TEST # 2. PHYS 203. Chapters 5-7. FALL 2002. October 22, 2002

NAME:

Problem 1. Dynamics of Uniform Circular Motion (20 points).

A small remote-control car with a mass of 1.20 kg moves at a constant speed of v=12.0 m/s in a vertical circle inside a hollow metal cylinder that has radius of 5.00 m (see figure). What is the magnitude of the normal force exerted on the car by the walls of the cylinder at (a) point A (at the bottom of the circle)? (b) point B (at the top of the circle)?

Problem 2. Work, Energy and circular motion (30 points) A package is thrown down a curved ramp as shown in the figure. The package moves from A to B through a quarter-circle with radius R=3.00 m. The mass of the package is 25.0 kg. The package starts from rest at point A and there is no friction.

(a) Find the speed of the package at the bottom of the ramp (point B).

(b) Find the normal force that acts on the package at point B (Hint: Notice that here the Work-energy theorem may not be useful).

(c) Consider now that the ramp is not frictionless and that the speed of the package at the bottom is 6.00 m/s. What work was done by the friction force acting on the package?

Problem 3. Linear Momentum. Collision in a horizontal plane. (30 points)

Two chunks of ice are sliding on a frictionless frozen pond. Chunk A, with mass $m_A = 5.0$ kg, moves with initial velocity $v_{A1} = 2.0$ m/s parallel to the x-axis. It collides with chunk B, which has mass m_B=3.0 kg and is initially at rest. After the collision, the velocity of chunk A is found to be $v_{A2} = 1.0$ m/s in a direction making an angle $\alpha = 30^o$ with the initial direction. What is the final velocity of chunk B?

Problem 4. Energy conservation (20 points)

A baseball is thrown from the roof of a 27.5 m tall building with an initial velocity of magnitude 16.0 m/s and directed at an angle of 37^o above the horizontal.

a) Using energy methods and ignoring air resistance, calculate the speed of the ball just before it strikes the ground.