Rock on the Move

Use trial data to distinguish weathering from erosion.

ESS.4.b "Analyze and interpret data to explain the effects of mechanical and chemical weathering and erosion on Earth's materials by wind, water, ice, and gravity."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Number the four conditions 1 to 4 in the order named in paragraph 2, write those numbers beside their matching table rows, underline one number showing rock change, and circle one number showing moved grains.

Four Trials on a Limestone Slope

1 On a limestone slope, dust scrapes rock and rain enters cracks. A class modeled these changes using matching limestone blocks beside equal piles of loose limestone grains on gently sloped trays. Each tray had a line downhill from the pile. The class measured block mass before and after each trial and weighed limestone grains that crossed the line.

2 The class tried four conditions on separate trays: wind carrying sand, mildly acidic rainwater, repeated freezing and thawing of water in a crack, and a sudden tilt of the tray. Scratches and widened cracks are signs of physical change. Limestone can also dissolve, leaving calcium in water. The table shows results from one set of trials.

RESULTS FROM FOUR LIMESTONE TRIALS

Condition	Block mass lost (g)	Grains past line (g)	Other evidence
Wind carrying sand	0.4	3.2	New scratches on block
Sudden tray tilt	0.0	8.4	Loose grains slid
Mildly acidic rainwater	1.5	6.1	Calcium detected in runoff
Repeated freezing and thawing	0.8	2.0	Crack widened; small pieces broke off

3 A lower block mass may mean that pieces broke off or that some rock dissolved. Grains beyond the line show that material moved, whether or not the block changed. These measurements track different effects, so one number alone cannot explain a trial. Surface observations and tests of water can help identify what caused a change.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare the wind and freezing trials. What evidence shows that each changed the block, and which moved more grains past the line?

2. What evidence suggests that the rainwater chemically weathered the limestone? How does its block mass loss compare with the wind trial?

3. Use two measurements from the tray-tilt trial to explain how erosion can happen without measurable weathering of the block.

4. A student claims that the trial with the greatest block mass loss also moved the most grains. Does the table support this claim? Cite both trials and their values.

3 YOUR TURN

Your own words

At a coastal walkway, water in limestone cracks freezes overnight, and a later wind piles loose limestone grit against a fence. In 3 to 4 sentences, explain which change shows mechanical weathering and which shows erosion, then propose one measurement for each and one test for chemical weathering.

ANSWER KEY

Rock on the Move

HIGH SCHOOL · ESS.4.b

PART 1 · READ AND MARK

Number the four conditions 1 to 4 in the order named in paragraph 2, write those numbers beside their matching table rows, underline one number showing rock change, and circle one number showing moved grains. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare the wind and freezing trials. What evidence shows that each changed the block, and which moved more grains past the line?	**Wind scratched the block, while freezing widened its crack and broke off pieces. Wind moved more grains, 3.2 g compared with 2.0 g.**
2	What evidence suggests that the rainwater chemically weathered the limestone? How does its block mass loss compare with the wind trial?	**Calcium in the runoff suggests that limestone dissolved. The block lost 1.5 g in the rainwater trial, compared with 0.4 g in the wind trial.**
3	Use two measurements from the tray-tilt trial to explain how erosion can happen without measurable weathering of the block.	**The tilt moved 8.4 g of grains past the line, but the block lost 0.0 g.**
4	A student claims that the trial with the greatest block mass loss also moved the most grains. Does the table support this claim? Cite both trials and their values.	**No. Rainwater caused the greatest block mass loss, 1.5 g, and moved 6.1 g of grains. The tray tilt moved the most grains, 8.4 g, but the block lost 0.0 g.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Freezing water widens the cracks in the limestone, which is mechanical weathering. I would measure crack width before and after the freeze. Wind moves loose grit to the fence, which is erosion, so I would weigh the grit there before and after the windy day. To test for chemical weathering, I would collect water that ran over the limestone and test it for dissolved calcium.

Accept other measurable evidence that distinguishes a change to rock from the movement of material. Dissolved calcium is a clue to chemical weathering, but its presence alone does not establish how much limestone dissolved.