Physics 201 MWF 9:10 Fall 2007 (Ford)

Name (printed)_____

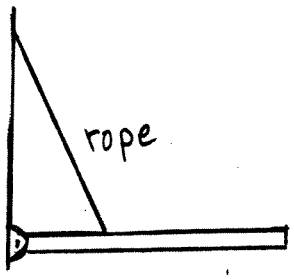
Name (signature as on ID)_____

Lab Section_____

Exam III Chapts. 9–11 in Young& Geller

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

(5 pts) 1. A uniform bar with mass 50 kg and length 6.0 m is attached to a wall by a frictionless hinge. The bar is held in a horizontal position by a light rope that is attached to the bar at a point 2.0 m from the hinge and makes an angle of 37° with the bar. The vertical component of the force that the hinge exerts on the bar is



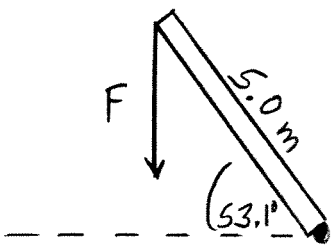
(a) upward
b (b) downward
(c) zero

(6 pts) 2. A wheel of radius 0.50 m starts from rest at $t = 0$ and then rotates with constant angular acceleration. If a point on the rim of the wheel has a constant tangential acceleration of 1.2 m/s^2, what is the angular velocity of the wheel at $t = 5.0$ s?

(a) 3.0 rad/s
(b) 24.0 rad/s
(c) 6.0 rad/s
d (d) 12.0 rad/s
(e) none of the above

(6 pts) 3. A force $F = 20$ N is exerted on a 5.0 m long bar as shown in the sketch. The bar makes an angle of 53.1° with the horizontal. For an axis at the lower end of the bar, the torque exerted on the bar by the force F has magnitude

(a) 100 N·m
(b) 80 N·m
C (c) 60 N·m
(d) 20 N·m
(e) 16 N·m
(f) 12 N·m
(g) none of the above



(5 pts) 4. A block of mass m moves in simple harmonic motion of the end of a horizontal spring with period $T = 4.0$ s and amplitude $A = 0.60$ m. If the amplitude is halved, so that A becomes 0.30 m but the mass and the spring remain the same, what is the period for the new amplitude?

(a) 0.50 s
(b) 16.0 s
(c) 8.0 s
d (d) 4.0 s
(e) 2.0 s
(f) none of the above

(7 pts) 5. A thin-walled hollow cylinder with mass M and radius R is rolling without slipping up an incline. At the base of the incline the center of mass of the cylinder has speed v. The moment of inertia of the cylinder for rotation about an axis through the center of the cylinder and parallel to its length is $I = MR^2$. The maximum vertical height above the bottom of the incline that is reached by the cylinder is

(a) $v^2/(2g)$
b (b) v^2/g
(c) $7v^2/(10g)$
(d) $v^2/(4g)$
(e) none of the above

(7 pts) 6. A block of mass m moves in simple harmonic motion on the end of a horizontal spring. When the block is at $x = A$, the total energy of the system is 8.0 J. What is the kinetic energy of the block when the block is at $x = A/2$?

a (a) 6.0 J
(b) 8.0 J
(c) 2.0 J
(d) 4.0 J
(e) none of the above

(7 pts) 7. A wheel starts from rest at $t = 0$ and turns through 8.0 rev in 2.0 s. If the angular acceleration of the wheel is constant, what is the angular velocity of the wheel at the end of the 2.0 s period?

a (a) 8.0 rev/s
(b) 4.0 rev/s
(c) 16.0 rev/s
(d) 12.0 rev/s
(e) none of the above

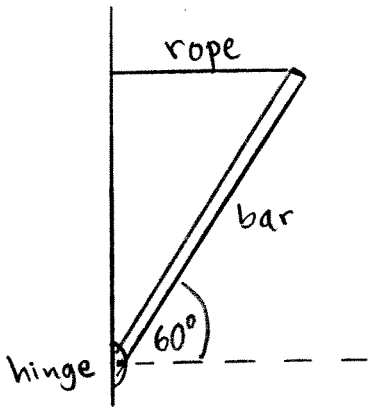
(7 pts) 8. A large horizontal disk has radius 2.0 m and moment of inertia $I = 60$ kg·m^2 for rotation about an axis at its center. The disk initially is rotating with an angular velocity of 4.0 rad/s. A bag of sand is dropped from a small height onto the disk at its rim. After the bag has come to rest relative to the disk, the angular velocity of the disk is 3.0 rad/s. The bag of sand may be treated as a point mass. What is the mass of the bag of sand?

(a) 11.7 kg
(b) 80.0 kg
C (c) 5.0 kg
(d) 20.0 kg
(e) none of the above

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

(16 pts) 9. One end of a uniform bar that is 6.0 m long is attached to a vertical wall by a frictionless hinge. The bar is held at an angle of 60° above the horizontal by a horizontal rope that is attached to the other end of the bar, as shown in the sketch. If the tension in the rope is 120 N, what is the mass m of the bar?

Ans. 42.4 kg



(16 pts) 10. A large door 2.0 m wide is initially at rest. The door is free to turn about frictionless hinges along one edge. A person applies a constant force $F = 120$ N perpendicular to the door at the edge opposite from the hinges, so a distance of 2.0 m from the line along the hinges. The force remains perpendicular to the door as the door rotates. The door turns through 90° in 4.0 s. What is the moment of inertia of the door for an axis along the hinges?

Ans. 1224 kg·m^2

(18 pts) 11. A block with mass 5.0 kg moves on a horizontal frictionless surface. The block is attached to a horizontal spring that has force constant 90 N/m. As the block moves in simple harmonic motion, its maximum speed is $v = 3.0$ m/s.

a) What is the amplitude of the motion of the block?

Ans. 0.707 m

b) What is the magnitude of the maximum acceleration of the block during its motion?

Ans. 12.7 m/s^2

c) How long does it take the block to move from $x = A$ to $x = 0$?

Ans. 0.370 s