Instructor(s): *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004 Final Exam May 1, 2006

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 with scratch work most questions demand.
(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.**

$g = 9.80$ m/s^2

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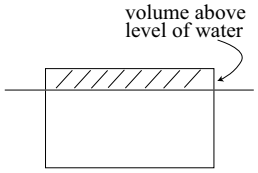
1. A block of wood of density 600 kg/m^3 floats in water. The density of water is 1000 kg/m^3. The volume of the block of wood is 0.1 m. What is the value of the volume of wood that is above the level of the water, in m^3?

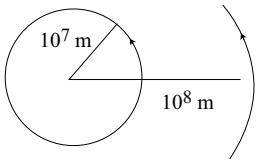


(1) 0.04 (2) 0.06 (3) 0.08 (4) 0.01 (5) 0.09

2. A bicycle tire of radius 0.5 m is initially rotating with an angular velocity of 20 rad/s. The radius of the tires is suddenly reduced to 0.25 m. Assume that angular momentum is conserved. In its final state, with radius = 0.25 m, how many revolutions does the tire make in 1 s?

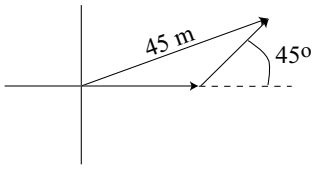
(1) 12.7 (2) 15.6 (3) 19.8 (4) 22.7 (5) 28.6

3. A satellite is in orbit about planet X. Initially, the satellite is in an orbit of radius 10^7 m, and the period of the orbit is 2 hours. The satellite is next moved into an orbit of radius 10^8 m. What is the period of the new orbit?



(1) 63 hr (2) 51 hr (3) 40 hr (4) 28 hr (5) 16 hr

4. (Tedious) A hiker walks in the positive x direction for 30 s at a speed of 1 m/s. In the second stage, the hiker walks for 20 s in a direction at an angle of 45° measured counterclockwise from the positive x direction. At the end of this second stage, the hiker is 45 m away from her initial starting point. How far does the hiker walk during the second stage?



(1) 18.5 m (2) 22.5 m (3) 14.5 m (4) 26.5 m (5) 30.5 m

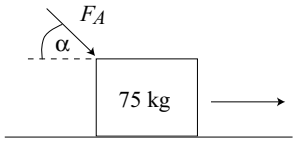
5. This problem involves 1-dimensional motion. An auto starts from rest and accelerates at a constant rate of acceleration for 10 s. It then stops accelerating and maintains constant velocity for 10 s. The auto travels a total distance of 600 m during this 20-second interval. What is the magnitude of the auto's acceleration during the first 10 seconds, in m/s^2?

(1) 4 (2) 2 (3) 1 (4) 6 (5) 8

6. A golfer hits a golf ball at an angle of 60° above the horizontal on the Moon. The golf ball travels a distance of 300 m before it hits the Moon's surface. The acceleration of gravity on the Moon is 1.6 m/s^2. What is the golf ball's speed just before it hits the Moon's surface?

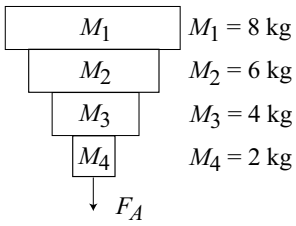
(1) 23.5 m/s (2) 19 m/s (3) 16.5 m/s (4) 63.5 m/s (5) 88 m/s

7. (Tedious) A force F_A is applied as shown to a 75 kg trunk in order to move it across a horizontal floor. The angle α is 30°. The coefficient of kinetic friction is $\mu_k = 0.5$. The trunk is accelerated at a constant rate of 0.25 m/s^2. What is the value of F_A in N?



(1) 625 (2) 335 (3) 965 (4) 1255 (5) 1635

8. Four blocks are glued together as shown and move above the Earth. A downward vertical force $F_A = 200$ N is applied to M_4 as shown. What is the magnitude of the force of M_1 on M_2?

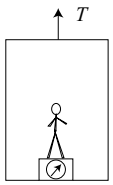


(1) 80 N (2) 320 N (3) 405 N (4) 515 N (5) 630 N

9. A 3000 kg elevator is initially moving up with a speed of 5 m/s as it passes the fifth floor of a building. After 40 s, it is moving up with a speed of 5 m/s as it passes the third floor of the building. The fifth floor is 15 m above the third floor. How much work is done by the elevator motor during this 40 s time interval?

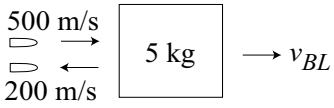
(1) -4.4×10^5 J (2) -2.2×10^5 J (3) $+5.6 \times 10^5$ J (4) $+8 \times 10^5$ J (5) $+2.3 \times 10^5$ J

10. A 50 kg lady stands on a scale in an elevator. The total mass of the elevator system (including the lady and scale) is 3×10^3 kg. The tension T in the elevator cable is 5×10^4 N. What is the reading on the scale for the lady's apparent weight in N?



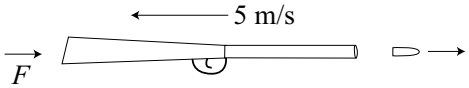
(1) 835 N (2) 500 N (3) 225 N (4) 1600 N (5) 1230 N

11. A 0.02 kg bullet traveling at 500 m/s in the positive x direction strikes a stationary metal block of mass 5 kg. The bullet rebounds in the negative x direction with a speed of 200 m/s. What is the speed v_{BL} of the block immediately after the impact?



(1) 2.8 m/s (2) 1.6 m/s (3) 2.2 m/s (4) 3.8 m/s (5) 4.4 m/s

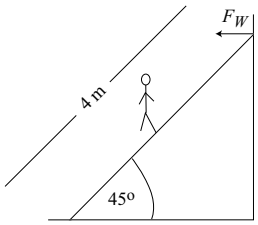
12. A 5 kg rifle fires a bullet and recoils at a speed of 5 m/s. How much force F must be exerted on the rifle for 0.1 s in order to stop its recoil motion?



(1) 250 N (2) 300 N (3) 350 N (4) 400 N (5) 800 N

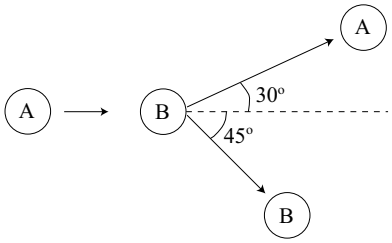
77777

13. A 75 kg climber stands at the middle of a 4 m uniform ladder of mass 75 kg. The ladder makes an angle of 45° with respect to the horizontal. The wall exerts a horizontal force F_W on the ladder. What is the value of F_W, in N?



(1) 735 N (2) 650 N (3) 525 N (4) 400 N (5) 325 N

14. Two balls undergo a 2-dimensional collision. Before the collision, ball A is traveling in the positive x direction, and ball B is at rest. After the collision, ball A is traveling at 10 m/s at an angle of 30° with respect to the x axis, and ball B is traveling at 5 m/s at angle of 45° with respect to the x axis. The mass of ball A is 0.2 kg. What is the mass of ball B, in kg?



(1) 0.28 (2) 0.14 (3) 0.20 (4) 0.38 (5) 0.56