REVIEW

Reading Toolbox

1. Sample answer: Scientific: The *friction* between the road surface and the tire allow the automobile to move. Non-scientific: *Friction* between the two students caused them to argue while working on a science activity.

Using Key Terms

2. both; The speed is 30 m/s, and the velocity is 30 m/s westward.
3. The reference frame defines the starting, ending, and comparison points.
4. Distance is the length of the path that you travel even if you change direction. Displacement is the straight-line distance between the starting point and the ending point.
5. Uniform circular motion is motion at constant speed in a circle.
6. Static means "not moving" (stationary) and kinetic means "moving." Static friction is greater than kinetic friction, because when two surfaces are not moving past each other, the irregularities in one surface can stick to the irregularities of the other surface more easily than when the surfaces are in motion.

Understanding Key Ideas

7. b
8. a
9. c
10. a
11. b
12. b
13. a
14. d

CHAPTER 11 Review

READING TOOLBOX

1. Everyday Words Used in Science The word *friction* can be used metaphorically in a nonscientific context. For example, *friction* can mean "conflict," as between two people. Write two sentences, one using the scientific meaning of *friction* and another using the word in a nonscientific way.

USING KEY TERMS

2. State whether 30 m/s westward represents a *speed*, a *velocity*, or both.

3. Why is identifying the *frame of reference* important in describing motion?

4. What is the difference between *distance* and *displacement*?

5. What is *uniform circular motion*?

6. How do *static friction* and *kinetic friction* differ from each other?

UNDERSTANDING KEY IDEAS

7. If you jog for 1 h and travel 10 km, 10 km/h describes your
- **a.** momentum.
- **b.** average speed.
- **c.** displacement.
- **d.** acceleration.

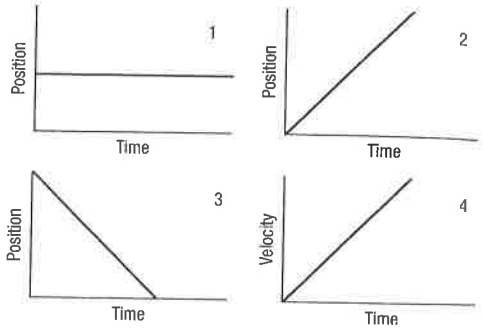
8. An object's speed is a measure of
- **a.** how fast the object is moving.
- **b.** the object's direction.
- **c.** the object's displacement per unit of time.
- **d.** All of the above

9. Which of the quantities below represents a velocity?
- **a.** 25 m/s
- **b.** 10 km/min
- **c.** 15 mi/h eastward
- **d.** 3 mi/h

10. A car travels a distance of 210 mi in exactly 4 h. The driver calculates that he traveled 52.5 mi/h. Which of the following terms most nearly describes his calculation?
- **a.** average speed
- **b.** instantaneous speed
- **c.** instantaneous acceleration
- **d.** displacement

11. Which of the following is *not* accelerated motion?
- **a.** a ball being juggled
- **b.** a woman walking at 2.5 m/s along a straight road
- **c.** a satellite circling Earth
- **d.** a braking cyclist

INTERPRETING GRAPHICS Use the graphs below to answer questions 12–14.



12. Which graph represents an object moving with a constant positive velocity?
- **a.** 1
- **b.** 2
- **c.** 3
- **d.** 4

13. Which graph represents an object at rest?
- **a.** 1
- **b.** 2
- **c.** 3
- **d.** 4

14. Which graph represents an object moving with constant positive acceleration?
- **a.** 1
- **b.** 2
- **c.** 3
- **d.** 4

EXPLAINING KEY IDEAS

15. At the end of a game, a basketball player on the winning team throws the basketball straight up as high as he can throw it. What is the basketball's velocity at the top of its path?

16. A book is sitting still on your desk. Are the forces acting on the book balanced or unbalanced? Explain.

17. Bob straps on his in-line skates and pushes himself down a hill. At the bottom of the hill, he slowly rolls to a stop. When is he accelerating?

CRITICAL THINKING

18. **Interpreting Data** A baseball is hit straight up at an initial velocity of 30 m/s. If the ball has a negative acceleration of about 10 m/s², how long does the ball take to reach the top of its path?

19. **Understanding Relationships** What can you conclude about the forces acting on an object traveling in uniform circular motion?

20. **Interpreting Data** When you drive, you will sometimes have to decide in a brief moment whether to stop for a yellow light. Discuss the variables that you must consider in making your decision. Use the concepts of force, acceleration, and velocity in your discussion.

21. **Identifying Relationships** What are some of the ways that competitive swimmers can decrease the amount of friction or drag between themselves and the water through which they are swimming? How does each method work to decrease friction?

Math Skills

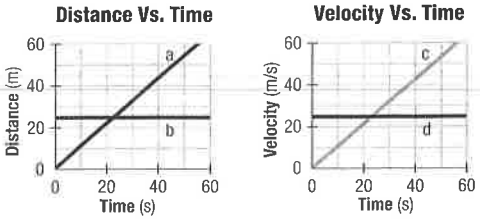
22. **Velocity** Simpson drives his car with an average velocity of 85 km/h eastward. How long will it take him to drive 560 km on a perfectly straight highway?

23. **Acceleration** A driver is traveling eastward on a dirt road when she spots a pothole ahead. She slows her car from 14.0 m/s to 5.5 m/s in 6.0 s. What is the car's acceleration?

24. **Acceleration** How long will it take a cyclist with an acceleration of −2.50 m/s² to bring a bicycle with an initial forward velocity of 13.5 m/s to a complete stop?

Graphing Skills

25. The graphs below describe the motion of four different balls—a, b, c, and d. Use the graphs to determine whether each ball is accelerating, sitting still, or moving at a constant velocity.



26. A rock is dropped from a bridge, and the distance it travels and the speed at which it is falling are measured every second until it hits the water. The data are shown in the chart below. Make two graphs of the data: a distance vs. time graph and a velocity vs. time graph. Use your graphs to answer the following questions.
    a. What shape is the distance vs. time graph? Explain.
    b. What shape is the velocity vs. time graph? Explain.
    c. Use the velocity vs. time graph to determine the rock's acceleration.

Time	Distance traveled	Downward speed
0 s	0 m	0 m/s
1 s	5 m	10 m/s
2 s	20 m	20 m/s
3 s	45 m	30 m/s

Assignment Guide

Section	Items
1	2–4, 7–10, 12–13, 15, 22
2	5, 11, 14, 17–18, 23–26
3	1, 6, 16, 19–21

Explaining Key Ideas

15. 0 m/s

16. The forces acting on the book are balanced. If the forces were not balanced, the book would not be sitting still.

17. He is accelerating both when going down the hill and when slowing to a stop.

Critical Thinking

18. Velocity at the top of the path is 0 m/s.

$t = \Delta v/a =$
$(0 \text{ m/s} - 30 \text{ m/s})/-10 \text{ m/s}^2 = 3 \text{ s}$

19. An object traveling in uniform circular motion must be accelerating, so there must be a net force. The acceleration is centripetal—toward the center of the circle—so the net force causing the centripetal acceleration must also be toward the center of the circle.

20. Answers may vary. Some of the variables include the length of time the light is yellow, the force that can be applied by the brakes, the force that can be applied with the engine, the distance to the intersection when the light turns yellow, and the width of the intersection. To stop successfully, the brakes must provide enough force for negative acceleration to give zero velocity before the intersection is entered. To get through the intersection safely, the engine must apply enough force to travel the distance to the intersection plus the width of the intersection before the light turns red.

21. Answers should involve streamlining (e.g., shaving heads, wearing bathing caps, wearing a helmet similar to racing bike helmets) and/or lubrication.

Graphing Skills

25. Objects *a* and *d* are moving with constant velocity; object *b* is at rest; object *c* is moving with constant acceleration.

26. **a.** The distance vs. time graph is curved because the rock is speeding up. The distance traveled in each succeeding time interval is bigger than the distance traveled in the preceding time interval.

b. The velocity vs. time graph is a straight line because the rock speeds up by the same amount in each time interval.

c. 10 m/s² downward

Math Skills

22. $t = \frac{d}{v} = \frac{560 \text{ km}}{85 \text{ km/h}} = 6.6 \text{ h}$

23. $a = \frac{5.5 \text{ m/s} - 14.0 \text{ m/s}}{6.0 \text{ s}} = \frac{-8.5 \text{ m/s}}{6.0 \text{ s}}$
$= -1.4 \text{ m/s}^2 \text{ eastward}$

24. $t = \frac{\Delta v}{a} = \frac{v_f - v_i}{a}$
$= \frac{0 \text{ m/s} - 13.5 \text{ m/s}}{-2.50 \text{ m/s}^2} = 5.4 \text{ s}$