Describing Motion

Position and Motion

······Before You Read ······

What do you think? Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind.

Before	Statement	After
	 Displacement is the distance an object moves along a path. 	
	2. The description of an object's position depends on the reference point.	

Describing Position

How would you describe where you are right now? You might say that you are sitting one meter to the left of your friend. You might explain that you are at home, which is two houses north of your school.

What do these descriptions have in common? Each states your location relative to a certain point. This point is called the reference point. A **reference point** *is the starting point you choose to describe the location, or position, of an object*. The reference point in the first example is your friend. In the second example, it is your school. These descriptions <u>specify</u> your location relative to a certain point. You compared your location to reference points, your friend and your school.

Each description of your location also includes your distance and direction from the reference point. Describing your location in this way defines your position. In the first example, the distance is one meter. The direction is to the left, and the reference point is your friend. In the second example, the distance is two houses. The direction is north, and the reference point is your school. A **position** *is an object's distance in a certain direction from a reference point*. A complete description of your position includes a distance, a direction, and a reference point.

Key Concepts

- How does the description of an object's position depend on a reference point?
- How can you describe the position of an object in two dimensions?
- What is the difference between distance and displacement?

Study Coach

Create an Outline As you read, make an outline to summarize the information in the lesson. Use the main headings in the lesson as the main headings in your outline. Use your outline to review the lesson.

ACADEMIC VOCABULARY specify (verb) to indicate or identify

Reading Check

1. Name two ways you could describe your position right now.



Make a half-book to organize your notes about how position and motion are related.



Visual Check 2. Interpret There are two reference points in the drawing. The arrows show the distances and directions from the different reference points. How do you know which reference point is farther from the table?

Key Concept Check

3. Summarize How does the description of an object's position depend on a reference point?

Visual Check 4. Locate State the position of the museum relative to the library.

Using a Reference Point to Describe Position

Suppose you are planning a family picnic at the park shown below. How would you describe the position of the picnic table you reserved? First, choose a reference point that is easy to find. In this park, a statue is a good choice. Next, describe the direction of the table from the reference point. The direction is toward the slide. Finally, suppose the table is about 10 m from the statue. You would say that the position of the table is about 10 m from the statue, toward the slide.



Entrance

Changing the Reference Point

Look again at the drawing of the park. Suppose you choose the drinking fountain as the reference point instead of the statue. Now the direction of the table is toward the dead tree. The distance from the drinking fountain to the table is about 12 m. You can tell your family that the table is about 12 m from the drinking fountain toward the dead tree. The table did not change position. Your description of its position and the reference point are different.

The Reference Direction

Sometimes direction is described using the words *positive* or *negative*. The reference direction is the positive (+) direction. The opposite direction is the negative (-) direction. Suppose east is the reference direction in the diagram below. The museum's entrance is 80 m east of a bus stop. The library is 40 m west of the bus stop. You could say that the museum is +80 m from the bus stop and the library is -40 m from the bus stop. Using the words *positive* or *negative* to describe direction can be useful for explaining changes in an object's position.



Reading Essentials

Describing Position in Two Dimensions

Sometimes you need to use more than one reference direction to describe an object's position. When you describe position using two directions, you are using two dimensions.

Reference Directions in Two Dimensions

The figure below is a map of a city. It shows positions in two dimensions. To describe a position on the map, you might choose north and east or south and west as the reference directions.

Sometimes north, south, east, and west are not the most useful reference directions. Imagine that you are looking at a skyscraper. You might describe a certain window as "up" and "to the left."



Locating a Position in Two Dimensions

Suppose you want to locate your classmate's home on the map above. To find a position in two dimensions, first choose a reference point. You could choose your home as a reference point. Next, give specific reference directions. In this case, you would use south and east. Then, determine the distance along each reference direction. On the map, your classmate's home is one block south and four blocks east of your home.

Describing Changes in Position

Sometimes you need to describe how an object's position changes. Suppose a boat is floating on a lake. How do you know whether the boat has moved throughout the day? You know this when its position changes relative to, or compared to, something else. **Motion** *is the process of changing position*.



5. Apply What are two other examples of directions you could use besides north, south, east, and west?

🕥 Visual Check

6. Describe If the library is the reference point, how would you describe the position of your home in two dimensions?

Key Concept Check 7. Summarize How can you describe the position of an object in two dimensions?



8. Describe Using the buoy as a reference point, describe the motion of the boat.

• Key Concept Check 9. Contrast What is the difference between distance and displacement?

Visual Check

10. Calculate Suppose the baseball player ran from home plate to third base. What is his distance and displacement?

Distance: _

Displacement: ____

Motion Relative to a Reference Point

In the figure below, is the man in motion? Use the fishing pole as the reference point. The positions of the man and the pole do not change relative to each other. This means the man does not move relative to the pole. When the buoy is the reference point, the man's distance from the buoy changes. The man is in motion relative to the buoy.



Distance and Displacement

Suppose a baseball player runs the bases. Distance is the length of the path the player runs. It is shown below by the arrows with dashed lines. He runs 90 ft to get to first base. When he gets to second base, he has run 90 ft + 90 ft = 180 ft.

Displacement *is the difference between the initial (first) position and the final position of an object.* Displacement is shown below by the arrows with solid lines. The initial position is home plate. At first base, the player's distance and displacement are the same. He has run a distance of 90 ft and he is 90 ft from home plate, where he started.

At second base, distance and displacement are different. Look at the middle drawing. The player has run a distance of 180 ft, but his displacement is 127 ft from home plate.

In the drawing on the far right below, the player has circled the bases. He has run a distance of 360 ft (90 ft \times 4), but his displacement is 0 ft. His starting position and ending position are the same—home plate.

Distance depends on the path taken. Only the starting and ending positions matter in displacement. Notice that distance and displacement are equal only if the motion is in one direction.



Reading Essentials

Mini Glossary

displacement: the difference between the initial (first) position and the final position of an object

position: an object's distance in a certain direction from a reference point

motion: the process of changing position

reference point: the starting point you choose to describe the location, or position, of an object

1. Review the terms and their definitions in the Mini Glossary. Write a sentence identifying three things you need to include in a description of any object's position. Then choose an object in the room. Write another sentence describing the position of the object.

After You Read ······

2. In the diagram below, the theater is your reference point. Your reference direction is east. The mall is located +2 blocks from the theater. The park is located -3 blocks from the theater. In the diagram, circle the locations of the mall and park and label them.



Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind? 📃 Connect Đ

Log on to ConnectED.mcgraw-hill.com and access your textbook to find this lesson's resources.



East -

Name _____ Date _____ Class _____

Content Vocabulary

Position and Motion

position of an object.

Directions: On each line, write the term from the word bank that correctly completes each sentence. NOTE: You may need to change a term to its plural form.

dimension	displacement	motion	position	
reference point	relative	specify		
1. If you ask a friend	to meet you somewhe	re, you will need	1	
to	your locat	tion.		
2	is the differe	nce between the	e initial position and	d the final

- 3. Your distance and direction from a reference point (for example, two blocks north of school) will define your _____.
- **4.** Comparing your location to a starting point, or ______, helps describe where you are.
- 5. To describe the position of your school on a map, you need to describe its location in two _____.
- 6. The people on a bus are not moving in relation to the seats inside the bus, but they are in _____ compared to the streets outside.
- **7.** For the field trip, the buses will park three blocks east of the museum; this describes the position of the parking spot ______ to the museum.

Lesson Outline

LESSON 1

Position and Motion

- **A.** Describing Position
 - **1.** A(n) ______ is a starting point you choose to describe the location, or position, of an object.
 - _____ is an object's distance and direction from a **2.** A(n) _____ reference point.
 - **3.** A complete description of a position includes a distance,

a(n) ______, and a reference point.

- **4.** A good choice for a(n) _______ is something that is easy to find.
- 5. If a reference point changes, the description of an object's

_____ will also change.

- 6. Changing a reference point does not change the actual _____ of an object.
- 7. When you describe an object's position, you compare its location to a reference _____
- **8.** A reference direction can be described as a(n) ______ direction. The opposite direction is the ______ direction.
- **B.** Describing Position in Two Dimensions
 - 1. When you describe position using two directions, you are using two _____.
 - _____ directions in two dimensions include 2. Examples of _____ "north and east" and "right and forward."
 - **3.** To find a position in two dimensions, first choose a reference

_____. Next specify reference _____.

Then determine the ________ along each reference direction.

C. Describing Changes in Position

- **1.** ________ is the process of changing position. It is always
- **2.** It is possible to move with regard to one ______ and stay motionless with regard to another _____

Lesson Outline continued

- **3.** _______ is the length of the path an object moves along.
- final position of an object.
- 5. Distance and displacement are equal only if the motion is in

one _____ .