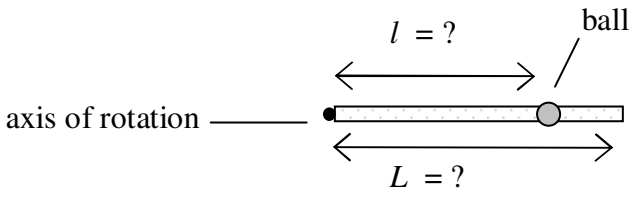
# Test 4
# Physics 410
# Fall 2008

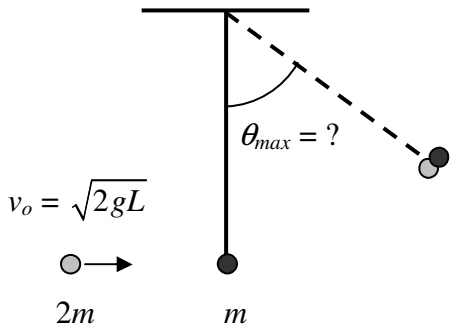
Show all your work on the exam pages. Partial credit can only be given if you show your work and I am able to follow it. Correct answers with no work shown receive very little partial credit. The point value for each problem is given.

1. A 500 gram ball is fastened to a thin rod so that the ball and the rod have the same kinetic energy at all times. The system starts from rest and is given an angular acceleration of 2.50 rad/s$^2$. At $t$ = 1.20 s, the radial acceleration of the ball is 9.80 m/s$^2$ and the tangential acceleration of the tip of the rod is 5.65 m/s$^2$. Find the mass of the rod, the tangential speed of the ball at 1.20 s, and the kinetic energy of the rod at 1.20 s. (20) (0.349 kg, 3.27 m/s, 2.67 J)

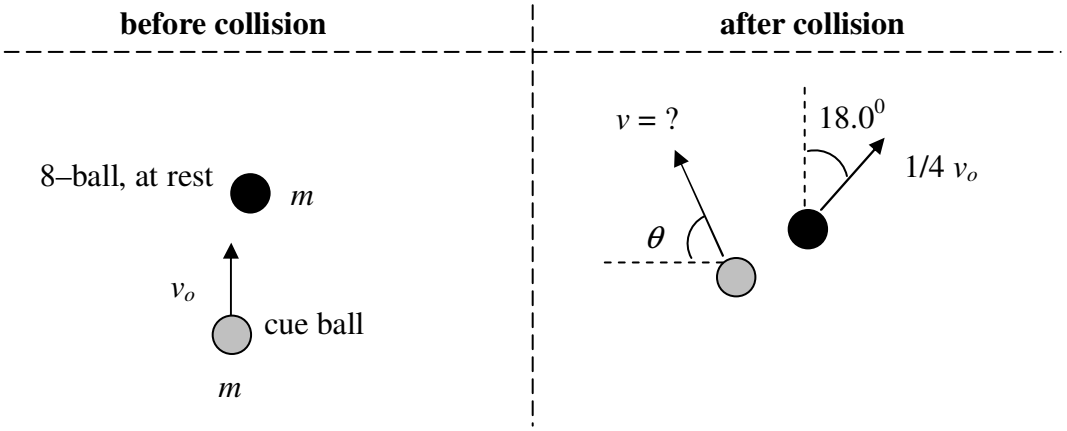



2. A clay ball of mass $m$ hangs from a string with length $L$ when a second clay ball with mass $2m$ approaches it with a speed of $\sqrt{2gL}$. See below. The collision is completely inelastic so that the balls stick together after the collision. Let $T_{ac}$ be the tension in the string **immediately after the collision** and $T_\theta$ be the tension in the string when the combined balls are at their maximum angle, $\theta_{max}$. Find $\frac{T_\theta}{T_{ac}}$.

   The known quantities are $m$, $g$, and $L$. (20) $\left(\frac{5}{17}\right)$

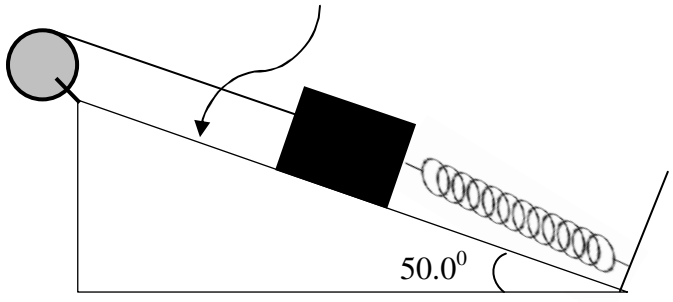


3. In a game of pool, you launch a cue ball towards the 8-ball. The two figures below show the before and after conditions. If the velocity of the 8-ball after the collision is 1/4 the initial velocity of the cue ball, find $\theta$. Note that this collision is not perfectly elastic. (20) (84.2$^0$)




4. A string is wrapped around a pulley and attached to a 5.00 kg block. A spring ($k$ = 350 N/m) is attached to the other end of the block. See below. Initially the spring is stretched 35.0 cm and the block is held at rest. The block is then released. Find the angular velocity of the pulley when the spring is at its unstretched length. Treat the pulley like a disk. The coefficient of kinetic friction is given. (20) (4.13 rad/s)

<u>pulley data</u>
8.0 kg, radius = 65.0 cm $\mu_k = 0.20$




**For Ch 11, review your HW problems from this chapter.**