11th physics unit 3 and 4 important 2 and 3 marks book inside

Unit 3 Laws of Motion

1.State Newton's laws

Newton's first Law:

Every object continues to be in the state of rest or of uniform motion unless there is external force acting on it

Newton's second Law:

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

$$\vec{F} = \frac{d\vec{p}}{dt}$$

Newton's third law:

For every action there is an equal and opposite reaction.

2. What are the steps followed for developing the free body diagram?

1. Identify the forces acting on the object.
2. Represent the object as a point.
3. Draw the vectors representing the forces acting on the object.

3. What are factors that the forces acting on the inclined plane decides?

a) acceleration of the object.

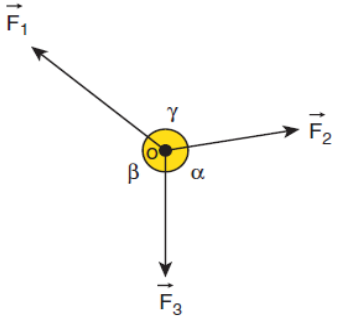
b) speed of the object when it reaches the bottom.

4.Why horizontal motion of strings is used/applicable in industries?

The tension in the string for horizontal motion is half of the tension for vertical motion for same set of masses and strings, so that the ropes used in conveyor belts (horizontal motion) work for longer duration than those of cranes and lifts (vertical motion).

5.State Lami's Theorem

If a system of three concurrent and coplanar forces is in equilibrium, then 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.



$$|\vec{F}_1| \propto \sin\alpha$$

$$|\vec{F}_2| \propto \sin\beta$$

$$|\vec{F}_3| \propto \sin\gamma$$

$$\frac{|\vec{F}_1|}{\sin\alpha} = \frac{|\vec{F}_2|}{\sin\beta} = \frac{|\vec{F}_3|}{\sin\gamma}$$

6.State the law of conservation of linear momentum.

If there are no external forces acting on the system, then the total linear momentum of the system is always a constant vector. In other words, the total linear momentum of the system is conserved in time.

7.Define impulse

If a very large force acts on an object for a very short duration, then the force is called impulsive force or impulse. $J = F\Delta t$

8. How did the ball bearing reduce kinetic friction?

If ball bearings are fixed between two surfaces, during the relative motion only the rolling friction comes to effect and not kinetic friction.

9. When a cricket player catches the ball, he pulls his hands gradually in the direction of the ball's motion. Why?

If he stops his hands soon after catching the ball, the ball comes to rest very quickly. It means that the momentum of the ball is brought to rest very quickly. So the average force acting on the body will be very large. Due to this large average force, the hands will get hurt. To avoid getting hurt, the player brings the ball to rest slowly.

10.What is the role of air bags in cars?

To prevent the fatal shock, cars are designed with air bags in such a way that when the car meets with an accident, the momentum of the passengers will reduce slowly so that the average force acting on them will be smaller.

11.What is the role shock absorbers in two wheelers?

When there is a bump on the road, a sudden force is transferred to the vehicle. The shock absorber prolongs the period of transfer of force on to the body of the rider. Vehicles without shock absorbers will harm the body due to this reason.

12.Why jumping on a concrete cemented floor is more dangerous than jumping on the sand?.

`Sand brings the body to rest slowly than the concrete floor, so that the average force experienced by the body will be lesser.

13.What are inertial frames?

Inertial frame is the one in which if there is no force on the object, the object moves at constant velocity. If an object is free from all forces, then it moves with constant velocity or remains at rest when seen from inertial frames.

14. State impulse momentum equation.

$\int_{t_i}^{t_f} F\,dt = J$ is called the impulse and it is equal to change in momentum of the object. If the force is constant over the time interval, then

$$\int_{t_i}^{t_f} F\,dt = F\int_{t_i}^{t_f} dt = F(t_f - t_i) = F\Delta t$$

$$F\Delta t = \Delta p$$

15.How did the car move on circular track?

When a car is moving on a circular track the centripetal force is given by the frictional force between the road and the tyres. Frictional force = $\mathbf{mv^2/r}$

where m-mass of the car, v-speed of the car r-radius of curvature of track.

Even when the car moves on a curved track, the car experiences the centripetal force which is provided by frictional force between the surface and the tyre of the car.

14.What is the reason for force changes the velocity of the particle?

- The magnitude of the velocity can be changed without changing the direction of the velocity. In this case the particle will move in the same direction but with acceleration.
- The direction of motion alone can be changed without changing the magnitude (speed).
- Both the direction and magnitude (speed) of velocity can be changed. If this happens non circular motion occurs.

15. What is meant by frictional force?

Frictional force is the force which always opposes the relative motion between an object and the surface where it is placed. If the force applied is increased, the object moves after a certain limit.

16. What is relative motion?

When a force parallel to the surface is applied on the object, the force tries to move the object with respect to the surface. This 'relative motion' is opposed by the surface by exerting a frictional force on the object in a direction opposite to applied force.

17. How is the centripetal force act in whirling motion?

In the case of whirling motion of a stone tied to a string, the centripetal force on the particle is provided by the tensional force on the string. In circular motion in an amusement park, the centripetal force is provided by the tension in the iron ropes.

18. What are the applications of angle of repose?

- The angle of inclination of sand trap of antlions is made to be equal to angle of repose.
- Children are fond of playing on sliding board. Sliding will be easier when the angle of inclination of the board is greater than the angle of repose

18. Define centripetal force.

If a particle is in uniform circular motion, there must be centripetal acceleration towards the center of the circle. If there is acceleration then there must be some force acting on it with respect to an inertial frame. This force is called centripetal force.

19. What are the three forces acting on the vehicle when it moves on a leveled circular road?

1. Gravitational force (mg) acting downwards
2. Normal force (mg) acting upwards
3. Frictional force (Fs) acting horizontally inwards along the road

20. What are the conditions for the car a) to have for safe turn.

$$\frac{mv^2}{r} \le \mu_s mg, \text{ or } \mu_s \ge \frac{v^2}{rg} \text{ or } \sqrt{\mu_s rg} \ge v$$

b) to skid

$$\frac{mv^2}{r} > \mu_s mg, \text{ or } \mu_s < \frac{v^2}{rg}$$

21. What is meant by banking of roads?.

To avoid the problem of skidding, usually the outer edge of the road is slightly raised compared to inner edge. This is called banking of roads or tracks. This introduces an inclination, and the angle is called banking angle.

22. Define centrifugal force.

A force, arising from the body's inertia, which appears to act on a body moving in a circular path and is directed away from the centre around which the body is moving, is known as the centrifugal force.

23.Define Inertia and its types.

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

- The inability of an object to change its state of rest is called inertia of rest.
- The inability of an object to change its state of uniform speed (constant speed) on its own is called inertia of motion.
- The inability of an object to change its direction of motion on its own is called inertia of direction

24. Define one Newton.

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

Problems: ***Examples*** 3.1 to 3.3,3.5,3.6,3.10,3.13,3.14,3.16 to 3.18,3.20,3.22,3.24 to 3.26

UNIT – 04 work, energy and power

1.Define unit of power:

One watt is defined as the power when one joule of work is done in one second. $1W = 1Js^{1}$

2.Explain Work done.

Work is said to be done b y the force when the force applied on a body displaces it. The work done is a scalar quantity. It has only magnitude and no direction. In SI system, unit of work done is N m (or) joule(J). Its dimensional formula is ML^2T^{-2}

3.When does work done becomes zero

- When the force is zero (F = 0).
- When the displacement is zero (dr = 0)
- When the force and displacement are perpendicular ($\theta = 90^0$) to each other.

4. Define Work done by a const ant force

When a constant force F acts on a body, the small work done (dW) by the force in producing a small displacement dr is given by the relation, $dW= (F \cos\theta)dr$

5.Define Work done by a variable force

When the component of a variable force F acts on a body, the small work done (dW) by the force in producing a small displacement dr is given by the relation $dW= (F \cos\theta) dr$ [$F \cos \theta$ is the component of the variable force F]

6.Define Energy, Kinetic energy and Potential Energy

Parameters	Definition	SI Unit	Dimensional Formula
Energy	The capacity to do work	Nm or joule	ML^2T^{-2}
Kinetic energy	The energy possessed by a body due to its motion	Nm or joule	ML^2T^{-2}
Potential energy	The energy possessed by the body by virtue of its position	Nm or joule	ML^2T^{-2}

7.Write the significance of kinetic energy in the work – kinetic energy theorem.

- If the work done by the force on the body is **positive** then its **kinetic energy increases.**
- If the work done by the force on the body is **negative** then its **kinetic energy decreases**.
- If there is **no work done** by the force on the body then there is **no change** in its kinetic energy

8.Define Work – kinetic energy theorem.

The work done by the force on the body changes the kinetic energy of the body.This is called work-kinetic energy theorem.

9.Define 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.

10.Define Conservative force

A force is said to be a conservative force if the work done by or against the force in moving 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.

11.Define Non-conservative force

A force is said to be 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. This means that the value of work done is different in different paths.

12.DefineAverage power

The average power (P_{av}) is defined as the ratio of the total work done to the total time taken.

$$P_{av} = \frac{\text{total work done}}{\text{total time taken}}$$

14.Define Instantaneous power

The instantaneous power (P_{inst}) is defined as the power delivered at an instant (as time interval approaches zero)

$$P_{inst} = \frac{dW}{dt}$$

15.What is meant by collision?

Collision is a common phenomenon that happens around us every now and then. For example, carom, billiards, marbles, etc.,. Collisions can happen between two bodies with or without physical contacts.

16.What is Elastic Collision?

In a collision, the total initial kinetic energy of the bodies (before collision) is equal to the total final kinetic energy of the bodies (after collision) then, it is called as elastic collision.

i.e., Total kinetic energy before collision = Total kinetic energy after collision

17.What is Inelastic Collision?

In a collision, the total initial kinetic energy of the bodies (before collision) is not equal to the total final kinetic energy of the bodies (after collision) then, it is called as inelastic collision.

i.e., Total kinetic energy before collision ≠ Total kinetic energy after collision

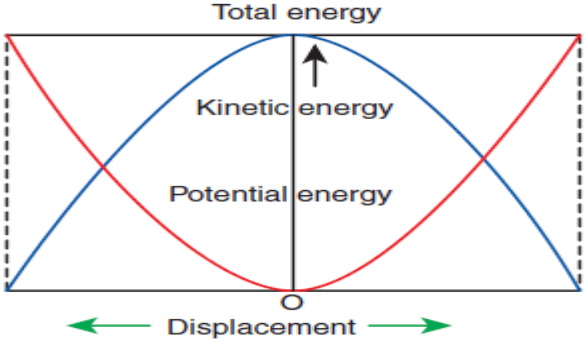
18. Define power.

Power is defined as the rate of work done or energy delivered.

$$\text{Power } (P) = \frac{\text{work done}(W)}{\text{time taken}(t)}$$

$$P = \frac{W}{t}$$

19.Draw the Potential energy–displacement graph for a spring mass system

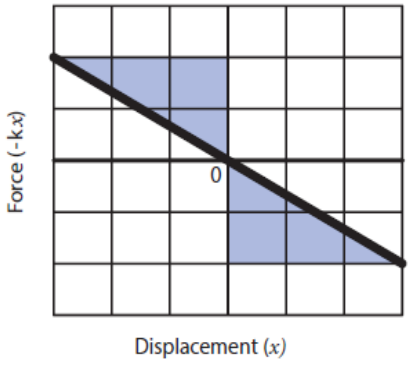


20.State the law of conservation of energy.

The law of conservation of energy states that energy can neither be created nor destroyed. It may be transformed from one form to another but the total energy of an isolated system remains constant.

21.Draw the Force–displacement graph for a spring

The restoring spring force and displacement are linearly related as $F = -kx$, and are opposite in direction, the graph between F and x is a straight line with dwelling only in the second and fourth quadrant.



22.Relation between power and velocity.

$$W = \int \vec{F} \cdot d\vec{r}$$

$$W = \int dW = \int \frac{dW}{dt} dt$$

(multiplied and divided by dt)

$$\int \vec{F} \cdot d\vec{r} = \int \left(\vec{F} \cdot \frac{d\vec{r}}{dt} \right) dt = \int (\vec{F} \cdot \vec{v}) dt \quad \left[\vec{v} = \frac{d\vec{r}}{dt} \right]$$

$$\int \frac{dW}{dt} dt = \int (\vec{F} \cdot \vec{v}) dt$$

$$\int \left(\frac{dW}{dt} - \vec{F} \cdot \vec{v} \right) dt = 0$$

$$\frac{dW}{dt} - \vec{F} \cdot \vec{v} = 0$$

Or

$$\frac{dW}{dt} = \vec{F} \cdot \vec{v}$$

23.Relation between momentum and kinetic energy.

$$KE = \frac{1}{2} mv^2 = \frac{1}{2} m (\vec{v} . \vec{v})$$

$$KE = \frac{1}{2} \frac{m^2 (\vec{v} . \vec{v})}{m}$$

$$= \frac{1}{2} \frac{(m\vec{v}) . (m\vec{v})}{m} \quad [\vec{p} = m\vec{v}]$$

$$= \frac{1}{2} \frac{\vec{p} . \vec{p}}{m}$$

$$= \frac{p^2}{2m}$$

$$KE = \frac{p^2}{2m}$$

$$|\vec{p}| = p = \sqrt{2m\ (KE)}$$

24.What are the various types of potential energy.

- The energy possessed by the body due to gravitational force gives rise to gravitational potential energy.
- The energy due to spring force and other similar forces give rise to elastic potential energy.
- The energy due to electrostatic force on charges gives rise to electrostatic potential energy.

Problems ***Examples*** 4.1, 4.3, 4.5 to 4.7 , 4.9, 4.10, 4.13, 4.15 to 4.19, 4.21, 4.22