tpo_25_passage_1

The evolutionary history of plants has been marked by a series of adaptations. The ancestors of plants were photosynthetic single-celled organisms probably similar to today's algae. Like modern algae, the organisms that gave rise to plants presumably lacked true roots, stems, leaves, and complex reproductive structures such as flowers. All of these features appeared later in the evolutionary history of plants. Of today's different groups of algae, green algae are probably the most similar to ancestral plants. This supposition stems from the close phylogenetic (natural evolutionary) relationship between the two groups. DNA comparisons have shown that green algae are plants' closest living relatives. In addition, other lines of evidence support the hypothesis that land plants evolved from ancestral green algae: green algae used the same type of chlorophyll and accessory pigments in photosynthesis as do land plants. This would not be true of red or brown algae. Green algae store food as starch, as do land plants and have cell walls made of cellulose, similar in composition to those of land plants. Again, the food storage and cell wall molecules of red and brown algae are different. Today green algae live mainly in freshwater, suggesting that their early evolutionary history may have occurred in freshwater habitats. If so, the green algae would have been subjected to environmental pressures that resulted in adaptations that enhanced their potential to give rise to land-dwelling organisms. The environmental conditions of freshwater habitats, unlike those of ocean habitats, are highly variable. Water temperature can fluctuate seasonally or even daily, and changing levels of rainfall can lead to fluctuations in the concentration of chemicals in the water or even to periods in which the aquatic habitat dries up. Ancient freshwater green algae must have evolved features that enabled them to withstand extremes of temperature and periods of dryness. These adaptations served their descendants well as they invaded land. The terrestrial world is green now, but it did not start out that way. When plants first made the transition ashore more than 400 million years ago, the land was barren and desolate, inhospitable to life. From a plant's evolutionary viewpoint, however, it was also a land of opportunity, free of competitors and predators and full of carbon dioxide and sunlight (the raw materials for photosynthesis, which are present in far higher concentrations in air than in water). So once natural selection had shaped the adaptations that helped plants overcome the obstacles to terrestrial living, plants prospered and diversified. When plants pioneered the land, they faced a range of challenges posed by terrestrial environments. On land, the supportive buoyancy of water is missing, the plant is no longer bathed in a nutrient solution, and the air tends to dry things out. These conditions favored the evolution of structures that support the body, vessels that transport water and nutrients to all parts of the plant, and structures that conserve water. The resulting adaptations to dry land include some structural features that arose early in plant evolution; now these features are common to virtually all land plants. They include roots or rootlike structures, a waxy cuticle that covers the surfaces of leaves and stems and limits the evaporation of water, and pores called stomata in leaves and stems that allow gas exchange but close when water is scarce, thus reducing water loss. Other adaptations occurred later in the transition to terrestrial life and are now widespread but not universal among plants. These include conducting vessels that transport water and minerals upward from the roots and that move photosynthetic products from the leaves to the rest of the plant body and the stiffening substance lignin, which supports the plant body, helping it expose maximum surface area to sunlight. These adaptations allowed an increasing

diversity of plant forms to exploit dry land. Life on land, however, also required new methods of transporting sperm to eggs. Unlike aquatic and marine forms, land plants cannot always rely on water currents to carry their sex cells and disperse their fertilized eggs. So the most successful groups of land plants are those that evolved methods of fertilized sex cell dispersal that are independent of water and structures that protect developing embryos from drying out. Protected embryos and waterless dispersal of sex cells were achieved with the origin of seed plants and the key evolutionary innovations that they introduced: pollen, seeds, and, later, flowers and fruits.

question 1

According to paragraph 1, all of the following are true of ancestral plants EXCEPT:

A They had cellulose-based cell walls.

B They were closely related to green algae.

C They were able to store nutrients.

D They had a sophisticated multicellular structure.

question 2

What can be inferred from paragraph 3 about ancient green algae?

A They lived in a generally wet environment that was sometimes dry.

B They adapted better to changes in water temperature than they did to other changes in the environment.

C They inhabited areas that were close to the ocean.

D They lived primarily on land.

question 3

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

A Terrestrial plants had the advantages of not having rivals and having easy access to photosynthetic material.

B The abundance of photosynthetic material made life on land easier for

pioneering plants.

C Once plants had eliminated their competitors and their predators, their evolutionary process proceeded smoothly.

D Plant evolution eliminated competitors and made the process of photosynthesis more efficient.

question 4

According to paragraph 4, which of the following is true about the terrestrial world at the time it was colonized by plants?

A It was exposed to high levels of solar radiation.

B It contained a limited supply of carbon dioxide.

C It had developed 400 million years earlier.

D It lacked the presence of any organisms.

question 5

According to paragraph 5, all of the following are problems that early terrestrial plants had to overcome EXCEPT

A a tendency to become dry

B the inability to limit surface sunlight

C the absence of a structure to support the body of the plant

D the inability to transport water and minerals through the plant

question 6

What purpose does paragraph 5 serve in the larger discussion of the origins of terrestrial plants?

A To emphasize how long it took for ancestral plants to adjust to life on land

B To disprove the argument that land plants adapted easily to their new terrestrial environment

C To explain how plant colonization changed the physical environment of the terrestrial world

D To describe how ancestral plants solved the problems they confronted in colonizing land

question 7

According to paragraph 6, the adaptations made by terrestrial plants had which of the following effects?

A Plants developed reproductive strategies usable in both land and water environments.

B The plant diversity achieved in water environments diminished on land.

C Seed plants became the dominant species among plants.

D A greater range of plants was able to develop.

question 8

Which of the following best describes the author's presentation of the information about land plants?

A The author provides an overview of the evolutionary relationships between specific species of algae and land plants.

B The author discusses the transformations plants underwent in the process of changing from an aquatic to a terrestrial environment.

C The author establishes a pattern of similarity between major land and water plant groups.

D The author presents evidence to support the hypothesis that plants first fully evolved in water before finding their way on to land.

question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

The evolutionary history of plants has been marked by a series of adaptations. The ancestors of plants were photosynthetic single-celled organisms probably similar to today's algae. Like modern algae, the organisms that gave rise to plants presumably lacked true roots, stems, leaves, and complex reproductive structures such as flowers. All of these features appeared later in the evolutionary history of plants. Of today's different groups of algae, green algae are probably the most similar to ancestral plants. This supposition stems from the close phylogenetic (natural evolutionary) relationship between the two groups. DNA comparisons have shown that green algae are plants' closest living relatives. In addition, other lines of evidence support the hypothesis that land plants evolved from ancestral green algae: green algae used the same type of chlorophyll and accessory pigments in photosynthesis as do land plants. This would not be true of red or brown algae. Green algae store food as starch, as do land plants and have cell walls made of cellulose, similar in composition to those of land plants. Again, the food storage and cell wall molecules of red and brown algae are different. Today green algae live mainly in freshwater, suggesting that their early evolutionary history may have occurred in freshwater habitats. If so, the green algae would have been subjected to environmental pressures that resulted in adaptations that enhanced their potential to give rise to land-dwelling organisms. [] The environmental conditions of freshwater habitats, unlike those of ocean habitats, are highly variable. [] Water temperature can fluctuate seasonally or even daily, and changing levels of rainfall can lead to fluctuations in the concentration of chemicals in the water or even to periods in which the aquatic habitat dries up. [] Ancient freshwater green algae must have evolved features that enabled them to withstand extremes of temperature and periods of dryness. [] These adaptations served their descendants well as they invaded land. The terrestrial world is green now, but it did not start out that way. When plants first made the transition ashore more than 400 million years ago, the land was barren and desolate, inhospitable to life. From a plant's evolutionary viewpoint, however, it was also a land of opportunity, free of competitors and predators and full of carbon dioxide and sunlight (the raw materials for photosynthesis, which are present in far higher concentrations in air than in water). So once natural selection had shaped the adaptations that helped plants overcome the obstacles to terrestrial living, plants prospered and diversified. When plants pioneered the land, they faced a range of challenges posed by terrestrial environments. On land, the supportive buoyancy of water is missing, the plant is no longer bathed in a nutrient solution, and the air tends to dry things out. These conditions favored the evolution of structures that support the body, vessels that transport water and nutrients to all parts of the plant, and structures that conserve water. The resulting adaptations to dry land include some structural features that arose early in plant evolution; now these features are common to virtually all land plants. They include roots or rootlike structures, a waxy cuticle that covers the surfaces of leaves and stems and limits the evaporation of water, and pores called stomata in leaves and stems that allow gas exchange but close when water is scarce, thus reducing water loss. Other adaptations occurred later in the transition to terrestrial life and are now widespread but not universal among plants. These include conducting vessels that transport water and minerals upward from the roots and that move photosynthetic products from the leaves to the rest of the plant body and the stiffening substance lignin, which supports the plant body, helping it expose maximum surface area to sunlight. These adaptations allowed an increasing

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question 10

Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

A. Neither brown nor red algae are likely to be ancestors of plants because of their difference in pigmentation.

B. The instability of freshwater habitats caused marine algae to develop adaptations to their harsh environment.

C. The colonization of land by plants was a major revolution in the history of Earth.

D. Terrestrial plants adjusted to life on land by undergoing structural changes that enabled them to support themselves, resist drying, and exchange gases.

E. To colonize new terrestrial habitats, plants needed to create a way of reproducing without water.

F. Once plants had overcome the challenges posed by terrestrial life, they prospered by becoming less diverse.