

Instructor(s): C. Parks

PHYSICS DEPARTMENT
EXAM 2

July 10, 2013

Name (print, last first): _____

Signature: _____

*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**

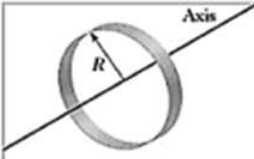
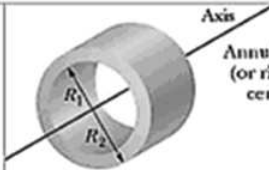
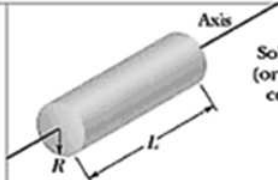
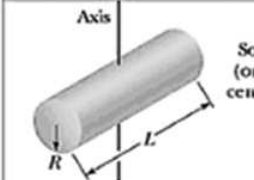
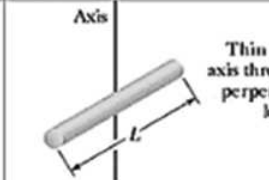
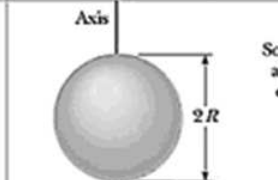
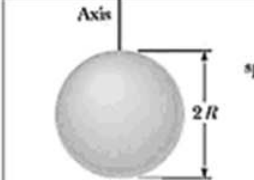
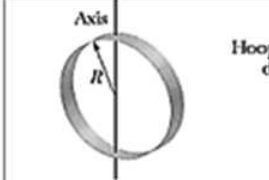
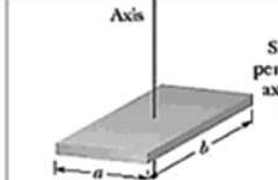
- (1) Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number). Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY.** Code your UFID number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
- (4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink.** Do not make any stray marks or some answers may be counted as incorrect.
- (5) **The answers are rounded off. Choose the closest to exact.** There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.
- (6) Hand in the answer sheet separately.

Given Information:

$g = 9.80 \text{ m/s}^2$

$1 \text{ m} = 100 \text{ cm}$

$1 \text{ kW} = 1000 \text{ W}$

 <p>Hoop about central axis</p> <p>$I = MR^2$ (a)</p>	 <p>Annular cylinder (or ring) about central axis</p> <p>$I = \frac{1}{2}M(R_1^2 + R_2^2)$ (b)</p>	 <p>Solid cylinder (or disk) about central axis</p> <p>$I = \frac{1}{2}MR^2$ (c)</p>
 <p>Solid cylinder (or disk) about central diameter</p> <p>$I = \frac{1}{4}MR^2 + \frac{1}{12}ML^2$ (d)</p>	 <p>Thin rod about axis through center perpendicular to length</p> <p>$I = \frac{1}{12}ML^2$ (e)</p>	 <p>Solid sphere about any diameter</p> <p>$I = \frac{2}{5}MR^2$ (f)</p>
 <p>Thin spherical shell about any diameter</p> <p>$I = \frac{2}{3}MR^2$ (g)</p>	 <p>Hoop about any diameter</p> <p>$I = \frac{1}{2}MR^2$ (h)</p>	 <p>Slab about perpendicular axis through center</p> <p>$I = \frac{1}{12}M(a^2 + b^2)$ (i)</p>

1. A 2-kg block slides down an plane inclined at 36.9° with the horizontal. The block slides 10 m along the incline. How much work is done by the normal force acting on the block?
(1) None of these. (2) 200 J (3) 120 J (4) 160 J (5) 16 J

2. A 4-N force acts on a 2-kg block for 6 s. The 2-kg block starts from rest and acquires kinetic energy after the force acts. At what height should a 3-kg block be placed so that it has the same potential energy as the 2-kg block?
(1) 4.9 m (2) 16 m (3) 3.3 m (4) 7.3 m (5) None of these.

3. A 0.1-kg ball is thrown at 8 m/s from a 10 m tower. What is its speed when it is 5 m above the ground?
(1) 13 m/s (2) 10 m/s (3) 160 m/s (4) 16 m/s (5) None of these.

4. Starting at 2 m/s, a 65-kg man riding a 10-kg bicycle coasts down a 10 m tall hill. At the bottom of the hill he applies the brakes. The brakes exert a constant 150-N frictional force to the bicycle. How far does the bicycle travel before it stops?
(1) 50 m (2) 49 m (3) 6 m (4) 7 m (5) None of these.

5. The length of a spring increases by 7 cm from its relaxed length when a mass of 1.4 kg is hanging in equilibrium from the spring. Another mass is added and when the spring is in equilibrium, its length increases by an additional 10 cm. What is the value of the added mass?
(1) 2.0 kg (2) 3.4 kg (3) 0.6 kg (4) 1.8 kg (5) None of these.

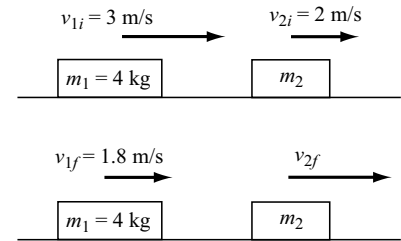
6. It takes a force of 80 N to compress a spring 0.196 m. A 0.20-kg ball is placed on the spring and the spring launches the ball vertically up. How far above the starting height will the ball rise after it is launched?
(1) 4.0 m (2) 1.0 m (3) 2.0 m (4) 3.0 m (5) None of these.

7. A 1500-kg car coasts down a 2.0° hill. The car attains a terminal speed of 20.0 m/s. How much power must the engine deliver to drive the car on a level road at 20.0 m/s?
(1) 10 kW (2) 290 kW (3) 1.0 kW (4) 20 kW (5) None of these.

8. A 2-kg mass has a 5 m/s velocity to the right. A 20-N force acts to the left for 4 seconds on the mass. What is the linear momentum of the mass after the force acts on it?
(1) 70 kg-m/s to the left
(2) 70 kg-m/s to the right
(3) 90 kg-m/s to the left
(4) 90 kg-m/s to the right
(5) None of these.

9. A 5-kg block is initially at rest. It explodes into two pieces, one piece 2 kg and the other 3 kg. The 2-kg piece is moving at 10 m/s to the left. What is the velocity of the 3-kg piece just after the explosion?
(1) 6.7 m/s to the right (2) 6.7 m/s to the left (3) 15 m/s to the right (4) 15 m/s to the left (5) 0 m/s

10. A 4-kg block travelling at 3 m/s collides elastically with another mass moving at 2 m/s in the same direction as shown. Since the masses are traveling in the same direction, the collision can be considered one dimensional. After the collision, the 4-kg block is moving in the same direction at 1.8 m/s and the other block is traveling in the same direction as well. What is the mass of the other block?



- (1) 6.0 kg
 (2) 0.55 kg
 (3) 3.7 kg
 (4) Cannot be determined without knowing the final speed of the other block.
 (5) None of these.

11. A 10-kg block slides to the right at 5.0 m/s. A second block slides to the left at 3.0 m/s. The blocks collide. After the collision, the 10-kg block is at rest, while the second block rebounds to the right with a speed of 2 m/s. What is the mass of the other block?

- (1) 10 kg (2) 4.5 kg (3) 50 kg (4) 15 kg (5) None of these.

12. A 1200-kg car traveling north collides with a 1500-kg truck traveling east. After the collision, the vehicles stick together and travel at 45° north of east. The car's speed before the collision is 15 m/s. What is the speed of the truck before the collision?

- (1) 12 m/s (2) 15 m/s (3) 20 m/s (4) 19 m/s (5) Cannot be determined.

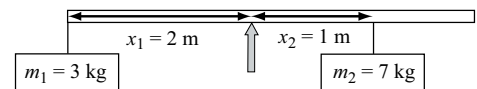
13. Two particles *A* and *B* of equal mass are located at some distance from each other. Particle *A* is at rest while *B* moves away from *A* at speed v . What happens to the center of mass of the system of two particles?

- (1) It moves away from *A* with speed $v/2$.
 (2) It moves away from *A* with speed v .
 (3) It moves towards *A* with speed $v/2$.
 (4) It moves towards *A* with speed v .
 (5) It does not move.

14. A solid disk rotating at 30 rad/s has a kinetic energy of 50 J. What is the rotational inertia of the disk?

- (1) 0.11 kg-m² (2) 0.33 kg-m² (3) 3.0 kg-m² (4) 9.0 kg-m² (5) None of these.

15. What is the net torque on the beam? Assume the beam is massless.



- (1) 9.8 N-m clockwise
 (2) 9.8 N-m counterclockwise
 (3) 130 N-m clockwise
 (4) 130 N-m counterclockwise
 (5) None of these.

16. A 10-kg, 3-m long ladder leans against the wall. The ladder makes a 25° angle with the wall, not the floor. What is the frictional force of the ground against the ladder? Assume the wall is frictionless and that the center of mass of the ladder is at the middle of the ladder.

- (1) 23 N (2) 49 N (3) 105 N (4) 46 N (5) None of these.

17. A solid sphere has a radius of 0.30 m and a mass of 1.5 kg. A 8.1 N-m torque acts on the sphere. What is the angular acceleration of the sphere?

- (1) 150 rad/s² (2) 60 rad/s² (3) 120 rad/s² (4) 90 rad/s² (5) None of these.

18. A spherical shell rolls down a hill. The hill is 20 m high and the spherical shell rolls without slipping. What is the shell's speed at the bottom of the hill if it starts from rest?
- (1) 15 m/s (2) 14 m/s (3) 16 m/s (4) 17 m/s (5) Cannot be determined.
19. A thin ring rotating at 300 rad/s about its axis has an angular momentum of 50 kg-m²/s. If the mass of the ring is 0.5 kg, what is its radius?
- (1) 0.58 m (2) 0.82 m (3) 0.91 m (4) 0.71 m (5) None of these.
20. The sun rotates once every 30 days. How long would it take the sun to rotate if its radius doubled (and its mass was unchanged)? Model the sun as a uniform solid sphere and assume that the angular momentum of the sun is conserved.
- (1) 120 days (2) 60 days (3) 15 days (4) 7.5 days (5) None of these.