

2) Two billiard balls roll towards each other. They each have a mass of 300g. Ball 1 is moving at 1 m/s to the right and Ball 2 is moving at 0.8 m/s to the left. Calculate the total momentum of the system

$$m_1 v_1 + m_2 v_2 = \vec{p} \text{ of total system}$$

$$m_1 = 0.3 \text{ kg}$$

$$m_2 = 0.3 \text{ kg}$$

$$v_1 = 1 \text{ m/s}$$

$$v_2 = -0.8 \text{ m/s}$$

$$(0.3 \text{ kg} \cdot \text{m/s}) + (-0.24 \text{ kg} \cdot \text{m/s})$$

$$\vec{p}_{\text{total}} = 0.06 \text{ kg} \cdot \text{m/s}$$

3) A rubber ball of mass 800g is dropped and strikes the floor at a velocity of 6 m/s. It bounces back with an initial velocity of 4 m/s. Calculate the change in momentum of the rubber ball caused by the floor.

$$p_1 = m_1 v_1$$

$$p_2 = m_2 v_2$$

$$= (0.8 \text{ kg})(6.0 \text{ m/s})$$

$$= (0.8 \text{ kg})(4.0 \text{ m/s})$$

$$p_1 = 4.8 \text{ kg} \cdot \text{m/s}$$

$$= 3.2 \text{ kg} \cdot \text{m/s}$$

therefore momentum

is NOT conserved

which we know from
bouncing a ball...

Energy is lost to heat,
friction & air resistance

NOT A CLOSED
System

Physics 11 - Practice Questions

Unit: 5.3 Momentum - Conservation



1. A 1.5×10^3 kg car travelling at 44 m/s collides head-on with a 1.0×10^3 kg car travelling at 22 m/s in the opposite direction. If the cars stick together on impact, what is the velocity of the wreckage immediately after impacts? (Hint: let the velocity of the second car be -22 m/s since it is moving in a direction opposite to the first car.)

$$m_1 v_1 + m_2 v_2 = m_3 v_3$$

$$m_1 = 1.5 \times 10^3 \text{ kg} \quad v_1 = 44 \text{ m/s}$$

$$m_2 = 1.0 \times 10^3 \text{ kg} \quad v_2 = -22 \text{ m/s}$$

$$m_3 = 2.5 \times 10^3 \text{ kg}$$

$$m_1 v_1 + m_2 v_2 = p_3$$

$$66 - 22 = p_3$$

$$44 \times 10^3 \text{ kg} \cdot \text{m/s} = m_3 v_3$$

$$44 \times 10^3 \text{ kg} \cdot \text{m/s} = (2.5 \times 10^3 \text{ kg}) v_3$$

$$v_3 = 18 \times 10^3 \text{ m/s}$$

4) A 53 kg skateboarder on a 2.0 kg skateboard is coasting along at 1.6 m/s. He collides with a stationary skateboarder of a mass 43 kg, also on a 2.0 kg skateboard, and the two skateboarders coast off in the same direction that the first skateboarder was travelling. What velocity will the combined skateboarders now have?

$$m_1 v_1 + m_2 v_2 = m_3 v_3$$

$$m_1 = 53 \text{ kg} + 2 \text{ kg} = 55 \text{ kg}$$

$$v_2 = 1.6 \text{ m/s}$$

$$m_3 = 55 \text{ kg} + 43 \text{ kg} + 2 \text{ kg} = 100 \text{ kg}$$

$$v_3 = ?$$

$$(55 \text{ kg})(1.6 \text{ m/s}) = (100 \text{ kg})(v_3)$$

$$88 \text{ kg} \cdot \text{m/s} = 100 \text{ kg}(v_3)$$

$$\div 100 \text{ kg} = 100 \text{ kg}$$

$$v_3 = 0.88 \text{ m/s}$$