


## Physics - Midterm Review Questions and Problems

## CHAPTER 1

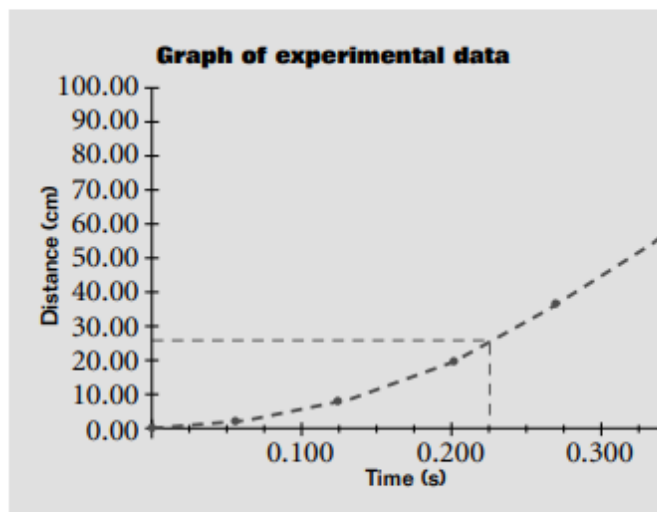
**MULTIPLE CHOICE**

- What area of physics deals with the subjects of heat and temperature?
  - mechanics
  - thermodynamics
  - electrodynamics
  - quantum mechanics
- What area of physics deals with the behavior of subatomic particles?
  - mechanics
  - thermodynamics
  - electrodynamics
  - quantum mechanics
- What term describes a set of particles or interacting components considered to be a distinct physical entity for the purpose of study?
  - system
  - model
  - hypothesis
  - controlled experiment
- What is the SI base unit for length?
  - inch
  - foot
  - meter
  - kilometer
- A light-year (ly) is a unit of distance defined as the distance light travels in one year. Numerically,  $1 \text{ ly} = 9\,500\,000\,000\,000 \text{ km}$ . How many meters are in a light-year?
  - $9.5 \times 10^{10} \text{ m}$
  - $9.5 \times 10^{12} \text{ m}$
  - $9.5 \times 10^{15} \text{ m}$
  - $9.5 \times 10^{18} \text{ m}$
- If you do not keep your line of sight directly over a length measurement, how will your measurement most likely be affected?
  - Your measurement will be less precise.
  - Your measurement will be less accurate.
  - Your measurement will have fewer significant figures.
  - Your measurement will suffer from instrument error.
- If you measured the length of a pencil by using the meterstick shown in the figure below and you report your measurement in centimeters, how many significant figures should your reported measurement have?
  - one
  - two
  - three
  - four
- A room is measured to be 3.6 m by 5.8 m. What is the area of the room? (Keep significant figures in mind.)
  - $20.88 \text{ m}^2$
  - $2 \times 10^1 \text{ m}^2$
  - $2.0 \times 10^1 \text{ m}^2$
  - $21 \text{ m}^2$
- What technique can help you determine the power of 10 closest to the actual numerical value of a quantity?
  - rounding
  - order-of-magnitude estimation
  - dimensional analysis
  - graphical analysis

10. Which of the following statements is true of *any* valid physical equation?

- F. Both sides have the same dimensions.
- G. Both sides have the same variables.
- H. There are variables but no numbers.
- J. There are numbers but no variables.

The graph below shows the relationship between time and distance for a ball dropped vertically from rest. Use the graph to answer questions 11–12.



11. About how far has the ball fallen after 0.200 s?

- A. 5.00 cm
- B. 10.00 cm
- C. 20.00 cm
- D. 30.00 cm

12. Which of the following statements best describes the relationship between the variables?

- F. For equal time intervals, the change in position is increasing.
- G. For equal time intervals, the change in position is decreasing.
- H. For equal time intervals, the change in position is constant.
- J. There is no clear relationship between time and change in position.

## SHORT RESPONSE

13. Determine the number of significant figures in each of the following measurements.

- A. 0.0057 kg
- B. 5.70 g
- C. 6070 m
- D.  $6.070 \times 10^3$  m

14. Calculate the following sum, and express the answer in meters. Follow the rules for significant figures.

$$(25.873 \text{ km}) + (1024 \text{ m}) + (3.0 \text{ cm})$$

15. Demonstrate how dimensional analysis can be used to find the dimensions that result from dividing distance by speed.

## EXTENDED RESPONSE

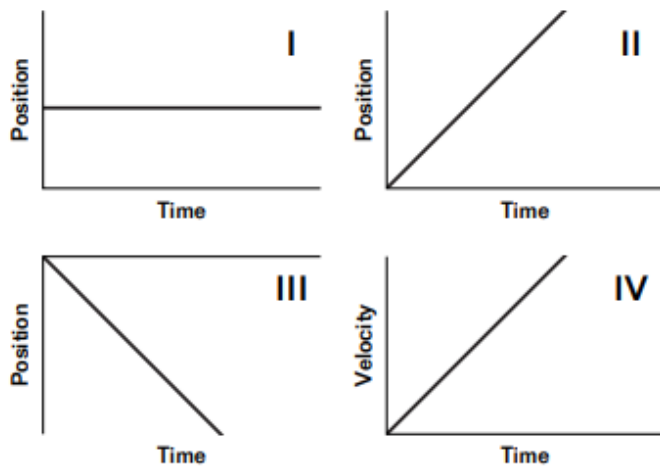
16. You have decided to test the effects of four different garden fertilizers by applying them to four separate rows of vegetables. What factors should you control? How could you measure the results?

17. In a paragraph, describe how you could estimate the number of blades of grass on a football field.

## CHAPTER 2

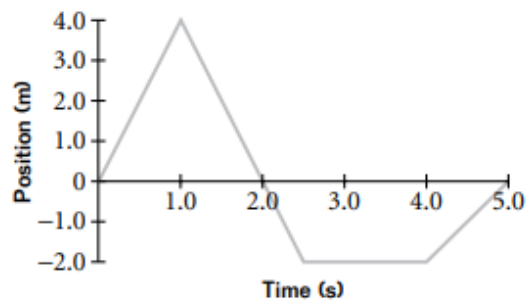
### MULTIPLE CHOICE

Use the graphs below to answer questions 1–3.



- Which graph represents an object moving with a constant positive velocity?
  - I
  - II
  - III
  - IV
- Which graph represents an object at rest?
  - I
  - II
  - III
  - IV
- Which graph represents an object moving with constant positive acceleration?
  - I
  - II
  - III
  - IV
- A bus travels from El Paso, Texas, to Chihuahua, Mexico, in 5.2 h with an average velocity of 73 km/h to the south. What is the bus's displacement?
  - 73 km to the south
  - 370 km to the south
  - 380 km to the south
  - 14 km/h to the south

Use the following position-time graph of a squirrel running along a clothesline to answer questions 5–6.

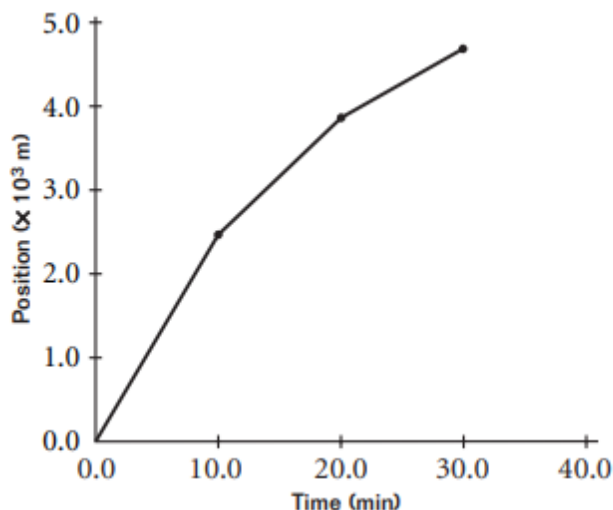


- What is the squirrel's displacement at time  $t = 3.0$  s?
  - 6.0 m
  - 2.0 m
  - +0.8 m
  - +2.0 m
- What is the squirrel's average velocity during the time interval between 0.0 s and 3.0 s?
  - 2.0 m/s
  - 0.67 m/s
  - 0.0 m/s
  - +0.53 m/s
- Which of the following statements is true of acceleration?
  - Acceleration always has the same sign as displacement.
  - Acceleration always has the same sign as velocity.
  - The sign of acceleration depends on both the direction of motion and how the velocity is changing.
  - Acceleration always has a positive sign.
- A ball initially at rest rolls down a hill and has an acceleration of  $3.3 \text{ m/s}^2$ . If it accelerates for 7.5 s, how far will it move during this time?
  - 12 m
  - 93 m
  - 120 m
  - 190 m

9. Which of the following statements is true for a ball thrown vertically upward?
- The ball has a negative acceleration on the way up and a positive acceleration on the way down.
  - The ball has a positive acceleration on the way up and a negative acceleration on the way down.
  - The ball has zero acceleration on the way up and a positive acceleration on the way down.
  - The ball has a constant acceleration throughout its flight.

### SHORT RESPONSE

10. In one or two sentences, explain the difference between *displacement* and *distance traveled*.
11. The graph below shows the position of a runner at different times during a run. Use the graph to determine the runner's displacement and average velocity:
- for the time interval from  $t = 0.0$  min to  $t = 10.0$  min
  - for the time interval from  $t = 10.0$  min to  $t = 20.0$  min
  - for the time interval from  $t = 20.0$  min to  $t = 30.0$  min
  - for the entire run



12. For an object moving with constant negative acceleration, draw the following:
- a graph of position vs. time
  - a graph of velocity vs. time
- For both graphs, assume the object starts with a positive velocity and a positive displacement from the origin.
13. A snowmobile travels in a straight line. The snowmobile's initial velocity is  $+3.0$  m/s.
- If the snowmobile accelerates at a rate of  $+0.50$  m/s<sup>2</sup> for 7.0 s, what is its final velocity?
  - If the snowmobile accelerates at the rate of  $-0.60$  m/s<sup>2</sup> from its initial velocity of  $+3.0$  m/s, how long will it take to reach a complete stop?

### EXTENDED RESPONSE

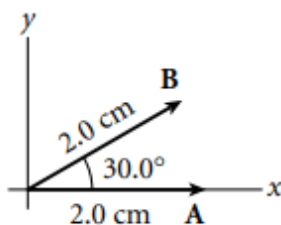
14. A car moving eastward along a straight road increases its speed uniformly from 16 m/s to 32 m/s in 10.0 s.
- What is the car's average acceleration?
  - What is the car's average velocity?
  - How far did the car move while accelerating?
- Show all of your work for these calculations.
15. A ball is thrown vertically upward with a speed of 25.0 m/s from a height of 2.0 m.
- How long does it take the ball to reach its highest point?
  - How long is the ball in the air?
- Show all of your work for these calculations.

## CHAPTER 3

### MULTIPLE CHOICE

1. Vector **A** has a magnitude of 30 units. Vector **B** is perpendicular to vector **A** and has a magnitude of 40 units. What would the magnitude of the resultant vector **A + B** be?
  - A. 10 units
  - B. 50 units
  - C. 70 units
  - D. zero
2. What term represents the magnitude of a velocity vector?
  - F. acceleration
  - G. momentum
  - H. speed
  - J. velocity

Use the diagram below to answer questions 3–4.



3. What is the direction of the resultant vector **A + B**?
  - A.  $15^\circ$  above the  $x$ -axis
  - B.  $75^\circ$  above the  $x$ -axis
  - C.  $15^\circ$  below the  $x$ -axis
  - D.  $75^\circ$  below the  $x$ -axis
4. What is the direction of the resultant vector **A - B**?
  - F.  $15^\circ$  above the  $x$ -axis
  - G.  $75^\circ$  above the  $x$ -axis
  - H.  $15^\circ$  below the  $x$ -axis
  - J.  $75^\circ$  below the  $x$ -axis

Use the passage below to answer questions 5–6.

A motorboat heads due east at 5.0 m/s across a river that flows toward the south at a speed of 5.0 m/s.

5. What is the resultant velocity relative to an observer on the shore?
  - A. 3.2 m/s to the southeast
  - B. 5.0 m/s to the southeast
  - C. 7.1 m/s to the southeast
  - D. 10.0 m/s to the southeast
6. If the river is 125 m wide, how long does the boat take to cross the river?
  - F. 39 s
  - G. 25 s
  - H. 17 s
  - J. 12 s
7. The pilot of a plane measures an air velocity of 165 km/h south relative to the plane. An observer on the ground sees the plane pass overhead at a velocity of 145 km/h toward the north. What is the velocity of the wind that is affecting the plane relative to the observer?
  - A. 20 km/h to the north
  - B. 20 km/h to the south
  - C. 165 km/h to the north
  - D. 310 km/h to the south
8. A golfer takes two putts to sink his ball in the hole once he is on the green. The first putt displaces the ball 6.00 m east, and the second putt displaces the ball 5.40 m south. What displacement would put the ball in the hole in one putt?
  - F. 11.40 m southeast
  - G. 8.07 m at  $48.0^\circ$  south of east
  - H. 3.32 m at  $42.0^\circ$  south of east
  - J. 8.07 m at  $42.0^\circ$  south of east

Use the information below to answer questions 9–12.

A girl riding a bicycle at 2.0 m/s throws a tennis ball horizontally forward at a speed of 1.0 m/s from a height of 1.5 m. At the same moment, a boy standing on the sidewalk drops a tennis ball straight down from a height of 1.5 m.

9. What is the initial speed of the girl's ball relative to the boy?
- A. 1.0 m/s
  - B. 1.5 m/s
  - C. 2.0 m/s
  - D. 3.0 m/s
10. If air resistance is disregarded, which ball will hit the ground first?
- F. the boy's ball
  - G. the girl's ball
  - H. neither
  - J. The answer cannot be determined from the given information.
11. If air resistance is disregarded, which ball will have a greater speed (relative to the ground) when it hits the ground?
- A. the boy's ball
  - B. the girl's ball
  - C. neither
  - D. The answer cannot be determined from the given information.
12. What is the speed of the girl's ball when it hits the ground?
- F. 1.0 m/s
  - G. 3.0 m/s
  - H. 6.2 m/s
  - J. 8.4 m/s

### SHORT RESPONSE

13. If one of the components of one vector along the direction of another vector is zero, what can you conclude about these two vectors?

14. A roller coaster travels 41.1 m at an angle of  $40.0^\circ$  above the horizontal. How far does it move horizontally and vertically?