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STUDY GUIDE

CHAPTER 22
Plants with Seeds

Section 22–1 Seed Plants—The Spermopsida *(pages 467–470)*

SECTION REVIEW

In this section you learned about the characteristics of seed plants, the spermopsida. You discovered that the members of this subphylum have numerous adaptations that allow them to survive life on land. Among these adaptations are roots, leaves, and stems; well-developed vascular tissues that conduct water and nutrients between roots and leaves; seeds; and a form of sexual reproduction that does not require standing water.

You learned that flowers and cones are the special reproductive structures of seed plants. It is within flowers and cones that the tiny gametophytes of seed plants grow and mature. The entire male gametophyte of a seed plant is contained in a structure called a pollen grain. The pollen grain is carried to the female gametophyte in a process called pollination.

In the last part of the section you learned that the zygotes of seed plants are protected by seeds. After fertilization, the zygote grows into a tiny plant called an embryo. The embryo then grows by using a supply of stored food within the seed.

Understanding Definitions: Building Vocabulary Skills

Each of the terms listed below has a special function that contributes to the successful growth and reproduction of seed plants. Match each term in the left column with its correct function in the right column.

_____ Xylem	**A.** Provide nourishment for growing plant embryo
_____ Seed coat	**B.** Provide place for gametophytes to grow and mature
_____ Pollination	**C.** Carries water and dissolved nutrients from the roots of plants to stems and leaves
_____ Phloem	**D.** Surrounds the plant embryo and protects it
_____ Flowers and cones	**E.** Contains the male gametophyte
_____ Pollen grain	**F.** Process by which the male gametophyte is carried to the female gametophyte
_____ Seeds	**G.** Transports products of photosynthesis from one part of the plant to another

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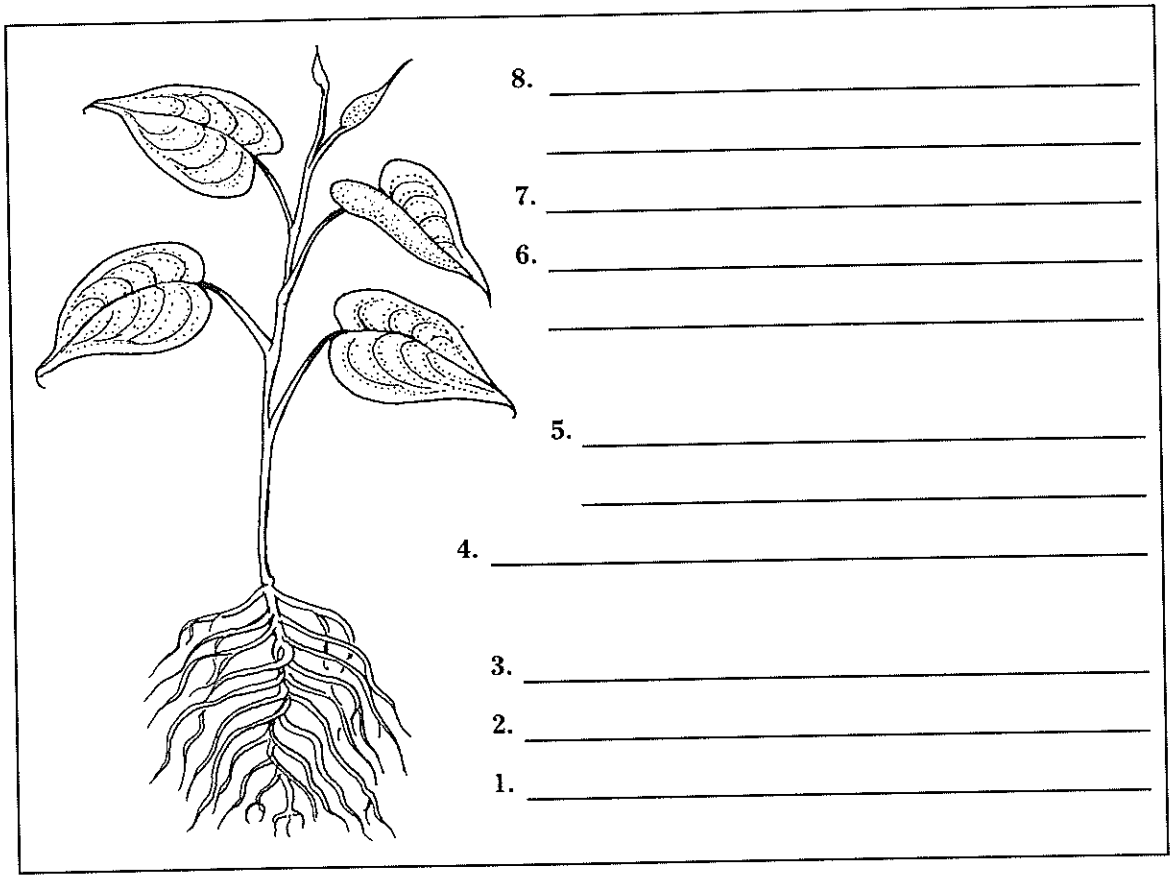
Roots, Stems, and Leaves: Understanding the Main Ideas

Each blank on the diagram below corresponds to one of the questions that follow. Read each question, then write the answer on the matching blank. When you are finished, you will have a labeled diagram that shows the most important adaptations of roots, stems, and leaves.



1. How do roots help nourish a plant?

2–4. What are three ways in which roots support and protect a plant?

5. What is the main function of stems?

6. Why are leaves vital to photosynthesis?

7. What adaptation slows down evaporation of water from leaves?

8. What substances enter and leave the leaf as needed? What adaptation allows this?

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 22–1 and how you would organize them into a concept map. Now look at the concept map for Chapter 22 on page 218. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 22–1. When you have finished the chapter, you will have a completed concept map.

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Section 22–2 Evolution of Seed Plants

(pages 471–475)

SECTION REVIEW

In this section you learned how seed plants evolved. You learned that the first seed plants to appear on Earth were seed ferns. Seed ferns were soon followed by the first cone-bearing plants, or gymnosperms. The gymnosperms have grown and flourished for several hundred million years. Many of these plants are important on Earth today. Flowering plants, or angiosperms, are relative newcomers to Earth. These plants first appeared during the early Cretaceous Period, about 125 million years ago.

As you continued studying this section you learned about the major characteristics of gymnosperms and angiosperms. You discovered that gymnosperms have reproductive structures called scales, which are grouped together in cones. The seeds are not covered by the cones but sit exposed on the scales.

You learned that unlike the seeds of gymnosperms, the seeds of angiosperms are protected by a fruit. You also learned that angiosperms can be separated into two subclasses, the monocots and the dicots. The most basic difference between these two groups is that monocots have one seed leaf when they first begin to grow, whereas dicots have two seed leaves.

Applying Definitions: Building Vocabulary Skills

Listed below are ten important terms from this section. Choose the correct term or terms from the list to answer the questions that follow.

scales	gymnosperms	pollen cones
flowers	angiosperms	fruit
monocots	cotyledons	dicots
vascular bundles		

1. Which terms are related to reproduction in angiosperms? _____

_____

2. Which terms are related to reproduction in gymnosperms? _____

_____

3. Which term refers to the first leaf that appears when a plant embryo begins to grow?

_____

4. Which terms describe two subclasses of flowering plants? _____

_____

5. Which term is related to xylem and phloem tissues? _____

_____

6. Which term includes trees such as pine and spruce? _____

7. Which term refers to plants such as tomatoes, apple trees, and orchids?

_____

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Interpreting a Time Line: Exploring the Main Ideas

The time line below shows the appearance of various types of seed plants. Use the time line to answer the questions that follow.

Time (millions of years ago)	430–395	395–345	345–280	280–225	225–190	190–136	136–125
Era	← Paleozoic →				←	Mesozoic	→
Period	Silurian	Devonian	Carboniferous	Permian	Triassic	Jurassic	Early Cretaceous
Plant Life	First land plants	Tree ferns grow into forests; first seed ferns appear; earliest conifers appear	Mosses and tree ferns continue to grow into forests; seed ferns continue to grow	Many cone-bearing plants appear	Cycads appear	Cone-bearing trees thrive	First flowering plants appear

1. What were the first types of seed-bearing plants to appear on Earth?

_____

2. How long ago and during what era and period did these plants appear?

_____

3. What changes did tree ferns and other spore-bearing plants undergo during the Devonian and Carboniferous periods? _____

4. During what period did the earliest conifers appear? _____

5. During what periods and how long ago did other cone-bearing plants appear?

_____

_____

6. How long ago and during what period did the first flowering plants appear?

_____

_____

7. About how long after the first plants appeared on Earth did flowering plants appear?

_____

8. About how many years were cone-bearing plants on Earth before flowering plants appeared? _____

_____

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Gymnosperms and Angiosperms

Each of the statements below describes either gymnosperms or angiosperms. If a statement describes gymnosperms, place a G in the blank before the statement. If a statement describes angiosperms, place an A in the blank before the statement.

_____ **1.** Include plants that are commonly called evergreens

_____ **2.** Are the most widespread of all land plants

_____ **3.** Palm trees are members of this group.

_____ **4.** Have reproductive structures called scales

_____ **5.** Some of these plants grow to more than 100 meters tall.

_____ **6.** Produce male and female cones

_____ **7.** Cyads are members of this group.

_____ **8.** Seeds are contained within a structure called a fruit.

Comparing Monocots and Dicots

The table below compares monocots and dicots. Fill in the missing information to complete the table.

Monocots	Dicots
Veins in leaves _____.	Veins in leaves _____.
Flower parts are in _____ or multiples of _____.	Flower parts are in _____ or multiples of _____.
In the stem, vascular bundles are _____ _____.	In the stem, vascular bundles are _____ _____.
Seeds have _____ cotyledon(s). .	Seeds have _____ cotyledon(s).
In the root, xylem _____ _____; phloem _____ _____.	In the root, xylem _____ _____; phloem _____ _____.

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 22–2 and how you would organize them into a concept map. Now look at the concept map for Chapter 22 on page 218. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 22–2. When you have finished the chapter, you will have a completed concept map.

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Section 22–3 Coevolution of Flowering Plants and Animals *(pages 476–481)*

SECTION REVIEW

In this section you took a second look at the evolution of seed plants. You discovered that flowering plants evolved at about the same time as the earliest mammals, after the earliest insects and birds. You learned that important relationships developed between flowering plants and a wide variety of animal species. These relationships evolved in a process that is known as coevolution. In coevolution, two organisms evolve structures and behaviors in response to changes in each other over time.

It is because of coevolution that various types of animals act as pollinators in the reproduction of flowering plants. Insects, birds, and mammals are attracted to flowering plants as a source of food. In turn, these animals carry pollen from one flower to another.

Coevolution has also made possible seed dispersal. Seed dispersal is the process by which seeds are distributed away from the parent plant. Although the seeds of some plants are dispersed by the wind, seeds of other plants are carried by animals. For example, some fruits have sharp barbs that become attached to the fur or feathers of mammals or birds. Other fruits are eaten by animals who excrete the indigestible seeds and thus deposit them in a new environment, where they can grow.

Understanding Definitions: Building Vocabulary Skills

1. What is vector pollination? Why is it important to flowering plants?

2. Discuss two reasons why seed dispersal is important to plants.

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Relating Concepts: Exploring the Main Ideas

The chart below shows several characteristics that have evolved among flowering plants and their pollinators. Use the chart to answer the questions that follow.

Plant Characteristic	Animal Characteristic
1. Flower color	Bees and birds are attracted by bright colors.
2. Flower odor	Moths, flies, and others have an excellent sense of smell.
3. Flower size and shape	Size and shape of body parts
4. "Landing platform"	Bees gather nectar only while standing.
5. Nectar composition	Diet requires ingredients found in nectar.
6. Nectar deep inside flower	Long tongue of moth

1. What senses enable pollinating animals to find flowers? _____

2. What characteristics of flowers make these senses useful? _____

3. In what ways have flowering plants and moths evolved to benefit each other?

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4. What special adaptations of flowers make them attractive to bees?

5. How has coevolution made flowers a source of food for animals?

6. How has the physical structure of flowers coevolved with the body structures of pollinating animals?

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 22–3 and how you would organize them into a concept map. Now look at the concept map for Chapter 22 on page 218. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 22–3. When you have finished the chapter, you will have a completed concept map.