Example 1

G:

$$M_a = M_B = 1000\text{kg}$$

R:

$$V'$$

E:

$$V' = \frac{M_a V_a + M_b V_b}{M_a + M_b}$$

S:

$$\frac{(10000\text{kg})(24.0\frac{m}{s}) + 0}{10000\text{kg} + 10000\text{kg}}$$

A:

$$12.0\frac{m}{s}$$

Elastic Collision

An elastic collision between two objects is one in which total KE as well as total momentum of the system is the same before and after the collision. Momentum: $m_A v_a + mBVb = mAV'_a + mBV'$ Kinetic Energy: Relative Velocity (head-on collision): V'_B

Example

Calculate the velocities of two objects following an elastic collision, given that: $m_A = 0.500\text{kg}$, $m_B = 3.50\text{kg}$, $V_A = 4.00\text{m/s}$, and $V_B = 0.00\text{m/s}$ Note that A is going to hit B Required V'_A and V'_B Equation 1: Momentum: $m_A v_A + mBVb = mAV'_a + mBV'$ Solution 1:

$$M_A V_A = M_A V'_A + M_B V'_B$$

$$(0.500\text{kg})(4.00\text{m/s}) = (0.500\text{kg})V'_A + (3.50\text{kg})V'_B$$

$$2.00\text{m/s} = (0.500)V'_A + (3.5)V'_B$$

Equation 2: Relative Velocity: $V'_B + V'_A = -(V_B - V_A)$ Solution 2:

$$V'_B + V'_A = -(0 - 4.00\text{m/s})$$

$$V'_B + V'_A = 4.00\text{m/s}$$

$$4.00\text{m/s} = V'_B + V'_A$$

Add:

$$2.00\text{m/s} = (0.500)V'A + (3.50)V'_B$$

$$(4.00\text{m/s} = V'_B + V'_A)0.500$$

Equals:

$$4.00\text{m/s} = 0 + (4.00)V'_B$$

Divide by 4:

$$V'_B = 1.00\text{m/s}$$

Find V'_A

$$4.00\text{m/s} = V'_B + V'_A$$
$$V'_A = V'_B - 4.00\text{m/s}$$
$$= 1.00\text{m/s} - 4.00\text{m/s}$$
$$V'_A = -3.00\text{m/s}$$