This is a test given summer 2002 - it is a sample - to show you what the tests are like - it is not meant for practice and these particular problems will probably not be on the test

Name _____ Roster # _____
Problems (14 points each)

1). A croquet ball traveling with a velocity of 4.8 m/s collides with an identical ball initially at rest. Immediately after the collision the original ball is observed to have a speed of 3.6 m/s at an angle of 28 degrees from its original direction. What is the velocity of the other croquet ball immediately after the collision?

b). If the mass of the balls is 0.8 kg what was the kinetic energy lost in the collision?

2. A bullet of mass 0.01 kg is traveling at 300 m/s. it encounters a block of mass 0.99 kg attached to a spring of spring constant k = 100 N/m. The block rests on a horizontal table where the coefficient of kinetic friction between the block and the table is 0.3. The bullet hits and embeds in the block, what is the resulting maximum compression of the spring?

b). After the spring compresses it starts to expand – what is the maximum extension of the spring?

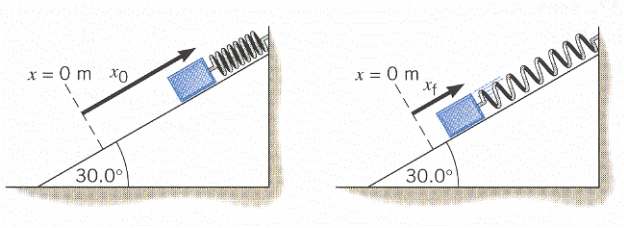
3. A sphere of radius 0.15 m is rolling on a level surface with a constant angular speed of 10 rad/s. It starts to roll up a 30 degree incline. How high will it get on this incline before it stops momentarily and begins to roll down?

4. A large cylindrical grinding wheel of radius 0.5 meter has a mass of 30 kg. It is rotating at 300 rpm when a guy puts a knife on it to sharpen the knife - he pushes down on the knife with a force of 50 N and the coefficient of friction between the knife and the wheel is 0.7.

a. How long will the wheel stay in motion?

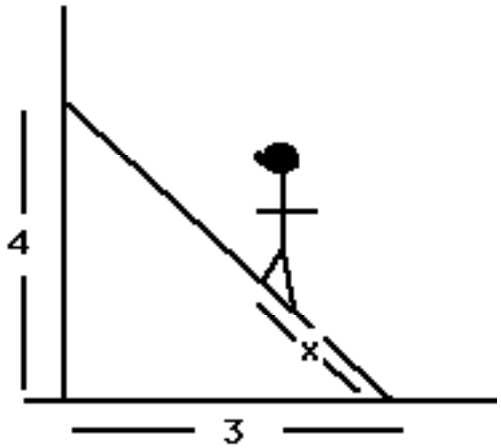
b. How many turns will the wheel make before coming to rest?

5. The drawing shows a block (m = 1.7 kg) and a spring (k = 310 N/m) on a frictionless incline. The spring is compressed by x_0 = 0.31 m relative to its unstrained position at x = 0 and then released. What is the speed of the block when the spring is still compressed by x_1 = 0.14 m?



6. A 5 meter ladder weighing 1000 N rests against a wall at a point 4 meters above the ground. A 1600 N man is climbing the ladder.

a. Assuming the wall is frictionless draw a diagram of the forces acting on the ladder. What are the forces exerted by the ground and the wall as a function of 'x'?



b. What minimum coefficient of friction is needed if the man is to make it all the way up the ladder without it slipping?

Short Answer (5 points each)

1. What is the acceleration of gravity on the surface of the sun.
Mass of sun = 2.0 X 10^{30} kg
Radius of sun = 7 X 10^{8} m

2. A skater has a moment of inertia of 100 kg m^2 when his arms are outstretched and a moment of inertia of 75 kg m^2 when his arms are tucked in close to his chest. If he starts to spin at an angular speed of 2.0 rps (revolutions per second) with his arms outstretched what will his angular speed be when they are tucked in?

3. A 5.0 kg mass is supported by an aluminum wire of length 2.0 m and a diameter of 2.0 mm. How much will the wire stretch?
For Aluminum $Y = 7 \times 10^{10}$ N/m^2

4. A spring has a spring constant of 40 N/m. How much work is required to stretch the spring from 2 cm to 4 cm from its equilibrium position?