Momentum

A 0.5-kg toy truck moving at a velocity of 0.5 m/s collides head-on with a 0.75-kg toy truck that is at rest. The trucks become entangled and lock together. What is the velocity of the two toy trucks after the collision?

1. Read and Understand

What information are you given?

\[
m_{\text{toy 1}} = 0.5 \text{ kg} \\
\vec{v}_{\text{toy 1}} = 0.5 \text{ m/s} \\
m_{\text{toy 2}} = 0.75 \text{ kg} \\
\vec{v}_{\text{toy 2}} = 0 \text{ m/s}
\]

2. Plan and Solve

What unknown are you trying to calculate?

\[ \vec{v}_{\text{after}} = ? \]

What formula contains the given quantities and the unknown?

\[
(\text{net } m\vec{v})_{\text{before}} = (\text{net } m\vec{v})_{\text{after}}
\]

Replace each variable with its known value.

\[
(0.5 \text{ kg})(0.5 \text{ m/s}) + (0.75 \text{ kg})(0 \text{ m/s}) = (0.5 \text{ kg} + 0.75 \text{ kg})(\vec{v}_{\text{after}})
\]

\[
0.25 \text{ kg} \cdot \text{m/s} = (1.25 \text{ kg})(\vec{v}_{\text{after}})
\]

\[ \vec{v}_{\text{after}} = 0.2 \text{ m/s} \]

3. Look back and check

Is your answer reasonable?

Yes, the number calculated is the quotient of distance and speed, and the units indicate a velocity.

Math Practice

On a separate sheet of paper, solve the following problems.

1. A 0.25-kg ball rolling at 1.0 m/s rolls and overtakes a 0.3-kg ball rolling in the same direction at 0.5 m/s. The balls stick together on impact. What is the velocity of the two balls after the collision?

2. A 5.0-kg puppy running at 2.0 m/s picks up a 1.0-kg stick that is sitting on the ground. What is the momentum of the puppy and the stick after the puppy picks up the stick?