Physics 201 MWF 9:10 Fall 2008 (Ford)

Name (printed)_____

Name (signature as on ID)_____

Lab Section_____

Exam III Chapts. 9–11 in Young& Geller

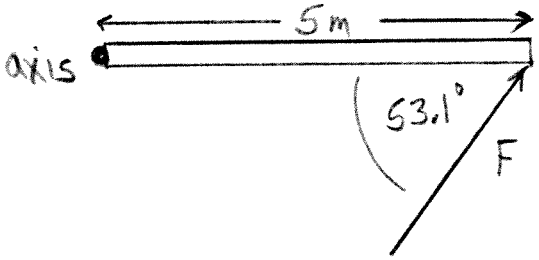
Circle the correct answer. No partial credit will be given.

(5 pts) 1. A block of mass m moves in simple harmonic motion on the end of a horizontal spring that has force constant k. When the amplitude of the motion is $A = 0.20$ m, the frequency of the oscillations is 8 Hz. If the amplitude of the motion is doubled, to 0.40 m, while the mass and the spring remain the same, the frequency becomes

(a) 2 Hz
(b) 4 Hz
(c) 6 Hz
d (d) 8 Hz
(e) 12 Hz
(f) 24 Hz
(g) none of the above

(6 pts) 2. A force $F = 20$ N is exerted at one end of a 5.0 m long bar as shown in the sketch. The force makes an angle of 53.1° with the bar. For an axis at the other end of the bar, the magnitude of the torque due to the force F is

(a) zero
c (b) 60 N·m
(c) 80 N·m
(d) 100 N·m
(e) none of the above



(5 pts) 3. A block moves on the end of a horizontal spring. It takes the block 0.10 s to travel from $x = A$ to $x = 0$. The frequency f of the motion is

(a) 0.10 Hz
(b) 0.25 Hz
(c) 1.0 Hz
(d) 2.0 Hz
(e) 2.5 Hz
(f) 4.0 Hz
(g) 5.0 Hz
(h) 10.0 Hz
(i) none of the above

e

(6 pts) 4. A woman stands on a platform that is free to rotate and she holds a can of beans in each hand. With her arms outstretched, the moment of inertia of the system (woman plus platform plus cans) is 16 kg·m^2 and she is rotating with an angular velocity of 9.0 rad/s. She then pulls the cans in to her side and the moment of inertia of the system becomes 12 kg·m^2. What is her angular velocity after she pulls the cans in to her side?

(a) 10.4 rad/s
(b) 12.0 rad/s
(c) 16.0 rad/s
(d) 27.7 rad/s
(e) 32.0 rad/s
(f) 42.7 rad/s
(g) none of the above

b

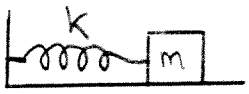
(6 pts) 5. Starting from rest a disk rotates through 20 radians in 4.0 s. The angular acceleration is constant. If the disk has radius 0.30 m, what is the tangential acceleration of a point on its rim at the instant when the disk has turned through 20 radians?

(a) 2.50 m/s^2
(b) 1.25 m/s^2
(c) 1.00 m/s^2
(d) 0.75 m/s^2
(e) zero
(f) none of the above

d

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

(18 pts) 6. A block with mass 0.50 kg moves on a horizontal frictionless surface. The block is attached to one end of a horizontal spring that has force constant $k = 120$ N/m and the other end of the spring is attached to a wall. When the block is at $x = -0.40$ m its speed is 4.0 m/s.



(a) What is the maximum speed of the block during its motion?

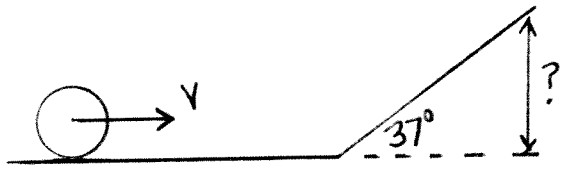
Ans. 7.38 m/s

(b) What is the maximum magnitude of the force that the spring exerts on the block during its motion?

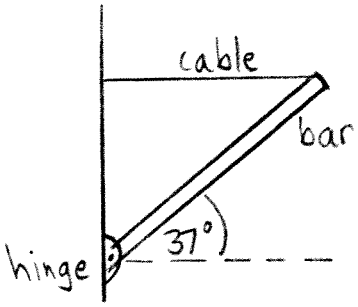
Ans. 57.1 N

(18 pts) 7. A thin-walled hollow sphere with mass 5.0 kg and radius 0.20 m is rolling without slipping at the base of an incline that slopes upward at 37° above the horizontal. At the base of the incline the translational speed of the center of mass of the sphere is $v = 12.0$ m/s. If the sphere rolls without slipping as it travels up the incline, what is the maximum vertical height that it reaches before it starts to roll back down?

Ans. 12.2 m



(18 pts) 8. A uniform bar has mass 30 kg and length 6.0 m. One of the bar is attached to a vertical wall by a frictionless hinge. A light horizontal cable connects the other end of the bar to the wall and holds the cable at an angle of 37° above the horizontal.



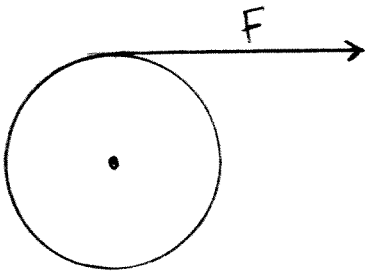
(a) What is the tension in the cable?

Ans. 196 N

(b) If the cable is cut, what is the magnitude of the angular acceleration of the bar just after the cable is cut?

Ans. 1.96 rad/s^2

(18 pts) 9. A uniform disk with mass 40 kg and radius 0.20 m is pivoted at its center about a horizontal frictionless axle. The disk is initially at rest and then a constant force of $F = 30$ N is applied tangent to the rim of the disk.



(a) What is the magnitude v of the tangential velocity of a point on the rim of the disk after the disk has turned through 0.20 revolutions?

Ans. 0.869 m/s

(b) What is the magnitude a of the resultant linear acceleration of a point on the rim of the disk after the disk has turned through 0.20 revolutions?

Ans. 4.07 m/s^2