Earth's Changing Surface
Lesson 4b: The Making of the Grand Canyon

Grade 2	**Length of lesson:** 40 minutes	**Placement of lesson in unit:** 4b of 6 two-part lessons on Earth's changing surface
Unit central questions: What does the surface of Earth look like? Does it ever change?		**Lesson focus questions:** What causes landforms to change? What is our evidence?
Main learning goal: Flowing water can change landforms over time.		
Science content storyline: Flowing water can change landforms over time by moving rock, soil, and sand from one place to another.		
Ideal student response to the focus questions: Water can change the land over time by slowly moving rocks and soil from one place to another.		

Preparation

Materials Needed

- Science notebooks
- Chart paper and markers
- Grand Canyon model (from lesson 4a)
  - Plastic bin approximately 18" x 6" x 29"
  - Stream-table model
  - 1 or 2 drip systems (to simulate a river)
  - Sand or a mixture of sand and soil (not potting soil)
- **Optional:** Plastic relief map of the United States (from lesson 2)

Student Handouts and Teacher Masters

- 4.1 Making the Grand Canyon, Part 1 (from lesson 4a)
- 4.3 Making the Grand Canyon, Part 2 (1 per student)
- 4.4 Grand Canyon Model Instructions, Part 2 (Teacher Master)

Ahead of Time

- Review the content background document.
- Prepare the Grand Canyon model by following the instructions in handout 4.4 (Grand Canyon Model Instructions, Part 2). Enough materials are provided for multiple uses. Fill the drip system(s) with water; then perform a trial run before class to ensure the model is working properly. **Note:** If the materials kit doesn't contain drip systems, you can make them by following the instructions in handout 4.4 (see the sidebar titled "How to Make Extra Drip Systems).

Lesson 4b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	**Link to previous lesson:** Based on the Grand Canyon model from the previous lesson, students revisit their ideas about what causes landforms to change. Then they share their questions and wonderings.	• The land hasn't always looked the way it does today. It's changing all the time. • Flowing water can change landforms by carrying rock and soil from one place to another.
1 min	**Lesson focus questions:** The teacher reviews the focus questions from the previous lesson: *What causes landforms to change? What is our evidence?*	
8 min	**Setup for activity:** Students draw and describe the Grand Canyon model on their handouts. Then they predict what will happen when a simulated river flows over the model.	• We can use models to better understand what causes landforms like the Grand Canyon to change.
10 min	**Activity:** Students observe what happens when a simulated river flows over the Grand Canyon model. Then they draw a picture of the model and record their observations in their handouts.	• Flowing water can move rocks and soil from one place to another, which can change landforms over time.
10 min	**Follow-up to activity:** Students share their observations of what happened during the river simulation. Then they discuss how the canyon model is like and not like the real Grand Canyon. They also explain how they think flowing water changes landforms.	
5 min	**Synthesize/summarize today's lesson:** The teacher reviews the focus questions, and students share their answers and evidence. Then the teacher summarizes key science ideas from the lesson.	• One of the processes that can change landforms over time is flowing water. As water moves rocks and soil from one place to another, the land can change over time.
1 min	**Link to next lesson:** The teacher announces that in the next lesson, students will use what they know to investigate how quickly or slowly landforms can change.	

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5 min	**Link to Previous Lesson** **Synopsis:** Based on the Grand Canyon model from the previous lesson, students revisit their ideas about what causes landforms to change. Then they share their questions and wonderings. **Main science idea(s):** • The land hasn't always looked the way it does today. It's changing all the time. • Flowing water can change landforms by carrying rock and soil from one place to another.	Make explicit links between science ideas and activities. Ask students questions to elicit student ideas and predictions.	**Show slides 1 and 2.** In our last lesson, we used a model to help us learn about what causes landforms to change. Based on our model, what ideas do you have so far? Think about what happened when the rain fell on our model. **NOTE TO TEACHER:** *Display the student ideas and evidence you recorded on chart paper in the previous lesson. Also give students time to look at their drawings and observations from handout 4.1 (Making the Grand Canyon, Part 1).*	Water can cause landforms to change. The water carried some of the dirt and sand away in our model. The rainwater made little streams in the model that moved dirt and sand to the bottom. I think maybe the canyon formed	How do you know? What evidence do you have from our model? Can you tell me more about how the water might carry the dirt away? Do you think this is how the Grand Canyon formed?

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			Does anyone have another idea to add? **Show slide 3.** Do you still have any questions or wonderings after our last investigation? **NOTE TO TEACHER:** *Record students' questions and wonderings on chart paper. You can use them for a science talk later on.* Those are great questions and wonderings! Let's see what we can find out today to help us answer them.	when the land caved in, or something like that. I think canyons get deeper because the water carries rocks and dirt away. Just like the water carries rock and soil out of the Grand Canyon to Lake Mead. How much dirt can the rainwater and streams carry away in a real canyon? I wonder how deep the Grand Canyon will get!	
1 min	**Lesson Focus Questions** **Synopsis:** The teacher reviews the focus	Set the purpose with a <u>focus</u>	**Show slide 4.** Today we'll continue thinking about our focus questions from last time: *What*		

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	questions from the previous lesson: *What causes landforms to change? What is our evidence?*	question or goal statement.	*causes landforms to change? What is our evidence?* By the end of the lesson, we'll have a lot more ideas to help us answer these questions.		
8 min	**Setup for Activity** **Synopsis:** Students draw and describe the Grand Canyon model on their handouts. Then they predict what will happen when a simulated river flows over the model. **Main science idea(s):** • We can use models to better understand what causes landforms like the Grand Canyon to change.	Select a content representation or model matched to the learning goal and engage students in their use. Make explicit links between science ideas and activities **before** the activity.	Today we'll investigate what happens when a river flows over our model. **NOTE TO TEACHER:** *Introduce the drip-system canyon model you'll be using and distribute handout 4.3 (Making the Grand Canyon, Part 2).* **Show slide 5.** Here's the model we'll be using today. **ELL support:** Be explicit about what each part of the model represents. It might be helpful to label the parts. Who remembers what the brown stuff represents? What do you think the bottle system represents?	Dirt. Sand. Rocks. I don't know.	

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		Ask students questions to elicit student ideas and predictions. Engage students in communicating in scientific ways.	Right! The bottle system represents a river, like the Colorado River in the Grand Canyon. **Show slide 6.** Before we make our river flow, make a sketch of the model on page 1 of your handouts. Then write down what you think will happen when the river begins to flow over our canyon model. **Whole-class share-out:** Let's hear your ideas and predictions. What do you think will happen when I open up the bottle and let the river start flowing over our model? **NOTE TO TEACHER:** *Leave this question open ended. Encourage students to agree or disagree with their classmates' ideas during this discussion, add their own ideas, or ask questions. Students may also signal agreement or disagreement by giving a thumbs-up or thumbs-down.*	Maybe a river? I think the river will make the land bumpy. Curvy like this. *[Student gestures with hands.]* I think the river will make puddles on the land.	What do you mean by "bumpy"? Do you think the puddles will stay on top of the land or go somewhere

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					else?
			Who has a different prediction about what will happen when the river flows over the model?	I think they'll just stay on top. I think the river will carry away some dirt and sand.	What makes you think that will happen?
			Who has a different idea?	Because we learned that the Colorado River carries soil and sand out of the Grand Canyon to Lake Mead. I think it river will make a little stream on the land.	Why do you think the river will make a little stream?
			You've made some interesting predictions. Now let's find out what happens!	Because there isn't much water in the bottle.	
10 min	**Activity** **Synopsis:** Students		Watch carefully what happens to the model when the river starts flowing over the plateau.		

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	observe what happens when a simulated river flows over the Grand Canyon model. Then they draw a picture of the model and record their observations in their handouts. **Main science idea(s):** • Flowing water can move rocks and soil from one place to another, which can change landforms over time.		**NOTE TO TEACHER:** *Open the shut-off valve to get the water flowing over the model. Allow the "river" to flow for a few minutes. Then shut off the valve and ask students to describe what's happening to the model. Following the discussion, have students sketch the model and record their observations on page 2 of their handouts.* Let's pause the flow of our river for a moment and talk about what we see. Who can describe what's happening with our model? What is the water doing to the land? What's happening to the sand and soil? **ELL support:** Allow ELL students to form shared-language pairs so they can discuss their observations in their home languages and in English. Remind them to	The water is moving the dirt and sand. The water is carrying the dirt and sand away. Down toward the bottom of the model.	Where is the water carrying the dirt and sand?

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			use the language resources available to them (e.g., visual resources, word wall, key-word dictionary).  Listen to students' ideas. What's visible about student thinking? Now I'd like you to write down at least two things you observed when the water started flowing over the model. Write these observations on page 2 of your handouts. **Individual work time.** Let's start our river again. Watch carefully to see what happens as the water continues flowing over the surface of our model. **NOTE TO TEACHER:** *After another minute or two, shut off the valve. Then give students time to finish their sketches and observations on their handouts.* OK, please make any final additions or changes to the sketches and observations on your handouts.		
10 min	**Follow-Up to Activity** **Synopsis:** Students share their observations of what happened during the river	Engage students in analyzing and	**Show slide 7.** Let's think about what we observed when the river was flowing over our model. What happened to the sand and soil? Is this		

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	simulation. Then they discuss how the canyon model is like and not like the real Grand Canyon. They also explain how they think flowing water changes landforms. **Main science idea(s):** • Flowing water can move rocks and soil from one place to another, which can change landforms over time.	interpreting data and observations.	what you predicted? **NOTE TO TEACHER:** *Record students' observations on chart paper during this discussion.* STOP Listen to students' ideas. What's visible about student thinking? What else did you see happen when the river was flowing over the land? Now look at your first sketch of the model, before the river started flowing. What did it look like?	A lot more sand and soil were carried to the bottom of the model than last time. That's what I thought might happen. Because there was a lot more water! The river started making a deep dent in the land, like a canyon. Because it had steep sides and went down deep. It was flat like a	Why do you think there was a lot more sand and soil at the bottom? Why do you think the river moved more of the sand and soil than the rain did? What made you think it looked like a canyon?

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			What else did you notice? Now look at your final sketch of the model after the river stopped flowing. What did it look like? What else did you notice? So based on our model, do you think flowing water can change landforms?	pancake! It was just soil and sand. It had holes in it. It had sand and soil at the bottom. It had a canyon down the middle. The river carried away soil and sand to the bottom of the model, just like the Colorado River carries soil and rocks away from the Grand Canyon to Lake Mead. Yes, it can carry away rocks and	Can you tell us more about how our canyon model shows what's happening in the Grand Canyon?

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				dirt. It has streams and canyons.	And what does the land look like after that?
			Last time we talked about scientists using models to help them study things that happen in the real world. How did our model help us learn about the Grand Canyon and what causes landforms to change?	It helped us see how water can make a canyon by carrying rocks and dirt from one place to another.	
			Show slide 8. Now I'd like you to think about the last three questions on your handouts and write down your ideas. Then we'll talk about them. **NOTE TO TEACHER:** *Give students a few minutes to write down their ideas for answering the last three questions on pages 3 and 4 of handout 4.3 (Making the Grand Canyon, Part 2).* So how is our model *like* the Grand Canyon? Who would like to share your		

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			ideas? Think about the different parts of our model. How was the rain from our spray bottles like what happens in the real world? How was our river like what happens in the real world? So we know that models are like things in the real world, but they aren't always *exactly* like the real thing, are they? How is our model *not like* the Grand Canyon?	Our model is a canyon too! Well, the rain from the bottles made little streams that carried sand and dirt to the bottom of the model, like what happens in a real canyon. The river in our model was like the Colorado River in the Grand Canyon because it carried a lot of sand and soil to the bottom of the model and carved out a canyon in the land. Our model is a lot smaller than the Grand Canyon!	

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			What did we discover from our model about what causes landforms to change?	The Colorado River is a lot bigger than our river was. We found out that water can change landforms over time.	How did the water in our model change the land?
			Do you think water can change the Grand Canyon the way it changed our model? Why or why not?	It carried away dirt and sand and carved out little streams and a canyon. Yes, I think water can change the Grand Canyon the same way because it has the same kinds of landforms as our model.	
		Ask questions to elicit student ideas and predictions.	Now let's think about time. It took just a few minutes for the water to make a canyon in our model. Do you think it took a short time or a long time for the Colorado River to carve out		

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			the Grand Canyon?	I think it took a long time because the Grand Canyon is so much bigger than our model. I think floods could have made it happen faster. Because floods have a lot of water that can carry a lot of dirt with them. And the water is moving faster.	Why do you think floods might have made it happen faster?
		Highlight key science ideas and focus question throughout.	Scientists know that the Colorado River took a very long time to carve out the Grand Canyon. There have been floods along the river too, but mostly the river has slowly carried away rocks, soil, and sand little by little year after year. Scientists think that the river has been carving out the Grand Canyon for more than five million years! **NOTE TO TEACHER:** *If time allows, share the following math connection with students and write the measurements on the board. Alternatively, you could save this activity for another lesson.*		

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			Optional Math Connection The Grand Canyon is 277 miles long, 18 miles wide, and 1 mile deep. That's really big, isn't it? Let's use a ruler to find out how big our model is. **NOTE TO TEACHER:** *Ask a volunteer to measure the Grand Canyon model with a ruler or measuring tape. The length should be measured from end to end, the width at the widest point, and the depth at the deepest point. Second-grade math standards don't include miles as a unit of measurement, so you'll need to convert miles into feet. Then have students compare the dimensions of the Grand Canyon in feet with the dimensions of the model in feet. The Grand Canyon is more than 1 million feet long, about 100,000 feet wide, and more than 5,000 feet deep. That's enormous! Students don't need to perform the calculations themselves; they simply need to understand that their 2-foot model is much, much smaller than the Grand Canyon.*		
5 min	**Synthesize/Summarize Today's Lesson**	Highlight key	**Show slide 9.** Let's revisit our focus questions, *What*		

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	Synopsis: The teacher reviews the focus questions, and students share their answers and evidence. Then the teacher summarizes key science ideas from the lesson. **Main science idea(s):** • One of the processes that can change landforms over time is flowing water. As water moves rocks and soil from one place to another, the land can change over time.	science ideas and focus question throughout. Engage students in making connections by synthesizing and summarizing key science ideas.	*causes landforms to change? What is our evidence?* Based on our model, how would you answer these questions now? Do you have any new ideas about what causes landforms to change? **Turn and Talk (3 min):** Share your ideas and evidence with an elbow partner and be ready to share them with the class. **Whole-class share-out (2 min):** Who would like to share your ideas about what causes landforms to change? Make sure to include evidence from our model. **NOTE TO TEACHER:** *As students share their ideas and evidence, record them on chart paper.* Who else has an idea to share? **ELL support:** Help ELL students make connections between the ideas students share and the lesson content.	We think that the more water you have, the more sand and rocks can be carried away. The river carried away more soil and sand than the rainfall did. We said that it takes a long, long time for a river to make a canyon, so the Grand Canyon	What evidence do you have from our model?

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		Summarize key science ideas.	Today we used our canyon model to continue exploring how water can change landforms over time. From our investigation, we learned that water can move rocks and soil from one place to another, and this can cause landforms to change very slowly. The Grand Canyon is a good example of how landforms can change over time.	must be very old.	
1 min	**Link to Next Lesson** **Synopsis:** The teacher announces that in the next lesson, students will use what they know to investigate how quickly or slowly landforms can change.	Link science ideas to other science ideas.	**Show slide 10.** From our virtual tour of the Grand Canyon in lesson 3, we know that the canyon is 2 centimeters deeper than it was 50 years ago. That's only this much. *[Show 2 centimeters with your fingers.]* So if it took 50 years for the Colorado River to make the Grand Canyon just 2 centimeters deeper, it will take more than 500 years for the river to make it 1 foot or 30 centimeters deeper! That's a very long time, isn't it? In our next lesson, we'll use what we've learned so far to investigate how quickly or slowly landforms change.		