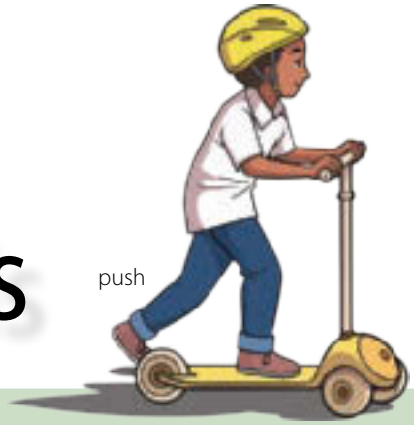
Core Knowledge® SCIENCE

Pushes and Pulls



push

designing things that move

pull

changing directions

starts and stops

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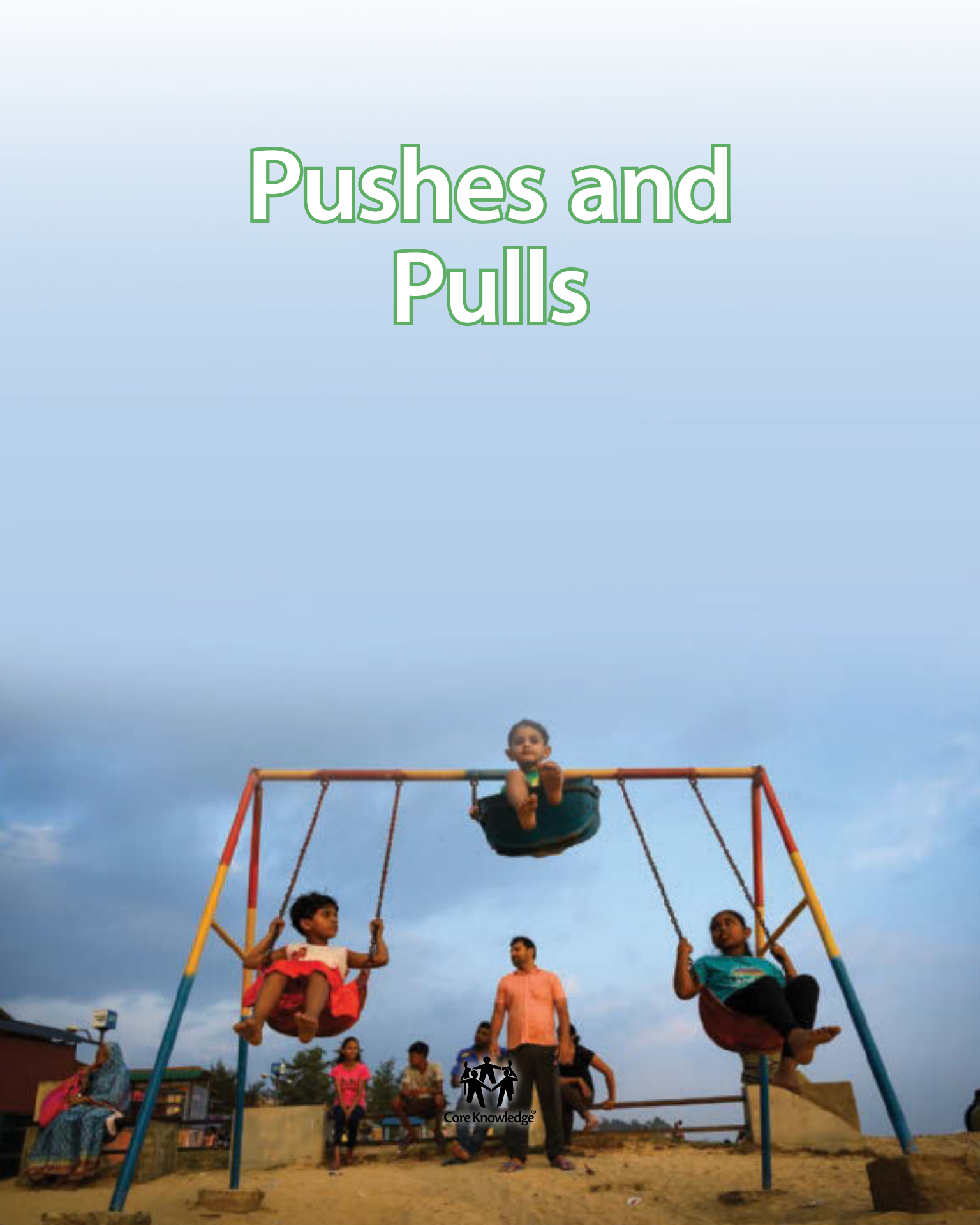
Pushes and Pulls



Core Knowledge®

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Pushes and Pulls

Table of Contents

CHAPTER 1

A Scooter Race

It is field day at school! Everyone plays games outside. Kamal is in a scooter race. The first one to cross the finish line wins. Kamal is ahead in the race.

Kamal will soon roll across the finish line. He places both feet on his scooter. But something unexpected happens! Maddy pushes past Kamal. She wins the race!

Field day at school has many races and games. They all have something that moves. Scooters are fun because they move.

A ball moves when the girl kicks.

Fun things on a playground move. Kids move on swings. Kids move on seesaws. Fun things at home can move, too. Wagons can move. Bicycles can move. How many fun moving things can you think of?

CHAPTER 2

How Do Things Move?

Carnival rides are fun because they move! What are some ways that carnival rides move?

A Ferris wheel moves around and around.

A carousel horse moves up and down.

A swinging ride moves back and forth.

How do some other things move?

This unicycle can move. The girl makes it roll forward and backward.

These swings can move. The boys make them move back and forth. When people design and build things that move, they have to figure out how to get them to move and stop.

You know that some things move. But they do not move all the time. Sometimes they are still. They stay still until something makes them move. The lawnmower is sitting still.

Now the lawnmower is moving. What makes it move?

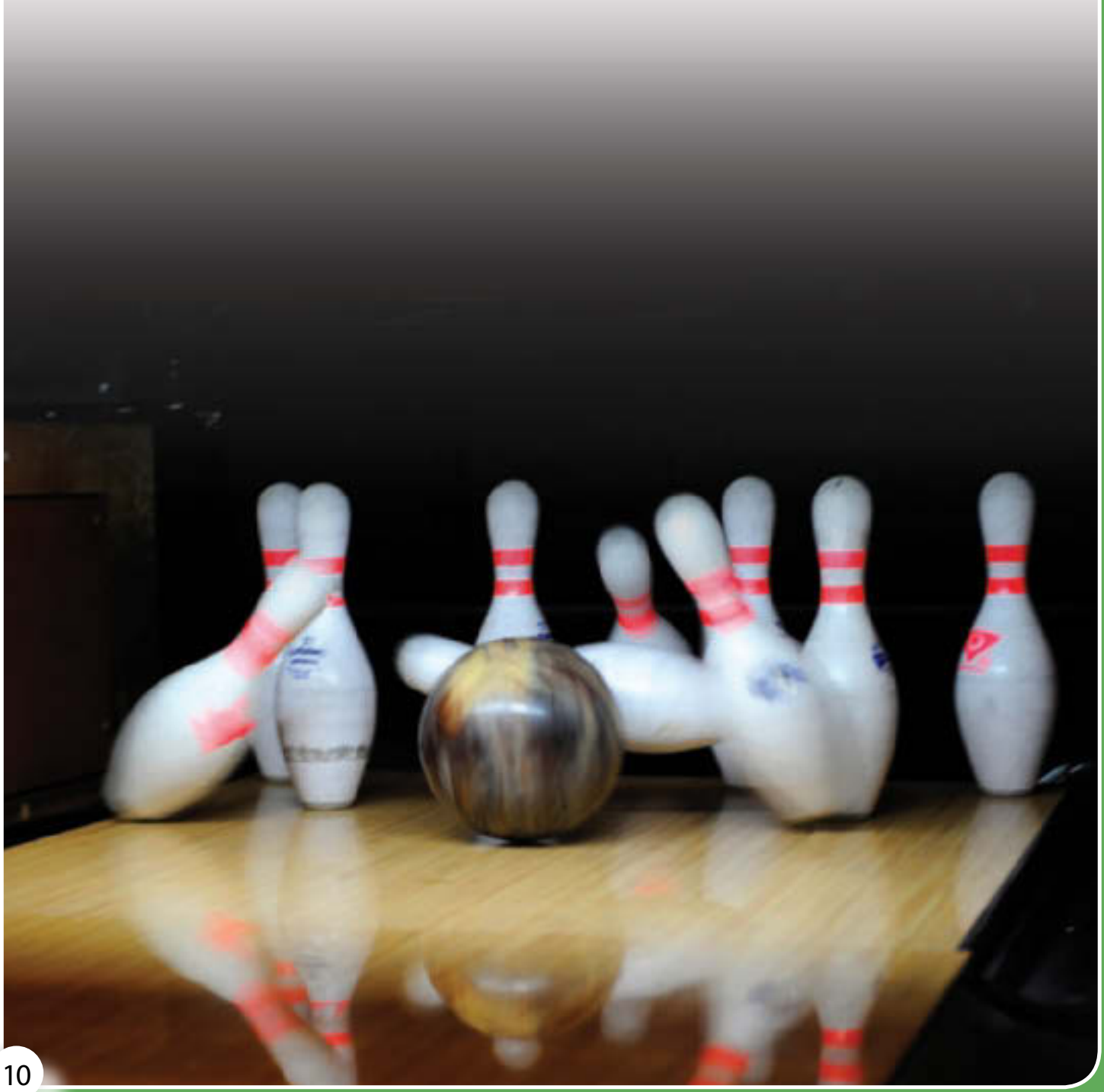
The lawnmower moved because someone pushed it. When things start to move, they are pushed or pulled. The grandparents push the child on the swing. The swing moves away from the grandparents.

The dog pulls the sled. The sled moves toward the dog.

Objects can push or pull each other.

A bowling ball pushes the pins. The pins fall over. The pins can push other pins, too. Then the other pins fall over. Why do some pins stay still?

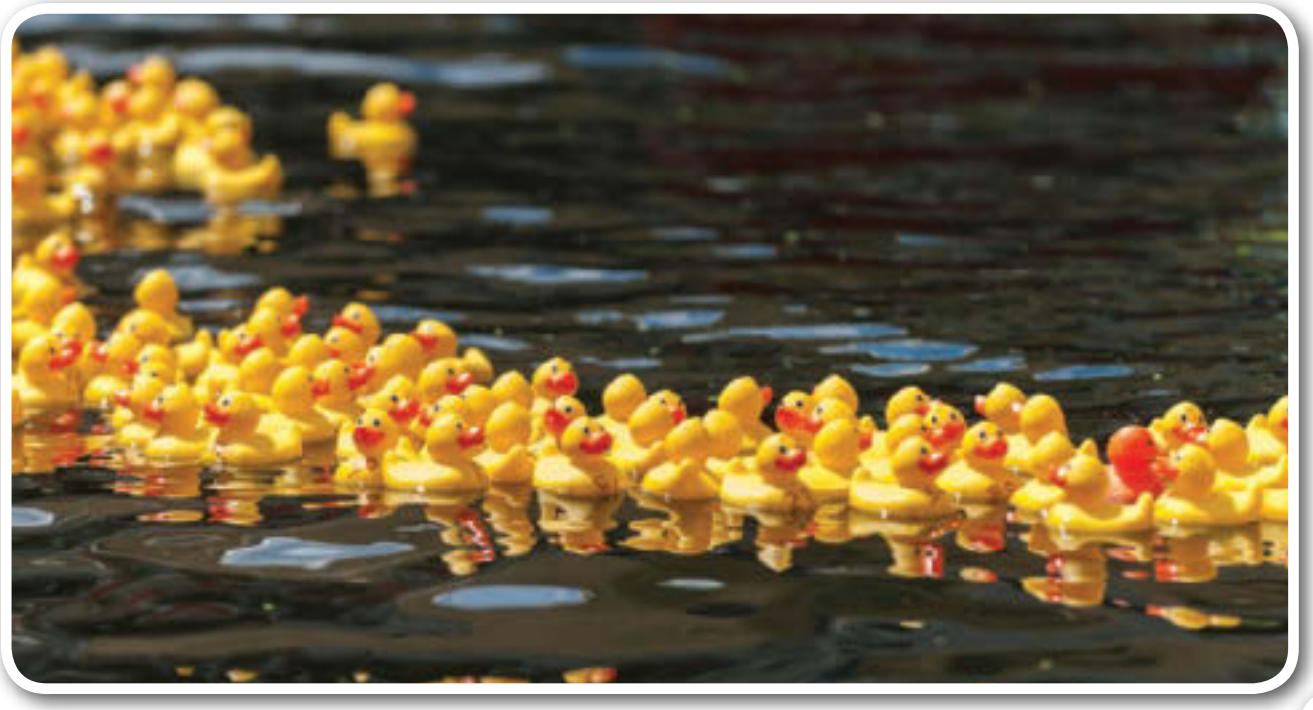
Why are some of the pins still standing?



Water can push things from one place to another.

Waves push shells onto a beach.

Water pushes these ducks downstream in a race.



You can't see air. But air can push things, too. Air pushes the flag. Air pushes dust around these pyramids. Air pushes tree leaves during a storm. Air pushes the pinwheel.

Something invisible is pulling on everything around you. It is even pulling on you right now. That pull is called gravity. Gravity pulls everything down. When something falls to the ground, it is pulled by gravity.

The girl pushed the ball with her foot. Her kick pushed the ball up. How will gravity pull on the ball now? Gravity pulls the ball back down

A motor pushes this swinging boat ride up. Then gravity pulls it back down toward the ground.

Pushes and Pulls Are All Around You

Pushes and pulls happen all around you every day. You can see pushes and pulls at home.

You pull open the refrigerator doors to look for a snack. Then you push the door to close it.

You can push or pull a handle to turn water on and off.

You can see pushes and pulls in everyday life.

At a grocery store, a shopper pulls fruit from a shelf.

Another shopper pushes a cart.

A baker pulls racks of bread.

A deli worker pushes and pulls a blade to cut meat.

Think about pushes and pulls on a playground.

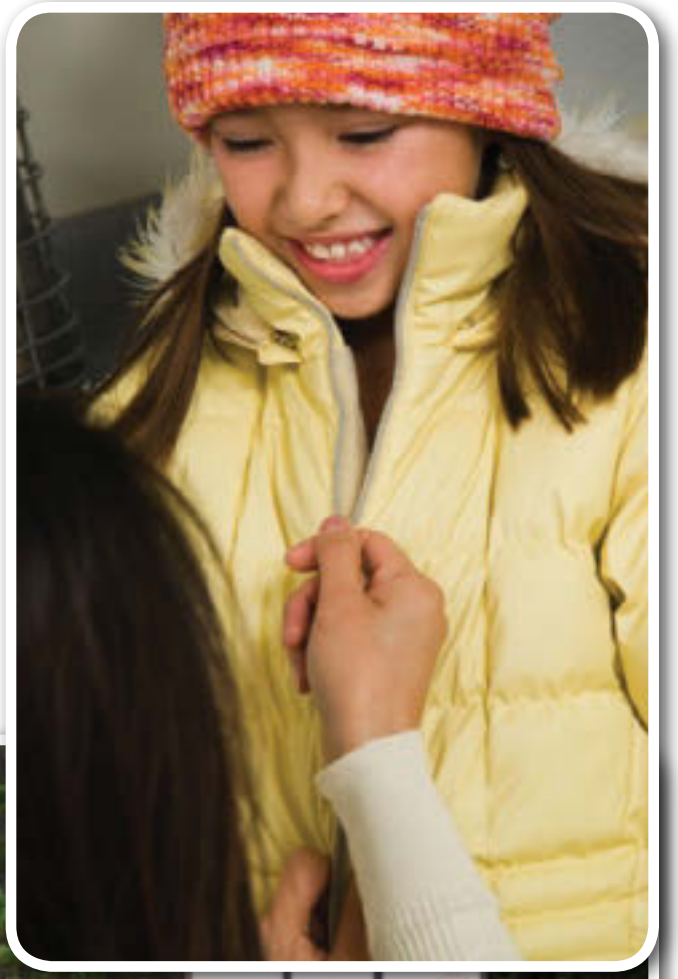
To climb up the ladder, you use pushes and pulls. You push with your legs. You pull up with your arms.

You don't push to go down the slide. Gravity pulls you down a slide.

Here are more pushes and pulls you might see every day. Pushes and pulls can make things move.

When a person zips your jacket, do they use a push or a pull?

The ball flies into the air. Who used a push to move the ball?



How Can You Describe Pushes and Pulls?

Pushes and pulls can be different strengths. They can also go in different directions. So you can describe pushes and pulls.

It takes a strong pull for this tractor to start to move a load of lumber.

Weak or Strong

Some pushes and pulls are soft and weak. Some pushes and pulls are hard and strong.

A weak push will move this softball only a little. A soft hit is a weak push.

A strong push will make the same ball go far. A hard swing is a strong push.

Pushes and pulls change the speed of things that are moving.

Riders get into the water on tubes. The water pushes them to begin slowly moving.

A hard push makes a hockey puck move very fast. What happens to the puck when the boy pushes softly?

Up and Down, Side to Side

Pushes and pulls move things in different directions.

The spinning toy rolls down the string. When it gets to the bottom, the string pulls on the toy. The pull changes a toy's direction. The toy goes back up.

A push moves the saw blade forward. Then a pull changes the saw's direction to backward.

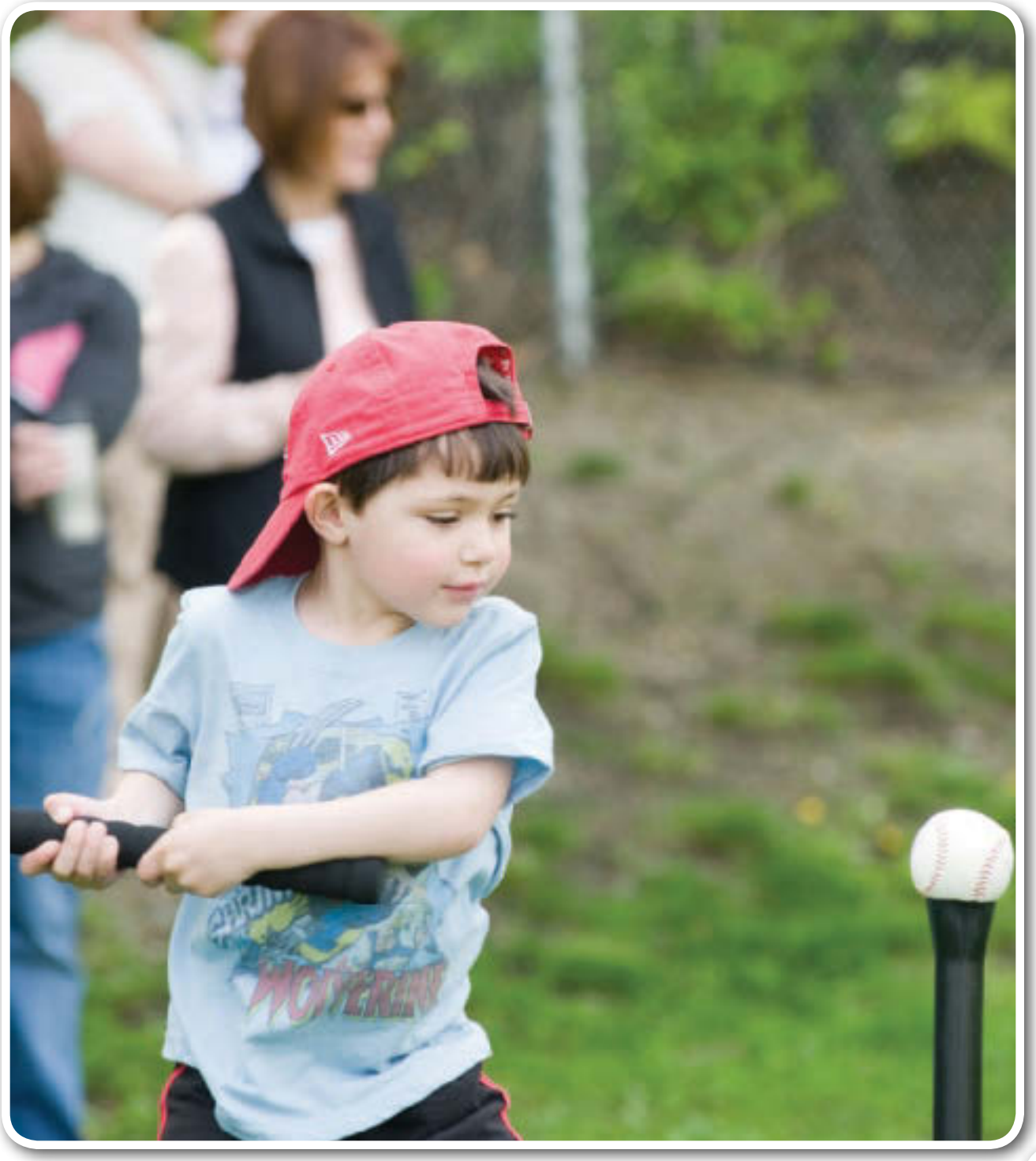
The ball is rolling toward the girls. Which one will push the ball with her stick? What will happen to the direction the ball is moving?

Starts, Stops, and Turns

Look around the room you are in. Many objects are still. They are not moving. They are at rest. An object that is not moving stays at rest until it is pushed or pulled.

Some of these objects are moving. Some are at rest. What will cause the objects at rest to move?

Moving objects can bump into each other, too. At first the bat is at rest. Then the boy pushes the bat. What will happen when the bat bumps into the ball?

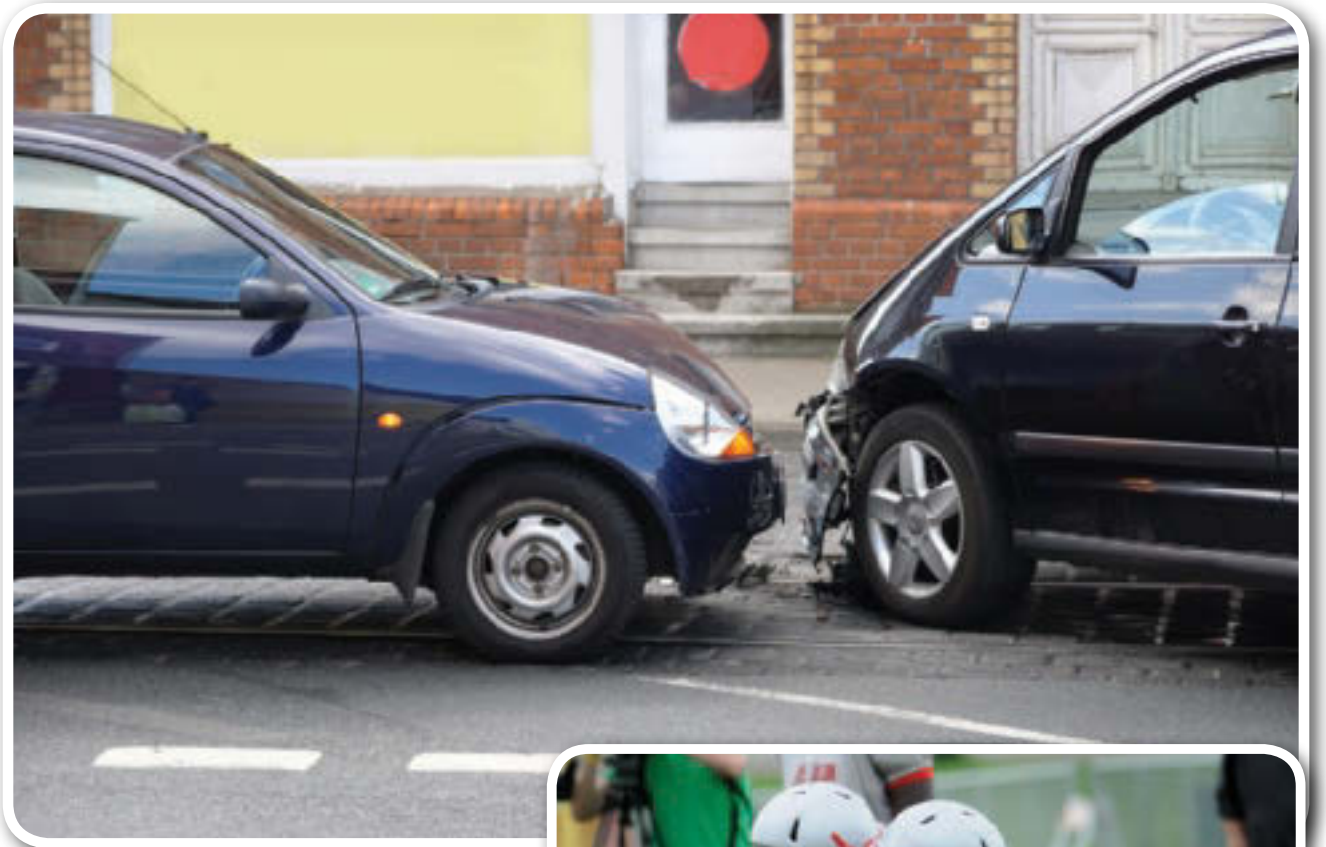


These balls are at rest.
They are not moving.

A player pushes the white ball with the stick. The white ball was at rest. Now it is moving.

The white ball bumps into the colored balls. Now the balls move. The balls push on each other.

Sometimes when objects bump into each other, they stop each other. One of these cars bumped into the other one. They once were moving. Now they are both at rest.



Football players push on each other. They slow each other down. Both were moving forward. Now neither one is moving forward.

Pushes and pulls can change the direction of something that is moving. Look at the tennis ball. Which way is it going? Which way do you think it will go after the racquet pushes it?

You know that pushes and pulls can be strong or weak. Weak and strong pushes and pulls change an object's motion in different ways. A strong push causes a big change to the motion of this ball.

A gentle push causes a smaller change to the motion of the same kind of ball.

How Can Pushes and Pulls Solve Problems?

Pushes and pulls can solve problems. What are some ways pushes and pulls help you at home? You push and pull a door to open and close it. The problem is how to get outside. You solve the problem by using a pull. The door opens. A problem is solved!

Here is another problem. It is dark. How can you turn on a light to see? You can pull a cord to turn on a light. A problem is solved!

Time for bed. The problem is getting up into the bed. You climb a ladder to get to the top bunk. A problem is solved! Is climbing pushing, pulling, or both?

How do you gather leaves? You pull them with a rake.

People use pushes and pulls to solve problems. People build things like doors and rakes so they can use pushes and pulls.

These inventions work using pushes and pulls, too. What problems do they help solve?

Does a snowplow push snow or pull it?

Painters use ropes to pull buckets of paint up to a rooftop. Can you think of an invention that could help solve that problem more easily?

Backhoes pull large amounts of dirt.

When people build things to solve problems, they go through steps. They have new ideas. They often draw their plans.

Here is a drawing of a plan that solves a problem. What is the problem? Does this plan solve the problem using pushes or pulls?

CHAPTER 5

Invisible Pushes and Pulls

Pushes and pulls happen when objects touch. Some pushes and pulls can also happen between objects that are not touching. These pushes and pulls are invisible!

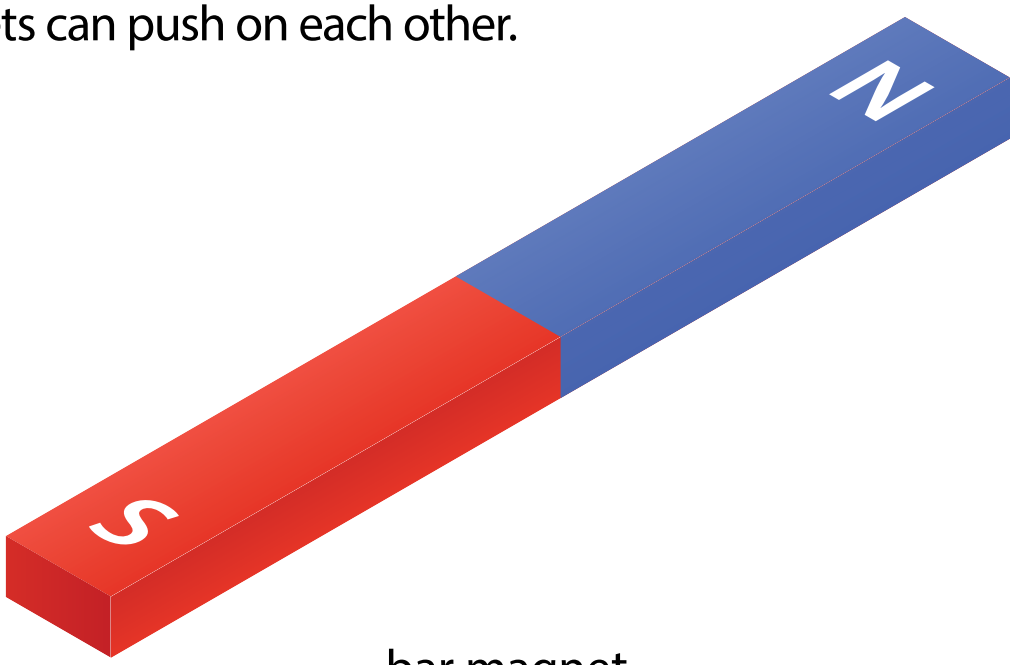
You have already learned about one invisible pull. That is gravity. This skier is up in the air now. Gravity will pull her down. Let's hope she lands safely!

Magnets produce invisible pushes and pulls, too.

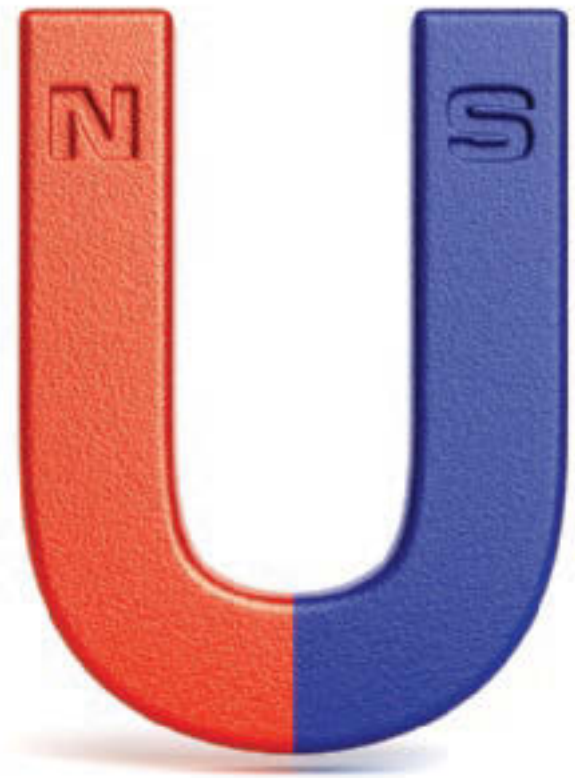
Magnets can pull on some kinds of metal. This magnet can pull large pieces of metal up from a pile. That is a strong pull!

Magnets can pull on each other.

Magnets can push on each other.



bar magnet



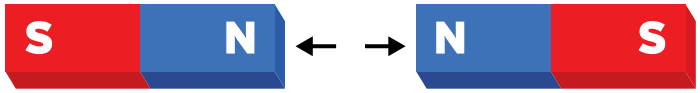
horseshoe magnet

Magnets have two ends. One end is the north pole. The other end is the south pole. Both poles can pull some metal objects.

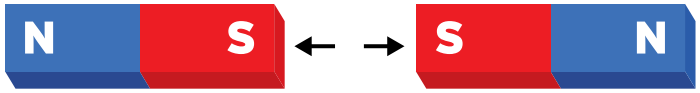
A north pole of one magnet pulls the south pole of another magnet. Different poles pull on each other.

A north pole of one magnet pushes on the north pole of another magnet. Two same poles push on each other.

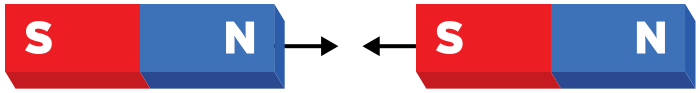
Two north poles push each other.

a) 

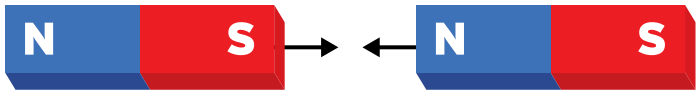
Two south poles push each other.

b) 

A north pole and a south pole pull each other.

c) 

A south pole and a north pole pull each other.

d) 

Magnets can help solve problems. You might want to stick a drawing to your refrigerator. That is a problem! Use magnets to hold the picture against the refrigerator. The problem is solved!

Microphones have magnets inside of them. A magnet causes pushes and pulls to make the microphone work.

Magnets are pushing and pulling tools we can use to help solve problems. Magnets help hold the train engine to the train car. Can you see the two magnets?

A magnetic rack can store tools. The metal strip is a magnet. It pulls on the metal parts of the tools.

Science in Action

Studying Pushes and Pulls

Kamal pushes his scooter faster and faster toward school. He is excited about science today. His class is going to have a video call with a scientist from the space program. The scientist's name is Dr. Shepard. She studies pushes and pulls. Pushes and pulls are types of forces. They affect people and objects in space! Dr. Shepard explains to the class that she studies forces like the pull of gravity.

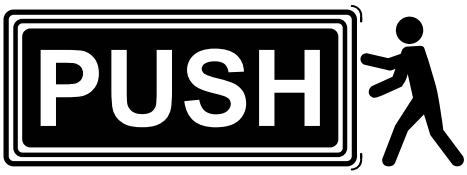
Gravity is a force that pulls objects toward the center of Earth. When astronauts are on Earth, gravity pulls them down, just like it does to all of us. When they are in space, they feel as if there is no force pulling them down at all. Changes of pushes and pulls on our bodies affect us in different ways. Dr. Shepherd does investigations to find out how.

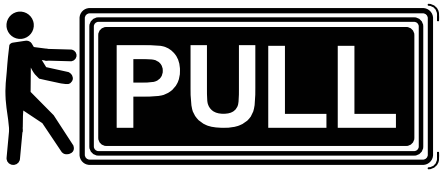
Investigations are experiments that scientists do to test their ideas. Scientists also do investigations to answer questions that they have. Dr. Shepherd can't go to space to find out about the effects of pushes and pulls on astronauts. Instead, she comes up with ways to test her ideas here on Earth. She works in laboratories, places where scientists use tools and equipment to test ideas.

In a big lab, Dr. Shepherd shows Kamal's class a machine called a centrifuge. An astronaut sits inside one end of the centrifuge. Then the machine spins around and around. The spinning causes the astronaut to feel as if strong pulls are acting on him. Dr. Shepherd uses the centrifuge to investigate how a strong pull can affect an astronaut's body during a rocket launch. Her research helps other scientists that launch astronauts into space.

To become a scientist herself, Dr. Shepard had to learn about pushes and pulls and gravity. Scientists always base their work on the discoveries of other scientists before them. Many scientists before Dr. Shepard have studied what happens when objects fall to the ground. They have observed how objects move when they are pushed and pulled.

Dr. Shepard tells Kamal's class that her work depends on discoveries made by a scientist named Sir Isaac Newton.





Sir Isaac Newton

Sir Isaac Newton was an English scientist who lived over 400 years ago. He was the first scientist to explain gravity the way that scientists today understand it to work.

Newton wrote descriptions about how pushes and pulls make things move. His descriptions are called the laws of motion.

The first law of motion says that things that are sitting still will remain still until something pushes or pulls on them. Things that are moving keep moving the same way until a push or pull changes their motion.

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Lebrecht Music & Arts/Alamy Stock Photo: 43a
Lev Dolgachov/Alamy Stock Photo: 21b
LH Images/Alamy Stock Photo: 6c
LightField Studios Inc./Alamy Stock Photo: 15a, 36a
Lisa Top/Alamy Stock Photo: 12c
Maskot/Alamy Stock Photo: 32
MediaPunch Inc/Alamy Stock Photo: 39
Michael Flippo/Alamy Stock Photo: 24b
Mike P Shepherd/Alamy Stock Photo: 12b
NASA Photo/Alamy Stock Photo: 40b
paul ridsdale pictures/Alamy Stock Photo: 33
PG Arphexad/Alamy Stock Photo: 21c
PHOVOIR/Alamy Stock Photo: 15d
Pixel-shot/Alamy Stock Photo: 5b
Pongphan Ruengchai/Alamy Stock Photo: 22c
RedDaxLuma/Alamy Stock Photo: 37b
Roman Lacheev/Alamy Stock Photo: 15c
RosalreneBetancourt 10/Alamy Stock Photo: 17b
Science History Images/Alamy Stock Photo: 41
sebnem koken/Alamy Stock Photo: 13b
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