Phys. 101 - Sec # 3 **(Ch. 9 & 10)**

Name: Key ID # SN#

A cart with mass of 340 g moving on a frictionless linear air track at an initial speed of 1.2 m/s undergoes an **elastic** collision with an initially stationary cart of unknown mass. After collision, the first cart continues in its original direction at 0.66 m/s.

a) What is the mass of the second cart, and b) what is its speed after collision.

$\vec{P}_i = \vec{P}_f$

$(0.34)(1.2)\hat{i} = m_2 \vec{v}_{2f} + 0.34(0.66)\hat{i}$

$m_2 v_2 = 0.34(1.2)\hat{i} - 0.34(0.66)\hat{i}$

$\boxed{m_2 \vec{v}_2 = 0.1836\,\hat{i}}$ (1)

$K_i = K_f$

$\frac{1}{2}(0.34)(1.2)^2 = \frac{1}{2} m_2 v_{2f}^2 + \frac{1}{2} 0.34 (0.66)^2$

$\Rightarrow \boxed{m_2 v_2^2 = 0.3415}$ (2) Solving (1) $\Rightarrow$ (2) we get:

$m_2 = 0.099$ kg

$v_{2f} = (1.86\ \frac{m}{s})\,\hat{i}$

c) What is the speed of the center of mass **before** and **after** collision? it is the same

$(v_{com})_i = \frac{(P_{tot})_i}{M_{tot}} = \frac{m_1 v_{1i} + m_2 v_{2i}}{m_1 + m_2} = \frac{(0.34)(1.2) + 0}{0.34 + 0.099}$

$= \frac{0.408}{0.439} = \boxed{0.929\ \frac{m}{s}} = (v_{com})_f$