FORCE AND LAWS OF MOTION

NCERT (CBSE) TEXTBOOK IN-TEXT QUESTIONS SOLVED

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 rupee coin and a one rupee coin.

Ans: (a) stone (b) train (c) five rupee coin.

Q.2: *In the following example, try to identify the number of times the velocity of ball changes:*

"A football player kicks a football to another player of his team who kicks the football towards the goal. The goalkeeper of the opposite team collects the football and kicks it towards a player of his own team."

Also identify the agent supplying the force in each case.

Ans: The velocity of the ball changes three times.

First time, the velocity changes when the football player of one team kicks the ball.
Second time the velocity changes when another player of the same team kicks the football.
Third time the velocity changes when the goalkeeper of the opposite team kicks the football.

The agent supplying the force in each case, have been underlined.

Q.3: *Explain why some of the leaves may get detached from a tree if we vigorously shake its branch.*

Ans:

Before shaking the branches the leaves are at rest. When the branches are shaken, they come in motion at once while the leaves tend to remain at rest due to inertia of rest. As a result leaves get detached from the branches and fall down.

Q.4: *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:

When a moving bus brakes to a stop, the lower part of our body in contact with bus comes to rest while the upper part of our body tends to keep moving due to inertia of motion. Hence we fall forwards. When the bus accelerates from rest, the lower part of our body comes into motion along with the bus while the upper part of body tends to remain at rest due to inertia of motion and as a result which we fall backwards.

Q.5: *If action is always equal to reaction, explain how a horse can pull cart.*

Ans:

The horse pulls the cart with a force (action) in the forward direction. Since every action has an equal and opposite reaction so, the cart also pulls the horse with an equal force (reaction) in the backward direction. As a result of which the two forces get balanced.

But while pulling the cart the horse also pushes the ground with its feet in the backward direction. The reaction of the earth of the earth makes it forward direction along with the cart. This is how the horse applies force and pulls the cart.

Q.7: *Explain why it is difficult for a fireman to hold a hose, which ejects large amount of water at a high velocity.*

Ans:

Water is ejected with a large forward force (action). As we know by Newton's third law of motion that every action has an equal and opposite reaction so, because of this action fireman experiences a large backward force or reaction. That is why he feels difficulty in holding the hose.

Q.9: From a rifle of mass 4 kg a bullet of mass 50 gm is fired with an initial velocity of 35 ms^{-1}. Calculate the initial recoil velocity of the rifle.

Ans:

Mass of bullet, m_1 = 50 gm = 0.05 kg.
Mass of rifle, m_2 = 4 kg.
Initial velocity of bullet, u_1 = 0
Initial velocity of rifle, u_2 = 0
Final velocity of bullet, v_1 = 35 ms^{-1}
Final velocity of rifle, v_2 =?

According to the law of conservation of momentum,

Total momentum after firing		=	Total momentum before firing,
Or,	$m_1v_1 + m_2v_2$	=	$m_1u_1 + m_2u_2$
Or,	$0.05 \times 35 + 4v_2$	=	$0 + 0$
Or,	v_2	=	$-0.44\ ms^{-1}$

The negative sign indicates the direction of recoil (backward).

Q.10: Two objects of masses of 100 gm and 200 gm are moving in along the same line and direction with velocities of 2 ms^{-1} and 1 ms^{-1} respectively. They collide and after collision, the first object moves at a velocity of 1.67 ms^{-1}. Determine the velocity of the second object.

Ans:

m_1 = 100 gm = 0.1 kg,
m_2 = 200 gm = 0.2 kg,
u_1 = 2 ms^{-1},
u_2 = 1 ms^{-1},
v_1 = 1.67 ms^{-1},
v_2 =?

By the law of conservation of momentum,

	$m_1v_1 + m_2v_2$	=	$m_1u_1 + m_2u_2$
Or,	$0.1 \times 1.67 + 0.2\ v_2$	=	$0.1 \times 2 + 0.23 \times 1$
Or,	v_2	=	$1.165\ ms^{-1}$.

It will move in the same direction after collision.