

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

CHAPTER MOTION

# 1 Vocabulary

position

speed

vector

reference point

velocity

acceleration

motion

CHAPTER 1  
Motion

## A. DEFINITIONS

On the line, write the vocabulary word that matches the definition.

1. This is a quantity that has both size and direction.

\_\_\_\_\_

2. This is a change of position over time.

\_\_\_\_\_

3. This is the rate at which velocity changes with time.

\_\_\_\_\_

4. This describes the location of a place or an object.

\_\_\_\_\_

5. This is a speed in a specific direction.

\_\_\_\_\_

6. This is a location with which you compare other locations.

\_\_\_\_\_

7. This is a measure of how fast something moves through a distance in a given amount of time.

\_\_\_\_\_

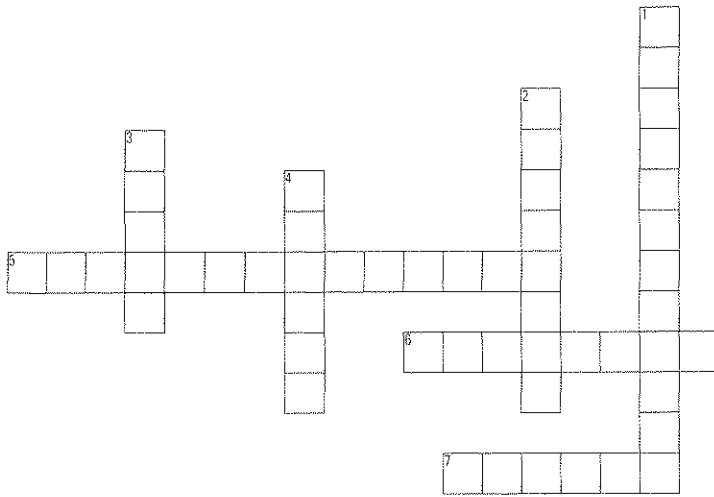
## B. WRITING WITH VOCABULARY WORDS

Imagine that you write for the student newspaper and your assignment is to cover a track meet. Write a paragraph describing the events of the track meet using at least three vocabulary words.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**C. CROSSWORD PUZZLE**

Read the clues below. Then complete the puzzle with the vocabulary words.

**ACROSS**

5. If you described where Santiago, Chile, was by saying that Santiago is about 3000 kilometers southwest of Brasilia, you were using the city of Brasília as this.
6. If you are walking east at a speed of 3 meters per second, you are describing this.
7. A change in position is evidence that this happened.

**DOWN**

1. In physics, this refers to any change in velocity.
2. Often you describe where something is by comparing this with where you currently are.
3. This is the rate at which the distance an object moves changes compared to time.
4. Speed is not this because speed is a measure of how fast or slow an object moves, not which direction it moves in.

**1 Math Support****Working with Units**

To express an answer in the appropriate unit of measure:

Look at the question you are to answer and decide what unit of measure would answer the question.

Include units with each term in your calculations.

Use cancellation to simplify to the correct unit of measure.

$$\text{FORMULA: Speed} = \text{distance/time} \quad S = d/t \quad t = d/S \quad d = St$$

**SAMPLE PROBLEM**

The earliest steam locomotives traveled at a speed of 4 mi/h. How far does the train travel in half an hour?

Decide units.      mi/h means miles per hour; mi means miles.  
Use miles for distance and hours for time.  
Answer should be a distance in miles.

Decide on formula and substitute.       $d = St; S = 4 \text{ mi/h}, t = 0.5 \text{ h}; d = 4 \text{ mi/h} \cdot 0.5 \text{ h}$

Simplify numbers.       $4 \cdot 0.5 = 2$

Simplify units.       $\text{h} \cdot \text{mi/h} = \frac{\cancel{\text{h}} \cdot \text{mi}}{\cancel{\text{h}}} = \text{mi}$

Give answer and simplified units.      2 mi

Answer.      The locomotive could travel 2 miles in half an hour.

**EXERCISES**

Solve each problem. Express your answers in the correct units of measure.

1. If a person walks 1.3 m/s, how far will that person walk in 300 s?

Decide units and formula.

Substitute.

Simplify and solve.

Answer.

2. A cyclist is traveling to a town 140 km away. She maintains a speed of 20 km/h. Excluding rest stops, how long will it take her to get to the town?

Decide units and formula.

Substitute.

Simplify and solve.

Answer.

**1 Math Practice****Working with Units**

**Solve each equation. Write the missing quantity, the correct unit of measure, and the quantity being measured (speed, distance, or time).**

1.  $x = 4 \text{ km/h} \cdot 3 \text{ hr}$

\_\_\_\_\_

2.  $x = \frac{50 \text{ m}}{10 \text{ m/s}}$

\_\_\_\_\_

3.  $x = 70 \text{ mi/h} \cdot 7 \text{ hr}$

\_\_\_\_\_

4.  $x = \frac{25 \text{ km}}{50 \text{ s}}$

\_\_\_\_\_

5.  $x = \frac{576 \text{ mi}}{16 \text{ mi/h}}$

\_\_\_\_\_

6.  $x = \frac{40 \text{ m}}{3 \text{ s}} \cdot 12 \text{ s}$

\_\_\_\_\_

**Solve each problem. Express your answers in correct units.**

7. How long would it take a car traveling at a speed of 40 mi/h to reach a town 160 miles away?

\_\_\_\_\_

8. Maglev, a vehicle that glides above a magnetic field without touching a track, makes a 625-mi trip in 2.5 h. What is the speed of the vehicle?

\_\_\_\_\_

9. A tour bus will travel 330 mi on the first day of the trip. The bus maintains an average speed of 55 mi/h. What will the driving time be for the first day of the trip?

\_\_\_\_\_

10. Anna runs 5 km in 20 minutes. What is her speed in kilometers per hour?

\_\_\_\_\_

11. Andrew runs a mile in 8.2 minutes. If he runs a 5-mile race at the same average speed, how long will it take him to finish the race?

\_\_\_\_\_

12. The Horseshoe Waterfall at Niagara Falls moves backward as the water flowing over it erodes the edge of the cliff. Between the years 1875 and 1905, the Horseshoe Waterfall had moved about 60 m (196 ft). What is the rate at which the falls eroded in meters per year?

\_\_\_\_\_

**1 Math Support****Calculating Acceleration**

Use the formula below when you calculate acceleration.

$$a = \frac{v_{final} - v_{initial}}{t}$$

Recall that  $a$  is the acceleration,  $t$  is the time interval during which the velocity changes,  $v_{final}$  is the velocity the object has at the end of the time interval, and  $v_{initial}$  is the velocity the object had at the beginning of the time interval.

**SAMPLE PROBLEM**

A soccer ball has a speed of 4 m/s. After 10 seconds, it rolls to a stop. What is the acceleration of the ball?

What do you know?  $v_{initial} = 4 \text{ m/s}$      $v_{final} = 0 \text{ m/s}$      $t = 10 \text{ s}$

Sometimes you may need to interpret a question to determine some of the information. For example, the phrase “rolls to a stop” means that the object has a final velocity of 0 m/s.

Substitute.  $a = \frac{0 \text{ m/s} - 4 \text{ m/s}}{10 \text{ s}}$

Solve.  $a = \frac{-4 \text{ m/s}}{10 \text{ s}} = 0.4 \text{ m/s}^2$

When you have an answer, consider if it makes sense. The ball is slowing down, so the acceleration should be negative.

Answer. The soccer ball has an acceleration of  $-0.4 \text{ m/s}^2$ .

**EXERCISES**

1. A bicyclist initially at rest increases her speed to 6 m/s in 30 seconds. What is her acceleration?

Formula

\_\_\_\_\_

Substitute.

\_\_\_\_\_

Solve.

\_\_\_\_\_

Answer.

\_\_\_\_\_

2. A car has an initial velocity of 25 m/s and 3 s later has a velocity of 49 m/s. What is the car's acceleration?

Formula

\_\_\_\_\_

Substitute.

\_\_\_\_\_

Solve.

\_\_\_\_\_

Answer.

\_\_\_\_\_

**1** | **Math Practice****Calculating Acceleration**

1.  $a = \frac{10\text{ m/s} - 5\text{ m/s}}{5\text{ s}}$   
\_\_\_\_\_

2.  $a = \frac{27\text{ m/s} - 21\text{ m/s}}{6\text{ s}}$   
\_\_\_\_\_

3.  $a = \frac{45\text{ m/s} - 10\text{ m/s}}{10\text{ s}}$   
\_\_\_\_\_

4.  $a = \frac{15\text{ m/s} - 40\text{ m/s}}{5\text{ s}}$   
\_\_\_\_\_

5.  $a = \frac{0\text{ m/s} - 30\text{ m/s}}{15\text{ s}}$   
\_\_\_\_\_

6.  $a = \frac{25\text{ m/s} - 50\text{ m/s}}{30\text{ s} - 10\text{ s}}$   
\_\_\_\_\_

**Use the formula for acceleration to find each answer.**

7. An object initially at rest accelerates forward in a straight line. It takes the object 7 s to reach a velocity of 42 m/s. What is the acceleration of the object?  
\_\_\_\_\_
8. A radio-controlled airplane has an initial velocity of 38 m/s. Five seconds later it reaches a velocity of 51 m/s. What is the acceleration of the plane?  
\_\_\_\_\_
9. A runner starts moving and reaches a speed of 4 m/s in 2 seconds. What is his acceleration?  
\_\_\_\_\_
10. A ball is moving at 6 m/s. After 4 seconds, it is moving at 1 m/s. What is the acceleration of the ball?  
\_\_\_\_\_
11. A zebra running at 20 m/s slows and comes to a stop in 10 seconds. What is the zebra's acceleration?  
\_\_\_\_\_

SECTION ACCELERATION MEASURES HOW FAST VELOCITY CHANGES.

**1.3 Challenge and Extension****BIG IDEA** The motion of an object can be described and predicted.**KEY CONCEPT** Acceleration measures how fast velocity changes.

**Velocity-time graphs** Janice decides to create a velocity-time graph for an object with an unusual acceleration. Every second, the acceleration is half what it was the second before. For example, if the object starts with an acceleration of  $8 \text{ m/s}^2$  for the first second, the next second the acceleration would be  $4 \text{ m/s}^2$ , and the second after that, it would be  $2 \text{ m/s}^2$ , and so on.

Janice uses the formula

$$\text{final velocity} = \text{initial velocity} + (\text{acceleration} \cdot \text{time interval})$$

and a time interval of 1 s for each calculation to start the following data chart. She copies the calculated final velocity as the initial velocity for the next row.

- Estimate: At what time do you predict the object will be moving at  $30 \text{ m/s}$ ? at  $31 \text{ m/s}$ ? at  $32 \text{ m/s}$ ?

Time (s)	Initial Velocity (m/s)	Acceleration ( $\text{m/s}^2$ )	Final Velocity at End of Second (m/s)
0	0	16	16
1	16	8	
2	24		28
3		2	
4			
5			
6			
7			
8			

- Finish the chart. On a sheet of graph paper, plot the data showing the initial velocity on the x-axis and time on the y-axis. Do not round the velocities.

- Compare your predictions in question 1 with your graph. At what time will the object be moving at  $30 \text{ m/s}$ ?  $31 \text{ m/s}$ ?  $32 \text{ m/s}$ ?

