Physics 172 – Recitation 13
Spring 2012

Purpose: The purpose of this recitation is to allow you to gain experience working with collisions and angular momentum.

Readings: 11.1-11.9

General Instructions:
- Identify your system
- State which objects are interacting with the system
- State the fundamental principle(s) you use to solve the problems
- State the approximations and simplifying assumptions you use.
- State what quantities are conserved and not conserved.

Note: You may find it useful to redefine your system for different parts of the problem.

Problem 1: A rigid rod of mass M is initially at rest and hangs vertically in gravitational field of the Earth, as shown, on an axle through its center of mass. The length of the rod is l.

A putty ball of mass m, strikes the lower end of the rod and sticks to it. Just before the collision the ball is moving horizontally at speed v.
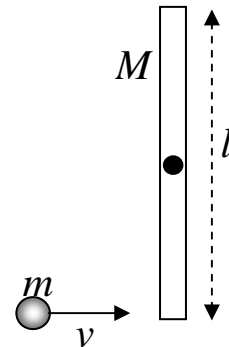
a) Describe in words the motion of the rod and putty ball after the collision. Be certain to address each of the bullet points above.
b) Find the angular velocity of the rod right after the collision.

Checkpoint 1

c) What conditions are required for the rod to make full turn after the collision?
d) What is the minimum speed v for which the rod will swing all the way around the pivot after the collision?

Checkpoint 2

Problem 2: A rigid beam of length l can rotate freely about an axle that runs through its center at point A. The assembly that supports the axle is not shown. A crate of mass M is at rest on the floor and attached to one end of the beam by a chain as shown in the figure. The beam is inclined at an angle of 45° to vertical. The masses of the chain and of the beam are negligible compared to M.
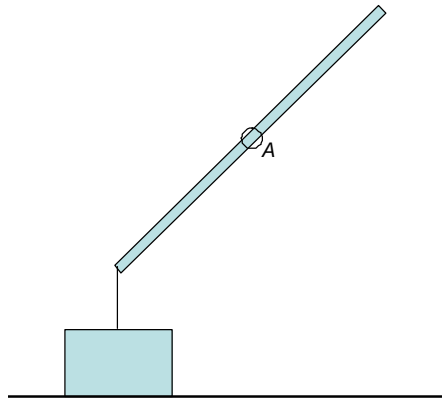
a) What is minimum magnitude of the force you must exert on the beam at its upper end in order to hold the crate just off the floor? What is the direction of this minimum force?

b) What is the force exerted on the beam by the axle when you are exerting the force you computed in part a)?

Checkpoint 3