

Answer on Question #77086, Physics, Mechanics, Relativity

An elastic collision occurs in one dimension, in which a 10 kg block traveling at 5 m/s collides with a 5 kg block traveling at 3 m/s in the same direction.

What are the velocities of the two blocks immediately after the collision?

Solution

From the law of conservation of momentum

$$m_1 \cdot v_{1i} + m_2 \cdot v_{2i} = m_1 \cdot v_1 + m_2 \cdot v_2$$

where v_{1i} - velocities before collision are $v_{1i}=5$ m/s Particles of $m_1=10$ kg

v_{2i} - velocities before collision are $v_{2i}=3$ m/s Particles of $m_2=5$ kg

v_1 - velocities after collision Particles of $m_1=10$ kg

v_2 - velocities after collision Particles of $m_2=5$ kg

Energy conservation law

$$\frac{m_1 \cdot v_{1i}^2}{2} + \frac{m_2 \cdot v_{2i}^2}{2} = \frac{m_1 \cdot v_1^2}{2} + \frac{m_2 \cdot v_2^2}{2}$$

From here

$$v_1 = \frac{v_{1i} \cdot (m_1 - m_2)}{m_1 + m_2} + \frac{v_{2i} \cdot 2 \cdot m_2}{m_1 + m_2} = \frac{5 \cdot (10 - 5)}{10 + 5} + \frac{3 \cdot 2 \cdot 5}{10 + 5} = 3.66 \frac{m}{s}$$

$$v_2 = \frac{v_{1i} \cdot 2 \cdot m_1}{m_1 + m_2} + \frac{v_{2i} \cdot (m_2 - m_1)}{m_1 + m_2} = \frac{5 \cdot 2 \cdot 10}{10 + 5} + \frac{3 \cdot (5 - 10)}{10 + 5} = 5.66 \frac{m}{s}$$

Answer: $v_1 = 3.66 \frac{m}{s}$, $v_2 = 5.66 \frac{m}{s}$

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