Short Answers

Q.1 Define the following terms:

(i) Inertia (ii) Momentum (iii) Force

(iv) Force of friction (v) Centripetal force

Ans: (i) Inertia:

Inertia of a body is its property due to which it any change in its state of rest or motion.

Galileo related the inertia of a body with its mass; greater is the mass of a body greater is its inertia.

Inertia ∝ mass of body

(ii) Momentum:

Momentum of a body is the quantity of motion it possesses due to its mass and velocity.

The momentum P of a body is given by the product of its mass m and velocity v. Thus

P=mv

Momentum is a vector quantity. Its SI unit is $kgms^{-1}$

Momentum of a system depends on its mass and velocity.

(iii) Force:

A force moves or tends to move, stops or tends to stop the motion of a body. The force can also change the direction of motion of a body.

F= ma

Si unit of a force is newton.

Note: A force can also change the shape or size of a body on which It acts.

(iv) Force of friction:

Friction:

The force, that opposes the motion of moving objects is called friction.

Friction is a force that comes into action as soon as body is pushed or pulled over a surface.

Factor on which friction depends:

In case of solids, the force of friction between two bodies depends upon many factors such as nature of the two surfaces in contact and the pressing force between them.

(v) Centripetal force:

Centripetal force is a force that keeps a body to move in a circle.

The centre seeking force is called the centripetal force. It keeps the body to move in a circle. Centripetal force always acts perpendicular to the motion of the body,

$$Fc = \frac{mv^2}{r}$$

Q.2 What is the difference between:

(i) Mass and weight

(ii) Action and reaction

(iii) sliding friction and rolling friction

Ans: (i) Mass and weight:

Mass	Weight
1.The quantity of matter contained in a body is called its mass.	**1.**Weight is a force with which earth attracts a body towards its centre.
2.The mass of a body remains constant everywhere, whether it is measured at a point far away from the centre of the earth, or the surface at the centre of the earth.	**2.**The weight of a body is not constant quantity but its value is different at different places.
3.Mass is a scalar quantity.	**3.**Weight is a vector quantity and is always directed towards the centre of the earth.
4.The SI unit of mass is kilogram.	**4.**The SI unit of weight is newton.
5.Mass is measured by ordinary balance.	**5.**weight is measured by spring balance.
6.Mass of the body cannot be zero.	**6.** Weight of the body can be zero i,e at the centre of the earth and in space where g=0 so w=mg=m×0=0
7.It is the measure of inertia in a body i.e: $m=\frac{w}{g}$	**7.**Weight is given by w=mg

(ii)Action and reaction:

Newton's third law of motion deals with the reaction of a body when a force act on it. Let a body A exerts a force on another body B. The body B react against this force and exerts a force on body A. The force exerted by a body A on B is the action force whereas the force exerted by body B on A is called reaction force.

Note that action and reaction forces act on different bodies.

Example:

Action and reaction forces act on different objects and in opposite directions. For example, if the rocket pushes the gas out, the gas pushes back against rocket. The forces on different objects (the gas, and the rocket, respectively), and in opposite direction.

(iii) Sliding friction and rolling friction

Sliding friction:

A force between the sliding objects which opposes the relative motion between them is called sliding friction.

Rolling friction:

Rolling friction is the force of friction between a rolling body and a surface over which it rolls. Rolling friction is lesser than the sliding friction.

Q.3 What is law of inertia?

Ans: Inertia:

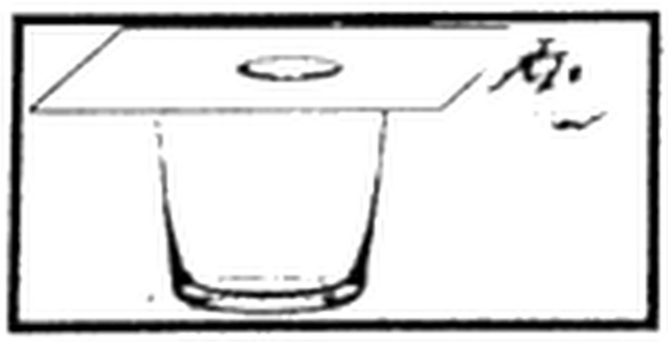
Inertia of a body is its property due to which it any change in its state of rest or motion.

Galileo related the inertia of a body with its mass. greater the mass of a body greater is its inertia.

Inertia ∝ mass of body

Experiment:

Take a glass and cover it with a piece of cardboard. Place a coin on the cardboard. Now kick the card horizontally, with jerk of your finger.

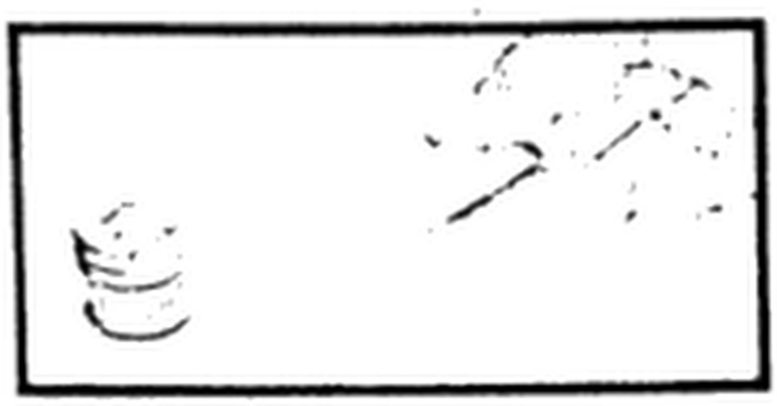


The coin falls into the glass as the card flicks away

The coin does not move with the cardboard due to inertia. The coin falls into the glass as the card flicks away.

Experiment:

Cut a strip of paper. Place it on the table. Stack a few coins at its one end. Pull out the paper strip under the coins with a jerk.



Coins stacked pver remain undisturbed on pulling the paper strip quickly

Coins stacked pver remain undisturbed on pulling the paper strip quickly due to inertia.

Q.4 Why it is dangerous to travel on the roof of a bus?

Ans: Because the friction force due air acting on the upper part pf body the person who travelling on the roof of running bus try to turn over which is dangerous for passenger while travelling on the lower portion remain at rest w.r.t the roof of the bus due to inertia.

Q.5 Why does a passenher move outward when a bus takes a turn?

Ans: An inward net force is required to make a turn in a circle. This inward net force requirment is known as a centripetal force requirement. In the absence of any net force, an object in motion(such as passenger) continuous in motion in a staright line at constant speed. Due to the absence of necessary centripetal force a passenger moves outward when a bus takes a turn.

Q.6 How can you relate a force with he change of momentum of a body?

Ans: Force and momentum:

Consider a body of mass m moving with initial velocity vi, let a force acts on the body which produces an acceleration a in it. This changes the velocity of the ody. Let its final velocity after tume t becomes vf. If pi and pf be the initial momentum and final momentum of the body related to initial and final velocities respectively then

$$P_i = mv_i$$

$$P_f = mv_f$$

Or

Change in momentum = final momentum – initial momentum

Or

P=mv

Thus the rate of change in momentum is given by:

$$\frac{pf.pi}{t} = \frac{mvf - mvi}{t}$$

Since $\frac{vf-vi}{t}$ is the rate of change of velocity equal to the acceleration a produced by the force F

$$\frac{pf.pi}{t} = ma$$

Accoridng to Newton's second law of motion,

F= ma

Or $\frac{pf.pi}{t} = F$ ..... (I)

Equation (I) also defines force and states Newton's second law of motion as:

When a force acts on a body, it produces an acceleration in the body and will be equal to rate of change of momentum of the body.

Q,7 What will be the tension in a rope that is pulled from its ends by two opposite forces 100N each?

Ans: Tension in he rope and its force pulls equally at both the ends if no forces acting on the rope except its ends, and the rope itself being in equilibrium, the the tension is the same throughout the rope.

$$\sum F = 0$$

Q.8 Action and reaction are always equal and opposite. Then how does a body moves?

Ans: Action and reactions (fores acting on an object) are always equal and opposite

When the object is at equilibrium. When we apply external force to pull,push and twist, the equilibrium is disturbed means now the magnitues of action (force provided by you) and reaction (force provided by the objects) is not equal. That is why it is possible to twist, pull, move and push the object in the direction of applied force.

Q.9 A horse pushes the cart. If the action and reaction are equal and opposite then how does the cart move?

Ans: First of all when the horse pulls o the cart, the cart exerts an equal but opposite reaction on the horse, the action and reaction . If this was the only force in action then the force and cart would indeed remain stationary.

However there is another force between the force and the ground. The horse's hooves press down on the ground and the ground pushes back on the horse.

It the reaction force of the ground is greater that the reaction force of the cart on the horse, then the horse will move forward. The cart will move forward when the force exerted on it by the horse is greater than the frictional force between the cart and the ground.

Q.10 What is the law of conservation of momentum?

Ans: Law of conservation of momentum:

The momentum of an isolated system of two or, more than two interacting bodies remains constant.

Example:

Consider the example of an air-filled ballon as described under the third law of motion. In this case, balloon and the air inside it form a system. Before

releasing the balloon, the system was at rest and hence the initial momentum of the system was zero. As soon as the balloon is set fre, air escapes oout of it with some veocity. The air coming out of it possesses moemntum. To conserve momentum, the belloon moves in a direction opposite to that of air rushing out.

Explanation:

Case I:

Consider an isolated system of two spheres of masses m1 and m2. They are moving in a straight line with initial velocities u1 and u2 respectively such that u1 is greater than u2. Sphere of mass m1 approaches the sphere of mass m2 as they move

Initial momentum of mass m1 =m1u1

Initial momentum of mass m2 =m2u2

Total initial momentum of the system before collision = m1u1+m2u2 .....(i)

Case II:

After sometimes mass m1 hit m2 with some force. According to newton;s third law of motion m2 exerts an equal and opposite reaction force on m1. Let their velocities become v1 ans v2 respectively after collision. Then

Final momentum of mass m1 =m1u1

Final momentum of mass m2 =m2u2

Total final momentum of the system before collision= m1u1+m2u2 .....(ii)

According to Law of conservation of momentum:

[total initial momentum of the system before collison]= [total initial momentum of the system before system]

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad \text{(iii)}$$

equation (iii) shows that the momentum of an isolated system before and after collisions remains the same which is the law of conservation of momentum. Law of conservation of momentum is an important law and has vast applications.

Q.11 Why is law of conservation of momentum important?

Ans: Law of conservation of momentum is applicable on all objecys in the universe. A rocket and jet engine taking off. The recoil of gun and bank-sj=hot in a pool are examples which demonstrate the importance of law of conservation of momentum.

Q.12 When a gun is fired, it recoils. Why?

Ans: Recoils of gun:

Consider a system of gun and a bullet. Before firing the gun, both the gun and buled are at rest, so the total momentum of the ysytem is zero. As the gun is fired, bullet shoots out the gun and acquires momentum. To conserve momentum of the system, the gun recoils.

According to the law of conservation of momentum, the total momentum of the gun and the bullet will also be zero after the gun is fired. Let m be the mass of the gun and v bbe its velocity on firing the gun, M be the mass of the gun and V be the velocity with which it recoils. Thus the totsl momentum of the gun and the bullet after the gun is fired will be.

[total momentum of the gun and the bullet after the un is fired]= MV + mv.....(i)

According to the law of conservation of momentum,

(total momentum of the gun and the bullet= (total momentum of the gun and the after the gun is fired) bullet before the gun is fired)

$$MV + mv = 0$$

Or $$MV = -mv$$

Hence $$\mathbf{V = \frac{m}{M} v} \qquad \textbf{(ii)}$$

Equation (ii) gives the velocity V of the gun. Ngative sign indicates that velocity of the gun is opposite to the velocity of the bullet i.e, the gun recoils. Since mass of the gun is much larger than the bullet, therefore the recoil is much smaller than the velocity of the bullet.

Q.13 Descrie two situations in which force of friction is needed.

Ans: i: Friction is needed to walk on the ground.

ii. It is risky to run on wet floor with shoes that have smooth soles. Atheletes use special shoes that have xetraordinary ground grip. Such shoes prevent them from slipping while running fast.

iii. To stop our bicycle we will apply brakes. The rubber pads pressed against the rims provide from friction. It is the friction that stops the bicycle.

Q.14 How does oiling the moving parts of a machine lowers friction?

Ans: The friction can be reduced by lubricating the sliding surfaces. The oil helps slick(polished) the two surfaces so that the molecular surfaces become easier to side on with less friction.

Q.15 Describe ways to reduce friction?

Ans: Methods of reducing friction:

1. The friction can be reduced by making the sliding surfaces smooth.
2. The friction can be reduced by making the fast moving objects a streamline. shape (fish shape) such as cars, aeroplanes etc. this causes the smooth flow of airand thus minimizes air resistance at high speeds.
3. The friction can be reduced by using ball bearings or roller bearings because the rolling friction is lesser than the sliding friction.
4. The friction can be reduced by lubricating the sliding surfaces.

Q.16 Why rolling friction is less than sliding friction?

Ans: Sliding friction:

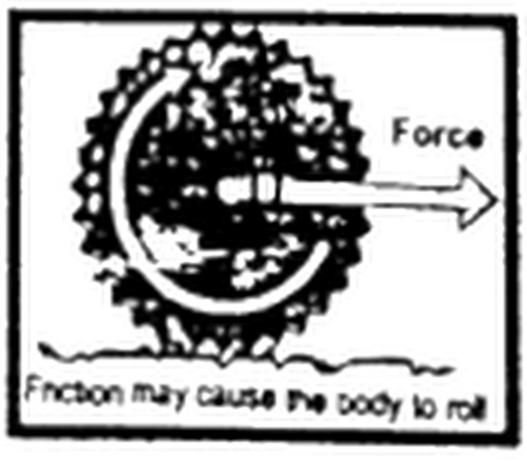
A force between the sliding objects which opposes the relative motion between them is called sliding friction.

Rolling friction:

Rolling friction is the force of friction between rolling body and a surface over which it rolls. Rolling friction is lesser than the sliding friction.

Explanation:

When a certain body rolls over the surface of another body, it has the contact with the surface only at a single point. As there is no relative motion between the two bdoies at this point, therefore sliding friction is zero. However practically the wheel is compressed a little temporarily at the contact point of the two surfaces under pressure. Because of that little sliding friction, rolling friction is produced.



But when a body moves over the surface of another body, there is relative motion between the two surfaces, thus, friction has some maximum value. That is why the rolling friction is less than sliding friction. The rolling friction is 100 times less than sliding friction.

Q.17 what you know about the following:

(i) tension in a string **(ii) limiting force of friction**

(iii) braking force **(iv) skidding of vehicles**

(v)seatbelts **(vi) banking of roads**

(vii)cream separator

Ans: (i) Tension in a string:

"the force exerted by a string when it is subjected to pull is called tension in the string"

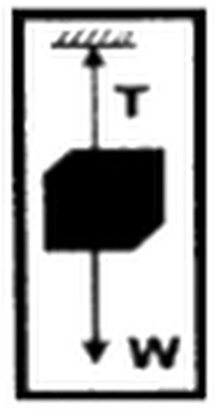
If a person is holding a block of weight W attached to the end of a string, a force is experienced by him. This force is known as Tension. When the body is at rest, the magnitude of tension is equal to the weight of the body suspended by the string Tension and the weight acts in the opposite direction.

Unit of tension:

In S.I. sytem: newton

In C.G.S. system: dyne

In F.P.S. sytem:pound



(ii) Limiting force of friction:

the maximum value of friction is known as the force limiting friction(Fs) . It depends on the normal reation (pressing force) between the two surfaces in contact $F_s=\mu R$

(iii) Braking force:

Friction between a rotating component (the drum or disc) and a stationary force is called braking force.

1. The diameter of the disc
2. The friction material
3. The size of the pad friction face
4. The force used too clamp the pads onto the disc
5. The greater the diameter of the disc, the furthur from the centre of the wheel the braking force can be applied. This in turn will generate a greater force, or torque, on the disc.

(vi)Skidding of vehicles:

Skids usually occur while driving the clutch is suddenly engaged or disengaged, the brakes are applied too hard, the vehicle accelerates too quickly or the steering wheel is turned too sharply. These can create a situation where power, either too much or too little, causes a loss of traction.

If the brakes are applied too strongly, the wheels of the car will lock up (stop turning) and the car will skid due to its large momentum. It will lose its directional control that may result in an accident. In order to reduce he chance of skidding, it isadvisable not to apply brakes too hard that lock up their rolling motion especially at high speed.

(v)Seatbelts:

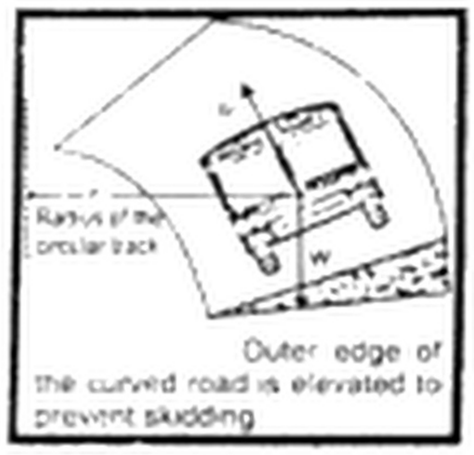
In case of an accident, a person not wearing seatbelt will continue moving until stopped by something before him, This something may be a windscreen another passenger or back of the seat in front of him/her. Seatbelts are useful in two ways.

1. They provide an external force to a person wearing seatbelt.
2. The additional time is required for stretchng seatbelts. This prolongs the stopping time for momentum to change is and reduces the effect of collision.

(vi)Banking of roads:

The curvature of the road must be inclined so as to control the Centrifugal force of the Vehicle.

Banking of road means to make the road to slide towards the center of curvature wuth an angle. It is helpful because it the velocity of car is more or there is less friction between the tyres and the road which reduce the danger of car to move out of circular track.



Outer edge of the curved road is elevated to prevent skidding

Explanation:

When a car takes a turn, centripetal force is needed to keep it in its curved track. The frction between the tyres and the road provides necessary centripetal force. The car would skid if the force of friction between the tyres and the road is not sufficent enough particularly when the roads are wet. This problem is solved by banking of cyrved roads.

(vii)Cream separator:

Most modern plants use a separator to control the fact contents of various products. A separator is a high speed spinner. It acts on the same principle of centrifuge machines. The bowl spins at very high speed causing the heavier contents of milk to move outward in the bowl pushing the lighter contents inward towards the spinning axis

Cream or butterfat is lighter than other components in milk. Theerefore, simmed milk, whivh is denser than cream is collected at the outer wall of the bowl. The lighter part (cream) is pushed towards the centre from where it is collected through a pipe.

Q.18 What would happen if all friction suddenly disappers?

Ans: If there was no friction then we could not walk, we would keep slipping. Nothing would be steady on the ground, many things would be just sliding and sliding.

Q.19 Why the spinner of washing machine is made to spin at a very high speed?

Ans: The dryer of a washing machine is basket spinners. They have a perforated wall having large numbers of fines holes in the cylindrical rotor. The lid of the

speed, the water from wet clothes is forced out through these holes due to lack of centripetal force.