Exam 2 Phys 105 **Fall 2005**

Name_____Section _____

The exam is closed book and closed notes.

Part I: There are 10 multiple choice Questions.
Make sure you put your name, section, and ID number on the SCANTRON form. The answers for the multiple choice Questions are to be placed on the SCANTRON form provided. Use a Number 2 pencil to fill in answers on the SCANTRON form. Make sure you give only one (1) answer to each question. **If you erase an answer on the SCANTRON form, make sure all traces are removed.**
Parts II : Workout problems. Show ALL your work. Correct answers with unsubstantiated work will receive **ZERO CREDIT**.

Part I (30 points**)**

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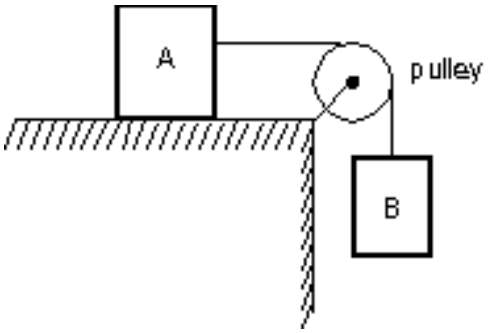
1. Block A, with a mass of 50 kg, rests on a horizontal table top. The coefficient of static friction is 0.40. A horizontal string is attached to A and passes over a massless, frictionless pulley as shown. The smallest mass m_B of block B, attached to the dangling end, that will start block A moving when it is attached to the other end of the string is:



A) 11 kg
B) 21 kg
C) 31 kg
D) 41 kg
E) 51 kg

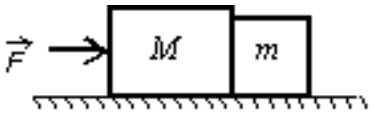
2. Two objects, one having three times the mass of the other, are dropped from the same height in a vacuum. At the end of their fall, their velocities are equal because:
A) the force of gravity is the same for both objects
B) anything falling in vacuum has constant velocity
C) all objects reach the same terminal velocity
D) the acceleration of the larger object is three times greater than that of the smaller object
E) none of the above

3. A 25-kg chair is pushed across a frictionless floor with a force of 20-N, directed 20° below the horizontal. The magnitude of the normal force on the chair is

   A) 6.8 N
   B) 19 N
   C) 245 N
   D) 252 N
   E) 680 N

4. An automobile moves on a level horizontal road in a circle of radius 30 m. The coefficient of friction between tires and road is 0.50. The maximum speed with which this car can round this curve is:
   A) 3.0 m/s
   B) 4.9 m/s
   C) 9.8 m/s
   D) 12 m/s
   E) 13 m/s

5. Two blocks with masses *m* and *M* are pushed along a horizontal frictionless surface with constant acceleration by a horizontal applied force $\vec{F}$ as shown. The magnitude of the force of either of these blocks on the other is:



   A) $mF/(m + M)$
   B) mF/M
   C) $mF/(M - m)$
   D) $MF/(M + m)$
   E) MF/m

6. An object moving in a circle at constant speed:
   A) must have only one force acting on it
   B) is not accelerating
   C) has no net force acting on it
   D) has an acceleration of constant magnitude
   E) has an acceleration that is tangent to the circle

7. A 1000-kg elevator is rising and its speed is increasing at 3 m/s^2. The tension in the elevator cable is:
   A) 6800 N
   B) 1000 N
   C) 3000 N
   D) 9800 N
   E) 12800 N

8. The speed of a 4.0-N hockey puck, sliding across a level ice surface, decreases at the rate of 0.61 m/s^2. The coefficient of kinetic friction between the puck and ice is:
   A) 0.062
   B) 0.41
   C) 0.62
   D) 1.2
   E) 9.8

9. The block shown moves with constant velocity on a horizontal surface. Two of the forces on it are shown. A frictional force exerted by the surface is the only other horizontal force on the block. The frictional force is:

   A) slightly more than 2 N, leftward
   B) slightly less than 2 N, leftward
   C) 2 N, leftward
   D) 2 N, rightward
   E) 0

10. A crate is sliding down an incline that is 35° above the horizontal. If the coefficient of kinetic friction is 0.40, the acceleration of the crate is

   A) 0
   B) 2.4 m/s^2
   C) 5.8 m/s^2
   D) 8.8 m/s^2
   E) 10.3 m/s^2

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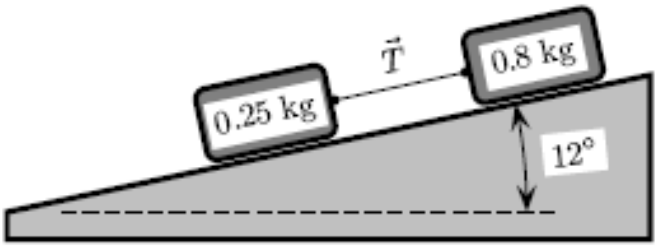
Part II: Workout problems (10 points each) **IN ORDER TO RECEIVE CREDIT, YOU MUST SHOW YOUR WORK. NO EXCEPTIONS.**

1. Two blocks attached by a string slide down a frictionless incline. The lower block has a mass of 0.25 kg, and the upper block has a mass of 0.80 kg. Neglect the mass of the string.



(a) Draw free body diagram(s) needed to find the acceleration of the blocks AND clearly indicate the coordinate system you are using. (2 points)

(b) Based on your free-body diagram(s), write down the equation(s) of motion (ie. $\mathbf{F}_{net}=m\mathbf{a}$) and determine the acceleration of the blocks down the plane. (3 points)

(c) Determine the tension in the string. (Hint: you may need to draw another free body diagram). (3 points)

d) If the order of the blocks is reversed, what is the tension in the string now? Clearly justify your answer. (2 points)

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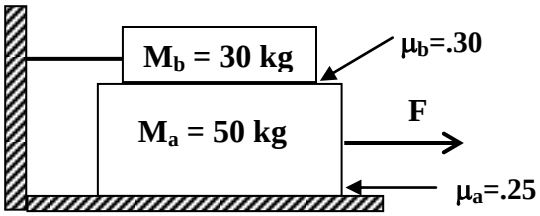
2. A 30-kg block is placed on top of a 50-kg block. A horizontal force F is applied to the 50-kg block and the 30-kg block is tied to the wall. The coefficients of static friction between the masses and between the 50-kg block and the ground are shown in the figure.



a) Draw a free-body Diagram for each block.

b) Write down Newton's Second Law for the x and y directions for each block.

Block a

Block b

3. What force F is needed to *just start* the lower block moving?

Answer _____N

4. What is the tension in the cord when 50-kg block *just begins* to move?

Answer_____N