Instructor: *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004 2nd Exam November 10, 2003

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 76–80 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. 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.**

$g = 9.80\ \text{m/s}^2$

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1. An automobile accelerates from rest at $t = 0$ at a constant rate of 5 m/s^2. The radius of its wheels is 0.33 m. How many revolutions does a wheel make during the initial 5 s of acceleration?

   (1) 30 (2) 40 (3) 48 (4) 53 (5) 62

2. In outer space (no gravity), a 0.5 kg ball is swung on a string in a vertical circle of radius 0.3 m. The tangential speed of the ball is maintained at a constant value, and the ball rotates at the rate of 3 revolutions/s. What is the tension in the string? Assume that the string is perpendicular to the tangential velocity of the ball.

   (1) 53 (2) 42 (3) 36 (4) 29 (5) 21

3. Satellite A is in a circular orbit of radius R_A about planet X. The period of its orbit is τ_A. Satellite B is in a circular orbit of radius $R_B = 4R_A$ about planet X. What is the period of the orbit of satellite B?

   (1) $8\tau_a$ (2) $4\tau_a$ (3) $2\tau_a$ (4) $12\tau_a$ (5) $16\tau_a$

4. A 25 kg block is initially sliding across a horizontal surface with initial velocity $v_i = 10$ m/s. A force F of magnitude 500 N is applied to the block in the horizontal direction opposite to the block's motion, and the block comes to rest after traveling a distance of 2 m. How much work in J is done by friction during this process?

   (1) ¡ 250 (2) ¡ 375 (3) ¡ 475 (4) ¡ 550 (5) ¡ 150

5. A motor lifts a 2000 kg elevator vertically at a constant speed of 2 m/s. What is the power output of the motor in watts?

   (1) 3.9 £ 10^4 (2) 2.1 £ 10^4 (3) 1.4 £ 10^4 (4) 9.2 £ 10^4 (5) 2.9 £ 10^4

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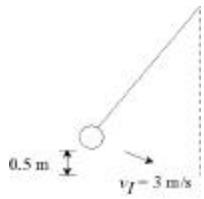
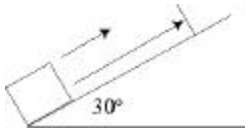
6. A pendulum ball is 0.5 m above its low point and is moving with speed $v_1 = 3$ m/s. What is the maximum height to which the ball will rise? Neglect friction.



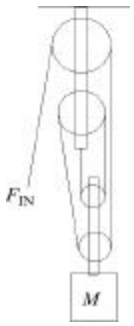
(1) 0.96m (2) 0.82m (3) 1.13m (4) 0.46m (5) 1.29m

7. A block of mass M is initially moving up a frictionless incline with velocity $v_1 = 5$ m/s. The incline makes an angle of 30° with respect to the horizontal. How far along the incline does the block travel before its velocity drops to zero?



(1) 2.6m (2) 3.1m (3) 3.6m (4) 4.1m (5) 4.6m

8. In the pulley system shown, an input force $F_{IN} = 800$ N is required to lift a 200 kg mass M. If the mass is raised through a distance of 0.5 m, how much work in J is done by the input force F_{IN}? Assume that all of the ropes supporting M are vertical.



(1) 1600
(2) 1300
(3) 100
(4) 1900
(5) 2200

9. A 0.1 kg baseball initially at rest is popped straight up. The baseball rises 30 m before coming down. What is the magnitude of the impulse applied to the baseball by the bat?

(1) 2.4Ns (2) 2.7Ns (3) 3.0Ns (4) 3.3Ns (5) 2.1Ns

10. Two autos have a head-on collision. One auto has initial velocity 30 m/s in the positive x direction, and the other has initial velocity 30 m/s in the negative x direction. One auto has mass 3 £ 10^3 kg, and the other has mass 10^3 kg. The autos have the same common velocity immediately after the collision. What is the magnitude of the change of velocity of the lighter auto?

(1) 45m/s (2) 35m/s (3) 25m/s (4) 15m/s (5) 5m/s

11. A 75 kg lady jumps horizontally at 5 m/s from a 200 kg stationary boat to a dock. What is the kinetic energy of the boat immediately after the lady jumps?

(1) 350J (2) 402J (3) 463J (4) 527J (5) 649J

12. A 7 kg rifle fires a 0.03 kg bullet. The rifleman's shoulder exerts a force of 250 N for 0.1 s in order to bring the recoiling rifle to rest. What is the speed of the bullet immediately after it is shot?

(1) 833m/s (2) 502m/s (3) 126m/s (4) 1206m/s (5) 1603m/s

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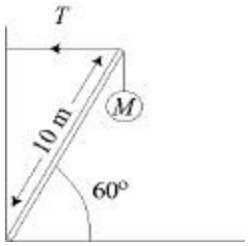
13. A stationary 10^3 kg auto is struck from behind by a 10^4 kg tractor-trailer moving at a speed of 10 m/s. Assume that the collision is one-dimensional and elastic. What is the speed of the auto immediately after the collision?

(1) 18m/s (2) 4m/s (3) 10m/s (4) 39m/s (5) 56m/s

14. A cue ball strikes an equal mass 8-ball. Before the collision the cue ball is moving in the positive x direction with velocity 30 m/s. After the collision, the cue ball is moving with velocity 15 m/s at an angle of 30° with respect to the positive x direction. What is the speed of the 8-ball after the collision?

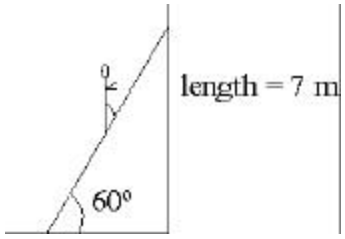
(1) 19m/s (2) 5m/s (3) 11m/s (4) 40m/s (5) 57m/s

15. A 200 kg mass M hangs in equilibrium from a uniform 200 kg steel rod of length $l = 10$ m as shown. The rod is supported by a horizontal cable attached to the end of the rod. What is the tension in the cable?



(1) 1700N (2) 1900N (3) 1400N (4) 1100N (5) 700N

16. A 75 kg man stands on a uniform ladder of length 7 m and mass 50 kg. The ladder leans against a vertical wall at an angle of 60° with respect to the horizontal. The force of the wall on the ladder is horizontal and has magnitude 250 N. How far up the ladder is the man from its bottom?



(1) 1.8m (2) 1.6m (3) 1.4m (4) 1.2m (5) 1.0m