Physics 7A- Fall 2008 (Lanzara)

1st MIDTERM

This exam is closed book, but you are allowed half page (double-sided) of handwritten notes of a one 8.5" x 11" page. You may use a calculator, however NO wireless calculators or any calculator functions on your cell phone are allowed. **Anyone using a wireless calculator will forfeit their exam and automatically receive the score of zero.**

Don't forget: a) Write your name, Discussion Section #, GSI name and SID# on the top of all materials you intend to hand in and want to be graded.
b) Remember to circle all of your final answers.
c) Cross out any work you decide is incorrect, with an explanation in the margin.

Suggestions:
Read through the entire exam. Start with the problems you are most familiar with. In this way you will secure some credits.
In general: Work to maximize your credit -- try to obtain at least partial credit on every part of every problem.
- For partial credits show all relevant drawings and explain clearly your reasoning.
- If you recognize that an answer does not make physical sense and you do not have time to find your error, write that you know that the answer cannot be correct and explain how you know this to be true. (We will award some credit for recognizing there is an error.).
- Do not get bogged down in algebra - if you have enough equations to solve for your unknowns, box the equations, state how you would finish, and move on (you can go back and complete the algebra later if you have time).

And if you have questions about the interpretation of a problem, *please ask!*

GOOD LUCK!

Print Name___________________________ Discussion Section# or Time ____________

Signature ____________________________ Discussion Section GSI ________________

Student ID# __________________________

Problem	Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
TOTAL	**100**	

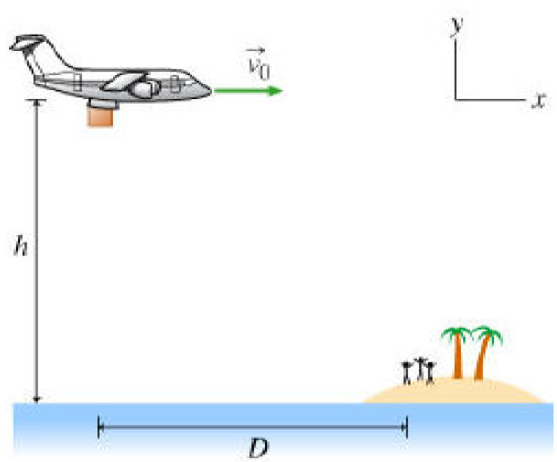
Problem 1 (20pts):

A relief airplane is delivering a food package to a group of people stranded on a very small island. The island is too small for the plane to land on, and the only way to deliver the package is by dropping it. The airplane flies horizontally with constant speed of v_0= 200 m/s at an altitude of h=1000m. For all parts, assume that the "island" refers to the point at a distance D from the point at which the package is released, as shown in the figure. Ignore the height of this point above sea level.

(a) (10pts) After a package is ejected from the plane, how long will it take for it to reach the sea level from the time it is ejected? Assume that the package, like the plane, has an initial velocity of v_0= 200 m/s in the horizontal direction.

(b) (5pts) If the package is to land right on the island, at what horizontal distance D from the plane to the island should the package be released?

(c) (5pts) What is the speed v_F of the package when it hits the ground?



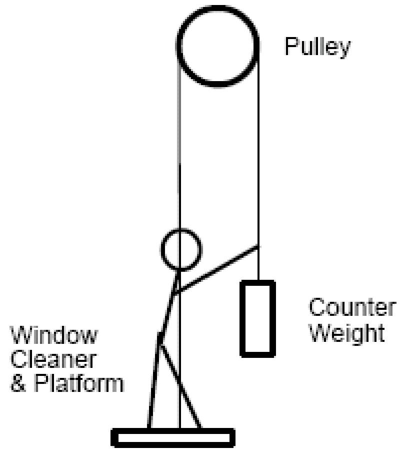
Problem 2 (20pts):

A window cleaner of mass m=70Kg stands on a platform of mass M=100Kg. The platform is suspended from a frictionless and massless pulley by a counter weight of 100 Kg as shown in figure:

Assume that the rope has no mass also.

(a) (10pts) How much force should the window cleaner apply to the rope in order that he can raise himself slowly at a constant speed?

(b) (10pts) Suppose the window cleaner is ascending with a constant speed of v= 3 m/s towards a window at a distance of d= 5 m above him. What force should he apply now in order that he will stop just in front of the window?



Problem 3- (20 points)

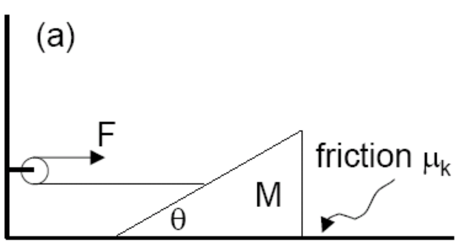
A large triangular wedge of mass M must be moved across a concrete floor towards a wall (assume a coefficient of dynamic friction μ_k). The workman assigned to move the wedge has a rope and a pulley (see figure below).

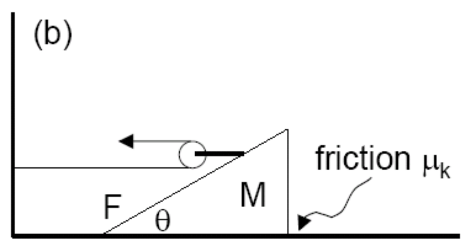
(a) (6pts) Of the two configurations shown in the figure below (panels a and b), which will require the smallest tension in the rope to move the box? Show your answer.

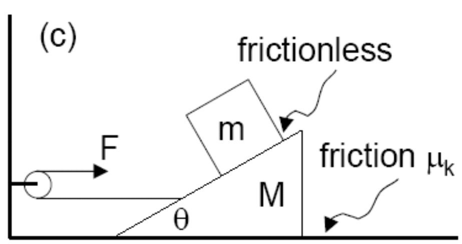
A smaller block of mass m is now added on top of the wedge. The block can slide frictionless on its top surface (see panel c).

(b) (4pts) Draw the free body diagram for the wedge (2pts) and the block (2pts).

(c) (10pts) What is the minimum value of the horizontal force F that the workman has to apply to the wedge that will cause the block m to neither slides up or down?







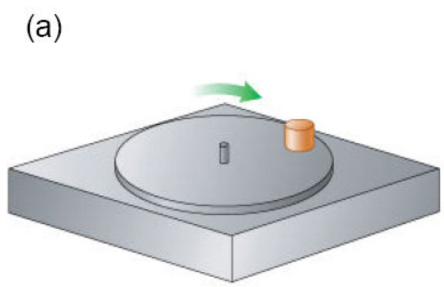
Problem 4 (20pts):

A small metal cylinder rests on a circular turntable that is rotating at a constant speed (see panel a). The small metal cylinder has a mass of m, the coefficient of static friction between the cylinder and the turntable is μ_s, and the cylinder is located at a distance r from the center of the turntable.

(a) (10pts) What is the maximum speed v_{max} that the cylinder can have to move along its circular path without slipping off the turntable?

The cylinder is now connected to the central post by a rope (see panel b).

(b) (10pts) How an observer outside (3pts) or an observer on the turntable (3pts) would draw the free body diagram? Write Newton's second law for the cylinder in both cases (4pts).



Problem 5 (20pts):

A pilot of mass m in a jet aircraft executes a loop as shown in the figure. In this maneuver the aircraft moves in a vertical circle of radius R at a constant speed v_0.

(a) (10pts) When does the pilot think that he is lighter?

(b) (10pts) What is the minimum velocity for the pilot to complete the loop without falling out of the plane?