Exercise -3(B)

1. **Name the physical quantity which cause motion in a body.**
   Solution:
   The physical quantity that causes motion in a body is force.

2. **Is force needed to keep a moving body in motion?**
   Solution:
   No, force is not required to be applied to a moving body unless the direction or the speed is required to be changed.

3. **A ball moving on a table top eventually stops. Explain the reason.**
   Solution:
   A ball moving on a table top is restricted by the force of friction between the ball and the table top as it opposes the motion.

4. **A ball is moving on a perfectly smooth horizontal surface. If no force us applied on it, will its speed decrease, increase or remain unchanged?**
   Solution:
   When no force is applied on a ball moving on a perfectly smooth and horizontal surface, its speed remains unchanged.

5. **What is Galileo's law of inertia?**
   Solution:
   Galileo's law of inertia is as stated below:
   "An object, if once set in motion, moves with uniform velocity if no force acts on it."

6. **State Newton's first law of motion.**
   Solution:
   Newton's first law states that – if a body is in a state of rest, it will remain in the state of rest and if it is in the state of motion, it will remain moving in the same direction with the same speed unless an external force is applied on it.

7. **State and explain the law of inertia (or Newton's first law of motion).**
   Solution:
   The law of inertia is as stated below:
   "if a body is in a state of rest, it will remain in the state of rest and if it is in the state of motion, it will remain moving in the same direction with the same speed unless an external force is applied on it"
   The first part of the law gives the definition of inertia as per which an object cannot change its state by itself. If an object is in the state of rest, it will remain in the state of rest and if it is moving in some direction, it will continue to move with the same speed in the same direction unless an external force is applied on it.

8. What is meant by the term inertia?

Solution:

The property of an object by virtue of which it tends to retain its state of rest or of uniform is called inertia.

9. Give qualitative definition of force on the basis of Newton's first law of motion.

Solution:

The qualitative definition of force on the basis of Newton's first law of motion is as follows: "force is that external cause which can move a stationary object or which can change the state of motion of a moving object".

10. Name the factor on which inertia of a body depends and state how it depends on the factor stated by you.

Solution:

One factor on which inertia of a body depends is mass. Mass and inertia are directly proportional to each other. Greater the mass, greater is the inertia.

11. Give two examples to show that greater the mass, greater is the inertia of the body.

Solution:

Listed below are the examples:

- Compared to a tennis ball, a cricket ball is massive. The cricket ball acquires much smaller velocity than a tennis ball when both the balls are pushed with equal force for the same duration.
- It is difficult to set a loaded trolley(has more mass) in motion than an unloaded trolley(which has lesser mass)

12. 'More the mass, more difficult it is to move the body from rest'. Explain this statement by giving an example.

Solution:

Mass of a body is directly related to inertia, the more the mass of an object, the more the inertia. Compared to an unloaded trolley, it is difficult to set a loaded trolley in motion as a larger force is required to set it to motion.

13. Name the two kinds of inertia.

Solution:

The two kinds of inertia are:

- Inertia of rest
- Inertia of motion

14. Give one example of each of the following:
(a) Inertia of rest, and (b) inertia of motion.

Solution:

Listed below are the examples:

(a) Inertia of rest – The passenger standing in the compartment tends to fall backwards when a train suddenly starts moving forward.

(b) Inertia of motion – A cyclist riding along a level road does not come to rest immediately after

he stops pedaling.

15. Two equal and opposite forces act on a stationary body. Will the body move? Give reason to your answer.

Solution:

When two equal and opposite forces are acting on a stationary body, the body will not move as the net force on the body is zero, hence the body will remain stationary. It will be in a state of rest due to inertia.

16. Two equal and opposite forces act on a moving object. How is its motion affected? Give reason.

Solution:

When two equal and opposite forces are acting on a moving body, the motion of the body is not affected, it remains unchanged. It is because the net force acting on the object is zero.

17. An aero plane is moving uniformly at a constant height under the action of two forces (i) upward force (lift) and (ii) downward force (weight). What is the net force on the aero plane.

Solution:

The net force acting on the aero plane is zero as it is acted upon by two opposing forces and hence remains unchanged.

18. Why does a person fall when he jumps out from a moving train?

Solution:

It is because inside the train, his whole body was in a state of motion with the train. On jumping out of the moving train, as soon as his feet touch the ground, the lower part of his body comes to rest, while the upper part still remains in motion due to inertia of motion.

19. Why does a coin placed on a card, drop into the tumbler when the card is rapidly flicked with the finger?

Solution:

A momentary force acts on the card when it is flicked with fingers which causes it to move away. But the coin placed on it is not does not share the motion at once and continues to stay at rest which is attributed to inertia of rest. Eventually, the coin falls down into the tumbler due to the gravitational pull.

20. Why does a ball thrown vertically upwards in a moving train, come back to the thrower's hand?

Solution:

Inside the train, the ball and the person both are in motion. Due to inertia of motion, as long as the ball stays in air, both the person and the ball move in the same direction which causes the ball to fall back to the thrower's hand.

21. Explain the following:

(a) When a train suddenly moves forward, the passenger standing in the compartment tends to fall backwards.

(b) When a corridor train suddenly starts, the sliding doors of some compartments may open.
(c) People often shake branches of a tree for getting down its fruits.
(d) After alighting from a moving bus, one has to run for some distance in the direction of bus in order to avoid falling.
(e) Dust particles are removed from a carpet by beating it.
(f) It is advantageous to run before taking a long jump.

Solution:

(a) It is because the lower part of the passenger's body is in close contact with the train. When the train starts moving, the lower part shares the motion at once, but the upper part cannot share the motion at the same time due to inertia of rest and hence remains at the same place.
(b) It is because the frame of sliding door is in contact with the floor of the train also comes in motion when the train starts but due to inertia, the sliding door remains in its position.
(c) It is because when the branches are shaken they are in motion but the fruits remain in the state of rest due to inertia. Hence the fruits that are weakly attached to the branches, detach and fall due to the pull of gravity.
(d) It is because if they were to halt at once, their feet would suddenly come to rest but their upper body would still continue to stay in its state of motion and hence they tend to fall forward.
(e) The section of the carpet which comes in contact with the carpet comes in motion at once, but the dust particles present on it, due to inertia of rest, stay in the state of rest. Consequently, the section of the carpet moves along the stick leaving dust particles behind which tend to fall down to the pull of gravity.
(f) It is advantageous to run before taking a long jump as the athlete sets his body in the state of motion hence it becomes easier to take the jump.

Multiple Choice Type:

1. **The property of inertia is more in:**
   (a) A car
   (b) A truck
   (c) A horse cart
   (d) A toy car

   Solution:

   (b) A truck

   The property of inertia is directly proportional to the mass of the object.

2. **A tennis ball and a cricket ball, both are stationary. To start motion in them:**
   (a) A less force is required for the cricket ball than for the tennis ball
   (b) A less force is required for the tennis ball than for the cricket ball
   (c) Same force is required for both the balls
   (d) Nothing can be said

   Solution:

   (b) A less force is required for the tennis ball than for the cricket ball

   Cricket ball is more massive than tennis ball hence cricket ball acquires much smaller velocity

than a tennis ball when the two balls are pushed with equal force for the same duration.

3. **A force is needed to:**
   (a) Change the state of motion or state of rest of the body
   (b) Keep the body in motion
   (c) Keep the body stationary
   (d) Keep the velocity of body constant

   Solution:

   (a) Change the state of motion or state of rest of the body

   A body cannot change its state itself until acted upon by an external force.