Chapter 2 – Describing Motion

Section Review 2.1

1. How is the position variable different from the distance variable in motion experiments?

2. A runner completes one lap around a 400-m oval track, returning to her starting position. What distance did she cover, and what was her displacement? Explain.

3. Why can velocity be negative, but non-zero speed is always positive?

4. Compare and contrast: constant velocity, average velocity, and instantaneous velocity.

5. Use the term *relative velocity* to explain why it is helpful to paddle a boat downstream.

6. What is the acceleration, in m/s^2, of a car that can go from 0 mph to 60 mph in 4 seconds? (*Hint*: Remember to convert all necessary units.)

Section Review 2.2

1. Explain how to calculate the slope of a graph.

2. What does the slope of a position vs. time graph represent?

3. Draw the position vs. time graph for an object moving at a constant velocity of 2 m/s.

4. Sketch a position vs. time graph (no number scale needed) for a ball rolling down a ramp.

Section Review 2.3

1. Why does the velocity vs. time graph for constant velocity have a horizontal line, when the position vs. time graph for the same motion is a diagonal line?

2. Figure 2.7 shows a position vs. time graph for two cars that have different constant velocities. Sketch a velocity vs. time graph for the same two cars.

3. What does the slope of a velocity vs. time graph represent?

4. How can you determine an object's displacement from its velocity vs. time graph? Is the method the same for both constant velocity and changing velocity?

5. How do you indicate direction on a velocity vs. time graph?

Chapter 2 Review

Understanding Vocabulary

Select the correct term in the term bank on page 48 to complete the sentences.

1. The rate at which speed changes is called ___________________.

2. ________________ is a variable that gives location relative to an origin.

3. ________________ describes the velocity of an object with respect to frame of reference.

4. A moving object has _______________ when both the speed and the direction of travel remain the same.

5. Dividing the total displacement by the total time taken determines the ________________.

6. The _________________ of a line is found by dividing the rise by the run.

Reviewing Concepts

Section 2.1

1. Compare and contrast the distance and displacement variables.

2. Olivia is doing a motion experiment with a car on a track. She records a negative displacement. Describe the motion of the car.

3. What is the difference between speed and velocity?

4. Can an object have negative speed? Can it have negative velocity? Explain.

5. What two values are needed to determine average velocity?

    a.

    b.

6. If an object has an acceleration of 20 cm/ s^2, what do you know about how its velocity changes over time?

7. Provide two ways the unit “meters per second per second” can be abbreviated.

a.

b.

8. An object accelerates if its velocity changes. What is the other way an object can accelerate (without changing speed)?

9. What is the acceleration of a car moving at a constant velocity of 50 mph?

Section 2.2

10. Explain how to calculate the slope of a line.

11. The slope of a position vs. time graph is equal to the object’s _________________.

12. Sam rolls down his driveway on a skateboard while Beth keeps track of his position every second for 15 seconds. When they make a graph of the data, the position vs. time graph is a curve that gets steeper as time increases. What does this tell you about Sam’s velocity?

Section 2.3

13. The slope of a velocity vs. time graph is equal to the object’s ___________________.

14. A graph is made of the velocity vs. time of a plane as it flies from San Francisco to the Kahului Airport on Maui. How could the displacement of the plane be calculated from the graph?

Solving Problems

Section 2.1

1. Ryan's family drives from San Diego to Phoenix. They continue from Phoenix to Flagstaff, and finally back to San Diego. Their travel is graphically represented on page 48.

    a. What distance did this family travel?

    b. What is their displacement?

2. A car travels in one direction for 30 min at an average velocity of 20 km/ h. What is the distance the car travels?

3. Emma is riding on a train. The train is moving at 50 m/s. Emma walks down the aisle at 1 m/s relative to the train in the same direction the train is moving. What is her relative velocity?

4. A car accelerates from 0 to 20 m/s in 10 seconds. Calculate its acceleration.

5. During a race, you speed up from 3 m/s to 5 m/s in 4 s.

    a. What is your change in velocity?

    b. What is your acceleration?

6. Marcus is driving his car at 15 km/ h when he brakes suddenly. He comes to a complete stop in 2 s. What was his acceleration in km/h/s? Was his acceleration positive, negative, or zero?

7. You start from rest and ski down a hill with an acceleration of 2 m/s^2. Find your velocity at the following times:

a. 1 s

b. 2 s

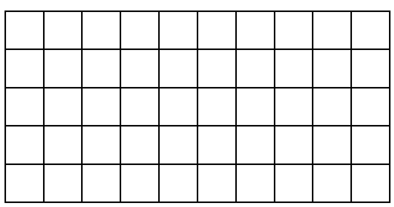
c. 3 s

d. 10 s

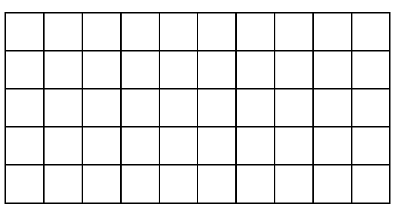
Section 2.2

8. Referring to the graph on page 49, rank the four points on the position vs. time graph in order from slowest to fastest.

9. Draw the position vs. time graph for a person walking at a constant speed of 1 m/s for 10 s. On the same axes, draw the graph for a person running at a constant speed of 4 m/s.



10. Draw the position vs. time graph for an object that is not moving.

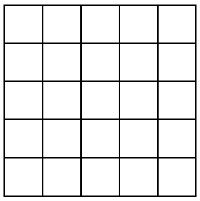


11. Why is the line in a position vs. time graph for an object in free fall a curve?

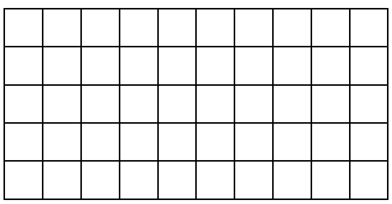
Section 2.3
View the graph on page 49 in your text, then answer the following:

a. Calculate the velocity from the position vs. time graph. Show your work.

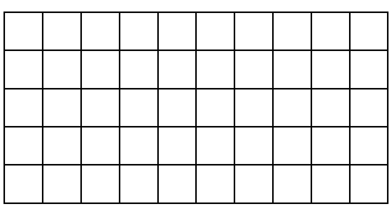
b. Draw the velocity vs. time graph showing the same motion.



13. Draw a velocity vs. time graph for a car that starts at rest and steadily accelerates until it is moving at 40 m/s after 20 s. Then calculate the car's acceleration and displacement during the first 20 s.



14. Draw a velocity vs. time graph for an object accelerating from rest with a constant acceleration of 2 m/s^2.



Test Practice

Section 2.1
1. Jill drives from her house to school. After school, she drives to the library. What is her displacement?

a. 0 km b. 5 km c. 10 km d. 15 km

2. An object in motion has a displacement of 50 m. The average velocity is 25 m/s. The time taken is ______________ s.

a. 0.5 b. 1 c. 2 d. 5

3. The table shows the speed of a person riding a bike uphill. What is the person's acceleration?

a. -2 m/s b. -1 m/s c. 1 m/s d. 2 m/s

4. A car starts at rest and accelerates at 2 m/s^2 for 10 s. What is the car's final velocity?

a. 2 m/s b. 5 m/s c. 10 m/s d. 20 m/s

Section 2.2

5. What is the velocity of the moving object represented by the position vs. time graph on page 50?

a. 0.5 m/s b. 1 m/s c. 2 m/s d. 5 m/s

6. A car on a track moves away from the origin with a constant velocity. Which position vs. time graph on page 50 could represent the car's motion?

a. A b. B c. C d. D

7. Which position vs. time graph represents the motion of an object with negative acceleration?

a. A. b. B c. C d. D

Section 2.3

8. The slope of a velocity vs. time graph represents the _____________ of the moving object.

a. velocity b. position c. acceleration d. displacement

9. Which velocity vs. time graph on page 51 represents a car moving at a constant velocity?

a. A b. B c. C d. D

10. The moving object represented by the velocity vs. time graph on page 51 has an acceleration of ________ m/s/s.

a. 0 b. 0.5 c. 1 d. 2

11. The velocity vs. time graph on page 51 represents the motion of a person riding a bike. The person's displacement after 4 s is

a. 1 m. b. 4 m. c. 8 m. d. 16 m.

Applying Your Knowledge – skip this section