Answer on Question 65625, Physics, Mechanics | Relativity

Question:

A toy train of mass 3.0 kg is raveling at 1.5 ms^{-1} to the right. The train collides with a similar train and the trains lock together. What was the velocity of the two trains together?

Solution:

We can find the final velocity of the two trains after collision from the law of conservation of momentum:

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f,$$

here, m_1, m_2 are the masses of two toy trains; v_{1i},v_{2i} are the initial velocities of the first and second trains (since we don't know the velocity and direction of the motion of the second train from the condition of the question, we assume that at the moment of collision the second train is at rest); v_f is the final velocity of the two trains after collision when it lock together.

From this equation we can find the final velocity of the two trains:

$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{(m_1 + m_2)} = \frac{3\ kg \cdot 1.5\ \frac{m}{s} + 3\ kg \cdot 0\ \frac{m}{s}}{(3\ kg + 3\ kg)} = 0.75\ \frac{m}{s}.$$

Answer:

$v_f = 0.75\ \frac{m}{s}$.