

SSC
Subject: Physics
Chapter: 3 (Force)
Concept

Force: Force is an external influence capable of changing a body's state of rest or motion.

Fundamental Force: A fundamental force is a known physical interaction in our universe that can't be broken down into any further basic processes.

Type of Fundamental Forces: There are four fundamental forces. These are:

1. Gravitational Force
2. Electromagnetic Force
3. Strong Nuclear Force
4. Weak Nuclear Force

Newton's First Law: Every object will continue in its state of rest or uniform motion in a straight line unless an external force is applied to it.

Newton's 2nd Law: The rate of change of momentum of a body is proportional to the applied force acting on it and takes place in the direction in which the force acts.

Newton's 3rd Law: To every action, there is an equal and opposite reaction.

Inertia: The tendency of a body to maintain its own state forever in which the body is at present or the property of a body to preserve that state is defined as inertia.

The conservation law of momentum: If no external force is applied on two or more bodies except their action and reaction force then the sum of the momentum of the bodies remains the same.

Momentum: The product of mass and velocity is called momentum of any object.

Impulse of force: The product of applied force and time is called impulse of force.

Formulas

$$1. F = \frac{mv - mu}{t} = ma$$

$$2. W = mg$$

$$3. m_1u_1 + m_2u_2 = m_1v_2 + m_2v_2$$

$$4. \frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$$

$$5. F = G \frac{m_1m_2}{d^2}$$

$$6. g = \frac{GM}{R^2}$$

Mathematical Problems

1. Two objects of masses of 8 kg and 4 kg were moving along the same straight line. Their velocity was 15 ms⁻¹ and 10 ms⁻¹ respectively. At a moment the first object pushed the second object. As a result, the velocity of the first object was 10 ms⁻¹.

[BB'19]

a) Find the impulse of the first object.

b) Will the kinetic energy be conserved in the case of two objects? Give your opinion with mathematical logic.

2. A cricket ball is thrown vertically upward by Mukul with an initial velocity of 20 ms⁻¹. At the same time, Nishan tried to catch the ball coming with a uniform velocity of 6 ms⁻¹ from 30m away.

a) Find out the maximum height of the ball.

b) Is it possible for Nishan to catch the ball before dropped on Earth? Give your opinion with a mathematical analysis.

3. Due to applying force upon a toy car of weight 3.92 N, it starts to move with an acceleration of 0.5 ms^{-2} on the floor where frictional force is 0.5 N.

[Din B'19]

a) Calculate the force acting upon the car.

b) Will you get any change in acceleration due to frictional and frictionless floor? Evaluate mathematically.

4. A boy threw a stone with a velocity of 12 ms^{-1} in order to free a mango of mass 0.25 kg from its but at a height 10m from the ground.

a) Calculate the potential energy of the mango at the hanging position.

b) Is it possible for the boy to free the mango from its but? Give your opinion on mathematical logic.

5. 50N force is applied on an object of 10 kg which was on a table of 1N friction. The force was applied for 10s.

i) What will be the change of momentum?

ii) How much distance will go the object before it stops?