

# Lesson 5

## Changing Motion: Starting Things Moving and Changing Direction



### A QUICK LOOK

#### Big Idea

The way to change how something moves is to give it a push or a pull.

#### Overview

Children begin an extended study of how forces (pushes and pulls) change an object's motion. They use toy cars and other props to discover that pushes and pulls are needed to get a still object to start moving. They also learn that pushes and pulls are required to change the direction of an object's motion, and they contemplate other changes in motion, such as slowing down and speeding up.

#### Key Note

- Consider teaching this lesson in two sessions. It would work well to teach the introductory discussion and exploration in one session and conduct the sharing and synthesizing discussion during a second session.
- Locate or prepare a flat, smooth surface to roll the toy cars on. If you have a smooth floor in your classroom, you can use that. If your classroom floor is carpeted, experiment with the cars to see how well they move when pushed or pulled on it. If they don't move well, try putting sheets of poster board over the carpet, or do the activities in another area (such as the gymnasium, hallway, or playground) or on a different surface (tables or desks).
- For more information about the science content in this lesson, see the "Forces" section of the Teacher Background Information.



## Materials

Item	Quantity	Notes
<b>ExploraGear</b>		
Marbles	Several	To try moving toy cars.
Straws, plastic	1 per child	To try moving toy cars.
String	Several pieces	To try moving toy cars.
Toy cars	1 per pair	To experiment with.
<b>Classroom Supplies</b>		
Balls	2	To demonstrate changes in direction.
Cardboard tubes	Several	To try moving toy cars. Toilet paper or paper towel tubes work well.
Chart paper	1 sheet	To record ideas and observations.
Rubber bands	Several	To try moving toy cars.
Rulers	Several	To try moving toy cars.
Stiff paper or cardboard	Several strips	To try moving toy cars.
Tape	1 roll	To try moving toy cars.
<b>Curriculum Items</b>		
<i>Motion Science Notebook, pages 6-7</i>		
<b>Motion Assessment 2: Pushes and Pulls (Forces) (optional)</b>		
<b>Motion Assessment 4: Conducting Experiments (optional)</b>		

### NOTES

### Preparation

- Gather materials children can use to try to get their toy cars to roll, including rulers, straws, string, tape, rubber bands, cardboard tubes, marbles, and strips of cardstock or poster board. Put these materials out in the classroom right before the lesson.
- Find two balls to use during the sharing and synthesizing discussion.
- Make a large chart, titled “What makes the cars start moving?” with columns labeled “Try” and “What Happened?”

### Vocabulary

**force** ..... A push or a pull.

## Teaching the Lesson

### Engage

#### *Introductory Discussion*

1. Place a toy car on a smooth surface where all the children can see it. Wait a few seconds and then look exasperated. Tell the class you are waiting for the car to start moving.
2. Wait a few more seconds and then order the car to start moving. Beg the car to start moving. Threaten the car. Bribe it with a piece of candy. Wave a wand over it and mutter incantations.

**TEACHER NOTE:** There is a subtle distinction between “making the car start to move” and “making the car move.” When you include the word “start,” you emphasize the important idea that force is associated with changes in motion. Try to use the phrases “start to move” and “start moving” consistently throughout this lesson.

3. Ask the class how to make the toy car start to move. (*The children will probably suggest that you push it.*) Tell them to be more specific and to indicate what they would use to push it. (*The most likely answer is their hands.*) Have a child come forward and demonstrate how they’d push the car.
4. Have the children think of more ways to make the car start to move. Record their ideas on the chart under “Try.” Encourage them to be specific and detailed, so that each entry on the chart is different. If they say something vague like “push it,” have them explain what they would use to push the car and how they would do it.
5. Choose one of the suggested ideas and try it.
6. Ask the children what they observed. Again, tell them to elaborate. Refer back to the concepts and language introduced in the previous lessons. How did the car move? Did it move in a straight line or follow a different path? Did it change its speed? Did it go fast? How far did it go? Record their observations on the chart under “What Happened?”
7. Try a few more proposed methods until you see that the children are providing detailed descriptions under the “Try” and “What Happened?” columns.



## NOTES



Science Notebook pages 6 and 7

### assessment opportunity

*As you circulate, note children's initial understanding of the connection between forces and changes in motion.*

## Explore

### *Making Cars Start to Move*

**MANAGEMENT NOTE:** To ensure that children are able to focus on the guidelines and goals of the experiment, you may want to give them a chance to play with the toy cars a bit before launching into the directions.

1. Divide the children into pairs, then direct the pairs to find many different ways to make the toy car start moving.
2. Go over science notebook pages 6 and 7. Explain that the children should use a picture and words to describe their favorite method of getting the car to start moving. They will use their entries when they report to the class.
3. Have one child from each pair get a toy car. Have the other child get the first item they want to use to try to push and pull the car. Tell them that these materials are there to give them ideas, but they are free to use other things around the room too. Encourage the children to be creative.

**+ SAFETY NOTE:** To minimize germ transmission, do not allow children to share straws. Instead, give each child their own straw to try as they see fit.

**MANAGEMENT NOTE:** Remind the children to share the items on the table and to put items back as soon as they are finished with them so others can have a turn. Discuss any other problems you anticipate, such as children being too rough, losing materials, or tripping on them. Have the children decide on a few rules that will keep everyone safe and able to learn.

4. Allow the class time to experiment with making the toy cars move. Circulate and talk with children about what they are trying, observing, and discovering. If any pairs are having difficulty, you may want to draw their attention to strategies you notice other children trying.

## Reflect and Discuss

### *Sharing and Synthesizing*

1. Bring the cars and other props to the meeting and have each pair demonstrate their favorite method for getting their car to start moving. As they share, record children's descriptions of their experiments in the "Try" column of the chart and their observations in the "What Happened?" column.

**TEACHER NOTE:** If children mention other things they'd like to try the next time they use these materials, add these ideas to the "Try" column as a way to remember them for later.

2. Ask whether any of the cars started to move by themselves. *(No) Emphasize that in every case, the children needed to do something to make the cars start moving. (Some may have attached string or rubber bands to the car and used them to pull it, while others may have pushed it with a stick, pencil, or stiff piece of paper. Some may have used gravity, such as rolling the car down a ramp or dropping it. Still others might have had a collision start the car moving by sending another object to push it. If children blew through the straw to start the car moving, they pushed it with air.)*
3. Introduce the term *force*. Explain that a force is simply a push or a pull, and that forces are needed to start something in motion or to change an object's motion. Forces can be made by muscles and many other things, such as some of the ones they tried in the lesson. If you sense that the word "force" is too confusing or too abstract for some children, stick to the more concrete words "push" and "pull."
4. Have the class look at the list of ways to make the car start moving classify each method as either a push or a pull. Talk about the following questions:
  - Did all the ways involve some push or pull? *(Yes) (See the note below on less obvious examples of pushes or pulls.)*
  - Can they think of any ways to get the cars moving that do not involve using a push or pull (a force)? *(No, force is necessary to start things moving.)*

**TEACHER NOTES:** Children may suggest that dropping the car or rolling it down a ramp is a way to get the car to start moving without using a push or a pull. Mention that the "pull of gravity" moved the car and let them know they will learn more about gravity in future lessons.

If none, or very few, of the pairs pulled the car, you may want to talk a bit more about pulling. Have the class think of ways to pull the toy car and try a few of their suggestions. You can also share other examples of pulling to get something to start moving, such as pulling a wagon, pulling a yo-yo up by its string, or a tow truck pulling a car.

## NOTES

5. Use a ball to demonstrate that pushes or pulls (forces) are also necessary to change an object's direction.
  - a. Roll a ball along a straight path and ask children to describe its motion. Be sure they describe its path: a straight line.
  - b. Ask children how you might get the ball to turn or change direction and try some of their ideas. If no one suggests them, try the following methods: rolling the ball so it bounces off a wall; hitting it with a ruler; and rolling a second ball into it.
  - c. Ask children if they can think of any ways to change the ball's direction that do not involve a push or a pull.
  - d. Confirm that, just as pushes and pulls are required to start an object moving, they are also required to change the direction an object is moving in. Have children think back to Lesson 3, when they moved along different paths. Help them realize that they used forces from their muscles to change their direction as they moved.
  - e. Explain that a push or a pull is required to change any aspect of an object's motion. Ask children to think about what other aspects of motion can be changed by pushes or pulls. (*Objects can speed up, slow down, and stop, in addition to starting and changing direction.*)

**TEACHER NOTE:** Children will have additional experiences with the role of forces in changing various aspects of motion in later lessons, but take some time now to establish an understanding of the basic concept that forces are involved in all changes in an object's motion.

## Maintenance

Keep the "What makes the cars start moving?" chart for the next lesson.

## Ongoing Learning

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### Science Center

- Put the cars and props in the Science Center and encourage children to continue to try different ways of making the cars start moving. Post the “What makes the cars start moving?” chart and help children record their results on it. Also encourage children to look for and document ways to change other aspects of the car’s motion, such as direction or speed.
- Put out small balls and encourage children to put them in motion and then try different ways to change their direction.



### NOTES

***Materials: Cars, props to make cars move, “What makes the cars start moving?” chart, balls***

## Extending the Lesson

### Further Science Explorations

#### *Experiencing Forces Through Our Muscles*

1. Direct the children to put their hands together and place the palms towards each other.
  - a. Tell them to push hard with each palm. What do they feel? *(Each palm feels the other one pushing on it.)*
  - b. Have the children push harder with their right hand. What happens? *(The left hand moves back as the right hand pushes it.)*
  - c. Have them push harder with their left hand. What happens? *(The right hand moves back as the left hand pushes it.)*



2. Have the children link their fingers together and pull.
  - a. What do they feel? *(The fingers of each hand feel the fingers of the other hand pulling on them.)*
  - b. Have them pull harder with their right hand. What happens? *(The left hand moves forward as the right hand pulls it.)*
  - c. Have them pull harder with their left hand. What happens? *(The right hand moves forward as the left hand pulls it.)*



3. Direct the children to stand up and place their hands on top of their chairs.
  - a. Have the children stand in one place and use their arms to push their chairs away from themselves.
  - b. Have them pull the chairs back to their original positions.
  - c. Ask the children how they were able to move the chairs.  
(By using their arm muscles)
4. Direct the children to sit on the floor behind their chairs with their knees bent and one foot placed on each rear chair leg.
  - a. Have the children stay seated on the floor and use their legs to slowly push their chairs away from themselves.
  - b. Now have them use their legs to pull the chairs back to their original positions.
  - c. Ask the children how they were able to move the chairs back to their original positions. (By hooking their feet around the chair leg and using their leg muscles to pull)
5. Direct the children to walk or run in a circle. Have them try to feel the muscles in their outside leg push to make them change direction.

### ***Thinking About Muscles, Forces, and Movement***

Solicit ideas about some of the many ways the children use their muscles in their daily lives to create forces that cause things (including themselves) to start to move, move faster, or change direction. Also encourage them to think about whether these changes in movements are created by a push, a pull, or a combination of both. Although there are often many muscles involved in creating movement, for this discussion simply concentrate on arms and legs. Use some of the following examples to stimulate thinking about the children's use of forces to start movement:

- Bike riding (push with the legs, push and pull with the arms for steering)
- Skating and skateboarding (push with the legs, especially when starting)
- Running, walking, skipping, and jumping (push with the legs, especially when starting or stopping suddenly or turning)
- Tree climbing (pull with the arms, push with the legs)
- Swimming (push and pull with the arms, push with the legs)



- Basketball (push with the arms to shoot, push with the legs to run)
- Crossing monkey bars (pull with the arms)
- Jumping rope (push with the legs, push and pull with the arms)
- Kicking a soccer ball (push with the legs)
- Throwing a baseball or football (push with the arms)
- Hitting a tennis ball or baseball (push with the arms)

## Language Arts Extension

### *Writing About Forces*

Have the children write about some of the pushes and pulls they use during their favorite activities, such as doing sports, playing an instrument, or using playground equipment.

## Art Extension

### *More Marble Art*

If children did the Marble Art extension in Lesson 3, have them think about the forces that created the different paths they represented. You might put out the materials again and encourage further exploration.

## Planning Ahead

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### For Lesson 6

Consider using part or all of the Further Science Exploration “Experiencing Forces Through Our Muscles,” above, as an introduction to the next lesson.

Science Notebook page 6

Date: \_\_\_\_\_

### Starting Things Moving

Draw your favorite way to start the car moving.

Starting Things Moving (Lesson 5)

Science Notebook page 7

Date: \_\_\_\_\_

### Starting Things Moving

Describe your favorite way to start the car moving.

Starting Things Moving (Lesson 5)

Teacher Master 3, Assessment 2

### Motion Assessment 2: Pushes and Pulls (Forces)

Note whether children demonstrate an understanding of the following concepts related to forces and changes in motion.

Child's Name	Assessment Criteria			
	A. The way to change how something moves is to give it a push or a pull.	B. There are many sources of pushes and pulls.	C. There are different sizes of pushes and pulls. Bigger pushes and pulls (and some bigger changes in motion) than smaller forces do.	D. Friction and gravity are pulling forces that affect an object's motion.
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Assessment 2: Pushes and Pulls (Forces) Motion Teacher Master 3

Teacher Master 5, Assessment 4

### Motion Assessment 4: Conducting Experiments

As children plan, conduct, analyze, and discuss simple experiments, note whether they are beginning to develop the following knowledge and behaviors related to scientific inquiry and experimentation.

**Teacher Note:** This and other early and informal exposure to these elements of scientific experimentation. They will be assessed more formally in later grades.

Child's Name	Assessment Criteria				
	A. Understands the purpose of a particular experiment.	B. Distinguishes between predictions and observations.	C. Recognizes the value of repeating an experiment several times.	D. Understands the reason for changing only one thing at a time when doing experiments.	E. Records results for future reference.
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Assessment 4: Conducting Experiments Motion Teacher Master 5