

Lessons 1–2

Grand Canyon Features and Patterns

Prepare

In this module, students discover how natural processes shape the features of Earth’s surface over time. The anchor phenomenon for this module, the Grand Canyon, illustrates how rock layers and fossils serve as evidence of change and how weathering and erosion play a role in shaping Earth’s surface.

Lesson 1 introduces students to the Grand Canyon as they learn about John Wesley Powell, who explored the Grand Canyon in 1869 and again in 1871. Students imagine what it would have been like to go on one of Powell’s expeditions by examining photographs and artwork of the Grand Canyon created during this time. Students then observe present-day photographs of the Grand Canyon and start to ask questions about how it might have formed. In Lesson 2, students build a driving question board based on their observations and questions in Lesson 1. The questions that students develop will help guide their learning throughout the rest of the module. Students then create an initial model of the Grand Canyon’s key features based on patterns in observed photographs. As they learn more throughout the module about how processes shape Earth’s features, students will update their anchor model to help explain how the Grand Canyon formed.

Concept 1: Rock Layers

Focus Question

What do Earth’s rock layers reveal?

Phenomenon Question

What can we discover in an unknown canyon?

Student Learning

Knowledge Statement

A landscape can be described by its distinctive features.

Objectives

- Lesson 1: Ask questions about the Grand Canyon’s distinctive features.
- Lesson 2: Develop a class anchor model of the Grand Canyon’s distinctive features.

Texas Essential Knowledge and Skills Addressed

- 4.3B **Represent the natural world using models** such as the water cycle and stream tables and identify their limitations, including accuracy and size. (Introduced)
- 4.3C **Connect grade-level appropriate science concepts with** the history of science, science careers, and **contributions of scientists.** (Introduced)
- 4.4 **Collect, record, and analyze information using tools, including** calculators, microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, mirrors, spring scales, balances, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, and **notebooks**; timing devices; and materials to support observation of habitats of organisms such as terrariums and aquariums. (Introduced)
- 4.7B **Observe and identify slow changes to Earth’s surface caused by weathering, erosion, and deposition from water, wind, and ice.** (Introduced)

English Language Proficiency Standards Addressed

- 2E **Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.**
- 3E **Share information in cooperative learning interactions.**
- 4A **Learn relationships between sounds and letters of the English language** and decode (sound out) words **using a combination of skills such as** recognizing sound-letter relationships and **identifying cognates**, affixes, roots, and base words.



Materials

		Lesson 1	Lesson 2
Student	Science Logbook (Lesson 1 Activity Guide)	●	
	Science Logbook (Lesson 2 Activity Guide, Module Question Log)		●
Teacher	John Wesley Powell Information (Lesson 1 Resource A)	●	
	Powell's 1871 Expedition Team Photographs (Lesson 1 Resource B)	●	
	<i>The Chasm of the Colorado</i> (Lesson 1 Resource C)	●	
	Present-Day Grand Canyon Photographs (Lesson 1 Resource D)	●	
Preparation	None		

Lesson 2

Objective: Develop a class anchor model of the Grand Canyon’s distinctive features.

Launch 2 minutes

Explain that John Wesley Powell kept very detailed notes of his observations and questions so that he could go back later to make sense of his observations, ensure that he answered his questions, and communicate his findings to others. Discuss that, in a similar manner, students have already begun their own record of observations and questions to help them make sense of information.

Display the class notice and wonder chart created during the previous lesson. Ask students whether they have thought of any more questions to add to the chart. Then ask students to select one question from the notice and wonder chart that interests them and that they think is important to develop an answer to the Phenomenon Question **What can we discover in an unknown canyon?** Have students write their questions on sticky notes.

Learn 40 minutes

Build a Driving Question Board 20 minutes

Display the driving question board, and write or reveal the Essential Question on the board: **How did the Grand Canyon’s features form?**

Agenda

Launch (2 minutes)

Learn (40 minutes)

- Build a Driving Question Board (20 minutes)
- Develop an Initial Model of Grand Canyon Features (10 minutes)
- Develop an Anchor Model (10 minutes)

Land (3 minutes)



English Language Development

As in most class discussions, allow students to consider each question and develop responses individually or with peers before whole-class sharing. This support may be particularly beneficial to English learners. For example, after posing each question about how the features of the Grand Canyon formed, invite students to share responses in pairs through a collaborative conversation routine such as Mix and Mingle or Inside-Outside Circles. These routines allow students to share thoughts with multiple peers before whole-class sharing. For more information, see the Instructional Routines section of the Implementation Guide (3E).

Explain that the driving question board and the Essential Question will help students focus the investigation of their questions throughout the module. 

Invite students to share the questions they wrote on their sticky notes. After one student reads a question and places it on the driving question board, ask students who think they have a related question to read theirs and place it next to that question. Throughout the discussion, ask follow-up questions or make suggestions to help students group their questions. 

Once students have finished posting their questions, work together to develop and post the Focus Question for each category on the driving question board. 



English Language Development

The Focus Questions in this module use vocabulary such as *layers*, *reveal*, *uncovered*, *form*, *processes*, and *features*. English learners may benefit from additional scaffolding in the form of sentence frames. Throughout the module, choose sentence frames based on students' English proficiency level and needs. Consider using sentence frames such as the ones below to scaffold conversations.

- Earth's rock layers reveal _____.
- The layers could show _____.
- We could observe _____ from the layers because _____.



Differentiation

If needed, differentiate how students share or group their questions. In smaller classes, students may write more than one question to provide enough questions. With English learners or striving writers, consider writing students' questions for them as the class shares. For groups reluctant to share questions, students may read each other's questions anonymously.



Teacher Note

As students share and post their questions to develop the driving question board, some teacher guidance will be necessary. To prepare, keep the Focus Questions for the module available for reference. As students post their questions, offer occasional guidance to ensure student question groups can later be summarized under each Focus Question.



Teacher Note

Some student questions may not fit into any of the four Focus Question categories. In that case, place the questions under the Essential Question or add a fifth category titled Other Questions. As students revisit the driving question board in future lessons, invite them to determine whether any of these questions can be answered or moved to a different category based on new knowledge.

Concept 1 Focus Question: **What do Earth's rock layers reveal?** 

Related student questions may include the following:

- *What made the different-colored stripes in the rocks?*
- *Is there anything in the layers?*

Concept 2 Focus Question: **How are Earth's rock layers uncovered?**

Related student questions may include the following:

- *Why is there a river at the bottom of the canyon?*
- *How long did the canyon take to form?*

Concept 3 Focus Question: **How do canyons around the world form?**

Related student questions may include the following:

- *Are there other canyons like the Grand Canyon?*
- *Do all canyons have rivers?*

Concept 4 Focus Question: **How do humans interact with Earth's features and processes?**

Related student questions may include the following:

- *Is anyone still exploring the Grand Canyon?*
- *Do people dig for fossils there?*

Keep the driving question board posted in a public place that makes it easy to update and revisit throughout the module. It may also be helpful to allow for space to post associated sample student products along the way. 🌟



Teacher Note

Each category on the driving question board relates to the Focus Questions that guide upcoming lessons. In Lessons 1 through 5, students explore rock layers with the Focus Question **What do Earth's rock layers reveal?** In Lessons 6 through 11, students explore weathering and erosion with the Focus Question **How are Earth's rock layers uncovered?** In Lessons 18 through 20, students explore patterns in Earth's features and processes with the Focus Question **How do canyons around the world form?** Finally, in Lessons 21 through 24, students begin to bridge to the Energy Module, which is focused on energy transfer and transformation, by exploring dams on the Colorado River through the Focus Question **How do humans interact with Earth's features and processes?**



Spotlight on Knowledge and Skills

The focus and relevance of student questions should improve as students continue to practice asking questions that can be investigated. To aid student growth, continually discuss which questions will lead to a deeper understanding of a phenomenon and how other questions can be improved. (4.2A)

Sample driving question board:

Essential Question: How did the Grand Canyon's features form?

Has the Grand Canyon always been there? What is the dark stuff covering the side of the Grand Canyon?

What do Earth's rock layers reveal?

What made the different-colored stripes in the rocks? Is there anything in the layers?

How are Earth's rock layers uncovered?

Why is there a river at the bottom of the canyon? How long did the canyon take to form?

How do canyons around the world form?

Are there other canyons like the Grand Canyon? Do all canyons have rivers?

How do humans interact with Earth's features and processes?

Is anyone still exploring the Grand Canyon? Do people dig for fossils there?

Related Phenomena:

Two empty colored boxes (green and purple) for student input.

At the bottom of the driving question board, add a section called *Related Phenomena*. Ask students to Think-Pair-Share with a partner as they generate a list of phenomena related to Earth's features. 📝

- ▶ **What other natural features have you observed? What does the Earth around you look like?**
 - *I went hiking on a mountain. It's tall and made of rock.*
 - *There are trees in the park. Are those natural features?*
 - *I saw a river in a movie that looks like the one near the Grand Canyon.*



Teacher Note

Using the collaborative conversation routine Think-Pair-Share allows students to share thoughts with peers before sharing with the whole class (3E).

► **What do you know about how other natural features form? Why might Earth look the way it does?**

- *The sidewalk can crack when plants grow in it. Is that making a natural feature?*
- *When it rains a lot, the pond near my house gets bigger. But I don't know if rain started the pond.*
- *I read about a volcano erupting. The book said the lava changed what the land looked like.*

As students share their ideas, record the relevant related phenomena. This student-generated list of phenomena should be referenced throughout the module and can be added to any time students suggest relevant related phenomena.

Develop an Initial Model of Grand Canyon Features 10 minutes

Tell students that Powell did not just write words in his journals; he also included sketches, diagrams, and models. Explain to students that diagrams and models do not require artistic skill, but they should include details and labels so others can understand what is being shown. Students should think about their previous observations about the Grand Canyon and how they might show that information by drawing their own models.

Instruct students to develop a model in their Science Logbooks (Lesson 2 Activity Guide) that incorporates the key **features**, or unique important parts, of the Grand Canyon.  As needed, allow students to refer to the photographs from the previous lesson. Once students finish their models, ask them to share their models with a partner. Students should discuss the similarities and differences between their models and record these observations in the table in their Science Logbooks (Lesson 2 Activity Guide). 



Content Area Connection: English

Add suffixes to *feature* to create new words such as *featuring*, *featured*, and *featureless*. Students use their knowledge of word meanings to determine the meaning of these new words, then use them in sentences. Challenge students to create sentences about both scientific and everyday contexts and use *feature* as a noun and verb.



English Language Development

Support English learners by providing sentence frames to help compare similarities and differences between models. For example, “My partner and I both _____.” or “My partner drew _____, but I drew _____.” (3E)



Check for Understanding

Students make many comparisons throughout this module. Ensure that students have meaningful conversations where they practice using precise terminology. Initially, students may use a variety of terms to describe the features of the Grand Canyon. Although students do not need to know the precise terminology at this point, assessing the prior knowledge that students bring to this subject helps monitor their progress throughout the module.

Evidence

- Students may refer to layers as *stripes*, *lines*, *bands*, or *colors*.
- Students may use *rocks*, *boulders*, *rubble*, *gravel*, *pebbles*, and similar terms interchangeably.
- Students may describe the holes in the canyon walls as *caves*, *craters*, or *black holes*.
- Students may think the river has cut through the rocks of the Grand Canyon.

Next Steps

Make notes of the language students use, and keep this list as a reference for future lessons. Lessons 3 and 4 build on this initial understanding and introduce precise terminology to students. As terms are introduced, encourage students to use the language in discussions, and use this list to remind students of the preferred terminology to use moving forward.

Sample student responses:

- *My partner and I both drew the Grand Canyon with a river at the bottom.*
- *I thought that the river cut through the rocks, but my partner thought the river was always there.*
- *I drew more layers in the walls of the Grand Canyon than my partner.*
- *My partner showed the little rocks at the bottom of the canyon, but I forgot. Then I added that to my model.*
- *I put a waterfall on my diagram to show the Grand Canyon can have falling water.*

Develop an Anchor Model 10 minutes

Explain that the class will develop an anchor model to demonstrate an understanding of the Essential Question **How did the Grand Canyon's features form?**



Teacher Note

The anchor model will be a point of reference throughout the module. As students uncover more about how natural processes (weathering and erosion) shape Earth's features, they will update this model to reflect their deepening understanding. At this point, students do not have enough information to explain how features formed.

Explain that the first step in developing a class anchor model is to determine what important features need to be included. Ask students what important features the anchor model should include. As students share features, ask the rest of the class to use nonverbal signals to indicate whether they agree that any new feature accurately represents a feature of the Grand Canyon. Call on students to justify their agreement or disagreement with evidence from their observations of the photographs of the Grand Canyon. As needed, ask additional questions to help students build on the ideas of others and express their own ideas clearly. 

Sample student responses:

- *I agree with drawing a river at the bottom of the Grand Canyon. We saw a river in the photographs from Powell's expedition and the photographs from now.*
- *I disagree with drawing trees everywhere in the Grand Canyon. Not all the photographs we looked at showed trees.*

If most students agree with adding a feature and can justify its inclusion, draw it on the anchor model. As the anchor model develops, students can choose to revise their initial models in their Science Logbooks.

Anchor models will vary, but most should include the following features:

- A river at the bottom of the Grand Canyon
- Layered walls
- Various colored rocks and layers

Depending on the class discussion, anchor models may also include features such as these:

- Arrows showing the flow of the river
- Landslides showing sides of the wall falling toward the river
- Caves, holes, or arches with water flowing through
- Sandy areas near the river's edge

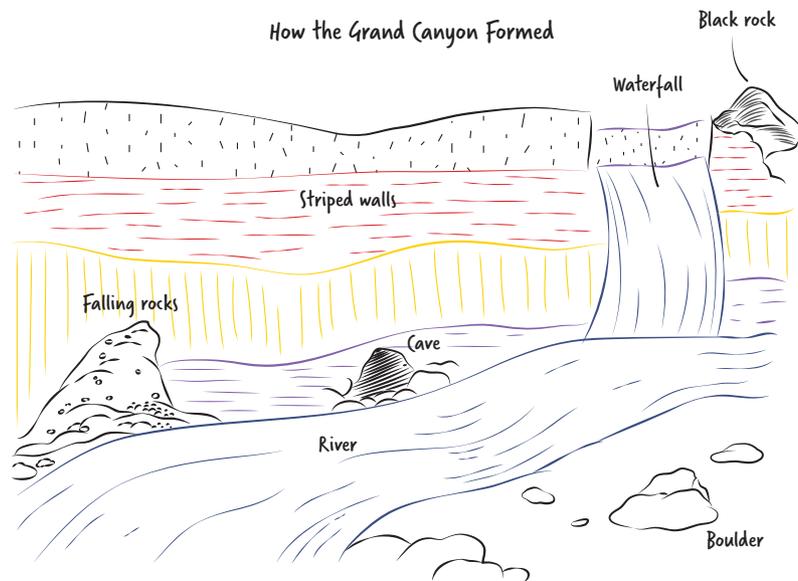
Include a title and an explanation on the anchor model.



Content Area Connection: English

In discussions, ensure that students share, expand, and clarify their thinking and listen carefully to others. Use additional questions and sentence frames to help students meet grade-level expectations for speaking and listening. For example, the sentence frame, “I agree (or disagree) with _____ because _____.” can help students “link to the remarks of others”. In addition, the follow-up question, “What evidence supports that idea?” can help students “explicitly draw on ... information known about the topic to explore ideas under discussion”. To encourage students to reference their classmates' remarks, consider requiring students to share something they learned from their partner when developing the anchor model.

Sample anchor model:



The rock walls of the Grand Canyon have different-colored stripes.

There is a river at the bottom of the canyon.

Land 3 minutes

Refocus students' attention back to the Essential Question, **How did the Grand Canyon's features form?**, and ask them to record it in the Module Question Log of their Science Logbooks. Then draw students' attention to the driving question board and ask them to think about which category would be the best place to begin answering the Essential Question. As needed, use a prompt such as this: Which of the Focus Questions must be answered first before the other questions can be answered?

Through discussion, guide students to choose the Concept 1 Focus Question: **What do Earth's rock layers reveal?** Inform students that over the next few lessons, the class will try to answer this question.

Optional Homework

Ask students to think about the key features they identified as part of the Grand Canyon by using a prompt such as this: Are those features found only in the Grand Canyon, or are there other places that have some of the same features? Students should make a list of ideas to share with classmates.

