

7.2.2 Processes that Change Earth's Surface

Unit: 7.2.2 Processes that change Earth's surface over time and spatial scales.	Utah SEEd Standard / NGSS Performance Expectation: Standard 7.2.2 Construct an explanation based on evidence for how processes have changed Earth's surface at varying time and spatial scales. Examples of processes that occur at varying time scales could include slow plate motions or rapid landslides. Examples of processes that occur at varying spatial scales could include uplift of a mountain range or deposition of fine sediments. (MS-ESS2.A, MS-ESS2.C)	Time: 90 minutes
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Access to all material for this lesson: [Link to final lesson folder](#)

Anchor Phenomenon	Pictures of: 1- Rocky Mountains, 2- Glaciers, 3- Himalayan Mountains, 4- Monument Valley, 5- Alaskan earthquake, 6- Hunga Tonga Volcano 7- Cedar City, Utah flood. Students will discuss what processes formed/caused these formations/events in relation to time/space scales.
Driving Question(s)	What processes affect the earth's surface over time and spatial scales?
Performance Task	Students will be able to construct an explanation based on evidence from the investigation for how processes have changed Earth's surface at varying times and spatial scales.



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Lesson Summary:

	Time	Guiding Question / Learning Objective	How are students answering the guiding question or meeting the learning objective?
 Engage	10 min	Phenomena: Show the pictures (7) of the Rocky Mountains, glaciers, Himalayan Mountains, Monument Valley, Alaskan earthquake, Hunga Tonga volcano, and a flood. Driving question: What processes affect the earth's surface over time and spatial scales ?	Through the phenomena, student groups will construct an explanation as to which processes they notice that affect earth's surface over time and spatial scales .
 Explore	5 min	Teacher explores time and spatial scales with the students by giving analogies of time and space to help students think about varying time and spatial scales. Students follow along with the teacher (video and slides) to investigate the formation of the Rocky Mountains and get introduced to how they will gather and use information in the rest of the lesson.	Explain an analogy of time : 100 seconds: less than 2 minutes: actual time 1000 seconds: 16.7 minutes: actual time 1,000,000 seconds: 11.5 days: actual date 1,000,000,000 seconds: 31.7 years: actual month/year Explain an analogy of space : Solar System Whole Planet Country State County Town/City
 Explain	30 min	Students will rotate through 6 stations and investigate which processes formed/caused these formations/events to analyze varying time and spatial scales.	The teacher will have the 6 stations printed out and ready for students to explain each process and answer the questions in the worksheet.
 Elaborate		Using the evidence from the information, students will create a time and spatial scale .	Students will document thinking and evidence on student worksheets.
 Evaluate		Students will construct an explanation based on evidence (from the stations) for how processes have changed Earth's surface at varying times and spatial scales.	Students will construct an explanation using the evidence collected to compare/contrast how Earth's processes affected the Earth's surface changed over time and spatial scale .

Three Dimensions Focused on in This Lesson		
Disciplinary Core Idea: NGSS Appendix E Construct an explanation based on evidence for how processes have changed Earth's surface at varying time and spatial scales. (ESS2.A, ESS2.C)	Science and Engineering Practices: NGSS Appendix F Construct an explanation: Students construct an explanation of changes to Earth's surface occurring over varying spatial and temporal scales.	Crosscutting Concept: NGSS Appendix G Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
Learning Objectives 1. Standard 7.2.2 Construct an explanation based on evidence for how processes have changed Earth's surface at varying time and spatial <u>scales</u>. (ESS2.A, ESS2.C)		
Related Knowledge and Skills from Prior Grades		
Disciplinary Core Idea: NGSS Appendix E - 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. - Water movement causes weathering and erosion, changing landscape features.	Science and Engineering Practices: NGSS Appendix F Constructing explanations and designing solutions in 6–8 builds on K– 5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.	Crosscutting Concept: NGSS Appendix G Students recognize natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.

	• Construct an explanation using models or representations. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. • Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real world phenomena, examples, or events. • Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.	
Connections to Mathematics and ELA/Literacy Standards		
ELA/Literacy Standards: • RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. • RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). • RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. • WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.		Mathematics Standards: • MP.2 Reason abstractly and quantitatively. • 7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.



Materials		
Handouts	Supplies	Other Resources
Student Worksheet Student Assessment Worksheet	Calculators (One at each station)	PowerPoint Teachers can make multiple sets of the six processes (slides 11-46) for each student group. Student Worksheet and Assessment Key Rocky Mountain Video

ENGAGE	
What processes affect the earth's surface over time and spatial scales? Phenomena: - Show students the Pictures (Slide 1) of the Rocky Mountains, Exit Glacier, Himalayan Mountains, Monument Valley, Alaskan earthquake, Hunga Tonga Volcano, and the Cedar City, Utah flood. Driving question: What processes changed the Earth's surface over time and on spatial scales? Students will: - Predict what order the events would change the Earth's Surface over time. (Have students share out their predictions) - Predict what order the events would change the Earth's Surface over spatial. (Have students share out their predictions)	Teacher Tips Have students attempt to identify the pictures. The teacher could have the students do a group talk for the two driving questions.



EXPLORE

The teacher explores time and spatial scales with the students by giving analogies of time and space to help students think about varying time and spatial scales.

Ask students how long ago each of the following was.

Time: **(See Slide 2)**

100 seconds: less than 2 minutes: actual time

1000 seconds: 16.7 minutes: actual time

1,000,000 seconds: 11.5 days: actual date

1,000,000,000 seconds: 31.7 years: actual month/year

Ask students: What is the biggest thing you can think of?

Analogy of space: **(See Slide 3)**

World

Country

State

County

Town/city

As a whole class, watch the [Rocky Mountain formation video](#) (Slide 5)

The teacher will demonstrate expectations for the [worksheet](#) by walking through the Rocky Mountain slides, information, and the table for the Rocky Mountains on the worksheet.

Fill in the Rocky Mountain table together. **(Slide 6)**

Teacher Tips

When giving the time analogy, giving students time to think helps them to realize how different the answers are from what they expect for the last two.

Reference to Solar System Scale (taught in 6th grade) MS-ESS1-1, MS-ESS1-3.

Analogy of Space. Recreate to local areas that students will have previous knowledge of.

Have students fill in the worksheet independently after watching the video; then, ask them what they don't know and what they do know. Students could discuss their answers in a group talk.

Slide 7 has some of the answers for the Rocky Mountain table.

EXPLAIN

Make copies of the pictures in the slides for each station.

STATION TIME: The teacher will give directions for students to obtain the information packets, the time for each packet, and when students are expected to complete the stations.

TIMER: The teacher sets a timer. (It's best if everyone can see it.)

Divide students up into small groups. (Groups of 3 work best)

Students will rotate through 6 stations and investigate how processes formed/caused these formations/events to

Teacher Tips

The teacher will need to time the rotations.

Having at least two sets for each rotation will help facilitate rotating the students through the groups, especially if you have more than six groups.

Giving group members specific station tasks can keep them focused and engaged.



analyze varying time and spatial scales, filling out the information on their worksheets as they go.	(Reader, Calculator, Recorder, etc.) Each Rotation will be 5 – 7 minutes each. Make multiple copies of rotation sets for large classes.
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ELABORATE	
Provide a printout of the seven areas (slides 50 – 51) for each group. In groups, students take the pictures and arrange them according to time (fastest to slowest). Using the evidence from the information, students will create a time and spatial scale on their worksheet (p. 4). Students will need to use the information collected from the stations for the evidence. In groups, have students arrange events according to spatial scales (smallest to largest).	Teacher Tips If time allows, have students either go to another group and see how they arranged the events or have each group present to the class.

EVALUATE	
Construct an explanation based on evidence (from the stations) for how processes have changed Earth's surface at varying times and spatial scales. Construct an explanation by comparing and contrasting two events/formations based on their time and spatial scales. Self-evaluation using rubrics	Teacher Tips

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS
Identify the other processes that were caused by the earthquake and the volcano.

This lesson was created by Trampas Williams, Jan Hermansen, Brice Reeves, Denver Smith, & Julie Castellon.



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