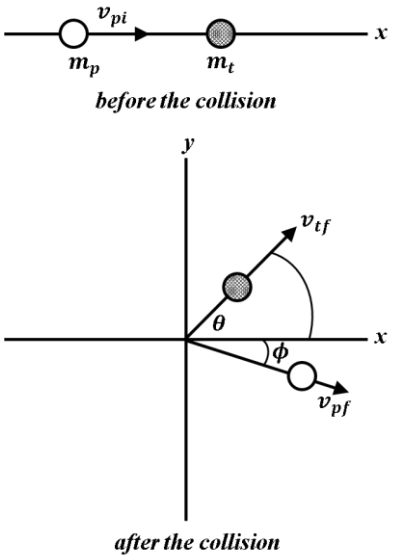
Physics 2125 Experiment 6 Pre-Laboratory Assignment

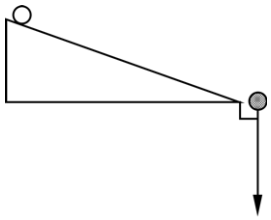
Name_____ Instructor name _____

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_p and m_t, on a surface where friction is negligible. Assume that m_t is initially at rest and that mass m_p, having a velocity $\boldsymbol{v} = v_{pi}\,\boldsymbol{i}$, collides with it. The diagram to the right shows the arrangement. After the collision, m_t (the target) and m_p (the projectile), travel at angles θ and ϕ, respectively. Write the expression for conservation of momentum in the $x-$ and $y-directions$. (8 pts)



2. One way of doing experiments involving collisions in two dimensions is to use an air hockey table. The air cushion between the hockey pucks and table minimizes friction and conservation of momentum apply; *i.e.*, no horizontal force acts during the collision. A second method is to collide the objects above the floor and allow each object to be a projectile. With air resistance neglected, no horizontal force acts on the objects during freefall. Each object falls to the floor under the vertical force of gravity. If the collision occurs a height H above the floor, show that the time t for each object to hit the floor is $t = \sqrt{\frac{2H}{g}}$. Where g is the acceleration due to gravity. The experimental apparatus is shown in the figure. (7 pts)



3. If the target ball is not present, show that the initial momentum of the projectile p_0 is given by $p_0 = m_p\left(\frac{R_0}{t}\right)$, where R_0 is the range of the projectile when no collision occurs. The important point to note here is that the range of the projectile is directly proportional to the projectile's momentum. As you will see in the experiment, similar expressions hold for the projectile and target ranges after the collision. (5 pts)