PHYSICS DEPARTMENT

PHY 2053 Practice Exam April 24, 2001

B. Whiting

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.

DIRECTIONS

(1) **Code your test number on your green answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. **Darken circles completely (errors can occur if too light)**. Code your student 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. 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 with scratch work most questions demand.
(4) **Blacken the circle of your intended answer completely, using a number 2 pencil**. Do not make any stray marks or the answer sheet may not read properly.
(5) There is no penalty for guessing.

>>>>>>>>**WHEN YOU FINISH** <<<<<<<<
Hand in the green answer sheet separately.

1. A trip consists of 4 segments. Segment A is directed north with length 10 m. Segment B is directed east with length 10 m. Segment C is directed northeast (45 degrees north of east) with length 20 m. If the net displacement is 0, what is the length of the remaining segment, in m?

(1) 34.1 (2) 22.6 (3) 48.2 (4) 0 (5) 56.8

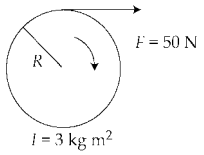
2. A passenger drops a rock from the window of a truck traveling at 20 m/s down a flat straight road. When the rock hits the ground, the horizontal distance between it and the window is 2.5 m. Assume that wind resistance gives the rock a horizontal acceleration of magnitude 10 m/s^2 relative to the truck. How high above the ground is the window, in m?

(1) 2.4 (2) 3.6 (3) 0.6 (4) 0.25 (5) 4.3

3. A blob of mass 20 kg is acted on by a constant net force. Starting from rest, the blob travels a distance of 20 m in 5 s while acted on by the force. What is the magnitude of the force in N?

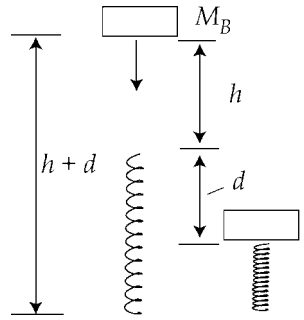
(1) 32 (2) 23 (3) 16 (4) 56 (5) 44

4. A constant force of 50 N is applied to the rim of a mounted flywheel (see figure). Starting from rest, the flywheel rotates through an angle of 3π radians in 2s. If the moment of inertia of the flywheel is 3 kg m^2, what is its radius in m?



(1) 0.28 (2) 0.57 (3) 1.07 (4) 0.12 (5) 0.03

5. A 6 kg book is dropped from rest onto the top of a vertical spring whose spring constant is 200 N/m (see figure). The book falls 1 m before reaching the top of the spring. By how much in m is the spring compressed before it bounces back in the upward direction?

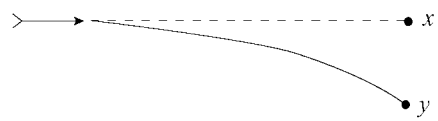


(1) 1.1 (2) 0.6 (3) 2.3 (4) 1.7 (5) 0.3

6. A 2 kg mass is attached to a spring whose spring constant is 200 N/m. The mass exhibits harmonic motion. At time $t = 0$ the spring is in its maximum stretched state. At what time in s has the spring returned to its unstretched state?

(1) 0.16 (2) 0.28 (3) 0.39 (4) 0.48 (5) 0.76

7. A dart is thrown horizontally toward x at 20 m/s as shown. It hits y 0.1 s later. The distance xy is _____ m.



(1) 0.05 (2) 2 (3) 1 (4) 0.5 (5) 0.1

8. The position of an object is given by $x(t) = 12 + t + 2t^3$, where x is in meters and t is in seconds. The average velocity between $t = 0$ and $t = 2$ second is _____ m/s.

(1) 9 (2) 6 (3) 15 (4) 0 (5) 21

9. A car rounds a curve on a flat road. The speed of the car is 12 m/s; the curve has a radius of curvature of 32 m; the mass of the car is 1000 kg; and the static friction coefficient is 0.8. What is the total friction force acting on the wheels?

(1) 4,500 N (2) 3,800 N (3) 5,800 N (4) 6,400 N (5) 7,000 N

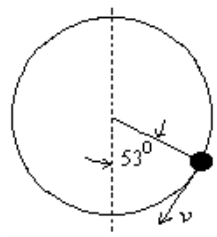
10. A uniform ladder of mass 5.0 kg and length 2.4 m is resting against a wall as shown in the figure. A person of mass 48 kg is standing at the midpoint P of the ladder. The wall is frictionless, while the coefficient of static friction between ladder and floor is 0.27. What is the minimum angle θ, in degrees, at which the ladder can be placed without slipping?

(1) 62 (2) 53 (3) 45 (4) 34 (5) 28

11. Pool balls A and B both have a mass of 0.1 kg and are initially moving toward each other along the x-axis (see figure), each with speed 10 m/s. Ball B is moving in the negative x direction. When the balls collide, they are in contact for 0.01 s. Immediately after the collision, ball B has x-compnent of velocity equal to +5m/s and y-component equal to −15m/s. What is the magnitude of the average force that A exerts on B during the collision?

(1) 212 N (2) 107 N (3) 153 N (4) 310 N (5) 376 N

12. A 0.5-kg ball is moving in a vertical circle at the end of a 2-m long massless cord. At the instant the ball is 53° from the lowest point, as shown, the ball has a speed of 4 m/s. What is tension in the cord? Hint: place your coordinate axes with the y axis along the cord!



(1) 7 N (2) 5 N (3) 10 N (4) 12 N (5) 13 N

13. A horizontal 10 m long plank weighs 100 N. It rests on two supports that are placed 1 m from each end as shown in the figure. How close to end A (in m) can a 800 N person stand without causing the plank to tip?

(1) 0.5 (2) 0 (3) 0.8 (4) 0.2 (5) 0.6

14. A cable stretches by an amount d when it supports a crate of mass M. The cable is cut in half. If the same crate is supported by either half of the cable, by how much will the cable stretch?

(1) $d/2$ (2) d (3) $d/4$ (4) $2d$ (5) $4d$

15. An object on a vertical spring oscillates up and down at an angular frequency of 5 rad/s. The same object is then placed on a horizontal frictionless table and pulled horizontally by the same spring to produce a constant acceleration of 0.5 m/s^2. By how much (in m) does the spring stretch?

(1) 0.02 (2) 0.01 (3) 0.03 (4) 0.04 (5) 0

16. A ball attached to a horizontal spring oscillates back and forth with a frequency of 6 rad/s when the spring is initially stretched by 0.2 m. What would be the frequency of oscillation (in rad/s) if the spring is initially stretched by 0.4 m?

(1) 6 (2) 12 (3) 3 (4) $6\sqrt{2}$ (5) $6/\sqrt{2}$

17. An airplane wing is designed so that the speed of the air across the top of the wing is 250 m/s when the speed of the air below the wing is 225 m/s. The density of the air is 1.29 kg/m^3. What is the pressure difference (in N/m^2) between the top and the bottom of the wing?

(1) 7.66×10^3 (2) 0.116×10^2 (3) 2.34×10^2 (4) 1.53×10^3 (5) 0

18. A large tank is filled with water to a depth of 15 m. A spout, located 10 m above the bottom of the tank is opened. With what speed (in m/s) will water emerge from the spout?

(1) 9.9 (2) 3.1 (3) 17.1 (4) 14.0 (5) 31.1

19. A block of ice (density = 920 kg/m^3) floats in an unknown liquid with 60% of its volume submerged. The density of the unknown liquid is _____ kg/m^3.

(1) 1530 (2) 2300 (3) 550 (4) 370 (5) x

20. Autos A and B engage in a race over a straight-line distance of 500 m. A accelerates from rest at 5 m/s^2 for 10 s and then maintains constant velocity. B accelerates from rest at constant rate for the whole race. The autos require the same amount of time to complete the race (a tie). What is the acceleration of B? (Hint: ask yourself what is the average velocity of A during each point of its trip.)

(1) 4.4 (2) 2.7 (3) 1.6 (4) 9.8 (5) 3.6