Atmosphere, Hydrosphere & Geosphere- Weathering & Erosion

Grade(s): 4th
Lesson Duration: Class 2 weeks
Course Name(s): 4th grade science, reading, writing, math
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BIG IDEAS

How does the landscape change over time?
How do the processes of weathering and erosion shape the Earth's surface?

EDUCATION STANDARDS

4-ESS2- Earth's Systems

NGSS Performance Expectation(s):

4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Science and Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Planning and Carrying out Investigations Planning and carrying out investigations to answer questions and test solutions to problems in 3-5 builds on K-2 experiences and progresses to include investigations that control variables and provide	***ESS2.A: Earth Materials and Systems*** ● *Water, wind, ice, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around*	**Cause and Effect** ● *Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS2-1)*

evidence to support explanation or design solutions. ● Make observations and/or measurements to produce data to serve as the basis of evidence for an explanation of a phenomenon (4-ESS2-1)	*(4-ESS2-1)*	

Common Core State Standards:

Math:
MP.2 Reason abstractly and quantitatively. 4-ESS2-1
MP.4 Model with mathematics. 4-ESS2-1
MP.5 Use appropriate tools. 4-ESS2-1
4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurement, express measurement in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table. 4-ESS2-1

and

ELA:
W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. 4-ESS2-1
W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. 4-ESS2-1
W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. 4-ESS2-1
RI.4.7 Interpret information presented visually, orally, or quantitatively(e.g. in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. 4-ESS2-1
RI. 4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inference from the text 4-ESS2-1

ITEEA Standards: *N/A*
Other Standards: *N/A*

MEASURABLE STUDENT LEARNING OBJECTIVES

ENGAGE

Students will be able to make predictions about how the earth landforms form and change.

EXPLORE

Students will be able to explain the different types of weathering.
Students will be able to describe how gravity, running water, wind, and ice cause weathering and erosion.
Students will be able to estimate the amount of erosion and deposition on an island.

EXPLAIN

Students will be able to use their prior knowledge to identify different types of landforms.
Students will be able to explain how different landforms are formed.
Students will begin to research how landforms are formed.
Students will be able to explain the type of weathering needed to form a landform.
Students will be able to explain the type of erosion that is needed to form a landform.

ELABORATE

Students will be able to explain what a mudslide is.
Students will be able to explain the causes of a mudslide.
Students will be able to research how to prevent a mudslide.
Students will be able to compose a persuasive letter on how to prevent a mudslide.
Students will create and test their solution to prevent mudslides.

Evaluate

Students will demonstrate their understanding of the unit by completing a formative assessment.

MATERIALS NEEDED

ENGAGE

Weathering and Erosion Unit Google Slides 3-11
Video on Google slide 4
Exit slip slide 11

EXPLORE

Weathering and Erosion Unit Google Slides 12-29
Used the video with one question , article with one question, satellite images activity from An Island Forms and Changes
Video on slide 26
Land Ho! Article on slide 28
Satellite images on slide 29
Anchor Chart and Markers

Student Notebook and pencils

EXPLAIN

Weathering and Erosion Unit Google Slides 30-37
video 1, video 2 and article 1 on slide 32
Recording sheet and pencils

ELABORATE

Weathering and Erosion Unit Google Slides 38-50
Article on slide 43
Link 1, link 2, and link 3 on slide 44
Lab link on slide 50
Lab Materials

Each group needs:

- *Model House Template*
- *cardstock, 1 sheet, for construction of model houses*
- *transparent tape*
- *scissors*
- *markers, colored pencils, or crayons to decorate houses*
- *2 small paper cups; one for water, one for test material*
- *Mini-Landslide Worksheet, one per student*

Class

- *2 ft (.6 m) section of plastic downspout (available at hardware stores; ~$5)*
- *1 small bag of sand*
- *1 small bag of gravel*
- *1 small bag of volcanic (lava) potting rock (available at garden and landscaping stores)*
- *plastic bins to hold, wet and store the sand, gravel and volcanic potting rock (optional, but helpful)*
- *1 large, shallow, plastic waterproof tub (8-in x 14-in x 30-in or 20-cm x 36-cm x 76-cm, clear plastic is better but not necessary)*
- *plastic scoop (optional, or use small paper cup)*
- *duct tape*
- *scissors (to cut downspout plastic)*
- *ruler (or tape measure)*
- *stack of books, stool or chair, to support downspout*

EVALUATE

Weathering and Erosion Unit Google Slides 51-71
Video on slide 71

ENGAGING CONTEXT/PHENOMENON

My students will investigate the different types of weathering and erosion and how these processes

continuously change the Earth.

DATA INTEGRATION

Students will use the An Island Forms and Changes: Student Activity. I am modifying this by only using the video with question #3, the Nasa Blog; Land Ho! Visiting a Young Island with question #1 and the satellite images activity. In addition, I will be using the video from Earth Observatory to estimate the deposition and erosion of the coastline.

TEACHER BACKGROUND KNOWLEDGE

The teacher will need to be familiar with the different types of weathering and erosion. The teacher will also need to understand how weathering and erosion is changing the surface of the Earth.

DIFFERENTIATION OF INSTRUCTION

ENGAGE
Sentence Stems can be provided for class discussion

EXPLORE
Teacher provided notes with fill in the blank and give a word bank
Model & Guided Practice:
Students could work in pairs
Recording sheet provided
Teacher reads aloud the directions.
Breaks into smaller tasks by only assigning one part at a time.
Review of small group expectation via anchor chart

EXPLAIN
Purposeful grouping of students
Review group expectations
Jobs can be assigned by ability
Audio the article

ELABORATE
Purposeful grouping of students
Review group expectations
Audios of articles
Discussion stems
Sentence stems
Letter template and example

EVALUATE
Ability to use notes and anchor charts
Sentence stems
Read aloud

REAL-WORLD CONNECTIONS FOR STUDENTS

Students will be able to describe the different types of weathering and erosion.
Students will be able to understand how the Earth is constantly changing through the processes of weathering and erosion.

POSSIBLE PRIOR or MISCONCEPTIONS

Students may not know what weathering and erosion are as well as additional tier 3 vocabulary terms.
Students may not know that humans can help prevent some of these natural processes.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
Engage *1 day duration*	**Lesson Objective:** *Students will be able to make predictions about how the earth landforms form and change.* **Procedure:** *HOOK: The teacher will begin the lesson with explaining that we are going to study the interaction of the different spheres, Then the teacher will show the video on slide 4 about the grand Canyon. The class will discuss which spheres that they recognize and discuss how they are interacting and what they are wondering.* *Modeling & Guided Instruction: The teacher will show slides 5-9. The class will discuss how they think these landforms were created.* *Closing: The teacher will show the landform from slide 10 and ask students if they think that the landform is still changing. Afterwards, students will complete the Exit Slip on slide 11.* **Modifications** *Sentence Stems can be provided for class discussion* **Standards Addressed** *W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. 4-ESS2-1* *W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. 4-ESS2-1* *RI.4.7 Interpret information presented visually, orally, or quantitatively(e.g. in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. 4-ESS2-1*

	Formative/Summative Assessments *Students will be assessed over being able to draw conclusions and explain about how the canyon was formed. Informally, the teacher will use the class discussion and reflections. The teacher will use this to check for comprehension. If needed, the teacher will pull small groups if need to clarify this.* **Resources** *Weathering and Erosion Unit Google Slides 3-11* *Video on Google slide 4* *Exit Slip on slide 11*
Explore *2 days*	**Lesson Objective:** *Students will be able to explain the different types of weathering.* *Students will be able to describe how gravity, running water, wind, and ice cause weathering and erosion.* *Students will be able to estimate the amount of erosion and deposition on an island.* **Procedure:** *Day 1:* *HOOK:* *The teacher will begin the lesson by asking the students to look at the picture on slide 12. The teacher will ask the class to think about what they learned from yesterday and describe what they think happened in the photograph.* *Model & Guided Practice:* *The teacher will explain that the purpose today is for students to gain knowledge about how the land changes over time. Next, the teacher will explain the vocabulary terms weathering, erosion, and deposition using slides 13-24 (This goes into detail about the different types of weathering and erosion, so if short on time you can move through this quickly). These slides explain what weathering and erosion is, and give examples of different types. Students will take notes in their science notebook.* *Independent Practice: Students will go back to slides 5-10 and use the knowledge that they just acquired to determine how these landforms were formed.* *Closing; The class will complete the exit slip on slide 25 and then share some of their conclusions.* *Day 2:* *Hook:* *The teacher will show the video of how the island changes over time on slide 26. Then the class will discuss what they noticed and wonder.* *Model & Guided Practice:* *The teacher will ask the class to reflect on their learning from yesterday and answer what process could cause such rapid change from slide 27. Then the class will examine the photograph on slide 28*

	and discuss what evidence that they notice for how the coastline and size change over time. *Independent Practice: Students will compare and contrast the satellite images on slide 29. They will also use the map scale to measure the deposition and erosion. Then they will make an estimation with their measurements for the amount of erosion and deposition that has occurred on the island.* **Modifications** *Teacher provided notes with fill in the blank and give a word bank* *Model & Guided Practice:* *Students could work in pairs* *Recording sheet provided* *Teacher reads aloud the directions.* *Breaks into smaller tasks by only assigning one part at a time.* *Review of small group expectation via anchor chart* **Standards Addressed** *MP.2 Reason abstractly and quantitatively. 4-ESS2-1* *MP.4 Model with mathematics. 4-ESS2-1* *MP.5 Use appropriate tools. 4-ESS2-1* *4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurement, express measurement in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table. 4-ESS2-1* *W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. 4-ESS2-1* *W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. 4-ESS2-1* *RI.4.7 Interpret information presented visually, orally, or quantitatively(e.g. in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. 4-ESS2-1* *RI. 4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inference from the text 4-ESS2-1* **Formative/Summative Assessments** *An Island Forms and Changes activity will use this formative assessment to plan to decide if additional time is needed on exploring the processes.* **Resources** *Weathering and Erosion Unit Google Slides 12-29* *Used the video with one question , article with one question, satellite images activity from An Island Forms and Changes*

	Video on slide 26 *Land Ho! Article on slide 28* *Satellite images on slide 29* *Anchor Chart and Markers* *Student Notebook and pencils*
Explain *1 day*	**Lesson Objective:** *Students will be able to use their prior knowledge to identify different types of landforms.* *Students will be able to explain how different landforms are formed.* *Students will begin to research how landforms are formed.* *Students will be able to explain the type of weathering needed to form a landform.* *Students will be able to explain the type of erosion that is needed to form a landform.* **Procedure:** *Day 1* *Hook:* *The teacher will review the vocabulary terms on slide 31.* *Group Work:* *The teacher will explain that today we are going to put all of our knowledge together today. The teacher will complete a jig saw sorting. Some students will be in charge of the first video, some will have the second video and the last group of students will have the article. Students will be given time to investigate their source and then return to their group with the information that they have learned. The teacher will have the groups share out and then share the information on slide 33.* *Independent Work:* *Students will be instructed to complete slides 34-37 by answering the questions about which landform is being shown? How was it created? What type of erosion and weathering is being shown?* *Closing:* *The students will share their findings and what was most interesting and surprising.* **Modifications** *Purposeful grouping of students* *Review group expectations* *Jobs can be assigned by ability* *Audio the article* **Standards Addressed** *W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. 4-ESS2-1,*

	W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. 4-ESS2-1 *RI.4.7 Interpret information presented visually, orally, or quantitatively(e.g. in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. 4-ESS2-1* **Formative/Summative Assessments** *The teacher will use the recording sheet to check the understanding that students are able to identify the landform, explain how it was formed, describe the type of weathering and erosion.* **Resources** *Weathering and Erosion Unit Google Slides 30-37* *video 1, video 2 and article 1 on slide 32* *Recording sheet and pencil*
Elaborate *2 day*	**Lesson Objective:** *Students will be able to explain what a mudslide is.* *Students will be able to explain the causes of a mudslide.* *Students will be able to research how to prevent a mudslide.* *Students will be able to compose a persuasive letter on how to prevent a mudslide.* *Students will create and test their solution to prevent mudslides.* **Procedure:** *Hook:* *The teacher will show the effects of mudslides photographs to the class on slides 39-42.* *Model & Guided Practice:* *The teacher will share what a mudslide is and the causes on slide 43. As a class, they will read the article on 43.* *Group Work:* *Students will be put into groups of three and each student will be given one of the resources to investigate mudslide on slide 44. The group will discuss their findings. Then the whole class will examine some of the erosion solutions that are pictured on slides 45-47.* *Independent Work:* *Afterwards, the teacher will explain that the students are going to write a letter to a mayor to give suggestions of how to help prevent mudslides in his community.* *Closing:* *The teacher will have the students share what their suggestions were.* *Day 2* *Hook:* *The teacher will explain that today students will test out some of their suggestions.*

Group Work:
Students will complete the on slide 50 where students will set up a landslide made from different materials. They will be measuring the impact by measuring how far the debris is able to travel with each trial.

Closing: Groups will present their findings from the experiment.

Modifications
Purposeful grouping of students
Review group expectations
Audios of articles
Discussion stems
Sentence stems
Letter template and example

Standards Addressed
MP.4 Model with mathematics. 4-ESS2-1
MP.5 Use appropriate tools. 4-ESS2-1
4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurement, express measurement in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table. 4-ESS2-1W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. 4-ESS2-1
W.4.8 Recall relevant information from experiences or gather relevant information from print and digital a sources; take notes and categorize information, and provide a list of sources. 4-ESS2-1

Formative/Summative Assessments
The mini-landslide worksheet will be used as a formative assessment to see how well students were able to test different variables to prevent mudslides.

Resources
Weathering and Erosion Unit Google Slides 38-50
Article on slide 43
Link 1, link 2, and link 3 on slide 44
Lab link on slide 50
Lab Materials
Each group needs:
- *Model House Template*
- *cardstock, 1 sheet, for construction of model houses*
- *transparent tape*
- *scissors*
- *markers, colored pencils, or crayons to decorate houses*
- *2 small paper cups; one for water, one for test material*
- *Mini-Landslide Worksheet, one per student*

	Class ● *2 ft (.6 m) section of plastic downspout (available at hardware stores; ~$5)* ● *1 small bag of sand* ● *1 small bag of gravel* ● *1 small bag of volcanic (lava) potting rock (available at garden and landscaping stores)* ● *plastic bins to hold, wet and store the sand, gravel and volcanic potting rock (optional, but helpful)* ● *1 large, shallow, plastic waterproof tub (8-in x 14-in x 30-in or 20-cm x 36-cm x 76-cm, clear plastic is better but not necessary)* ● *plastic scoop (optional, or use small paper cup)* ● *duct tape* ● *scissors (to cut downspout plastic)* ● *ruler (or tape measure)* ● *stack of books, stool or chair, to support downspout*
Evaluate *1 Day*	**Lesson Objective:** *Students will demonstrate their understanding of the unit by completing a formative assessment.* **Procedure:** *The teacher will explain to the students that now they will complete the assessment on slides 52-71. The teacher can read aloud each slide while the students answer the question. On slide 71, students will need to pick 2 years in the video. The students will measure by using the scale in order to create estimates of the erosion and deposition that has occurred.* **Modifications** *Ability to use notes and anchor charts* *Sentence stems* *Read aloud* **Standards Addressed** *MP.4 Model with mathematics. 4-ESS2-1* *MP.5 Use appropriate tools. 4-ESS2-1* *4.MD.A.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurement, express measurement in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table. 4-ESS2-1* *W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. 4-ESS2-1* *W.4.8 Recall relevant information from experiences or gather relevant information from print and digital a sources; take notes and categorize information, and provide a list of sources. 4-ESS2-1* *W.4.9 Draw evidence from literary or informational texts to support*

	analysis, reflection, and research. 4-ESS2-1 *RI.4.7 Interpret information presented visually, orally, or quantitatively(e.g. in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. 4-ESS2-1* **Formative/Summative Assessments** *Formative assessment on slides 52-71 will be used as a summative assessment of the unit.* **Resources** *Weathering and Erosion Unit Google Slides 51-71* *Video on slide 71*

References:

Engage-

Smithsonian Channel. (2016). *How was the Grand Canyon Formed?.* Retrieved November 20, 2023, from https://www.youtube.com/watch?v=t6IBg4Srb6E

Explore-

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Explain-

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Elaborate-

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Evaluate-

Earth Observatory. (2023). *World of Change: Coastline Change.* Retrieved on November 20, 2023, from https://earthobservatory.nasa.gov/world-of-change/CapeCod