General Physics I (PHYS 203) Fall 2006 **Name:_____**

Exam 3: November 15, 2006

Questions and Problems: Provide clear and logical answers to each of the following questions. In question 1 answer 3 of the 4 parts (a-d). Where calculations are required, neatly show all work. You must clearly show all work to receive full credit. Be sure that your answers have the correct units. If you continue your work on another sheet of paper, be sure that it is clearly labeled. Be sure to include FBDs where appropriate.

1a (15 parts) A truck driver is traveling to the right at 22.0 m/s in a straight line along a level road. There is an unsecured crate on the back of the truck. What is the maximum acceleration that truck may experience such that the block does not slide relative to the truck? (For full credit include an appropriate FBD.)

1b (15 points) A horizontal force $\vec{F} = 45\hat{i} + 30\hat{j}$ Newtons is applied to a cart that experiences a displacement of $\Delta\vec{r} = 20\hat{i} - 10\hat{j}$ meters. Determine the angle between the force and the displacement. How much work is done by this force?

1c (15 points) A ping pong ball (mass = 2.40 x 10^{-3} kg) moves under the influence of gravity and air resistance. The initial velocity is $\vec{v}_i = 4.00\hat{i} + 3.00\,\hat{j}$ m/s and the ball returns to the same height with a final velocity of $\vec{v}_f = 3.30\hat{i} - 2.00\,\hat{j}$ m/s. The x direction is horizontal and the y direction points vertically upward. Determine the initial kinetic energy of the ball. Determine the work done by air resistance.

1d (15 points) Molecular oxygen has a mass of approximately 5.35 x 10^{-26} kg. Determine the force due to gravity on molecular oxygen at the surface of the earth and 100 km above the earth's surface.

2 (20 points) An amusement park ride consists of a small rotating circular platform to which 10.0 kg seats are attached by 11.6 m chains with no significant mass. When the system rotates, the chains make and angle of 28° with the vertical. Draw a free body diagram for a chair that is rotating with a 40.0 kg child in it. Determine the tension in the cable. Determine the speed at which the seat and child are rotating. Does the speed depend on the mass of the child and chair? Demonstrate.

3 (20 points) An archeology team is investigating the feasibility of using an incline plane to move a large block. As shown in the figure, they set a 500 kg block on a rough (μ_s=.4, μ_s=.2) 10° incline. A rope extends from the block over a pulley to a hitch. What force must be applied to the hitch to get the block to move up the incline? Once the block is moving, what will be the acceleration of the block due to this force?

4 (20 points) A 10 kg block is released from point A in the figure. The block travels down the track, hits a spring of force constant 2,250 N/m, and compresses the spring before coming to rest momentarily. Assuming the entire track is frictionless, determine the distance the spring is compressed from equilibrium.

Now consider the track to be frictionless except for the portion between points B and C, which has a length of 6.00 m. The block travels down the track, hits a spring constant of force constant 2,250 N/m, and compresses the spring 0.300 m from its equilibrium position before coming to rest momentarily. Determine the coefficient of friction between the block and the rough surface between B and C.