TEST 3. CHAPTERS 8-11. PHYS 203. FALL 2002. November 19, 2003

NAME:

- Do all the problems.

1. Rotational kinematics (10 points)

1.1. A circular disk 0.20 m in diameter starts from rest and accelerates with constant angular acceleration to an angular velocity of 210 rad/s in 10.00 s. Find the angular acceleration and the angle which the disk has turned in degrees.

1.2 A car with tires of radius 32 cm drives on the highway at 60 km/h. What is the angular speed of the tires?

2. Rigid objects in equilibrium (30 points)

Consider the wall-mounted lamp (sconce) shown in the figure. The sconce consists of a light, curved rod (with zero mass) that is bolted to the wall at its lower end. Suspended from the upper end of the rod (a horizontal distance h from the wall) is the lamp of mass $m = 2.00$ kg. The rod is also connected to the wall by a horizontal wire a vertical distance d above the bottom of the rod. Find the tension in the wire, and the horizontal and vertical components of the force exerted by the bolt on the rod.

3. Springs (30 points)

A block with mass 5.0 kg is suspended from an ideal spring having negligible mass and stretches the spring 0.20 m to its equilibrium position.

(a) What is the force constant of the spring ?

(b) The spring is then stretched 0.80 m from its equilibrium position and then released with velocity zero. Calculate the velocity of the mass when the mass is at the equilibrium position.

4. Fluids (10 points) Water ($\rho = 1000$ kg/m^3) enters a pipe on the ground with an inside diameter of 2 cm at a pressure of 4 x 10^5 Pa. Then a 1 cm-diameter pipe leads the water to a height of 5 m above the ground. The flow speed at the inlet is $v_1 = 1.5$ m/s

(a) Find the flow speed at the outlet (2).

(b) Find the pressure at the outlet (2).

5. Fluids (20 points) The water tank in the figure is open to the atmosphere and has two holes in it, one 0.80 m and one 3.6 m above the floor on which the tank rests. If the two streams of water strikes the floor in the same place, what is the depth of water in the tank? (Assume that the holes are very small and the tank is very large and the top surface of the water has essentially zero speed)