



Physics 117A – Exam #2 – Fall 2006

Only calculators and pens/pencils are allowed on your desk. No cell phones or additional scrap paper. You have 1.5 hours to complete the exam.

Name \_\_\_\_\_

Section (Circle):      Hutson      MWF 10:10-11:00

                                 Sheldon      TR 11:00-12:15

*I pledge my honor that I have neither given nor received aid on this work.*

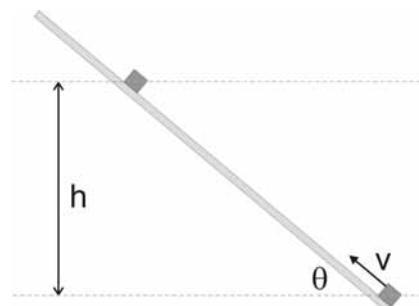
Signed \_\_\_\_\_



MC (50) = \_\_\_\_\_ Prob 11 (25) = \_\_\_\_\_ Prob 12 (25) = \_\_\_\_\_ Total = \_\_\_\_\_

**Multiple choice, circle the correct answer (5 pts each).**

1. You lift some heavy books off the floor at constant velocity. Ignore air resistance. You lift the books to a shelf on your bookcase, and do so in a time  $t$ . Consider only the force you exert on the books. The amount of work you do depends on which of the following? (Circle all that apply)
  - (a) The work you do is zero.
  - (b) The height of the shelf.
  - (c) The time  $t$ .
  - (d) What path the books take: if you move them straight up the work will be different than if the books take a more circuitous path.
  - (e) The mass of the books.
  
2. Two marbles, *one twice as heavy as the other*, are dropped from an equal height. Just before hitting the ground:
  - (a) Both marbles have equal kinetic energy.
  - (b) The heavier marble is moving twice as fast as the lighter marble.
    - (c) The heavier marble has four times the kinetic energy of the lighter marble.
  - (d) The heavier marble is moving  $\sqrt{2}$  times faster than the lighter marble.
  - (e) The heavier marble has twice as much kinetic energy as the lighter marble.
  
3. At time  $t = 0$  s, a wheel has an angular displacement of zero radians and an angular velocity of  $+20.0$  rad/s. The wheel has a constant angular acceleration of  $-5.00$  rad/s<sup>2</sup>. Which of the following is closest to the angular displacement of the wheel when it changes direction (from counterclockwise to clockwise rotation)?
  - (a) 10 radians
  - (b) 20 radians
  - (c) 40 radians
  - (d) 100 radians
  - (e) 400 radians
  
4. A block is shot up a frictionless  $40^\circ$  slope with initial velocity  $v$ . It reaches height  $h$  before sliding back down. The same block is then shot with the same velocity up a frictionless  $20^\circ$  slope. On this slope, the block reaches a height
  - (a)  $2h$ .
  - (b)  $h$ .
  - (c)  $\frac{1}{2}h$ .
  - (d) greater than  $h$ , but there is not enough information to predict an exact value.
  - (e) less than  $h$ , but there is not enough information to predict an exact value.



5. You push a 24-kg crate with a constant force  $\vec{F} = +3.0\hat{i} - 4.0\hat{j}$  (in Newtons).  $\hat{i}$  is horizontal and  $\hat{j}$  is vertical. The crate moves 6.0 m across a horizontal floor in the +x-direction. It does so at a constant speed of 1.0 m/s. During this time, how much work did you do on the crate?

- (a) -6 J
- (b) 12 J
- (c) 18 J
- (d) -24 J
- (e) 30 J

6. Two people on skates are initially at rest. Ignore friction between the skaters and the ice they are standing on. Person A throws a ball to person B, who catches it. Which of the following is true (circle all that apply):

- (a) The skaters end up at rest, exactly in the same position as where they started.
- (b) The skaters end up moving away from each other.
- (c) The skaters end up at rest, but farther apart than when they started.
- (d) If you define the system to be the two skaters and the ball, the center of mass of the system never moves.
- (e) If you define the system to be the two skaters and the ball, the Mechanical Energy (Kinetic plus Potential) of the system is conserved.

7. You are traveling upward in an elevator. You begin at rest on the first floor, and accelerate to a positive velocity in the up direction as you pass the second floor. Which of the following is true about the relevant quantities? ( $\Delta K$  is the change in kinetic energy: final minus initial.  $W_{mg}$  is the work done on you by gravity.  $W_n$  is the work done on you by the normal force of the elevator floor.  $W_{tot}$  is the total work done by all forces.)

	$\Delta K$	$W_{mg}$	$W_n$	$W_{tot}$
(a)	+	+	0	0
(b)	+	0	+	+
(c)	+	-	+	+
(d)	-	-	0	-
(e)	0	-	+	0

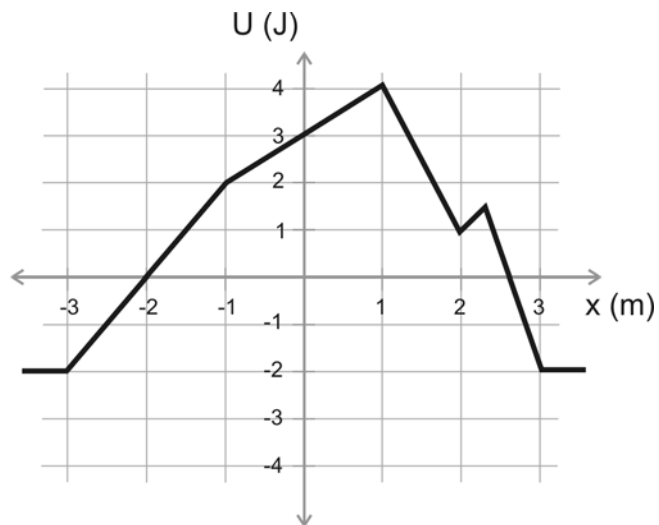
8. An object of mass **4 kg** and initial speed of **3 m/s** collides with an object of mass **8 kg** which is initially at rest. After the collision, the **8 kg** object is observed to be moving as shown with a speed of **2 m/s**. Which of the following is true?



- (a) The mechanical energy of the system is conserved.  
 (b) After the collision, the total kinetic energy of both blocks is smaller.  
 (c) After the collision, the total kinetic energy of both blocks is larger.  
 (d) There is not enough information given to figure out the final kinetic energy.
9. A 2.0-kg object moves along the  $x$ -direction subject to a potential energy as shown. When the object is at  $x = -3.0$  m, it is moving in the  $+x$  direction with a speed of 2.0 m/s.

The point at which the object will turn around and begin moving in the  $-x$ -direction is closest to:

- A. -2 m  
 B. -1 m  
 C. 0 m  
 D. +1 m  
 E. +2 m  
 F. +3 m



**Show all your work on the problems. Place boxes around your final answers. Partial credit will be given, but we need to see your work.**

- 10. (25 pts.)** An artillery shell *at rest* explodes into three pieces with masses of  $\frac{1}{2}$  kg,  $\frac{1}{3}$  kg and  $\frac{1}{6}$  kg. *Each piece flies off in an initially horizontal direction.* The  $\frac{1}{2}$ -kg piece flies off to the North at 600 m/s; and the  $\frac{1}{3}$ -kg piece flies off to the East at 1200 m/s. The velocity of the  $\frac{1}{6}$  kg piece was not measured, but it can be determined by the other information given above. During the explosion, how much internal energy was converted to mechanical energy?

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**Show all your work on the problems. Place boxes around your final answers. Partial credit will be given, but we need to see your work.**

**11. (25 pts)** On a fine winter afternoon, Alan and Brenda are out playing hockey. Alan is skating due North at a speed of 8.33 m/s. Brenda is trying to catch him and is skating  $17^\circ$  East of North at 11.5 m/s. When Brenda catches up to Alan, she gives him a hard shove (a “check” in hockey terminology). Immediately after the shove, Alan is moving in a direction  $40^\circ$  East of North at a speed of 12.3 m/s.

- A. In what direction and at what speed is Brenda moving right after she “checks” Alan?
- B. If Alan and Brenda were in contact for 0.21 s, what was the average force (magnitude and direction) exerted by Brenda on Alan during the check? How about the average force exerted by Alan on Brenda? (Note that you do not have to solve part A correctly to get part B.)

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