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REVIEW AND REINFORCEMENT GUIDE
CHAPTER 1 ■ *What Is Motion?*

SECTION
1-1 Frames of Reference

(pages 12–13)

KEY CONCEPTS

▲ Whenever you describe something that is moving, you are comparing it with something that is assumed to be stationary, or not moving.

Building Vocabulary Skills: Writing Definitions

Use the following words to write a definition of **frame of reference**. You may write more than one sentence if you need to.

background moving compare

stationary object

_____

_____

_____

_____

Frames of Reference: Understanding the Main Ideas

Now use your definition to help you identify the frame of reference in each of the following situations.

1. The sun rises over the horizon.

   Frame of reference: _____

2. A bus moves past people standing on the sidewalk.

   Frame of reference: _____

3. A passenger on a train sees a ball roll down the aisle.

   Frame of reference: _____

4. Two express subway trains traveling at the same speed on parallel tracks whiz past passengers waiting on the platform of a local station.

   Frame of reference: _____

5. A passenger on one of the subway trains looks out the window and sees another train standing still.

   Frame of reference: _____

6. A person standing near a railroad track sees a train pass by, then notices an airplane fly overhead in the same direction as the train, but at a much faster speed.

   Frame of reference: _____

7. A passenger in the airplane looks down and sees the train moving backward.

   Frame of reference: _____

A Star-tling Discovery: Extending the Main Ideas

Until 1930, scientists thought that the planet Pluto was just another star. Then they looked at two photographs of this "star" that were taken twenty-four hours apart. What they saw led to the discovery that Pluto is a planet, not a star.

Look at the illustrations of the two photographs and see for yourself. (The arrows point to Pluto.) Then answer the questions.

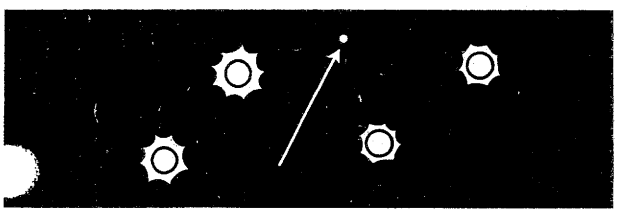

Illustration A

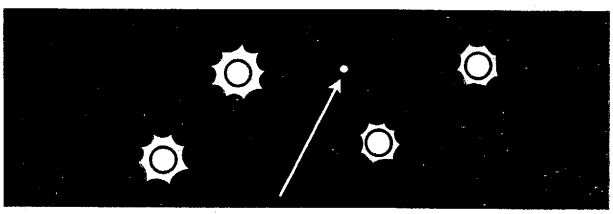

Illustration B

1. What has happened to Pluto from the time of photo A to the time of photo B?

   _____

   _____

2. What frame of reference did you use to describe the change in Pluto?

   _____

3. Is this frame of reference also moving? If you think so, use another frame of reference to describe its motion.

   _____

4. Why do you think these photographs helped scientists realize that Pluto was not just another star?

   _____

   _____

   _____

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SECTION
1-2 Measuring Motion

(pages 14–21)

KEY CONCEPTS

- A change in position in a certain amount of time is motion.
- Speed is the rate at which an object moves.
- Velocity is speed in a given direction.

Building Vocabulary Skills: Relating Terms

For each group of terms, write a sentence that shows how the terms are related.

1. position: time: motion

_____

2. speed: motion

_____

3. speed: distance: time

_____

_____

4. velocity: speed

_____

5. time: distance: direction: velocity

_____

_____

At a Snail's Pace: Applying the Main Ideas

A snail moves at an average speed of 5 centimeters per minute (5 cm/min). Individual snails, however, may move at somewhat faster or slower speeds. To prove this point, three snails decide to have a race. They agree to race the length of a meter stick from 0 cm to 100 cm. They line up the meter stick from east to west on a smooth patch of grass. At the finish line, they place some tasty lettuce leaves for the winning snail to eat.

The race begins at 10 AM sharp. Figure 1 shows the lineup of the snails.

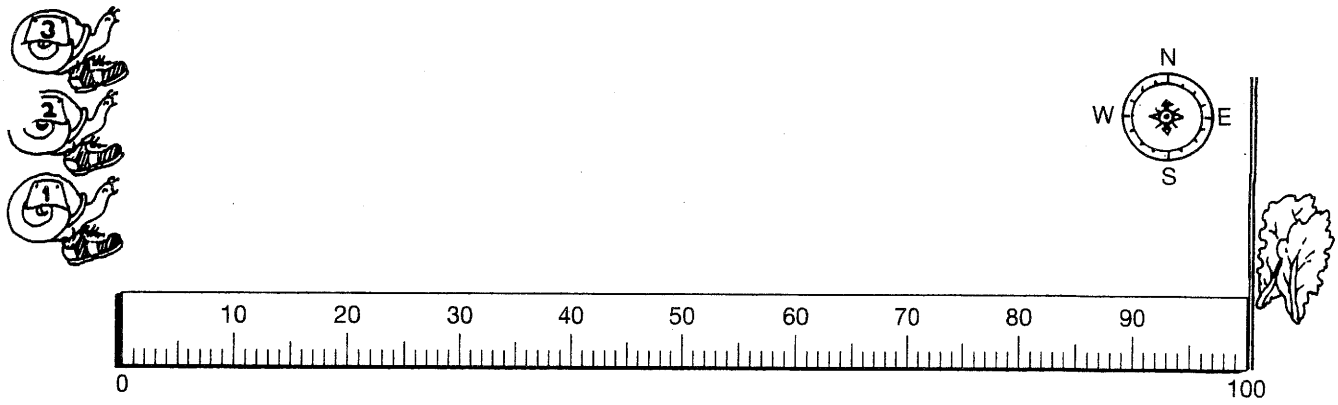
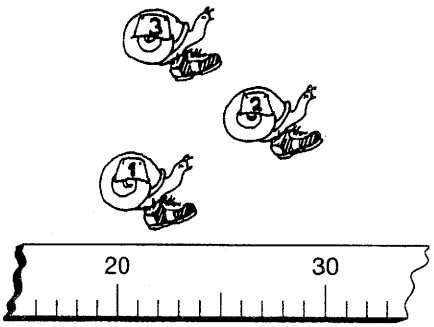
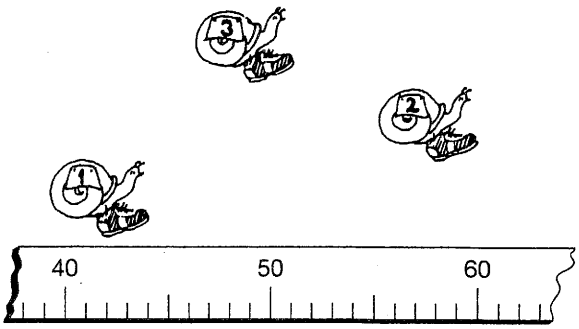


Figure 2 shows the positions of the snails after the first 5 minutes of the race.
Figure 3 shows their positions after the second 5 minutes.





1. Determine the distance that each snail traveled between 10:05 AM and 10:10 AM.

   Snail 1: _____

   Snail 2: _____

   Snail 3: _____

2. Calculate the average speed for each snail.

   Snail 1: _____

   Snail 2: _____

   Snail 3: _____

3. What is each snail's velocity during this time period?

   Snail 1: _____

   Snail 2: _____

   Snail 3: _____

4. A person watching the race noticed that at exactly 10:05 AM an ant wandered onto the snails' meterstick. The ant crawled onto the 94-cm mark and reached the 50-cm mark at exactly 10:04 AM. What was the velocity of the ant?

   _____

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SECTION
1-3 Changes in Velocity

(pages 21–25)

KEY CONCEPTS

▲ The rate of change in velocity is known as acceleration.

Building Vocabulary Skills: Understanding Definitions

Read each of the following statements. If a statement describes acceleration, write A before the item. If the statement does not describe acceleration, write N.

_____ **1.** Your pet dog runs around in circles, chasing his tail.

_____ **2.** A car slows down as it comes to a red light.

_____ **3.** You pedal your bicycle uphill at a speed of 5 km/hr.

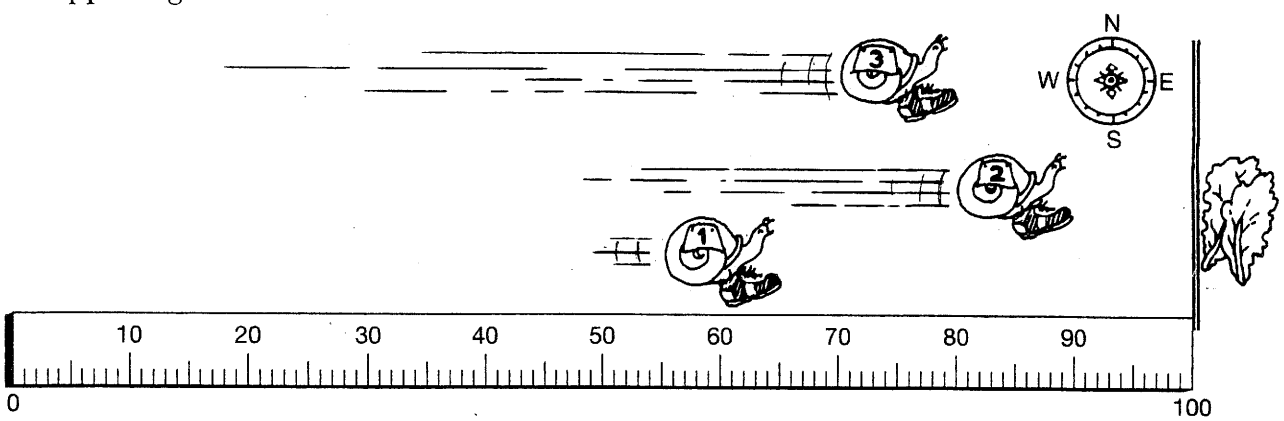
_____ **4.** Your brother walks across the room to open the window.

_____ **5.** As you see your friend approaching, you jump up from your chair and run over to greet her.

_____ **6.** You begin to walk faster when you sense that someone is following you.

At a Snail's Pace: Applying the Main Ideas

In the last section, three snails began a race along a meterstick. When you last saw the snails, they had just completed 10 minutes of their race. Let's see what is happening to the snails now.



1. At 10:15 AM, Snail 1 crossed the 65-cm mark with a velocity of 4 cm/min. In a great burst of energy, Snail 1 raced to the 90-cm mark in 3 minutes. His velocity as he crossed the 90-cm mark was 7 cm/min. What was the acceleration of Snail 1?

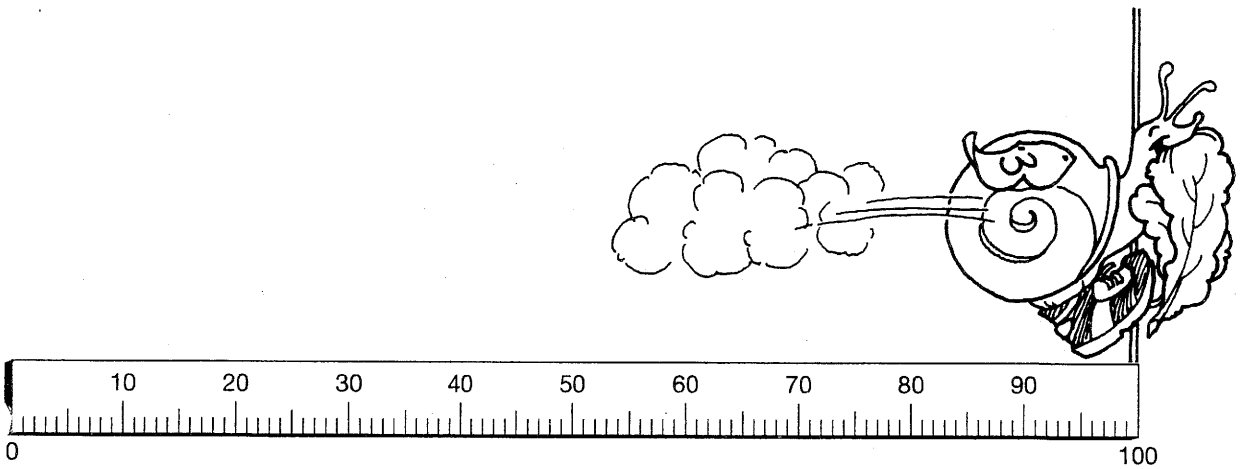
_____

2. Snail 2, the speedy snail, flew past the 90-cm mark at 10:15 AM with a velocity of 7 cm/min. Unfortunately, Snail 2 stubbed his foot on the meterstick and could only limp across the 93-cm mark 3 minutes later with a velocity of 1 cm/min. Calculate the acceleration of Snail 2.

_____

3. Snail 3, trying to keep up with Snail 2, managed to get to the 80-cm mark at 10:15 AM with a velocity of 6 cm/min. Continuing his excellent effort, he crossed the finish line with a velocity of 7.2 cm/min and gobbled the lettuce leaves at exactly 10:18 AM. What was the acceleration of the winning snail?

_____



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SECTION
1-4 Momentum

(pages 25–28)

KEY CONCEPTS

- Momentum depends on the mass of the object and the velocity with which it is traveling.
- The total momentum of any group of objects remains the same unless outside forces act on the objects.

Building Vocabulary Skills: Understanding Definitions

Which of the following statements *do not* accurately describe momentum? Draw an X through the numbers of those statements.

1. Momentum is equal to the mass of an object divided by its velocity.
2. The momentum of an object can change.
3. Two objects with the same mass will always have the same momentum.
4. All moving objects have momentum.
5. When an object speeds up, it gains momentum.
6. Objects with different masses can have the same momentum.
7. Direction does not matter when you are measuring momentum.
8. Momentum cannot be transferred from one object to another.
9. When objects collide, some momentum is lost.
10. A tiny bullet can have more momentum than a huge truck.

Calculating Momentum: Understanding the Main Ideas

Use the information in Table 1 to calculate the momentum of each object. Then list the objects in order according to momentum. Begin with the object that has the least momentum and end with the object that has the greatest momentum.

Table 1

Object	Mass (kg)	Velocity (m/s)	Momentum (kg-m/sec)
blackbird	0.04	19	
football player	100	10	
skier	60	20	
bullet	0.004	600	
frog	0.9	12	
meteorite	0.1	1,000	
baseball	0.14	30	
rocket	36,000	1,800	
wagon	2	3	
satellite	3,000	8,000	

OBJECTS IN ORDER OF MOMENTUM: _____

_____

1. Does the order of these objects surprise you? If you had seen just the names of the objects without the data, would you have placed some in a different order? Why?

_____

_____

_____

_____

2. Do you think that these objects would always be placed in the same order according to momentum? Why or why not?

_____

_____

3. Was the distance you walked the same in each of the trials in Part B? If not, why did it vary?

4. How would the distance walked change if the length of time you measured were increased? Decreased?

5. Describe a relationship between the distance you walk, the time it takes you to walk, and how fast or slow you walk.