

Physical Science

Forces and Motion

On Level

# How Things Move

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FOR:

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Student Book  
•  
Assessments and Reading Activities

# How Things Move

What causes objects to move?

## CORE CURRICULUM STATEMENTS

### **Energy and matter interact through forces that result in changes in motion.**

The position of an object can be described by locating it relative to another object or the background (e.g., on top of, next to, over, under, etc.).

The position or direction of motion of an object can be changed by pushing or pulling.

The force of gravity pulls objects toward the center of Earth.

The forces of gravity and magnetism can affect objects through gases, liquids, and solids.



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# Student Book

How Things Move

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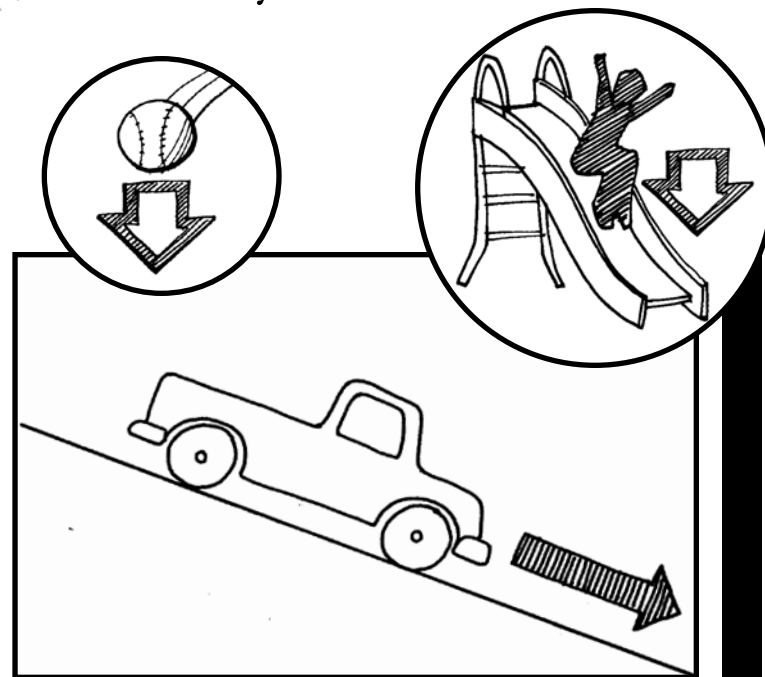


Physical Science

Force and Motion

# How Things Move

by Tom Sibila





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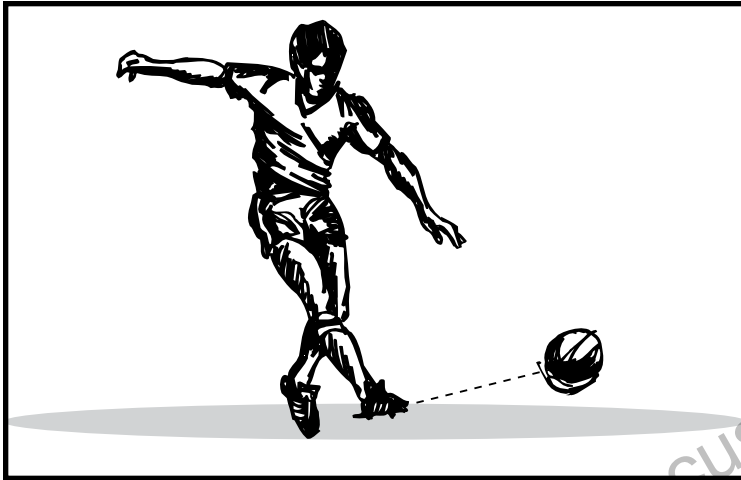
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– Predict –

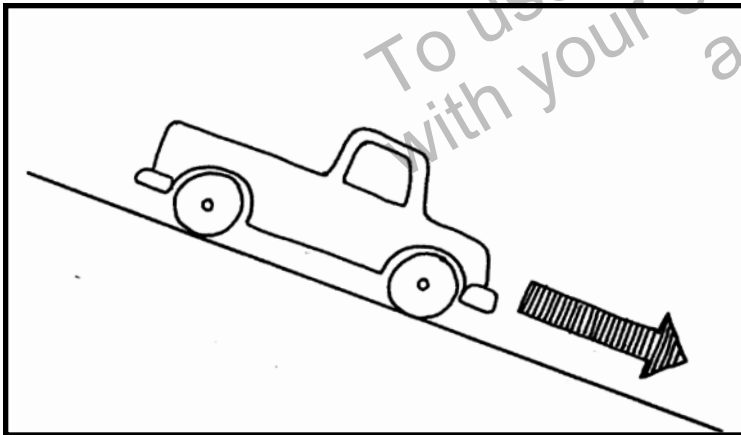
*What do you think you will  
learn from reading this book?*

---

## Objects Move When Forces Push or Pull on Them



*This ball is being pushed by the boy's foot.*



*This car is being pulled down a hill by the force of gravity.*

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## INTRODUCTION

### What Is Motion?

At a playground, a boy is on top of a slide. He is above his friend waiting at the bottom. Gravity pulls the boy down the slide. His friend climbs up the ladder. She is now above the boy.

Everything that moves is put in motion by a **force** applied to it. Force comes from the power of pushing or pulling.

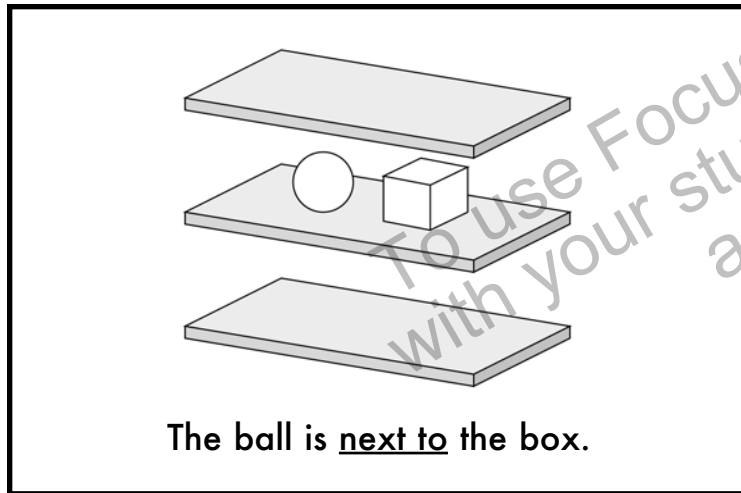
There are different types of forces that affect motion. They include pushes, pulls, gravity, and magnetism. Read on to learn more about what causes motion.

**force:** a push or pull that changes the movement of an object

## Locating Positions of Objects

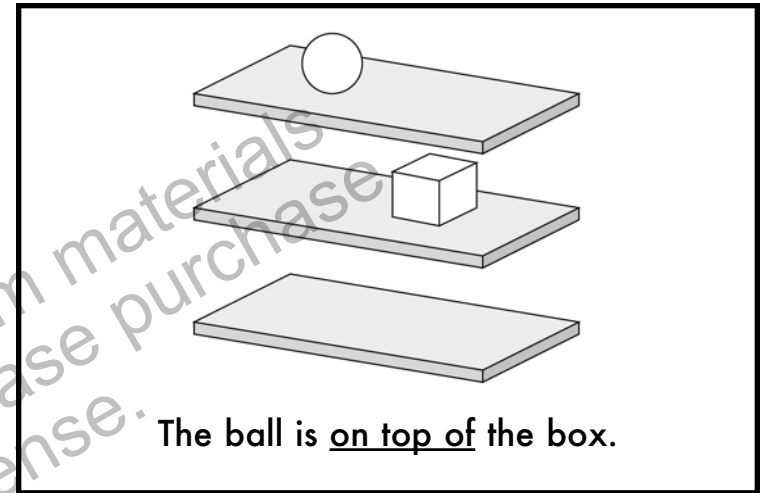
When a force moves an object, the object changes its position **relative** to other objects.

For example, in this picture the ball is next to the box on the shelf.

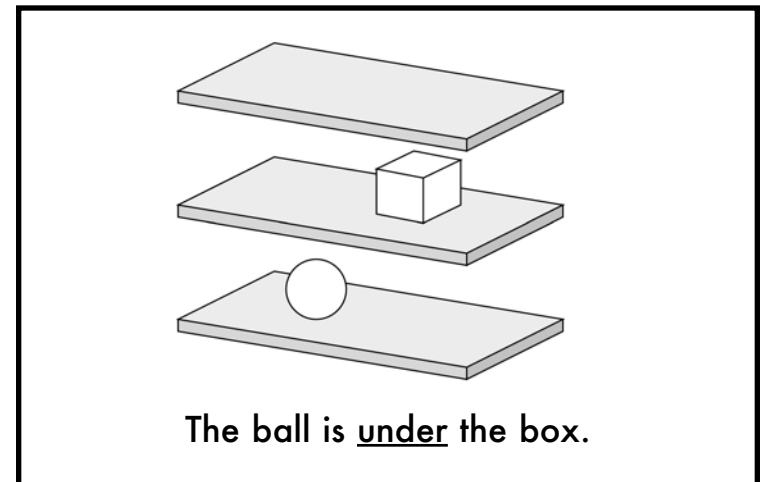


**relative:** compared to others

You could move the ball to be on top of the box.



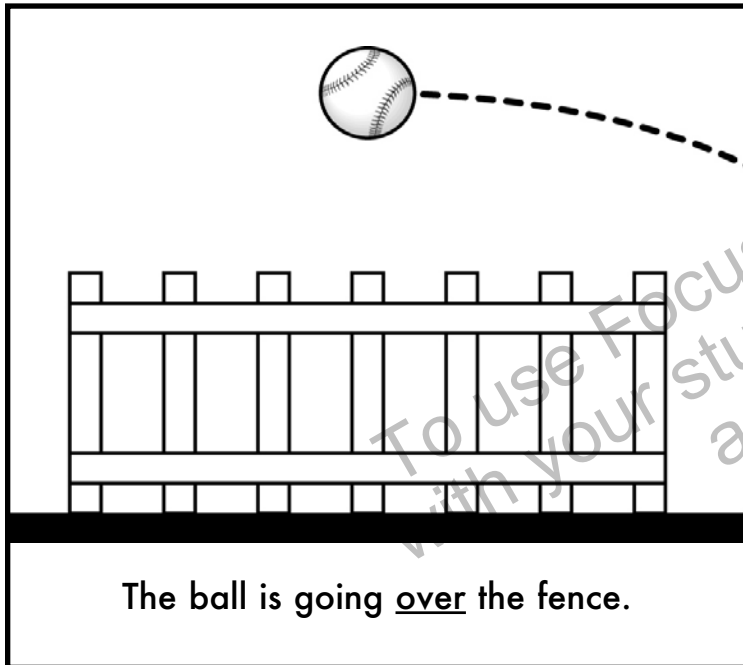
You could also move the ball to be under the box.





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We describe the location of objects by comparing them to the position of other objects. In the diagram below, we compare the location of the baseball with the position of the fence.

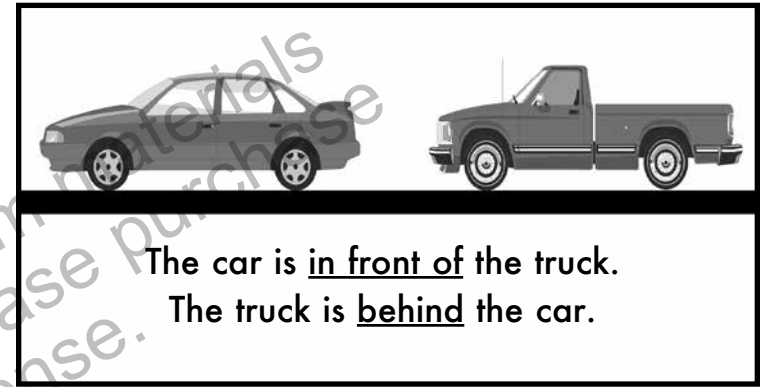


– Extend –

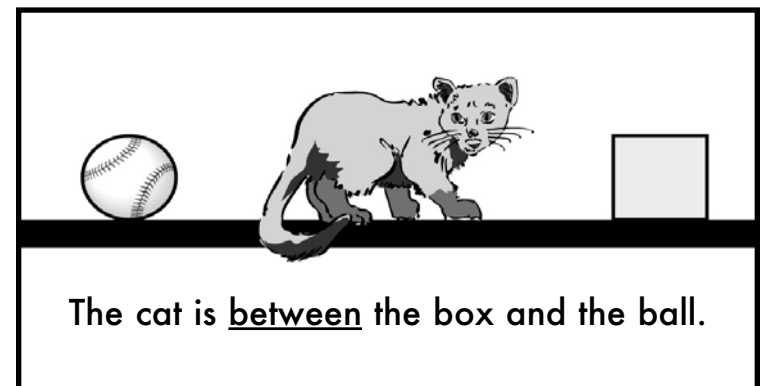
*What other words describe the location of objects?  
Brainstorm a list of words with a friend.*

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In the drawing below, we compare the location of the car with the position of the truck in two ways.



Below, we compare the location of a cat with two objects. How else can you describe the cat's location?



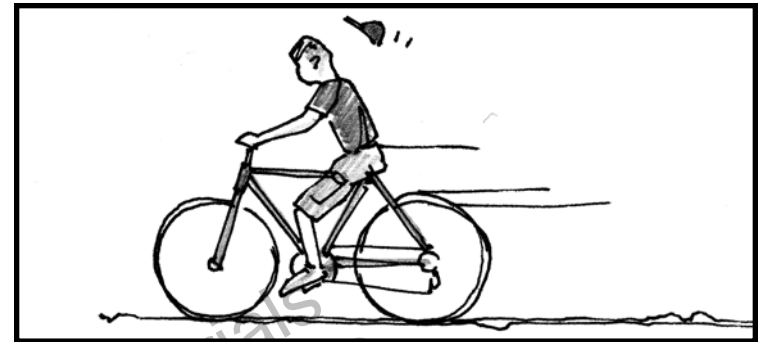
## Pushes and Pulls

Remember the ball and box on the shelf? In one picture, the ball was next to the box. In another, the ball was above the box. How did the ball get there? It was moved, or was put into motion. What caused this motion?

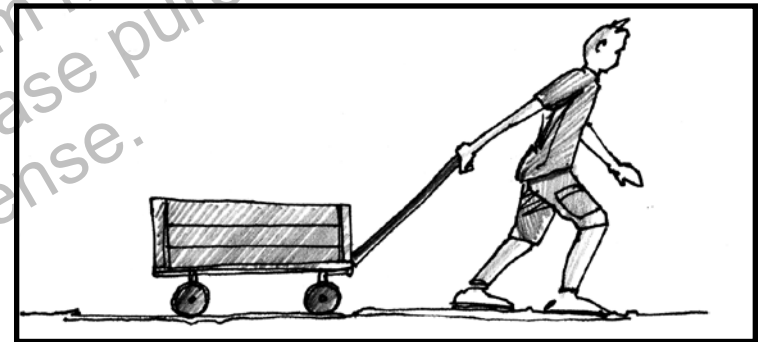
Motion is caused by a force. A force is a push or a pull. Pushes and pulls usually move things.

You cannot see forces. They are **invisible**. But, you can see the effects of forces. You can see a friend ride a bicycle. You can tug on a wagon to move it forward. You can see a leaf fall from a tree.

**invisible:** not able to be seen



*This boy is pushing the pedals to move the bicycle.*



*This boy is pulling the wagon to move it forward.*

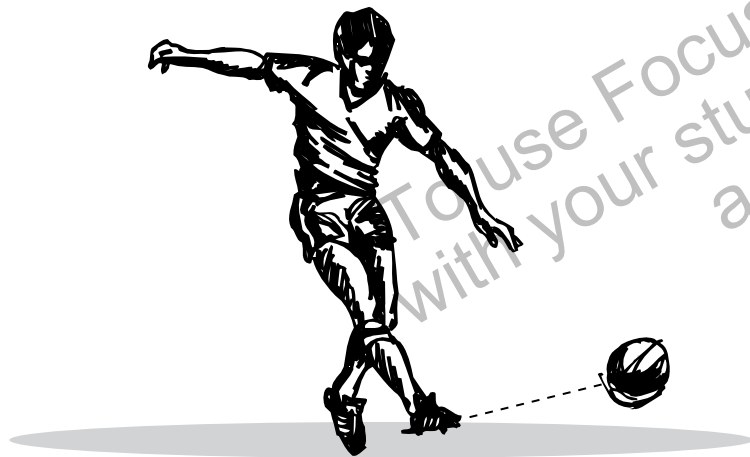


*This leaf is being pulled to the ground.*

---

A force can move an object that is at rest. A force can also act on objects that are already moving.

You can kick a moving soccer ball to make it go faster and farther. When you kick the ball, you increase the force acting on the ball. The ball moves faster.



*If you kick a soccer ball that is already moving, it will move faster and farther.*

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Push a friend on a swing. Your friend moves faster and higher. Push again a little harder. Your friend goes even faster and higher.



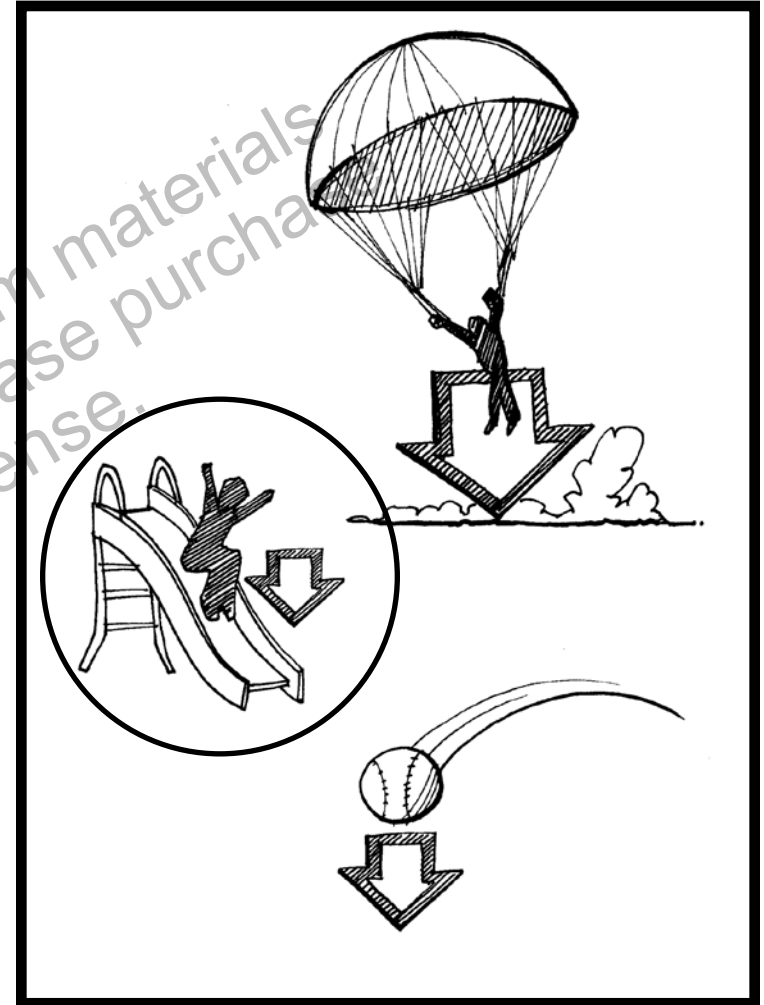
*The harder you push, the more force you use. The swing will move faster and higher.*

# Gravity

Acorns fall from trees in Central Park. Water pours over a waterfall. Rocks tumble down from the top of a mountain. The force of gravity causes this.

All objects on Earth are pulled toward the center of Earth. Like other forces, gravity is invisible. Still, we can see its effects everywhere.

## The Force of Gravity

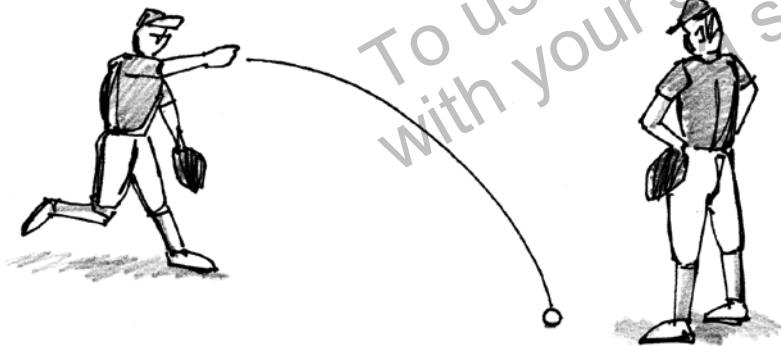


*The force of gravity pulls all objects on Earth toward the planet's center.*

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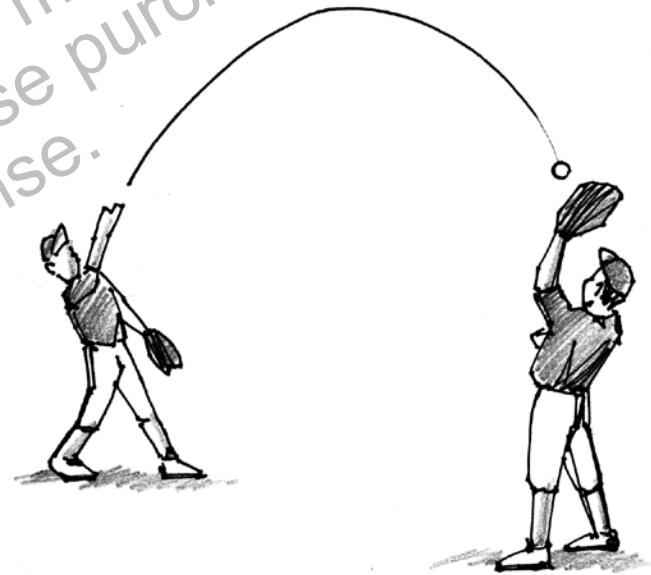
Gravity has an effect on other forces. Have you ever thrown a ball to a friend far away, but the ball did not reach him or her? What happened?

You used a force to make the ball move forward. However, you probably noticed that the ball did not move in a straight line. It moved lower and lower the farther it traveled. Why?



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The force of gravity pulled the ball down. In order to get the ball to your friend, you need to throw the ball high. If you throw the ball high enough and with enough force, it will get to your friend.



Next time you see something moving, remember that a force pushed or pulled to set it in motion.

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## Glossary

**force**—a push or pull that changes the movement of an object

**invisible**—not able to be seen

**relative**—compared to others

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## To Find Out More . . .

Want to learn more about how things move?

### Try these books

*Force & Motion* by Peter Lafferty.  
Dorling Kindersley, Inc. 1992

*Speed and Acceleration* by Richard Spilsbury. Heinemann Library, 2007.

### Access these Web sites

The Little Shop of Physics

<http://littleshop.physics.colostate.edu/>

Fizzics Fizzle! An Interactive Guide to Physics

<http://library.thinkquest.org/16600/>

### Write for more information

National Student Research Center  
606 Lafitt Street

Mandeville, Louisiana 70448

National Academy of Engineering  
500 Fifth Street, NW

Washington, DC 20001

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# Assessments

How Things Move

Print pages 18–20 of this PDF for the assessments.



# Check Understanding

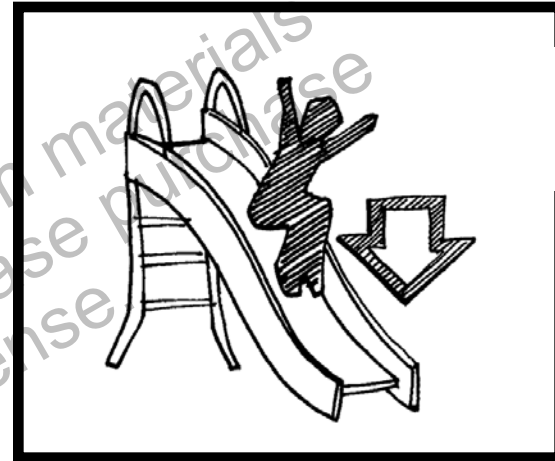
**Shade the circle next to the correct answer.**

1. A plastic cup rests on the table. Gravity is pulling the cup
- Ⓐ down
  - Ⓑ up
  - Ⓒ to the left
  - Ⓓ to the right

Note that question 2 has only three choices.

2. Gravity is a type of
- Ⓐ matter
  - Ⓑ force
  - Ⓒ motion

3. The picture below shows a child and a slide.



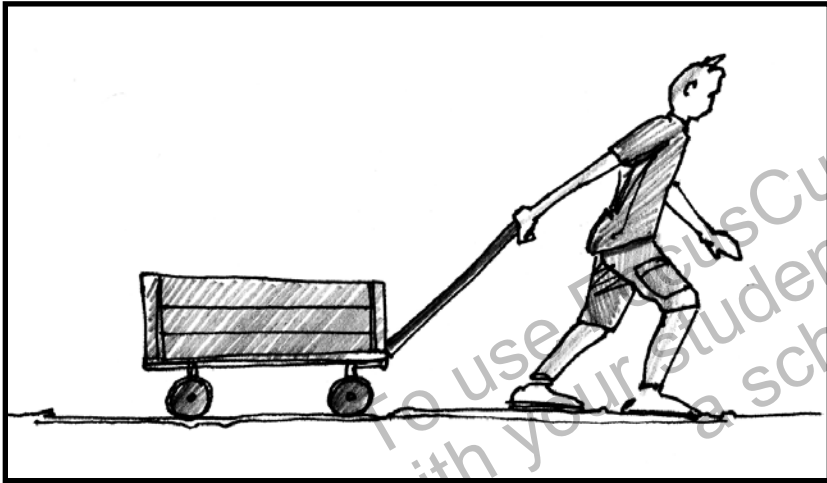
What is the position of the child relative to the slide?

- Ⓐ The child is on the slide.
- Ⓑ The child is under the slide.
- Ⓒ The child is next to the slide.
- Ⓓ The child is in front of the slide.

# Check Understanding

Shade the circle next to the correct answer or write your answer on the lines provided.

4. The picture below shows a child moving a wagon.



What type of force is the child exerting on the wagon?

- Ⓐ push
- Ⓑ pull
- Ⓒ motion
- Ⓓ gravity

5. What two forces affect a ball when it is thrown?

- (1) \_\_\_\_\_
- (2) \_\_\_\_\_

Explain how those forces affect the ball.

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# Assessment Scoring Guidelines

1. Answer A is correct.
2. Answer B is correct.
3. Answer A is correct.
4. Answer B is correct.
5. A push and gravity

A person uses a push to throw the ball. Once in the air, gravity pulls the ball down toward the center of Earth. The push causes the ball to move forward. Gravity causes the ball to move down until it comes to rest on the ground.

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# English Language Arts Activities

How Things Move

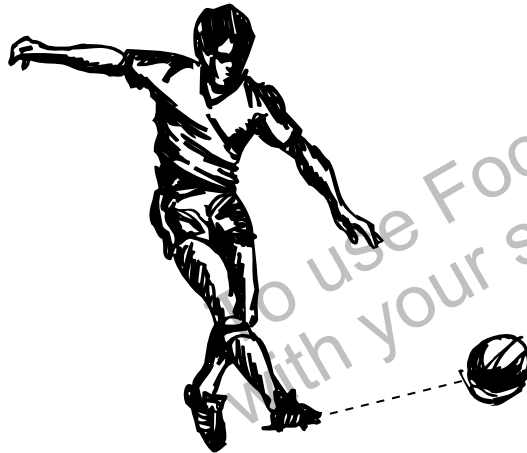
Print pages 22–26 of this PDF for the reading activities.

# Use Captions

## TRY THE SKILL

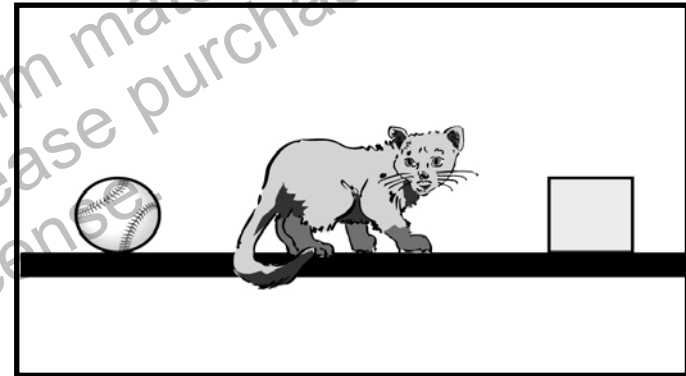
A caption is a short description of a picture or diagram. Captions give you important information to help you understand the picture.

**Look at this picture. Then read the caption.**



*If you kick a soccer ball that is already moving, it will move faster and farther.*

**Look at the picture below. Shade the circle next to the sentence that is the best caption.**



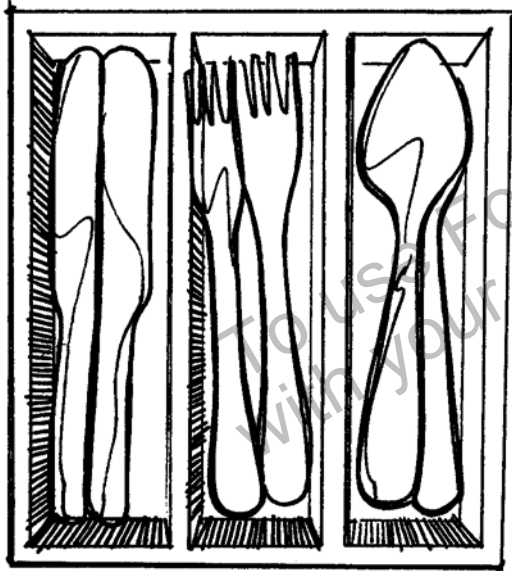
1.  (A) Motion is caused by a push or a pull.  
 (B) Gravity is an invisible force.  
 (C) The cat is between the ball and the box.  
 (D) The ball is below the shelf.

# Location Words

## TRY THE SKILL

Location words are words used to describe the position of an object. They compare the position of two or more objects.

**Look at the picture below. Where are the forks located compared to the knives and spoons?**



The forks are between the knives and spoons.

1. Describe the location of the knives.

---

---

2. Describe the location of the ball in this picture.



---

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# Fact and Opinion

## TRY THE SKILL

A fact is a statement that can be proven.

For example:

*Gravity pulls all objects toward the center of Earth.*

An opinion is a statement based on what someone thinks or believes. It may or may not be a fact. For example:

*He won't be able to kick the ball that far.*

Sometimes writers mix facts and opinions.

It is important to ask questions when you read. Ask yourself, "Is this always true or is this what someone thinks?" If the answer is "always true," then it is a fact.

**Read the following sentences. Shade the circle next to the sentence that is an opinion.**

1.  A You cannot run any faster.

B You cannot see a force.

C You can see a force's effect.
2.  A Everything that moves is put in motion by a force.

B Force comes from the power of pushing or pulling.

C The picture would look better if you moved it next to the window.

# Main Idea and Supporting Details

TRY THE SKILL

The main idea is the author's main point. A supporting detail tells more about the main idea.

**Read the paragraph below. The graphic organizer below shows the main idea and details.**

All objects on Earth are pulled toward the center of Earth. Like other forces, gravity is invisible. Still, we can see its effects everywhere.

## Main Idea

All objects are pulled to the center of Earth.

## Supporting Details

- Gravity is invisible.
- We can see the results of gravity.

**Read this paragraph.**

The pull to Earth of objects is the result of the force of gravity. Gravity is a pull that objects have on other objects. The larger the size of an object, the stronger gravity's pull will be.

**Now complete this graphic.**

**Main Idea**

**Supporting Details**



# Answer Key

## Use Captions

1. C

## Location Words

1. The knives are next to the forks.
2. The ball is in front of the boy.

*Or*

The ball is between the ground and the boy's hand.

## Fact and Opinion

1. A
2. C

## Main Idea and Supporting Details

### Main Idea

Objects on Earth are pulled to its center because of the force of gravity.

### Supporting Details

- Gravity is a pull that objects have on other objects.
- The larger the size of an object, the stronger gravity's pull will be.