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

Grade 2	**Length of lesson:** 35 minutes	**Placement of lesson in unit:** 4a 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 (see handout 4.2)
  - Plastic bin approximately 18" x 6" x 29" (to catch water)
  - Stream-table model (premade)
  - 3 or 4 large spray bottles filled with water (to simulate rain or melting snow)
  - Sand or a mixture of sand and soil (but not potting soil)
- **Optional:** Plastic relief map of the United States (from lesson 2a)

Student Handouts and Teacher Masters

- 4.1 Making the Grand Canyon, Part 1 (1 per student)
- 4.2 Grand Canyon Model Instructions, Part 1 (Teacher Master)
- 4.5 Grand Canyon Stream-Table Model Construction (Teacher Master)

Ahead of Time

- Review the content background document.
- Prepare the Grand Canyon model by following the instructions in handout 4.2 (Grand Canyon Model Instructions, Part 1). Enough materials are provided for multiple uses. Fill the water bottles with water; then perform a trial run to ensure the model is working properly.
- **Stream-table model:** If the materials kit doesn't contain a premade stream-table model, make one by following the instructions in handout 4.5 (Grand Canyon Stream-Table Model Construction).

Lesson 4a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	**Link to previous lesson:** Students share their ideas about how the Grand Canyon was formed. Then the teacher reviews key science ideas from the previous lesson.	• The land hasn't always looked the way it does today. Landforms on Earth's surface are changing all the time, and sometimes they change very slowly.
1 min	**Lesson focus questions:** The teacher introduces the focus questions, *What causes landforms to change? What is our evidence?*	
10 min	**Setup for activity:** The teacher introduces the Grand Canyon model and asks students how different parts of the model represent the real world. Then students draw and describe the model on their handouts and predict what will happen when "rain" falls on the model.	• We can use models to better understand what causes landforms like the Grand Canyon to change. • Models help us understand things that are too far away to visit, too big to bring into the classroom, or too dangerous to investigate in person.
8 min	**Activity:** Students observe what happens when simulated rain falls on the Grand Canyon model. Then they draw a picture of the model and record their observations on their handouts.	• Water can move rocks and soil from one place to another, which can change landforms over time. • Rain and melting snow can make small streams in the land that move sand and soil from one place to another.
5 min	**Follow-up to activity:** Students share their observations of what happened when rain fell on the model.	
5 min	**Synthesize/summarize today's lesson:** The teacher reviews the focus questions; then students share their ideas for answering them.	• One of the processes that can change landforms over time is flowing water. As water slowly moves rocks and soil from one place to another, the land can change over time.
1 min	**Link to next lesson:** The teacher informs students that in the next lesson, they'll use their model again to find out what happens when a "river" starts flowing through the model.	

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5 min	**Link to Previous Lesson** **Synopsis:** Students share their ideas about how the Grand Canyon was formed. Then the teacher reviews key science ideas from the previous lesson. **Main science idea(s):** • The land hasn't always looked the way it does today. Landforms on Earth's surface are changing all the time, and sometimes they change very slowly.	Ask students questions to elicit student ideas and predictions.	**Show slides 1 and 2.** In our last two lessons, we took a virtual tour of the Grand Canyon from right here in our classroom. What did we learn about the Grand Canyon during our tour? What else did we learn? **Show slide 3.** Now let's review your ideas from last time about what might be causing the Grand Canyon to change. What are some of your ideas? **NOTE TO TEACHER:** *Display the chart of student ideas from the previous lesson during this review. Also allow students to refer to the information they recorded in their notebooks.*	We learned that the Grand Canyon is getting deeper. Because it's 2 centimeters deeper than 50 years ago. We also learned that the river carries rock and soil out of the canyon and dumps them in Lake Mead. I think that when the water moves the rock and soil out of the canyon, the canyon gets deeper. I think maybe the water carried all the dirt away.	How do we know? Can you tell me

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					more about how the water might carry all the dirt away?
				I'm not sure how, but I think the river made the canyon deeper because it carried away all the rock and dirt.	
					Does anyone else have an idea to add?
				I think the land may have caved in or something, and that's what formed the canyon.	
			Show slide 4.		
		Summarize key science ideas.	So from our Google Earth investigation, we've learned that the Grand Canyon is slowly getting deeper. In fact, it's 2 centimeters deeper than it was 50 years ago! We also learned that the Colorado River carries loose soil and rock with it as it flows through the canyon. This soil and rock are carried all the way to Lake Mead, where they're filling up the lake. All of this evidence means that landforms can change! **Show slide 5.**		

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			Does anyone have any questions or wonderings about what might be causing the Grand Canyon to change? **NOTE TO TEACHER:** *As students share their questions and wonderings, record them on chart paper and add your own at the end of the discussion.* Those are great wonderings! I'm wondering how water can change rock. Do you think water is strong enough to carry rock all the way from the Grand Canyon to Lake Mead? Today we'll see if we can find some answers for our wonderings.	I wonder how deep the Grand Canyon will get. I wonder how the river can carry rocks and dirt all the way to Lake Mead. I think most rocks are too heavy for water to move.	
1 min	**Lesson Focus Questions** **Synopsis:** The teacher introduces the focus questions, *What causes landforms to change? What is our evidence?*	Set the purpose with a focus question or goal statement.	**Show slide 6.** Our focus questions for this lesson are *What causes landforms to change? What is our evidence?* Let's find out! First, write these questions in your science notebooks and draw a box around them. **NOTE TO TEACHER**: *Write the focus*		

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			questions on the board for students to refer to throughout the lesson.		
10 min	**Setup for Activity** **Synopsis:** The teacher introduces the Grand Canyon model and asks students how different parts of the model represent the real world. Then students draw and describe the model on their handouts and predict what will happen when "rain" falls on the model. **Main science idea(s):** • We can use models to better understand what causes landforms like the Grand Canyon to change. • Models help us understand things that are too far away to visit, too big to bring into the classroom, or too dangerous to investigate in person.	Summarize key science ideas. Select content representations and models matched to the learning goal and engage students in their use. Make explicit links between science ideas and activities **before** the activity.	So we know that landforms can change based on the evidence we gathered from our virtual tour of the Grand Canyon. Our evidence is that the canyon is 2 centimeters deeper than it was 50 years ago, and the Colorado River carries rock and soil out of the canyon to Lake Mead. But those changes happen so slowly, we can't see them with our eyes. So can't know for sure what's causing the canyon to change, can we? Today we'll use a model to learn more about what causes landforms like the Grand Canyon to change. **Show slide 7.** We've used models before to help us understand things. Who can tell me what a model is in science? What do scientists use models for? **NOTE TO TEACHER:** *Students will have heard the word* model *used in many contexts and should have some experience working with scientific models. Be sure to emphasize that scientists use models to study processes or events that happen in the real world.*	A model in science is something that's smaller than the real thing so we can observe it better. Like when we used cotton balls for cottonwood-tree	Can you give an example?

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				seeds last year. That the wind blows smaller cottonwood-tree seeds farther away from the trees.	And what did that model help us learn?
		Highlight key science ideas and focus question throughout.	**Show slide 8.** So we know that models are representations of things that happen in the real world. Scientists use models to help them understand things that are too small or too big to observe or study directly. They also use models when it's too dangerous to observe the real thing in person or something is too far away to study, like the Grand Canyon! **NOTE TO TEACHER:** *You might want to use the plastic relief map of the United States (from lesson 2a) as an example of a model that represents landforms in the real world. Then introduce the Grand Canyon model and explain what each part represents in the real world.* **Show slide 9.**		
		Ask questions to elicit student ideas and predictions.	Here's the model we'll be using today. Can anyone tell me what you think this is a model of? What do you think it looks like?	Flat land.	

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			Show slide 10. What do you think the brown stuff represents on the model? What about these spray bottles? What do you think they represent? *[Demonstrate by spraying some water into the air.]* Right! The spray bottles are going to be our rain, so we can observe what happens when rain falls on our model. What do you notice about the model? Can you identify any landforms on our model? **NOTE TO TEACHER:** *Distribute handout 4.1 (Making the Grand Canyon, Part 1) and read the overview aloud.* Before we begin our investigation, I'd like you to make a sketch of our model on your handouts and write down two things you	Dirt. Dirt. Rocks. It could be a plateau. I don't know. It could be rain. It looks like a plain. The dirt is really smooth.	

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			observe about it. Try to use some of the words we've learned to describe landforms and bodies of water. **Individual work time.** **ELL support:** Be explicit about what is and is not included in the model. How is it similar to and different from the Grand Canyon? What might be missing, and what is included? **NOTE TO TEACHER:** *Give students a few minutes to sketch the model and record their observations on their handouts*. **Show slide 11.** What do you think will happen if a lot of rain falls on our model? Think about what we've learned about how water can change the land. Then write your predictions on page 2 of your handouts. **Individual work time.** **Whole-class share-out:** Let's hear your predictions. What do you think will happen if a lot of rain falls on our model?	Ask students questions to elicit student ideas and predictions.	I think the rainwater will run over the dirt.	

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				I think the rain could move the dirt. It might move the dirt a few inches. Because we know that water can move soil and rock out of the Grand Canyon.	Do you think the water will leave the dirt in the same place? Why or why not? How far do you think the rain might move the dirt? Why do you think so?
8 min	**Activity** **Synopsis:** Students observe what happens when simulated rain falls on the Grand Canyon model. Then they draw a picture of the model and record their observations on their handouts. **Main science idea(s):** • Water can move rocks and soil from one place	Select content representations and models matched to the learning goal and engage students in their use.	Now let's see what happens when rain falls on our model. I'll need a few volunteers to use the spray bottles to create rain that falls on the top and sides of the model. **NOTE TO TEACHER:** *Select three or four volunteers and give each of them a spray bottle. Ask them to spray "rain" over the top and sides of the model. Then pause the rain and have students describe what's happening to the model. Following the*		

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	to another, which can change landforms over time. • Rain and melting snow can make small streams in the land that move sand and soil from one place to another.	Engage students in analyzing and interpreting data and observations.	*discussion, have them sketch the model and record their observations on page 2 of their handouts.* OK, volunteers, stop the rain for a moment so we can talk about what's happening with the model. Who can describe what's happening? **NOTE TO TEACHER:** *Encourage as many students to share their observations as possible.* **ELL support:** It may be helpful for ELL students to pair up with a same-language partner so they can practice sharing their observations in their home language and English. STOP Listen to students' ideas. What's visible about student thinking? Now I'd like you to sketch what happened to the model when the rain fell. Make your sketch on page 2 of your handout and then write down two things you observed. **Individual work time.** Let's have our volunteers start the rain again. Keep watching what happens to the model.	The land is changing. The dirt is moving. The water is moving the land.	What's making the dirt move? How far is the land moving?

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			NOTE TO TEACHER: *After another minute or two, ask your volunteers to stop spraying. Then give students time to revise or add to their drawings and observations on their handouts.* OK, please make any final additions or changes to your sketches and observations on the handout.		
5 min	**Follow-Up to Activity** **Synopsis:** Students share their observations of what happened when rain fell on the model. **Main science idea(s):** • Water can move rocks and soil from one place to another, which can change landforms over time. • Rain and melting snow can make small streams in the land that move sand and soil from one place to another.	Engage students in analyzing and interpreting data and observations.	**Show slide 12.** Now look at the sketch you drew of our model after the rain fell and review your observations. **NOTE TO TEACHER:** *Give students a moment to review their observations and sketches.* What happened when it rained on our model? What did you observe? Did you predict that the rain would move some of the sand and dirt?	We saw the water move some of the dirt and sand to the bottom of the bin. No, I didn't think the water from the spray bottle could do that.	Can you tell me more about why you didn't think the water could

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					do that?
			What did we observe as the rain continued falling on our model? Do you think that little streams could form on the land around the Grand Canyon, too?	Yes, I thought the spray bottle would make enough water to carry the soil and sand away. Little streams formed on the land. Maybe. They might move the dirt from one place to another like we saw in our model.	How do you think these streams might change the canyon?
5 min	**Synthesize/Summarize Today's Lesson** **Synopsis:** The teacher reviews the focus questions; then students share their ideas for answering them.	Highlight key science ideas and focus question throughout.	**Show slide 13.** Let's return to our focus questions: *What causes landforms to change? What is our evidence?* **ELL support:** Encourage ELL students to refer to their visual resources and the word		

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	Main science idea(s): • One of the processes that can change landforms over time is flowing water. As water slowly moves rocks and soil from one place to another, the land can change over time.	Engage students in making connections by synthesizing and summarizing key science ideas. Engage students in constructing explanations and arguments.	wall as they think about the focus questions. What new ideas did our model give us for answering these questions? **Turn and Talk (3 min):** Talk about this question with an elbow partner and share your ideas and evidence. Be ready to share some ideas with the class. **Whole-class share-out:** Who would like to share your ideas about what causes landforms to change? Make sure to include evidence from our model. Who has another idea to share?	We think that rain can cause some landforms to change, but only a little bit. We said that if there was enough rain for a long time, maybe it could move more sand and dirt farther down the model. Maybe there wasn't enough water?	Explain what you mean by "a little bit." Why do you think just the rain alone didn't make a deep canyon?

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1 min	**Link to Next Lesson** **Synopsis:** The teacher informs students that in the next lesson, they'll use their model again to find out what happens when a "river" starts flowing through the model.	Link science ideas to other science ideas.	**Show slide 14.** Today we saw what happened when rain fell on our model. Little streams formed and carried some of the soil and sand to the bottom of the model. But what do you think might happen if a river flows through our model? We'll find out next time!		