Instructor(s): *Mueller/Rinzler*

PHYSICS DEPARTMENT

PHY 2048 Exam 2 November 4, 2008

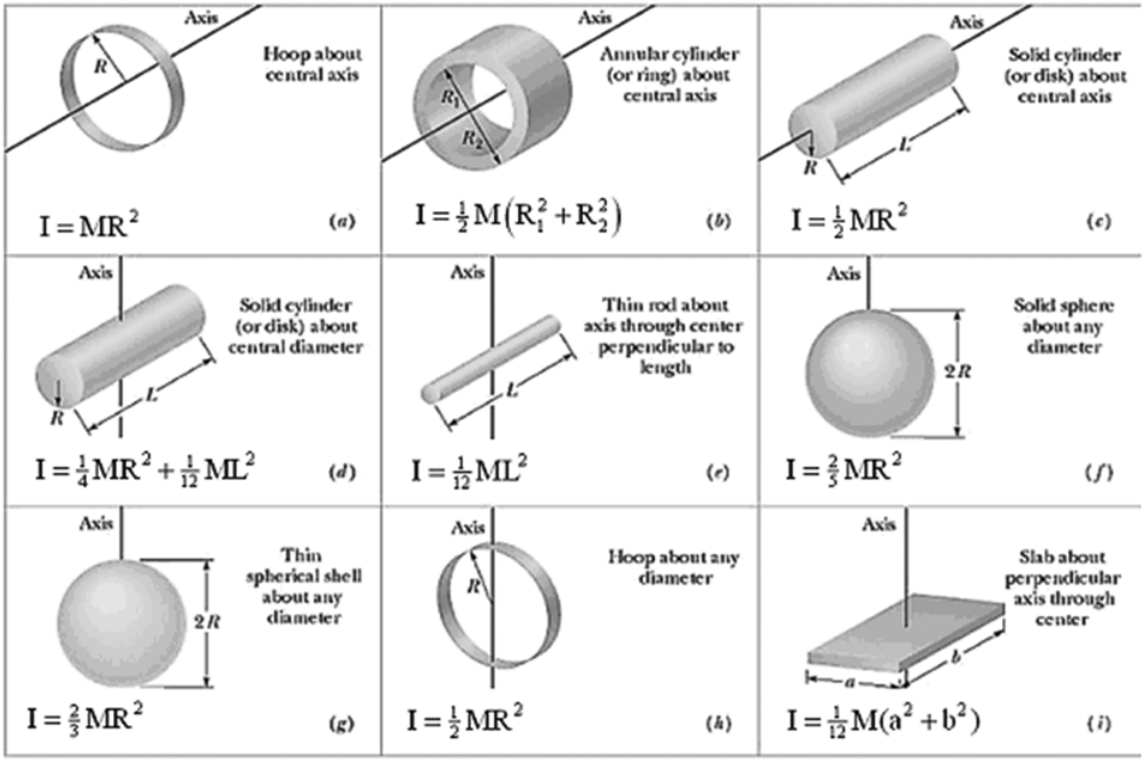
Name (print, last first): _____ Signature: _____

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.
(6) **Hand in the answer sheet separately.**

Where needed use $g = 9.80$ m/s^2



1. The weight of an object on the moon is one-sixth of its weight on Earth. The ratio of the kinetic energy of a body on Earth moving with speed V to that of the same body moving with speed V on the moon is:

   (1) 1:1 (2) 6:1 (3) 36:1 (4) 1:6 (5) 1:36

2. An object of mass 1 kg is whirled in a horizontal circle of radius 0.5 m at a constant speed of 2 m/s. The work done on the object during one revolution is:

   (1) 0 J (2) 1 J (3) 2 J (4) 4 J (5) 16 J

3. Camping equipment weighing 6,000 N is pulled across a frozen lake by means of a horizontal rope. The coefficient of kinetic friction is 0.05. How much work is done by the campers in pulling the equipment 1,000 m if its speed is increasing at the constant rate of 0.20 m/s^2?

   (1) 4.2×10^5 J (2) -4.2×10^5 J (3) 1.8×10^5 J (4) 3.0×10^5 J (5) 1.2×10^5 J

4. At time $t = 0$ a 2-kg particle has a velocity of $(4m/s)\hat{i} - (3m/s)\hat{j}$. At $t = 3$ s its velocity is $(2m/s)\hat{i} + (3m/s)\hat{j}$. During this time the work done on it was:

   (1) -12 J (2) 4 J (3) -4 J (4) -40 J (5) 0 J

5. A cave rescue team lifts an injured spelunker directly upward and out of a sinkhole by means of a motor-driven cable. The lift is performed in three stages, each requiring a vertical distance of 10.0 m: (a) the initially stationary spelunker is accelerated to a speed of 6.0 m/s; (b) he is then lifted at the constant speed of 6.0 m/s; (c) finally he is decelerated to zero speed. How much *net* work is done on the 80.0 kg spelunker by the force lifting him during the overall rescue?

   (1) 23,520 J (2) 229,280 J (3) 6,400 J (4) 26,400 J (5) 0 J

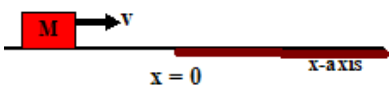
6. A horizontal force of magnitude 35 N pushes a block of mass 4 kg across a floor where the coefficient of kinetic friction is 0.6. If the thermal energy of the block increases by 40 J when the block slides through a displacement of 5 m across the floor, what is the increase in the kinetic energy of the block?

   (1) 57.4 J (2) 135 J (3) 40 J (4) 17.4 J (5) 0 J

7. A stone of mass M rests on an elastic spring which is compressed a distance of 1 cm by the stone. The stone is pushed down an additional distance of 3 cm and then released. What is the maximum height reached by the stone relative to the release point?

   (1) 8 cm (2) 16 cm (3) 4 cm (4) 12 cm (5) need to know the spring constant k

8. Near the surface of the Earth a block of mass M and initial velocity 9.8 m/s is sliding to the right along the (negative) x- axis as shown. The surface is frictionless for $x < 0$ and has a kinetic coefficient of friction of 0.5 for $x \geq 0$. At what point x does the block come to a stop?



   (1) $x = 9.8$ m (2) $x = 4.9$ m (3) $x = 19.6$ m (4) $x = -4.9$ m (5) $x = 0.0$ m

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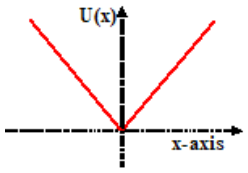
9. A particle moves along the x-axis under the influence of a conservative force. The potential energy is given by U(x) = (5.0 J/m)$|x|$, where x is in meters as shown in the figure (*i.e.*, if $x \geq 0$, U(x) =(5.0J/m)x and if $x < 0$, U(x) =−(5.0J/m)x). If the total mechanical energy is 20 J, the limits of motion are:

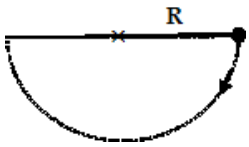


(1) −4.0 m; 4.0 m (2) −2.0 m; 2.0 m (3) 0 m; 4.0 m (4) −5.0 m; 5.0 m (5) −4.0 m; 0 m

10. A 4-kg particle moves along the x-axis under the influence of a conservative force. The potential energy is given by U(x) = (8.0 J/m^3)x^3, where x is in meters. What is the magnitude of the acceleration of the particle when it is at $x = 2$ m? (*Hint:* remember that $F_x = -dU/dx$)

(1) 24 m/s^2 (2) 12 m/s^2 (3) 8 m/s^2 (4) 64 m/s^2 (5) 0 m/s^2

11. A small object of mass m, on the end of a light cord, is held horizontally at a distance R from a fixed support as shown. The object is then released. What is the tension force of the cord when the object is at the lowest point of its swing?



(1) 3mg (2) mg (3) 2mg (4) mgR (5) 4mg

12. A child, riding on a large merry-go-round, travels a distance of 3,000 m in a circle of diameter 40 m. The total angle through which she revolves is:

(1) 150 rad (2) 50 rad (3) 75 rad (4) 314 rad (5) 120 rad

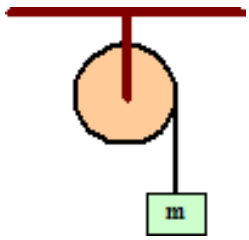
13. A wheel initially has an angular velocity of 18 rad/s but it is slowing at a rate of 2.0 rad/s^2. By the time it stops it will have turned through:

(1) 81 rad (2) 160 rad (3) 245 rad (4) 330 rad (5) 410 rad

14. A particle moves in a circular path of radius 0.10 m with a constant angular speed of 5 rev/s. The acceleration of the particle is:

(1) $10\pi^2$ m/s^2 (2) $0.1\pi^2$ m/s^2 (3) 0.5 m/s^2 (4) 500π m/s^2 (5) $1000\pi^2$ m/s^2

15. A 16-kg block is attached to a cord that is wrapped around the rim of a flywheel of diameter 0.40 m and hangs vertically, as shown. The rotational inertia of the flywheel is 0.50 kg·m^2. When the block is released and the cord unwinds, the acceleration of the block is:

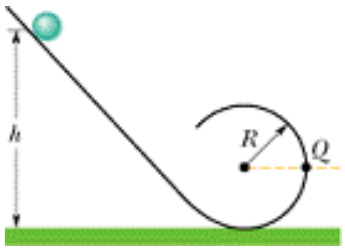


(1) 0.56g (2) 0.15g (3) 0.84g (4) g (5) 1.3g

16. A 5.0 g bullet moving at speed v strikes a 500 g wooden block at rest on a frictionless surface. The bullet emerges, traveling in the same direction with its speed reduced to $v/2$. What is the resulting speed of the block?

(1) $v/200$ (2) $v/100$ (3) $v/500$ (4) $v/2$ (5) $v/50$

17. A solid brass ball of mass M, radius r, and rotational inertia $I = 2Mr^2/5$ will roll smoothly along a loop-the-loop track when released from rest along the straight section. The circular loop has radius R, and the ball has radius $r << R$. What is h if the ball is on the verge of leaving the track when it reaches the top of the loop?

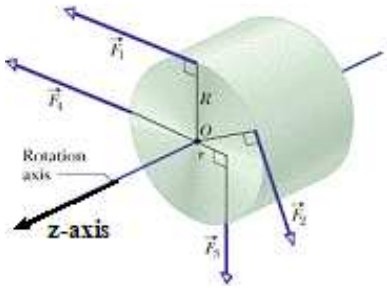


(1) $27R/10$ (2) $7R/5$ (3) $2R$ (4) $5R/2$ (5) need to know M

18. At $t = 0$ a 2 kg particle is located at $\vec{r} = (2m)\hat{i} + (4m)\hat{j}$), and its velocity is $\vec{v} = -(6m/s)\hat{i} + (3m/s)\hat{j}$, and it is subject to the force $\vec{F} = (6N)\hat{i} - (8N)\hat{j}$. The magnitude of the angular momentum of the particle about the origin and the magnitude of the torque about the origin are, respectively:

(1) 60 kg·m^2/s; 40 N·m (2) 30 kg·m^2/s; 40 N·m (3) 60 kg·m^2/s; 24 N·m (4) 30 kg·m^2/s; 24 N·m (5) 24 kg·m^2/s; 16 N·m

19. A solid cylinder having a mass of 2 kg can rotate about its central axis through point O (*i.e.*, z-axis as shown). Forces are applied as shown with $F_1 = 3.0$ N, $F_2 = 1.0$ N, $F_3 = 8.0$ N, and $F_4 = 10.0$ N. Also, $r = 5.0$ cm and $R = 20.0$ cm. Taking the clockwise direction to be negative, find the angular acceleration of the cylinder.



(1) 0 rad/s^2 (2) 20.0 rad/s^2 (3) -20.0 rad/s^2 (4) 40.0 rad/s^2 (5) -40.0 rad/s^2

20. The coefficient of static friction between a certain cylinder with radius R and a horizontal floor is 0.40. If the rotational inertia of the cylinder about its symmetry axis is given by $I = MR^2/2$, then the magnitude of the maximum acceleration the cylinder can have without sliding is:

(1) 0.8g (2) 0.1g (3) 0.2g (4) 0.4g (5) g