Name _____ Date _____ Class _____



# Acceleration

### Key Concepts

- What kind of motion does acceleration refer to?
- How do you calculate acceleration?
- What graphs can be used to analyze the motion of an accelerating object?

**Acceleration** is the rate at which velocity changes. Recall that velocity has two components—direction and speed. Acceleration involves a change in either of these components. **In science, acceleration refers to increasing speed, decreasing speed, or changing direction.**

Any time the speed of an object changes, the object experiences acceleration. That change can be an increase or decrease. A decrease in speed is sometimes called deceleration, or negative acceleration.

An object that is changing direction is also accelerating, even if it is moving at a constant speed. A car moving around a curve or changing lanes at a constant speed is accelerating because it is changing direction.

Many objects continuously change direction without changing speed. The simplest example of this type of motion is circular motion, or motion along a circular path. The moon accelerates because it is continuously changing direction as it revolves around Earth.

Acceleration describes the rate at which velocity changes. **To determine the acceleration of an object, you must calculate its change in velocity per unit of time.** This is summarized by the following formula.

$$\text{Acceleration} = \frac{\text{Final velocity} - \text{Initial velocity}}{\text{Time}}$$

If velocity is measured in meters/second and time is measured in seconds, the unit of acceleration is meters per second per second, which is written as $m/s^2$.

**You can use both a speed-versus-time graph and a distance-versus-time graph to analyze the motion of an accelerating object.** When a graph shows speed versus time as a slanted straight line, the acceleration is constant. You can find acceleration by calculating the slope of the line. If an object accelerates by a different amount each time period, a graph of its acceleration will not be a straight line. A graph of distance versus time for an accelerating object is curved.





Name _____ Date _____ Class _____

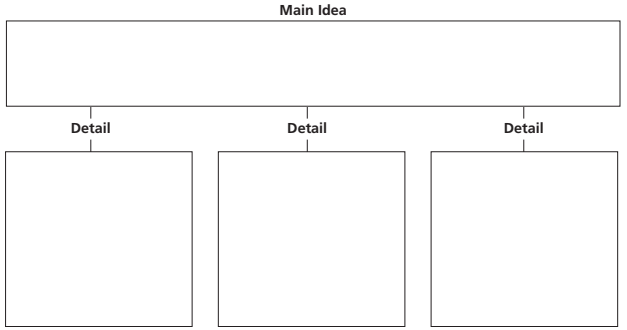


# Acceleration (pp. 350–355)

*This section describes what happens to the motion of an object as it accelerates, or changes velocity. It also explains how to calculate acceleration.*

### Use Target Reading Skills

*Locate the main idea of the text under the heading "Calculating Acceleration" on page 352. It is the boldfaced sentence. Write the main idea in the graphic organizer below. Then look for details and examples that support the main idea. Write these supporting details in the lower portion of the graphic organizer.*




### Changing Velocity (pp. 350–351)

1. What is acceleration?

   _____

   _____

2. Acceleration involves a change in either _____ or _____.
3. Any time the speed of an object increases, the object undergoes _____.
4. Is the following sentence true or false? Acceleration refers to increasing speed, decreasing speed, or changing direction. _____
5. Deceleration is another word for negative _____.
6. Is the following sentence true or false? An object can be accelerating even if its speed is constant. _____

**7.** Circle the letter of each sentence that describes an example of acceleration.

- **a.** A car follows a gentle curve in the road.
- **b.** A batter swings a bat to hit a ball.
- **c.** A truck parked on a hill doesn't move all day.
- **d.** A runner slows down after finishing a race.

**8.** The moon revolves around Earth at a fairly constant speed. Is the moon accelerating?

_____

_____

**9.** Use the table below to compare and contrast the meanings of acceleration.

| Acceleration | |
|---|---|
| **In Everyday Language** | **In Scientific Language** |
| | Increasing speed |
| Slowing down | |
| Turning | |

## Calculating Acceleration (pp. 352–353)

**10.** What must you calculate to determine the acceleration of an object?

_____

_____

**11.** What is the formula you use to determine the acceleration of an object moving in a straight line?

_____

**12.** Is the following sentence true or false? To calculate the acceleration of an automobile, you must first subtract the final speed from the initial speed. _____





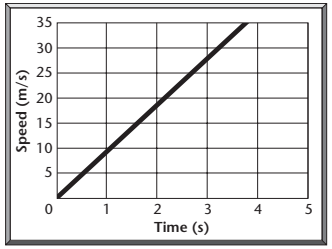


## Acceleration *(continued)*

**13.** Circle the letter of each sentence that is true about calculating the acceleration of a moving object.

- **a.** If an object is moving without changing direction, then its acceleration is the change in its speed during one unit of time.
- **b.** If an object's speed changes by the same amount during each unit of time, then the acceleration of the object at any time is the same.
- **c.** To determine the acceleration of an object, you must calculate the change in speed during only one unit of time.
- **d.** If an object's acceleration varies, then you can describe only average acceleration.

## Graphing Acceleration (pp. 354–355)




**14.** The graph above shows the motion of an object that is accelerating. What happens to the speed of the object over time?

_____

_____

**15.** The line on the graph is slanted and straight. What does this line show about the acceleration of the object?

_____

_____