

Instructor(s): *Saab/Sabin*PHYSICS DEPARTMENT
Exam 2

PHY 2048

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.
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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:

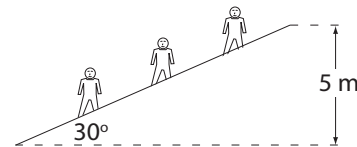
(1) $aL^2/2 + bL^3/3$ (2) $aL + 2bL^2$ (3) $a + 2bL$ (4) bL (5) $aL^2 + bLx^3$

2. An object is constrained by a cord to move in a circular path of radius 0.5 m on a horizontal frictionless 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

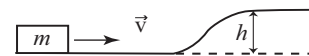
3. An escalator is used to move 20 people (60 kg each) per minute from the first floor of a department store to the second floor, 5 m above. Neglecting friction, the power required is approximately:

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



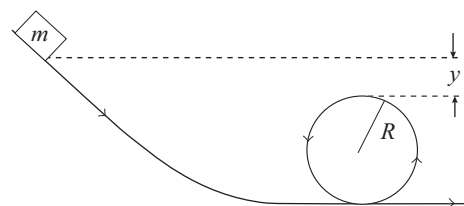
4. For a block of mass m to slide without friction up the rise of height h shown, it must have a minimum initial speed of:

(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:

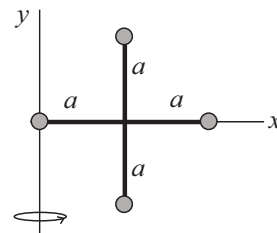
- (1) $\pi/30$
- (2) $\pi/1800$
- (3) $\pi/60$
- (4) 2π
- (5) 60

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 on the cylinder, the angular velocity of the cylinder, in rad/s, is:

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

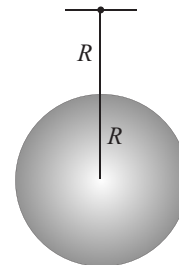
12. Four identical particles, each with mass m , are arranged in the x, y plane as shown. They are connected by light sticks to form a rigid body. If $m = 2.0$ kg and $a = 1.0$ m, the rotational inertia of this array about the y axis is:

- (1) $12 \text{ kg}\cdot\text{m}^2$
- (2) $4.0 \text{ kg}\cdot\text{m}^2$
- (3) $9.6 \text{ kg}\cdot\text{m}^2$
- (4) $4.8 \text{ kg}\cdot\text{m}^2$
- (5) none of these



13. A sphere of radius R and mass M has a rotational inertia about a diameter that is given by $\frac{2}{5}MR^2$. 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

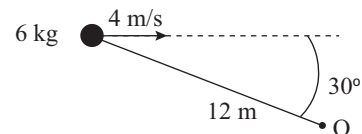
15. A thin-walled hollow tube rolls without slipping along the floor. The ratio of its translational kinetic energy to its rotational kinetic energy (about an axis through its center of mass) is:

- (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 $\text{kg}\cdot\text{m}^2/\text{s}^2$ 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) $(m_2/m_1)^2$