Roots, Rock, and Air

Trace how plants and Earth's systems shaped one another over time

ES.ESS2.7 "Engage in argument from evidence for how the simultaneous co-evolution of Earth's systems and life on Earth led to periods of stability and change over geologic time."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline evidence that plants changed air or rock, and circle evidence that Earth's conditions changed living things. Number two sentences that show a long-lasting pattern and its disruption.

When Forests Changed the Planet

(1) Around 385 million years ago, early forests spread across land that had once held far fewer plants. Their roots broke silicate rock into smaller pieces, and microbes living near the roots helped release minerals. Rainwater carried those minerals toward the sea. Over long spans of time, some of that material formed carbonate rock, a process that can remove carbon dioxide (CO_2) from the air. With less CO_2 trapping heat, Earth could cool. Thus living roots changed the geosphere and atmosphere, while the new soils held more water and nutrients, making it easier for later plants to grow.

(2) By about 320 million years ago, vast wetlands grew in parts of the tropics. Swamp plants made oxygen (O_2) through photosynthesis, as plants do today. When plants die and decay in air, decomposers consume O_2 and return much of the carbon to the air as CO_2. In waterlogged swamps, however, some dead plants were buried before they fully decayed. Their carbon later became coal, and the oxygen released during their growth was not all used up by decay. Over millions of years, this helped raise atmospheric O_2. Higher oxygen may have helped some large insects and other arthropods breathe.

(3) For millions of years, repeated plant growth and burial in wetlands helped keep carbon stored underground and oxygen relatively high. Those conditions supported ecosystems that included large arthropods, while wetland plants kept changing the air and land. But around 305 million years ago, many tropical wetlands shrank as climates shifted toward drier conditions in some regions. Fewer wet places meant less plant material could escape decay and become coal. This weakened one source of long-term oxygen buildup and changed habitats for wetland species. The record shows both directions of influence: life altered air and rock, and changing climate reshaped life.

2 ANSWER WITH EVIDENCE

Use the passage

1. Make a claim about how early forests could have cooled Earth. Support it with two linked details from the passage.

2. Why did burying swamp plants affect atmospheric O_2 differently from letting plants decay in air? Use evidence from the passage.

3. Argue that the wetlands were part of a long-lasting pattern involving both life and Earth's systems. What evidence supports your claim?

4. Argue that the drying around 305 million years ago set off more than one change. Trace its effects on living things and the atmosphere using passage evidence.

3 YOUR TURN

Your own words

Imagine forests spread across a rocky continent, but almost no dead plant matter is buried. In one paragraph, argue whether CO_2 and O_2 would both change as they did in the passage. Use two mechanisms from the text and identify one uncertainty.

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PART 1 · READ AND MARK

Underline evidence that plants changed air or rock, and circle evidence that Earth's conditions changed living things. Number two sentences that show a long-lasting pattern and its disruption. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Make a claim about how early forests could have cooled Earth. Support it with two linked details from the passage.	**Forest roots and nearby microbes helped break down silicate rock and release minerals. Some of that material later formed carbonate rock, removing CO_2 that would otherwise trap heat.**
2	Why did burying swamp plants affect atmospheric O_2 differently from letting plants decay in air? Use evidence from the passage.	**Decay in air consumes O_2. Burial kept some swamp plants from fully decaying, so not all the O_2 released during their growth was used up.**
3	Argue that the wetlands were part of a long-lasting pattern involving both life and Earth's systems. What evidence supports your claim?	**For millions of years, wetland plants repeatedly grew and were buried. This kept carbon underground and atmospheric O_2 relatively high, conditions that supported ecosystems with large arthropods.**
4	Argue that the drying around 305 million years ago set off more than one change. Trace its effects on living things and the atmosphere using passage evidence.	**Drier conditions shrank tropical wetlands, changing habitats for wetland species. With less plant matter buried, a source of long-term atmospheric O_2 buildup weakened.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

CO_2 might still fall because roots speed the weathering of silicate rock, which can eventually store carbon in carbonate rock. O_2 would be less likely to build up as it did when swamp plants were buried. Without much burial, decomposers would consume O_2 and release CO_2 as dead plants decay. The amount of CO_2 change is uncertain because the passage does not show whether removal through weathering would exceed the CO_2 returned by decay.

Accept claims that distinguish the possible CO_2 effect of rock weathering from the O_2 effect of plant burial and decay. Students should acknowledge that the net change in CO_2 cannot be determined from the passage.