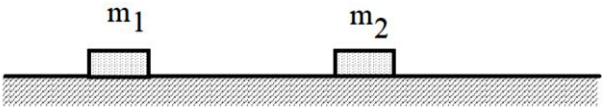
Physics 2125 Experiment 8 Pre-Laboratory Assignment

Name_____ Instructor name _____

You must show and explain all work neat and organized to receive credit. Please show each step for calculations. YOU MUST TURN IN THIS SHEET to have your assignment graded.



1. Consider two masses, m_1 and m_2, on a surface where friction is negligible. Assume that m_2 is initially at rest and that mass m_1, having a velocity $\boldsymbol{v} = v_{1i}\,\boldsymbol{i}$, collides with it. When the collision occurs, m_1 exerts a force $F_{1on2}\,\boldsymbol{i}$ on m_2. What is the force that m_2 exerts on m_1? For this specific problem, show that $m_1 v_{1i} = m_1 v_{1f} + m_2 v_{2f}$, where v_{1f} and v_{2f} are the final velocities of m_1 and m_2, respectively, after the collision. (7 pts)

2. (8 pts) (a) If the momentum $\boldsymbol{p}$ is defined as $\boldsymbol{p} = m\boldsymbol{v}$, show that Newton's second law of motion may be written as $\boldsymbol{F} = d\boldsymbol{p}/dt$ so long as m is a constant. (b) Using the results in part (a) show that the change in momentum of m_2 is given by

$$\Delta \boldsymbol{p}2 = \int \boldsymbol{F}_{1on2}\, dt.$$

This integral of force with respect to time is called the impulse and is equal to the change in momentum of the mass. (c) Using Newton's third law and the previous results show that

$$\Delta \boldsymbol{p_1} + \Delta \boldsymbol{p_2} = 0 \; or \; \Delta(\boldsymbol{p_1} + \boldsymbol{p_2}) = 0.$$

State using words what this mathematical expression means. Please show detailed calculations.

3. For a completely inelastic collision, the fractional change in kinetic energy can be found as a function of the masses of the projectile and target carts only. (a) Show in detail that the fractional change in kinetic energy is given by $\frac{\Delta(KE)}{KE_i} = \frac{(KE_f - KE_i)}{KE_i} = -\frac{M}{(m+M)}$. (b) What is the significance of the negative value for the fractional change in kinetic energy? (5 pts)