Monument Valley: The Forces That Shape Our Earth

Unit	Utah SEEd Standard / NGSS Performance Expectation	Estimated Lesson Time:
Pattern is Earth's History and Processes	Standard ESS.2.4 Obtaining, evaluating, and communicating information about how Earth's internal and surface operate at different spatial and temporal scales. Emphasize how the appearance of land and seafloor features are a result of both constructive forces and destructive mechanisms. Examples of constructive forces could include tectonic uplift or mountain building. Examples of destructive mechanisms could include weathering or mass wasting. (ESS2.B)	45-60 Minutes

Lesson Overview

Learning Objective

Students will construct an explanation about the constructive and destructive forces that shaped Monument Valley and how these forces contributed to both stability and change in the landscape over time.

Anchor Phenomenon

The Monument Valley on the Utah-Arizona border

Driving Question

How do the combined effects of constructive and destructive forces shape Monument Valley over time?

Lesson Level Performance Expectations

Students will construct an explanation of how Monument Valley was formed. On the worksheet, they will answer: Explain how constructive & destructive forces worked together to form Monument Valley.

LESSON SNAPSHOT

LESSON SUMMARY:

	Estimated Time	Section Overview	How are students answering the driving question or meeting the learning objectives? (Highlight SEPs, DCIs, and CCCs)
Experience the Phenomenon	3-5	Phenomenon of Monument Valley and construct initial explanations	Students use prior knowledge to construct an initial explanation of how constructive and destructive forces shaped the formation of Monument Valley—ultimately affecting the area's stability and changes.
Investigate the Phenomenon	20-35	Card sort	Students will participate in an introductory lesson about the differences between constructive and destructive forces, with examples of each. They will use that knowledge to sort a set of cards based on those criteria. Afterwards, students will be prompted to sort according to their own criteria. Students will be required to construct an explanation for how they sorted the cards for the teacher's sign-off.
Model the Phenomenon	15	Demo and final explanations	The teacher will present either a demonstration or a video explaining how geological land formations develop. Students will use their observations and new knowledge to construct a final explanation for Monument Valley (its stability and change), resulting from various constructive and destructive processes.

DISCIPLINARY CORE IDEAS	SCIENCE & ENGINEERING PRACTICES	CROSSCUTTING CONCEPTS
NGSS Appendix E **ESS2.A Earth materials and systems** **Standard ESS.2.4** **Develop and use a model** to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales. Emphasize how the appearance of land and seafloor features are a result of both constructive forces and destructive mechanisms. Examples of constructive forces could include tectonic uplift or mountain building. Examples of destructive mechanisms could include weathering or mass wasting. (ESS2.B)	NGSS Appendix F **Constructing Explanations** Compare, integrate, and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.	NGSS Appendix G **Stability & Change** Much of science deals with constructing explanations of how things change and how they remain stable. Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. Feedback (negative or positive) can stabilize or destabilize a system.

		Systems can be designed for greater or lesser stability.
Related knowledge and skills from prior grades		
Disciplinary Core Idea: **NGSS Appendix E** By the end of grade 2. Wind and water change the shape of the land. By the end of grade 5. Four major Earth systems interact. Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, organisms, and gravity break rocks, soils, and sediments into smaller pieces and move them around. By the end of grade 8. Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes. High School Feedback effects exist within and among Earth's systems.	Science and Engineering Practices **NGSS Appendix F** Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.	Crosscutting Concept: **NGSS Appendix G** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. Small changes in one part of a system might cause large changes in another part. Stability might be disturbed either by sudden events or gradual changes that accumulate over time. Systems in dynamic equilibrium are stable due to a balance of feedback mechanisms.

Materials

Link to all materials on the 3DRST website (3drst.byu.edu): https://3drst.byu.edu/ess-2-4-earth-forces
Link to all materials on Canvas Commons: https://tinyurl.com/3DRSTearth

Student Materials	Teacher Materials	Lab Materials/Other Resources
Monument Valley Student Worksheet Card Sort Monument Valley Article Monument Valley Article (accommodation version)	Monument Valley Teacher Slides	How Monument Valley was Formed Video If doing the demonstration in class instead of showing the video: - Fine play sand from a hardware store. - A large tinfoil pan used for casseroles or cooking turkeys. - Water (A water bottle works nicely or a spray bottle)

Lesson Preparation

Material Preparation: Print the sort cards. You will need one set of cards for each group. You could laminate the cards if you want to reuse them.
Print the student worksheets and the reading articles for each student.
Obtain and prepare the demonstration materials.

How Monument Valley was Formed Demonstration

1. Show the video; or
2. Do the demonstration yourself
   - Demonstrate the process shown in the video yourself using a tray of sand and a bottle of water. Take your time and practice before you demonstrate.

Required Previous Knowledge:
This lesson builds on students' prior understanding of the following DCIs developed in previous units

- 2nd–5th grade → basic weathering, erosion, landforms
- 6th–8th grade → plate tectonics, geologic hazards, surface processes over time
- High School Earth Science → plate tectonics + Earth's history + human interaction with surface processes

Supports students will need/adaptations: A lower reading level article is provided for students who need help.

Vocabulary Definitions: Geologic Processes, Constructive and destructive forces, weathering, erosion, landforms, plate tectonics, uplift, cementation, deposition.

Experience the Phenomenon/Problem (Engage)

What Students Are Doing
Students use their existing knowledge and curiosity to investigate how Earth's surface evolves over time. They start developing an initial explanation of how these forces have shaped the distinctive landscape of Monument Valley. Students fill out the top box on the student workshop, answering the question, "What are your initial thoughts about how Monument Valley formed?"
What Teachers Are Doing
Slide 2: The teacher presents the phenomenon of Monument Valley using visuals or a video, encourages students to make observations, and guides discussion. Have students write down their initial thoughts on how these famous structures formed. They can include drawings to help them explain.

INVESTIGATE THE PHENOMENON (EXPLORE)

What Students Are Doing	Teacher Tips

Students engage in an introductory investigation to distinguish between constructive and destructive Earth processes. Using prior knowledge and new information, they collaboratively sort a set of scenario cards into two categories: constructive and destructive forces. Then, they are challenged to re-sort the cards according to their chosen criteria, promoting deeper thinking about how these forces interact and affect Earth's surface. Students document and explain their reasoning for the sort, which is reviewed and discussed with the teacher for feedback and clarification.	***For Initial Sort***
	• Use visuals or brief video clips to introduce **real-world examples** (e.g., volcanoes = constructive; erosion = destructive).
	• Offer a **word wall or anchor chart** to help students retain vocabulary.
	• Provide sentence frames like:
	  ○ *"We think this is constructive because…"*
	  ○ *"This process changes the land by…"*
	
	For Student-Created Sort
	• Encourage deeper patterns such as:
	  ○ Speed of the process (fast vs. slow)
	  ○ Natural vs. human-caused
	  ○ Water-based vs. wind-based forces
	• Validate creative reasoning, even if not perfect, as long as explanations are evidence-based.
	•
	For Explanations
	• Offer a **short writing template or graphic organizer** to scaffold reasoning.
	• Use this as a **formative assessment checkpoint** — assess students' understanding before moving into more complex applications (like Monument Valley analysis).

What Teachers Are Doing	**Teacher Tips**
Slides 3-4: The teacher introduces the concepts of constructive and destructive forces using clear definitions and real-world examples. **Slide 5:** As students work on the initial sort, the teacher circulates to observe group discussions, ask probing questions, and clarify misconceptions. When students are prompted to create their own sorting criteria, the teacher encourages flexible thinking and guides students to focus on key patterns or effects. The teacher reviews each group's explanation and provides feedback, helping students connect these ideas to how landscapes like Monument Valley form and change.	Sort #1- students sort according to constructive, destructive, or both Sort #2- students sort according to their own ideas- they must be prepared to discuss Sort #3- Students sort one more way that is different from the past two sorts. Be prepared to discuss with a different group.

MODEL THE PHENOMENON (EXPLAIN)

What Students Are Doing	Teacher Tips

Slide 6: Students observe a demonstration or video that shows how geological landforms are created and transformed through constructive and destructive forces (e.g., deposition, erosion, weathering, uplift). Using their prior knowledge, card-sort experience, and new observations, students develop a final explanation of how Monument Valley was formed and how it has changed over time. Students include specific evidence from the lesson to support their claims, focusing on both stability and change in the landscape.
Slide 7: Students read an article about how Monument Valley formed, and (**Slide 8)** take notes on their worksheets.
	Scaffold Explanation Writing:
	• Use prompts like:
	  ○ *"I think Monument Valley looks the way it does today because…"*
	  ○ *"The land changed when ___, which is a ___ force."*
	  ○ *"This process helped the land stay stable by…"*
	
	Visual Models Help:
	• Encourage students to draw diagrams showing the landform's evolution over time—labeling constructive vs. destructive processes.
	
	Connect Back to CCCs:
	• Use guiding questions like:
	  ○ *"What stayed the same? What changed?"*
	  ○ *"What caused this change?"*
	
	Provide Model Explanations (with intentional gaps):
	• Share a partial explanation and ask students to complete or critique it.

What Teachers Are Doing	**Teacher Tips**

The teacher selects and presents a high-quality video or demonstration showing how natural processes (e.g., erosion, uplift, volcanic activity) shape landscapes. During and after the video/demo, the teacher prompts students to observe closely and make connections to constructive and destructive forces. The teacher facilitates a class discussion, modeling how to connect observations to scientific concepts. Then, the teacher supports students in constructing written or visual explanations of how Monument Valley formed, ensuring that students include reasoning that accounts for both change and stability over time.	**Choose Strong Media**:
	
	• Select videos or demos that clearly show:
	  ○ *Erosion by water/wind*
	  ○ *Weathering of rock formations*
	  ○ *Layering and uplift over time*
	
	Model Think-Alouds:
	
	• Pause during the video/demo and model scientific observation:
	  ○ *"Notice how the rock layers are getting worn away—that's an example of destructive forces at work."*
	
	Use Sentence Starters or Graphic Organizers:

	• Give students tools to organize their thinking: ○ *Cause → Effect → Stability/Change* **Check for Understanding**: • Have students turn and talk or use exit slips to explain one constructive and one destructive force at work in Monument Valley. **Optional Extension**: Have students compare Monument Valley to another landform and explain differences in formation processes.

Possible Extensions/Alternative Adaptations

1. Compare & Contrast Landforms

- **Task**: Students research and compare Monument Valley with another landform (e.g., Grand Canyon, Bryce Canyon, Devil's Tower, Hawaiian Islands, Himalayan Mtn Range, Pine Valley Mountain, Delicate Arch, Colorado River Delta).
- **Focus**: Identify which forces (constructive/destructive) shaped each landform and how the processes differed.
- **Crosscutting Concepts**: Stability and Change; Cause and Effect

2. Create a Time-Lapse Landform Model

- **Task**: Students build a physical or digital model showing Monument Valley's formation over time.
- **Materials**: Sand, clay, diorama materials, or digital modeling tools (like Tinkercad or Google Slides).
- **Focus**: Emphasize layers, erosion, and rock formations developing over time.
- **Science and Engineering Practice**: Developing and Using Models

3. STEM Design Challenge: Preventing Erosion

- **Task**: In teams, students design a structure or method to slow down erosion in a landscape similar to Monument Valley.
- **Focus**: Use understanding of natural processes to solve a real-world problem.
- **SEP & CCC**: Designing Solutions; Cause and Effect

4. Write a Scientific Narrative

- **Task:** Craft a short story from the "point of view" of a rock or landform in Monument Valley, describing how it was shaped over millions of years.
- **Integration**: Combines science with creative writing and literacy standards.
- **Focus**: Reinforce vocabulary and geological timeline.

5. Local Connections Project

- **Task**: Investigate local or regional landforms that were shaped by similar forces (e.g., cliffs, canyons, river valleys).
- **Focus**: Apply understanding to local geology.
- **Enhancement**: Invite a geologist or use online geological maps and databases.

6. Cause and Effect Concept Map

- **Task**: Create a visual map showing how specific forces (wind, water, ice, tectonic uplift) caused specific changes in Monument Valley.
- **Tool**: Use Google Drawings or large chart paper.
- **CCC Focus**: Deepens understanding of cause-and-effect relationships.

7. Time Scale Timeline

- **Task**: Students build a timeline showing the formation of Monument Valley, noting when major constructive and destructive processes occurred.
- **Integration**: Supports understanding of **geological time**.
- **CCC Focus**: Scale, Proportion, and Quantity

This lesson was created by Mary Lamoreaux, Parker Peterson, and Ken Thornock