14.07.21 Ch-9 Force and Laws of Motion

Home Assignment

1) Two objects of Masses 100g and 200g are moving along the same line and direction with velocities of 2 m/s and 1 m/s respectively. They collide and after the collision the first moves at a velocity of 1.67 m/s. Determine the velocity of the second object.

Ans) Given,
Mass of one of the objects (m_1) = 100g = 0.1kg
Mass of the other object (m_2) = 200g = 0.2kg
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

Find out → Velocity of m_2 after collision (v_4)

Solution,
According to the law of conservation of momentum.
Total momentum before collision = Total momentum after collision.

Therefore,
$m_1 v_1 + m_2 v_2 = m_1 v_3 + m_2 v_4$
Substituting the given values,
$2(0.1) + 1(0.2) = 1.67(0.1) + v_4 \times (0.2)$
$0.4 = 0.167 + 0.2 \times v_4$
$\therefore v_4 = 1.165$ m/s

2) From a rifle of mass 4kg, a bullet of mass 50 g is fired with an ~~actual~~ initial velocity of 35 m/s. Calculate the intial recoil velocity of the rifle.

Ans, Given,

Mass of the rifle $(M_1) = 4kg$

Mass of the bullet $(M_2) = 50kg = 0.05Kg$

Recoil velocity of the rifle $= V_1$

A bullet is fired with an intial velocity $(V_2) = 35m/s$

Find out :-

The intial recoil velocity of the rifle.

Solution :- Intial, the rifle is at rest.

Thus, its intial velocity $(V) = 0$

The total intial momentum of the rifle and bullet System.

$\Rightarrow (m_1 + m_2) \times V = 0$

The total momentum of the rifle and bullet System after firing.

$= m_1 V_1 + m_2 + V_2$

$= (4 \times V_1) + (0.05 \times 25) = 4v_1 + 1.75$

According to the law of conservation of momentum Total momentum after the firing = Total momentum before the firing.

$4v_1 + 1.75 = 0, \Rightarrow V_1 = -1.75/4, \Rightarrow V_1 = -0.4375 m/s.$

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