

Earth's Changing Surface

Lesson 6a: Erosion and Deposition in a Stream Model

Grade 4	Length of lesson: 50 minutes	Placement of lesson in unit: 6a 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 does flowing water change Earth's surface?
Main learning goal: The processes of erosion and deposition change the surface of Earth by carrying and depositing weathered earth materials, such as rocks and soil, from one place to another.		
Science content storyline: The movement of water in rivers and streams shapes and reshapes Earth's surface by transporting rocks and soil from higher elevations and depositing them at lower elevations. <i>Erosion</i> is the process by which weathered earth materials, such as rock fragments, sand, and soil, are transported from higher elevations to lower elevations. <i>Deposition</i> occurs when earth materials are dropped off or deposited in a new location. Erosion helps wear down higher places, while deposition helps build up lower places.		
Ideal student response to the focus question: Water in rivers and streams moves sand, soil, gravel, and rocks from higher places (like mountains) to lower places. When the water can't carry these materials any farther, they're deposited in streambeds, along the banks of streams and rivers, in lakes, or in the ocean.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Student notebooks • Chart paper and markers • <i>For each stream-table setup (1 per group of 4–5 students):</i> <ul style="list-style-type: none"> • Optional: Drawing paper and crayons/marker/colored pencils • Plastic tray for catching water • Plastic tray (same size as tray for catching water) with a V cut to hold the sand/soil (See picture in black binder for placement of V cut.) • 2 plastic trash bags to cover the work area and floor • Empty gallon water jug • Aluminum foil to line tray with V cut • 2–3 large books, wrapped in plastic • 2 cups of sand and/or soil • 1 cup of gravel and a few larger rocks • Sponge or paper towels to wipe up any spills • Optional: Large bucket of water (for rinsing hands and to carry water outside) • Protractors <p>Student Handouts and Teacher Masters</p> <ul style="list-style-type: none"> • 6.1 Stream-Model Observations (1 per student) • 6.2 Erosion and Deposition Cards (cut apart; 1 set per group) • 6.3 Example of Steam-Table Setup (Teacher Master) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review Earth's Changing Surface Content Background Document: sections 7 and 8. • Use a stream-table kit or follow these steps to assemble each stream-table setup: <ul style="list-style-type: none"> • Cover the work area and floor with plastic bags. • Line the V-cut tray with aluminum foil and set it inside the tray for catching water. • Stack the books on the work area and cover them with plastic. • Fill the gallon water jug with water and replace the cap. • Set the bucket of water, sponge, and paper towels in a convenient location for students to use for cleaning up any messes. • Note: Consider enlisting a few students to help you set up the stream tables in advance. • Cut apart the erosion and deposition cards from handout 6.2. Each group of 4–5 students should be given 1 set. • Run through stream-table investigation so you know what to expect when students use the model. Adjust the angle and speed of water flow so that some materials will wash easily down the slope and others won't. Ideally, little "rivers" will develop and carry materials downhill. • Decide where to dispose of the sand/soil and sandy water (just not in a sink!).
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Lesson 6a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
4 min	Link to previous lesson: The teacher reviews science ideas about weathering from previous lessons and the focus questions, <i>Can mountains grow so tall they reach outer space? Why or why not?</i>	<ul style="list-style-type: none"> Weathering can wear down mountains by causing rock to break into smaller and smaller pieces.
5 min	Lesson focus question: The teacher introduces the focus question, <i>How does flowing water change Earth's surface?</i> and students write their initial ideas for answering this question in their science notebooks.	
10 min	Setup for activity: The teacher introduces the stream-table model and elicits student ideas about erosion and deposition. Students prepare for the activity by reviewing parts 1 and 2 of the Steam-Model Observations handout.	<ul style="list-style-type: none"> <i>Erosion</i> is the process by which weathered earth materials are transported from higher elevations to lower elevations. <i>Deposition</i> occurs when these earth materials are dropped off or deposited in a new location.
20 min	Activity: Students study erosion and deposition in a stream-table model and record their observations.	<ul style="list-style-type: none"> We can use a stream table as a model to show how flowing water erodes earth materials, such as rock fragments, sand, and soil, and deposits them in various places on Earth's surface. We can observe how and where flowing water causes the erosion of earth materials and how and where those materials are deposited.
5 min	Follow-up to activity: Students finalize their observations and drawings of the stream-table model, paying special attention to where erosion and deposition occurred.	<ul style="list-style-type: none"> Water in rivers and streams moves weathered earth materials, such as sand, soil, gravel, and rocks, from higher elevations to lower elevations. Water changes the landscape by carrying away some earth materials and depositing them in different locations.
5 min	Synthesize/summarize today's lesson: Students revisit their predictions about what happens when water flows over sand, soil, gravel, and rocks. Then they summarize key science ideas.	<ul style="list-style-type: none"> Overall, weathering and erosion wear away the surface of Earth, although deposition can build it up in specific locations.
1 min	Link to next lesson: The teacher links science ideas to the next lesson.	

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4 min	<p>Link to Previous Lesson</p> <p>Synopsis: The teacher reviews science ideas about weathering from previous lesson and the focus questions, <i>Can mountains grow so tall they reach outer space? Why or why not?</i></p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Weathering can wear down mountains by causing rock to break into smaller and smaller pieces. 	Engage students in making connections by synthesizing and summarizing key science ideas.	<p>Show slides 1 and 2.</p> <p>NOTE TO TEACHER: <i>The focus questions from lesson 5 should be displayed where students can refer to them throughout today's lesson.</i></p> <p>What did we learn from previous lessons about what can happen to rocks on Earth's surface?</p> <p>What do these ideas have to do with whether mountains can grow so tall they reach outer space?</p>	<p>We learned that rock can get broken into smaller pieces.</p> <p>Water can freeze in the cracks of rocks and break the rocks apart.</p> <p>Tree roots can grow in cracks in rock and break it apart.</p> <p>Rocks can crash into other rocks and break off pieces.</p> <p>The freezing water and tree roots break the rock on mountains into smaller pieces. So instead of growing</p>	Tell me more. How does that happen?

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			<p>What is the name of the process that breaks down rock and keeps mountains from reaching outer space?</p>	<p>taller, the mountains wear down.</p> <p>Weathering.</p>	
5 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher introduces the focus question, <i>How does flowing water change Earth's surface?</i> and students write their initial ideas for answering this question in their science notebooks.</p>	<p>Set the purpose with a <u>focus question</u> or goal statement.</p>	<p>Show slide 3.</p> <p>In today's lesson, we'll build on the focus questions from last time and explore another way that water can keep mountains from growing so tall they reach outer space.</p> <p>Our focus question for today is <i>How does flowing water change Earth's surface?</i></p> <p>Write this question in your science notebooks and draw a box around it.</p> <p>NOTE TO TEACHER: Write the question on the board for students to see and refer to throughout the lesson.</p> <p>Think about this question for a moment and then write your ideas in your science notebooks using this sentence starter:</p> <p><i>I think flowing water changes Earth's surface by _____.</i></p> <p>Individual writing time.</p> <p>Whole-class discussion: OK, let's hear your ideas. How do you think flowing water changes the surface of Earth?</p>	<p>It can cause flooding.</p>	<p>Does that change the</p>

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				<p>Yes, it covers the surface up with water and mud.</p> <p>When it rains a lot, there can be landslides.</p> <p>It knocks down hills.</p> <p>Water, like rivers, can cut into the land.</p> <p>Like a canyon.</p>	<p>surface of Earth?</p> <p>How does that change the surface of Earth?</p> <p>What do you mean by “cut into the land”?</p> <p>Do others have ideas to add?</p>
10 min	<p>Setup for Activity</p> <p>Synopsis: The teacher introduces the stream-table model and elicits student ideas about erosion and deposition. Students prepare for the activity by reviewing parts 1 and 2 of the Stream-Model Observations handout.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • <i>Erosion</i> is the process by which weathered 	<p>Make explicit links between science ideas and activities before the activity.</p> <p>Select content representations and models matched to the learning goal</p>	<p>Show slide 4.</p> <p>Do you know that some scientists spend their entire lives studying rivers and streams?</p> <p>Most of the time, they study real streams, but sometimes they use models of streams to learn more about how they behave and change the surface of Earth.</p> <p>Today we’re going to become stream scientists and use a model like this one [<i>point to a stream-table setup</i>] to find out how rivers and streams change Earth’s</p>		

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	<p>earth materials are transported from higher elevation to lower elevations. <i>Deposition</i> occurs when these earth materials are dropped off or deposited in a new location.</p>	<p>and engage students in their use.</p> <p>Highlight key science ideas and focus question throughout.</p> <p>Engage students in communicating in scientific ways.</p>	<p>surface.</p> <p>NOTE TO TEACHER: <i>Show students one of the preassembled stream-table models and describe how they'll use it to investigate today's focus question. Don't run any water through the earth materials at this time.</i></p> <p>Show slide 5.</p> <p>Scientists use the word <i>erosion</i> to describe what happens when flowing water or wind moves earth materials like sand, soil, gravel, and rocks from a higher elevation to a lower elevation. In this lesson sequence, we'll just focus on water.</p> <p>Scientists use another word to describe what happens when flowing water drops off or deposits weathered earth materials in a new location. That word is <i>deposition</i>.</p> <p>Show slide 6.</p> <p>Turn and Talk: Now I'd like you to work with a partner to define <i>erosion</i> and <i>deposition</i> in your own words.</p> <p>Pairs work on definitions.</p> <p>Whole-class discussion: So what definitions did you come up with for <i>erosion</i> and <i>deposition</i>? Be ready to add to each other's ideas or suggest improvements.</p>		

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			<p>Show slide 7.</p> <p>During this investigation, you'll work in small groups, looking for two main things:</p> <ol style="list-style-type: none"> 1. Examples of <i>erosion</i> (when flowing water moves earth materials from a higher elevation to a lower elevation), and 2. Examples of <i>deposition</i> (when earth materials are left or deposited in a new location) <p>NOTE TO TEACHER: <i>Divide the class into groups of 4–5 students. Distribute</i></p>	<p>Erosion is when water moves things.</p> <p>Like when a big rainstorm causes a landslide, and all the dirt and stuff falls down.</p> <p>Deposition is where the water drops rocks and stuff.</p> <p>When the water makes a pile of rocks and dirt at the bottom of the hill.</p>	<p>Can you give an example?</p> <p>What do you mean by “stuff falls down”?</p> <p>So in the landslide example, where or when does deposition happen?</p>

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			<p><i>handout 6.1 (Stream-Model Observations) to each student. Then give each group a set of erosion and deposition cards (from handout 6.2). Read aloud the directions for parts 1 and 2 on handout 6.1. Students won't work on part 3 until lesson 6b.</i></p> <p>Show slide 8.</p> <p>Let's talk for a moment about what stream scientists do.</p> <p>First, they predict what they think flowing water will do to earth materials. Then they conduct their investigation and observe what happens to earth materials when water flows over them. Finally, they record their observations.</p> <p>Now let's review the directions for our investigation in our Stream-Model Observations handout. Make sure to follow these directions carefully during the investigation.</p> <p>NOTE TO TEACHER: <i>Go over the procedures you want students to follow so the classroom stays reasonably clean. This activity doesn't have to be messy! One way to minimize chaos during the activity is to have groups set up their stream tables and wait for you to give the signal for everyone to release the water at the same time and then signal for everyone to replace the stopper on their jugs after about one third</i></p>		

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		Ask questions to elicit student ideas and predictions.	<p><i>of the water is released. Do this for parts 1 and 2 of the activity.</i></p> <p>Show slide 9.</p> <p>Do you remember what you'll be looking for during this investigation?</p> <p>How many times does the handout tell you to stop and record your observations in your notebooks?</p> <p>Where will you place your erosion and deposition cards?</p> <p>Show slide 10.</p> <p>Before we begin our investigation, write in your science notebooks what you predict will happen to the sand, soil, gravel, and rocks in your stream-table models when the water starts running. Use the sentence starter on the slide:</p> <p><i>I predict that _____.</i></p>	<p>Examples of erosion and deposition.</p> <p>Once in part 1 and once in part 2.</p> <p>Where we see erosion or deposition happening in our stream model.</p>	
20 min	<p>Activity</p> <p>Synopsis: Students study erosion and deposition in a stream-table model and record their observations.</p> <p>Main science idea(s):</p>	Select content representations and models matched to the learning goal and engage students in their use.	<p>Show slide 11.</p> <p>Now let's add the sand, soil, gravel, and a few different-sized rocks to your stream tables and then observe how the flowing water changes the surface.</p> <p>As you follow the directions on the Stream-</p>		<i>Questions to ask</i>

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	<ul style="list-style-type: none"> We can use a stream table as a model to show how flowing water erodes earth materials, such as rock fragments, sand, and soil, and deposits them in various places on Earth’s surface. We can observe how and where flowing water causes the erosion of earth materials and how and where those materials are deposited. 	<p>Make explicit links between science ideas and activities during the activity.</p>	<p>Model Observations handout, make sure to pay attention to where erosion and deposition are occurring in the model. Mark these places with your erosion and deposition cards. Then describe your observations in your notebooks for parts 1 and 2 and add detailed pictures to illustrate what you see.</p> <p>Think like stream scientists and be as detailed and specific as possible!</p> <p>NOTE TO TEACHER: <i>If students can’t get much water to flow from the water jug after removing the plug, have them loosen the cap.</i></p> <p><i>Emphasize that they should focus on a small area at the top of the slope on their models and watch what happens to the earth materials in that spot. They should also pay attention to when and where erosion and deposition of earth materials are taking place.</i></p> <p><i>Make sure students use their erosion and deposition cards to mark where earth material is being carried away and where it’s being dropped off, or deposited.</i></p> <p><i>Circulate around the room during the activity and remind students to stop and draw pictures of their stream models at appropriate points. Ask them to show you examples of erosion and deposition they’ve</i></p>		<p><i>during the investigation:</i></p> <ul style="list-style-type: none"> Where is erosion occurring? What earth materials is the water eroding? What materials are harder for the water to erode? Where is deposition occurring? Where might erosion happen in our community?

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			<i>observed so far. As needed, remind groups of specific steps or procedures they should be following.</i>		
5 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students finalize their observations and drawings of the stream-table model, paying special attention to where erosion and deposition occurred.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Water in rivers and streams moves weathered earth materials, such as sand, soil, gravel, and rocks, from higher elevations to lower elevations. Water changes the landscape by carrying away some earth materials and depositing them in different locations. 	Make explicit links between science ideas and activities after the activity.	<p>NOTE TO TEACHER: <i>Before students begin cleaning up their work areas, ask them to finalize their observations and drawing in their notebooks. It's important that students have accurate drawings and complete observations when they work on part 3 of the Stream-Model Observations handout in lesson 6b, since their stream models won't be available to look at unless you have space to store them.</i></p> <p>Show slide 12.</p> <p>Now that you've completed parts 1 and 2 of the handout, take a few minutes to complete your descriptions and drawings in your science notebooks. Read over what you've written and make any final changes.</p> <p>Make sure you've labeled your drawings to show where you observed erosion and deposition occurring. Remember that your handout instructions say to be detailed and specific.</p> <p>NOTE TO TEACHER: <i>After students finalize their descriptions and drawings, move the stream tables to the side of the room and ask students to clean up their work areas.</i></p>		

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5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students revisit their predictions about what happens when water flows over sand, soil, gravel, and rocks. Then they summarize key science ideas.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Overall, weathering and erosion wear away the surface of Earth, although deposition can build it up in specific locations. 	Engage students in making connections by synthesizing and summarizing key science ideas.	<p>Show slide 13.</p> <p>Now I'd like you to take a few minutes and think about today's investigation.</p> <p>First, review your predictions about what might happen to the sand, soil, gravel, and rocks in your stream tables when the water started running.</p> <p>Let's have a few of you share your predictions. Were your predictions correct, or did the results surprise you?</p> <p>Show slide 14.</p> <p>What did you learn from today's investigation about how flowing water changes Earth's surface? Have any of your initial ideas about erosion and deposition changed?</p> <p>Let's find out! Think about the question on the slide for a moment and then complete this sentence in your science notebooks:</p> <p><i>From today's investigation of erosion and deposition, I learned that _____.</i></p> <p>Individual writing time.</p> <p>Whole-class share-out: How did you complete the sentence? What did you learn from today's investigation? Have any of your ideas about erosion and deposition</p>		

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		Summarize key science ideas.	<p>changed?</p> <p>As you share your ideas, I'll record them on chart paper so we can review and add to them in the next lesson.</p> <p>NOTE TO TEACHER: <i>Don't probe or challenge student ideas at this time. Simply record them on chart paper so you can refer back to them in lesson 6b after students complete part 3 of the Stream-Model Observations handout.</i></p> <p>Show slide 15.</p> <p>Let's review the key science ideas we've explored about erosion and deposition.</p>	<p>I learned that the water didn't really soak in, at least not everywhere.</p> <p>I learned that the water moves from the top of the stream model to the bottom like we predicted.</p> <p>I learned that the water carries more sand and soil than gravel and rocks.</p> <p>I learned that larger rocks are harder for the water to move.</p> <p>I learned that the water makes a channel.</p> <p>I learned that some sand piles up along the sides of a stream, but a lot of it winds up at the end like it did in our tray.</p>	

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		Highlight key science ideas and focus question throughout.	<p>Scientists use the word <i>erosion</i> to describe what happens when flowing water moves weathered earth materials, such as sand, soil, gravel, and rocks, from a higher elevation to a lower elevation. And they use the word <i>deposition</i> to describe what happens when flowing water drops off or deposits these earth materials in a new location.</p> <p>Do these ideas help us answer our focus question, <i>How does flowing water change Earth's surface?</i></p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher links science ideas to the next lesson.</p>	Link science ideas to other science ideas.	<p>Show slide 16.</p> <p>Today we used a stream model to show how flowing water can change Earth's surface through the processes of erosion and deposition.</p> <p>During our investigation, we observed that flowing water eroded sand, soil, gravel, and rocks and deposited them in different places.</p> <p>Next time, we'll use the data we collected to answer questions about erosion and deposition in part 3 of our handout.</p>		