emits monochromatic radiation of frequency $5.40\ x\ 10^{14}\ Hz$adn that has a radiant intensity of $\frac{1}{683}$ watt/steratdian in that direction.

18. What is one radian?
    - ☆ One radian is the angle subtended at the centre of a circle by an arc equal in length to the radius of the circle.
    - ☆ $1\ rad = 57.27°$

19. What is one steradian?

    One steradian is the solid angle subtended at the centre of a sphere, by that surface of the sphere, which is equal in area, to the square of radius of the sphere.

20. What is parallax?

    The shift in the position of an object when viewed with two eyes, keepin one eye closed at a time is known as parallax.

21. What is light year?
    - ☆ The distance travelled by light in vacuum in one year is called one light year.
    - ☆ 1Light year $= 9.467 \times 10^{15}\ m$

22. What is one astronomical unit?
    - The mean distance of the Earth from the Sun is called astronomical unit.
    - 1 (AU) $= 1.496 \times 10^{11}\ m$

23. Differentiate accuracy and precision.

Accuracy:-

It refers to how far we are from the true value.

Precesion:-

It refers to how well we measure.

24. What is an error?

The uncertainty in a measurement is called an error.

25. What are systematic errors?

Systematic errors are reproducible inaccuracies that are consistently in the same direction.

26. What is absolute error?

The difference between the true value and the measured value of a quantity is called absolute error.

27. What is mean absolute error?

The arithmetic mean of the magnitude of absolute errors in all the measurements is called the mean absolute error.

28. What is relative error?

The ratio of mean absolute error to the mean value is called relative error.

29. What is percentage error?

The relative error expressed as percentage is called percentage error.

30. What are significant figures?

The digits which tell us the number of units we are reasonably sure of having counted in making a measurement are called significant figures.

31. What is dimension of a physical quantity?

The dimensions of a physical quantity are the powers to which the untis of base quantities are raised to represent a derived unit of that quantity.

32. What are dimensional variables?
    - Physical quantities, which posses dimensions and have variable values are called dimensional variables.
    - Example: length, velocity.

33. What are dimensionless variables?
    - Physical quantities which have no dimensions, but have variable values are called dimensionless variables.
    - Example: specific gravity, strain.

34. What are dimensional constants?
    - Physical quantities which possess dimensions and have constant values are called dimensional constants.
    - Example: Planck's constant.

35. What are dimensionless constants?
    - Quantities which have constant values and also have no dimensions are called dimensionless constants.
    - Examples: e, numbers.

36. State principle of homogeneity of dimensions.

The principle of homogeneity of dimensions states that the dimensions of all the terms in a physical expression should be the same.

37. What is unification?

Attempting to explain diverse physical phenomena with a few concepts and laws is unification.

38. What is reductionism?

An attempt to explain a macroscopic system in terms of its microscopic constituents is reductionism.

39. What is one parsec?
    - ∗ Distance at which an arc of length 1 AU subtends an angle of 1 second of arc.
    - ∗ 1 parsec $= 3.26$ light year

40. What is one Chandrasekhar limit?
    - ∗ Chandrasekhar limit is the largest practical unit of mass.
    - ∗ 1 CSL = 1.4 times the mass of the Sun.

41. Define mass. Give its unit.
    - Mass of a body is defined as the quantity of matter contained in a body.
    - Its unit is kilogram.

42. How does the personal error araised?

These errors are due to individual performing the experiment, may be due to incorrect initial setting up of the experiment.

43. How does the error occur due to external causes?

The change in the external conditions during an experiment can cause error in measurement.

44. What is least count error?

Least count is the smallest value that can be measured by the measuring instrument, and the error due to this measurement is least count error.

45. What is one shake?
    - The smallest practical unit of time is Shake.
    - 1 Shake = 10^{-8} s

2.KINEMATICS

1. What is frame of reference?

If we imgine a coordinate system and the position of an object is described relative to it, then such a coordinate system is called frame of reference.

2. What is Cartesian coordinate system?

At any given instant of time, the frame of reference with respect to which the position of the pobject is described in terms of position coordinates is called Cartesian coordinates system.

3. What is linear motion?
   - An object is said to be in linear motion if it moves in a straight line.
   - Ex: An athlete running on a straight track

4. What is circular motion?
   - Circular motion is defined as a motion described by an object traversing a circular path.
   - Ex: The motion of the satellite around the Earth.

5. What is rotational motion?
   - If any object moves in a rotational motion about an axis, the motion is called rotation.
   - Ex: Spinning of the Earth about its own axis.

6. What is vibratory motion?
   - If an object of executes a to-and-fro motion about a fixed point, it is said to be in vibratory motion.
   - Ex: Movement of a swing

7. What is one dimensional motion?
   - One diemensional motion is the motion of a particle moving along a straight line.
   - Ex: Motion of a train along a straight railway track.

8. What is two dimensional motion?
   - If a particle is moving along a curved path in a plane, then it is said to in two dimensional motion.
   - Ex: Motion of a coin on a carom board

9. What is three dimensional motion?
   - A particle moving in usual three dimensional space has three dimensional motion.
   - Ex: A bird flying in the sky

10. Define –vector.
    - It is a quantity which is described by both magnitude and direction.
    - Ex: force, velocity.

11. Define – scalar.
    - It is a property which can be described only by magnitude.
    - Ex: distance, mass.

12. Define scalar product or dot product of two vectors.
    - The scalar product or dot product of two vectors is defined as the product of the magnitudes of both the vectors and the cosine of the angle between them.
    - $\vec{A} . \vec{B} = AB \cos\theta = C$ (scalar)

13. Define vector product or cross product of two vectors.
    - The vector product or cross product of two vectors is defined as another vector having a magnitude equal to the product of the magnitudes of two vectors and the sine of the angle between them.
    - $\vec{A} \times \vec{B} = AB \sin\theta \hat{n} = \vec{C}$ (vector)

14. How will you denote a vector quantity?
    - The length of a vector is called its magnitude.
    - It is always a positive quantity.

15. What are equal vecotrs?
    Two vectors said to be equal when they have equal magnitude and same direction and represent the same physical quantity.

16. What are collinear vectors?
    Collinear vectors are those which act in the same direction or in the opposite directions along the same line

17. What are parallel vectors?
    If two vectors act in the same direction along the same line or on parallel lines, then they are called as parallel vectors.

18. Whar are anti-parallel vectors?
    If two vectors act in the opposite directions along the same line or on parallel lines, then they are called as anti-parallel vectors.

19. What is unit vector?
    - A vector divided by its magnitude is a unit vector.
    - Its magnitude is equal to one.
    - $\hat{A} = \frac{\vec{A}}{A}$

20. What are orthogonal vectors?
    The vectors which are perpendicular to each other are called orthogonal vectors.

21. Sate triangular law of vector addition
    If two vectors represent the two adjacent sides of a triangle taken in the same order, then the resultant is given by the third side of the triangle.

22. State right hand thumb rule of vector product.
    The rule states that if the curvature of the fingers of the right hand represents the sense of rotation of the object, then the thumb, held perpendicular to the curvature of the fingers, represents the direction of the resultant $\vec{C}$.

23. How do you deduce that two vectors ae perpendicular?
    If scalar product of two vectors is zero, then the two vectors are said to be perpendicular vectors.

24. Define distance and displacement.

Distance	**Displacement**
It is the actual path length travelled by an object in the given interval of time during the motion	It is the difference between the final and initial positions of the object in a given interval of time.
It is a positive scalar quantity	It is a vector quantity.

25. Define velocity and speed.

Velocity	Speed
Rate of change of velocity with respect to time is called velocity	The magnitude of velocity is called speed
It is a vector quantity	It is a scalar quantity.

26. Define acceleration.

Rate of change of velocity with respect to time is called acceleration. Its unit is $m\ s^{-2}$.

27. Differentiate velocity and average velocity.

Velocity	Average velocity
It is the rate of change of position vector with respect to time	It is the ratio of the displacement vector to the corresponding time interval
It is measured at any instant of time	It is measured in a given time interval

28. Define angular displacement and angular velocity.

Angular displacement	Angualr velocity
The angle described by the particle about the axis of rotation in a given time is called angular displacement.	The rate of change of angular displacement is called angular velocity
Its unit is radian	Its unit is $rad\ s^{-1}$

29. Define an instantaneous velocity.
    - It is the rate of change of position vector with respect to time.
    - Its unit is $m\ s^{-1}$

30. What is uniform circular motion?

When a point object is moving on a circular path with a constant speed, then the object is said to be in uniform circular motion.

31. What is non-uniform circular motion?

If the speed of the object in circular motion is not constant, then the motion is called non-uniform circular motion.

32. Write down the kinematic equations for angular motion.
    - $\omega = \omega_0 + \alpha t$
    - $\theta = \omega_0 t + \frac{1}{2}\alpha t^2$
    - $\omega^2 = {\omega_0}^2 + 2\alpha\theta$
    - $\theta = \frac{(\omega_0+\omega)t}{2}$

33. Write down the expression for angle made by resultant acceleration and radius vector in the non uniform circular motion.
    - $\tan\theta = \frac{a_t}{\left(\frac{v^2}{r}\right)}$
    - $\theta = \tan^{-1}\left[\frac{a_t}{\left(\frac{v^2}{r}\right)}\right]$

34. Define average speed.

Average speed is the defined as the ratio of total path length travelled by the particle in a time interval.

35. Define momentum.
    - The momentum of a particle is defined as product of mass with velocity.
    - It is a vector quantity.
    - $kg\ m\ s^{-1}$

36. What is relative velocity?

When two objects are moving with different velocities, then the velocity of one object with respect to another object is called relative velocity.

37. Define average acceleration.
    - It is defined as the ratio of change in velocity over the given time interval.
    - $\vec{a}_{avg} = \frac{\Delta\vec{v}}{\Delta t}$

38. Define instantaneous acceleration.

The acceleration of the particle at an instant is equal to rate of change of velocity.

39. What is projectile?

When an object is thrown in the air with some initial velocity and then allowed to move under the action of gravity alone, the object is known as a projectile.

40. Give the examples of projectile motions.
    - An object dropped from window of moving train
    - A bullet fired from rifle
    - A ball thrown in any direction
    - A javelin thrown by an athlete

41. What are types of projectile motion.
    - Horizontal projection
    - Angular projection

42. What are the concepts to be considered in projectile motion?
    - Air resistance is neglected
    - The effect due to rotation of Earth and curvature of Earth is negligible.
    - The acceleration due to gravity is constant in magnitude and direction at all points of the motion of the projectile.

43. What is trajectory?

The path followed by the particle is called its trajectory.

44. What is time of flight?

The time taken by the projectile to hit the ground is called time of flight.

45. What is horizontal range?

The horizontal distance covered by the projectile from the foot of the tower to the point where the projectile hits the ground is called horizontal range.

46. What is maximum height?

The maximum vertical distance travelled by the projectile during its journey is called maximum height.

47. What is angular acceleration?

The rate of change of angular velocity is called angular acceleration.

3. LAWS OF MOTION

1. What is inertia?

   The inability of objects to move on its own or change its state of motion is called inertia.

2. What is inertia of rest?

   The inability of an object to change its state of rest is called inertia of rest.

3. What is inertia of motion?

   The inability of an object to change its state of uniform speed on its own is called inertia of motion.

4. What is inertia of direction?

   The inability of an object to change its direction of motion on its own is called inertia of direction.

5. State Newton's first law of motion.

   The law states that every object continues to be in the state of rest or of uniform motion unless there is external force acting on it.

6. State Newton's second law of motion.

   The law states that the force acting on an object is equal to the rate of change of its momentum.

7. Define one Newton.

   One Newton is defined as the force which acts on 1 kg of mass to give an acceleration $1 m\,s^{-2}$ in the direction of the force.

8. State Newton's third law of motion.

   The law states that for every action there is an equal and opposite reaction.

9. What is free body diagram?

   Free body diagram is a simple tool to analyse the motion of the object using Newton's laws.

10. What are the steps to be followed in free body diagram?
    - Identify the forces acting on the object
    - Represent the object as a point
    - Draw the vectors representing the forces acting on the object.

11. What are concurrent forces?

    A collection of forces is said to be concurrent, if the lines of forces act at a common point.

12. What are coplanar forces?

    Concurrent forces need not be in the same plane. If they are in the same plane, they are concurrent as well as coplanar forces.

13. State Lami's theorem.

    Lami's theorem states that the magnitude of each force of the system is proportional to sine of the angle between the other two forces.

14. State law of conservation of total linear momentum.

    The law states that if there are no external forces acting on the system, then the total linear momentum of the system is always a constant vector.

15. Defien impulsive force or impulse.
    - If a very large force acts on an object for a very short duration, then the force is called impulsive force or impulse.
    - $J = F \text{ x } \Delta t$
    - Its unit is N s

16. What is frictional force?

    The frictional force which always opposes the relative motion between an object and the surface where it is placed.

17. What is static friction?

    Static friction is the force which opposes the initiation of motion of an object on the surface.

18. State the empirical laws of static and kinetic friction.
    - Empirical relation for static friction: $0 \leq f_s \leq \mu_s N$
    - Empirical relation for kinetic friction: $f_k = \mu_k N$

19. What is kinetic friction?

    If the external force acting on the object is greater than maximum static friction, the objects begin to slide. When an object slides, the surface exerts a frictional force called kinetic friction.

20. What is angle of friction?

    The angle of friction is defined as the angle between the normal force and the resultant force of normal force and maximum friction force.

21. What is angle of repose?

    The angle of repose is the angle of inclined plane with the horizontal such that an object placed on it begins to slide.

22. Under what condition will a car skid on a level circular road?
    - $\frac{mv^2}{r} > \mu_s mg$
    - $\mu_s < \frac{v^2}{rg}$
    - $\sqrt{\mu_s rg} < v$

23. What is centrifugal force?

    Centrifugal force arises whenever the motion is analysed from rotating frame. It is a pseudo force.

24. What is pseudo force?
    - Centrifugal force is called as pseudo force.
    - Pseudo force has no origin.
    - It arises due to the non inertial nature of the frame considered.

4.WORK, ENERGY & POWER

1. Define – Work

   Work is said to be done by the force when the force applied on a body displaces it.

2. Define – Energy

   Energy is defined as the ability to do work.

3. Define – Power

   The rate of work done is called power.

4. In which of the conditions work done is zero?
   - $If\ F = 0,\ W = 0$
   - $If\ dr = 0,\ W = 0$
   - $If\ \theta = 90°,\ W = 0$

5. What is kinetic energy?
   - The energy possessed by a body due to its motion is called kinetic energy.

6. State work – kinetic energy theorem.
   The theorem states that the work done by the force on the body changes the kinetic energy of the body.

7. What is potential energy?
   The enrgy possed by the body by virtue of its position is called potential energy.

8. What is elastic potential energy?
   The potential energy possessed by a spring due to a deforming force which stretches or compresses the spring is termed as elastic potential energy.

9. What is conservative force?
   A force is said to be a conservative force if the work done by or against the force in moving the the body depends only on the initial and final positions of the body and not on the nature of the path followed between the initial and final positions.

10. Give the examples for conservative force.
    - Spring force
    - Electrostatic force
    - Magnetic force
    - Gravitational force

11. What is non-conservative force?
    A force is said to by non-conservative if the work done by or against the force in moving a body depends upon the path between the initial and final positions.

12. Give the examples for non-conservative forces.
    - Frictional forces
    - Force due to air resistance
    - Viscous forces

13. State law of conservation of energy.
    - Energy can neither be created nor destroyed.
    - It may be transferred from one form to another
    - But the total energy of an isolated system remains constant.

14. Define – average power.
    The average power I sdefined as the ratio of the total work done to the total time taken.

15. Define – instantenous power.
    Instantaneous power is defined as the power delivered at an instant.

16. Define unit of power or one watt.
    One watt is defined as the power when one joule of work is done in one second.

17. What is elastic collision?
    In a collision, the total initial kinetic energy of the bodies is equal to the total final kinetic energy of the bodies then, it is called as elastic collision.

18. What is inelastic collision?
    In a collision, the total kinetic energy of the bodies is not equal to the total final kinetic energy of the bodies then, it is called as inelastic collision.

19. Define – Coefficient of restitution.
    It is defined as the ratio of velocity of separation after collision to the velocity of approach before collision.

20. Write the SI equivalent of other units of energy.
    - 1 erg 10^{-7} J
    - 1 electron volt 1.6 x 10^{-19} J
    - 1 calorie 4.186 J
    - 1 kilowatt hour 3.6 x 10^{6} J

5. MOTION OF SYSTEM OF PARTICLES AND RIGID BODIES

1. What is a rigid body?
   A rigid body is the one which maintains its dimension and fixed shape even when an external force acts on it.

2. Define center of mass.
   The center of mass of a body is defined as a point where the entire mass of the body appears to be concentrated.

3. Define torque. Give its unit.
   Torque is defined as the moment of the external applied force about a point or axis of rotation. Its unit is N m.

4. What are the conditions in which force does not produce torque?
   - $\tau = rF\ \sin\theta$
   - $If \theta = 0°\ then\ \tau = 0$
   - $If \theta = 180°\ then\ \tau = 0$
   - $If\ r = 0\ then\ \tau = 0$

5. What is equilibrium?
   A rigid body is said to be in mechanical equilibrium when both its linear momentum and angular momentum remain constant.

6. Define angular momentum. Give its unit.
   The angular momentum of a point mass is defined as the moment of its linear momentum. Its unit is kg $m^2\ s^{-1}$

7. Define couple.
   A couple is defined as a pair of forces which are equal and opposite and separated by a perpendicular distance causes a turning effect.

8. Give some examples for couple.
   * Opening a cap of a pen
   * Turning a steering wheel of a car
   * Opening a water tap

9. How do you distinguish between stable and unstable equilibrium.

Stable equilibrium	Unstable equilibrium
1. The body returns to equilibrium after disturbance	The body does not returns to equilibrium after disturbance
2. The center of mass shifts higher during disturbance	The center of mass shifts lower during disturbance
3. Potential energy is minimum and increased during disturbance	Potential energy is maximum and decreased during disturbance

10. State principle of moments.

When an object is in equilibrium the sum of the anticlockwise moments about a turning point must be equal to the sum of the clockwise moments.

11. Define center of gravity.

The center of gravity of a body is the point at which the entire weight of the body acts irrespective of the position and orientation of the body.

12. Define moment of inertia. Give its unit.

Moment of inertia is defined as the sum of the products of the mass and the square of the perpendicular distance to the axis of rotation of each particle in a body rotating about an axis. Its unit is kg m^2

13. Mention any two physical significance of moment of inertia.

* Lesser the moment of inertia, greater the speed of rotation.
* Greater the mass concentrated away from the axis of rotation, greater the moment of inertia.

14. What is radius of gyration? Give its unit.

The radius of gyration of an object is the perpendicular distance from the axis of rotation to an equivalent point mass, which has same mass and moment of inertia of the object. Its unit is metre.

15. State law of conservation of angular momentum.

When no external torque acts on the body, the net angular momentum of a rotating rigid body remains constant.

16. What is the condition for pure rolling?

In pure rolling, the total kinetic energy must be equal to the sum of kinetic energies of translational and rotational motion.

17. What is the difference between sliding and slipping?

Sliding	Slipping
The translation is more than rotation	The rotation is more than translation
Relative velocity is non zero	Relative velocity is zero

18. What are the rotational equivalents for the physical quantities (i) mass (ii) force?

(i) Mass – Inertia (ii) Force - Torque