3-5 SCIENCE
PERFORMANCE TASK TEACHER INSTRUCTIONS

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TASK OVERVIEW

TITLE	GRADE LEVEL	SUBJECT AREA	INSTRUCTIONAL UNIT	TIME FRAME: HOW LONG TO ADMINISTER THE TASK?
Save Our Beaches! Coastal Flooding: Weathering and Erosion	4	Science	Soil, Rocks & Landforms	Three 45 minute periods

CONTENT AREA
PROFICIENCIES AND PERFORMANCE INDICATORS

GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
#7 Earth and Space Sciences - Earth Systems and Human Impact	Students will demonstrate an understanding of how and why Earth is constantly changing (ESS2) and how Earth's surface processes and human activities affect each other (ESS3) through the integration of scientific and engineering practices and crosscutting concepts.	D	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1)
#7 Earth and Space Sciences - Earth Systems and Human Impact	Students will demonstrate an understanding of how and why Earth is constantly changing (ESS2) and how Earth's surface processes and human activities affect each other (ESS3) through the integration of scientific and engineering practices and crosscutting concepts.	G	Generate and compare multiple solutions to reduce the impacts of natural earth processes on humans. (4-ESS3-2)

CROSS-CURRICULAR
PROFICIENCIES AND PERFORMANCE INDICATORS

GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
Problem Solving and Critical Thinking	Students will demonstrate problem solving and critical thinking by applying processes to define problems, evaluating possible outcomes, and persevering in solving complex problems.	6	Evaluate, justify and defend the relative effectiveness of the plan or process of approach.

NEXT GENERATION SCIENCE STANDARDS

Disciplinary Core Ideas
Rainfall helps to shape the land and affects the types of living things found in a region.

- Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- Living things affect the physical characteristics of their regions
- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
- Testing a solution involves investigating how well it performs under a range of likely conditions

Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Cross-Cutting Concepts

Cause & Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change

Stability & Change

- For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known

risks, and meet societal demands.
- People's needs and wants change over time, as do their demands for new and improved technologies

Science and Engineering Practices
- Make **observations** and/or **measurements** to produce data to **provide evidence** of weathering and the rate of erosion
- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
- Testing a solution involves investigating how well it performs under a range of likely conditions

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
- **Generate** and **compare** multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

SCORING CRITERIA[1]

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING
#7 Earth and Space Sciences - Earth Systems and Human Impact: D Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1)	Make observations of weathering and/or erosion.	Make observations and/or measurements to provide evidence of weathering and/or erosion.	Make observations and/or measurements to provide evidence of a cause and effect relationship between the rate of weathering/erosion and the environment.	Make observations and/or measurements from multiple forms of weathering and erosion and use them to provide evidence of a cause and effect relationship between weathering/erosion and the environment.

#7 Earth and Space Sciences - Earth Systems and Human Impact: G Generate and compare multiple solutions to reduce the impacts of natural earth processes on humans. (4-ESS3-2)	**Generate a solution** related to the impacts of natural earth processes on humans.	**Generate solutions** to reduce the impacts of natural earth processes on humans based on scientific information.	**Generate and compare multiple solutions** to reduce the impacts of natural earth processes on humans based on scientific information and the constraints and criteria of the design problem.	**Generate, compare, and evaluate multiple solutions** to reduce the impacts of natural earth processes on humans based on scientific information and the constraints and criteria of the design problem in order to make recommendations for improvement.
Problem Solving and Critical Thinking: 6 Evaluate, justify and defend the relative effectiveness of the plan or process of approach.	**Describe** the data/information gathered from plan or approach and **state** whether the plan or process of approach was effective.	**Identify** relationships in data/information gathered from plan or approach and **describe** whether the plan or process of approach was effective.	**Analyze** patterns and trends to identify relationships in data/information gathered from the plan or approach and to **evaluate** the effectiveness of the plan or approach.	**Justify** a data collection strategy by **analyzing** strengths and weaknesses and **critiquing** the potential effectiveness of a range of solutions with consideration of real-life constraints.

[1] Modifications were made to the Proficient and Expanding categories of Scoring Criteria for #7D to more accurately reflect the expectations of the Performance Indicator. The modified version is shown below.

If the decision is made to use this task, we advise using the modified Scoring Criteria. This may require the user to make adaptations to the task before administering it to students.

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING

#7 Earth and Space Sciences - Earth Systems and Human Impact: D Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (4-ESS2-1)	Make observations of weathering and/or erosion.	Make observations and/or measurements to provide evidence of weathering and/or erosion.	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	Use observations and/or measurements to explain the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

CONNECTIONS TO INSTRUCTIONAL UNIT

UNIT SUMMARY May include big ideas, authentic context, enduring understandings, essential questions.
This unit focuses on the phenomena that weathering by water, ice, wind, living organisms, and gravity breaks rocks into smaller pieces, erosion (water, ice, and wind) transports earth materials to new locations, and deposition builds new land as a result of the transport process. Students conduct controlled experiments by incrementally changing specific environmental conditions to determine the impact of changing the variables of slope and amount of water in stream tables. Students interpret data from diagrams and visual representations to build explanations from evidence and make predictions of future events. They develop model mountains and represent the landforms from different perspectives to look for change. Students gain experiences that will contribute to the understanding of crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; structure and function; and stability and change. **Essential Question**: How and why is earth constantly changing?

What will students know as a result of instruction in this unit in order to complete the task?	**What will students be able to do as a result of instruction in this unit in order to complete the task?**
Rainfall helps to shape the land and affects the types	Students work as a team to use stream tables to observe

of living things found in a region. ● Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ● Living things affect the physical characteristics of their regions Erosion is the transport of weathered rock material from one location to another. A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. ● Testing a solution involves investigating how well it performs under a range of likely conditions **Developing Possible Solutions** ● Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. ● At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. **Vocabulary:** weathering, erosion, deposition, sediment, flood, evidence, engineering, criteria, constraints, fair test	erosion. Students work in groups to use stream tables to learn how environmental variables can affect erosion. Students look for evidence of erosion in school yard. Students will be able to... Make **observations** and/or **measurements** to produce data to **provide evidence** of weathering and the rate of erosion **Generate** and **compare** multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

How will teachers know what students know and can do prior to the task? Which relevant concepts and skills have students struggled with, had misconceptions about or missed entirely?	**What background knowledge do students need (cultural, language, etc)? Have both content goals and language demands for ELL students been considered? Have the needs of diverse learners been considered?**
Formative assessments, notebooks, etc. Common misconceptions: difference between erosion and weathering, forces of weathering,	● Making scientific observations ● Engineering design process ● Conducting a Fair Test

	• Making claims, supporting with evidence and reasoning (CER) • What is a beach?

CULMINATING TASK

TASK SUMMARY
Students will research the problems of weathering and erosion that are occurring in coastal areas in order to design and evaluate multiple solutions using a closed stream table to simulate waves crashing on the beach. They will collaborate to research possible solutions to the problem, create models to compare solutions, and to deliver a persuasive letter, speech or presentation to the "town council" of the best solution. **Anchoring Phenomenon:** Rhode Island beaches are disappearing. In the areas that are most affected by erosion,the coastline has lost more than 250 feet of beach in the past 50 years. http://www.beachsamp.org

STUDENT ACTIVITY[2]

Part 1:

1. Students will work independently to make observations of erosion in coastal RI Communities.

2. Students will work together to research and compare possible solutions to reduce effects of erosion.

3. Students will work in groups to generate one additional possible solution to reduce effects of erosion.

Part 2:

4. Students will construct and test two models of the solutions they researched and/or generated.

5. Students will share observations of the effectiveness of their models in reducing weathering and erosion of their beach.

Part 3:

6. Students will write a letter or speech (claim/evidence/reasoning) to the town council presenting what they believe is the best method for reducing the effects of weathering and erosion of the town's beaches.

[2] The design team adjusted parts of the task based on their experiences administering it to students. As indicated in the student template, in step 1 students will work both as a group and independently.

CONSIDERATIONS FOR DIFFERENTIATION AND ACCESSIBILITY

- Graphic organizer for observations
- Students given sites to research to narrow focus
    - Table
    - Kiddle
    - Video
    - RI Beach SAMP
    - US Climate Resilience Toolkit
    - BBC
- Scaffold brainstorm strategies and/or provide graphic organizer
- Procedure to test models created by teachers instead of groups/students.
- Sentence starters
- Access to CER graphic organizer, word bank, and/or sentence starters.

ADMINISTRATION NOTES AND DIRECTIONS

1. Blendspace and student task sheet contains photos of erosion, and a place to note observations. Photos are also included in the Student Template. A time lapse video could also be used: time lapse of beach erosion

2. Use the table to reduce the number of choices that students can research. Websites are available for students who need access to additional research.

3. Prompt students to generate ideas by combining research and things they have learned about erosion. Students can brainstorm individually on post-it notes and then share out ideas and organize into like categories. Provide students with sentence starters: I think a solution would be to… I think this would work because…

4. Students will construct and test 2 different models using materials provided in 1 class period.

5. Sentence starters might include:
I noticed…I found out…My evidence shows…

6. Anchor charts with sentence starters and vocabulary words can be used. Students can choose from Google Docs, Screencastify, or Flipgrid as technology options for letter or speech.

MATERIALS AND RESOURCES

- Computers
- Coastal Observation Student Sheet
- 2 Stream Tables per groups of 4 students, (hole covered)
- Water
- Ruler to make waves
- Soil/sand

Design Supplies:

- Popsicle sticks
- Straws
- Rocks
- Tape
- Clay
- Legos
- Paper towel rolls

Supporting Resources:

CER graphic organizer

- Kiddle
- Video
- Table
- RI Beach SAMP
- US Climate Resilience Toolkit
- USGS: National Assessment of Coastline Change
- BBC