Physics 7A, Section 2 and 3 (Speliotopoulos)
Second Midterm, Spring 2011
Berkeley, CA

Rules: *This midterm is closed book and closed notes. You are allowed two sides of one sheet of 8.5" x 11" of paper on which you may write whatever you wish. You are also allowed to use scientific calculators in general, but not ones which can communicate with other calculators through any means, nor ones that can do symbolic integration.* ***Anyone who does use a wireless-capable device will automatically receive a zero for this midterm.*** *Cell phones must be turned off during the exam, and placed in your backpacks.* ***In particular, cell-phone-based calculators cannot be used.***

Please make sure that you do the following during the midterm:

- *Write your name, discussion number, ID number on all documents you hand in.*
- *Make sure that the grader knows what s/he should grade by circling your final answer.*
- *Cross out any parts of the your solutions that you do not want the grader to grade.*

Each problem is worth 20 points. We will give partial credit on this midterm*, so if you are not altogether sure how to do a problem, or if you do not have time to complete a problem, be sure to write down as much information as you can on the problem. This includes any or all of the following: Drawing a clear diagram of the problem, telling us how you would do the problem if you had the time, telling us why you believe (in terms of physics) the answer you got to a problem is incorrect, and telling us how you would mathematically solve an equation or set of equations once the physics is given and the equations have been derived. Don't get too bogged down in the mathematics; we are looking to see how much physics you know, not how well you can solve math problems.*

If at any point in the exam you have any questions, just raise your hand, and we will see if we are able to answer them.

Copy and fill in the following information on the front of your bluebook:

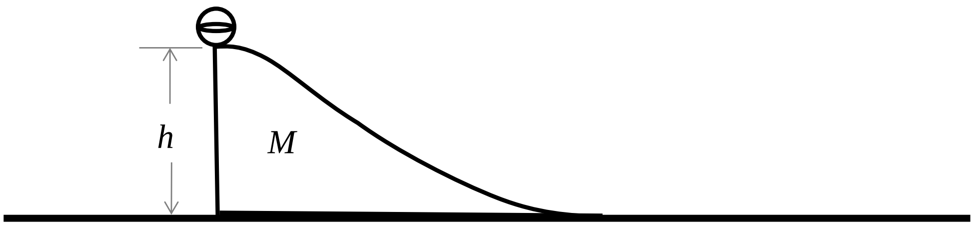
Name: ________________________________ *Disc Sec Number:* ________________________

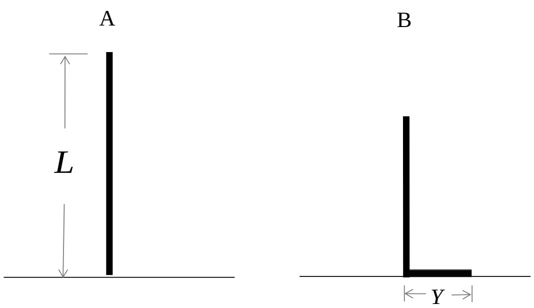
Signature: _____________________________ *Disc Sec GSI:* ____________________________

Student ID Number: _____________________

1. Block A has mass, m, and an initial velocity, v_A. It collides with Block B which has the same mass, m, but is initially at rest. If a fraction, $p < 0$, of the initial energy of the system is loss during the collision, find u_A/v_A and u_B/v_A, where u_A and u_B are the final velocities of blocks A and B, respectively.

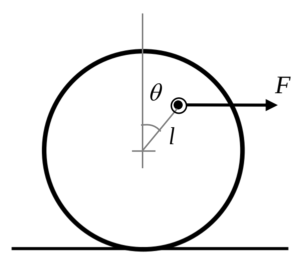
2. The figure below shows a solid sphere of mass, M_s, and radius, R, on top of a curved incline with mass, M, with height, h, that is placed on top of a *frictionless* table. There *is* friction between the sphere and the incline, however. The sphere rolls down the incline, and onto the table. If the sphere rolls without slipping while it is on the incline, what is the final velocity, V, of the sphere, and, U, of the mass?

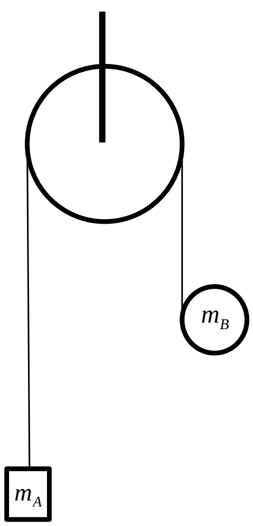




3. A flexible cord with uniform mass, M, and length, L, is initially held vertically by one end so that the other end just touches a table (see figure A to the left). The cord is then let go, and starts falling onto the table.
   a. What is the potential energy, $U(Y)$, of the cord after a length, Y, of it has fallen onto the table (see figure B to the left)?
   b. What is the velocity, $V(Y)$, of the cord at this point?

4. The figure to the right shows a disk with mass, M, and radius, R, on a table. A rod with negligible mass is attached to the disk at a distance, l, from the center of the disk, and an angle, θ, from the vertical. This rod is orientated perpendicular to the plane of the disk, while parallel to the table; the disk can rotate freely about this rod. A horizontal force, F, is applied to the disk at the rod. If the disk rolls without slipping, what is the static friction, f_S, between the disk and the table?





5. The figure to the left shows a modified Atwood's machine. While on one side of the pulley there is a block with mass, m_A, on the other side there is now a disk with mass, m_B, and radius, R. The two masses are connected by a string with negligible mass that is wound around the disk. The pulley also has negligible mass, and it turns without friction. What is the accelerations, a_A and a_B, of the two masses? Assume that the string does not slide with respect to either the disk or the pulley.