

Earth's Changing Surface

Lesson 7b: Use and Apply

Grade 4	Length of lesson: 50 minutes	Placement of lesson in unit: 7b 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 question: How can we use what we've learned about Earth's changing surface to answer the unit central questions?
Main learning goal: Landforms, like mountains and valleys, can be explained using science ideas about plate movement, weathering, and erosion. At any given point in time, Earth's surface is being built up and worn down.		
Science content storyline: Earth's surface is continually being built up and worn down. Plate collisions and volcanic eruptions are building mountains on Earth's surface. At the same time, weathering and erosion are wearing them down. As plate collisions and volcanic eruptions lift earth materials (like rock) higher, weathering breaks them into smaller pieces, and erosion moves them to lower elevations. Mountain building is still occurring in the western United States, but weathering and erosion are also occurring. Older mountains in the eastern United States have mostly stopped growing, and erosion is wearing them down significantly.		
Ideal student response to the unit central questions: Mountains on Earth's surface are built up in areas where crustal plates collide and push upward (like mountains on the West Coast of the United States). Mountains are also formed where volcanoes erupt. That's why Earth's surface isn't flat everywhere. But even though plate collisions and volcanoes are constantly building up the surface, weathering and erosion are constantly wearing it down. In the middle of Earth's crustal plates, the surface tends to be more flat. But even there, weathering and erosion keep wearing down and changing Earth's surface. As long as the layer of hot rock underneath Earth's crustal plates keeps moving and causing the surface to build up, and as long as water and other forces keep wearing it down, Earth's surface will keep changing and will look different in different places.		

Preparation


<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Optional: Chart paper and markers • Plastic relief map of the United States (1 per group of 4–6 students) (from lessons 1a and 1b) <p>Student Handouts</p> <ul style="list-style-type: none"> • 4.1 Map of Plate Boundaries around the World (1 per group) (from lesson 4a) • 4.2 Physical Map of the World (1 per group) (from lesson 4b) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review Earth's Changing Surface Content Background Document: section 9.
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Lesson 7b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
3 min	Link to previous lesson: The teacher reviews key science ideas from the scenarios students classified in the previous lesson.	<ul style="list-style-type: none"> • Collisions of Earth’s tectonic plates, volcanic eruptions, and deposition of earth materials by flowing water build up Earth’s surface, and the processes of weathering and erosion wear it down.
2 min	Unit central questions and lesson focus question: The teacher reviews the unit central questions, <i>Why isn’t all of Earth’s surface flat? What causes the surface to look different in different places?</i> Then the teacher reviews the focus question from the previous lesson: <i>How can we use what we’ve learned about Earth’s changing surface to answer the unit central questions?</i>	
5 min	Setup for activity: The teacher introduces and explains the use-and-apply task students will work on in small groups.	
15 min	Activity: Students work in small groups to explain how the San Gabriel Mountains in California formed and whether they are currently being built up or worn down. Then students record their ideas in their science notebooks.	<ul style="list-style-type: none"> • Plate collisions and volcanic eruptions are continually building up mountains on Earth’s surface. At the same time, weathering and erosion are constantly wearing them down.
10 min	Follow-up to activity: As students answer the embedded assessment questions about the San Gabriel Mountains, the teacher guides their thinking and corrects any misconceptions.	<ul style="list-style-type: none"> • When Earth’s tectonic plates collide and push upward, mountains are formed, and Earth’s surface is built up. At the same time, weathering and erosion are constantly wearing down mountains and other landforms on Earth’s surface.
15 min	Synthesize/summarize today’s lesson: The teacher revisits the unit central questions. Then students synthesize ideas about Earth’s changing surface by engaging in a small-group discussion and an independent-writing task. Afterward, students share their ideas in a class discussion to come up with their best summary of science ideas.	<ul style="list-style-type: none"> • Earth’s surface is in a continuous cycle of being built up (<i>uplift</i>) and worn down. This explains why the surface isn’t flat everywhere but looks different in different places. Evidence of these processes can be seen on relief maps.

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
3 min	<p>Link to Previous Lesson</p> <p>Synopsis: The teacher reviews key science ideas from the scenarios students classified in the previous lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Collisions of Earth’s tectonic plates, volcanic eruptions, and deposition of earth materials by flowing water build up Earth’s surface, and the processes of weathering and erosion wear it down. 	Engage students in making connections by synthesizing and summarizing key science ideas.	<p>Show slides 1 and 2.</p> <p>In our last lesson, we examined different scenarios to help us think about the processes that shape Earth’s surface.</p> <p>Who remembers the name of our unit of study?</p> <p>That’s right! Earth’s Changing Surface. Once more, let’s review the processes that change Earth’s surface over time.</p> <p>What processes build up Earth’s surface?</p> <p>What processes wear down Earth’s surface?</p>	<p>Earth’s Changing Surface.</p> <p>The collision of Earth’s tectonic plates.</p> <p>Volcanic eruptions.</p> <p>When rivers leave rocks and dirt at the end.</p>	<p>How do plate collisions build up Earth’s surface?</p> <p>Say more about how volcanoes build up Earth’s surface.</p> <p>What do you mean by “leave rocks and dirt at the end”? Can you use the name of the science idea?</p>

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			<p>That's a great review of the key science ideas we've explored in our unit on Earth's changing surface!</p> <p>Today we're going to pull together everything we've learned about how Earth's surface is built up and worn down and apply these ideas to a familiar landform: the San Gabriel Mountains.</p>	<p>Rivers deposit rocks and dirt in new locations.</p> <p>Weathering.</p> <p>Erosion.</p> <p>No. Wind can also move earth materials from higher to lower places.</p>	<p>Describe what you mean by "weathering."</p> <p>In what ways does erosion wear down Earth's surface? Is flowing water the only way erosion happens?</p>
2 min	<p>Unit Central Questions and Lesson Focus Question</p> <p>Synopsis: The teacher reviews the unit central questions, <i>Why isn't all of</i></p>		<p>Show slide 3.</p> <p>Our goal for this final lesson is to answer our unit central questions: <i>Why isn't all of Earth's surface flat? What causes the surface to look different in different places?</i></p>		

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	<p><i>Earth's surface flat? What causes the surface to look different in different places? Then the teacher reviews the focus question from the previous lesson: How can we use what we've learned about Earth's changing surface to answer the unit central questions?</i></p>	<p>Set the purpose with a <u>focus question</u> or goal statement.</p>	<p>To help us accomplish this, we'll look at maps we used in previous lessons. We'll also use science ideas about mountain building, weathering, and erosion to explain a familiar landform we have right here in California.</p> <p>Show slide 4.</p> <p>Our focus question for today is the same one from last time: <i>How can we use what we've learned about Earth's changing surface to answer the unit central questions?</i></p> <p>NOTE TO TEACHER: Make sure the unit central questions and the lesson focus question are displayed where students can refer to them throughout the lesson.</p>		
5 min	<p>Setup for Activity</p> <p>Synopsis: The teacher introduces and explains the use-and-apply task students will work on in small groups.</p>		<p>So how much do you think you've learned about Earth's changing surface in this unit?</p> <p>Let's find out!</p> <p>Show slide 5.</p> <p> Embedded Assessment Task</p> <p>This is a photo of the San Gabriel Mountains in California.</p> <p>Your challenge today is to apply everything you've learned in this unit to explain how these mountains formed and whether they're still growing or are wearing down.</p>		

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		<p>Make explicit links between science ideas and activities before the activity.</p>	<p>Show slide 6.</p> <p>For this investigation, you'll work in small groups to develop answers for these questions:</p> <ol style="list-style-type: none"> 1. How do you think the San Gabriel Mountains were formed? What is your evidence? 2. Do you think the San Gabriel Mountains today are being built up and growing taller, or do you think they're wearing down and getting smaller? What is your evidence? <p>Make sure to evidence from the maps to support your answers.</p> <p>After your group work, you'll write your own answers to these question in your science notebooks using complete sentences. You may also include labeled drawings to illustrate your ideas.</p> <p>Any questions before we begin?</p>		
15 min	<p>Activity</p> <p>Synopsis: Students work in small groups to explain how the San Gabriel Mountains in California formed and whether they are currently being built up or worn down. Then students record their ideas</p>	<p>Make explicit links</p>	<p>NOTE TO TEACHER: <i>Divide the class into groups of 4–6 students; then distribute to each group a relief map of the United States from lesson 1, handout 4.1 (Map of Plate Boundaries around the World), and handout 4.2 (Physical Map of the World). Continue displaying slide 7 throughout the investigation.</i></p> <p>As you work on this task in your small</p>		

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	<p>in their science notebooks.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Plate collisions and volcanic eruptions are continually building up mountains on Earth’s surface. At the same time, weathering and erosion are constantly wearing them down. 	<p>between science ideas and activities during the activity.</p> <p>Engage students in using and applying new science ideas in a variety of ways and contexts.</p> <p>Link science ideas to other science ideas.</p>	<p>groups, think of all the science ideas we’ve learned about in this unit and use them to explain what you think is happening with the San Gabriel Mountains.</p> <p>Students work in groups on the use-and-apply task.</p> <p>NOTE TO TEACHER: <i>As students think and talk about the use-and apply questions, observe the map features they’re focusing on. Are they noticing things related to plate tectonics? Are they noticing things related to erosion, such as rivers? Are they thinking about whether the mountains might get icy in the winter or where trees and bushes might grow?</i></p> <p><i>Make sure you can understand student writings and drawings without any clarification. If you can’t, ask questions to probe their thinking and challenge them to clarify their explanations and drawings.</i></p> <p>Show slide 7.</p> <p>Next, I’d like you to complete the sentences on the slide in your science notebooks. You should work on this task independently. Make sure to use evidence from the maps in your answers. You can also include drawings to illustrate your ideas.</p> <p>1. <i>The San Gabriel Mountains were formed by _____. My evidence is _____.</i></p>		

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		<p>Ask questions to probe student ideas and predictions.</p> <p>Ask questions to challenge student thinking.</p>	<p>2. <i>The San Gabriel Mountains are [building up /wearing down]. My evidence is _____.</i></p> <p>NOTE TO TEACHER: <i>Circulate around the room as students work on this task. Ask questions to probe their thinking and challenge them to clarify their explanations and drawings.</i></p>		
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: As students answer the embedded assessment questions about the San Gabriel Mountains, the teacher guides their thinking and corrects any misconceptions.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> When Earth's tectonic plates collide and push upward, mountains are formed, and Earth's surface is built up. At the same time, weathering and erosion are constantly wearing down mountains and other landforms on Earth's surface. 	Engage students in constructing explanations and arguments.	<p>Show slide 8.</p> <p>Whole-class share-out: Let's hear your ideas for answering the questions about the San Gabriel Mountains. Make sure to include evidence from one or more of the maps to support your explanations.</p>	<p><i>Ideal student response to the use-and-apply task:</i></p> <p>1. Plate collisions were likely involved in the formation of the San Gabriel Mountains because the plate-boundaries map shows the Pacific Plate and the North American Plate colliding. <i>[Although the answer is much more complicated than this, it's unlikely that</i></p>	

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				<p><i>students will go beyond plate collisions in their responses.]</i></p> <p>2. The mountains are probably still growing because Earth's crustal plates are still moving slowly toward each other. <i>[In fact, the San Gabriel Mountains are still getting taller by about 1–2 mm per year.]</i></p> <p>3. Like all of Earth's surface, the San Gabriel Mountains are constantly being worn away by weathering and erosion. We can see many rivers flowing out of the San Gabriels and toward the Pacific Ocean to the west and into a few rivers <i>[Owens and Truckee Rivers]</i> in the east that empty into lakes <i>[Owens Lake and Pyramid Lake]</i>.</p>	

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		Engage students in using and applying new science ideas in a variety of ways and contexts.	<p>Show slide 9.</p> <p>Great job! Now I'd like you to think about this challenge question: <i>Is it possible for landforms to build up and wear down at the same time?</i></p> <p>Turn and Talk: Discuss this question with a partner and be ready to share your ideas and reasoning with the class.</p> <p>Whole-class discussion: So do you think it's possible for landforms to build up and wear down at the same time? Why or why not? Let's hear your ideas and reasons!</p> <p>NOTE TO TEACHER: <i>During this discussion, make sure students have grasped the key science idea that landforms can build up and wear down at the same time. This is why mountains can never get as high as outer space. Some students may not have connected these ideas yet.</i></p>		
15 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: The teacher revisits the unit central questions. Then students synthesize ideas about Earth's changing surface by engaging in a small-group discussion and an independent-writing task. Afterward, students share</p>	Engage students in making connections by synthesizing and summarizing key science ideas.	<p>Show slide 10.</p> <p>Let's revisit our unit central questions, <i>Why isn't all of Earth's surface flat? What causes the surface to look different in different places?</i></p> <p>Look over the ideas you've written in your science notebooks throughout this unit on Earth's changing surface.</p> <p>Then discuss in your small group which</p>		

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	<p>their ideas in a class discussion to come up with their best summary of science ideas.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Earth’s surface is in a continuous cycle of being built up (<i>uplift</i>) and worn down. This explains why the surface isn’t flat everywhere but looks different in different places. Evidence of these processes can be seen on relief maps. 	<p>Engage students in communicating in scientific ways.</p>	<p>ideas will help you craft a <i>complete</i> answer to the unit central questions.</p> <p>Small-group discussion.</p> <p>Now I’d like you work independently on writing your <i>best</i> answer to these questions in your notebooks, using all of the science ideas you came up with in your group.</p> <p>Individual writing time.</p> <p>Whole-class share-out: So how did you answer these important questions about Earth’s changing surface?</p> <p>Try to come up with your best summary of the science ideas we’ve explored in this unit. Think like scientist and be ready to agree, disagree, add on, and ask questions.</p> <p>First, how did you answer the question, <i>Why isn’t all of Earth’s surface flat?</i></p>	<p><i>Ideal response to question 1:</i></p> <ul style="list-style-type: none"> • Mountains on Earth’s surface are built up in areas where crustal plates collide and push upward (like mountains on the West Coast of the United States). Mountains are also formed where volcanoes erupt. That’s why Earth’s 	

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			<p>How did you answer the second question, <i>What causes Earth's surface to look different in different places?</i></p>	<p>surface isn't flat everywhere.</p> <p><i>Ideal response to question 2:</i></p> <ul style="list-style-type: none"> • Even though plate collisions and volcanoes are constantly building up the surface, weathering and erosion are constantly wearing it down. In the middle of Earth's crustal plates, the surface tends to be more flat. But even there, weathering and erosion keep wearing down and changing Earth's surface. As long as the layer of hot rock underneath Earth's crustal plates keeps moving and causing the surface to build up, and as long as water and other forces keep wearing it down, Earth's surface will keep changing and will look different in 	

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				different places.	