From Pond to Stone

Trace traits that reveal plant evolutionary relationships.

BOT.2.1 "Summarize and justify the characteristics of nonvascular algae (blue-green and green algae) and bryophytes that provide evidence of evolution within the plant kingdom."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two traits green algae share with land plants, circle two moss features that help life on land, and write 1 beside a detail showing that mosses still depend on water.

A Film, a Pond, and a Moss

1 After a rainstorm, a slick green film appears beside a pond, while moss cushions hold water on a nearby stone. These organisms can look alike, but their cells tell different evolutionary stories. So-called blue-green algae are actually cyanobacteria, bacteria without nuclei or chloroplasts. They use sunlight to make food and release oxygen. Long ago, a cyanobacterium living inside another cell became the ancestor of chloroplasts. That event helps explain why plants can photosynthesize, but cyanobacteria are not plants, and today's cyanobacteria are not the direct ancestors of today's mosses.

2 In pond water, green algae have cells with nuclei and chloroplasts. Like land plants, they contain chlorophyll a and b, store food as starch, and often have cell walls made of cellulose. These shared features support an evolutionary connection. Among green algae, a lineage called charophytes shares additional cell structures with land plants. This evidence points to a common ancestor, not to modern pond algae changing into moss. Water supports many algae, and in some species, swimming reproductive cells travel through it. On land, a plant must keep its young from drying out and spread to new places without staying submerged.

3 Mosses are bryophytes, a group of small land plants that also includes liverworts and hornworts. A moss keeps its developing embryo attached to and sheltered by the parent plant. Its spores have protective walls that help them survive drying and travel through air. Rhizoids anchor the moss to a surface, but they are not true roots. Mosses lack the xylem and phloem that move water and sugars through vascular plants, so they generally stay small. Their sperm still need a film of water to reach eggs. Together, protected embryos and water-dependent fertilization show both a land adaptation and an older constraint.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does the origin of chloroplasts link cyanobacteria to plants without making cyanobacteria plants?

2. Which shared traits support an evolutionary connection between green algae and land plants? Why do these traits not mean today's pond algae became mosses?

3. How do two moss features help it live on land, and which part of reproduction still requires water?

4. A student says moss rhizoids and small size prove mosses are fully adapted to dry land. Use two details to challenge that claim, including one linked to mosses' lack of vascular tissue.

3 YOUR TURN

Your own words

Write a four- or five-sentence museum label for three living specimens: a cyanobacterial mat, green algae, and moss. Explain two shared traits, one land adaptation, and why the specimens do not form a direct ancestor chain.

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PART 1 · READ AND MARK

Underline two traits green algae share with land plants, circle two moss features that help life on land, and write 1 beside a detail showing that mosses still depend on water. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does the origin of chloroplasts link cyanobacteria to plants without making cyanobacteria plants?	**A cyanobacterium inside another cell became the ancestor of chloroplasts. Cyanobacteria remain bacteria without chloroplasts or nuclei, not plants.**
2	Which shared traits support an evolutionary connection between green algae and land plants? Why do these traits not mean today's pond algae became mosses?	**Both have chlorophyll a and b, store starch, and often have cellulose cell walls. The shared traits point to a common ancestor, not a change from modern pond algae into mosses.**
3	How do two moss features help it live on land, and which part of reproduction still requires water?	**A sheltered embryo protects the young plant, and protective spore walls help spores survive drying. Sperm still need a film of water to reach eggs.**
4	A student says moss rhizoids and small size prove mosses are fully adapted to dry land. Use two details to challenge that claim, including one linked to mosses' lack of vascular tissue.	**Rhizoids are not true roots, and mosses generally stay small because they lack xylem and phloem. Their sperm also need water to reach eggs.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The cyanobacterial mat represents the bacterial lineage whose ancient member became the ancestor of plant chloroplasts. Green algae share chlorophyll a and b and cellulose cell walls with land plants, evidence of a common ancestor. Moss has a protected embryo, an adaptation that helps young plants survive on land. It still needs water for sperm to reach eggs and lacks true vascular tissue. These living specimens reveal evolutionary relationships, not a chain in which one present-day specimen became the next.

Accept other passage-supported shared traits, such as starch storage, and land adaptations, such as protective spore walls. Look for a distinction between evidence of common ancestry and a claim that living organisms are one another's direct ancestors.