

Forces

Lesson 1b: What Is a Force?

Grade 3	Length of lesson: 45 minutes	Placement of lesson in unit: 1b of 6 two-part lessons on forces
Unit central questions: What makes something start to move? What makes something stop moving or change direction?		Lesson focus question: What makes something start to move?
Main learning goal: A <i>force</i> is a push or pull that involves an interaction between two objects and causes a change in an object’s motion.		
Science content storyline: An object starts to move because something is pushing or pulling it. These pushes and pulls are called <i>forces</i> . Forces cause a change in an object’s motion. The words <i>push</i> or <i>pull</i> imply that something is <i>being</i> pulled or pushed, and something else is <i>doing</i> the pushing or pulling. In other words, an interaction is taking place between two objects. In most cases, two objects must touch to exert a force that causes an object to move, but gravity is a type of pulling force that doesn’t require two objects to touch. When an object drops or falls, we can say that Earth is pulling on the object with the force of gravity.		
Ideal student response to the focus question: An object starts to move when something pushes or pulls it or when it drops or falls. Pushes and pulls are called <i>forces</i> . Forces cause objects to move. For an object to move, two objects usually need to touch, but gravity is a type of force that pulls an object toward Earth even though it isn’t touching the ground. When something drops or falls, gravity is pulling it toward the ground.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper and markers • Optional: Tray of objects from lesson 1a <p>Student Handouts</p> <ul style="list-style-type: none"> • 1.2 Forces (1 per student) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review sections 1 and 2 in the content background document. • Decide whether to have students read handout 1.2 (Forces) individually, in pairs, or as a class. • Write the following definitions on cards to post on a word wall during the lesson activity: <ul style="list-style-type: none"> • Force: A <i>force</i> is a push or pull. In most cases, two objects must touch to exert a force that causes a change in motion. • Gravity: <i>Gravity</i> is a type of force that pulls objects toward Earth even when they aren’t touching the ground. • ELL support: Review the reading from handout 1.2 (Forces) with ELL students before the lesson. Also review vocabulary words with students, including <i>force</i>, <i>gravity</i>, and <i>motion</i>.
--	--

Lesson 1b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
10 min	Link to previous lesson: Students review their tree maps from the previous lesson and share the sentences they completed to answer the focus question.	<ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. Pushing and pulling involve an interaction between two objects that causes motion or a change in motion.
1 min	Lesson focus question: The teacher reviews the focus question from the previous lesson: <i>What makes something start to move?</i>	
2 min	Setup for activity: The teacher introduces <i>force</i> as a word scientists use to describe a pushing or pulling action.	<ul style="list-style-type: none"> A <i>force</i> is a push or pull that causes motion or a change in motion and involves an interaction between two objects.
15 min	Activity: Students read about forces and describe to a partner what force and gravity are. The teacher posts the words <i>force</i> and <i>gravity</i> on a word wall.	<ul style="list-style-type: none"> Scientists use the term <i>force</i> to describe a push, pull, twist, or drop that causes a change in an object's motion. In most cases, two objects must touch to exert a force that causes motion or a change in motion. <i>Gravity</i> is a special type of force that pulls an object toward Earth without requiring it to touch the ground. When an object drops or falls, we can say that Earth is pulling on the object with the force of gravity.
6 min	Follow-up to activity: Students brainstorm and share everyday examples of force and gravity. They identify forces, or interactions between two objects, based on what is <i>being</i> pushed or pulled and what is <i>doing</i> the pushing or pulling.	<ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. The words <i>push</i> and <i>pull</i> imply that something is <i>being</i> pulled or pushed, and something else is <i>doing</i> the pushing or pulling. In other words, an interaction is taking place between two objects. In most cases, the objects must touch to exert a force that causes motion or a change in motion. But gravity is a special type of pulling force that doesn't require objects to touch. When an object drops or falls, we can say that Earth is pulling on the object with the force of gravity.
10 min	Synthesize/summarize today's lesson: Students revisit the focus question and draw pictures in their science notebooks that illustrate their current understandings of force and motion.	<ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. The interaction between two objects, or between an object and the force of gravity pulling the object toward the ground, can be represented in a drawing.
1 min	Link to next lesson: The teacher links students' drawings to the next lesson's focus question, <i>How can we draw the forces pushing or pulling an object when we can't see them?</i>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
10 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students review their tree maps from the previous lesson and share the sentences they completed to answer the focus question.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. Pushing and pulling involve an interaction between two objects that causes motion or a change in motion. 	<p>Make explicit links between science ideas and activities.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p>Show slide 1.</p> <p>Last time, we investigated what makes something start to move. What did you observe about motion from the different objects you worked with? Make sure to include action words in your descriptions.</p> <p>So <i>push</i> and <i>pull</i> are important words that describe motion.</p> <p>Show slide 2.</p> <p>At the end of the lesson, you answered the focus question, <i>What makes something start to move?</i> by completing this sentence:</p> <p><i>My object, [name of object], started to move because _____.</i></p>	<p>When we <i>pushed</i> an object, it started to move.</p> <p>When you <i>pulled</i> the cart, you made it move in the opposite direction.</p>	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>I'd like a few of you to share your sentences and what you recorded on your tree maps about the objects you investigated. Make sure to tell the class the name of your object and how you answered the three questions about that object on the handout.</p> <p>NOTE TO TEACHER: <i>Students might still be struggling to understand the difference between what causes something to move and the movement itself. Encourage them to be as specific as possible in their descriptions. Focus on the words push, pull, drop, and fall (and gravity if students used that term in the previous lesson).</i></p> <p>Great thinking about what causes</p>	<p><i>Sample description:</i> My object was the ball. It started to move because I pushed it.</p> <p>My hand pushed the ball.</p> <p>The ball rolled.</p> <p>My hand pushing it?</p>	<p>What do you mean by "I pushed it"? What pushed the ball? Be specific.</p> <p>Yes, your <i>hand</i> was the other object that made the ball start to move.</p> <p>What action caused the motion?</p> <p>Yes, but what caused the ball to roll?</p> <p>Yes, <i>pushing</i> made the ball start moving.</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		<p>Highlight key science ideas and focus question throughout.</p>	<p>things to move!</p> <p>Show slide 3.</p> <p>Let's review two key science ideas about motion:</p> <ol style="list-style-type: none"> 1. Something starts to move when <i>something else</i> pushes or pulls it. 2. An <i>interaction</i> between two objects makes something start to move. <p>CONTENT NOTE TO TEACHER: <i>In most cases, two objects in an interaction must touch to exert a force that causes motion or a change in motion. One exception is the force of gravity, which doesn't require two objects to touch for something to move (e.g., an apple in a tree and the ground). Students will learn more about gravity in this lesson.</i></p> <p>We'll continue thinking about these important science ideas in today's lesson.</p>		
1 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher reviews the focus question from the previous lesson: <i>What makes something</i></p>	<p>Set the purpose with a <u>focus question</u> or goal statement.</p>	<p>Show slide 4.</p> <p>In this lesson, we'll continue thinking about our focus question from last time: <i>What makes something start to move?</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<i>start to move?</i>		You've already answered this question using ideas about motion that we discovered last time, but today we'll learn about the words scientists use when they describe what causes objects to move.		
2 min	<p>Setup for Activity</p> <p>Synopsis: The teacher introduces <i>force</i> as a word scientists use to describe a pushing or pulling action.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • A <i>force</i> is a push or pull that causes motion or a change in motion and involves an interaction between two objects. 	Make explicit links between science ideas and activities before the activity.	<p>Show slide 5.</p> <p>An important word scientists use to describe what makes something start moving, change speed or direction, or stop moving is <i>force</i>.</p> <p>The essay you'll read next will help you learn how scientists think and talk about this important science idea.</p> <p>NOTE TO TEACHER: <i>Record the word force on the board, but don't post the definition on the word wall until after students have read the handout.</i></p>		
15 min	<p>Activity</p> <p>Synopsis: Students read about forces and describe to a partner what force and gravity are. The teacher posts the words <i>force</i> and <i>gravity</i> on a word wall.</p> <p>Main science idea(s):</p>		<p>NOTE TO TEACHER: <i>Distribute handout 1.2 (Forces) and use classroom strategies that will help students navigate the reading. Have students read the essay individually, in pairs, or as a class. Encourage them to highlight or underline words on the handout that can help them understand the science ideas. Also</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<ul style="list-style-type: none"> Scientists use the term <i>force</i> to describe a push, pull, twist, or drop that causes a change in an object’s motion. In most cases, two objects must touch to exert a force that causes motion or a change in motion. <i>Gravity</i> is a special type of force that pulls an object toward Earth without requiring it to touch the ground. When an object drops or falls, we can say that Earth is pulling on the object with the force of gravity. 	<p>Make explicit links between science ideas and activities during the activity.</p> <p>Engage students in constructing explanations and arguments.</p>	<p><i>encourage them to “stop and think” when they’re asked to do so in the reading.</i></p> <p>ELL support: For this activity, pair ELL students with strong English-language readers or have an adult—you, a parent, or a teaching assistant—lead a group of ELL students in reading the essay.</p> <p>After you read this essay on forces, you’ll have an opportunity to share what you’ve learned with an elbow partner.</p> <p>Reading time (5 min).</p> <p>Show slide 6.</p> <p>Turn and Talk: Now that everyone has finished reading the essay, discuss the questions on the slide with an elbow partner:</p> <ul style="list-style-type: none"> • What is a force? • What is gravity? <p>You can look at the handout, but answer these questions in your own words.</p> <p>Whole-class discussion: How did you answer these questions? First,</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		Link science ideas to other science ideas.	<p>let's hear how you defined the word <i>force</i>.</p> <p>NOTE TO TEACHER: <i>Invite a few students to share their definitions with the class. Then post the definition card you prepared ahead of time on the word wall.</i></p> <p>Now let's hear how you defined the word <i>gravity</i>.</p> <p>NOTE TO TEACHER: <i>Invite a few students to share their ideas with the class. Then post the definition card you prepared ahead of time on the word wall.</i></p> <p>Think-Pair-Share: Next, read the handout again and look for examples of forces and gravity. Then share the examples you found with your partner.</p> <p>ELL support: <i>Encourage ELL students to highlight or circle the examples in the reading so they can find them easily.</i></p>		
6 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students brainstorm and share</p>	Ask questions to elicit student	<p>Show slide 7.</p> <p>Who can come up with examples of forces and gravity from your own</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>everyday examples of force and gravity. They identify forces, or interactions between two objects, based on what is <i>being</i> pushed or pulled and what is <i>doing</i> the pushing or pulling.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. The words <i>push</i> and <i>pull</i> imply that something is <i>being</i> pulled or pushed, and something else is <i>doing</i> the pushing or pulling. In other words, an interaction is taking place between two objects. In most cases, the objects must touch to exert a force that causes motion or a change in motion. But gravity is a special type of pulling force that doesn't require objects to touch. When an object drops or falls, we can say that Earth is pulling on the object with the force of gravity. 	<p>ideas and predictions.</p> <p>Make explicit links between science ideas and activities after the activity.</p>	<p>life?</p> <p>ELL Support: <i>Pair ELL students with shared-language classmates for this activity.</i></p> <p>As you share your examples with the class, talk about the interactions between two objects that make something move. Do the objects touch to make something move? If so, how? Remember to use science words like <i>force</i>, <i>gravity</i>, <i>push</i>, <i>pull</i>, and <i>twist</i>.</p> <p>So what examples can you think of from your everyday lives that illustrate forces and gravity?</p> <p>NOTE TO TEACHER: <i>If time allows, have students describe the objects they investigated in lesson 1a using the terms force and gravity. Which object exerts a force that causes something else to start moving?</i></p>	<p><i>Example 1:</i> A scooter!</p> <p>My foot makes the scooter move.</p> <p>The force of my foot pushing the ground makes the scooter move.</p>	<p>Tell us more about the scooter and the force that makes it move.</p> <p>Please use our science word <i>force</i>.</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
				<p><i>Example 2:</i> Riding my bike.</p> <p>The wheels are the force that makes the bike start moving.</p> <p>Oh, my foot is pushing on the bike pedal, so that must be the force.</p> <p><i>Example 3:</i> My pencil rolling off my desk.</p> <p>When my hand pushes the pencil, it rolls. Then it falls on the floor.</p>	<p>How is a force involved in riding your bike?</p> <p>Remember that a force is a push or pull. So what is pushing the bike?</p> <p>Good. Your foot pushes the pedal and provides the force.</p> <p>Tell us about the forces involved in your pencil rolling off your desk. What is pushing or pulling the pencil?</p> <p>Can you describe</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
				The force or push from my hand makes the pencil start rolling. Then gravity pulls on the pencil and makes it fall to the ground.	the force involved using science words from today's lesson?
10 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students revisit the focus question and draw pictures in their science notebooks that illustrate their current understandings of force and motion.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. The interaction between two objects, or between an object and the force of gravity pulling the object toward the ground, can be represented in a drawing. 	<p>Summarize key science ideas.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p>Show slide 8.</p> <p>Today, we learned about the words scientists use to describe motion. <i>Forces</i> are pushes or pulls between two objects that make an object start moving, change speed or direction, or stop moving. <i>Gravity</i> is a special kind of force that pulls an object toward Earth without requiring it to touch the ground.</p> <p>Show slide 9.</p> <p>Let's revisit our focus question: <i>What makes something start to move?</i></p> <p>Please open your science notebooks to the page where you answered this question last time.</p> <p>Show slide 10.</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		Engage students in making connections by synthesizing and summarizing key science ideas.	<p>To summarize today’s lesson, draw a picture in your notebooks that shows what makes something start to move.</p> <p>You can use an example from today’s reading, from our investigation of different objects last time, or from your own life.</p> <p>Use words from our word wall (such as <i>push, pull, force, and gravity</i>) to label the force in your drawing. What force is making something start to move, and where is that force located in the drawing?</p> <p>ELL support: Remind students to use visual and language resources, such as a word wall or a key-word dictionary, to help them label their drawings. Also provide some examples of ways they might depict motion and force in their drawings. Alternatively, after some students finish their drawings, use them as examples for ELL students as you circulate around the room.</p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher links students’ drawings to the next lesson’s focus</p>	Link science ideas to other science ideas.	<p>Show slide 11.</p> <p>Next time, we’ll look at a few of your drawings and see how you illustrated the forces that make objects move.</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>question, <i>How can we draw the forces pushing or pulling an object when we can't see them?</i></p>		<p>Then we'll think about this question: <i>How can we draw the forces pushing or pulling an object when we can't see them?</i></p> <p>NOTE TO TEACHER: <i>Before the next lesson, look through students' science notebooks and identify a few (three to five) drawings that show different ways of representing motion or force. Typical examples include wavy lines, arrows, or streaks. You'll display these sample drawings during the next lesson.</i></p>		