

SECTION 8-1**SECTION SUMMARY**

The Plant Kingdom

Guide for Reading

- ◆ What characteristics do all plants share?
- ◆ What do plants need to live successfully on land?

Plants are autotrophs that produce their own food. In addition, all plants are eukaryotes that contain many cells.

The process by which plants make food is called photosynthesis. During photosynthesis, a plant uses carbon dioxide gas and water to make food and oxygen.

Most plants live on land. **For plants to survive on land, they must have ways to obtain water and other materials from their surroundings, retain water, transport materials throughout the plant, support their bodies, and reproduce successfully.**

Most plants have a waxy, waterproof layer covering their leaves called a **cuticle**. The cuticle helps keep water inside a plant cell rather than let it evaporate into the air.

Some plants have **vascular tissue**, an internal system of tubelike structures through which food and water move inside the plant. The vascular tissue also strengthens and supports the large bodies of plants.

All plants undergo sexual reproduction that involves **fertilization**. **Fertilization** occurs when a sperm cell unites with an egg cell. The fertilized egg is called a **zygote**.

Plants have complex life cycles that are made up of two different stages. In one stage, called the **sporophyte**, the plant produces spores. Spores are tiny cells that can grow into new organisms. A spore develops into the second stage, called the **gametophyte**. In this stage, the plant produces **gametes**, which are sperm cells and egg cells.



SECTION 8 - 1 **REVIEW AND REINFORCE**

The Plant Kingdom

◆ Understanding Main Ideas

Answer the following in the space provided.

- 1. What characteristics do all plants share?

- 2. What do plants need to live successfully on land?

◆ Building Vocabulary

From the list below, choose the term that best completes each sentence and write it in the blank.

- | | | | |
|-----------------|---------------|---------|------------|
| gametophyte | tissue | cuticle | gamete |
| vascular tissue | fertilization | zygote | sporophyte |

- 3. A group of similar cells that perform a similar function is called a(n) _____.
- 4. Internal transporting system through which water and food move inside the plant is called _____.
- 5. In the _____ stage, the plant produces two kinds of sex cells.
- 6. When a sperm cell unites with an egg cell, _____ occurs.
- 7. A(n) _____ is a waxy, waterproof layer that covers the leaves of most plants.
- 8. In the _____ stage, the plant produces spores.
- 9. A(n) _____ is either a sperm cell or an egg cell.
- 10. A fertilized egg is called a(n) _____.

SECTION 8-2

SECTION SUMMARY

Mosses, Liverworts, and Hornworts

Guide for Reading

- ◆ What characteristics do nonvascular plants share?

Mosses are a type of **nonvascular plant**. Some other nonvascular plants are liverworts and hornworts. **All nonvascular plants are low-growing plants that lack vascular tissue.** These small, low-growing plants have only their rigid cell walls for support. They do not have complex systems to transport water, nutrients, and food through their bodies. Nonvascular plants can only pass these materials from one cell to the next. Nonvascular plants must live in places with enough moisture for them to survive and reproduce.

The familiar green, fuzzy part of the moss is the gametophyte. The sporophyte generation grows out of the gametophyte. It is made up of a slender stalk with a capsule at the end. The capsule contains spores. Thin rootlike structures called **rhizoids** anchor the moss and absorb water and nutrients from the soil.

Sphagnum moss is a type of moss that grows in a wetland called a **bog**. The bog water is so acidic that the plants do not decompose when they die. Instead, layers of moss pile up at the bottom of the bog. Over time, the mosses become compressed into layers and form a blackish-brown material called **peat**. In Europe and Asia, people use peat as a fuel to heat homes and to cook food.

Many mosses are pioneer plants. They are among the first organisms to grow in areas destroyed by volcanoes or in burnt-out forests.

Two other kinds of nonvascular plants are liverworts and hornworts. The body of a liverwort looks somewhat like a human liver. Liverworts grow flat along the ground on moist soil and rocks. Hornworts grow horn-like structures, which are the sporophytes. Hornworts grow in moist soil.

REVIEW AND REINFORCE

Mosses, Liverworts, and Hornworts

◆ Understanding Main Ideas

Replace each number in the table with the correct word or phrase.

Characteristic	Mosses	1.	Hornworts
contain vascular tissue	no	2.	no
height	3.	low-growing	low-growing
size	small	small	4.
moisture needs	5.	places high in moisture	places high in moisture
where they grow	tree trunks or wet rocks	moist rocks or moist soil	6.
sporophyte appearance	stalks grow upward	7.	slender, hornlike structures

◆ Building Vocabulary

Write the letter of the correct answer on the line at the left.

- _____ **8.** Peat is made of
- a.** clay.
 - b.** layers of dead moss.
 - c.** sandy soil.
 - d.** fossilizing plant matter.
- _____ **9.** A bog is a type of wetland with
- a.** stagnant water.
 - b.** only dead plants.
 - c.** warm, slow-moving water.
 - d.** still, acidic water.
- _____ **10.** A nonvascular plant lacks all of the following except
- a.** vascular tissue.
 - b.** roots.
 - c.** leaves.
 - d.** cells.
- _____ **11.** The structures that anchor a moss and absorb water and nutrients from the soil are called
- a.** stems.
 - b.** rhizoids.
 - c.** sporophytes.
 - d.** gametophytes.

SECTION 8-3**SECTION SUMMARY**

Ferns and Their Relatives

Guide for Reading

- ◆ What are the main characteristics of seedless vascular plants?

The plants that grew in ancient forests were the ancestors of three groups of plants that are alive today—ferns, club mosses, and horsetails. **Ferns and their relatives share two major characteristics. They have vascular tissue and use spores to reproduce.**

Vascular plants, plants that have vascular tissue, are much better suited to life on land than are nonvascular plants. This is because vascular tissue strengthens the plant's body and transports food and water throughout the plant.

Ferns, club mosses, and horsetails need to grow in moist surroundings because they produce spores. These spores grow into gametophytes. When the gametophytes produce egg cells and sperm cells, they need water for fertilization to occur.

Most ferns have underground stems, leaves, and roots. The roots anchor the fern to the ground and absorb water and nutrients from the soil. The leaves of ferns are called **fronds**. The upper surface of each frond is coated with a cuticle that helps the plant retain water.

The familiar part of the fern with its fronds is the sporophyte stage of the plant. Spores develop in tiny spore cases on the underside of the mature fronds. After a time, the spores are released. If a spore lands in moist, shaded soil, it develops into a tiny gametophyte.

Two other groups of seedless, vascular plants are the club mosses and horsetails. Like ferns, club mosses and horsetails have true leaves, stems, and roots. They also have a similar life cycle. There are relatively few species of club mosses and horsetails alive today.

SECTION 8-3

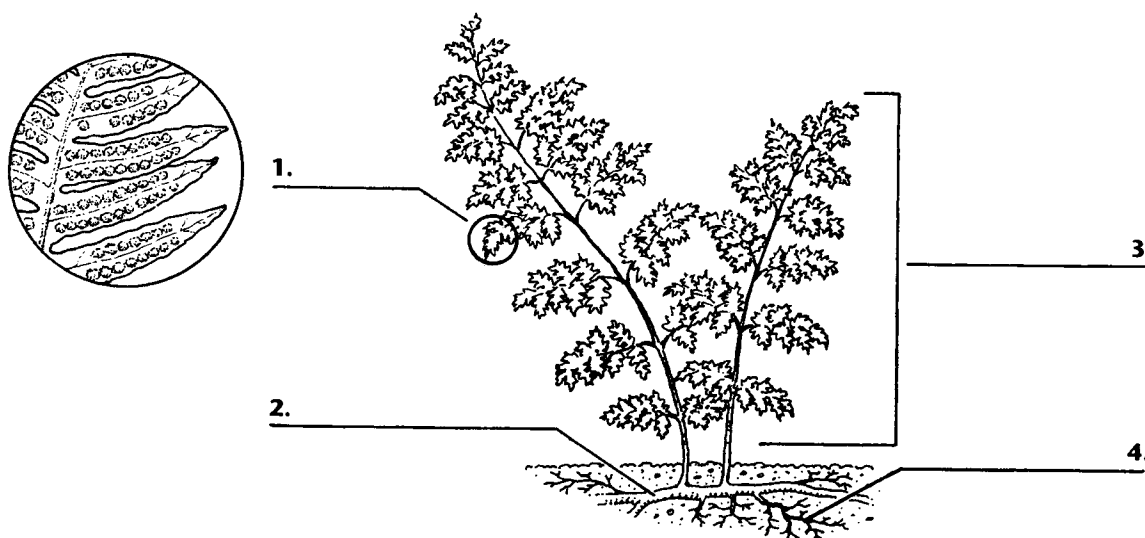
REVIEW AND REINFORCE

Ferns and Their Relatives

◆ Understanding Main Ideas

Choose the correct word to label the parts in the diagram below.

frond stem root
structures where spores are produced



Use the diagram to fill in the blanks with the correct term.

5. The entire organism represented above is the _____ stage of the plant.
6. When a spore falls into moist, shaded soil, it develops into the _____ stage.

Answer the following questions on the lines provided.

7. What two characteristics do ferns and their relatives share?

8. What are plants that have vascular tissue called?

9. Name the two groups of plants that are considered relatives of ferns.

SECTION 9-1**SECTION SUMMARY**

The Characteristics of Seed Plants

Guide for Reading

- ◆ What characteristics do seed plants share?
- ◆ What are the main parts of a seed?
- ◆ What are the functions of leaves, stems, and roots?

All seed plants share two characteristics. They have **vascular tissue** and **use seeds to reproduce**. They all have body plans that include leaves, stems, and roots.

Water, food, and nutrients are transported throughout plants in vascular tissue. There are two types of vascular tissue. **Phloem** is the vascular tissue through which food moves. When food is made in the plant's leaves, it enters the phloem and travels to the plant's stems and roots.

Water and nutrients travel in the vascular tissue called **xylem**. The plant's roots absorb water and nutrients from the soil. These materials enter the root's xylem and move upward into the stems and leaves.

Seeds are structures that contain a young plant inside a protective covering. **A seed has three important parts—an embryo, stored food, and a seed coat.**

The young plant that develops from the zygote, or fertilized egg, is called the **embryo** and has the beginnings of roots, stems, and leaves. In some plants, food is stored inside one or two seed leaves, or **cotyledons**. The outer covering of a seed is called the seed coat.

Germination is the early growth stage of the embryo. Germination begins when the seed absorbs water from the environment and uses its stored food to begin to grow.

Leaves capture the sun's energy and carry out the food-making process of photosynthesis. The underside of the leaf has small openings, or pores, called **stomata**. These open and close to control when gases enter and leave the leaf. The process by which water evaporates from the stomata in a plant's leaves is called **transpiration**.

The stem carries substances between the plant's roots and leaves. The stem also provides support for the plant and holds up the leaves so they are exposed to the sun. Inside the stem is a layer of cells called the **cambium**. The cells of the cambium divide to produce new phloem and xylem and to increase the stem's width.

Roots anchor a plant in the ground and absorb water and nutrients from the soil. The tip of the root is rounded and is covered by a **root cap**. The root cap protects the root from injury from rocks and other material as the root grows through the soil.

SECTION 9-1**REVIEW AND REINFORCE**

The Characteristics of Seed Plants

◆ Understanding Main Ideas

Answer the following questions in the space provided.

1. Name four characteristics of seed plants.

2. What are three important parts of a seed?

◆ Building Vocabulary

Fill in the spaces in the table below.

Part of Plant	Function
leaf	3.
cambium	4.
5.	anchors plants and absorbs water and minerals
seed	6.
7.	the vascular tissue through which water and nutrients travel
8.	the vascular tissue through which food moves
root cap	9.
10.	small openings or pores on the underside of leaves
stem	11.
cotyledon	12.



SECTION 9-2

SECTION SUMMARY

Gymnosperms

Guide for Reading

- ◆ What are the characteristics of gymnosperms?
- ◆ How do gymnosperms reproduce?

A **gymnosperm** is a seed plant that produces naked seeds—seeds that have no protective covering. **All gymnosperms produce naked seeds. In addition, many gymnosperms also have needlelike or scalelike leaves and deep-growing root systems.** Most gymnosperms are trees, although a few are shrubs and vines. Gymnosperms are classified into four groups—the cycads, the ginkgo, the gnetophytes, and the conifers. The conifers are the largest group of gymnosperms on Earth today.

Most gymnosperms have reproductive structures called **cones**. Most gymnosperms produce two types of cones: male cones and female cones. Male cones produce tiny grains of **pollen**, which contain the microscopic cells that will later become sperm cells. Female cones contain at least one ovule at the base of each scale. An **ovule** is a structure that contains an egg cell. After being fertilized, the ovule develops into a seed.

To reproduce, **first, pollen falls from a male cone onto a female cone. In time, a sperm cell and an egg cell join together in an ovule on the female cone.** The transfer of pollen from a male reproductive structure to a female reproductive structure is called **pollination**.

Many useful products come from conifers. Some of these products include paper and the lumber to build homes. Conifers are also used to make the rayon fibers in clothes.

Conifers are grown in large forests. Clear cutting is one method to obtain lumber. In clear cutting, all the trees in a large area of forest are cut down. This practice can destroy animals' homes and cause the soil to be washed away by rains.

SECTION 9-2

REVIEW AND REINFORCE

Gymnosperms

◆ Understanding Main Ideas

Study the diagram and read the following statements.
Fill in the blank to complete each statement.

1. All gymnosperms produce naked seeds. Many have _____ or scalelike leaves, and deep root systems.
2. Cycads, ginkgo, gnetophytes, and conifers are all gymnosperms. The plant shown is a _____.
3. The _____ shown on the plant are the reproductive structures.
4. The tree shown produces _____ in male cones.
5. The tree shown produces _____ in female cones.



◆ Building Vocabulary

Answer the following item in the space provided.

pollen ovule pollination

6. Briefly describe reproduction in gymnosperms. Be sure to include the above terms in your description.

SECTION 9-3

SECTION SUMMARY

Angiosperms

Guide for Reading

- ◆ What characteristics do angiosperms share?
- ◆ How do angiosperms reproduce?

An **angiosperm** is a plant that produces seeds that are enclosed in a fruit. Seeds develop in a protective structure called an **ovary**. The ovary is located within an angiosperm's **flower**—the reproductive structure of an angiosperm. **Two characteristics of angiosperms are that they all produce flowers and fruits.**

Although all flowers have the same function—reproduction—not all flowers appear the same. Some flowers lack **petals**—the colorful structures that you see when flowers open. A flower bud is enclosed by leaflike structures called **sepals** that protect the developing flower. Within the petals are the flower's male and female reproductive parts. Thin stalks topped by small knobs inside the flower are **stamens**, the male reproductive parts. The thin stalk is called the filament. Pollen is produced in the knob, or anther, at the top of the stalk. The female parts, or **pistils**, are usually found in the center of the flower. The sticky tip of the pistil is called the stigma. A slender tube, called a style, connects the stigma to the ovary, a hollow structure at the base of the flower. The ovary contains one or more ovules.

For angiosperms to reproduce, **first, pollen falls on a stigma. In time, the sperm cell and egg cell join together in the flower's ovule. The zygote develops into the embryo part of the seed.** As the seed develops, the ovary changes and eventually becomes a **fruit**—a ripened ovary and other structures that enclose one or more seeds.

Angiosperms are divided into monocots and dicots. **Monocots** are angiosperms that have only one seed leaf. Grasses, including corn, wheat, and rice, and plants such as lilies and tulips, are monocots. Dicots produce seeds with two seed leaves. **Dicots** include plants such as roses, violets, and dandelions.

Angiosperms have many uses. People and many animals depend on various kinds of angiosperms for food. Fibers such as cotton and flax are used to make clothing. Angiosperms are used to make many medicines. These include digitalis, which is a heart medication, and cortisone, which is used to treat arthritis and other joint problems.

SECTION 9-3

REVIEW AND REINFORCE

Angiosperms

◆ Understanding Main Ideas

Answer the following questions in the spaces provided.

1. Name two characteristics of angiosperms.

2. What do the male parts of the flower produce?

3. What do the female parts of the flower produce?

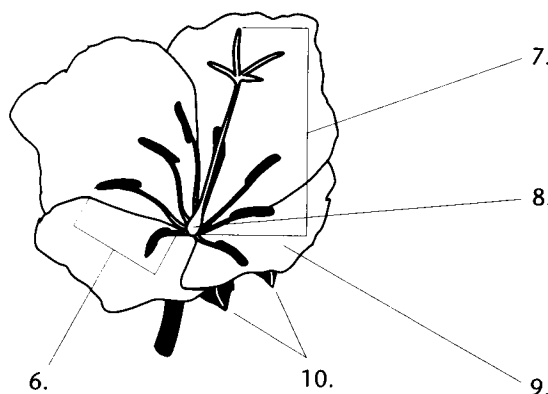
4. Briefly describe the process of embryo formation in an angiosperm.

5. What is the difference between a monocot and a dicot?

◆ Building Vocabulary

Fill in the blank with the term that matches the numbered part of the flower in the figure.

6. _____
 7. _____
 8. _____
 9. _____
 10. _____



SECTION 9-4

SECTION SUMMARY

Plant Responses and Growth

Guide for Reading

- ◆ What are three stimuli that produce plant responses?
- ◆ What functions do plant hormones control?

A plant's growth response toward or away from a stimulus is called a **tropism**. **Touch, light, and gravity are three important stimuli to which plants respond.**

A **hormone** produced by a plant is a chemical that affects how the plant grows and develops. **In addition to tropisms, plant hormones also control germination, the formation of flowers, stems, and leaves, the shedding of leaves, and the development and ripening of fruit.** One important plant hormone is named **auxin**. Auxin speeds up the rate at which a plant's cells grow. Auxin controls a plant's response to light by making some cells grow faster than others so that the plant bends toward the light.

Flowering plants that flower and die in the same year are called annuals. Annuals include marigolds, petunias, and pansies. Wheat, tomatoes, and cucumbers are also annuals. Biennials complete their life cycle in two years. Parsley and celery are biennials. Flowering plants that live for more than two years are called perennials. Oak trees and honeysuckle are examples of perennials.

SECTION 9-4

REVIEW AND REINFORCE

Plant Responses and Growth

◆ Understanding Main Ideas

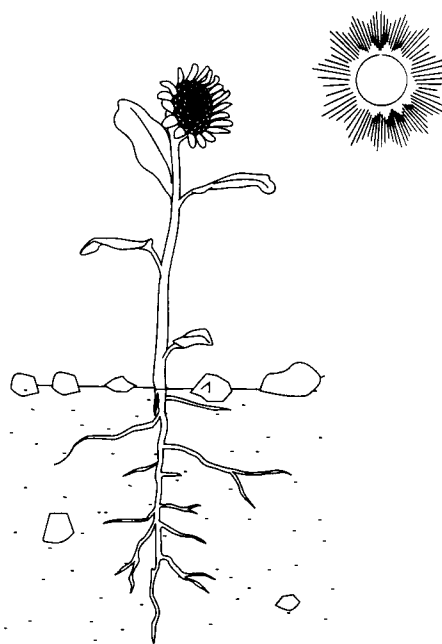
Study the diagram below, then answer the following questions in the spaces provided.

1. The plant in the figure is responding to what two types of stimulus?

2. What is the growth response shown in the figure called?

3. Are the plant's roots showing a positive or negative response?

4. Is the plant's flower showing a positive or negative response?



◆ Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term.

_____ 5. tropism

a. controls a plant's response to light

_____ 6. hormone

b. a plant's growth response toward or away from a stimulus

_____ 7. auxin

c. a chemical that affects how the plant grows and develops