Life Reshapes Earth

Trace evidence of changing Earth systems and changing life.

HS-ESS2-7 "Construct an argument based on evidence about the simultaneous coevolution of Earth systems and life on Earth. Clarification Statement: Emphasis is on the dynamic causes, effects..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each action by living things, circle each change in a nonliving Earth system, and number the cause-to-effect links that form a feedback. These marks will help you build an evidence-based argument about coevolution.

A Planet Changed by Life

1. More than two billion years ago, some microbes in shallow seas used sunlight to make food. They released oxygen as a waste product. At first, much of that oxygen reacted with dissolved iron and rocks. Over time, oxygen began to build up in the atmosphere. This change was caused by life, but it also changed nonliving Earth systems. Oxygen altered the chemistry of surface environments and supported more efficient forms of respiration. Organisms that could use oxygen gained access to more energy, opening possibilities for larger, more complex life.

2. As atmospheric oxygen rose, chemical weathering on land changed. Weathering breaks rock into smaller pieces and dissolved materials. Oxygen helped create minerals that weather more readily under some surface conditions, and weathering released nutrients into soils and waters. Rivers carried these materials to lakes and oceans, where they could affect habitats. Weathering also removed carbon dioxide from the atmosphere over long time spans when carbon became stored in sediments. Thus, a biological change in the atmosphere influenced the geosphere, hydrosphere, and climate. Those changes created new environmental limits and opportunities for living things.

3. Life continued to reshape land. Microbes living on bare rock can produce acids and organic material. Their activity helps break down rock and add material that can become part of soil. Soil holds water and nutrients, making land less hostile to later plants. As plants spread, roots further cracked rock, and dead plant matter added more organic material to soil. Plant cover also slowed erosion in many places. Here, organisms changed the geosphere, while the new soils changed which organisms could survive on land. The result was a feedback: life modified conditions that later supported more life.

2 ANSWER WITH EVIDENCE

Use the passage

1. What evidence from paragraph 1 supports the claim that life changed Earth's atmosphere?

2. Trace the cause-to-effect chain in paragraph 2 from rising oxygen to one change in a nonliving Earth system.

3. How does paragraph 3 show a feedback between life and the geosphere?

4. Use details from paragraphs 1 and 2 to explain why the rise of oxygen was more than an atmospheric change.

3 YOUR TURN

Your own words

Scientists observe that reef-building corals make calcium carbonate skeletons that form reefs. Reefs reduce wave energy, alter erosion and deposition, and create habitats for many organisms. Write exactly four sentences that construct an argument explaining how this evidence shows coevolution between life and a coastal Earth system.

ANSWER KEY

Life Reshapes Earth

HIGH SCHOOL · HS-ESS2-7

PART 1 · READ AND MARK

Underline each action by living things, circle each change in a nonliving Earth system, and number the cause-to-effect links that form a feedback. These marks will help you build an evidence-based argument about coevolution. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What evidence from paragraph 1 supports the claim that life changed Earth's atmosphere?	**Photosynthetic microbes released oxygen, and over time that oxygen built up in the atmosphere.**
2	Trace the cause-to-effect chain in paragraph 2 from rising oxygen to one change in a nonliving Earth system.	**Oxygen rose in the atmosphere, which changed chemical weathering on land. Weathering released nutrients into soils and waters and also removed carbon dioxide over long time spans.**
3	How does paragraph 3 show a feedback between life and the geosphere?	**Microbes helped form soil, and soil held water and nutrients that made land more suitable for plants. Plants then further broke rock and added organic material to soil.**
4	Use details from paragraphs 1 and 2 to explain why the rise of oxygen was more than an atmospheric change.	**Microbial life increased atmospheric oxygen. The oxygen changed weathering, affected soils and waters, and influenced carbon dioxide and climate, creating new conditions for life.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Reef-building corals can coevolve with coastal Earth systems because they change shoreline conditions while those conditions affect life. Corals build calcium carbonate skeletons that form reefs. Reefs reduce wave energy, alter erosion and deposition, and create habitats for many organisms. Changes in sediment, water conditions, and habitats can then affect which corals and other organisms survive, creating a feedback between life and the coastal environment.

Accept responses that accurately identify a living cause, a change in one or more nonliving Earth systems, and a later effect on life. For the open task, require a defensible claim, use of both provided evidence statements, and reasoning that describes a feedback.