

Lesson 2: Water and Earth's Surface Erosion

Strand 3: System Interactions: Atmosphere, Hydrosphere and Geosphere		Time: 2 - 80 min classes
Objective: Develop and use a model to explain the mechanism of physical and chemical weathering as matter cycles through Earth's systems		
Utah Science with Engineering Education Standard (SEEd)		
ESS.3.1 Plan and carry out an investigation of the properties of water and its effects on Earth materials and surface processes.		
NGSS		
Science/Engineering Practice	Disciplinary Core Ideas	Cross Cutting Concepts
Planning/Carrying out Investigations Students will conduct an investigation to determine factors that impact surface weathering on bedrock and other materials found in a stream	(ESS2.C) The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics.	Cause/Effect students will set up a stream system that has controlled factors and measurable responses to changes within that system.

Rock Tumblers and Granite: Erosion by water and friction

Day 1:

Materials: Rock hammer, steel plate, impact goggles, water, 2 lb rock tumbler

1. Students will attempt to break apart a piece of granite, they will make and record observations about the force required and patterns of fractured pieces of granite.
2. Students will record the total and individual masses of 3-4 samples of granite.
3. They will take a picture of their rock samples, numbering/labeling a paper next each with their individual mass.
4. They will then place their samples in the barrel of the tumbler and fill ~half full with water.
5. They will seal the barrel and place on their base, these will be ran for 12 hours after school/overnight.

Day 2:

6. Students will carefully open their barrels in a tan tote. They will use a water bottle to 'rinse' the excess materials from their samples. These will be placed on a paper towel to dry BEFORE obtaining masses.
7. They will record observations regarding the appearance of their samples AND the material in the tub from the barrel.
8. Students will then obtain the masses of their dried samples and place them back on their original paper with the final masses recorded. NOTE: they will do their best to match them up however any outer marking would now be gone.
9. They will then complete the analysis portion of this lab analyzing the varied rates of weathering for their samples.

Stream Table Weathering Exploration

Day 1 PreLab

1. Explore previous knowledge: Discuss personal experiences, erosion/deposition, flooding, slot canyons (utah connection)
2. Teacher demonstration/class discussion of stream table set up, features, safety concerns, materials available, pour techniques, what types of observations they may make.
3. Students will plan their lab: materials, drawings of set up, explanation of variables and roles of each student for each 'test' in the group for the following day's lab.
4. Students will test the stream table set up and practice releasing water using an empty stream table with only water.
5. Students will obtain their materials, set up and run their experiment collecting data and observations.
 - a. Gradient/Water Speed
 - i. Record the time for water to flow in an empty stream table at each angle/height
 - ii. Students will calculate averages for each angle and develop a Claim-Evidence-Reasoning statement about gradient and water speed

6. Day 2

- a. Water speed and sediments
 - i. Students will set up a land mass in the upper half of the stream table, they will release a set amount of water at a slow/steady rate 3 times for each height of the ramp (1 block, 2 blocks and 3 blocks) They will measure time for the water to travel AND the distance stream matter traveled for each.
 - ii. Students will observe erosion patterns, distance matter traveled and the sizes of particles
- b. Channel Shape/Deposition Erosion patterns
 - i. Collect data on erosion/deposition patterns using 1 block for each of the following first with 'normal' water flow and next with flood water flow.
 1. Straight stream path
 2. Curving back and forth stream path

Day 2 Assessment/Conclusion/Reflection

1. Students will work first in their groups to answer each of the following questions, then we will discuss them as a class.
 - a. What patterns did you observe in erosion and deposition?
 - b. Where did the sediment originally come from for each process?
 - c. How does gravity impact the rates and patterns of erosion? (consider angle/speed of both the slope and water)
 - d. How does the speed of the water impact the path of streams?
 - e. What conditions would create meandering streams and oxbow formations?
 - f. What are some limitations of our models?
 - g. Does friction have an impact on erosion in stream beds?