

21-P-MOM-AG-043

A m_1 kg person jumps off rail cart A at $V_1 \frac{m}{s}$, measured relative to the cart. Then, he lands just at the closest edge of cart B. Both carts are originally at rest. If cart B begins moving at $V_2 \frac{m}{s}$ when the person lands on it, how much does the car weigh? Assuming the carts are identical, how fast was cart A moving the instant the person jumped off?

ANSWER:

First, we write the equation for conservation of momentum for the person and cart B. Then, we rearrange to solve for m_B .

$$0 + m_{person}v_{person,1} = (m_B + m_{person})v_{B,2}$$

$$m_1V_1\left(\frac{12}{13}\right) = (m_B + m_1)V_2$$

$$m_B = \frac{12m_1V_1}{13V_2} - m_1$$

Now, to find the speed of cart A, we write the equation for conservation of momentum again, and rearrange to solve for V_A .

$$0 = m_{person}v_{person,1} - m_Av_{A,1}$$

$$m_1V_1\left(\frac{12}{13}\right) = m_BV_A$$

$$V_A = \frac{12m_1V_1}{13m_B}$$