

# Forces and Motion

A low-angle, upward-looking photograph of a carousel. The ornate, painted canopy of the carousel is visible on the left side of the frame. Numerous ropes extend from the canopy to chairs suspended in the air. Several people are seated in these chairs, which are at various heights and angles, suggesting motion. The background is a bright blue sky with scattered white clouds. The overall composition emphasizes the height and dynamic movement of the ride.

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# **Forces and Motion**

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# What Is Motion?



## VOCABULARY



motion



distance



speed



**Motion** is a change of position.

Something has to move to change its position. You are in motion when you swing back and forth.



**Distance** is how far one place is from another. Distance is often measured in inches, yards, and miles. You can use a ruler to measure distance.



**Speed** is the distance an object moves in a certain period of time. You use both distance and time to find speed. This skater moves fast. She moves a long distance in a short time.





## READING FOCUS SKILL **COMPARE AND CONTRAST**

When you **compare and contrast**, you tell how things are alike and different.

Look for ways to **compare and contrast** how objects move.

### **Types of Motion**

Everything has a position, or location. What is your position? You may be sitting at your desk. If you stand up and walk across the room, you are in motion. **Motion** is a change of position. When you sit down again, you are no longer changing position. You are no longer in motion.

◀ Back-and-forth motion

▶ Straight-line motion ▶





**Zigzag motion**



**Round-and-round motion**

There are many kinds of motion. An object can keep moving in one direction. It can change directions, too. It can move fast or slowly. Look at the pictures. How are the children moving? How do you move on a playground?



**Compare the motions in the pictures. How are they alike and different?**

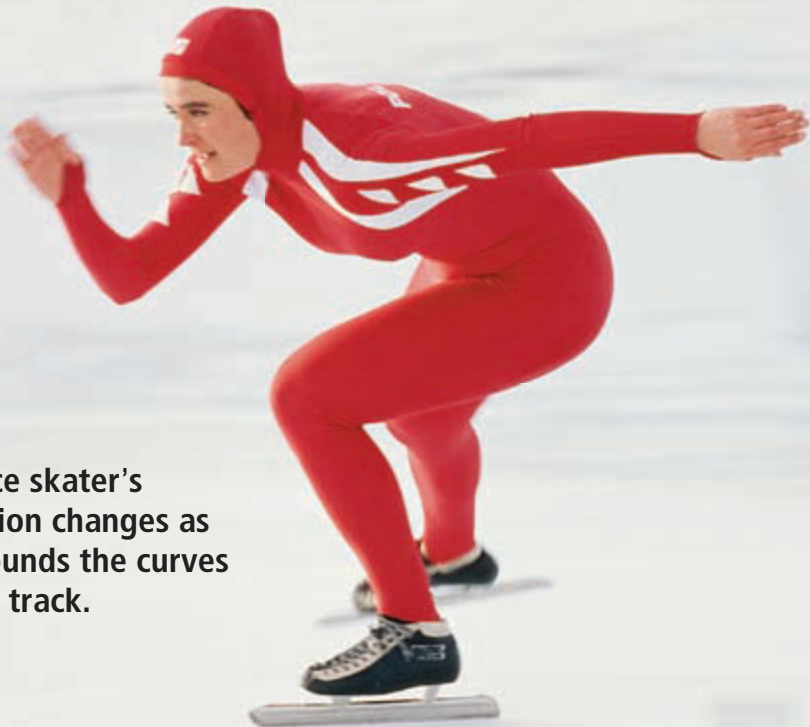
**Fast motion and slow motion**



## Distance, Direction, and Time

- When you travel from home to school, you move a distance. You also move in a direction.
- Distance** is how far it is from one place to another. The distance from your home to school may be one mile.
- The direction of a moving thing may be up or down. It may be north, south, east, or west. You may go east on the way to school and west on the way home.

- This ice skater's direction changes as she rounds the curves of the track.

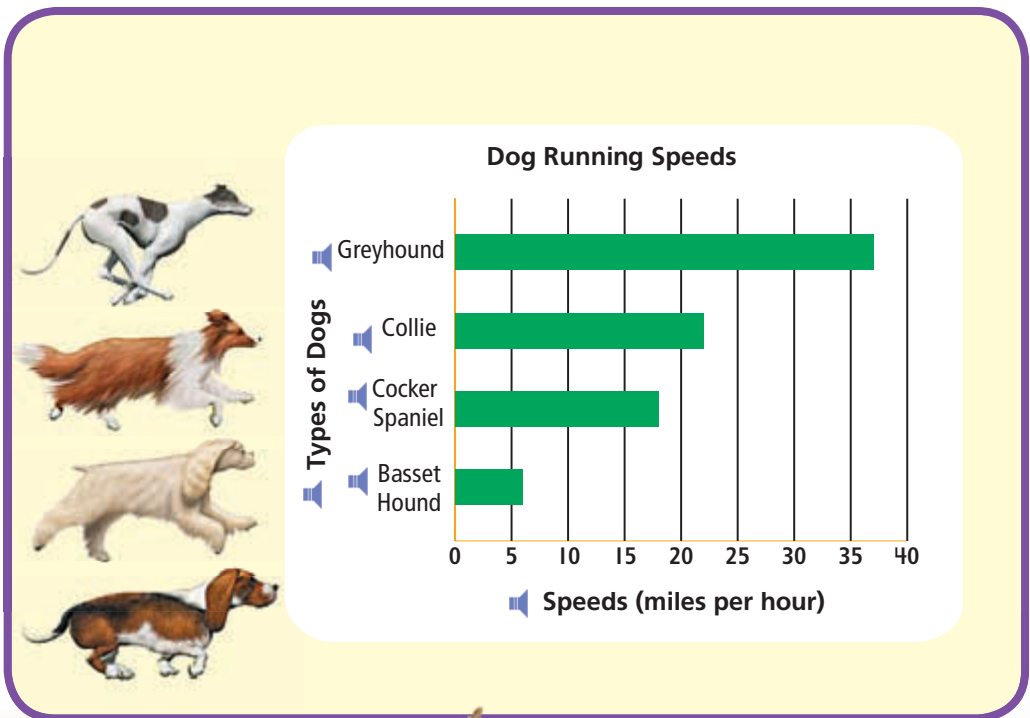




▶ You can measure the distance an object moves. Distance can be measured in inches, yards, and miles. Scientists measure in centimeters, meters, and kilometers.

▶ You can also measure the time it takes an object to move. Time is measured in seconds, minutes, hours, days, or years. Something that moves fast covers a long distance in a short time.

▶  **Which dog below is the slowest? Which dog is the fastest?**



# Speed

- ▶ **Speed** is the distance an object moves in a certain period of time. You use both distance and time to find speed.
- ▶ Many things travel the same distance in different times. You can run 50 meters in much less time than a snail can. Your speed is greater.



▶ Plants turn toward the sun at such a slow speed that you cannot see them move. This motion is measured in millimeters per days.

Now, suppose you and a friend run for two minutes, but you run farther. The one who travels farther has the greater speed. That's you!



Suppose a zebra runs 15 kilometers and a bear runs 10 kilometers within one hour. Which animal has the greater speed?



A hummingbird can beat its wings 90 times per second.

## Review



Complete the **compare and contrast** statements.

1. When you go back and forth or round and round, you are in \_\_\_\_\_.
2. Motion is a change of \_\_\_\_\_ of an object, and \_\_\_\_\_ is how far it moves.
3. \_\_\_\_\_ is a measure of how long it takes an object to move, and \_\_\_\_\_ is the distance it moves during that period.

# What Are Forces?

## VOCABULARY

- force
- gravity
- weight



- Gravity** is a force that pulls two objects toward each other. Gravity pulls a roller coaster back to Earth.



▶ A **force** is a push or pull.  
It takes a force to move an object.



▶ **Weight** is a measure of the force of gravity on an object. Objects with a large mass weigh more.





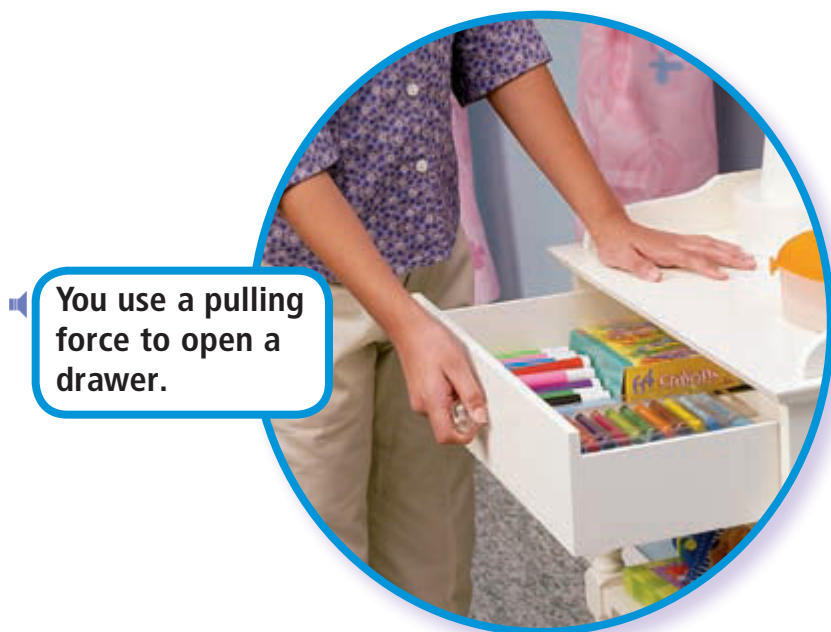
## READING FOCUS SKILL

### MAIN IDEA AND DETAILS

The **main idea** is what the text is mostly about. **Details** tell more about the main idea. Look for **details** that tell about forces.


## Types of Forces

- It takes a force to move things. A **force** is a push or a pull. You pull to open a drawer. You push to close it.
- Forces can make things change directions. If you push down on one end of a seesaw, the other end comes up.



🔊 *Friction* is a force that stops things or slows them down. When two objects rub together, there is friction. Rough surfaces make more friction than smooth ones. That is why you could slide farther on ice than on dirt.

🔊 A magnet has a force. It can push or pull things made of iron and steel without touching them.

🔊  **Tell what force you make when you rub your hands together.**

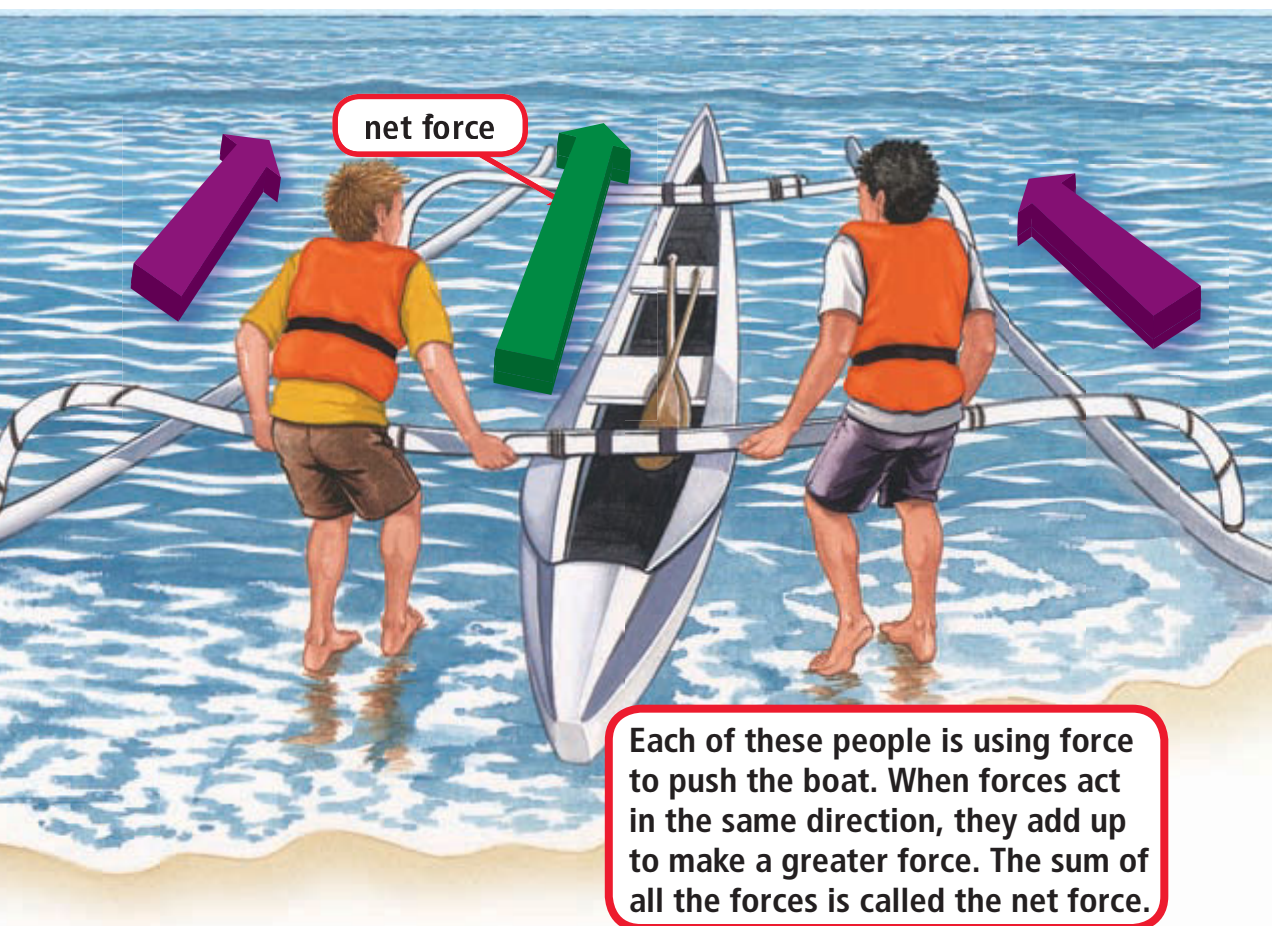


## Ways Forces Change Motion

Three things affect the motion of an object.

- The strength of the force
- The direction of the force
- The mass of the object

The stronger the force is, the greater the change in motion. When you toss a ball gently, it does not move fast or far. When you throw a ball hard, it moves faster and farther.





▶ The stroller moves in the direction that the jogger pushes it.

▶ An object moves in the direction of the force that is pushing or pulling it. If you pull up on an object, it comes up. If you push to the right, the object moves right.

▶ The smaller an object's mass is, the easier it is to move it. A pencil has less mass than a book. So it takes less force to pick up a pencil.



**Tell what three things affect an object's motion.**



# Gravity

- ▶ **Gravity** is a force that pulls two objects toward each other. If you toss a ball into the air, it will come back down. Earth's gravity pulls it down.
- ▶ The force of gravity between most objects is weak. You don't feel the force of gravity between you and your desk. But the pull of Earth's gravity is very strong because Earth is so large.



- ▶ ◀ The force of gravity pulls the water back down to Earth.



- ▶ The force of gravity depends on how much mass an object has. **Weight** is a measure of the force of gravity on an object. An object with a large mass weighs more than an object with a small mass.



Does gravity pull harder on a mother pig or on one of her young? Tell how you know.



Mother pig and young

## Review



Complete the **main idea** statement.

- ▶ 1. Force is a \_\_\_\_\_ or \_\_\_\_\_ that moves an object.

▶ Complete these **detail** statements.

- ▶ 2. The strength and \_\_\_\_\_ of a force affect the motion of an object.
- ▶ 3. Gravity is a force that pulls a ball back to \_\_\_\_\_ when you toss it into the air.
- ▶ 4. The force of gravity on an object depends on how much \_\_\_\_\_ it has.



# How Do Waves Move?



## VOCABULARY



wave



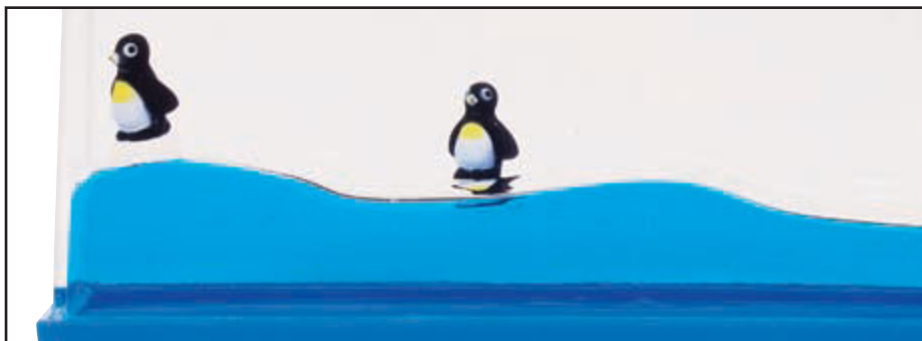
crest



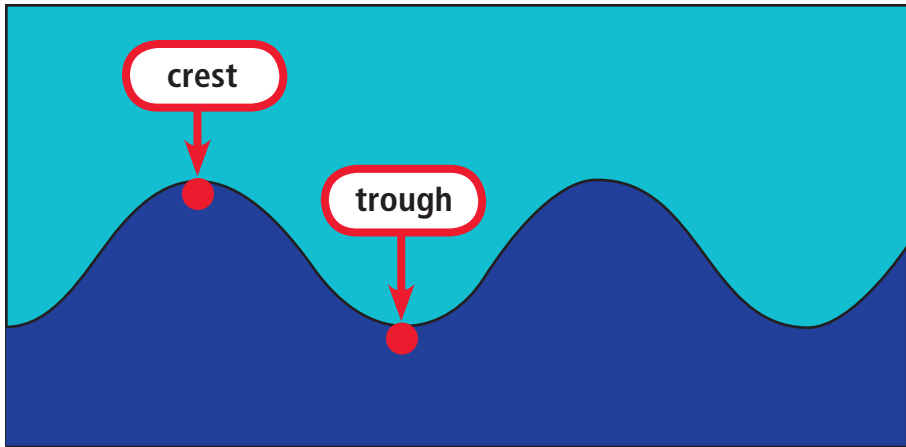
trough



wavelength



A **wave** forms when something vibrates. A wave travels through matter or space. It carries energy. Light and sound travel in waves.



- ▶ The **crest** is the highest point of a wave.
- ▶ The **trough** is the lowest point of a wave.



- ▶ **Wavelength** is the distance from one wave to the next wave. The distance from one crest to the next crest is one way to measure wavelength.



## READING FOCUS SKILL

### MAIN IDEA AND DETAILS

The **main idea** is what the text is mostly about. **Details** tell more about the main idea.

- 🔊 Look for **details** about kinds of waves and the parts of a wave.

## Types of Waves

- 🔊 Waves are all around you. Sound waves travel to your ears. Light waves travel to your eyes. Microwaves cook your food. X-ray waves take pictures of the inside of your body. Ocean waves crash against the beach.

- 🔊 Sound waves bring sound energy to your ears.





🔊 Waves disturb the water.

🔊 A **wave** is a disturbance that travels through matter or space. A wave forms when something vibrates. When you speak, your vocal cords vibrate to make sound waves.

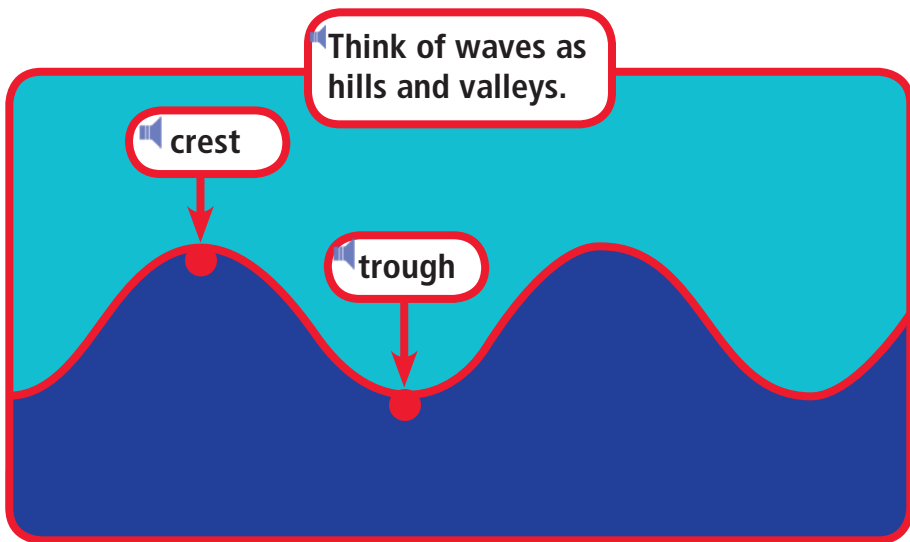
🔊 There are two types of waves. Some waves, like light waves, move up and down. Other waves, like sound waves, move back and forth.

🔊  **Tell what a wave is and how it forms.**



# Measuring Waves

Waves have parts that you can measure. The **crest** is the highest point of a wave. The **trough** is the lowest point of a wave. The greater the distance between the two points, the larger the wave is. The more energy it carries, too.




▶ The crest and trough of waves can be used to measure wavelength. **Wavelength** is the distance from one point of a wave to the same point of the next wave.

▶ Forces affect how much energy waves carry. If you beat hard on a drum, the sound is louder than if you tap softly.



▶ ▲ Wavelength can be measured.

▶  What are the parts of a wave?

## Review



Complete the **main idea** statement.

▶ 1. A wave forms when something \_\_\_\_\_.

▶ Complete the **detail** statements.

▶ 2. Waves travel through matter or \_\_\_\_\_.



▶ 3. The greater the distance between the trough and \_\_\_\_\_ of a wave, the more energy it carries.

▶ 4. Waves move up and down or \_\_\_\_\_.

## 🔊 **GLOSSARY**



- 🔊 **crest** (KREST) the highest point of a wave (22)
- 🔊 **distance** (DIS•tuhns) how far one location is from another (6)
- 🔊 **force** (FAWRS) a push or a pull (12)
- 🔊 **gravity** (GRAV•ih•tee) a force that pulls two objects toward each other (16)
- 🔊 **motion** (MOH•shuhn) a change of position (4)
- 🔊 **speed** (SPEED) the distance that an object moves in a certain period of time (8)
- 🔊 **trough** (TRAWF) the lowest point of a wave (22)
- 🔊 **wave** (WAYV) a disturbance that travels through matter or space (21)
- 🔊 **wavelength** (WAYV•length) the distance from one point of one wave to the same point on the next wave (23)
- 🔊 **weight** (WAYT) the measure of the force of gravity on an object (17)

## **Think About the Reading**

-  **1.** What is motion? What are forces? How do forces affect motion? What force pulls on you?
-  **2.** What causes waves? Why are waves important? How are waves measured?

## **Hands-On Activity**

Use a large tub of water, a rock, and a pebble to explore waves.

-  **1.** Drop a pebble into the center of a tub of water. Observe the waves. Repeat with a rock.
-  **2.** Compare the waves made by the pebble and the rock. Draw your observations.

## **School-Home Connection**

Tell a family member what you read about the different types of motion. Then together, choose an activity or sport that you both enjoy. Then draw and label the types of motion you use.

**GRADE 3**

Book 15

**WORD COUNT**

775

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Expository Nonfiction

**LEVEL**

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