

Name: \_\_\_\_\_  
Mr. Willis  
Conceptual Physics: \_\_\_\_\_  
Date: \_\_\_\_\_

Unit II  
Motion  
Need extra help?  
Check out <http://www.bayhicoach.com>

## Unit II Study Guide

### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

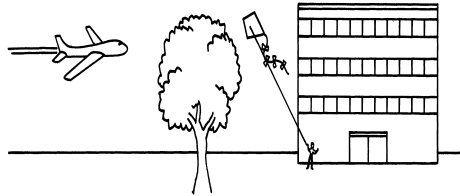


Figure 11-1

- \_\_\_\_ 1. Examine Figure 11-1. If you were standing under the tree, which object would appear to be moving?
- a. the tree
  - b. the airplane
  - c. the boy
  - d. the building
- \_\_\_\_ 2. A passenger in the rear seat of a car moving at a steady speed is at rest relative to
- a. the side of the road.
  - b. a pedestrian on the corner ahead.
  - c. the front seat of the car.
  - d. the wheels of the car.
- \_\_\_\_ 3. Which distance can be most accurately measured with a meterstick?
- a. the length of a river
  - b. the width of this room
  - c. the distance between two cities
  - d. the size of an object under a microscope
- \_\_\_\_ 4. One kilometer equals 1000 meters. What does the prefix *kilo-* mean?
- a. 1
  - b. 10
  - c. 100
  - d. 1000
- \_\_\_\_ 5. A person walks 1 mile every day for exercise, leaving her front porch at 9:00 A.M. and returning to her front porch at 9:25 A.M. What is the total displacement of her daily walk?
- a. 1 mile
  - b. 0
  - c. 25 minutes
  - d. none of the above
- \_\_\_\_ 6. A person drives north 3 blocks, then turns east and drives 3 blocks. The driver then turns south and drives 3 blocks. How could the driver have made the distance shorter while maintaining the same displacement?
- a. by driving east 3 blocks from the starting point
  - b. by driving north 1 block and east 4 blocks
  - c. by driving west 3 blocks from the starting point
  - d. by driving back to the starting point by the same route
- \_\_\_\_ 7. A ball is rolled uphill a distance of 3 meters before it slows, stops, and begins to roll back. The ball rolls downhill 6 meters before coming to rest against a tree. What is the magnitude of the ball's displacement?

- a. 3 meters
- b. 6 meters

- c. 9 meters
- d. 18 meters

\_\_\_\_ 8. Displacement vectors of 1 km south, 3 km north, 6 km south, and 2 km north combine to a total displacement of

- a. 12 km.
- b. 6 km.

- c. 4 km.
- d. 2 km.

\_\_\_\_ 9. What is the most appropriate SI unit to express the speed of a cyclist in the last leg of a 10-km race?

- a. km/s
- b. km/h

- c. m/s
- d. cm/h

\_\_\_\_ 10. Speed is the distance an object moves divided by

- a. the amount of time needed to travel the distance.
- b. the direction the object moves.
- c. the displacement of the object.
- d. the motion of the object.

\_\_\_\_ 11. Instantaneous speed is measured

- a. at the starting point.
- b. when the object reaches its destination.
- c. at a particular instant.
- d. over the duration of the trip.

\_\_\_\_ 12. A car traveled 88 km in 1 hour, 90 km in the next 2 hours, and then 76 km in 1 hour before reaching its destination. What was the car's average speed?

- a. 254 km/h
- b. 63.5 km/h

- c. 209 km/h
- d. 74.5 km/h

\_\_\_\_ 13. The slope of a line on a distance-time graph is

- a. distance.
- b. time.

- c. speed.
- d. displacement.

\_\_\_\_ 14. A horizontal line on a distance-time graph means the object is

- a. moving at a constant speed.
- b. moving faster.

- c. slowing down.
- d. at rest.

\_\_\_\_ 15. What is the speed of a bobsled whose distance-time graph indicates that it traveled 100 m in 25 s?

- a. 4 m/s
- b. 250 m/s

- c. 0.25 mph
- d. 100 m/s

\_\_\_\_ 16. A distance-time graph indicates that an object moves 100 m in 4 s and then remains at rest for 1 s. What is the average speed of the object?

- a. 50 m/s
- b. 25 m/s

- c. 20 m/s
- d. 100 m/s

\_\_\_\_ 17. A river current has a velocity of 5 km/h relative to the shore, and a boat moves in the same direction as the current at 5 km/h relative to the river. How can the velocity of the boat relative to the shore be calculated?

- a. by subtracting the river current vector from the boat's velocity vector
- b. by dividing the river current vector by the boat's velocity vector
- c. by multiplying the vectors
- d. by adding the vectors

- \_\_\_\_ 18. Vector addition is used when motion involves
- more than one direction.
  - more than one velocity.
  - more than one speed.
  - all of the above
- \_\_\_\_ 19. The rate at which velocity changes is called
- speed.
  - vectors.
  - acceleration.
  - motion.
- \_\_\_\_ 20. Which example identifies a change in motion that produces acceleration?
- a speed skater moving at a constant speed on a straight track
  - a ball moving at a constant speed around a circular track
  - a particle moving in a vacuum at constant velocity
  - a vehicle moving down the street at a steady speed
- \_\_\_\_ 21. Objects in free fall near the surface of the Earth experience
- constant speed.
  - constant velocity.
  - constant acceleration.
  - constant distance.
- \_\_\_\_ 22. Which example describes constant acceleration due ONLY to a change in direction?
- increasing speed while traveling around a curve
  - an object at rest
  - riding on a Merry-go-round
  - an object in free fall
- \_\_\_\_ 23. Suppose you increase your walking speed from 1 m/s to 3 m/s in a period of 2 s. What is your acceleration?
- $1 \text{ m/s}^2$
  - $2 \text{ m/s}^2$
  - $4 \text{ m/s}^2$
  - $6 \text{ m/s}^2$
- \_\_\_\_ 24. An object moving at 30 m/s takes 5 s to come to a stop. What is the object's acceleration?
- $30 \text{ m/s}^2$
  - $-30 \text{ m/s}^2$
  - $-6 \text{ m/s}^2$
  - $6 \text{ m/s}^2$
- \_\_\_\_ 25. The slope of a speed-time graph indicates
- direction.
  - acceleration.
  - velocity.
  - speed.
- \_\_\_\_ 26. A speed-time graph shows that a car moves at 10 m/s for 10 s. The car's speed then steadily decreases until it comes to a stop at 30 s. Which of the following describes the slope of the speed-time graph from 10 s to 30 s?
- linear, horizontal
  - curved, upward
  - linear, sloping downward
  - linear, sloping upward
- \_\_\_\_ 27. An object that is accelerating may be
- slowing down.
  - gaining speed.
  - changing direction.
  - all of the above
- \_\_\_\_ 28. A train approaching a crossing changes speed from 25 m/s to 10 m/s in 240 s. How can the train's acceleration be described?
- The train's acceleration is positive.
  - The train is not accelerating.
  - The train will come to rest in 6 minutes.
  - The train's acceleration is negative.

- \_\_\_\_ 29. What is instantaneous acceleration?
- how fast a speed is changing at a specific instant
  - how fast a velocity is changing at a specific instant
  - how fast a direction is changing at a specific instant
  - all of the above

- \_\_\_\_ 30. Which of the following statements is true?
- An object that is accelerating is always changing direction.
  - An object has an instantaneous acceleration, even if the acceleration vector is zero.
  - An object at rest has an instantaneous acceleration of zero.
  - Instantaneous acceleration is always changing.

### Completion

*Complete each sentence or statement.*

31. The motion of an object looks different to observers in different \_\_\_\_\_.
32. The SI unit for measuring \_\_\_\_\_ is the meter.
33. The direction and length of a straight line from the starting point to the ending point of an object's motion is \_\_\_\_\_.
34. Displacement and velocity are examples of \_\_\_\_\_ because they have both magnitude and direction.
35. The sum of two or more vectors is called the \_\_\_\_\_.
36. Speed is measured in units of \_\_\_\_\_.
37. A car's speedometer measures \_\_\_\_\_.
38.  $\bar{v} = \frac{d}{t}$  is the equation that defines \_\_\_\_\_.
39. A constant slope on a distance-time graph indicates \_\_\_\_\_ speed.
40. The difference between speed and velocity is that velocity indicates the \_\_\_\_\_ of motion and speed does not.
41. A distance-time graph indicates an object moves 20 km in 2 h. The average speed of the object is \_\_\_\_\_ km/h.
42. Because its \_\_\_\_\_ is always changing, an object moving in a circular path experiences a constant change in velocity.
43. Two or more velocities add by \_\_\_\_\_.
44. A moving object does not \_\_\_\_\_ if its velocity remains constant.
45. Freely falling objects accelerate at  $9.8 \text{ m/s}^2$  because the force of \_\_\_\_\_ acts on them.
46. The velocity of an object moving in a straight line changes at a constant rate when the object is experiencing constant \_\_\_\_\_.
47. The acceleration of a moving object is calculated by dividing the change in \_\_\_\_\_ by the time over which the change occurs.
48. Accelerated motion is represented by a(an) \_\_\_\_\_ line on a distance-time graph.
49. A car that increases its speed from 20 km/h to 100 km/h undergoes \_\_\_\_\_ acceleration.

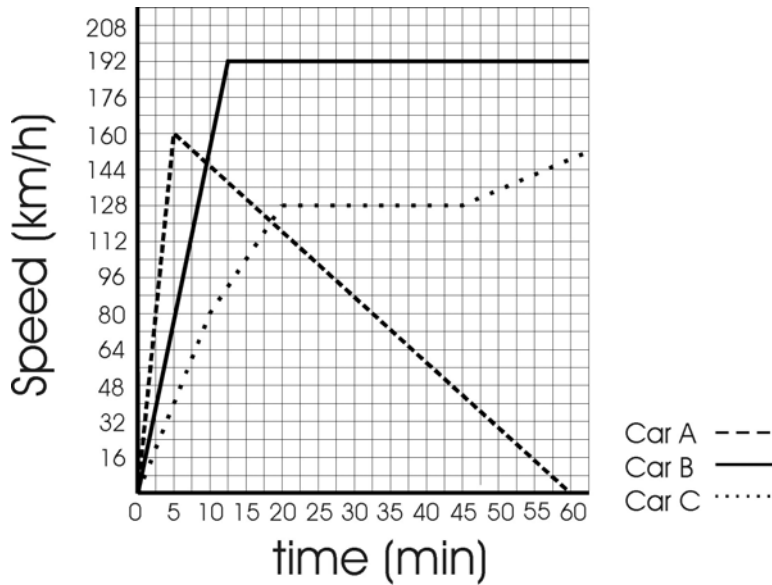
50. \_\_\_\_\_ is how fast a velocity is changing at a specific instant.

**Matching**



- a. slope is negative
- b. slope is positive
- c. slope is zero

- \_\_\_\_\_ 51. between 1 hour and 5 hours
- \_\_\_\_\_ 52. between 5 and 5.5 hours
- \_\_\_\_\_ 53. between 0 and 1 hour



- a. Car A
- b. Car B

c. Car C

- \_\_\_\_\_ 54. Has the greatest acceleration
- \_\_\_\_\_ 55. Went the fastest speed
- \_\_\_\_\_ 56. appears to stall
- \_\_\_\_\_ 57. Went the farthest
- \_\_\_\_\_ 58. shows a zero acceleration between 20 and 45 minutes

**Short Answer**

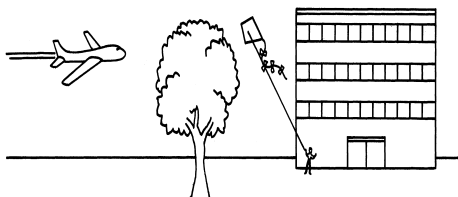


Figure 11-1

59. From which frame of reference in Figure 11-1 does the tree appear to be in motion?
60. What is the SI unit best suited for measuring the height of a building?
61. Distance is a measure of length. What information does displacement give in addition to distance?
62. A child rolls a ball 4 m across a room. The ball hits the wall and rolls halfway back toward the child. Using vector addition, calculate the ball's displacement.
63. Which is the most suitable SI unit for expressing the speed of a race car?
64. What are two types of speed that can be used to describe the motion of a car driving on the highway?
65. Bus A travels 300 m in 12 s. Bus B travels 200 m in 12 s. Both vehicles travel at constant speed. How do the distance-time graphs for these two speeds differ?
66. What is the significance of the slope in a distance-time graph?
67. Vector addition allows you to add what two quantities for any number of vectors?
68. What types of changes in motion cause acceleration?
69. How is motion described when the velocity of an object changes by the same amount each second?
70.  $a = \frac{v_f - v_i}{t}$  is the equation for calculating the acceleration of an object. Write out the relationship shown in the equation, using words.
71. In the equation for acceleration,  $a = \frac{v_f - v_i}{t}$ , how can you describe acceleration if the numerator is negative?
72. What information does the slope of a speed-time graph provide?
73. The slope of the curve at a single point on a distance-time graph of accelerated motion gives what information?

### Problem

74. During a race, a runner runs at a speed of 6 m/s. Four seconds later, she is running at a speed of 10 m/s. What is the runner's acceleration? Show your work.
75. If you ride your bike at an average speed of 2 km/h and need to travel a total distance of 20 km, how long will it take you to reach your destination? Show your work.

**Essay**

76. Explain how velocity is different from speed.

77. Picture a ball traveling at a constant speed around the inside of a circular structure. Is the ball accelerating? Explain your answer.

78. A girl walks from her home to a friend's home 3 blocks north. She then walks east 2 blocks to the post office, 1 block north to the library, and 1 block east to the park. From the park, she walks 2 blocks west to the movie theater. After the movie, she walks 4 blocks south to the pet store. What is the girl's displacement from her starting point to the pet store? Where is the location of the pet store in relation to her home? Calculate the distance she walked in blocks.

## Other

## USING SCIENCE SKILLS

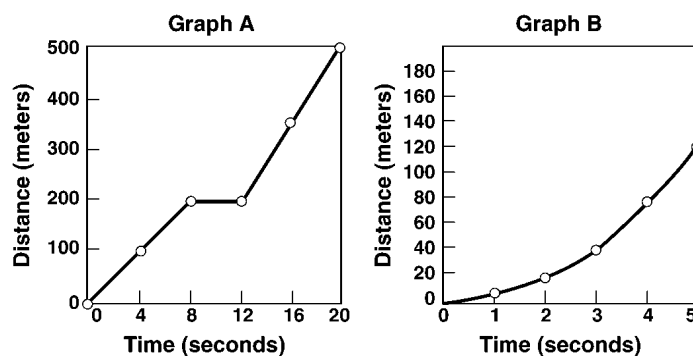


Figure 11-2

79. **Using Tables and Graphs** Which graph in Figure 11-2 shows periods of constant speed? Explain your answer.

80. **Interpreting Graphics** Look at Figure 11-2. Describe the motion of the object in Graph A.

81. **Using Models** Which graph in Figure 11-2 shows acceleration? How do you know?

82. **Calculating** Using Graph A in Figure 11-2, calculate the average speed of the object in motion from 12 s to 20 s. Explain your calculation.

83. **Comparing and Contrasting** Compare Graphs A and B in Figure 11-2. At a time of 2 seconds, which graph shows a greater velocity? How do you know?

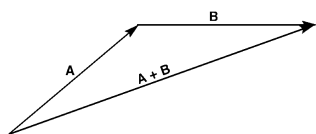


Figure 11-3A

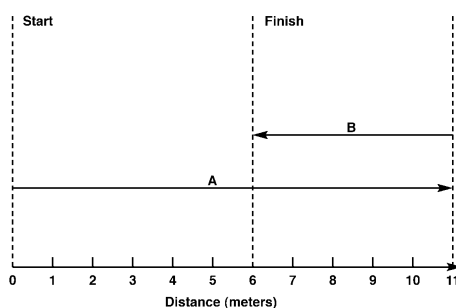


Figure 11-3B

84. **Interpreting Graphics** Figure 11-3B illustrates the displacement of an object moving in a plane. Explain what information is provided by arrows A and B.

85. **Calculating** Using vector addition, calculate the distance traveled by the object and the displacement of the object represented by Figure 11-3B.

86. **Using Models** Arrows A and B in Figure 11-3A represent velocities. Describe the motion modeled by the vectors.

87. **Predicting** Suppose vector B in Figure 11-3B had a length of 12 m (instead of 5 m). What would be the distance the object moved? What would be the magnitude of the object's displacement?

88. **Applying Concepts** Vectors A and B in Figure 11-3A represent the path walked by a student from home to school. What does the resultant vector  $A + B$  represent?