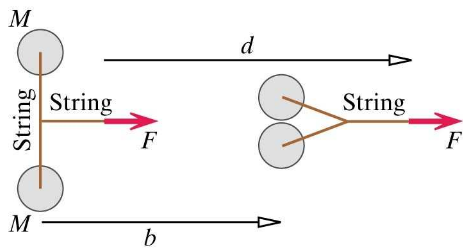
Physics 172 – Recitation 09

Spring 2012

Problem 1. Two disks are initially at rest, each of mass *M*, connected by a light string between their centers as shown below.



The disks slide on low-friction ice as you pull straight ahead on a second string attached to the center of the first one. You exert a constant force $\vec{F}$ on the end of the second string. As you do this, the disks move in the direction you are pulling. They also move toward each other, collide and stick together. When the disks have moved ahead the distance *b*, shown above, you have pulled the end of the string a distance *d*.

a) What is the speed of the stuck-together disks at that point?

[Checkpoint 1]

b) When the disks collide and stick together their temperature rises slightly. Determine the increase in disks internal energy assuming that the temperature rises so quickly that there is not sufficient time for their to be much transfer of energy to the ice due to the temperature difference. Also, neglect the small amount of energy radiated away as sound produced during the collision. (Notice the geometry: d > b!)

[Checkpoint 2]

Problem 2. You hold a mass m_1 in your left hand and a mass m_2 in your right hand, both at rest and the same height above the floor. The masses are connected by a light spring with stiffness *k*. Initially, your hands are positioned so that the spring is relaxed. Later, you've moved your right hand horizontally a distance *s* closer to your left hand and are, again, holding the masses at rest. Your left hand did not move during this exercise.

a) How much work did you do with your left hand on the m_1-m_2-spring system? With your right hand? How much did the internal energy of the m_1-m_2-spring system change?

b) How much work did you do with your left hand on the m_2-only system? With your right hand? How much did the internal energy of the m_2-only system change? Did any other object in the surroundings of the m_2-only system do work on it, and if yes, how much?

[Checkpoint 3]