PHYSICS 131 **Sample Midterm**

200 points
1 hour, 48 minutes

Student Name: _____

Recitation Instructor (circle one): Moe Larry Curly Groucho Chico Harpo

Recitation hour (circle one): 11:30 12:30

- **Write your name and circle the name of your recitation instructor and recitation hour on every page.** The pages of this exam will be separated and each page graded by a different instructor. You must have your name on each sheet to receive a grade.
- **Feel free to detach the equation sheet, but you must return the equation sheet to us at the end of the exam.**
- **You must show your work and justify your answers** except on multiple choice and fill-in-the-blank questions.
- **Force, acceleration, velocity, etc. are vectors so answer accordingly.**
- **Neglect the effect of air resistance, friction and the mass of ropes and pulleys unless instructed otherwise. Note that friction can be clearly implied in a problem, for example, a monkey climbing a rope.**
- **Good luck!**

Page 1 _____ Page 4 _____

Page 2 _____ Page 5 _____

Page 3 _____ Page 6 _____

Total _____

Sample Midterm, Physics 131 Name_____

Recitation instructor (circle one): **Moe** **Larry** **Curly** **Groucho** **Chico** **Harpo**

Recitation hour (circle one): **11:30** **12:30**

Problem 1 [25 points]. A car, starting from rest, moves at constant acceleration for 1.33 km on a straight track. Then the driver hits the brakes and the car decelerates at 6.00 m/s^2 for 14.9 s until it comes to a halt. Answer the following questions in whatever order is most convenient:

(a) What was the total distance traveled?

(b) How long did the entire trip take?

Problem 2 [6 points]. You are riding in a car blindfolded. Suddenly, the car's motion changes and you feel your seat pushing hard against your back. Even though you can't see, you are asked some questions about the car's kinematics during the time you felt the seat pushing.

(a) The car's acceleration was (circle one): **forward** **backward** **can't be determined**

(b) The car's velocity was (circle one): **forward** **backward** **can't be determined**

Recitation instructor (circle one): **Moe** **Larry** **Curly** **Groucho** **Chico** **Harpo**

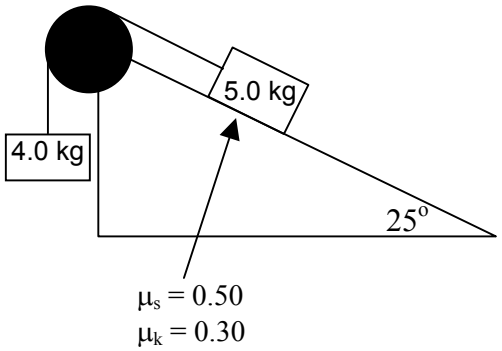
Recitation hour (circle one): **11:30** **12:30**

Problem 3 [17 points]. A plane flying level at 200 km/hour on a no-wind day drops a 10 kg lead ball that strikes a target place on level ground a horizontal distance of 400 m past the release point.

(a) [10 points] What was the plane's altitude?

(b) [7 points] What was the balloon's speed just before it landed?

Problem 4 [18 points]. A 5.0 kg box lies at rest on an inclined plane as shown. What is the magnitude of the friction force exerted on the box by the inclined plane?



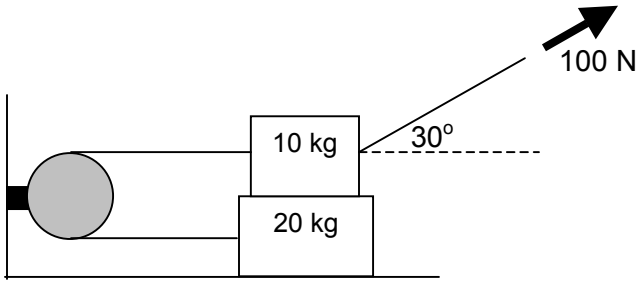
Recitation instructor (circle one): **Moe** **Larry** **Curly** **Groucho** **Chico** **Harpo**

Recitation hour (circle one): **11:30** **12:30**

Problem 5 [34 points]. Two boxes are stacked on top of each other with ropes attached as shown. The rope on the left goes around a pulley. The rope on the right has a constant tension of 100 N on it because someone (not shown) is pulling on it. The floor is frictionless, but there is kinetic friction ($\mu_k = 0.25$) between the boxes.

(a) What is the magnitude of the normal force exerted on the 10 kg box by the 20 kg box?

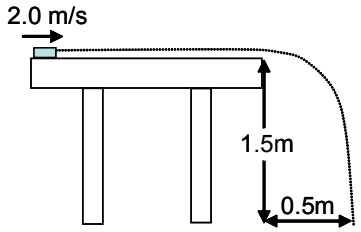
(b) What is the magnitude of the acceleration of the 10 kg box?



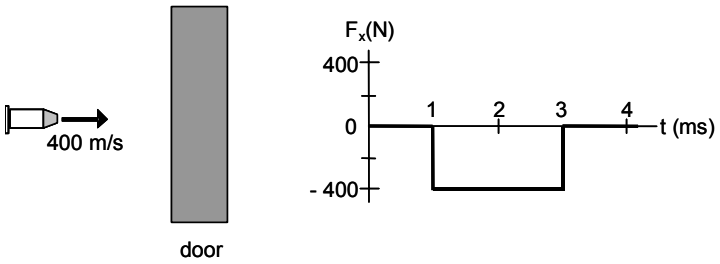
Problem 6 [33 points] A penny (mass = 2.35 g), starting at one edge of a table, slides directly toward the other edge with an initial velocity of 2.0 m/s. The penny sails off the edge 0.75 s later and falls to the ground as shown in the figure.

(a) [25 points] What is the coefficient of kinetic friction between the penny and the table's surface?

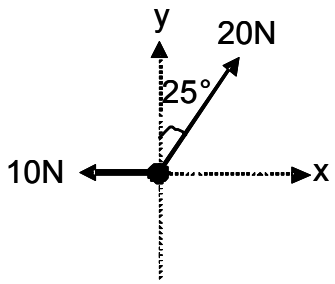
(b) [8 points] How long is the table?



Problem 7 [13 points] A 10g bullet is fired with a speed of 400 m/s toward a thick wood door. The net force on the bullet as it passes through the door is plotted in the figure. How fast is the bullet traveling after it passes through the door?



Problem 8 [13 points] A 5.0 kg object is subject to the forces shown. Assuming the object starts from rest at the origin, calculate the position $\vec{r}$ of the object at $t = 5.0$ s .



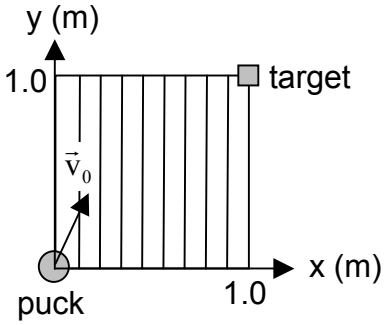
Recitation instructor (circle one): **Moe** **Larry** **Curly** **Groucho** **Chico** **Harpo**

Recitation hour (circle one): **11:30** **12:30**

Problem 9 [25 points] A 100 g hockey puck travels across a grooved surface such that the coefficient of kinetic friction in the x direction ($\mu_{kx} = 0.10$) is different than in the y direction ($\mu_{ky} = 0.20$). The puck reaches the target in $\Delta t = 2.5$ s.

(a) [8 points] Calculate the x and y components of the acceleration.

(b) [17 points] Calculate the x and y components of the initial velocity.



Problem 10 [16 points; 4 each] Consider the **v(t)** graph. The particle starts at the origin at t=0. Choose **the point or points** where:

(a) The displacement is maximum: _____

(b) The acceleration is zero: _____

(c) The particle is speeding up: _____

(d) The particle is turning around: _____