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Name: _____

Physics 2A Spring 2009 Exam 3

<u>MAKE SURE TO SHOW ALL WORK IN COMPLETE DETAIL! NO CREDIT WILL BE GIVEN</u> <u>IF NO WORK IS SHOWN!</u> EXPRESS ALL ANSWERS IN SI UNITS.

 A 12.0 g bullet is fired into a 100 g wooden block initially at rest on a horizontal surface (bullet becomes imbedded in block). After impact, the block slides 8.0 m before coming to rest. If the coefficient of kinetic friction between the block and the surface is 0.650, calculate the speed of bullet before impact. (10 pts)

- 2. Two cars, one a compact with mass 1200 kg and the other a large gas-guzzler with a mass of 3000 kg, collide head-on at 60 mi/hr. (10 pts)
 - a) Which car has a greater magnitude of momentum change? Which car has a greater change in velocity?
 - b) Which car's occupants would you expect to sustain greater injuries? Explain!

3. A block of mass m = 1.5 kg is placed against a spring (k = 21.0 cm/N) on a frictionless incline plane with angle θ = 30° as shown below. (The spring is not attached to the block) The spring is compressed 25.0 cm and then released.



- a) Defining the system to be the <u>block + spring + earth</u>, explain why the Total Mechanical Energy of the system must be conserved.
- b) What is the elastic potential energy of the compressed spring?
- c) What is the change in gravitational potential energy of the system when the block moves from its release point to its highest point on the incline plane?
- d) Calculate the maximum distance the block moves along the incline plane from the release point.

4. A bead slides without friction around a loop-the-loop as shown below. The bead is released from rest from a height of 4R. (10 pts)



a. What is the speed at point A?

b. Calculate the normal force on the bead at point A if its mass is 10.0g.