Name Date

Section 9.1 Summary

Describing Acceleration

Textbook pages 380–391

Before You Read

Are you accelerating if you are slowing down? Explain your answer on the lines below.

_____

_____

Create a Quiz

After you have read this section, create a five-question quiz based on what you have learned. Repeat the quiz until you get all the answers correct.

How can you calculate a change in velocity?

A **change in velocity** ($\Delta\vec{v}$) occurs when the speed of an object changes, or its direction of motion changes, or both. Changes in velocity can be either positive or negative. To find a change in velocity, subtract the initial velocity ($\vec{v}_i$) from the final velocity ($\vec{v}_f$).

$$\Delta\vec{v} = \vec{v}_f - \vec{v}_i$$

How do signs indicate changes in velocity?

North, east, up, and right are considered positive (+) and south, west, down, and left are negative (–). If you slow down from 9 m/s forward (positive) to 2 m/s forward (positive), your change in velocity is as follows:

$$\begin{aligned}\Delta\vec{v} &= \vec{v}_f - \vec{v}_i \\ &= +2 \text{ m/s} - (+9 \text{ m/s}) \\ &= -7 \text{ m/s}\end{aligned}$$

Your change in velocity is 7 m/s opposite the forward motion. Your initial forward direction is *positive*, so your change in velocity is *negative* when you slow down.

What is acceleration?

Reading Check

1. Define acceleration.

_____

_____

_____

Acceleration is the rate at which the velocity of a moving object changes. A change in velocity can be a change in either speed or direction. Thus, acceleration occurs when the speed of an object changes, or its direction of motion changes, or both. Acceleration is a rate of change. This means it also takes into account how quickly the velocity changes.

How do signs indicate changes in acceleration?

Recall that forward motion is defined as positive and backward motion is defined as negative. Different factors can help you decide if an object's acceleration is positive or negative, as shown in the table below:

Factor	Velocity	Acceleration
increase in speed while travelling forward, e.g., accelerating after you have stopped at a stop sign	+ (positive)	+ (positive)
decrease in speed while travelling forward, e.g., applying the brakes on a bicycle	+ (positive)	– (negative)
increase in speed while travelling backward, e.g., a ball falling to earth	– (negative)	– (negative)
no change in speed, e.g., running at a constant speed	constant	0

Note that an object that is slowing down is changing its velocity; therefore, it is accelerating. Acceleration in a direction that is opposite the direction of motion is sometimes called **deceleration.**

Reading Check

2. What is the acceleration of an object travelling at a constant velocity?

Name Date

Cloze Activity
Section 9.1

Use with textbook pages 380–386.

Velocity and acceleration

Vocabulary	
constant velocity	positive acceleration
deceleration	same direction
negative	speed
negative acceleration	vector
opposite direction	velocity
positive	

Use the terms in the vocabulary box to fill in the blanks. You may use each term only once.

1. Since velocity is a _____, it is dependent on the _____ of the object and the direction in which the object is moving.
2. A change in velocity is _____ when an object speeds up.
3. A change in velocity is _____ when an object slows down.
4. An object has _____ when it is travelling with uniform motion.
5. Acceleration is the rate of change in _____ .
6. An object has a _____ when its speed is increasing.
7. An object has a _____ when its speed is decreasing.
8. If an object's acceleration is in the _____ as its velocity, the object's speed increases.
9. If an object's acceleration is in the _____ as its velocity, the object's speed decreases.
10. Acceleration that is opposite to the direction of motion is called _____ .

Use with textbook page 382.

Calculating change in velocity

1. Complete the following table by calculating the missing quantities. Positive (+) represents the forward motion. Use the formula $\Delta\vec{v} = \vec{v}_f - \vec{v}_i$. In the last column, describe the change in velocity (e.g. object is slowing down, object is speeding up, or object is in uniform motion).

$\vec{v}_i$	$\vec{v}_f$	$\Delta\vec{v}$	Description of $\Delta\vec{v}$
+ 14 m/s	+ 5 m/s		object is slowing down
+ 8 m/s		0 m/s	
	+ 25 m/s	+ 12 m/s	
+ 20 m/s	– 30 m/s		
– 38 m/s		– 10 m/s	
	– 16 m/s	0 m/s	
– 3 m/s	+ 22 m /s		

2. Use the following data table to calculate the change in velocity for each time interval. Suppose motion toward north is positive (+).

Time (s)	Velocity (m/s)
0	0
10	15
20	28
30	28
40	22
50	12

a) 0 s – 10 s _____

b) 10 s – 20 s _____

c) 20 s – 30 s _____

d) 30 s – 40 s _____

e) 40 s – 50 s _____

Use with textbook page 385–386.

Positive, negative, and zero acceleration

1. In each situation described below, identify whether the object or person has positive acceleration, negative acceleration, or zero acceleration.

a) an airplane taking off _____

b) a person standing still at a bus stop _____

c) a bus braking as it approaches a red light

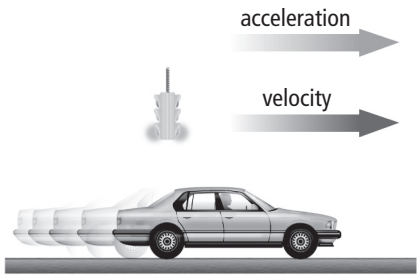
_____

d) a person sliding down a water slide with constant velocity

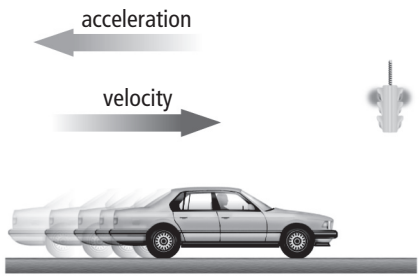
_____

2. In each illustrated example shown below, identify whether the object or person has positive acceleration, negative acceleration or zero acceleration.

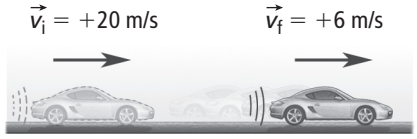
a) _____



b) _____

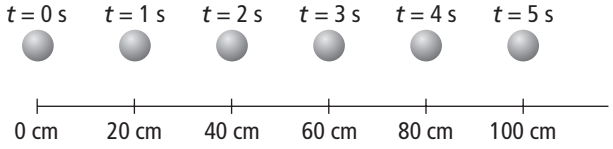


c) _____

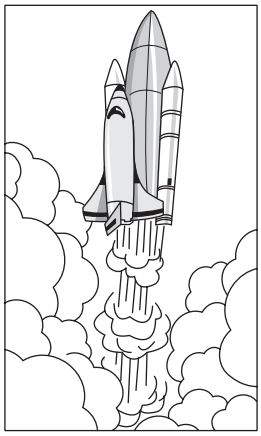


d) _____

e) _____



f) _____



Use with textbook pages 382–386.

Describing acceleration

Match the Term on the left with the best Descriptor on the right.Each Descriptor may be used only once.

Term	Descriptor
1. _____ acceleration **2.** _____ deceleration **3.** _____ constant velocity **4.** _____ change in velocity	**A.** rate at which an object changes its velocity **B.** an object travelling with uniform motion in a straight line **C.** acceleration in a direction that is opposite to the direction of motion **D.** change that occurs when the speed of an object changes, or its direction of motion changes, or both

Circle the letter of the best answer.

5. The tortoise moved slowly and steadily. The hare ran quickly, then fell asleep near the finish line. Identify the following quantities as scalar or vector, respectively: the average velocity of the tortoise during the entire race, the acceleration of the hare during the first 2 minutes of the race and the time it takes for the tortoise and the hare to finish the race.

A. vector, vector, scalar

B. scalar, scalar, vector

C. vector, scalar, vector

D. scalar, vector, scalar

6. If the acceleration of an object is in the opposite direction as the velocity, which of the following happens?

A. the object speeds up

B. the object slows down

C. the object remains at rest

D. nothing happens to the object

7. Suppose an object moving forward changes its velocity from 15 m/s to 6 m/s.What is the change in velocity?

A. –21 m/s

B. –9 m/s

C. 9 m/s

D. 21 m/s

8. Which of the following have an acceleration in the same direction as the object's motion?

I.	$\vec{v}_i$ = 3.5 m/s [east]; $\vec{v}_f$ = 7.5 m/s [east]
II.	$\vec{v}_i$ = 45 km/h [north]; $\vec{v}_f$ = 60 km/h [north]
III.	$\vec{v}_i$ = 15 m/s [right]; $\vec{v}_f$ = 10 m/s [left]

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

9. Which of the following are true about acceleration?

I.	When an object's speed is constant, the object has zero acceleration.
II.	When an object's speed is increasing, the object has a positive acceleration.
III.	When an object's speed is decreasing, the object has a negative acceleration.

A. I and II only

B. I and III only

C. II and III only

D. I, II, and III