Clues in Stone

Use rock and fossil evidence to explain different rates of evolutionary change.

E.8.7.4 "Use research and evidence to document how evolution has been shaped both gradually and through mass extinction by Earth's varying geological conditions (e.g., climate change, meteor impacts, and volcanic eruptions)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline evidence about changing conditions on Earth, circle evidence from fossils or rocks, and number each cause-and-effect link you find. Use your marks to compare gradual change with sudden mass extinction.

When Earth Changed the Rules

1 Horse fossils show that evolution can unfold over millions of years. Early members of the horse family lived among trees and ate leaves. As climates changed, grasslands spread across some regions. Fossils from later branches of the horse family include teeth with taller crowns, which lasted longer when grinding tough grasses and gritty food. Scientists compare these teeth with fossils of ancient plants and soils to study the connection between changing habitats and feeding traits. The fossil record shows several branches, not a single straight path to modern horses.

2 Some changes were far more sudden. About 66 million years ago, an asteroid struck near what is now Mexico. A thin rock layer from that time contains unusually high amounts of iridium, an element more common in asteroids than in Earth's crust. It also contains shocked quartz, a mineral altered by extreme impact pressure. Dust and other material thrown into the air blocked sunlight, disrupting food webs. Fossils show that many groups, including nonbird dinosaurs and ammonites, disappeared at this boundary in the rock record.

3 Rock layers help scientists compare the two patterns. Across many layers, horse-family fossils show changes in teeth as habitats changed. Near the asteroid-impact layer, the fossil record instead shows the disappearance of many groups within a short span of geological time. Some mammals survived, and their descendants later spread into a wider variety of habitats. The impact did not instantly turn survivors into new species. Rather, extinction changed which organisms remained, while evolution continued in the populations that survived.

2 ANSWER WITH EVIDENCE

Use the passage

1. What two kinds of evidence help scientists connect changing habitats with changes in horse-family teeth?

2. How do iridium and shocked quartz support the explanation for a sudden change in life about 66 million years ago?

3. How does the fossil evidence for gradual change in the horse family differ from the evidence for mass extinction at the asteroid-impact boundary?

4. A student says the impact instantly turned surviving mammals into new species. Which evidence in the passage challenges that claim?

3 YOUR TURN

Your own words

At a fictional coastal site, snail shells become thicker across many rock layers as water slowly cools. In one higher layer, volcanic ash appears, and most shell types are absent above it. Write four or five sentences explaining what might have happened gradually, what might have happened suddenly, and what further evidence would help test the volcano explanation.

ANSWER KEY

Clues in Stone

GRADE 8 · E.8.7.4

PART 1 · READ AND MARK

Underline evidence about changing conditions on Earth, circle evidence from fossils or rocks, and number each cause-and-effect link you find. Use your marks to compare gradual change with sudden mass extinction. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What two kinds of evidence help scientists connect changing habitats with changes in horse-family teeth?	**They compare fossil teeth with fossils of ancient plants and soils.**
2	How do iridium and shocked quartz support the explanation for a sudden change in life about 66 million years ago?	**Iridium is unusually abundant in the rock layer, and shocked quartz shows extreme impact pressure. Both support an asteroid impact, which sent material into the air and disrupted food webs.**
3	How does the fossil evidence for gradual change in the horse family differ from the evidence for mass extinction at the asteroid-impact boundary?	**Changes in horse-family teeth appear across many rock layers. At the impact boundary, many groups disappear within a short span of geological time.**
4	A student says the impact instantly turned surviving mammals into new species. Which evidence in the passage challenges that claim?	**Some mammals survived, but their descendants spread into more habitats later. The passage describes continued evolution after the extinction, not an instant change.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The thicker shells across many layers suggest that the snail population may have changed gradually as the water cooled. The ash layer and the loss of most shell types suggest a much faster event. A volcanic eruption may have changed the water or air enough to contribute to an extinction. Ash alone does not prove that the eruption caused the loss. I would look for the same ash layer and sudden fossil loss at other coastal sites to test that explanation.

For Part 3, accept explanations that treat the slow shell change and abrupt fossil loss as different patterns, while recognizing that ash and missing fossils alone do not prove a cause. A useful proposed test should seek additional evidence linking the eruption to the loss.