

NTSE

NCERT Solutions for Class 9 Science
PHYSICS – Force and Laws of Motion



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NCERT ANNEXURE

Below are the questions and their solutions as per NCERT Annexure.

Q.1. Which of the following has more inertia: (a) a rubber ball and a stone of the same size? (b) a bicycle and a train? (c) a five rupees coin and a one-rupee coin?

Ans.: Inertia is the measure of the mass of the body. The greater is the mass of the body; the greater is its inertia and vice-versa.

(a) Mass of a stone is more than the mass of a rubber ball of the same size. Hence, the inertia of the stone is greater than that of a rubber ball.

(b) Mass of a train is more than the mass of a bicycle. Hence, the inertia of the train is greater than that of the bicycle.

(c) Mass of a five rupee coin is more than that of a one-rupee coin. Hence, inertia of the five rupee coin is greater than that of the one-rupee coin.

Q.2. Explain why some of the leaves may get detached from a tree if we vigorously shake its branch.

Ans.: Some leaves of a tree get detached when we shake its branches vigorously. This is because when the branches of a tree are shaken, it moves to and fro, but its leaves tend to remain at rest. This is because the inertia of the leaves tend to resist the to and fro motion. Due to this reason, the leaves fall down from the tree when shaken vigorously.

Q.3. Why do you fall in the forward direction when a moving bus brakes to a stop and fall backwards when it accelerates from rest?

Ans.: Due to the inertia of the passenger. Every object tries to maintain its state of motion or state of rest. If a body is at rest, then it tries to remain at rest. If a body is moving, then it tries to remain in motion. In a moving bus, a passenger moves with the bus. As the driver applies brakes, the bus comes to rest. But, the passenger tries to maintain his state of motion. As a result, a forward force is exerted on him. Similarly, the passenger tends to fall backwards when the bus accelerates from rest. This is because when the bus accelerates, the inertia of the passenger tends to oppose the forward motion of the bus. Hence, the passenger tends to fall backwards when the bus accelerates forward.

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Q.4. From a rifle of mass 4 kg, a bullet of mass 50 g is fired with an initial velocity of 35 m s⁻¹. Calculate the initial recoil velocity of the rifle.

Ans.: Mass of the rifle, $m_1 = 4$ kg

Mass of the bullet, $m_2 = 50$ g

Recoil velocity of the rifle = v_1

Bullet is fired with an initial velocity $v_2 = 35$ m/s

Initially, the rifle is at rest.

Thus, its initial velocity, $v = 0$

Total initial momentum of the rifle and bullet system $(m_1 + m_2) v = 0$.

Total momentum of the rifle and bullet system after firing:

$$\text{P } m_1 v_1 + m_2 v_2 = 4v_1 + 0.005 \times 35$$

$$\text{P } 4v_1 + 1.75 = 0$$

According to the law of conservation of momentum:

Total momentum after the firing = Total momentum before the firing

$$4v_1 + 1.75 = 0$$

$$v_1 = -1.75/4 = -0.4375 \text{ m/s}$$

The negative sign indicates that the rifle recoils backwards with a velocity of 0.4375 m/s.

Q.5 Two objects of masses 100 g and 200 g are moving along the same line and direction with velocities of 2 m s⁻¹ and 1 m s⁻¹, respectively.

They collide and after the collision, the first object moves at a velocity of 1.67 m s⁻¹. Determine the velocity of the second object.

Ans.: Mass of one of the objects, $m_1 = 100$ g = 0.1 kg, Mass of the other object, $m_2 = 200$ g = 0.2 kg. Velocity of m_1 before collision, $v_1 = 2$ m/s Velocity of m_2 before collision, $v_2 = 1$ m/s Velocity of m_1 after collision, $v_3 = 1.67$ m/s. Velocity of m_2 after collision = v_4

According to the law of conservation of momentum:

Total momentum before collision = Total momentum after collision

Therefore, $m_1 v_1 + m_2 v_2 = m_3 v_3 + m_4 v_4$

$$(0.1) \times 2 + (0.2) \times 1 = (0.1) \times 1.67 + (0.2) v_4$$

$$0.4 = 0.167 + 0.2 v_4$$

Therefore $v_4 = 1.165$ m/s

Hence, the velocity of the second object becomes 1.165 m/s after the collision.

**Success
STORY**

I still wonder how one man has such a deep understanding of an examination. It becomes the truth what ever Vipin Sir says about NTSE.

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NCERT EXEMPLAR

Below are few objective type questions and their answers as per NCERT Exemplar.

1. Which of the following statements is *not* correct for an object moving along a straight path in an accelerated motion?

- (A) Its speed keeps changing (B) Its velocity always changes
(C) It always goes away from the earth (D) A force is always acting on it

Ans. (C)

2. According to the third law of motion, action and reaction

- (A) always act on the same body
(B) always act on different bodies in opposite directions
(C) have same magnitude and directions
(D) act on either body at normal to each other

Ans. (B)

3. A goalkeeper in a game of football pulls his hands backwards after holding the ball shot at the goal. This enables the goal keeper to

- (A) exert larger force on the ball
(B) reduce the force exerted by the ball on hands
(C) increase the rate of change of momentum
(D) decrease the rate of change of momentum

Ans. (B, D)

4. The inertia of an object tends to cause the object

- (A) to increase its speed (B) to decrease its speed
(C) to resist any change in its state of motion (D) to decelerate due to friction

Ans. (C)

5. A passenger in a moving train tosses a coin which falls behind him. It means that motion of the train is

- (A) accelerated (B) uniform (C) retarded (D) along circular tracks

Ans. (A)

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