

PHYSICS 149

EXAM I

February 12, 2002

Name: _____ ID#: _____

This is a closed book exam. Print and encode your name, student ID number, and recitation number on the answer sheet. Answers to all the questions are to be recorded on the answer sheet. There are 10 multiple choice questions for a total of 100 points. Do not do the problems in the order in which they are given. Do the easy problems first. There is only one correct answer to each question. No penalty for a wrong answer. However, all credit for a question will be lost if more than one choice is marked for that question. You may use your crib sheet and calculator. Fill out the op-scan card gradually, as soon as you finish a problem. Do not wait filling out the op-scan card during the last hectic five minutes!

USEFUL CONSTANT:

$$g = 9.81 \text{ (m/s}^2\text{)}$$

1. (10 points) The mathematical relationship between three physical quantities is given by $a = \frac{b^2}{c}$. If the dimension of b is $\frac{[L]}{[T]}$; and the dimension of c is $[L]$. Which of the following choices is the dimension of a ?

(A) () $[L]$

(B) () $[T]$

(C) () $\frac{[L]}{[T]}$

(D) () $\frac{[L]}{[T]^3}$

(E) () $\frac{[L]^2}{[T]^2}$

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2. (10 points) A displacement vector has a magnitude of 810 m and points at an angle of 18° above the positive x axis. What are the x and y scalar components of this vector?

x scalar component

y scalar component

- | | | |
|---------|-------|-------|
| (A) () | 770 m | 250 m |
| (B) () | 560 m | 585 m |
| (C) () | 585 m | 560 m |
| (D) () | 250 m | 750 m |
| (E) () | 713 m | 385 m |

3. (10 points) Use the component method of vector addition to find the resultant of the following three vectors:

$$\mathbf{A} = 56 \text{ km, east}$$

$$\mathbf{B} = 11 \text{ km, } 22^\circ \text{ south of east}$$

$$\mathbf{C} = 88 \text{ km, } 44^\circ \text{ west of south}$$

(A) () 81 km, 14° west of south

(B) () 97 km, 62° south of east

(C) () 52 km, 66° south of east

(D) () 68 km, 86° south of east

(E) () 66 km, 7.1° west of south

4. (10 points) In the process of delivering mail, a postal worker walks 161 m, due east from his truck. He then turns around and walks 194 m, due west from his truck. What is the worker's displacement relative to his truck?

- (A) 33 m, due west
- (B) 33 m, due east
- (C) 194 m, due west
- (D) 252 m, due east
- (E) 355 m, due west

5. (10 points) An elevator is moving upward with a speed of 11 m/s. Three seconds later, the elevator is still moving upward, but its speed has been reduced to 5.0 m/s. What is the average acceleration of the elevator during the 3.0 s interval?

- (A) 2.0 m/s², downward
- (B) 2.0 m/s², upward
- (C) 5.3 m/s², downward
- (D) 5.3 m/s², upward
- (E) 2.7 m/s², downward

6. (10 points) Which of the following is *not* a vector quantity?

- (A) () acceleration
- (B) () average speed
- (C) () displacement
- (D) () average velocity
- (E) () instantaneous velocity

7. (10 points) A brick is dropped from rest from a height of 4.9 m. How long does it take for the brick to reach the ground?

(A) 0.6 s

(B) 1.0 s

(C) 1.2 s

(D) 1.4 s

(E) 2.0 s

8. (10 points) A projectile is fired at an angle of 60.0° above the horizontal with an initial speed of 30.0 m/s.

How long does it take the projectile to reach the highest point in its trajectory?

(A) () 1.5 s

(B) () 2.7 s

(C) () 4.0 s

(D) () 6.2 s

(E) () 9.8 s

9. (10 points) A tennis ball is thrown vertically upward in an evacuated chamber with an initial speed of 20.0 m/s at time $t = 0 \text{ s}$. Approximately, what is the *initial* speed of the ball relative to an observer in a car that moves *horizontally* past the evacuated chamber with a constant speed of 30 m/s ?

- (A) 10 m/s
- (B) 20 m/s
- (C) 30 m/s
- (D) 36 m/s
- (E) 50 m/s

10. (10 points) A projectile is fired horizontally with an initial speed of 50.0 m/s. Neglect air resistance.

What is the magnitude of the acceleration of the projectile 3.00 s after it is fired?

(A) 9.8 m/s²

(B) 16.6 m/s²

(C) 29.4 m/s²

(D) 5.42 m/s²

(E) 4.07 m/s²