Exam 1--PHYS 201--F14--Chapters 1 & 2

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

1. Which of these equations is dimensionally correct?
   
   I. \( v = v_0 + at \)
   
   II. \( \frac{ma}{x} = \frac{mv^3}{x^2} \)
   
   III. \( mv = \frac{1}{2} \frac{ma}{x} \)
   
   a. I
   
   b. I & II
   
   c. II
   
   d. II & III
   
   e. all of these are correct

2. Consider this expression. How many significant figures should the final answer have?
   
   \( \frac{(4.1 + 0.920)^2}{2.54} \)
   
   a. 1
   
   b. 2
   
   c. 3
   
   d. 4

3. The current standard for a kilogram is a cylinder in France. What is the new proposed standard?
   
   a. the mass of a particular number of silicon atoms
   
   b. the mass of a silicon sphere in Australia
   
   c. the mass required to construct a silicon sphere 3 cm across
   
   d. the mass of a silicon sphere that will have a period of 1 s on a pendulum

4. How many centimeters are in a kilometer?
   
   a. 10,000 cm
   
   b. 100,000 cm
   
   c. 1,000,000 cm
   
   d. 10,000,000 cm

5. A pencil is about how many meters long?
   
   a. 0.02 m
   
   b. 0.2 m
   
   c. 2.0 m
   
   d. 20 m

6. Convert the acceleration 12 m/s\(^2\) to the British system of units (miles/hour\(^2\)). (1 mile=1609 m)
   
   a. 0.0015 miles/hour\(^2\)
   
   b. 97,000 miles/hour\(^2\)
   
   c. 15 miles/hour\(^2\)
   
   d. 27 miles/hour\(^2\)

7. Which of the following weighs about a pound?
   
   a. 0.05 kg
   
   b. 0.5 kg
   
   c. 5 kg
   
   d. 50 kg
   
   e. 500 kg

8. What are the units of this equation?
   
   \( \frac{v^2 mx}{a} \)
   
   a. kg m s
   
   b. \( kg \frac{m^2}{s^2} \)
   
   c. \( kg \frac{m^3}{s^3} \)
   
   d. \( kg \frac{m^3}{s} \)
9. You move along this track, measured in meters, from point A to point B. What is your displacement?

-1 0 1 2 3 4

a. 4 m  
b. -4 m  
c. -3 m  
d. 3 m  
e. -2 m

10. Consider this position versus time graph. Which of the following best represents the velocity versus time graph for the object described in the position versus time graph?

11. Your speedometer measures which of these?

a. speed  
b. velocity  
c. both of these  
d. neither of these

12. 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. v=0 and a=0  
b. v=0 and a≠0  
c. v≠0 and a≠0  
d. v≠0 and a=0

13. You drop a rock off a bridge. When the rock has fallen 4 m, you drop a second rock. As the two rocks continue to fall, what happens to their velocities?

a. the velocity of the first rock increases faster than the velocity of the second  
b. the velocity of the second rock increases faster than the velocity of the first  
c. both increase at the same rate  
d. both velocities stay constant

14. You drop a ball from a certain height. Which of these represents the velocity versus time graph for the ball’s motion?

15. Consider this position versus time graph. Which of these best describes the acceleration?

a. a<0  
b. a>0  
c. a=0  
d. there is not enough information to determine the sign of a
Problem

16. (15 pts) This plot shows the position versus time for an object travelling from \( y=0\text{m} \) (at \( t=0\text{s} \)) and returns to its original position. Answer the following questions.

\[
x(t)=10t^2+20t
\]

a) Estimate, from the graph, the velocity at \( t=1.5 \text{ seconds} \). Please show your work on the above plot.

b) Write the function that describes the velocity.

c) What is the acceleration of this object?

d) How long is the object in motion? Show how you get your answer.

e) What is the velocity of the object at \( t=1.1 \text{ seconds} \)?
17. (20 pts) In World War II, there were several reported cases of airmen who jumped from their flaming airplanes with no parachute to escape certain death. Some fell about 20,000 feet (6000 m), and some of them survived, with few life-threatening injuries. For these lucky pilots, snow drifts on the ground allowed their deceleration to be relatively small. Assume that the snow stopped him over a distance of 3.0 m.

a) How long does the airman take to fall the 6000 m?
b) How fast is the airman traveling when he reaches the ground?
c) How long did it take the airman to come to rest when he strikes the snowbank?
d) What is the airman’s rate of acceleration after striking the snowbank?
18. (5pts) Estimate how many baseballs will fit inside this classroom. Please show all work and assumptions for full credit.

19. (10 pts) Derive the equations of motion.
20. (20 pts) An object follows a path that is described by this function:

\[ y(t) = -4t^2 + 3t \]

a) Write the functions for velocity and acceleration.

b) At what time(s) does the object come to rest?

c) At what time(s) is the object at \( y=0 \) m?

d) What is the velocity at \( t=1 \) s?

e) Draw the velocity versus time graph describing this object’s motion.

f) Draw the position versus time graph describing this object’s motion.
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Answer Section

MULTIPLE CHOICE

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

PROBLEM

16. ANS:
   
   PTS:  1
17. ANS:
   
   PTS:  1
18. ANS:
   
   PTS:  1
19. ANS:
   
   PTS:  1
20. ANS:
   
   PTS:  1