

Earth's Changing Surface

Lesson 1b: Patterns of Landforms on Earth's Surface

Grade 4	Length of lesson: 50 minutes	Placement of lesson in unit: 1b of 7 two-part lessons on Earth's changing surface
Unit central questions: Why isn't all of Earth's surface flat? What causes the surface to look different in different places?		Lesson focus questions: In what ways does Earth's surface look different or the same in different places? Do you think the surface of Earth changes? Why do you think that?
Main learning goal: Earth's surface has a variety of landforms that are distributed in different patterns.		
Science content storyline: Landforms, or surface features, on Earth's surface aren't the same everywhere. The landforms of any single location can look different from those of other regions in the United States even though specific landforms, such as mountains and river valleys, can be found in a variety of locations. Describing and categorizing landforms can help us identify patterns in the locations of specific landforms on Earth's surface. Students have different ideas about whether Earth's landforms have always looked the same. In future lessons, we'll investigate whether and how Earth's surface changes.		
Ideal student response to the focus questions: The relief map of the United States shows that the land looks different in different places. One landform pattern we noticed is that valleys are always located near mountains. We also saw a lot of mountains in the west and in the east, but places in the middle of the map had no mountains at all. I think the surface of Earth changes because earthquakes can cause cracks in the land.		

Preparation

Materials Needed <ul style="list-style-type: none"> • Student notebooks • Chart paper and markers • Plastic relief map of the United States (1 per group of 4–6 students) (from lesson 1a) • Landforms on Earth's Surface (class chart from lesson 1a) 	Ahead of Time <ul style="list-style-type: none"> • Review Earth's Changing Surface Content Background Document: sections 1–3.
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Lesson 1b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
3 min	Link to previous lesson: Students review the list of landforms they identified in the previous lesson, as well as some differences and similarities in where those landforms are located.	<ul style="list-style-type: none"> • There are a variety of landforms on Earth’s surface, including mountains, hills, valleys, canyons, plains (flat surfaces), rivers, and lakes. • Landforms on Earth’s surface aren’t the same everywhere. • We can observe and describe the similarities and differences in landforms and where they’re located on a relief map.
1 min	Lesson focus questions: The teacher reviews one of the focus questions from the previous lesson: <i>In what ways does Earth’s surface look different or the same in different places.</i> Then the teacher introduces today’s focus questions, <i>Do you think the surface of Earth changes? Why do you think that?</i>	
5 min	Setup for activity 1: The teacher introduces the first lesson activity and announces that students will use the relief map from the previous lesson to search for patterns in the locations of different landforms on Earth’s surface.	<ul style="list-style-type: none"> • Earth’s surface has a variety of landforms, or surface features, that are distributed in different patterns.
10 min	Activity 1: Using a relief map of the United States, students work in small groups to identify landform patterns and record them in their science notebooks.	<ul style="list-style-type: none"> • Landforms on Earth’s surface aren’t the same everywhere. • By examining a relief map, we can identify patterns in the locations of specific landforms on Earth’s surface.
10 min	Follow-up to activity 1: Students discuss the landform patterns they identified on the relief map.	<ul style="list-style-type: none"> • Landforms on Earth’s surface aren’t the same everywhere. There are a variety of surface landforms distributed in different patterns.
2 min	Setup for activity 2: Students think about whether the surface of Earth changes.	<ul style="list-style-type: none"> • We have some ideas about how landforms on Earth’s surface might have changed over time and might continue to change in the future.
5 min	Activity 2: Students write about whether they think Earth’s surface changes and why.	
5 min	Follow-up to activity 2: Students share their ideas about whether Earth’s surface changes and why?	
8 min	Synthesize/summarize today’s lesson: Students revisit the focus questions and summarize key science ideas from the lesson.	<ul style="list-style-type: none"> • Landforms on Earth’s surface aren’t the same everywhere. • Various surface landforms are distributed in diverse patterns and look different in various parts of the United States and the world. We think these landforms might change over time.
1 min	Link to next lesson: The teacher links science ideas to the next lesson.	

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3 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students review the list of landforms they identified in the previous lesson, as well as some differences and similarities in where those landforms are located.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • There are a variety of landforms on Earth’s surface, including mountains, hills, valleys, canyons, plains (flat surfaces), rivers, and lakes. • Landforms on Earth’s surface aren’t the same everywhere. • We can observe and describe the similarities and differences in landforms and where they’re located on a relief map. 		<p>Show slides 1 and 2.</p> <p>Let’s begin today’s lesson by reviewing the landforms on Earth’s surface that we identified last time.</p> <p>NOTE TO TEACHER: <i>Refer to the list of landforms you recorded in lesson 1a on a class chart (Landforms on Earth’s Surface).</i></p> <p>What landforms did we list on our class chart?</p> <p>NOTE TO TEACHER: <i>Elicit as many landforms from the previous lesson as possible.</i></p> <p>Are landforms the same everywhere?</p> <p>What evidence did you find on the relief map that landforms aren’t the same everywhere?</p> <p>NOTE TO TEACHER: <i>Keep this discussion brief and avoid asking probe questions. Students will explore this further during this lesson.</i></p> <p>Great observations!</p> <p>Show slide 3.</p>	<ul style="list-style-type: none"> • Mountains • Valleys • Canyons • Plains • Rivers • Lakes <p>No, there are different landforms in different places.</p> <p>Some places on the map had mountains, and some didn’t. We saw really big lakes only in the middle northern part of the map.</p>	

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		Highlight key science ideas and focus question throughout.	<p>So far we've learned that there are different kinds of landforms on Earth's surface, and these landforms aren't the same everywhere.</p> <p>Relief maps can help us identify and describe the differences and similarities among landforms in various locations.</p>		
1 min	<p>Lesson Focus Questions</p> <p>Synopsis: The teacher review one of the focus questions from the previous lesson: <i>In what ways does Earth's surface look different or the same in different places?</i> Then the teacher introduces today's questions, <i>Do you think the surface of Earth changes? Why do you think that?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 4.</p> <p>In this lesson, we'll continue exploring one of the focus questions from last time: <i>In what ways does Earth's surface look different or the same in different places?</i></p> <p>We'll also talk about whether landforms on Earth always stay the same or change over time.</p> <p>Our focus questions for today are <i>Do you think the surface of Earth changes? Why do you think that?</i></p> <p>Write these new questions in your science notebooks and draw a box around them.</p> <p>NOTE TO TEACHER: <i>Write today's focus questions on the board for students to see and refer to throughout the lesson.</i></p>		
5 min	<p>Setup for Activity 1</p> <p>Synopsis: The teacher introduces the first lesson</p>	Make explicit links between science	<p>Show slide 5.</p> <p>In our first activity, we'll use the same relief map we used in our last lesson, but this</p>		

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	<p>activity and announces that students will use the relief map from the previous lesson to search for patterns in the locations of different landforms on Earth's surface.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Earth's surface has a variety of landforms, or surface features, that are distributed in different patterns. 	<p>ideas and activities before the activity.</p> <p>Ask questions to elicit student ideas and predictions.</p>	<p>time, we'll dig a little deeper and investigate the <i>locations</i> of landforms on Earth's surface. We'll also search for patterns.</p> <p>What do you think the word <i>pattern</i> means?</p> <p>Those are good examples of patterns in numbers or colors, but today we'll look for patterns in where different kinds of <i>landforms</i> are located in the United States.</p> <p>Show slide 6.</p> <p>Before we begin our investigation, let's practice finding landform patterns on a map. The map on this slide uses triangles to show where volcanoes are located.</p> <p>How would you describe the landform patterns for volcanoes in the United States?</p>	<p>Like when you have numbers that go 121212.</p> <p>It's a design that repeats itself, like a checked shirt that goes blue-white-blue-white-blue-white.</p> <p>The volcanoes are located in the west on the map, but not in the east.</p> <p>The volcanoes are in a</p>	<p>What other patterns do you see in the location of volcanoes?</p>


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			<p>Show slide 7.</p> <p>Now I'd like you to gather in the same small groups from last time for this investigation. Your group will study the US relief map and look for any patterns in where different landforms are located. For example, which areas on the map have mountains, and which don't? Or are mountains scattered evenly across the United States?</p> <p>The challenge will be to identify <i>at least three</i> patterns on the map. Each time someone in your group identifies a pattern, describe it in your science notebooks using a complete sentence. Be ready to share the patterns you find with the class.</p> <p>NOTE TO TEACHER: <i>After students have gathered in their small groups and are clear about the task, distribute a relief map to each group.</i></p>	<p>long strip that goes from south to north.</p>	
10 min	<p>Activity 1</p> <p>Synopsis: Using a relief map of the United States, students work in small groups to identify landform patterns and record them in their science notebooks.</p>	<p>Make explicit links between science ideas and activities during the activity.</p> <p>Ask questions to probe student ideas and predictions.</p>	<p>NOTE TO TEACHER: <i>Continue displaying slide 7 throughout the activity. Circulate among the groups and ask students to share their observations about where specific landforms are located. Remind them to use appropriate vocabulary or names for Earth's landforms.</i></p> <p><i>Probe and challenge student thinking to help them prepare for the class discussion</i></p>		

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	<p>Main science idea(s):</p> <ul style="list-style-type: none"> Landforms on Earth’s surface aren’t the same everywhere. By examining a relief map, we can identify patterns in the locations of specific landforms on Earth’s surface. 	<p>Ask questions to challenge student thinking.</p>	<p><i>in the follow-up to the activity. Remind students to use complete sentences when they describe the patterns in their science notebooks.</i></p> <p><i>If students are having trouble finding landform patterns, ask the following questions.</i></p> <ul style="list-style-type: none"> <i>In how many places do you see a specific landform, such as a mountain, a lake, a canyon, or a river?</i> <i>Do you see any patterns in the locations of mountains on the map? Are they everywhere, or are they located in particular regions?</i> <i>Do all river valleys look the same? If not, how are they different? Where are large rivers located? Where are the smaller rivers in relationship to the larger rivers?</i> <i>Where do you find canyons? What about lakes?</i> 		
10 min	<p>Follow-Up to Activity 1</p> <p>Synopsis: Students discuss the landform patterns they identified on the relief map.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Landforms on Earth’s surface aren’t the same everywhere. There are a variety of surface 	<p>Engage students in analyzing and interpreting data and observations.</p> <p>Engage students in communicating in scientific ways.</p>	<p>Show slide 8.</p> <p>Whole-class share-out: So what landform patterns did your group find on the relief map?</p> <p>As your classmates share the patterns they observed on the map, listen carefully and think about whether you agree, disagree, or have something to add to their ideas. When you share your observations, make sure to use evidence from the map. I’ll record on</p>	<p>The right and left sides of the US have mountains, but the middle doesn’t.</p>	<p>Instead of saying “right” and “left,” can you say this again using the words <i>east</i> and</p>

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	landforms distributed in different patterns.		<p>chart paper the patterns you observed and anything you wonder about.</p> <p>NOTE TO TEACHER: <i>As students share the patterns they identified on the map, record them on a T-chart. Label the first column “Patterns We Noticed” and label the second column “What We Wonder About.”</i></p> <p><i>If students have trouble coming up with “wonderings,” model one for them: “I wonder if Florida is flat because the ocean surrounds it on the east, south, and west.”</i></p> <p><i>If students need prompting as they share the patterns they observed, ask the questions from the previous phase.</i></p>	<p>There are mountains on the east and west sides of the US, but the middle doesn’t have any.</p> <p>The mountains in the east aren’t as high as the mountains in the west.</p> <p>I wonder why! And I wonder how tall mountains can get. Can they be a mile high?</p> <p>About half of the US is covered in mountains.</p> <p>The mountains are taller in the west than in the east.</p> <p>The area in the center of the US is pretty flat, but you can still feel a few little bumps. The area around Florida is</p>	<p><i>west?</i></p> <p>What else did you notice about mountains?</p> <p>Do you have any wonderings about this?</p> <p>Say more about “half of the US.” Why do you think that?</p>

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			<p>What other wonderings do you have about these landform patterns?</p>	<p>totally flat.</p> <p>A plain.</p> <p>A valley.</p> <p>California has a really flat area in the middle of a bunch of mountains.</p> <p>Little rivers flow together to make big rivers.</p> <p>Sometimes lakes are connected to rivers, and sometimes they're not.</p> <p>I thought lakes were always connected to rivers, so I wonder</p>	<p>What is the name for that flat landform? What is it called?</p> <p>Can you explain why you think a valley is flat? Can you point to the map to support your idea?</p> <p>Show us an example on the map.</p> <p>Show us an example. Does this happen in many places or in just one place?</p> <p>Do you have any wonderings about that?</p>

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				<p>why some aren't.</p> <p>I wonder why Michigan is surrounded by lakes, and Florida is surrounded by ocean.</p>	
2 min	<p>Setup for Activity 2</p> <p>Synopsis: Students think about whether the surface of Earth changes.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> We have some ideas about how landforms on Earth's surface might have changed over time and might continue to change in the future. 	Highlight key science ideas and focus question throughout.	<p>Show slide 9.</p> <p>Next, we'll explore our second set of focus questions: <i>Do you think the surface of Earth changes? Why do you think that?</i></p> <p>Think about questions on the slide and how you might answer them based on what you observed about landforms on the relief map of the United States:</p> <ol style="list-style-type: none"> Do you think the landforms on Earth's surface have always looked the way they do now? Why? Do you think these landforms will change in the future? Why? <p>NOTE TO TEACHER: <i>Give students 2 minutes to think quietly about these questions and come up with ideas.</i></p>		
5 min	<p>Activity 2</p> <p>Synopsis: Students write about whether they think surface of Earth changes and why.</p> <p>Main science idea(s):</p>	Engage students in constructing explanations and arguments.	<p>Show slide 10.</p> <p>Now I'd like you to write down a few ideas in your science notebooks explaining why you do or don't think the landforms on Earth's surface have always looked the way they do now. Then write down a few ideas</p>		

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	<ul style="list-style-type: none"> We have some ideas about how landforms on Earth’s surface might have changed over time and might continue to change in the future. 		<p>explaining why you do or don’t think these landforms will change in the future. Make sure to include your reasoning, and be ready to share your ideas with the class. The only wrong answer at this point is “I don’t know.”</p>		
5 min	<p>Follow-Up to Activity 2</p> <p>Synopsis: Students share their ideas about whether Earth’s surface changes and why?</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> We have some ideas about how landforms on Earth’s surface might have changed over time and might continue to change in the future. 	<p>Engage students in communicating in scientific ways.</p> <p>Ask questions to probe student ideas and predictions.</p>	<p>Show slide 11.</p> <p>Whole-class share-out: So do you think the surface of Earth ever changes? Let’s hear some of your ideas. And make sure to give reasons for your answers.</p> <p>As others share their ideas, listen carefully and think about whether you agree, disagree, or have something to add on. Be prepared to give feedback.</p> <p>NOTE TO TEACHER: <i>During the share-out, record student ideas on chart paper and save them for the next lesson. Title the chart “Ways Earth’s Surface Might Change over Time.” Don’t attempt to correct students’ responses at this time; simply ask probe questions to make student thinking visible. Misconceptions will be addressed in future lessons.</i></p> <p> <i>Listen to students’ ideas. Are students aware that Earth’s surface changes over time? Do they relate those changes to building up or wearing down the surface</i></p>	<p>I’ve been to [Death Valley, the Grand Canyon, Arches National Monument], and a park ranger said that the land didn’t always look the way it does now.</p> <p>I’ve been to Hawaii, and there was a big volcano erupting.</p>	<p>Tell us more about that. If it didn’t always look the way it does today, what do you think it used to look like?</p> <p>Make a connection between the erupting volcano you saw and changes on Earth’s</p>

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			<p><i>(mountain building or weathering and erosion)? Do they mention anything about continents moving (plate tectonics)? Do they mention changes related to glaciation during ice ages (forming the Great Lakes, carving mountains)?</i></p>	<p>The lava is flowing onto the land, and that changes Earth's surface.</p> <p>I saw on the news that Japan moved 12 feet during an earthquake. That's a change in Earth's surface!</p> <p>The land moved and shook.</p> <p>Tsunamis can wash away peoples' homes.</p>	<p>surface. What do you think caused the surface to change to look like it does now?</p> <p>What do you think caused the earthquake?</p> <p>Does that change Earth's surface?</p>
8 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students revisit the focus questions and summarize key science ideas from the lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Landforms on Earth's surface aren't the same everywhere. 	<p>Highlight key science ideas and focus question throughout.</p> <p>Engage students in making connections by synthesizing and</p>	<p>Show slide 12.</p> <p>Today we explored these focus questions: <i>In what ways does Earth's surface look different or the same in different places? Do you think the surface of Earth changes? Why do you think that?</i></p> <p>Let's spend a few minutes summarizing what we've learned so far about Earth's surface and landform patterns.</p> <p>ELL support: Since ELL students have</p>		

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	<ul style="list-style-type: none"> Various surface landforms are distributed in diverse patterns and look different in various parts of the United States and the world. We think these landforms might change over time. 	summarizing key science ideas.	<p>been studying a relief map of the United States, you might want to explicitly note that this map is a <i>model</i> of what the land looks like in one part of the world. Then you can expand to using world maps later.</p> <p>Turn and Talk (4 min): Pair up with an elbow partner and use ideas about Earth’s surface and landform patterns to answer these questions. Make sure to include your observations and evidence from the relief map of the United States. Be prepared to share your answers with the class.</p> <p>Whole-class share-out (4 min): What ideas did you come up with for answering our first focus question, <i>In what ways does Earth’s surface look different or the same in different places?</i></p>	<p>We know that Earth’s surface doesn’t look the same everywhere because we have evidence from the map.</p> <p>We agree, because, like, there are no mountains in the middle of the United States, but there are</p>	<p>When you say “everywhere,” what do you mean? Do you mean all over the world?</p>

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			<p>What about our second set of focus questions: <i>Do you think the surface of Earth changes? Why do you think that?</i></p>	<p>mountains in the west and the east. So that shows that Earth's surface doesn't look the same everywhere.</p> <p>The pattern is that mountains are located in the east and the west but not in the middle of the country.</p> <p>We think Earth's surface does change because we've seen pictures of when dinosaurs lived, and it looked really swampy everywhere. Not like today.</p> <p>There are cracks in the Earth after a big earthquake.</p> <p>And lava runs all over the ground after a volcano erupts.</p>	<p>Can you say this again using the word <i>pattern</i>?</p>
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher links science ideas to the</p>	Summarize key science ideas.	<p>Show slide 13.</p> <p>Today we continued our investigation of Earth's surface and identified landform</p>		

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	next lesson.	Link science ideas to other science ideas.	<p>patterns on a relief map of the United States. These patterns offer more evidence that Earth’s surface isn’t the same everywhere.</p> <p>We also thought about whether Earth’s surface changes over time.</p> <p>We’ll continue this investigation in our next lesson and see if we can figure out whether Earth’s surface really does change over time, and if it does, how and why these changes happen.</p>		