Q1. Define force and write its S.I. unit.

Ans. Force (Effort): Push or pull of an object is called force.

When we do an effort to move a body means we apply force on that body.

Force is vector quantity and its S.I. unit is Newton (N) Or k gm/sec^2

Q2. What are the effects of force ?

Ans. Effects force are given below.

Effects of force:
1. Force can change the shape of an object.
2. Force can move a stationary object.
3. Force can stop a moving object.
4. Force can change the direction of an object.
5. Force can change the velocity of an object.

Q3. Write the types of force and explain its parts.

Ans. Types of force : There are two types of force:
1. Balanced force
2. Unbalanced force

Balanced force:

If the resultant of all the forces acting on an object is zero then it is called balanced force.

Balanced force can't change the state of an object

For exp. In the tug of war if both the team apply similar magnitude of forces in opposite direction, rope does not move in either sides. This happens because of balanced forces in which resultant of an applied forces becomes zero.

Balanced force can change the shape and size of an object.

Unbalanced force: If the resultant of all the forces acting on an object is not zero, then it is called unbalanced force.

For exp. When a man pushes a heavy box then man apply more force than the frictional force means he apply an unbalanced force which causes change in the state of the box and so that the box move.

It can change the state of an object.

Q4. What does Galileo Galilei state about the law of motion?

Ans. Laws of motion:

Galileo Galilei : Galileo first of all said that object move with a constant speed when no force act on them. This means if an object is moving on a frictionless path and no other force is acting upon it, the object would be moving forever.

This is, there is no unbalanced force working on the object.

But practically it is not possible for any object. Because to attain the condition of zero, unbalanced force is impossible. Force of friction, force of air and many other forces are always acting upon an object.

Q5. Write the Newton's first law of motion

Ans. Newton's First Law of Motion:

It states that any object in the state of uniform motion or in the state of rest along a straight line, until we apply an external force on it.

Q6. Why does a person standing in a bus fall backward when bus starts moving suddenly ?

Ans. A person standing in a bus falls backward when bus starts moving suddenly .This happens because the person and bus both are in rest while bus is not moving, but as the bus starts moving, the legs of the person start moving along with bus but rest portion of his body has the tendency to remain in rest. Because of this, the person falls backward; if he is not alert.

Q7. Why does a person standing in a moving bus falls forward if driver applies breaks suddenly ?

Ans. A person standing in a moving bus falls forward if driver applies breaks suddenly .This happens because when bus is moving, the person standing in it is also in motion along with bus .But when driver applies brakes the speed of bus decreases suddenly or bus comes in the state of rest suddenly, in this condition the legs of the person which are in contact with the bus come in rest while the rest part of his body have the tendency to remain in motion. Because of the person falls forward if he is not alert.

Q8. Before hanging the wet clothes over laundry line, usually many jerks are given to the clothes to get them dried quickly. Why?

Ans . Before hanging the wet clothes over laundry line, usually many jerks are given to the clothes to get them dried quickly. Because of jerks, droplets of water from the pores of the cloth falls on the ground and reduced amount of water in clothes dries them quickly. This happens because when suddenly clothes are made in motion by giving jerks, the water droplets init have the tendency to remain in rest and they are separated from clothes and falls on the ground.

Q9. When the pile of coin on the carom-board is hit by a striker, coin only at the bottom moves away leaving rest of the pile of coin at same place. Explain it.

Ans. When the pile of coin on the carom-board is hit by a striker, coin only at the bottom moves away leaving rest of the pile of coin at same place. This happens because when the pile is struck with a striker, the coin at the bottom comes in motion while rest of the coin in the pile has the tendency to remain in the rest and they vertically falls the carom-board and remain at same place.

Q10. Explain about Inertia.

Ans. Inertia: The property of an object by which an object opposes any change in the state of rest, state of motion or state of direction which called inertia.

Inertia is of three types:

1. **Inertia of motion**-The property by virtue of an object by which it opposes to any change in the state of motion is called inertia of motion.
2. **Inertia of Rest**-The property by virtue of an object by which it opposes to any change in the state of rest is called inertia of rest.
3. **Inertia of Direction**-The property by virtue of an object by which it opposes to any change in the state of direction is called inertia of direction.

Q11. Define momentum. Write its formula and its S.I. unit

Ans. Momentum: It is the product of mass and velocity. It is denoted by 'p'

The S.I. unit of momentum is kg/sec.

$$p = mv$$

Q12. Define the Newton's second law of motion and derive the formula for it.

Ans. Newton's Second Law of Motion: The external force acting on an object is directly proportional to the rate of change in momentum.

Derivation:

We know that $p_1= mu$

$P_2= mv$

Change in momentum= $p_2-p_1= mu - mv = m(v-u)$

According to second law motion, Force is directly proportional to the rate of change of momentum

$$\text{So } F \alpha \frac{\text{change in momentum}}{\text{time taken}}$$

$$F \alpha \frac{m (v-u)}{t}$$

$$F \alpha \, ma, \quad (\text{where } a = \frac{v-u}{t})$$

$$F = k \, ma \quad (\text{Where k is the constant})$$

$$\text{If, F=1 N, m= 1kg and a = 1 m/sec}^2$$

$$\text{So, k = 1,}$$

$$\text{Therefore} \quad [\, F= ma]$$

Now we can say that force is the product of mass and acceleration.

Q13. Define 1 Newton.

Ans. Define : When an acceleration of 1 m/s^2 is seen in a body of mass 1 kg, then the force applied on the body is said to be 1 Newton.

Impulse: It is the product of force and time.

It is also equal to the change in momentum.

$$I = F \, x \, t = p_2-p_1$$

Q14. While catching a cricket ball a player lower its hand with a ball explain briefly Why ?

Ans. When the ball is caught by a player momentum of the ball is reduced to zero. By lowering his hand with the ball, the player increases time of catching

i.e. time to stop the ball consequently for same change in momentum. The rate of

change of momentum that is the force exerted by the ball on the player's hand will be less. Consequently, chances of players being hurt very much reduced.

Q15. How can a karate player break a pile of ice?

Ans. Karate expert raises his hand high and then very quickly strike on the slab of ice at the middle. In this process change in momentum of hand has taken place during a very short time. A hand exert as a large force on ice slab and the slave is divided into two part.

Q16. Explain the Newton third law of motion.

Ans. Newton Third Law of Motion:

Newton states that for every action there is equal and opposite reaction.

$$F = -F$$

Action = -reaction

This forces are present in pairs and a single accelerated force is an impossible.

Q17. Show that walking of a man is an example of Newton 3rd law of motion.

Ans. While walking a man presses the ground with his feet in backward direction. The ground in turn pushes the man in the forward direction thus it is the reaction force due to ground which enables a man to walk.

Q18. It is difficult to walk on a sandy [slippery] surface. Why?

Ans. While walking we press the ground backward and are able to move forward due to reaction of ground on us. In case of sand is slippery surface. It is difficult to press the surface backward and action force is less, reaction force is also be corresponding less and it will be difficult to walk.

Q19. Define law of conservation of momentum and derive it.

Ans. The total momentum of the system of two or more particles before and after is the same.

Momentum before collision = momentum after collision

Suppose, two object A and B each of mass m_1 and mass m_2 are moving initially with velocities u_1 and u_2, strike each other after time t and start moving with velocities v_1 and v_2 respectively.

Now, initial momentum of object A = m_1u_1

Initial momentum of object B = m_2u_2

Final momentum of object A = m_1v_1

Final momentum of object B = m_2v_2

So, Rate of change of momentum in A, $F_1 = \dfrac{m_1v_1 - m_1u_1}{t}$

$$= \frac{m1\ (v1\text{-}u1)}{t} \qquad\qquad \text{--- (1)}$$

And Rate of change of momentum in B, $F_2 = \dfrac{m2v2\text{-}m2u2}{t}$

$$= \frac{m2(v2\text{-}u2)}{t}$$

We know that $\qquad\qquad F_1 = \text{-}\ F_2$

So, $\qquad\qquad \dfrac{m1(v1\text{-}u1)}{t} = \text{-}\ \dfrac{m2\ (v2\text{-}u2)}{t}$

$$m_1v_1 - m_2v_2 = \text{-}\ m_2v_2 + m_2u_2$$

$$\mathbf{m_1u_1 + m_2u_2 = m_1\ v_1 + m_2\ v_2}$$

Initial momentum = Final momentum