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STUDY GUIDE

CHAPTER 21
Mosses and Ferns

Section 21–1 Plants Invade the Land *(pages 449–451)*

SECTION REVIEW

In this section you read about the earliest land plants. You also learned about major challenges that plants had to meet in order to survive on land.

The evolution of land plants was a long, slow process. Algae that could live out of water appeared about 500 to 600 million years ago. From these algae ancestors emerged at least two groups of land plants. One of these groups evolved into the bryophytes: mosses, liverworts, and hornworts. Another group evolved into the tracheophytes: ferns and the rest of the higher plants.

Both bryophytes and tracheophytes have adaptations that enable them to survive on land by acquiring water and nutrients from the environment; preventing water loss; exposing the plant to the sunlight needed for photosynthesis supporting the body of the plant; transporting water, nutrients, and other materials; allowing for gas exchange; and permitting reproduction in the absence of standing water. It is important to keep in mind that some land plants lack some of these adaptations. Not all land plants have completely solved the problems of life on land.

Designer Plants: Finding the Main Ideas

Design a plant that is adapted to the demands of life on land. Draw your plant in the space provided. Label and briefly describe the features that enable your plant to survive on land. *Note:* You may wish to draw your plant on a separate sheet of paper. If your plant has not completely solved the problems of living on land, describe what adaptations it lacks. Explain how the lack of these adaptations restricts the kinds of environments in which your plant can live.

Concept Mapping

The construction of and theory behind concept mapping are discussed on pages vii–ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 21–1 and how you would organize them into a concept map. Now look at the concept map for Chapter 21 on page 208. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 21–1. When you have finished the chapter, you will have a completed concept map.

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Section 21–2 The Mosses, Liverworts, and Hornworts *(pages 451–454)*

SECTION REVIEW

Bryophytes, like the algae from which they evolved, have life cycles that involve an alternation of generations between a haploid gametophyte and a diploid sporophyte. Also like the algae, these plants need water for reproduction to occur. Thus they can survive only in wet areas or in areas where a great deal of rain falls for at least part of the year. Bryophytes include mosses, liverworts, and hornworts.

Mosses, liverworts, and hornworts do not grow well outside of wet habitats for several reasons. They lack the water-conducting tubes that are found in higher plants. They lose water quickly to the surrounding air because their "leaves" lack a waterproof covering and are only one cell thick. And they also lack true roots, so they are not very efficient at taking in water from the soil.

The reproductive cycle of bryophytes is tied to a source of water because they have sperm cells that must swim through water to fertilize the eggs. In the last part of this section you examined the life cycle of a typical bryophyte: the moss *Mnium*. Recall that moss gametophytes have reproductive structures at their tips. One structure, the antheridium, produces sperm. The other structure, the archegonium, produces eggs. When a sperm joins with an egg, a diploid zygote is produced. The zygote grows into a diploid sporophyte plant, which grows on top of the gametophyte plant and is dependent on it for water and nutrients. The sporophyte produces haploid spores within a capsule. If a spore lands in a favorable place when it is released, it grows into an algalike mass of tiny filaments called a protonema. The protonema eventually develops into a gametophyte plant.

Small Plants, Big Ideas: Finding the Main Ideas

Bryophytes are small plants that are easily overlooked. However, they are important because they were the first plants to live on land.

1. Using your own words, explain how reproduction in bryophytes is similar to that in algae. _____

2. Describe places you would most likely find bryophytes growing. Why are these places good for bryophytes? _____

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3. Describe a place in which you would probably not find bryophytes growing. Explain why bryophytes would not grow in this place. _____

_____

_____

_____

_____

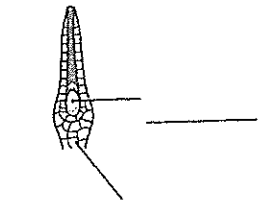
_____

Sequencing Events: Building Vocabulary Skills

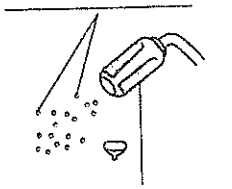
Diagrams A through H show parts of the life cycle of a moss. However, they are not in order.

Part A. Label the structures in Diagrams A through H.

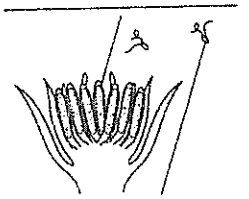
Part B. Put Diagrams A through H in the correct order by writing their corresponding letters in proper sequence in the table on the following page. In the proper place in the table, briefly describe the structures and events shown in each diagram. The first row has been filled out to help you get started.



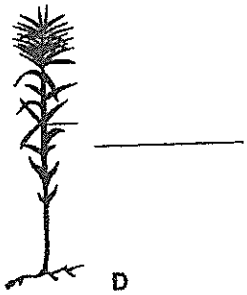
A



B

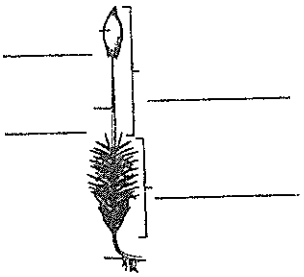


C

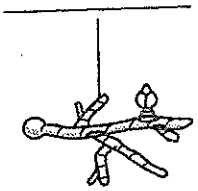


D

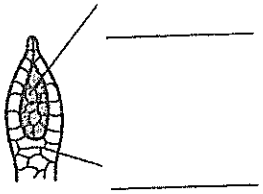
E



F



G



H

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	Diagram	Description
1	D	Mature gametophyte possesses reproductive structures at its tip.
2		
3		
4		
5		
6		
7		
8		

Concept Mapping

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Section 21–3 The Ferns and the First Vascular Plants *(pages 455–459)*

SECTION REVIEW

In this section you were introduced to the first "true" land plants, the tracheophytes. Members of this phylum have evolved ways of freeing themselves from dependence on wet environments. Tracheophytes have tissues specialized for internal transport, or vascular tissues. There are two types of vascular tissues: xylem and phloem. Xylem conducts water from the roots to all parts of the plant. Phloem transports nutrients and the products of photosynthesis around the plant. Tracheophytes are also characterized by true roots, stems, and leaves.

The first vascular plants, known as psilophytes, were small and lived close to the surface of the ground. Psilophytes had primitive vascular tissues but lacked true roots and leaves. Other groups of primitive tracheophytes include lycophytes (club mosses) and sphenophytes (horsetails). Only a few species of these two groups are alive today.

Unlike lycophytes and sphenophytes, which also evolved about 400 million years ago, ferns have been quite successful. There are more than 11,000 species of ferns alive today. Ferns have true vascular tissues, strong roots, creeping or underground stems called rhizomes, and large leaves called fronds. Even though ferns can survive in drier areas than mosses, the reproduction of ferns still depends upon water for sperm to swim to eggs. The life cycles of ferns, like those of other plants, involve alternation of generations. The large plants we recognize as ferns are the diploid sporophytes. Fern gametophytes are tiny, inconspicuous heart-shaped plants.

Standing Tall: Building Vocabulary Skills

Vascular plants such as ferns grow taller than bryophytes. In your own words, tell how each of the following structures enables vascular plants to overshadow the smaller bryophytes.

1. Vascular tissues: _____

2. Tracheids: _____

3. Cuticle: _____

4. Vascular cylinder: _____

5. Veins: _____

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Two Faces of Ferns: Finding the Main Ideas

1. **a.** What does a fern sporophyte look like?

_____

_____

_____

_____

b. Draw a sporophyte in the box labeled **Sporophyte.** Label the rhizome, roots, frond, and sori.

Sporophyte

2. **a.** What does a fern gametophyte look like?

_____

_____

_____

b. Draw a gametophyte in the box labeled **Gametophyte.** Label the prothallium, rhizoids, archegonia, and antheridia.

Gametophyte

3. Which generation can better survive drying? Explain.

_____

_____

_____

4. How does the sporophyte generation of a fern differ from the sporophyte generation of a moss?

_____

_____

_____

_____

_____

Concept Mapping

The construction of and theory behind concept mapping are discussed on pages vii–ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 21–3 and how you would organize them into a concept map. Now look at the concept map for Chapter 21 on page 208. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 21–3. When you have finished the chapter, you will have a completed concept map.

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Section 21–4 Where Mosses and Ferns Fit Into the World *(pages 460–461)*

SECTION REVIEW

In this section you briefly reviewed how mosses and ferns fit into the natural world. You then read about a few of the ways in which these plants affect humans.

Mosses and ferns are used by gardeners in several ways. Some are grown for their beautiful shapes and colors. Others, such as sphagnum moss and peat moss, are added to garden soils to make the soil better able to support the growth of other plants.

After certain kinds of mosses die and are subjected to enormous pressure for long periods of time, they form a type of coal called peat. The energy produced by burning peat can be used to heat homes and generate electricity.

A few types of ferns are eaten directly by humans. Young fern fronds, or fiddleheads, are harvested when they appear in the early spring. These fronds can be cooked and eaten.

Mosses and Ferns and People Too: Finding the Main Ideas

Certain newspapers have advice columns for gardeners. In these columns, an expert answers letters from readers and helps them solve their gardening problems. Suppose that you were in charge of such a column. In the space provided, respond to each of the following questions from your readers.

Question 1: I'd like to grow some mosses and ferns in my garden. What kinds of growing conditions are best for these plants?

Answer: _____

_____

_____

_____

_____

_____

Question 2: The dirt beneath the redwood deck in my backyard tends to wash away when it rains. Are there any kinds of ground cover plants that can be planted beneath the deck to hold the dirt in place?

Answer: _____

_____

_____

_____

_____

_____

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Question 3: I usually keep my fern plant indoors, but two weeks ago I put it outside so that it could benefit from the summer sunshine. Now the edges of its fronds are turning yellow and drying up. What should I do?

Answer: _____

Question 4: There is an unsightly patch of moss growing beneath a large tree in my yard. How do I get rid of it? I would prefer not to use chemical pesticides.

Answer: _____

Concept Mapping

The construction of and theory behind concept mapping are discussed on pages vii–ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 21–4 and how you would organize them into a concept map. Now look at the concept map for Chapter 21 on page 208. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 21–4. When you have finished the chapter, you will have a completed concept map.