Exam 1--PHYS 201--Fall 2011--16 September 2011

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Which of these is the appropriate answer for this mathematical operation:
\[
\frac{3.4}{1.24} + 6.72
\]

a. 9.46  
b. 9.42  
c. 9  
d. 9.4  
e. 9.462

2. Which of these equations are dimensionally correct? (m: mass; v: velocity; a: acceleration; x: position; t: time)
I. \( v^2 = v_0^2 + 2a(x-x_0) \)
II. \( xma = \frac{1}{2}mv^2 - 4a^2t^2m \)
III. \( ma^2 = mxv^2 \)

a. I  
b. II  
c. III  
d. I & II  
e. II & III

3. Estimate the volume of your closed fist in cubic centimeters.

a. 10 cm\(^3\)  
b. 100 cm\(^3\)  
c. 1000 cm\(^3\)  
d. 10,000 cm\(^3\)  
e. 100,000 cm\(^3\)
4. This graph is relevant to the following 3 questions:

What is the position at t=20 s?

![Position vs. Time Graph]

a. 30 m  

b. 0 m  

c. 1.5 m  

d. None of these

5. The current standard for the kilogram is a metal cylinder in France. Why are scientists seeking to change the standard we use for the kilogram?

a. It is changing  

b. It is not accessible to everyone  

c. It is not based on some fundamental constant of nature  

d. all of these

6. Which of these has never been a standard for the meter?

a. \( \frac{1}{10,000,000} \) the distance from the equator to the North Pole  

b. 10,000,000,000 the distance across the cesium atom  

c. the length of a particular metal bar in France  

d. the distance light travels in \( \frac{1}{3 \times 10^8} \) s
7. Consider the motion of the particle described by the following graph. What is the sign of the acceleration of this particle?

a. negative  

b. positive  

c. zero acceleration  

d. Not enough information

8. Does the odometer in a car measure distance or displacement?

a. displacement  

b. distance  

c. neither

9. When throwing a ball straight up, which of the following is true about its velocity v and its acceleration a at the highest point in its path?

a. a≠0, v=0  

b. a≠0, v≠0  

c. a=0, v=0  

d. a=0, v≠0
10. Consider this position versus time graph; the vertical lines mark particular points in the motion. At what point is the velocity zero?

a. a  
b. b  
c. c  
d. d

11. Which of these are scalar quantities?

I. Speed  
II. Displacement  
III. Mass  
IV. Velocity

a. II & IV  
b. I  
c. III  
d. II

12. From the same height (and at the same time), one ball is dropped and another ball is fired horizontally. Which one will hit the ground first?

a. the dropped ball  
b. the fired ball  
c. both hit at the same time  
d. it depends on the speed at which the ball is fired.

13. In the previous problem, which ball has the greater velocity at ground level?

a. the dropped ball  
b. the fired ball  
c. both have the same velocity  
d. it depends on the speed at which the ball is fired.
14. This figure shows the vectors A and B. What is the resultant vector of B-A?

- [Image of vectors A and B]

   a.  
   b.  
   c.  
   d.  

15. Consider the motion of the particle described by the following graph. Which of these statements best describe the particle’s motion?

   - a. negative, increasing velocity
   - b. constant, positive velocity
   - c. constant, positive acceleration
   - d. negative acceleration
Problem

16. (10 pts) Derive the equations of motion.
17. (20 pts) A particle’s position is given by this function:

\[ \vec{d}(t) = (3.4t)\hat{i} + (5.6t - 4.9t^2)\hat{j} \]

a) Give functions for the particle’s velocity and acceleration.

b) What is magnitude and direction of the particle’s initial velocity?

c) Sketch the velocity versus time graphs for both the x- and y-components of the velocity. Let the graphs cover the time from when the initial position is zero to when the final position is zero (ie. from launch to landing on the ground).

d) What is the total time that the particle is in motion (assume the particle stops when \( \vec{d}(t) = 0\hat{i} + 0\hat{j} \) m; ie. when it hits the ground)?

e) What is the maximum horizontal range of the particle?
18. (15 pts) Consider this graph of velocity versus time.

![Velocity vs. Time Graph]

a) What is the velocity at t= 35 s?

b) What is the instantaneous acceleration at t= 5 s?

c) What is the average acceleration from t= 0 to t= 30 s?

d) What distance is traveled by the particle during the time interval from t=30 to t=50 s?
19. (20 pts) A car is travelling at 100 miles per hour when a state trooper begins his pursuit. The car slows down and comes to a stop in 22 seconds. (1 mile = 1609 meters)

a) What is the car’s initial speed in meters/second?

b) How far does the car travel after it begins to slow down?

c) At t=11 seconds, what is the car’s speed in miles per hour?
20. (5 pts) You drop a rock into a deep well and 3.2 s later hear the splash. How far down is the water?
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Answer Section

MULTIPLE CHOICE

1. ANS: D  PTS: 1
2. ANS: D  PTS: 1
3. ANS: C  PTS: 1
4. ANS: A  PTS: 1
5. ANS: D  PTS: 1
6. ANS: B  PTS: 1
7. ANS: A  PTS: 1
8. ANS: B  PTS: 1
9. ANS: A  PTS: 1
10. ANS: B  PTS: 1
11. ANS: C  PTS: 1
12. ANS: C  PTS: 1
13. ANS: B  PTS: 1
14. ANS: C  PTS: 1

HW

15. ANS: C  PTS: 1

PROBLEM

16. ANS:

PTS: 1
17. ANS:

PTS: 1
18. ANS:

PTS: 1
19. ANS:

PTS: 1
20. ANS:

PTS: 1