

Forces

Lesson 1a: What Makes Something Start to Move?

Grade 3	Length of lesson: 50 minutes	Placement of lesson in unit: 1a 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 causes a change in an object’s motion.		
Science content storyline: An object starts to move because something is pushing or pulling 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. For one object to push or pull another object, the objects need to touch.		
Ideal student response to the focus question: An object starts to move when something pushes or pulls it. For one object to push or pull another object, the objects need to touch.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper and markers • Rolling cart (or chair) (1 per class) • Tray for objects (1 per group) • Ball, block, paddleball, and toy car (1 of each per group) <p>Student Handouts</p> <ul style="list-style-type: none"> • 1.1 Tree Map (1 per student) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Read sections 1 and 2 in the content background document. • Assemble the tray of objects for each group. • Photocopy handout 1.1 (Tree Map) and place one copy per student on each group’s tray. • ELL support: Identify Tier 2 and Tier 3 words in the lesson plan to review in advance with ELL students. Examples include <i>force</i>, <i>friction</i>, <i>gravity</i>, <i>surface</i>, <i>object</i>, <i>push</i>, and <i>pull</i>.
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Lesson 1a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
7 min	Unit central questions: The teacher introduces the unit central questions, <i>What makes something start to move? What makes something stop moving or change direction?</i> Then students share their initial ideas for answering the questions.	
2 min	Lesson focus question: The teacher introduces the focus question, <i>What makes something start to move?</i>	
10 min	Setup for activity: Students consider actions that make a rolling cart start to move, and the teacher records their ideas on a chart.	<ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. Pushing and pulling involves an interaction between two objects.
15 min	Activity: Students work in small groups to examine and describe several common objects. Then they record on a tree map the <i>interactions</i> that cause each object to start moving, change speed or direction, or stop moving.	<ul style="list-style-type: none"> An object starts to move when something pushes or pulls it. 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 <i>interaction</i> is taking place between two objects. An object won't start to move unless there is such an interaction.
10 min	Follow-up to activity: Students share their object descriptions and tree maps in their small groups.	<ul style="list-style-type: none"> An object starts to move because something pushes or pulls it. An interaction between two objects is required for an object to start moving, change speed or direction, or stop moving. We can use a tree map to identify the interaction between two objects that changes an object's motion.
5 min	Synthesize/summarize today's lesson: Students select an object they investigated and complete a sentence about the object that answers the focus question.	<ul style="list-style-type: none"> An object starts to move when something pushes or pulls it.
1 min	Link to next lesson: The teacher informs students that in the next lesson, they'll learn the specific words scientists use to describe the pushing and pulling actions that make objects move.	

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7 min	<p>Unit Central Questions</p> <p>Synopsis: The teacher introduces the unit central questions, <i>What makes something start to move? What makes something stop moving or change direction?</i> Then students share their initial ideas for answering the questions.</p>	<p>Ask questions to elicit student ideas and predictions.</p>	<p>Show slides 1 and 2.</p> <p>Throughout this unit on forces, we'll think about two important questions: <i>What makes something start to move?</i> and <i>What makes something stop moving or change direction?</i></p> <p>Write these unit central questions in your science notebooks and draw a double-lined box around them.</p> <p>NOTE TO TEACHER <i>Display the unit central questions where students can see and refer to them throughout the lesson series. Model for students how to draw the double-lined box around the questions.</i></p> <p>Have you ever thought about these questions before? Picture something that's moving. What made it start moving? What might make it stop moving?</p> <p>NOTE TO TEACHER: <i>Give students time to think of an example. Invite one or two students to share their ideas with the class if some students are finding it difficult to think of something.</i></p> <p>Does everyone have something in</p>	<p>NOTE TO TEACHER: <i>Scientifically inaccurate student responses and misconceptions are noted in italicized brackets. In column 6, the teacher doesn't correct inaccurate ideas but may instead ask probe questions to reveal more about student thinking or challenge question that push students to make connections to science ideas developed during classroom activities. The teacher also listens, keeping track of student misconceptions and planning how to address them as the lessons progress.</i></p>	

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			<p>mind? Give me a thumbs-up or a thumbs-down.</p> <p>Turn and Talk (1 min): Now turn to an elbow partner and share the moving thing you thought of. Then share your ideas about what made it start to move and what might make it stop moving. Each of you will have 1 minute to share your ideas.</p> <p>NOTE TO TEACHER: <i>Let pairs know when 1 minute is up so the other partner can share his or her ideas.</i></p> <p>Whole-class share-out: Let's hear some of your ideas. What moving things did you think of? What made them start to move, and what might make them stop moving?</p> <p>NOTE TO TEACHER: <i>To keep this discussion as brief as possible, invite only two or three students to share their ideas. Chart their examples and ideas so you can come back to them later in the lesson series.</i></p>	<p>A car moves. The engine makes it start moving, and the brakes make it stop moving.</p> <p>A person moves. Muscles make the person start and stop moving.</p> <p>The wind moves, but I don't know what makes it start or stop</p>	

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			<p>These are all wonderful examples! I'm glad you could think of so many moving things!</p> <p>Over the next several days, we'll explore what makes something start to move, speed up or slow down, change direction, or stop moving.</p>	<p>moving!</p> <p>A soccer ball moves when you kick it, and you can stop it with your foot.</p> <p>Roller skates start moving when you push off with your feet, and you can stop by putting the toe of the skate down or moving sideways.</p>	
2 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher introduces the focus question, <i>What makes something start to move?</i></p>	Set the purpose	<p>Show slide 3.</p> <p>Each lesson in this unit will begin with a special question called a <i>lesson focus question</i>. We'll think about this question throughout the lesson, and the ideas we learn about in the activity will help us answer it.</p> <p>Our focus question for today is <i>What makes something start to move?</i></p>		

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		with a <u>focus question</u> or goal statement.	<p>Notice that this question is the same as one of our unit central questions.</p> <p>Take a moment and write the focus question under our unit central questions in your notebooks and draw a box around it.</p> <p>At the end of class, we'll write an answer to this question using science ideas from today's lesson.</p> <p>NOTE TO TEACHER: <i>Write the focus question on the board for students to see and refer to throughout the lesson.</i></p>		
10 min	<p>Setup for Activity</p> <p>Synopsis: Students consider actions that make a rolling cart start to move, and the teacher records their ideas on a chart.</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 involves an interaction between two objects. 	<p>Select content representations and models matched to the learning goal and engage students in their use.</p> <p>Ask questions to</p>	<p>NOTE TO TEACHER: <i>Position the rolling cart (or chair) where everyone can see it.</i></p> <p>Show slide 4.</p> <p>Let's think about what can make this cart start moving. Does anyone have any ideas?</p> <p>NOTE TO TEACHER: <i>As students share their ideas, record on chart paper the action words they use (e.g., push, pull, drop, fall).</i></p>	<p>The wheels can move it. <i>[Inaccurate]</i></p>	<p>Tell us more about the wheels moving the cart. Will the wheels make it start moving?</p>

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		<p>elicit student ideas and predictions.</p> <p>Make explicit links between science ideas and activities before the activity.</p>	<p>ELL support: Consider having ELL students create a key-word dictionary for the words they use or draw images for a word wall.</p> <p>NOTE TO TEACHER: <i>Help students realize that at least two things must be touching for something to move. Emphasize that a student had to touch or push the cart for it to start moving.</i></p> <p><i>Don't raise the idea of gravity unless a student brings it up. If a student observes that the cart could fall, point out that a force called gravity can pull something toward the ground even though the ground and the object aren't touching. Let students know that you'll explore this concept in the next lesson.</i></p> <p><i>Following this discussion, highlight the words you recorded on the chart.</i></p>	<p>I could <i>push</i> the cart.</p> <p>It moved.</p> <p>I could make the cart go backwards.</p> <p>I could <i>pull</i> the cart.</p> <p>The cart moved in the opposite direction from the direction it</p>	<p>OK, why don't you come up and try that?</p> <p>What happened when you pushed the cart?</p> <p>In what direction did the cart move? Did it keep moving after you finished pushing it?</p> <p>What do you mean by "backwards"? Can you come up and show us? What's another way to say this?</p> <p>In what direction did the cart move when you pulled it? Did it keep moving after you pulled it, or did it stop as soon as you let go?</p>

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		Highlight key science ideas and focus question throughout.	<p>What two words did you use to describe how the cart might start to move?</p> <p>So you could <i>push</i> the cart, or you could <i>pull</i> it.</p> <p>Notice that the cart never moved all by itself. Something had to touch the cart and do the pushing or pulling to make it move. This is an important idea to keep in mind.</p>	<p>moved when it was pushed.</p> <p>No. The cart needs to have someone do something to it. It won't start to move on its own.</p> <p><i>Push and pull.</i></p>	Is there any way the cart could start moving on its own without someone doing something to it?
15 min	<p>Activity</p> <p>Synopsis: Students work in small groups to examine and describe several common objects. Then they record on a tree map the <i>interactions</i> that cause</p>	<p>Make explicit links between science ideas and activities during the activity.</p> <p>Select content representations</p>	<p>In today's activity, you'll have an opportunity to use the words <i>push</i> and <i>pull</i> to describe what causes something to move.</p> <p>For this investigation, you'll work in small groups, so I'll assign the groups now, and then we'll go over the</p>		

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	<p>each object to start moving, change speed or direction, or stop moving.</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> 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 <i>interaction</i> is taking place between two objects. An object won't start to move unless there is such an interaction. 	<p>and models linked to the learning goal and engage students in their use.</p>	<p>instructions.</p> <p>NOTE TO TEACHER: <i>Divide the class into groups of four students. Then distribute handout 1.1 (Tree Map). Wait until after you've gone over the instructions to distribute a tray of objects to each group.</i></p> <p>Show slide 5.</p> <p>On each tray are four objects that are normally used as toys. But in this investigation, you'll use them as <i>science tools</i> to learn about motion. So don't play with them!</p> <p>Each of you will select one object from the tray and explore different ways to make the object move. If you select the paddleball, make sure to direct it toward the ground, not toward your neighbor!</p> <p>NOTE TO TEACHER: <i>Model the appropriate use of the paddleball. Strike the ball gently with the paddle in a downward motion so it moves straight toward ground and comes back toward the paddle.</i></p> <p>On the Tree Map handout, you'll see four column headings that show the</p>		

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			<p>name of each object. Draw a circle around the object you're investigating and then answer the three questions in the space provided:</p> <ul style="list-style-type: none"> • What <i>other object</i> caused your object to move? (In other words, what pushed or pulled your object?) • What <i>action</i> caused the motion? • What <i>action</i> caused the object to speed up or slow down, change direction, or stop? <p>NOTE TO TEACHER: <i>Display the Tree Map handout on a document reader or projector and add the cart as an example. Demonstrate for students how to circle the name of the object and record their responses on the tree map.</i></p> <p>Show slide 6.</p> <p>Try to be specific as possible in your answers and use words like <i>push</i> or <i>pull</i> to describe actions. As you work with your object, ask questions like these:</p> <ul style="list-style-type: none"> • What's moving? • What other object is touching (pushing or pulling) this object 		

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			<p>and causing it to move?</p> <ul style="list-style-type: none"> • What action is causing a change in the object’s motion or making it stop? • Does the object ever move without anything else touching it? <p>You’ll have 10 minutes for this activity, so explore as many objects on the tray as you can, but make sure to answer all of the questions on the handout for <i>each</i> object.</p> <p>NOTE TO TEACHER: <i>Distribute the tray of objects to each group and direct students to select one object to explore. Allow 10 minutes for students to explore their objects and record their answers and observations on the handout.</i></p> <p><i>As students work with their objects, circulate among the groups and have students describe the interactions they observe. Ask, “What two things touch to make the object move?” Have students identify (name) what pushes or pulls the object and describe how the object moves as a result.</i></p> <p><i>Encourage students to explore as many objects as possible in the allotted time and record their</i></p>	<p><i>Possible student observations:</i></p> <p>I pushed the paddle, and the ball went forward and then came back.</p>	<p>OK, you pushed the paddle. What pushed the ball?</p>

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			<p><i>observations on their tree maps. Ideally, at least one student per group should examine and record observations for all four objects.</i></p> <p><i>Following the activity, ask students to place the objects back on the tray and have one student in each group return the tray to you.</i></p>	<p>The paddle pushed the ball.</p> <p>The rubber band made the ball come back.</p> <p>It pulled the ball back.</p> <p>I pushed the toy car, and it rolled off the table.</p> <p>The car moved in the same direction I pushed it. But when it got to the end of the table, it fell to the floor.</p>	<p>Why didn't the ball just keep going when you pushed it? What made it come back?</p> <p>How did the rubber band make the ball come back?</p> <p>OK, you pushed the car. In what direction did you push it? Did it move in that direction?</p> <p>Why didn't the car keep moving in that direction after it went off the end of the table? What do you think made</p>

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				<p>I think gravity pulled the car to the floor.</p> <p>I blew on the ball, and it moved.</p> <p>I did!</p> <p>No. I didn't touch the ball.</p> <p>Air. I blew the ball, and the air from my mouth pushed it and made it move.</p>	<p>the car fall to the floor?</p> <p>Oh, that's interesting. You said that gravity pulled the car to the floor. Is that another kind of pull? Keep that idea in mind and write it in your notebook.</p> <p>What made the ball move when you blew on it?</p> <p>Were you touching the ball when it moved?</p> <p>What was touching the ball that made it move?</p>
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students share</p>		Show slide 7.		

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	<p>their object descriptions and tree maps in their small groups.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> An object starts to move because something pushes or pulls it. An interaction between two objects is required for an object to start moving, change speed or direction, or stop moving. We can use a tree map to identify the interaction between two objects that changes an object's motion. 	<p>Make explicit links between science ideas and activities after the activity.</p>	<p>Now that you've explored at least one object on the tray, I'd like you to share your object descriptions and tree maps in your small group. To make sure all of the objects on the tray are included, each group member should select a different object to describe.</p> <p>Tell the group the name of your object and then share your descriptions from the tree map.</p> <ol style="list-style-type: none"> 1. What <i>other object</i>, or thing, made the object move? (What pushed or pulled it?) 2. What <i>action</i> caused the motion? 3. What <i>action</i> caused the object to speed up, slow, down, change direction, or stop? <p>Show slide 8.</p> <p>NOTE TO TEACHER: <i>Use the cart example you recorded earlier on the projected tree map to model how you want students to share their objects. You might say something like this: "My object is the cart. My hand caused the cart to start moving. Pushing the cart caused the motion. Pulling the cart with my hand made it change direction."</i></p> <p>Each of you will have 1 minute to share your object and your</p>		

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		Engage students in communicating in scientific ways.	<p>observations about what made it start moving or caused a change in motion. I'll let you know when it's time for the next person to share.</p> <p>As your classmates share, listen carefully to their descriptions. If there's time after they've finished sharing, be ready to ask questions and offer comments or suggestions. If you think someone else's suggestion will improve your description, you can make changes to your tree map.</p> <p>NOTE TO TEACHER: <i>Track the time by setting a timer or watching the clock. Let groups know when it's time for the next student to share.</i></p> <p><i>Circulate among the groups during the share-out and listen for words like push, pull, fall, and drop. As time allows, encourage students to ask questions and respectfully suggest another idea if they don't agree with someone's description. Give students an opportunity to revise their tree maps based on the feedback they receive (again, if time allows).</i></p>		
5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students select</p>		You've done a great job describing your objects! At the beginning of the next lesson, we'll review our tree maps as a class, so keep them handy!		

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	<p>an object they investigated and complete a sentence about the object that answers 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. 	<p>Highlight key science ideas and focus question throughout.</p> <p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>Show slide 9.</p> <p>As we wrap up today’s lesson, let’s use the science ideas we learned about in our investigation to answer the focus question, <i>What makes something start to move?</i></p> <p>Answer this question in your science notebooks using the sentence starter on the slide:</p> <p><i>My object, [name of object], started to move because _____.</i></p> <p>Include words like <i>push, pull, fall, and drop</i> in your answers. You can also refer to your tree maps to refresh your memories.</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 construct answers to the focus question.</p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher informs students that in the next lesson, they’ll learn the specific words scientists use to describe</p>	Link science ideas to other science ideas.	<p>Show slide 10.</p> <p>In our next lesson, we’ll learn some important words that scientists use to describe the pushing and pulling that make an object move.</p>		

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	the pushing and pulling actions that make objects move.	Ask questions to elicit student ideas and predictions.	Do you have any ideas about what those words might be?	<ul style="list-style-type: none"> • Power • Energy • Strength • Muscles • Force • Gravity 	