

Kindergarten Science

Unit 1: Pushes and Pulls

13 lessons and a unit quiz. Use this pack with the **Pushes and Pulls Student Reader** (print it, or download it once from the course) to teach the whole unit without the internet.

What is in this pack

- A lesson plan for each chapter: the Big Question, words to know, which pages to read, questions to talk over and the activity pages.
- The unit quiz, ready to print.
- Answers for the teacher at the back: every discussion question and the quiz key.

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Lesson schedule

Two or three lessons a week, about 30 minutes each. Tick each one off as you go.

	Lesson	Reader pages	Activity pages
☐	Getting started: Meet the Big Question	PDF pages 6–9	—
☐	Lesson 1.1: Pushing and Pulling	PDF pages 10–17	AP 1.1.1
☐	Lesson 1.2: Types of Pushes and Pulls	—	AP 1.2.1, AP 1.2.2
☐	Lesson 1.3: Motion Everywhere	—	AP 1.3.1
☐	Lesson 1.4: Changing Direction	—	AP 1.4.1
☐	Lesson 1.5: Lesson 1 Roundup: Different Pushes and Pulls	—	AP 1.5.1
☐	Lesson 2.1: Starting and Stopping	—	AP 2.1.1
☐	Lesson 2.2: Golf Pushes and Pulls	—	AP 2.2.1, AP 2.2.2
☐	Lesson 2.3: Pushes and Pulls Everywhere	PDF pages 18–35	AP 2.3.1
☐	Lesson 2.4: Lesson 2 Roundup: Tee Time	—	AP 2.4.1
☐	Lesson 3.1: No-Touch Forces	PDF pages 36–41	AP 3.1.1
☐	Lesson 3.2: Invisible Pushes and Pulls	—	AP 3.2.1
☐	Lesson 3.3: Lesson 3 Roundup: Invisible Tee Time	PDF pages 42–52	AP 3.3.1
☐	Unit review and assessment	—	AP UO.1
☐	Words quiz	—	—

Page numbers are the PDF page numbers of the Student Reader file, so they match what your PDF reader shows.

Getting started: Meet the Big Question

THE BIG QUESTION

How can pushes and pulls change the motion of objects?

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 23–29: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 1: “A Scooter Race”: PDF pages 6–9. Look at the pictures and maps together.

Talk it over

1. LITERAL— Is Kamal pushing or pulling?
2. She wins the race! 3 • Why did Maddy win the race?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can pushes and pulls change the motion of objects?

Lesson 1.1: Pushing and Pulling

THE BIG QUESTION

What happens when something moves?

Words to know

- **force** — a push or pull on an object
- **object** — a thing made of material

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 30–36: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 2: “How Do Things Move?”: PDF pages 10–17. Look at the pictures and maps together.

Talk it over

1. What makes something move?
2. SUPPORT—Circulate as students explore motion, and ask targeted questions such as the following: DCI PS2.A Monitor Progress • What is moving?
3. What can you observe that is moving now?
4. The effect is a change in motion. 28 PUSHES AND PULLS NGSS Elements What is causing the change in the motion?
5. What effect happened when I used a force on the ball?
6. What did you observe moving?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What happens when something moves?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.1.1: Pushing and Pulling — Teacher Guide PDF page 147

Lesson 1.2: Types of Pushes and Pulls

THE BIG QUESTION

What happens when you push or pull different objects in different ways?

Words to know

- **closer** — nearer to
- **friction** — the resistance of motion when something rubs against something else
- **move** — to change position
- **pull** — a force to make something move toward whatever is doing the pulling (v. to apply a pulling force)
- **push** — a force to make something move away from whatever is doing the pushing (v. to apply a pushing force)

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 37–44: the steps, materials and timing for this lesson.

Talk it over

1. What was the effect of all the medium pushes and pulls you made to the cube?
2. How did the surface affect the movement of the cube?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What happens when you push or pull different objects in different ways?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.2.1: Push and Pull — Teacher Guide PDF page 148
- Activity Page 1.2.2: Pushing Shapes — Teacher Guide PDF pages 149–150

Lesson 1.3: Motion Everywhere

THE BIG QUESTION

How can I describe pushes and pulls?

Words to know

- **force** — a push or pull on an object
- **forward** — toward the front
- **gravity** — the invisible force that pulls objects down toward the surface of Earth
- **motion** — the process of something changing position

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 45–58: the steps, materials and timing for this lesson.

Talk it over

1. We can put a hose around the chain so fingers don't get pinched. Activity Page AP 1.3.1 What should we use to connect the seat to the swing? Have students draw on A Push or a Pull?
2. Wind, water, and gravity pull and push without a person touching them. Activity Page AP 1.3.1 Have students add pictures of two pushes and two pulls to A Push or a Pull?
3. Similarities: Both are forces that make things move. NGSS Elements Formative Assessment Review student responses in the discussion and to A Push or a Pull?
4. A swinging ride moves back and forth. 6 LITERAL—What are some ways the rides move?
5. When people design and build things that move, they have to figure out how to get them to move and stop. 7 LITERAL—What is causing things to move in these pictures?
6. LESSON 1.3 | MOTION EVERYWHERE 43 INFERENTIAL—What do people have to think about when they build things?
7. A pull is a force to make something move toward whatever is doing the pulling. • What is the difference between a push and a pull?
8. What examples of pulls did you see in the video?
9. Monitor Progress EXTEND—What other ways could the lawnmower move?
10. The sled moves toward the dog. 9 LITERAL—Which object is being pushed, and who or what is pushing?
11. What kinds of pushes and pulls did you have on the playground?
12. If students hesitate, supply the hint that a bump is a kind of push. 48 PUSHES AND PULLS EXTEND—Can you identify three different pushes that happen when a bowling ball hits pins like what we see in this picture?

13. Water pushes these ducks downstream in a race. 11 LITERAL—How can water push things?
14. EXTEND—What happens when you pull on water?
15. Air pushes the pinwheel. 12 LITERAL—How is air pushing things in the pictures on this page?
16. EXTEND—Can you think of an example of air pulling things?
17. Then gravity pulls it back down toward the ground. 13 NGSS Elements LITERAL—If you drop a pencil, what happens to it?
18. DCI PS2.A CCC 2 SEP 8 INFERENTIAL—How is dropping a pencil similar to what you see in the pictures on this page?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can I describe pushes and pulls?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.3.1: A Push or a Pull? — Teacher Guide PDF page 151

Lesson 1.4: Changing Direction

THE BIG QUESTION

What happens when you push or pull different objects in different ways?

Words to know

- **affect** — to create a change in something
- **back** — the opposite of the front-facing side of a thing or place
- **down** — toward a lower position
- **effect** — a change that happens because of a cause
- **force** — a push or pull on an object
- **forward** — toward the front
- **left** — on the side of an object that is to the west as that object faces north; opposite of right
- **result** — the outcome of something
- **right** — on the side of an object that is to the east as that object faces north; opposite of left
- **up** — toward a higher position

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 59–63: the steps, materials and timing for this lesson.

Check for understanding

- Answer the Big Question in a sentence or two: What happens when you push or pull different objects in different ways?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.4.1: Changing Direction — Teacher Guide PDF page 152

Lesson 1.5: Lesson 1 Roundup: Different Pushes and Pulls

THE BIG QUESTION

What do pushes and pulls do?

Words to know

- **at rest** — still, not in motion
- **contrast** — to look for differences between two things; words and phrases are model for students during instruction; terms do not have specific page-lated drill or memorization
- **direction** — the path along which something moves or the point toward which something is aimed
- **force** — a push or pull on an object
- **investigate** — to observe and study something to collect information
- **strength** — the condition of being strong and able to withstand a great amount of force

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 64–68: the steps, materials and timing for this lesson.

Talk it over

1. What affected the movement of the ball?
2. LESSON 1.5 | DIFFERENT PUSHES AND PULLS 61 NGSS Elements How did you decide to push or pull the ball to move it to a particular spot?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What do pushes and pulls do?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.5.1: Hitting the Spot — Teacher Guide PDF page 153

Lesson 2.1: Starting and Stopping

THE BIG QUESTION

How are pushes and pulls related to the starting and stopping of moving things?

Words to know

- **catch** — to capture
- **collide** — to hit with force when moving
- **collision** — the occurrence of two objects making contact with each other
- **contact** — to physically touch something
- **direction** — the path along which something moves or the point toward which something is aimed
- **move** — to change position
- **pull** — a force to make something move toward whatever is doing the pulling (v. to apply a pulling force)
- **push** — a force to make something move away from whatever is doing the pushing (v. to apply a pushing force)

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 69–75: the steps, materials and timing for this lesson.

Talk it over

1. 68 It bounced on the floor or against the wall and then slowed down. PUSHES AND PULLS What is the effect of bumping into something, or colliding?
2. How can you make something move farther and faster?
3. If a ball rolls off the edge of a table, what happens?
4. Is the ball falling a change in direction?
5. Can objects move without being pushed or pulled?
6. Did you push or pull your body in the red light, green light game?
7. SEP 4 CCC 2 DCI PS2.A How did you start and stop motion in your game of catch?
8. How did the ball stop if you didn't catch it?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How are pushes and pulls related to the starting and stopping of moving things?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.1.1: Start and Stop — Teacher Guide PDF page 154

Lesson 2.2: Golf Pushes and Pulls

THE BIG QUESTION

How do pushes and pulls change motion in a miniature golf course?

Words to know

- **collide** — to hit with force when moving
- **collision** — the occurrence of two objects making contact with each other
- **contact** — to physically touch something
- **direction** — the path along which something moves or the point toward which something is aimed
- **move** — to change position
- **pull** — a force to make something move toward whatever is doing the pulling (v. to apply a pulling force)
- **push** — a force to make something move away from whatever is doing the pushing (v. to apply a pushing force)

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 76–81: the steps, materials and timing for this lesson.

Talk it over

1. See the Online Resources Guide for a link to the recommended video:
www.coreknowledge.org/cksci-online-resources What do you need to play miniature golf?
2. How does the ball change direction?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How do pushes and pulls change motion in a miniature golf course?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.2.1: My Miniature Golf Hole Plan — Teacher Guide PDF page 155
- Activity Page 2.2.2: My Miniature Golf Hole — Teacher Guide PDF page 156

Lesson 2.3: Pushes and Pulls Everywhere

THE BIG QUESTION

How do pushes and pulls change motion?

Words to know

- **bounce** — to move quickly away from a surface after striking it, without breaking
- **bump into** — to contact each other when two moving objects meet careful adj. cautious, with the intention of avoiding risk, harm, or damage
- **collide** — to hit with force when moving
- **contact** — to physically touch something
- **direction** — the path along which something moves or the point toward which something is aimed
- **fast** — at a high rate of speed (faster, adj. at a higher speed than something else)
- **pull** — a force to make something move toward whatever is doing the pulling (v. to apply a pulling force)
- **push** — a force to make something move away from whatever is doing the pushing (v. to apply a pushing force)

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 82–104: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapters 3–4: “Pushes and Pulls Are All Around You” and “How Can Pushes and Pulls Solve Problems?”: PDF pages 18–35. Look at the pictures and maps together.

Talk it over

1. internet access and the means to project images/video for whole-class viewing
Activity Page Push Me or Pull Me?
2. They should mark each picture with a circle and X because each of the objects can be pushed and pulled. NGSS Elements Review student responses in the reading questions and to Push Me or Pull Me?
3. Gravity pulls you down a slide. 16 EVALUATIVE—What pushes and pulls do you see every day?
4. EVALUATIVE—How do you describe pushes and pulls?
5. LITERAL—What will make the object in each picture move?
6. The balls push on each other. 24 INFERENTIAL—What is happening in the pictures when a moving object bumps into another object?

7. A gentle push causes a smaller change to the motion of the same kind of ball. 27
LITERAL—What can you expect will happen when a ball is pushed strongly instead of weakly?
8. INFERENTIAL—How can pushes and pulls solve problems?
9. Backhoes pull large amounts of dirt. 30 INFERENTIAL—What are some tools you use to help pushes and pulls solve problems?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How do pushes and pulls change motion?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.3.1: Push Me or Pull Me? — Teacher Guide PDF page 157

Lesson 2.4: Lesson 2 Roundup: Tee Time

THE BIG QUESTION

Does our miniature golf course change the speed and direction of a ball the way we planned it to?

Words to know

- **compare** — to examine characteristics of two or more things, particularly looking for similarities
- **design** — a plan to show how something is made or how a process should work
- **evaluate** — to examine the details of something and determine the value or effectiveness of it
- **investigate** — to observe and study something to collect information
- **materials** — matter that makes up different things
- **problem** — a condition that falls short of satisfying a want or a need
- **record** — to collect and keep information
- **solution** — a process, action, or device that fixes a problem

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 105–109: the steps, materials and timing for this lesson.

Talk it over

1. Which hole was the most difficult to complete and why?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: Does our miniature golf course change the speed and direction of a ball the way we planned it to?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.4.1: Tee Time — Teacher Guide PDF page 158

Lesson 3.1: No-Touch Forces

THE BIG QUESTION

How can magnets push and pull?

Words to know

- **contact** — to physically touch something
- **force** — a push or pull on an object
- **gravity** — the invisible force that pulls objects down toward the surface of Earth
- **magnetic** — having the ability of a magnet to attract
- **metallic** — having properties of a metal

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 110–117: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 5: “Invisible Pushes and Pulls”: PDF pages 36–41. Look at the pictures and maps together.

Talk it over

1. Distribute Magnetic or Not?
 2. SEP 4 CCC 2 • DCI PS2.A Briefly review what students learned about motion in Lessons 1 and 2 by asking these questions: What is the difference between a push and a pull?
 3. What do pushes and pulls have to do with motion?
 4. How can you make something move farther and faster?
 5. Do things move without being pushed or pulled more?
 6. Did you push or pull the marble to make it fall?
 7. What made the object fall?
 8. PUSHES AND PULLS Can you see the force that made the object fall?
 9. Which direction did you fall?
 10. Did something push or pull you?
 11. What will happen if you put the marble at the high end and let go?
 12. What made the marble roll down and not up?
 13. Could you see the magnetic force?
 14. What are the items that are attracted to the magnet made of?
 15. Based on this classification, you could predict that birds with talons are carnivores.
- 110 PUSHES AND PULLS What items are not attracted to magnets?

16. Did everyone find that the same materials were magnetic and not magnetic?
17. Can you feel a pull between two magnetic marbles?
18. Can you feel a push between two magnetic marbles?
19. Confirm student understanding by asking these questions: • SEP 1 How can magnets help us do things?
20. SEP 4 CCC 2 DCI PS2.A Monitor Progress • How do you use gravity to get things done?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can magnets push and pull?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.1.1: Magnetic or Not? — Teacher Guide PDF page 159

Lesson 3.2: Invisible Pushes and Pulls

THE BIG QUESTION

What are some invisible pushes and pulls?

Words to know

- **pole** — either of two related opposite ends of something
- **problem** — a condition that falls short of satisfying a want or a need
- **solution** — a process, action, or device that fixes a problem

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 118–127: the steps, materials and timing for this lesson.

Talk it over

1. Ask these questions: What happened to the marble?
2. What caused the one marble to roll?
3. What caused the marble on the flat surface to stay put?
4. LESSON 3.2 | INVISIBLE PUSHES AND PULLS 113 Why didn't the marble on the flat surface roll?
5. Will things always go to the lowest point?
6. That is a strong pull! 33 Online Resources LITERAL—Is the big magnet pushing or pulling the metal?
7. See the Online Resources Guide for a link to the recommended video.
www.coreknowledge.org/cksci-online-resources EVALUATIVE—What are some ways magnets can be useful?
8. A magnet causes pushes and pulls to make the microphone work. 36 INFERENTIAL—Why do people use magnetic letters and kitchen magnets?
9. It pulls on the metal parts of the tools. 37 EVALUATIVE—How can you solve problems with magnets?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What are some invisible pushes and pulls?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.2.1: Invisible Pushes and Pulls — Teacher Guide PDF page 160

Lesson 3.3: Lesson 3 Roundup: Invisible Tee Time

THE BIG QUESTION

Can objects that are not touching push and pull each other?

Words to know

- **compare** — to examine characteristics of two or more things, particularly looking for similarities
- **design** — a plan to show how something is made or how a process should work
- **evaluate** — to examine the details of something and determine the value or effectiveness of it

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 128-144: the steps, materials and timing for this lesson.

Read

Read Student Book, Chapter 6: "Science in Action": PDF pages 42-52. Look at the pictures and maps together.

Talk it over

1. to study gravity 134 PUSHES AND PULLS LITERAL—What does Dr. Shepard want to find out?
2. NGSS Elements Lead a whole-class discussion about how the unseen forces of gravity and magnetism could be used in their golf course. • SEP 1 SEP 4 How could gravity be used in a miniature golf course to stop the ball from moving forward?
3. DCI PS2.A Differentiation • How could gravity be used in a miniature golf course to help the ball move forward?
4. Did you have to change how hard or soft you pushed or pulled the ball because of the invisible force?
5. Which type of invisible force affected play the most?
6. For those who used gravity, how would play change if you had a flat course?
7. LITERAL—What is Kamal excited about?
8. Shepard study?
9. INFERENTIAL—Why do you think astronauts feel a strong pull of gravity when they launch into space from Earth?
10. Shepard use a laboratory to study pushes and pulls?
11. Shepard use the centrifuge?
12. Shepard testing the astronaut in a rocket?

13. UNIT SUPPLEMENT | SCIENCE IN ACTION: STUDYING PUSHES AND PULLS 135
LITERAL—Is the apple being pulled or pushed down?
14. LITERAL—What do scientists base their work on?
15. Things that are moving keep moving the same way until a push or pull changes their motion. 43 136 PUSHES AND PULLS LITERAL—Why is Isaac Newton important in understanding forces?
16. INFERENTIAL—Use the first law of motion to describe what will happen to those marbles when the big marble is pushed into them?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: Can objects that are not touching push and pull each other?
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.3.1: Invisible Tee Time — Teacher Guide PDF page 161

UNIT REVIEW

Unit review and assessment

- Activity page answer key (for the teacher): Teacher Guide PDF pages 162–163
- Activity Page UO.1 — Teacher Guide PDF page 146

WORDS QUIZ

Pushes and Pulls

Name: _____ Date: _____

Circle the letter of the best answer.

1. Which word means “a force to make something move away from whatever is doing the pushing (v. to apply a pushing force)”?

- a) hard
- b) magnetic
- c) change
- d) push

2. Which word means “to change direction”?

- a) contact
- b) centrifuge
- c) left
- d) turn

3. Which word means “to create a change in something”?

- a) speed
- b) affect
- c) push
- d) down

4. Which word means “having the ability of a magnet to attract”?

- a) metal
- b) move
- c) movement
- d) magnetic

5. Which word means “to look for differences between two things and words and phrases are model for students during instruction and terms do not have specific page labeled drill or memorization”?

- a) closer
- b) cause
- c) laboratory
- d) contrast

6. Which word means “a process, action, or device that fixes a problem”?

- a) catch
- b) magnetic pole
- c) solution
- d) right

- 7.** Which word means “to collect and keep information”?
- a) at rest
 - b) record
 - c) move
 - d) solution
- 8.** Which word means “to end something”?
- a) catch
 - b) stop
 - c) speed
 - d) force
- 9.** Which word means “the process of changing position”?
- a) pole
 - b) change
 - c) movement
 - d) start
- 10.** Which word means “either of two related opposite ends of something”?
- a) laboratory
 - b) design
 - c) pole
 - d) result
- 11.** Which word means “having properties of a metal”?
- a) metallic
 - b) friction
 - c) not touching
 - d) opposite ends
- 12.** Which word means “to become different”?
- a) gravity
 - b) down
 - c) astronaut
 - d) change

Answers

Getting started: Meet the Big Question

1. **LITERAL— Is Kamal pushing or pulling?**
Pushing **INFERENTIAL—**What would happen if he stopped pushing?
2. **She wins the race! 3 • Why did Maddy win the race?**
She pushed harder than the others.

Lesson 1.1: Pushing and Pulling

1. **What makes something move?**
Something falls. Something is pushed. Something is pulled.
2. **SUPPORT—Circulate as students explore motion, and ask targeted questions such as the following: DCI PS2.A Monitor Progress • What is moving?**
Me, the ball, the swing
3. **What can you observe that is moving now?**
For example, the clock, papers moving due to a breeze, a fish in an aquarium, a person breathing
4. **The effect is a change in motion. 28 PUSHES AND PULLS NGSS Elements What is causing the change in the motion?**
For example, wind, falling, motor, physical energy
5. **What effect happened when I used a force on the ball?**
The ball started rolling.
6. **What did you observe moving?**
For example, a ball, a swing, a person on the slide What caused the change in the motion?

Lesson 1.2: Types of Pushes and Pulls

1. **What was the effect of all the medium pushes and pulls you made to the cube?**
Every medium push or pull made the cube move more than the gentle pushes and pulls. What was the effect of all the strongest pushes and pulls you made to the cube?
2. **How did the surface affect the movement of the cube?**
The cube did not move as far on the rough surface as it did on the smooth surface.

Lesson 1.3: Motion Everywhere

1. **We can put a hose around the chain so fingers don't get pinched. Activity Page AP 1.3.1 What should we use to connect the seat to the swing? Have students draw on A Push or a Pull?**
AP 1.3.1
2. **Wind, water, and gravity pull and push without a person touching them. Activity Page AP 1.3.1 Have students add pictures of two pushes and two**

pulls to A Push or a Pull?

AP 1.3.1

3. **Similarities: Both are forces that make things move. NGSS Elements Formative Assessment Review student responses in the discussion and to A Push or a Pull?**

AP 1.3.1

4. **A swinging ride moves back and forth. 6 LITERAL—What are some ways the rides move?**

Around and around

5. **When people design and build things that move, they have to figure out how to get them to move and stop. 7 LITERAL—What is causing things to move in these pictures?**

The girl is pushing the pedals to make the unicycle move.

6. **LESSON 1.3 | MOTION EVERYWHERE 43 INFERENTIAL—What do people have to think about when they build things?**

For something like a unicycle, designers have to figure out where a rider will sit. They have to figure out how to hold the wheel to the frame and seat but still allow the wheel to turn. They must figure out how the pedals will attach to the wheel so a rider could push on them with his or her feet.

7. **A pull is a force to make something move toward whatever is doing the pulling. • What is the difference between a push and a pull?**

A push is away from the pusher. A pull is toward the puller.

8. **What examples of pulls did you see in the video?**

Students should identify examples of pushes such as pulling a wagon, a horse pulling a cart, pulling a rope, pulling a door, a dog pulling a woman, and pulling open a book.

9. **Monitor Progress EXTEND—What other ways could the lawnmower move?**

The man could pull it back.

10. **The sled moves toward the dog. 9 LITERAL—Which object is being pushed, and who or what is pushing?**

The swing is being pushed by the grandparents. LITERAL—Which object is being pulled, and who or what is pulling?

11. **What kinds of pushes and pulls did you have on the playground?**

I pushed my friend on the swing. The force made them move.

12. **If students hesitate, supply the hint that a bump is a kind of push. 48 PUSHES AND PULLS EXTEND—Can you identify three different pushes that happen when a bowling ball hits pins like what we see in this picture?**

The ball pushes on pins.

13. **Water pushes these ducks downstream in a race. 11 LITERAL—How can water push things?**

Water pushes things from one place to another. LITERAL—What happens if you push on water?

14. **EXTEND—What happens when you pull on water?**
The water slides through my hands. LESSON 1.3 | MOTION EVERYWHERE
15. **Air pushes the pinwheel. 12 LITERAL—How is air pushing things in the pictures on this page?**
Air (wind) pushes the flag to make it flap from the side of the flagpole.
16. **EXTEND—Can you think of an example of air pulling things?**
A vacuum cleaner works when air pulls dirt from the floor.
17. **Then gravity pulls it back down toward the ground. 13 NGSS Elements LITERAL—If you drop a pencil, what happens to it?**
It falls straight to the ground.
18. **DCI PS2.A CCC 2 SEP 8 INFERENTIAL—How is dropping a pencil similar to what you see in the pictures on this page?**
The pencil, soccer ball, and swinging boat are pulled toward the ground.
EXTEND—Does a person have to touch things in order for them to move?

Lesson 1.5: Lesson 1 Roundup: Different Pushes and Pulls

1. **What affected the movement of the ball?**
The amount and direction of the push or pull
2. **LESSON 1.5 | DIFFERENT PUSHES AND PULLS 61 NGSS Elements How did you decide to push or pull the ball to move it to a particular spot?**
If the spot was toward you, you pulled. If it was away from you, you pushed.

Lesson 2.1: Starting and Stopping

1. **68 It bounced on the floor or against the wall and then slowed down. PUSHES AND PULLS What is the effect of bumping into something, or colliding?**
See Know the Science.
2. **How can you make something move farther and faster?**
Push or pull harder. Make sure the surface is smooth. PUSHES AND PULLS
3. **If a ball rolls off the edge of a table, what happens?**
The ball falls
4. **Is the ball falling a change in direction?**
Yes
5. **Can objects move without being pushed or pulled?**
Yes, until another force changes the motion of the object or the direction in which it is moving
6. **Did you push or pull your body in the red light, green light game?**
I pushed. My feet pushed on the ground.
7. **SEP 4 CCC 2 DCI PS2.A How did you start and stop motion in your game of catch?**
I pushed the ball to throw it, and my partner stopped it by catching it.

8. **How did the ball stop if you didn't catch it?**

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Lesson 2.2: Golf Pushes and Pulls

1. **See the Online Resources Guide for a link to the recommended video: www.coreknowledge.org/cksci-online-resources What do you need to play miniature golf?**

SEP 1 SEP 4

2. **How does the ball change direction?**

It bumps into the side or an obstacle.

Lesson 2.3: Pushes and Pulls Everywhere

1. **internet access and the means to project images/video for whole-class viewing Activity Page Push Me or Pull Me?**

AP 2.3.1

2. **They should mark each picture with a circle and X because each of the objects can be pushed and pulled. NGSS Elements Review student responses in the reading questions and to Push Me or Pull Me?**

AP 2.3.1

3. **Gravity pulls you down a slide. 16 EVALUATIVE—What pushes and pulls do you see every day?**

For example, pushing a stroller, pulling a wagon or a chain on a lamp

4. **EVALUATIVE—How do you describe pushes and pulls?**

For example, pushes and pulls make things move. CORE VOCABULARY—Explain that to move means to change location from one place to another. Movement and motion are words related move. SUPPORT—Have students demonstrate a movement by, for example, raising their hands. Discuss whether the movement was caused by a push or a pull.

5. **LITERAL—What will make the object in each picture move?**

The push of the domino, the push of the golf club, the dog pushing, the wind pushing the pinwheel CORE VOCABULARY—Explain that like opposites push and pull and fast and slow, start and stop are opposites. Ask students to demonstrate starting to raise their hands and then stopping.

6. **The balls push on each other. 24 INFERENTIAL—What is happening in the pictures when a moving object bumps into another object?**

Objects move in different directions. CORE VOCABULARY—Explain that to bump into something means that a moving object touches another object. If something is moving fast, you can break or bruise something. If a moving object bounces, it also touches something but does not break. Ask students to demonstrate gently bumping into a desk or chair. Then demonstrate a bounce by dropping a ball on a table or floor and watching it bounce.

7. **A gentle push causes a smaller change to the motion of the same kind of ball. 27 LITERAL—What can you expect will happen when a ball is pushed**

strongly instead of weakly?

It will go faster and farther.

8. INFERENTIAL—How can pushes and pulls solve problems?

A push or pull can make something move so you get what you want.

9. Backhoes pull large amounts of dirt. 30 INFERENTIAL—What are some tools you use to help pushes and pulls solve problems?

For example, a broom, a hairbrush, a hammer, a rope, a wagon

Lesson 2.4: Lesson 2 Roundup: Tee Time

1. Which hole was the most difficult to complete and why?

Responses will depend on student demonstrations.

Lesson 3.1: No-Touch Forces

1. Distribute Magnetic or Not?

AP 3.1.1

2. SEP 4 CCC 2 • DCI PS2.A Briefly review what students learned about motion in Lessons 1 and 2 by asking these questions: What is the difference between a push and a pull?

A push is away from you. A pull is toward you.

3. What do pushes and pulls have to do with motion?

They make things move.

4. How can you make something move farther and faster?

Push or pull harder. Make sure the surface is smooth.

5. Do things move without being pushed or pulled more?

Yes. An object can be motion without any force acting on it.

6. Did you push or pull the marble to make it fall?

No

7. What made the object fall?

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8. PUSHES AND PULLS Can you see the force that made the object fall?

No

9. Which direction did you fall?

Down

10. Did something push or pull you?

•

11. What will happen if you put the marble at the high end and let go?

•

12. What made the marble roll down and not up?

•

13. Could you see the magnetic force?

No

14. **What are the items that are attracted to the magnet made of?**
They are all metal.
15. **Based on this classification, you could predict that birds with talons are carnivores. 110 PUSHES AND PULLS What items are not attracted to magnets?**
They are wood and plastic and some metal.
16. **Did everyone find that the same materials were magnetic and not magnetic?**
Yes
17. **Can you feel a pull between two magnetic marbles?**
Yes
18. **Can you feel a push between two magnetic marbles?**
Online Resources
19. **Confirm student understanding by asking these questions: • SEP 1 How can magnets help us do things?**
A magnet can hold something in place, like a screw on a screwdriver or a picture on a refrigerator. Magnets can be used to pick up metal objects.
20. **SEP 4 CCC 2 DCI PS2.A Monitor Progress • How do you use gravity to get things done?**
You pour liquids down into a glass. You can coast downhill on a bike.

Lesson 3.2: Invisible Pushes and Pulls

1. **Ask these questions: What happened to the marble?**
It rolled down the ramp.
2. **What caused the one marble to roll?**
The invisible force of gravity caused the marble to roll to the lowest place.
3. **What caused the marble on the flat surface to stay put?**
The desk held the marble up.
4. **LESSON 3.2 | INVISIBLE PUSHES AND PULLS 113 Why didn't the marble on the flat surface roll?**
It was already at the lowest point.
5. **Will things always go to the lowest point?**
•
6. **That is a strong pull! 33 Online Resources LITERAL—Is the big magnet pushing or pulling the metal?**
Pulling
7. **See the Online Resources Guide for a link to the recommended video. www.coreknowledge.org/cksci-online-resources EVALUATIVE—What are some ways magnets can be useful?**
For example, picking up metal pins if you drop them or holding a screw in a screwdriver

8. **A magnet causes pushes and pulls to make the microphone work. 36**
INFERENTIAL—Why do people use magnetic letters and kitchen magnets?
 You can display messages that will stay in place. **EVALUATIVE—What are some other things that use magnets?**
9. **It pulls on the metal parts of the tools. 37** **EVALUATIVE—How can you solve problems with magnets?**
 For example, pick up spilled paper clips, hold a picture on a refrigerator, hold a door closed

Lesson 3.3: Lesson 3 Roundup: Invisible Tee Time

1. **to study gravity 134 PUSHES AND PULLS LITERAL—What does Dr. Shepard want to find out?**
 See Know the Standards 4.
2. **NGSS Elements Lead a whole-class discussion about how the unseen forces of gravity and magnetism could be used in their golf course. • SEP 1 SEP 4**
How could gravity be used in a miniature golf course to stop the ball from moving forward?
 A ramp could be set up so you have to hit the ball uphill.
3. **DCI PS2.A Differentiation • How could gravity be used in a miniature golf course to help the ball move forward?**
 The plan could include ramps going down to make the ball roll.
4. **Did you have to change how hard or soft you pushed or pulled the ball because of the invisible force?**
 Responses will depend on student demonstrations.
5. **Which type of invisible force affected play the most?**
 Gravity made the ball roll around more.
6. **For those who used gravity, how would play change if you had a flat course?**
 I would not have to hit the ball up the ramp.
7. **LITERAL—What is Kamal excited about?**
 He is excited to have a call with a scientist from the space program.
8. **Shepard study?**
 She studies forces that push and pull.
9. **INFERENTIAL—Why do you think astronauts feel a strong pull of gravity when they launch into space from Earth?**
 Gravity is trying to pull them back down. **INFERENTIAL—Why do you think astronauts get tested before they fly a rocket?**
10. **Shepard use a laboratory to study pushes and pulls?**
 She cannot go into space herself. **INFERENTIAL—Why might Dr. Shepard not be able to go into space herself?**
11. **Shepard use the centrifuge?**
 To study gravity

12. **Shepard testing the astronaut in a rocket?**
No, she is testing the astronaut in a laboratory. Page 42
13. **UNIT SUPPLEMENT | SCIENCE IN ACTION: STUDYING PUSHES AND PULLS**
135 LITERAL—Is the apple being pulled or pushed down?
The apple is being pulled down. LITERAL—How can you tell the “Pull” sign is being pulled?
14. **LITERAL—What do scientists base their work on?**
They base their work on work done by others before them. INFERENTIAL—How is the apple like a rocket being launched?
15. **Things that are moving keep moving the same way until a push or pull changes their motion. 43 136 PUSHES AND PULLS LITERAL—Why is Isaac Newton important in understanding forces?**
He explained how pushes and pulls make things move. INFERENTIAL—Describe the motion of the marbles on the ground using the first law of motion.
16. **INFERENTIAL—Use the first law of motion to describe what will happen to those marbles when the big marble is pushed into them?**
The little marbles will get pushed and start moving.

Unit quiz key

1. d 2. d 3. b 4. d 5. d 6. c 7. b 8. b 9. c 10. c 11. a 12. d