Physics 201 MWF10:20 Fall 2005 (Ford)

Name (printed)_____

Name (signature as on ID)_____

Lab Section_____

Exam III Chapts. 8–11 in Cutnell and Johnson 6th ed

Circle the correct answer. No partial credit will be given.

(5 pts) 1. You are standing on a platform that is free to rotate about a vertical axis. You hold weights in your hands. When you have your arms outstretched you are turning at 2.0 rad/s and the total kinetic energy of the rotating system (you, the platform and the weights) is 72 J. You pull your arms into your sides and your rotation rate becomes 6.0 rad/s. The kinetic energy of the system after you pull in your arms is

(a) 8 J
(b) 24 J
(c) 72 J
(d) 216 J
(e) 648 J
(f) none of these

(5 pts) 2. A block is moving in simple harmonic motion on the end of a horizontal spring. As it moves back and forth its maximum kinetic energy is $KE_{\max}$. When the block is at its maximum displacement from $x = 0$ it suddenly splits into two identical pieces and only one piece remains attached to the spring. After the block splits the maximum kinetic energy of the block during its motion is

(a) $(KE_{\max})/2$
(b) $(KE_{\max})/\sqrt{2}$
(c) $KE_{\max}$
(d) $\sqrt{2}(KE_{\max})$
(e) $2(KE_{\max})$
(f) none of these

(5 pts) 3. You are floating in a canoe in the middle of a swimming pool. With you in the boat is a large rock. You drop the rock over the side of the canoe and the rock sinks to the bottom. After the rock has come to rest at the bottom of the pool, is the level of the water in the pool higher, lower or the same as when the rock was in the boat?

(a) higher
(b) lower
(c) same as

(5 pts) 4. A uniform solid cylinder with mass m and radius R is rolling without slipping on a horizontal surface. The center of mass of the cylinder is moving with linear speed v. The moment of inertia of the cylinder for an axis through its center is $\frac{1}{2}mR^2$. The total kinetic energy of the cylinder is given by

(a) $\frac{1}{4}mv^2$

(b) $\frac{1}{2}mv^2$

(c) $\frac{7}{10}mv^2$

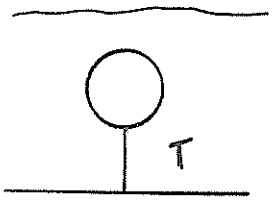
(d) $\frac{3}{4}mv^2$

(e) mv^2

(f) none of these

On the following problems show all your work. Partial credit will be given if earned. Write your answers in the blanks provided.

(16 pts) 5. A uniform solid plastic sphere that has mass 61.2 kg is held beneath the surface of the water (density 1000 kg/m^3) in a tank by a vertical cable that runs from the sphere to the bottom of the tank. The tension in the cable is $T = 200$ N.



a) What is the buoyant force that the water exerts on the sphere?

Ans. _____

b) What is the density of the sphere?

Ans. _____

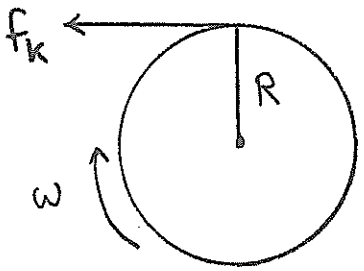
(20 pts) 6.
a) A block of mass 2.0 kg is attached to a horizontal spring and moves in simple harmonic motion on a horizontal frictionless surface. The period of the motion is 0.80 s. The maximum speed of the block is 6.0 m/s. What is the amplitude of the motion?

Ans. _____

b) A spring with force constant 400 N/m is hung from the ceiling. A 20.0 kg block is attached to the free end of the unstretched spring. When released from rest, how far does the block travel downward before momentarily coming to rest?

Ans. _____

(21 pts) 7. A uniform wheel with $I = 400$ kg·m^2 and radius $R = 0.80$ m is mounted on a horizontal axis through its center and turns without friction at the axis. The wheel is initially rotating at 50 rev/min. Then a brake pad is pushed against the edge of the wheel and this produces a tangential friction force $f_k = 60$ N that opposes the motion of the wheel.



a) What is the angular acceleration of the wheel, in rad/s^2?

Ans. _____

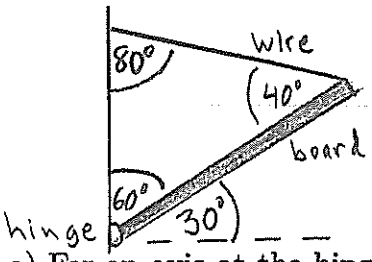
b) How many revolutions does the wheel turn through, from when the brake is applied until the wheel stops?

Ans. _____

c) While the wheel is slowing down, at the instant that its rotation rate is 5.0 rev/min what is the magnitude of the total (resultant) linear acceleration of a point on the rim of the wheel?

Ans. _____

(23 pts) 8. A uniform board that is 8.0 m long and that weighs 400 N is attached to the wall by a frictionless hinge. The board is held at 30° above the horizontal by a wire that runs from the end of the board to the wall. The wire makes a 40° angle with the board.



a) For an axis at the hinge, what are the magnitude and direction (clockwise or counter-clockwise) of the torque due to the weight of the board?

Ans. magnitude _____

direction _____

b) What is the tension T in the cable?

Ans. _____

c) What is the magnitude of the vertical component of the force exerted by the hinge on the board? What is the direction of this force, upward or downward?

Ans. magnitude _____

direction _____