(6 pts) 1. A wheel rotating with constant angular acceleration starts from rest and turns through 8.0 rev in a time of 2.0 s. What is the angular velocity of the wheel at the end of the 2.0 s interval?

(a) 16.0 rev/s 
(b) 8.0 rev/s 
(c) 4.0 rev/s 
(d) 2.0 rev/s 
(e) 1.0 rev/s 
(f) none of the above

(6 pts) 2. A uniform wheel with radius \( r = 0.200 \) m is rotating at constant angular velocity about a stationary axis through its center. The moment of inertia of the wheel for this axis is 8.00 kg\( \cdot \)m\(^2\). If a point on the rim of the wheel has linear speed 4.00 m/s, what is the kinetic energy of the wheel?

(a) 3200 J 
(b) 1600 J 
(c) 128 J 
(d) 2.56 J 
(e) none of the above

(6 pts) 3. A horizontal turntable is rotating at 4.0 rev/s about a vertical frictionless axle at its center. The turntable has a radius of 0.500 m and a moment of inertia of 20 kg\( \cdot \)m\(^2\) for rotation about the axle. A bag of sand is dropped from a very small height onto the rim of the turntable. After the bag has come to rest relative to the turntable, the turntable is rotating at 3.0 rev/s. The bag of sand can be treated as a point mass. What is the mass of the bag of sand?

(a) 53.3 kg 
(b) 80.0 kg 
(c) 107.0 kg 
(d) 6.7 kg 
(e) 25.7 kg 
(f) none of the above
(6 pts) 4. A vertical force $F = 5.0$ N is exerted at one end of a bar that is 4.0 m long. The bar makes an angle of $36.9^\circ$ with the horizontal, as shown in the sketch. For an axis at the other end of the bar, what is the magnitude of the torque on the bar due to the force $F$?

(a) 20.0 N·m
(b) 16.0 N·m
(c) 12.0 N·m
(d) 4.0 N·m
(e) 3.0 N·m
(f) none of the above

(6 pts) 5. A block with mass $m = 6.0$ kg is attached to a horizontal spring with force constant 400 N/m. The block is moving in simple harmonic motion on a horizontal frictionless surface. If the amplitude of the motion is 0.20 m, the period of the motion is 2.0 s. What is the period of the motion if the amplitude is changed to 0.40 m?

(a) 8.0 s
(b) 1.0 s
(c) 4.0 s
(d) 2.0 s
(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) 6. A thin-walled hollow sphere with radius $R = 0.050$ m is released from rest at the top of an incline, a vertical distance of 2.0 m above the bottom of the incline. The moment of inertia of the sphere about the rotation axis through its center is $(2/3)mR^2$. There is sufficient friction for the sphere to roll without slipping. What is the angular velocity of rotation of the sphere when it gets to the bottom of the incline?

Ans. ___________________
(18 pts) 7. A wheel of radius $R = 0.20$ m is mounted with frictionless bearings about an axle through its center. A light rope is wrapped around the wheel and an object of mass $m = 5.0$ kg is suspended from the free end of the rope. When the system is released from rest, the block descends with linear acceleration $a = 2.0$ m/s$^2$.

(5 pts) (a) What is the angular acceleration of the wheel?

Ans. 

(5 pts) (b) While the block is descending, what is the tension in the rope?

Ans. 

(8 pts) (c) What is the moment of inertia of the wheel about an axis at the axle?

Ans.
8. A uniform bar with mass 50 kg and length 4.0 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 at the end of the bar. The other end of the rope is attached to the wall. The rope makes an angle of 30° with the wall.

(a) What is the tension in the rope?

Ans. _________________

(b) What is the magnitude of the resultant force that the hinge exerts on the bar?

Ans. _________________
(18 pts) 9. A block with mass 0.80 kg moves on a horizontal frictionless surface. The block is attached to one end of a horizontal spring and the other end of the spring is attached to the wall. When the block is at \( x = +0.30 \) m, its speed is 6.0 m/s and the magnitude of its acceleration is 12.0 m/s\(^2\).

(9 pts) (a) What is the maximum kinetic energy of the block during its motion and at what value of \( x \) does this occur?

Ans. \( K_{\text{max}} = \) ______________

\[ x = \] ______________

(9 pts) (b) What is the maximum value for the acceleration of the block during its motion and at what value of \( x \) does this occur?

Ans. \( a_{\text{max}} = \) ______________

\[ x = \] ______________