Instructor(s): *J. Ipser*

PHYSICS DEPARTMENT

PHY 2004   3rd Exam   April 10, 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 <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.
(6) **Hand in the answer sheet separately.**

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

1. A bullet of mass 0.02 kg is fired by a rifle. As it travels down the rifle barrel, the ignited gunpowder gases exert an average force of 200 N on the bullet, and as a result, the bullet leaves the barrel at a speed of 500 m/s. How much time does the bullet spend traveling through the barrel? (Hint: think about the bullet's momentum.)

   (1) 0.05 s   (2) 0.1 s   (3) 0.01 s   (4) 3 s   (5) 0.2 s

2. A 0.02 kg bullet traveling at 500 m/s imbeds itself in an initially stationary 2 kg block. What is the subsequent speed of the block/bullet system?

   (1) 5 m/s   (2) 1 m/s   (3) 10 m/s   (4) 20 m/s   (5) 30 m/s

3. Two bumper cars undergo an elastic collision. Each bumper car has a mass of 200 kg. Before the collision, bumper car 1 is moving in the positive x direction at 7 m/s, and bumper car 2 is at rest. What is the velocity of bumper car 1 after the collision?

   (1) 0   (2) 7 m/s   (3) 5 m/s   (4) 3 m/s   (5) 10 m/s

4. (Save for last.) Two balls undergo a 2-dimensional collision. Ball A has a mass of 0.2 kg, and ball B has a mass of 0.1 kg. Before the collision, ball A is traveling in the positive x direction at 20 m/s, and ball B is at rest. After the collision, ball A is moving at angle $\theta_1 = 30°$ with respect to the x axis, and ball B is moving at angle $\theta_2 = 45°$ with respect to the x axis. What is the final speed of ball B?

   (1) 21 mph   (2) 5 mph   (3) 11 mph   (4) 16 mph   (5) 0
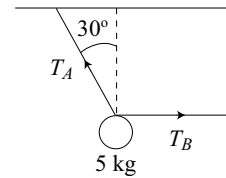
5. A 5 kg weight is suspended in equilibrium via 2 wires. Wire A makes an angle of 30° with respect to the vertical, while wire B is horizontal as shown. What is the tension in wire B?

(1) 28 N (2) 64 N (3) 34 N (4) 41 N (5) 53 N

6. A uniform ladder of mass 50 kg and length 4 m leans against a wall in equilibrium. The ladder makes an angle of 60° with respect to the horizontal. The force of the wall on the ladder is horizontal. The (vertical) normal force of the floor on the ladder is denoted by V, and the (horizontal) friction force of the floor on the ladder is denoted by H. What is the minimum value of the coefficient of static friction?
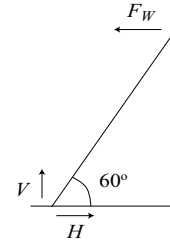
(1) 0.3 (2) 0.4 (3) 0.5 (4) 0.6 (5) 0.7

7. A uniform seesaw of length 4 m is supported in equilibrium by a fulcrum at its midpoint. A mass $M_1 = 50$ kg sits at one end of the seesaw and a mass $M_2 = 50$ kg sits on the seesaw at a distance of 1 m from M_1. How far from the fulcrum must mass $M_3 = 100$ kg be located if the seesaw is in equilibrium?
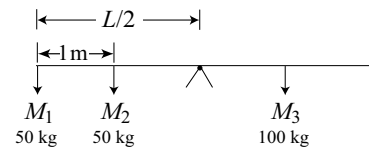
(1) 1.5 m (2) 1 m (3) 0.5 m (4) 2 m (5) 0

8. An autombile accelerates at constant acceleration from 0 to 30 m/s in 6 s. The radius of the auto's tires is 0.33 m. How many revolutions does each of the auto's tires make during this 6 s interval? Assume that the tires do not slip.

(1) 43 (2) 64 (3) 93 (4) 13 (5) 28