Instructor(s): *Saab/Sabin*

PHYSICS DEPARTMENT

PHY 2048 Exam 2 October 26, 2010

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.

ANSWER 1 is correct choice for all problems

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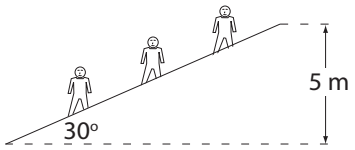
1. When a certain rubber band is stretched a distance x, it exerts a restoring force $F = ax + bx^2$, where a and b are constants. The work done in stretching this rubber band from $x = 0$ to $x = L$ is:

   (1) $aL^2/2 + bL^3/3$ (2) $aL + 2bL^2$ (3) $a + 2bL$ (4) bL (5) $aL^2 + bLx^3$

2. An object is constrained by a cord to move in a circular path of radius 0.5 m on a horizontal fictionless surface. The cord will break if its tension exceeds 16 N. The maximum kinetic energy the object can have is:

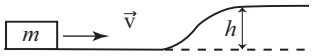
   (1) 4 J (2) 8 J (3) 16 J (4) 32 J (5) 64 J

3. An escalator is used to move 20 people (60 kg each) per minute from the first floor of a department store to the second floor, 5 m above. Neglecting friction, the power required is approximately:



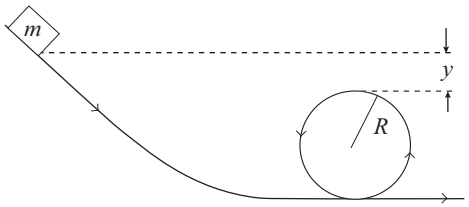
   (1) 1000 W (2) 100 W (3) 200 W (4) 2000 W (5) 60,000 W

4. For a block of mass m to slide without friction up the rise of height h shown, it must have a minumum initial speed of:



   (1) $\sqrt{2gh}$ (2) $1/2\sqrt{gh}$ (3) $\sqrt{gh/2}$ (4) $2\sqrt{2gh}$ (5) $2\sqrt{gh}$

5. A small object of mass m starts from rest at the position shown and slides along the frictionless loop-the-loop track of radius R. What is the smallest value of y such that the object will slide without losing contact with the track?



   (1) $R/2$ (2) $R/4$ (3) R (4) $2R$ (5) zero

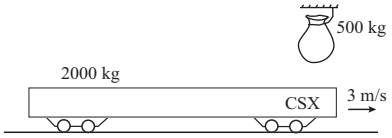
6. The potential energy of a body of mass m is given by $U = -mgx + \frac{1}{2}kx^2$. The corresponding force is:

   (1) $mg - kx$ (2) $-mgx^2/2 + kx^3/6$ (3) $mgx^2/2 - kx^3/6$ (4) $-mg + kx/2$ (5) $-mg + kx$

7. Block A, with a mass of 4 kg, is stationary, while block B, with a mass of 8 kg, is moving at 3 m/s. The center of mass of the two block system has a speed in m/s of:

   (1) 2 (2) 0 (3) 1.5 (4) 3 (5) 12

8. A 500-kg sack of coal is dropped on a 2000-kg railroad flatcar which was initially moving at 3 m/s as shown. After the sack rests on the flatcar, the speed of the flatcar is:



   (1) 2.4 m/s (2) 0.6 m/s (3) 1.2 m/s (4) 1.8 m/s (5) 3.6 m/s

9. A cart loaded with sand slides along a horizontal frictionless track. As the car moves, sand trickles out at a constant rate through a hole in the back of the cart. The speed of the cart will:

(1) remain the same
(2) decrease at a constant rate
(3) increase at a constant rate
(4) decrease at a variable rate
(5) increase at a variable rate

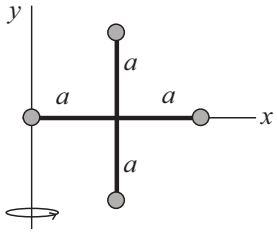
10. The angular speed in rad/s of the second hand of a watch is:

(1) $\pi/30$ (2) $\pi/1800$ (3) $\pi/60$ (4) 2π (5) 60

11. String is wrapped around the periphery of a 5.0-cm radius cylinder, free to rotate on its axis. If the string is pulled out at a constant rate of 10 cm/s and does not slip ont he cylinder, the angular velocity of the cylinder, in rad/s, is:

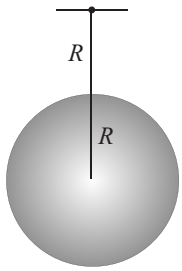
(1) 2.0 (2) 5.0 (3) 10 (4) 25 (5) 50

12. Four identical particles, each with mass m, are arranged in the x, y plane as shown. They are connected by light sticks to form a rigid body. If $m = 2.0$ kg and $a = 1.0$ m, the rotational inertia of this array about the y axis is:



(1) 12 kg·m^2
(2) 4.0 kg·m^2
(3) 9.6 kg·m^2
(4) 4.8 kg·m^2
(5) none of these

13. A sphere of radius R and mass M has a rotational inertia about a diameter that is given by $\frac{2}{5}M/R^2$. A string of length R is attached to the surface and used to suspend the sphere from the ceiling. Its rotational inertia about the point of attachment at the ceiling is given by XMR^2 where X is:



(1) 4.4
(2) 0.4
(3) 1.4
(4) 2.4
(5) 0.8

14. The coefficient of static friction between a certain cylinder lying lengthwise and a horizontal floor is 0.40. If the rotational inertia of the cylinder about its symmetry axis is given by $I = \frac{1}{2}MR^2$, then the maximum acceleration the cylinder can have without slipping is:

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

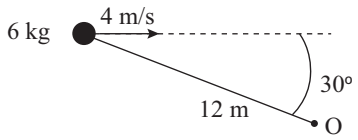
15. A thin-walled hollow tube rolls without slipping along the floor. The ratio of its translational kinetic energy to its rotational kinetic energy (about an axis through its center of mass) is:

(1) 1 (2) 2 (3) 3 (4) $\frac{1}{2}$ (5) $\frac{1}{3}$

16. A hoop has a mass of 200 g and a radius of 25 cm. It rolls without slipping along level ground at 500 cm/s. Its total kinetic energy, in J, is:

(1) 5 (2) 2.5 (3) 10 (4) 250 (5) need to be told the angular velocity

17. A 6-kg particle moves to the right at 4 m/s as shown. Its angular momentum in kg·m^2/s^2 about the point O is:



(1) 144 (2) zero (3) 288 (4) 24 (5) 249

18. A firecracker is placed between two cans of mass m_1 and m_2 respectively, where $m_1 = 2m_2$. Find the ratio of their kinetic energies, E_1/E_2, immediately after the firecracker explodes.

(1) $\frac{1}{2}$ (2) 1 (3) $\frac{1}{4}$ (4) $\frac{1}{8}$ (5) 2

19. A 0.1 kg ice cube (no friction), slides along a horizontal surface with velocity 6 m/s and hits a stationary ice cube of mass 0.2 kg. The two stick together, then slide up a 30° slope to a height (measured vertically) of h. Find h.

(1) 0.2 m (2) 0.1 m (3) 0.6 m (4) 0.3 m (5) 0.4 m

20. Two objects of mass m_1 and m_2 have the same kinetic energies. Find the ratio of their momenta, p_1/p_2.

(1) $\sqrt{m_1/m_2}$ (2) m_1/m_2 (3) $(m_1/m_2)^2$ (4) m_2/m_1 (5) $(m_2/m_1)^2$