Physics 8.01 TEAL   **Fall Term 2004**

In-Class Problems 27-29: Momentum and Collisions

Section_____Table and Group Number _____

Names _____

        _____

        _____

Hand in one solution per group.

Problem 27: Elastic One Dimensional Collision

Consider the elastic collision of two carts along a track; the incident cart 1 has mass m_1 and moves with initial velocity $v_{1,0}$. The target cart has mass $m_2 = 2m_1$ and is initially at rest $v_{2,0} = 0$. Immediately after the collision, the target cart has final speed $v_{1,f}$ and the target cart has final speed $v_{2,f}$. Calculate the final velocities of the carts as a function of the initial velocity $v_{1,0}$.

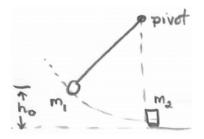**Problem 28:** *(Conservation of Momentum)*

Two people, each with mass m , stand on a railway flatcar of mass m_c. They jump off one end of the flatcar with velocity of magnitude u relative to the car. The car rolls in the opposite direction without friction.

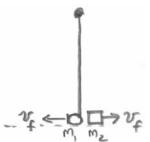a) What is the final velocity of the car if the two people jump at the same time?

b) What is the final velocity of the car if the two people jump off one at a time?

c) In which of the two above cases, does the railcar have the greatest final velocity?

Problem 29: *Pendulums and Collisions*

A simple pendulum consists of a bob of mass m_1 that is suspended by a massless string. The bob is pulled out and released from a height h_0 as measured from the bottom of the swing and swings downward in a circular orbit. At the bottom of the swing, the bob collides with a block of mass m_2 that is initially at rest on a frictionless table. Assume the pivot point is frictionless.

a) What is the velocity of the bob immediately before the collision at the bottom of the swing?

b) Assume the collision is perfectly elastic. The block moves along the table and the bob moves in the opposite direction but with the same speed as the block. What is the mass, m_2, of the block?

c) Suppose the collision is completely inelastic due to some putty that is placed on the block. What is the velocity of the combined system immediately after the collision? (Assume that the putty is massless.)

d) After the completely inelastic collision, the bob and block continue in circular motion. What is the maximum height, h_f, that the combined system rises after the collision?