Earth's Changing Surface
Lesson 2: What causes deltas to form?

Grade: 4	**Length of lesson:** 60 minutes	**Placement of lesson:** 2 of 6 lessons
Anchoring Phenomenon: The Mississippi delta has grown over thousands of years.		
Unit Learning Goal: At any given point in time, Earth's surface is both building up and wearing down. Some processes build up Earth's surface, while other processes wear down Earth's surface. These processes include weathering, erosion, and deposition and cause Earth's surface to look different in different places.		
Lesson Main Learning Goal: Erosion and deposition are processes that change the surface of Earth by carrying and depositing earth materials from one place to another. These processes are the driver of delta formation. **Science and Engineering Practices** Developing and Using Models • Develop and/or use models to describe and/or predict phenomena. **Crosscutting Concepts** Cause and Effect • Cause and effect relationships are routinely identified, tested, and used to explain change.		
Unit Central Question: What can cause Earth's surface to look the way it does?		**Lesson Focus Question:** What causes deltas to form?
Science content storyline: Moving water in rivers and streams shapes and reshapes Earth's surface by moving rocks and soil from higher elevations and depositing them at lower elevations. Erosion is the process by which earth materials, such as rock fragments, sand, and soil, are removed from one place on Earth's surface and transported by wind and/or water. As the kinetic energy of the wind or water decreases, the earth materials are deposited, building up new land. Deltas form at the end of rivers when this new land builds up over time.		
Ideal student response to the Lesson Focus Question: Water moves sand, rocks, pebbles, and soil in a river from higher places to lower places. Where the river meets the ocean, the water has less energy and slows down. The sand and soil that the river was carrying is deposited. When the material builds up over time, it makes a delta.		

Preparation

MATERIALS NEEDED	AHEAD OF TIME
Teacher Resources • TE2.1 *Lesson 2 Analogy Chart Answer Key* • TE2.2 *Stream Table Setup Instructions* • chart paper and chart markers **Student Handouts** • HO2.1 *Lesson 2 Analogy Chart* (1 per student) • HO2.2 *Stream Model Observations* (1 per student) **Other Materials (per group)** • 1 plastic tray, 20 inches long with no drain holes • 1 empty gallon milk jug • 1 golf tee and scissors if needed (to poke a hole into jug) • books (covered in a plastic bag), plastic container, or wood block (to elevate jug) • 8 cups of slightly moist sand and/or soil • 1 cup of mixed gravel and small rock • A pinch of dark-colored sand (blue or red) • tap water **Other Materials (per class, optional for easier clean up)** • large bucket with water (for rinsing hands or to carry water outside) • 1 sponge, paper towels to wipe up any spills • plastic trash bags to cover the work areas • aluminum foil to line trays	• Review the *Content Background* document. • Use a stream table kit *or* prepare the stream tables using the teacher reference sheet provided: TE2.2 *Stream Table Setup Instructions*. • Practice with your stream table so you know what to expect as students use them. Try to get the angle of the tray and the speed of water flow so that the water will form a channel and "delta" at the bottom. ○ Once you have an acceptable setup, run the stream table again, smoothing out the stream bed before you start. Make a video of the stream table running. The entire surface of the stream table should be visible. The video should be of the stream running from a clean stream bed to the point where 1/3 of the jug is emptied. You will use this video in the next lesson. If you forget to record the video before class, record one during this lesson as students are running the stream table. • Plan where to dispose sandy water—not in a sink!!

Lesson 2 General Outline

Time	Phase of lesson	How the science content storyline develops
3 min	**Link to Previous Lesson:** Class reviews ideas and questions from the previous lesson on the Mississippi River and delta. They consider how the delta might form.	
5 min	**Lesson Focus Question:** Teacher introduces Lesson Focus Question: *What causes deltas to form?* Students write their initial ideas in their notebook and share with the class.	
10 min	**Setup for Activity:** Teacher introduces the stream model, and students use an analogy chart to discuss what each feature represents in the real world. Students make predictions about what might happen when water is released at the top of the table.	Moving water in rivers and streams shapes and reshapes Earth's surface by moving rocks and soil from higher elevations and depositing them at lower elevations.
15 min	**Activity:** Students study erosion and deposition in a stream model and record their observations.	
15 min	**Follow-up to Activity:** Students use their observations and records from the stream model to interpret and reason about the effects of erosion and deposition on the surface of Earth. Students learn the processes they have observed are erosion and deposition. The class discusses the results of their investigation.	Erosion is the process by which earth materials, such as rock fragments, sand, and soil, are removed from one place on Earth's surface and transported by wind and/or water. As the kinetic energy of the wind or water decreases, the earth materials are deposited (deposition), building up new land.
10 min	**Synthesize and Summarize Today's Lesson:** Students synthesize ideas about erosion and deposition as they answer the focus question in their notebooks.	Deltas form at the end of rivers when this new land builds up over time.
2 min	**Link to Next Lesson:** Teacher asks questions to link what they have learned to the next lesson's focus question.	

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
3 min	**Link to Previous Lesson** Synopsis: Class reviews ideas and questions from the previous lesson on the Mississippi River and delta. They consider how the delta might form.	Ask questions to elicit student ideas and predictions.	***NOTE TO TEACHER:*** *Have Lesson 1's focus questions—Has Earth's surface always looked this way? Why or why not?—written in a place where students can refer to them again throughout today's lesson.* *Begin by saying,* Today, we are going to continue to think about how new land can form at the end of a river. What did we learn last time about this? And what were some of our ideas and questions about how this happens?	We saw the Mississippi delta get bigger over time. **What do you mean by "get bigger"? Did anyone else notice this? Did you notice something different?** It also changed direction. **Why might that happen?** I think dirt piles up in the ocean. **Do you have ideas for how we might be able to test this idea?** Maybe waves wash the sand up on the beach?

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
5 min	**Lesson Focus Question** Synopsis: Teacher introduces Lesson Focus Question: *What causes deltas to form?* Students write their initial ideas in their notebook and share with the class.	Set the purpose with a focus question. Ask questions to elicit student ideas and predictions.	*Introduce the Lesson Focus Question by saying,* In today's lesson, we will build on Lesson 1's focus questions and explore whether the water in the river has anything to do with creating new land at the end of the river. Our focus question for today is, *What causes deltas to form?* ***NOTE TO TEACHER:*** *Write the question on the board for the class to see and then refer to it throughout the lesson. If this was a question on your DQB, mark that this question is one that we wondered about in the last lesson.* *Ask students to write this focus question in their notebook.* I want you to take a few minutes and think about our Lesson Focus Question: *What causes deltas to form?* In your notebook, write down your ideas using this sentence starter: "I think deltas form at the end of a river because _____." ***NOTE TO TEACHER:*** *Write the sentence starter on the board and give students quiet time to write individually in their notebook.* *Once they have had time to write, ask for a few volunteers to share. Ask probe questions so you can understand what they are thinking but avoid challenge questions at this point in the lesson.* *As students share, record their initial ideas underneath the focus question box on the Lesson 2*	When it floods it washes a bunch of dirt to the end of the river. **How do you think that changes the surface of Earth?** Big storms pile sand and dirt up. **What do you mean by "pile up"?** The river carries the sand and dirt to the end.

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
			Focus Question chart. Use the same color for initial ideas that was used for initial ideas on the Lesson 1 Focus Question chart.	**Do others have ideas they would like to add?**
10 min	**Setup for Activity** Synopsis: Teacher introduces the stream model, and students use an analogy chart to discuss what each feature represents in the real world. Students make predictions about what might happen when water is released at the top of the table. Main Science Idea: Moving water in rivers and streams shapes and reshapes Earth's surface by moving rocks and soil from higher elevations and depositing them at lower elevations. (This idea continues into the next phase of the lesson.)	Engage students in using content representations and models.	***NOTE TO TEACHER**: Using the teacher demonstration stream table, show students the stream table model and describe how they will use the stream table to investigate the Lesson Focus Question. Do not run any water through the sand or soil at this time.* Do you know that there are scientists who spend their lives studying rivers and streams? Most of the time, they study real streams, but sometimes they use models of streams to learn more about how streams behave and how they change the surface of Earth. Today, we are going to become stream scientists and find out how deltas form at the end of rivers. Since we are using a model, we will use an analogy chart to think about how the model relates to the real world. ***NOTE TO TEACHER**: Pass out HO2.1* Lesson 2 Analogy Chart. Let's look at the stream table setup and think about what each part represents in the real world. What do you think the soil and rocks represent? Add this information to your analogy chart now so that you can think about how this model can help us understand how deltas form at the end of rivers. What about this jug of water at the top of the stream table? If I let water out of the jug and it runs onto the tray, what would that represent?	Land! The dirt and soil around and in a river. **How are they alike?** There is sand and rocks of different sizes around rivers. A river.

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
		Make explicit links between science ideas and activities (before activity).	What about the water at the bottom of the tray? How is this stream table different from the real world? ***NOTE TO TEACHER:*** *Students might say the water gets deeper as the table fills. Highlight that this is another way the model is different from the real world. The water at the bottom of the stream table is contained in an area much smaller than the ocean. Also, the ocean has waves and tides.* Alright, so we have some ideas for what this stream table represents in the real world. Now, if we let water run through the soil, sand, gravel, and rocks in the bed of the stream table, what do you think might happen? Take a moment to record your predictions. ***NOTE TO TEACHER****: Pass out HO2.2* Stream Model Observations*. Students record their ideas in part 1. Invite a few students to share their ideas with the class.*	**How are they alike?** A river is a stream of water that flows downward. A lake! The ocean! **How are they alike?** Rivers flow into lakes and oceans. The stream table is smaller. The real world has grass and trees and buildings. The ocean is much bigger. It might soak in. **Why do you think that?** It might run quick off the top. **Have you seen anything like that yourself? Where?** The water will move the material from the top to the bottom. **What do you think will happen to the material at the bottom?**

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
			 *Listen to students' ideas. What's visible about student thinking? Do they have ideas related to how big the particles are that can be carried by water? Do they mention the type of materials that are part of the stream table?* *Record students' ideas on chart paper or the board so you can refer to them in the follow-up to the activity. Title the list "Our predictions".* In this activity, you will look for two main things: 1) where you see flowing water moving earth materials to a new location and 2) where the earth materials are left, or deposited, in a new location. ***NOTE TO TEACHER**: Write on the board these two main things to watch for so you can remind the students of these. Remind them that noticing what happens in these two instances will help them answer the Lesson Focus Question.* *Instruct students in the procedures you want them to follow so the classroom stays reasonably clean. This activity does not have to be a messy one! One way to minimize chaos during the activity is to have student teams set up the stream tables and wait for the teacher to signal to release the water all at the same time and to signal again after about 1/3 of the water is released from everyone's jug to close the valve and stop the water flow. See TE2.2* Stream Table Setup Instructions *for using the milk jug lid as a valve. Try to*	

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
			aim for the same spot where the water hits the stream table each time the water is released.	
15 min	**Activity** Synopsis: Students study erosion and deposition in a stream model and record their observations. Main Science Idea: Moving water in rivers and streams shapes and reshapes Earth's surface by moving rocks and soil from higher elevations and depositing them at lower elevations.	Make explicit links between science ideas and activities (during activity).	***NOTE TO TEACHER:*** *Read directions on parts 1 and 2 of the* Stream Model Observations *handout together. Emphasize that students should focus on a small area at the top of the slope and watch what happens to the earth materials in that spot as well as the area where the land meets the water. They should pay attention to when and where earth materials are moving from one place to another and when and where they stop moving. Students should make and record observations on their handout.* *Remind students of the two things they should focus on as water is running through their table. These are the two items you wrote on the board earlier. Also remind them that they should run the stream table until 1/3 of the water is released. That will be at your first marked line. Then they will repeat the process and release water to the second marked line on the jug. If you didn't make a video as described in the "Ahead of Time" section, record it here. You will use this video in the next lesson.* *As students work, circulate around the room and make sure students are stopping to make observations and draw pictures of their stream model in their notebook at appropriate points. Ask them to show you in their stream table model the examples of where they see water moving earth materials and where they see earth materials stopping to be deposited. Example questions and dialogue are shown on the right.*	**Where do you see rock and sand being moved by the water?** It seems to move everywhere the water goes. **What materials are being carried in the water?** I think they all move a little. **Do any materials move a lot?** Yeah, the really tiny sand moves the most. Some moved all the way to the bottom! **What materials are harder for the water to move?** The bigger pebbles are harder to move. **Can you think of any time where the bigger ones would move?** **Where does the sand go? Where is the sand ending up??** At the bottom!

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			When students complete their observations (parts 1 and 2 of the handout), ***keep one stream table out for a demonstration in the next part of this lesson****. Have the class clean up their work area and move the stream tables to the side of the room. These will be used again in Lessons 3 and 4.*	**How is this going to help us answer our focus question?**
15 min	**Follow-up to Activity** Synopsis: Students use their observations and records from the stream model to interpret and reason about the effects of erosion and deposition on the surface of Earth. Students learn the processes they have observed are erosion and deposition. The class discusses the results of their investigation. Main Science Ideas: Erosion is the process by which earth materials, such as rock fragments, sand, and soil, are removed from one place on Earth's surface and transported by wind and/or water. As the kinetic energy of the wind or water decreases, the earth materials are deposited	Engage students in analyzing and interpreting data and observations.	*When students are finished with cleaning up, say,* Now that you have evidence from the stream table for how water can change the land, answer the questions in part 3 of your handout. You have 5 minutes to finish. ***NOTE TO TEACHER:*** *Allow students 5 minutes to individually answer questions in part 3 on their observations sheet. When students are done, continue with a class discussion.* Now, let's share some of our ideas and drawings about how water changed the land in our stream table. First, tell me where materials were being moved on the table. Which earth materials were carried by water easily?	The sand and small rocks were washing down with the water. **Where did they start? Do you have an idea why this happened?** Sand. Little pieces of dirt.

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	(deposition), building up new land.	Engage students in using content representations and models.	Which were not easily carried by water? OK, now where did most of the earth materials end up? Why do you think this happened? ***NOTE TO TEACHER:*** *An important idea is illustrated in the dialogue to the right—that earth materials are deposited when the water (or wind) slows down. If a student suggests that this is why earth materials are deposited where they are, then ask if the class would like to test that idea. Ask them what they learned about moving things and energy in the "Energy: Every Day, Everywhere" unit (see sample dialogue to the right). They learned that faster objects have more energy, and they know that they have more energy because they move another object farther upon impact (marble in a Styrofoam block). They also*	**What is your evidence? Why do you think these moved more easily?** Pebbles and rocks. **How do you know that pebbles and rocks were not as easily carried by water?** At the bottom of the stream table because that was as far as it could go. **What do you think would happen in a real river where the end of the river is the ocean?** I think the river water mixes with the ocean water and the river water slows down. **Why do you think the water slows down at the end of a river?** Maybe because the river water hits all the ocean water. Or maybe it isn't as steep when it gets to the ocean. **A river moves from higher places to lower places. You moved a marble in a similar way in the unit about energy. Can anyone make a connection between the water flowing in the river and the marble and the ramps we used in the energy unit?**

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		Link science ideas to other science ideas. Make explicit links between science ideas and activities (after activity).	*learned that if the ramp is steeper, the marble would move faster and have more energy to move the Styrofoam farther upon impact. You can connect this to a steeper river having faster-flowing water and more energy to move earth materials farther. They may conclude that if the water slowed down, it could not carry the earth materials as far, so they are deposited at the place the water slows down. If students are not convinced that the river water slows down once it encounters the ocean, ask them if any of them have ever been on a water slide that dropped them off at the bottom into a large pool or lake. Ask them to think about how their speed changed once they hit the pool of water or lake—they slowed down.* *After connecting to previous lessons on energy, ask,* Can you use what you learned about speed and energy and connect it to our river? Turn and talk with your elbow partner. ***NOTE TO TEACHER:*** *Monitor student conversations and listen for students to connect more energy in the marble (because it was moving faster) moving the Styrofoam block farther to more energy in water moving more earth materials or moving earth materials farther. They may also connect that when materials are deposited, it is because the river has less energy because it slowed down, so the river cannot carry the materials anymore.* *Content note: The kinetic energy of the river depends on the velocity of the river* ***and*** *the mass of the water in the river. More mass that is moving = more kinetic energy, even if the velocity stays the same. Students in 4th grade are only expected to understand that more*	The marble moved down the ramp like water in a river moves to the ocean. **How did you connect the marble's speed with the amount of energy it has?** The faster the marble went the more energy it has! **And what was your evidence?** The faster marbles moved the Styrofoam block farther. **How does this connect to our river?** As the motion energy decreases, the earth materials slow down and are deposited in a new location.

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
			velocity = more energy (as long as the mass stays the same) and not consider the mass. In a river system, as in all systems that are moving, the kinetic energy depends on both mass and velocity of the moving matter. Considering the mass of the river water is above grade level and is not addressed in this lesson. But it is important for you to know that not all rivers are slower at the end of the river, but the energy of the river water spreads out once the river water encounters the much larger ocean. When water carries materials away, it always goes downhill. Does *all* the material get deposited at the end of the river? ***NOTE TO TEACHER:*** *Seeing that not all material is transported all the way to the end of the stream is an important observation. If students or if some groups did not see this, use the stream table and run more water through it. Have students watch a small piece of sand or a small pebble as you start the flow of water in the stream table. The water should move some earth materials only a short distance, and those materials are deposited along the sides of the river or at the bottom. Using a pinch of colored sand at the top may make these observations easier to see.* How is your stream model like the Mississippi River and its delta?	No. **Where else can materials like rocks and pebbles and sand be deposited?** At the bottom of the river. Along the sides of the river.

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
				It has flowing water like the Mississippi River. It started to make a delta at the end too.
			How is it different?	**Did other groups see a delta form?**
				It's a lot smaller. We only did it for five minutes, not thousands of years!
				How might it be different if it was bigger or if the river was longer?
			You observed two processes at your stream table. These two processes play a big role in changing the shape of the land around rivers. The first process was that water moved sand and pebbles. We call the process where water or wind moves sand, pebbles, or even rock *erosion*. Write that new word in your notebook along with the definition. Draw an example of erosion or describe an example to help you remember the word. ***NOTE TO TEACHER:*** *Write this new vocabulary word on the board or add it to a Word Wall:* "**Erosion**—the process where flowing water or wind moves earth materials, such as sand, soil, gravel, and rocks, to a different location." *If there is time, have a few students share their examples and/or drawings and use the word* erosion *in a sentence.*	

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
			If students wonder if erosion can happen if ocean waves were present in the model, invite students to add the question to the Driving Question Board. Return to this question during Lesson 4. *Introduce the next new term by saying something like,* You also observed another process at your stream table. Once the water moved, or eroded, the sand, the sand piled up at the end of the river. When earth materials that have been eroded, like sand, pile up or drop out of the water, we call that *deposition*. The sand was deposited at the end of the river and other places along the way. Add this word to your notebook and, again, draw or describe an example to help you remember the word. ***NOTE TO TEACHER:*** *Write this new vocabulary word on the board or add it to a Word Wall: "***Deposition**—when eroded earth materials, such as sand, soil, gravel, and rocks, are deposited, or dropped, in a new location." *If there is time, have a few students share their examples and/or drawings and use the word* deposition *in a sentence.*	Erosion is when water moves things. **Can you give me an example?** Like a big rainstorm causes a landslide and all the dirt and stuff falls down. **Do you think water is the only thing that can move soil? What about wind? Can it cause erosion? Do you have an example?** Deposition is where the water drops rocks and stuff. The pile of rocks and dirt that form at the bottom of the hill. **Do you have ideas about how that might happen?** The water has less energy at the bottom of the hill. The water slows down when it dumps into the ocean. **Do others have similar or different ideas?**

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
10 min	**Synthesize and Summarize Today's Lesson** Synopsis: Students synthesize ideas about erosion and deposition as they answer the focus question in their notebooks. Main Science Idea: Moving water in rivers and streams shapes and reshapes Earth's surface by moving rocks and soil from higher elevations and depositing them at lower elevations. Erosion is the process by which earth materials, such as rock fragments, sand, and soil, are removed from one place on Earth's surface and transported by wind and/or water. As the kinetic energy of the wind or water decreases, the earth materials are deposited, building up new land. Deltas form at the end of rivers when this new land builds up over time.	Highlight key science ideas and focus question throughout. Engage students in making connections by synthesizing and summarizing key ideas.	Last time, we saw how the Mississippi delta formed over thousands of years. *Point to Lesson 1's focus questions, Has Earth's surface always looked this way? Why or why not?* How does what we saw today help us understand our new focus question, *What causes deltas to form?* In your science notebook, I'd like you to answer today's focus question: *What causes deltas to form?* Be sure to use the words *erosion* and *deposition* in your explanations. Start with the text "Deltas form because_____." As an extra challenge, include your thinking about how much time it takes for this process to occur. *Embedded assessment task*	The delta is where the rocks and sand pile up at the end of the river. **And where did we see that in the activity?** We watched the dirt and sand flow down the land, and it ended up in the water at the end of the river. **You said "flow down"—what did you mean by that?** That the water moved from higher places to lower places. Can you use one of our new vocabulary words to say the same thing? **Does anyone else have an idea to tag onto that to connect it to the Mississippi delta?** The sand and rocks that were moving with the river piled up and that made the delta. The water at the end is like the ocean and the sand and dirt became the delta.

Time	Phase of lesson and how the science content storyline develops	STeLLA strategy	Teacher talk and questions	Possible student and teacher dialogue
			NOTE TO TEACHER: *An ideal student response would include a connection between the process of erosion carrying soil, rock, and sand along a river and the process of deposition building up new land where the soil and rock accumulate at the end of a river. Encourage students to include their ideas about how much time it takes for this process to happen and the direction rivers flow—from higher places to lower places.* *Invite a few students to share out. Record student revised ideas on the Lesson 2 Focus Question chart, using the same color for revised ideas that was used on the Lesson 1 Focus Question chart.*	
2 min	**Link to Next Lesson** Synopsis: Teacher asks questions to link what they have learned to the next lesson's focus question.	Summarize key science ideas. Link science ideas to other	*Link to the next lesson by saying,* We saw in the video we watched in the last lesson that it took thousands of years for the Mississippi delta to form. Do you think that means that erosion and deposition are always slow?	Yes! No! **Why do you think that way?** Well, if it took thousands of years to form a delta, it must have taken thousands of years for erosion and deposition. That's slow! But if it floods, maybe it happens fast because faster rivers might carry more soil. And, more water might carry more sand too! **So maybe faster water can make this process happen faster. Are there**

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		science ideas (links to next lesson).	In our next lesson, we will test some ideas for how we can speed up or slow down this process.	**other ideas for what might cause it to happen faster?** If there is really loose sand, it could happen faster. **Say more about what you are thinking about loose sand.**

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Transforming Science Education Through Research-Driven Innovation

Earth's Changing Surface

Lesson 2

What causes deltas to form?

1

What did we figure out?

Lesson 1 Focus Questions

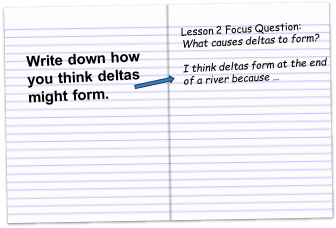
Has Earth's surface always looked this way? Why or why not?

How did we answer these questions in our last class?

2

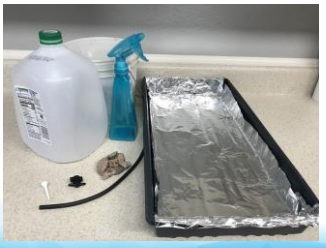
Lesson 2 Focus Question

What causes deltas to form?



3

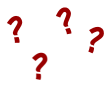
Investigating a River



4

Investigating a River

When we release the water, what do you think will happen?



As you investigate, look for

- **where you see flowing water moving earth materials to a new location and**
- **where the earth materials are left, or deposited, in a new location.**

5

Investigating a River

As you investigate, look for

- **where you see flowing water moving earth materials to a new location and**
- **where the earth materials are left, or deposited, in a new location.**

6

How did water change the land?

Where did you see earth materials move because of the water?

Do all earth materials move the same?

Can you use ideas about speed and energy to explain how earth materials move?

Where do the earth materials go?

How will this help us answer our focus question?

What evidence did you get from investigating with a stream table?

What new questions do you have?

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7

Investigating a River

As you investigated, you looked for

- **where you see flowing water moving earth materials to a new location and**
- **where the earth materials are left, or deposited, in a new location.**

Erosion: the process where flowing water or wind moves earth materials, such as sand, soil, gravel, and rocks, to a different location.

Deposition: when eroded earth materials, such as sand, soil, gravel, and rocks are deposited, or dropped, in a new location.

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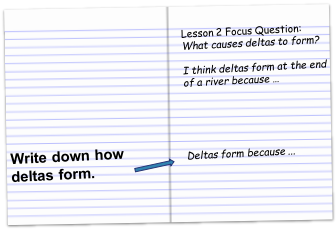
8

Lesson 2 Focus Question

What causes deltas to form?

Remember to use ideas about erosion and deposition!



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10

“Earth’s Changing Surface”

Lesson 2 Analogy Chart

Lesson Focus Question: *What causes deltas to form?*

Part of model		Part of real world	They are alike because …
Sand, soil, and rocks	**... is/are like ...**		
Water as it runs out of the jug			
Water at the bottom of the stream table			

"Earth's Changing Surface"

Lesson 2 Analogy Chart Answer Key

Lesson Focus Question: *What causes deltas to form?*

Part of model	... is/are like ...	Part of real world	They are alike because ...
Sand, soil, and rocks		Land	There is sand and rocks of different sizes around rivers.
Water as it runs out of the jug		River	A river is a stream of water that flows downward.
Water at the bottom of the stream table		Ocean	Rivers flow into lakes and oceans.

Stream Model Observations

Directions

Part 1: Prepare the stream table and make initial observations.

a. Spread the earth materials—sand, soil, pebbles, and small rocks—all across your stream table so that it looks like the land on a hillside. Make sure you have a mix of different-size earth materials throughout.

b. Focus your attention on a few pieces of sand, 1 or 2 pebbles, and a larger rock that are all located together near the top of your stream table. Also, study the lower end of the stream table where the land meets the water.

   Predict: When the water starts running, what do you think will happen to the sand, pebbles, and rocks at the top of the stream table? What about the land near the bottom of the table?

I predict that…

Part 2: Start the flow of water and make observations.

a. Remove the golf tee and let water run through the earth materials.

b. Let about one-third of the water in the jug flow slowly through the earth materials and then replace the golf tee to stop the water.

c. Observe where the water moves in the stream model and where the earth materials move.

d. As a team, identify where earth materials are being taken away by water and where they end up on the stream table.

e. Repeat the water flowing one more time to see if you notice anything new or different.

Draw a bird's-eye view of your stream table showing where materials were moved from one place to another. **Use labels** to communicate your observations.

Part 3: Analyze and interpret your observations.

Describe your observations using the questions below. What happened when you let water flow over sand, pebbles, and rocks? Be detailed and specific.

1. On your stream table, where are earth materials being taken away?

2. On your stream table, where are earth materials being built up?

3. How is your stream model like the Mississippi River and its delta? How is it different?

Stream Table Setup Instructions

Use this reference for stream tables for Lessons 2, 3, and 4.

Number of Groups

- Lesson 2: The basic stream tables can be done in groups of 5–6 students so that all students can participate and make observations. We recommend having 5 setups and one additional setup for whole-class demonstrations.
- Lesson 3: There are five conditions to test. The lesson is written so that each group tests one condition and then shares their observations with the whole class.
- Lesson 4: This can be done in five groups (like in Lessons 2 & 3) or as a whole-class demonstration.

Supply list for all three lessons

- 6 gardening trays with no drain holes
- 6 plastic milk jugs with lids
- 7 golf tees (6 for Lesson 2; 1 extra for Lesson 3 big river condition)
- 1 50lb bag of play sand (8 cups per stream table)
- 6 cups of pebbles and small rocks (1 cup per stream table)
- 1 small container of dark-colored sand (blue or red)
- tap water
- books (wrapped in plastic bags) or waterproof objects to elevate jugs
- extra books to elevate one stream table (steep slope condition)
- fake grass, moss, gardening decorations (vegetation condition)
- 2 spray bottles (precipitation condition)
- 1 pair of scissors
- aluminum foil (can be folded to create a dam and create waves in Lesson 4)

Optional for easier cleanup

- foil to line trays
- 1 large bucket for collecting sand
- large bucket in which to drain water
- plastic bags to cover workspace and books
- sponge and/or paper towels

For Lesson 2

Make 6 basic stream tables.

- To make each setup, following these steps:
  - Mark each jug in thirds with a permanent marker.
  - Cover the work areas with plastic trash bags.
  - Line tray with foil for easier cleanup.
  - Mix 8 cups of sand and 1 cup of gravel/small rocks in each stream table.
  - To elevate the jug, stack the books and cover them with plastic. Alternatively, use wood blocks or other waterproof objects to elevate the jug.
  - Insert golf tee into jug and leave in place.
  - Fill the milk jug with water, replace the cap, and place the jug on top of the books. Make sure it is not leaking.
  - Set the buckets, sponge, and paper towels in a convenient location for students to independently clean any mess.

Mark jug in thirds.

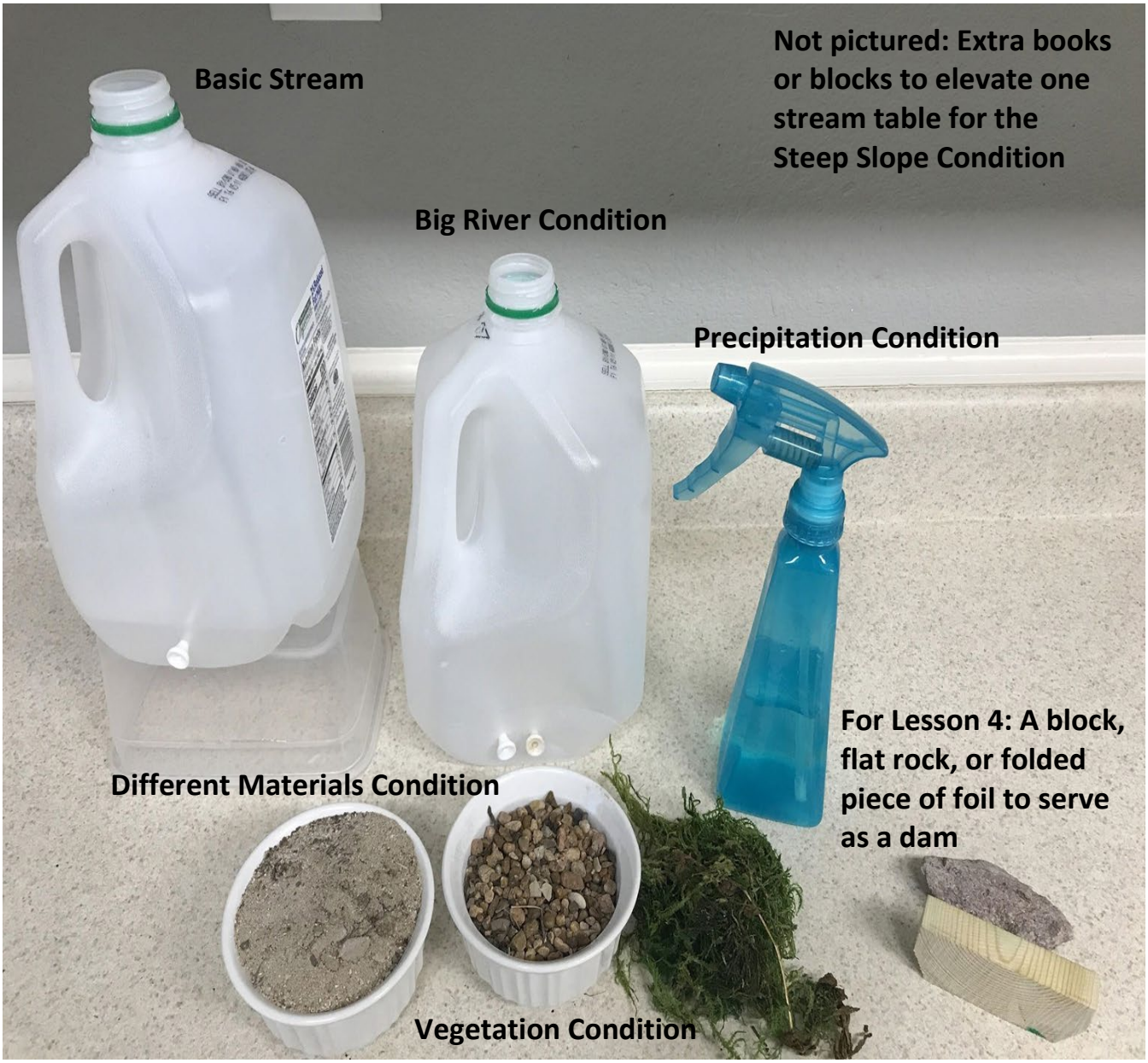
Jug with golf tee as the plug. Elevate on a stack of books or waterproof object.

Mixture of sand with some pebbles and rocks. If sand is very dry, moisten slightly using the spray bottle. Use a sloped condition.

To speed up the delta formation, consider using your finger to create a river channel in the sand.

Make a video of the stream table running: The entire surface of the stream table should be visible. The video should be of the stream running from a clean and level stream bed to the point where 1/3 of the jug is emptied. Before running the stream table, practice turning the milk jug lid, which acts as a valve to create a steady stream of water into an empty container. When running the stream table, try to aim for a single spot where the water hits the stream table each time. You will use this video in Lesson 3 as a comparison. If you forget to record the video before class, record one during class as students are running the stream table.

Additional Materials for Lessons 3 & 4



Lesson 3

Condition	Setup	Tips
Big river		• Use a new milk jug and two golf tees to create a big river scenario.
Steep slope		• Large textbooks work well to elevate both the stream table and the milk jug. • Wrap the books in plastic to protect them from any water that might spill.
Different materials		• Use a mixture of sand, pebbles, and rocks on one side. Use only sand on the other side. • Have students run the stream down one side at a time and then compare the results.

Condition	Setup	Tips
Vegetation		• You can choose to use real grass here, such as a small chunk of sod. • If using fake grass, moss, plastic shrubbery (as pictured), be sure to press them into the soil well.
Precipitation		• You can have multiple spray bottles to accelerate the effects of rain on the stream table system.

Lesson 4

Condition	Setup	Tips
Dam		• Use a wood block, flat rock, or folded foil to serve as the dam. • Be sure to carve out a river channel with your finger. • Consider running it first without a dam and then doing it a second time with the dam in place.