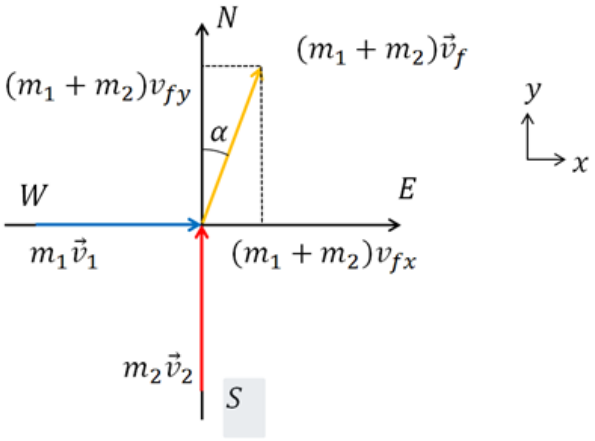
Answer on Question #72188, Physics / Molecular Physics | Thermodynamics

Question. At the intersection of the Figure below, a yellow subcompact car with mass $950\ kg$ traveling east collides with a red pickup truck with mass $1900\ kg$ that traveling north and ran a red light. The two vehicles stick together as a result of the collision, and the wreckage slides at $16.0\ m/s$ in the direction $24.0°$ east of north y (north). Calculate the speed of each vehicle before the collision. The collision occurs during a heavy rainstorm; you can ignore friction.

Given. $\alpha = 24.0°; v_f = 16.0\ m/s; m_1 = 950\ kg; m_2 = 1900\ kg.$

Find. $v_1, v_2 - ?.$

Solution.



According to the Law of Momentum Conservation, we have

$$m_1\vec{v}_1 + m_1\vec{v}_1 = (m_1 + m_2)\vec{v}_f$$

in projections on the axis

$$X: m_1v_1 = (m_1 + m_2)v_{fx} = (m_1 + m_2)v_f \sin\alpha$$

$$Y: m_2v_2 = (m_1 + m_2)v_{fy} = (m_1 + m_2)v_f \cos\alpha$$

Hence

$$v_1 = \frac{(m_1 + m_2)v_f \sin\alpha}{m_1} = \frac{(950 + 1900)\cdot 16 \cdot \sin 24°}{950} = 19.5\ m/s$$

$$v_2 = \frac{(m_1 + m_2)v_f \cos\alpha}{m_2} = \frac{(950 + 1900)\cdot 16 \cdot \cos 24°}{1900} = 21.9\ m/s$$

Answer. $v_1 = 19.5\ m/s; v_2 = 21.9\ m/s.$