Instructor(s): *C. Parks*

PHYSICS DEPARTMENT

PHY2053, Summer 2012   EXAM 2   July 18, 2012

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

On my honor, I have neither given nor received unauthorized aid on this examination.

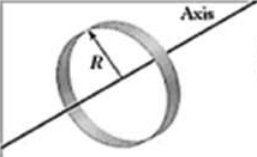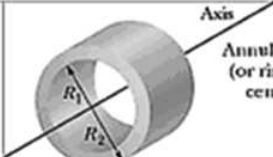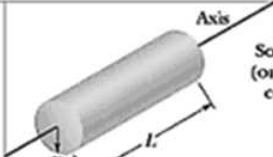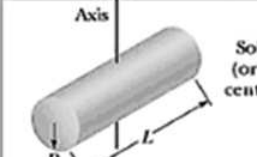**YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**
(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number).**
Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
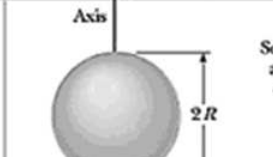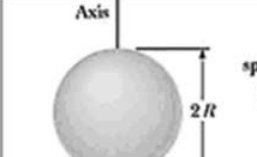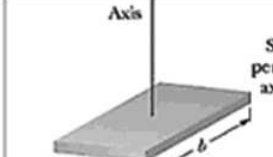(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or <u>blue</u> or <u>black</u> 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.**
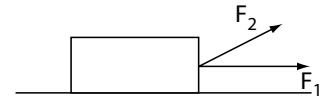(6) Hand in the answer sheet separately.
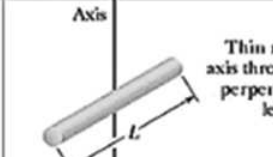
<u>Given Information:</u>

$g = 9.80$ m/s^2 density of water $= 1000$ kg/m^3 1 atmosphere $= 1.01 \times 10^5$ Pa

1. The block shown in the diagram slides at constant speed to the right. How much work is done by kinetic friction after the block has traveled 6 m? F_1 is 10 N and F_2 is 15 N and it points at $37°$ above the horizontal.

   (1) -130 J   (2) -60 J   (3) -72 J   (4) -90 J   (5) None of these.

2. A roller coaster is traveling at 3 m/s when it is 60 m above the ground. What is the speed when the roller coaster is 30 m above the ground? Assume that friction and air resistance can be ignored.

   (1) 24 m/s (2) 6 m/s (3) 34 m/s (4) 12 m/s (5) Cannot be determined without knowing the mass of the roller coaster.

3. A 45-kg boy drags his 15-kg sled to the top of a 15-m tall hill. He rides down the hill (with no friction or air resistance) and then applies brakes over a level section of ground, stopping over a distance of 44 m. What is the average braking force exerted on the sled?

   (1) 200 N   (2) 150 N   (3) 49 N   (4) 590 N   (5) None of these.

4. It takes a force of 80 N to compress a spring of a toy popgun 0.20 m to load a 0.018-kg ball. With what speed will the ball leave the gun?

   (1) 30 m/s   (2) 42 m/s   (3) 60 m/s   (4) 20 m/s   (5) None of these.

5. A car with mass of 1000 kg accelerates from 10 m/s to 40 m/s in 10 s. Ignore air resistance. The engine has 22% efficiency, which means that 22% of the energy released by the burning gasoline is converted into mechanical energy. What is the average mechanical power output of the engine?

   (1) 7.5×10^4 W   (2) 7.5×10^5 W   (3) 8.0×10^4 W   (4) 1.65×10^4 W   (5) None of these.

6. In Super Smash Brothers, Peach uses her vegetable attack to hold off Bowser. She throws the turnip at Bowser and it bounces back. Assume the turnip has a mass of 1.5 kg. When it hits Bowser, it is traveling at 6 m/s and when it bounces back it is traveling at 2 m/s. If the turnip is in contact with Bowser for 0.2 s, what is the average force exerted by the turnip on Bowser?
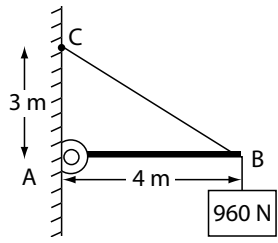
   (1) 60 N   (2) 30 N   (3) 5.2 m/s   (4) 16 m/s   (5) None of these.

7. A 15-kg rocket is traveling horizontally at 40 m/s. The rocket explodes, breaking into two pieces. The 5-kg piece is traveling at 60 m/s in the same direction as the original intact rocket. What is the velocity of the other piece?

   (1) 30 m/s in the same direction as the intact rocket
   (2) 30 m/s in the opposite direction as the intact rocket
   (3) 40 m/s in the same direction as the intact rocket
   (4) 40 m/s in the opposite direction as the intact rocket
   (5) None of these.

8. A 2-kg mass sliding at 5 m/s collides elastically with a 3-kg mass sliding at 2 m/s as shown in the diagram. The collision is in a straight line, so it can be considered to me a one-dimensional collision. What is the speed of the 3-kg mass after the collision?
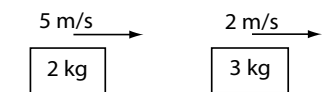
   (1) 4.4 m/s   (2) 1.4 m/s   (3) 3.2 m/s   (4) 5.0 m/s   (5) None of these.

9. While driving down Museum Road, you see Mr. Parks crossing the road. Seeing your opportunity, you accelerate your car (1200 kg) from 9.0 m/s (about 20 miles/hour) to 15 m/s. Unfortunately, you do not see another car (mass of 1500 kg) pull out in front of you at 10 m/s. The cars are traveling perpendicular when they collide and they stick together after the collision. What is the speed of the cars immediately after they collide?

(1) 8.7 m/s   (2) 12 m/s   (3) 9,4 m/s   (4) 13 m/s   (5) None of these.

10. A uniform 2-m long rod has a 3 kg mass. Another mass is attached to the left end of the rod. The center of mass of the system is now 25 cm to the left of the center of the rod. What is the value of the attached mass?

(1) 1 kg   (2) 2 kg   (3) 3 kg   (4) 4 kg   (5) None of these.

11. A 3-kg uniform disk has a radius of 0.6 m. An additional 1-kg mass is glued to the edge of the disk. What is the rotational inertia of the combination if the disk/mass combination rotates about the center of the disk?

(1) 0.90 kg-m^2 (2) 0.54 kg-m^2 (3) 0.36 kg-m^2 (4) 0.72 kg-m^2 (5) None of these.

12. A 960-N block is suspended as shown. The beam is weightless and is hinged to the wall. The tension in the cable BC has magnitude

(1) 1600 N
(2) 720 N
(3) 1200 N
(4) 1280 N
(5) None of these.

13. A 100-kg thin circular hoop has radius 2 m. Its angular velocity decreases from 20 rad/s to zero in 200 s due to friction. What is the frictional torque acting on the hoop?

(1) 40 N-m   (2) 20 N-m   (3) 16 N-m   (4) 27 N-m   (5) None of these.

14. A solid sphere, a solid cylinder, and a hollow cylindrical ring all have the same masses and outer radii. They are released simultaneously from the top of a ramp and they roll without slipping to the bottom. In what order do they arrive at the bottom?

(1) sphere, cylinder, ring
(2) cylinder, sphere, ring
(3) ring, cylinder, sphere
(4) ring, sphere, cylinder
(5) They all arrive at the same time.

15. A figure skater is in a position where he spins once in 1.8 seconds. If he pulls his arms and legs in so that his rotational inertia is reduced by one half, how long does it take for him to spin one time?

(1) 0.90 s   (2) 3.6 s   (3) 1.8 s   (4) 2.7 s   (5) None of these.

16. I decided to drop the Pascal's principle question since no homework was assigned from that section. Were you assigned homework on Pascal's principle?

(1) no   (2) yes   (3) yes   (4) yes   (5) None of these.

17. You swim in a lake to a depth of 2 m. At what depth will you experience twice that pressure. Hint: Do not forget to include the effect of the atmosphere.

    (1) 14 m   (2) 4 m   (3) 10 m   (4) 8 m   (5) None of these.

18. A metal has a density of 3000 kg/m^3. What is the buoyant force acting on a 15-kg block of metal?

    (1) 49 N   (2) 150 N   (3) 100 N   (4) 440 N   (5) None of these.

19. As shown in the diagram, a pipe with constant diameter is bent into a large S shape. The top of the pipe is 6 m above the bottom of the pipe and it is open to the atmosphere. The pressure at the upper end would be one atmosphere. What is the pressure at the lower end of the pipe?
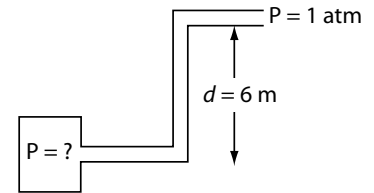
    (1) 1.6×10^5 Pa
    (2) 1.0×10^5 Pa
    (3) 1.3×10^5 Pa
    (4) Cannot be determined without knowing the speed of the water in the pipe.
    (5) None of these.

20. Use Poiseuille's law to find the pressure gradient ($\Delta P/L$) in a 5-cm diameter fire hose delivering water at 2.3×10^{-2} m^3/s. The viscosity of water is 1.0×10^{-3} Pa-s.

    (1) 150 Pa/m   (2) 6.7×10^{-3} Pa/m   (3) 12 Pa/m   (4) 9.4×10^{-2} Pa/m   (5) None of these.