Glencoe Science

Chapter Resources

Plant Reproduction

Includes:

Reproducible Student Pages

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- ✔ Chapter Review

HANDS-ON ACTIVITIES

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- ✔ Laboratory Activities
- ✔ Foldables–Reading and Study Skills activity sheet

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- ✔ Spanish Resources
- ✔ Teacher Guide and Answers

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Additional Assessment Resources available with Glencoe Science:

- Exam*View*® Pro Testmaker
- Assessment Transparencies
- Performance Assessment in the Science Classroom
- Standardized Test Practice Booklet
- MindJogger Videoquizzes
- Vocabulary PuzzleMaker at **msscience.com**
- Interactive Chalkboard
- The Glencoe Science Web site at: **msscience.com**
- An interactive version of this textbook along with assessment resources are available online at: **mhln.com**

To the Teacher

This chapter-based booklet contains all of the resource materials to help you teach this chapter more effectively. Within you will find:

Reproducible pages for

- Student Assessment
- Hands-on Activities
- Meeting Individual Needs (Extension and Intervention)
- Transparency Activities

A teacher support and planning section including

- Content Outline of the chapter
- Spanish Resources
- Answers and teacher notes for the worksheets

Hands-On Activities

MiniLAB and Lab Worksheets: Each of these worksheets is an expanded version of each lab and MiniLAB found in the Student Edition. The materials lists, procedures, and questions are repeated so that students do not need their texts open during the lab. Write-on rules are included for any questions. Tables/charts/graphs are often included for students to record their observations. Additional lab preparation information is provided in the *Teacher Guide and Answers* section.

Laboratory Activities: These activities do not require elaborate supplies or extensive pre-lab preparations. These student-oriented labs are designed to explore science through a stimulating yet simple and relaxed approach to each topic. Helpful comments, suggestions, and answers to all questions are provided in the *Teacher Guide and Answers* section.

Foldables: At the beginning of each chapter there is a *Foldables: Reading & Study Skills* activity written by renowned educator, Dinah Zike, that provides students with a tool that they can make themselves to organize some of the information in the chapter. Students may make an organizational study fold, a cause and effect study fold, or a compare and contrast study fold, to name a few. The accompanying *Foldables* worksheet found in this resource booklet provides an additional resource to help students demonstrate their grasp of the concepts. The worksheet may contain titles, subtitles, text, or graphics students need to complete the study fold.

Meeting Individual Needs (Extension and Intervention)

Directed Reading for Content Mastery: These worksheets are designed to provide students with learning difficulties with an aid to learning and understanding the vocabulary and major concepts of each chapter. The *Content Mastery* worksheets contain a variety of formats to engage students as they master the basics of the chapter. Answers are provided in the *Teacher Guide and Answers* section.

Directed Reading for Content Mastery (in Spanish): A Spanish version of the *Directed Reading for Content Mastery* is provided for those Spanish-speaking students who are learning English.

Reinforcement: These worksheets provide an additional resource for reviewing the concepts of the chapter. There is one worksheet for each section, or lesson, of the chapter. The *Reinforcement* worksheets are designed to focus primarily on science content and less on vocabulary, although knowledge of the section vocabulary supports understanding of the content. The worksheets are designed for the full range of students; however, they will be more challenging for your lower-ability students. Answers are provided in the *Teacher Guide and Answers* section.

Enrichment: These worksheets are directed toward above-average students and allow them to explore further the information and concepts introduced in the section. A variety of formats are used for these worksheets: readings to analyze; problems to solve; diagrams to examine and analyze; or a simple activity or lab which students can complete in the classroom or at home. Answers are provided in the *Teacher Guide and Answers* section.

Note-taking Worksheet: The *Note-taking Worksheet* mirrors the content contained in the teacher version—*Content Outline for Teaching*. They can be used to allow students to take notes during class, as an additional review of the material in the chapter, or as study notes for students who have been absent.

Assessment

Chapter Review: These worksheets prepare students for the chapter test. The *Chapter Review* worksheets cover all major vocabulary, concepts, and objectives of the chapter. The first part is a vocabulary review and the second part is a concept review. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Chapter Test: The *Chapter Test* requires students to use process skills and understand content. Although all questions involve memory to some degree, you will find that your students will need to discover relationships among facts and concepts in some questions, and to use higher levels of critical thinking to apply concepts in other questions. Each chapter test normally consists of four parts: Testing Concepts measures recall and recognition of vocabulary and facts in the chapter; Understanding Concepts requires interpreting information and more comprehension than recognition and recall—students will interpret basic information and demonstrate their ability to determine relationships among facts, generalizations, definitions, and skills; Applying Concepts calls for the highest level of comprehension and inference; Writing Skills requires students to define or describe concepts in multiple sentence answers. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Transparency Activities

Section Focus Transparencies: These transparencies are designed to generate interest and focus students' attention on the topics presented in the sections and/or to assess prior knowledge. There is a transparency for each section, or lesson, in the Student Edition. The reproducible student masters are located in the *Transparency Activities* section. The teacher material, located in the *Teacher Guide and Answers* section, includes Transparency Teaching Tips, a Content Background section, and Answers for each transparency.

Teaching Transparencies: These transparencies relate to major concepts that will benefit from an extra visual learning aid. Most of these transparencies contain diagrams/photos from the Student Edition. There is one *Teaching Transparency* for each chapter. The *Teaching Transparency Activity* includes a black-and-white reproducible master of the transparency accompanied by a student worksheet that reviews the concept shown in the transparency. These masters are found in the *Transparency Activities* section. The teacher material includes Transparency Teaching Tips, a Reteaching Suggestion, Extensions, and Answers to Student Worksheet. This teacher material is located in the *Teacher Guide and Answers* section.

Assessment Transparencies: An *Assessment Transparency* extends the chapter content and gives students the opportunity to practice interpreting and analyzing data presented in charts, graphs, and tables. Test-taking tips that help prepare students for success on standardized tests and answers to questions on the transparencies are provided in the *Teacher Guide and Answers* section.

Teacher Support and Planning

Content Outline for Teaching: These pages provide a synopsis of the chapter by section, including suggested discussion questions. Also included are the terms that fill in the blanks in the students' *Note-taking Worksheets.*

Spanish Resources: A Spanish version of the following chapter features are included in this section: objectives, vocabulary words and definitions, a chapter purpose, the chapter Activities, and content overviews for each section of the chapter.

Reproducible Student Pages

Reproducible Student Pages

Hands-On Activities

Observing Asexual Reproduction

Procedure

1. Using a pair of **scissors**, cut a stem with at least two pairs of leaves from a **coleus or another house plant**.
2. Carefully remove the bottom pair of leaves.
3. Place the cut end of the stem into a **cup that is half-filled with water** for two weeks. Wash your hands.
4. Remove the new plant from the water and plant it in a small **container** of **soil**.

Data and Observations

Analysis

1. Draw and label your results in the Data and Observations section above.
2. Predict how the new plant and the plant from which it was taken are genetically related.

TRY AT HOME Mini LAB

Modeling Seed Dispersal

Procedure

1. Find a **button** you can use to represent a seed.
2. Examine the seeds pictured in **Figure 18** in your text and invent a way that your button seed could be dispersed by wind, water, on the fur of an animal, or by humans.
3. Bring your button seed to class and demonstrate how it could be dispersed.

Analysis

1. Explain how your button seed was dispersed.

2. On the lines below, write a paragraph describing your model. Also describe other ways you could model seed dispersal.

Comparing Seedless Plants

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Why is it important to be careful when using coverslips?

2. What power of the microscope will you use to observe the spores?

All seedless plants have specialized structures that produce spores. Although these sporophyte structures have a similar function, they look different. The gametophyte plants also are different from each other. Do this lab to observe the similarities and differences among three groups of seedless plants.

Real-World Question

How are the gametophyte stages and the sporophyte stages of liverworts, mosses, and ferns similar and different?

Materials

live mosses, liverworts, and ferns with gametophytes and sporophytes
magnifying lens
forceps
dropper
microscope slides and coverslips (2)
microscope
dissecting needle
pencil with eraser

Goals

- **Describe** the sporophyte and gametophyte forms of liverworts, mosses, and ferns.
- **Identify** the spore-producing structures of liverworts, mosses, and ferns.

Safety Precautions

Procedure

1. Obtain a gametophyte of each plant. With a magnifying lens, observe the rhizoids, leafy parts, and stemlike parts, if any are present.
2. Obtain a sporophyte of each plant and use a magnifying lens to observe it.
3. Locate and remove a spore structure of a moss plant. Place it in a drop of water on a slide.
4. Place a coverslip over it. Use the eraser of a pencil to gently push on the coverslip to release the spores.
WARNING: *Do not break the coverslip.*
Observe the spores under low and high power.
5. Make labeled drawings of all observations in the Data and Observations section on the next page.
6. Repeat steps 3 and 4 using a fern.

LAB (continued)

Data and Observations

Drawings:

Conclude and Apply

1. **Compare** the gametophyte's appearance to the sporophyte's appearance for each plant.

2. **List** a structure(s) common to all three plants.

3. **Hypothesize** about why each plant produces a large number of spores.

Communicating Your Data

Prepare a bulletin board that shows differences between the sporophyte and gametophyte stages of liverworts, mosses, and ferns. **For more help, refer to the Science Skill Handbook.**

Design Your Own

Germination Rate of Seeds

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. What variables might affect a seed during germination?

2. What safety symbols are associated with this lab?

Many environmental factors affect the germination rate of seeds. Among these are soil temperature, air temperature, moisture content of soil, and salt content of soil. What happens to the germination rate when one of these variables is changed? Can you determine a way to predict the best conditions for seed germination?

Real-World Question

How do environmental factors affect seed germination?

Form a Hypothesis

Based on your knowledge of seed germination, state a hypothesis about how environmental factors affect germination rates.

Possible Materials

seeds
water
salt
potting soil
plant trays or plastic cups
**seedling warming cables*
thermometer
graduated cylinder
beakers

**Alternate materials*

Goals

- **Design** an experiment to test the effect of an environmental factor on seed germination rate.
- **Compare** germination rates under different conditions.

Safety Precautions

WARNING: *Some kinds of seeds are poisonous. Do not place any seeds in your mouth. Be careful when using any electrical equipment to avoid shock hazards.*

Test Your Hypothesis

Make a Plan

1. As a group, agree upon and write your hypothesis and decide how you will test it. Identify which results will confirm the hypothesis.
2. **List** the steps you need to take to test your hypothesis. Be specific, and describe exactly what you will do at each step. List your materials.
3. **Prepare** a data table in your Science Journal to record your observations.
4. Reread your entire experiment to make sure that all of the steps are in a logical order.
5. **Identify** all constants, variables, and controls of the experiment.

LAB (continued)

Follow Your Plan

1. Make sure your teacher approves your plan and your data table before you proceed.
2. Use the same type and amount of soil in each tray.
3. While the experiment is going on, record your observations accurately and complete the data table.

Analyze Your Data

1. **Compare** the germination rate in the two groups of seeds.

2. **Compare** your results with those of other groups.

3. Did changing the variable affect germination rates? Explain.

4. Make a bar graph in the space below of your experimental results.

Conclude and Apply

1. **Interpret** your graph to estimate the conditions that give the best germination rate.

2. **Describe** the conditions that affect germination rate.

Communicating Your Data

Write a short article for a local newspaper telling about this experiment. Give some ideas about when and how to plant seeds in the garden and the conditions needed for germination.

LAB 1 Laboratory Activity

Observing the Effects of Drugs on Seed Growth

Drugs change the way in which living things carry out everyday functions, such as growth and repair. It would be very hard to experiment on humans or other animals to show that this is true. It is possible to experiment with drugs and certain living things, such as plants. The living things used in this experiment are seeds.

Strategy

You will test the effect of four different drugs on the growth of two types of seeds. You will compare how each seed type responded to each of four drugs.

Materials

small beakers (5)
labels (10)
scissors
ruler
cheesecloth
tobacco (4)
twist ties (2)
spoon
ground coffee (caffeinated)
radish seeds (50)
pinto bean seeds (50)
graduated cylinder
ethyl alcohol
aspirin
petri dishes (5)
paper towels

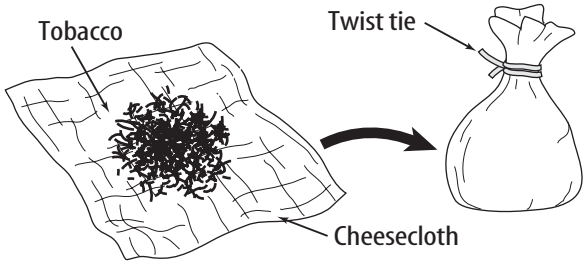
WARNING: *Some kinds of seeds are poisonous. Do not place any seeds in your mouth. Keep all food and chemicals away from your face and mouth.*

Procedure

Part A—Soaking Seeds

1. Label five small beakers as follows: water, alcohol, aspirin, nicotine, caffeine. Add your name to each label.
2. Use scissors to cut two 12 cm × 12 cm pieces of cheesecloth.
3. Obtain a small amount of tobacco from your teacher. Place all the tobacco into the center of one cheesecloth square. Wrap the tobacco in the cheese cloth. Tie the ends of the cheesecloth together with a twist tie. See Figure 1.
4. Prepare a second cheesecloth bag. In this bag, place one spoonful of ground coffee instead of tobacco.

Figure 1



5. Place 10 radish seeds and 10 pinto seeds in each of the five labeled beakers.
6. Using the graduated cylinder, measure 50 mL of ethyl alcohol, then add it to the beaker labeled "alcohol." Carefully rinse the graduated cylinder. Measure, then add, 50 mL of water to each of the other four beakers. Place the coffee, the tobacco, and the aspirin tablet into their labeled beakers.
7. Allow the seeds to soak overnight in the beakers of liquid.

Part B—Preparing Petri Dishes

1. Label the tops of five petri dishes as follows: water, alcohol, aspirin, nicotine, and caffeine. **NOTE:** *The top of the petri dish is wider than the bottom.* Add your name to each label.
2. Stack five paper towels together. On top of these towels, make five separate circles by tracing around the bottom of the petri dish five times.
3. Using scissors, cut out each set of circles (all five layers) and place one set in the bottom of each petri dish. See Figure 2.

Laboratory Activity 1 (continued)

Figure 2

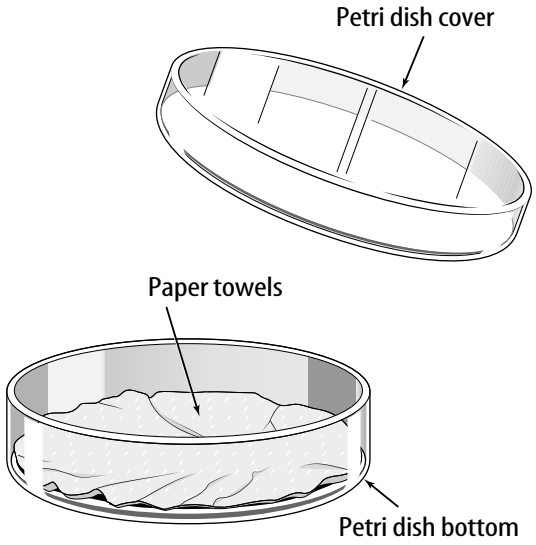
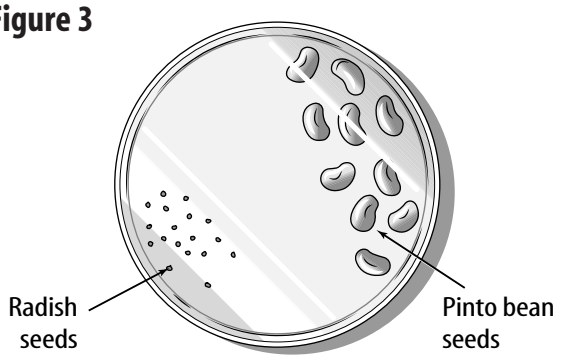


Figure 3



Part C—Observing Seed Germination

After a 24-h period:

1. Put the matching beakers and labeled petri dishes beside each other.
2. Remove the cover of one petri dish and pour about half the liquid from its matching beaker onto the paper towels. **NOTE**: *The tobacco and coffee bags should stay in the beakers.*
3. Carefully remove the seeds from the same beaker and place them on the paper towels. Separate the two seed types as in Figure 3. Replace the cover of the petri dishes.
4. Repeat steps 2 and 3 for each of the other four beakers.
5. Examine all seeds in each petri dish. Look for signs of seed growth. See Figure 4 in order to tell if your seeds are growing. A small root will stick out from the seed if it is alive and growing.
6. Record in Table 1 how many seeds of each type are growing in each petri dish. Consider today as Day 1 in the experiment.
7. Place the petri dishes in a place indicated by your teacher.
8. Observe the seeds for four more days. Each day, record in Table 1 the total number of radish seeds and pinto bean seeds growing in each petri dish.

Figure 4

Seed	Not growing	Growing
Radish		
Bean		

Laboratory Activity 1 (continued)

Data and Observations

Table 1

	Water		Aspirin		Alcohol		Nicotine		Caffeine	
Day	Radish	Bean	Radish	Bean	Radish	Bean	Radish	Bean	Radish	Bean
1										
2										
3										
4										
5										

Questions and Conclusions

1. a. What different kinds of seeds were used in this experiment?

_____

b. What different drugs were used in this experiment?

_____

2. What was the purpose of this experiment?

_____

3. Using your results for Day 5, list the number of radish seeds that were growing in

a. water _____ **c.** aspirin _____ **e.** caffeine _____

b. ethyl alcohol _____ **d.** nicotine _____

4. a. Do the different drugs used seem to affect the number of radish seeds that grew?

b. Support your answer by comparing the number of radish seeds that grew in the drugs to the number that grew in water.

_____

_____

5. Using your results for Day 5, list the number of pinto bean seeds that were growing in

a. water _____ **c.** aspirin _____ **e.** caffeine _____

b. ethyl alcohol _____ **d.** nicotine _____

Laboratory Activity 1 (continued)

6. a. Do the different drugs used seem to affect the number of pinto bean seeds that grew? _____

b. Support your answer by comparing the number of pinto bean seeds that grew in the drugs to the number that grew in water.

7. Write a short paragraph that sums up your findings in this experiment.

8. a. Might all living things show the same type of reaction to these different drugs as did the seeds?

b. How could you find this out?

c. Why might this type of experiment be difficult to carry out on animals?

Strategy Check

_____ Can you test the effect of drugs on the growth of seeds?

_____ Can you compare how two types of seeds responded to each of four drugs?

LAB 2 Laboratory Activity

Parts of a Seed

Seeds are important to plants because they aid in reproduction. When a seed is opened, you can usually find a miniature plant (embryo) inside that is surrounded by a food supply. If planted, the embryo grows into a new plant. Some seeds can be easily split into equal halves or cotyledons (the stored food), while others cannot be split. Those seeds that can be split evenly are called dicotyledons (*di* means two), while those that cannot be split are called monocotyledons (*mono* means one).

Strategy

You will observe and identify the parts of a lima bean seed.
You will learn the functions of seed parts.
You will examine and compare other seeds with a lima bean.
You will learn the difference between a monocotyledon and a dicotyledon seed.

Materials

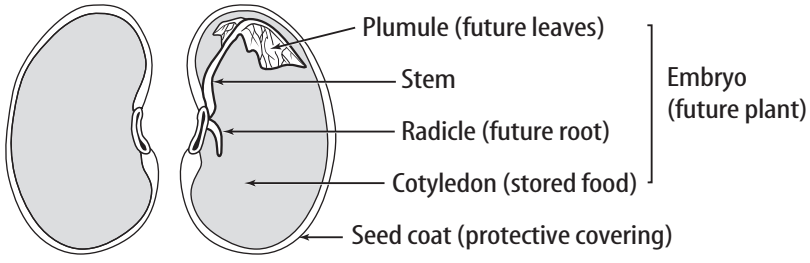
scalpel
seeds (each soaked in water for 24 hours)
- lima bean
- peanut
- corn
- sunflower
- pea

WARNING: *Use care when handling sharp objects. Some kinds of seeds are poisonous. Do not place any seeds in your mouth.*

Procedure

1. Use your fingernail to carefully peel off the thin outer covering or seed coat from a soaked lima bean. Split the seed in half and identify the parts shown in Figure 1.
2. Remove the seed coat from the following soaked seeds: peanut, corn, sunflower, pea. Split each seed in half. Those seeds that do not open easily after the seed coat is removed should be sliced open lengthwise using a scalpel. **WARNING:** *Use care when cutting with a scalpel to avoid injury to yourself and others.*
3. Identify the seed parts.

Figure 1



Laboratory Activity 2 (continued)

Data and Observations

Table 1

Seed Structure					
Type of seed	Seed coat (hard or soft)	Easily opened cotyledons (yes or no)	Number of cotyledons (one or two)	Seed category (monocotyledon or dicotyledon)	Plumule and radicle (yes or no)
1. Lima bean					
2. Peanut					
3. Corn					
4. Sunflower					
5. Pea					

Questions and Conclusions

1. What is the function of the seed coat and the cotyledons?

2. Why is it important that all seeds have a supply of stored food?

3. How does the ease of splitting open a monocotyledon seed compare with that of splitting open a dicotyledon seed?

4. Were there any seeds without a plumule and radicle?

5. What would you expect to grow if a seed without a plumule and radicle were planted?

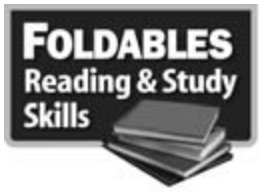
Strategy Check

_____ Can you identify the parts of a lima bean seed?

_____ Can you list the functions of seed parts?

_____ Can you compare other seeds with a lima bean?

_____ Can you identify the difference between a monocotyledon and a dicotyledon seed?



Plant Reproduction

Directions: Use this page to label your Foldable at the beginning of the chapter.

Sexual

Both

Asexual

involves the formation of sex cells

does not involve sex cells

produces offspring genetically identical to the parent organism

produces offspring genetically different from both parent organisms

offspring produced without seed

offspring grow from seed

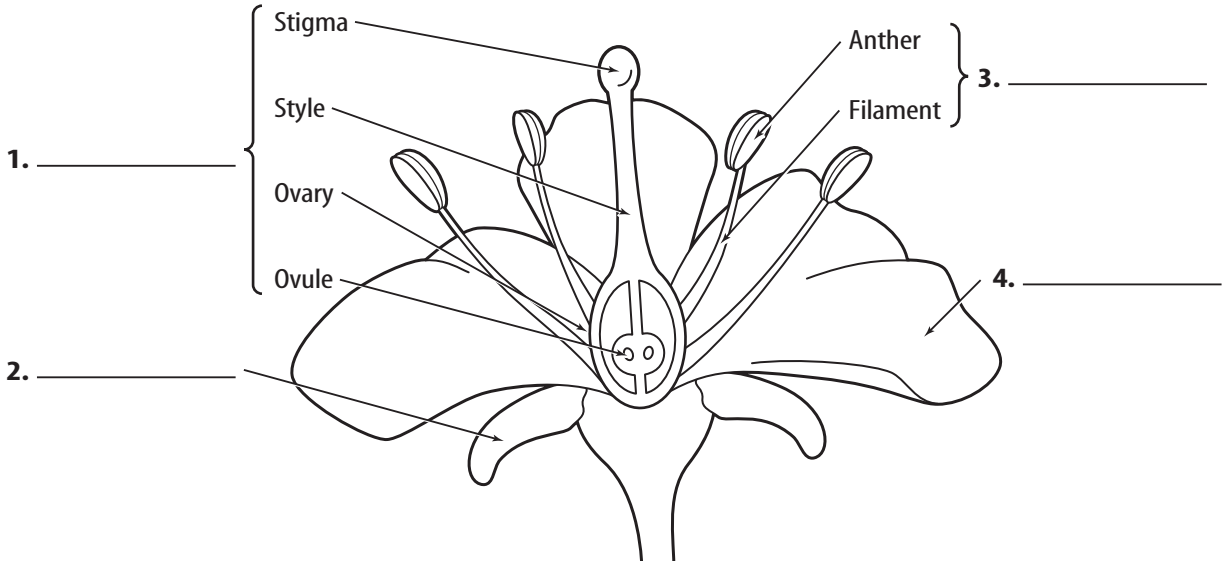
Hands-On Activities

Directed Reading for Content Mastery

Overview Plant Reproduction

Directions: *Read the following information, then label the flower.*

Flowers contain the reproductive organs of angiosperms. The male organ is the stamen. It includes the anther and the filament. The female organ is the pistil. It is made of three parts: the stigma, the style, and the ovary, which contains the ovules. The brightly colored petals attract insects and the sepals protect the growing flower.



Directions: *Use the above information to answer the questions below.*

5. Which part of the stamen contains pollen grains? _____

6. Which part of the pistil is sticky and attracts pollen grains? _____

Directions: *Complete the following sentences using the correct terms.*

7. New potato plants sprouting from the eyes of cut-up potatoes are an example of _____ reproduction.

8. _____ are vascular seedless plants. _____ are nonvascular.

Meeting Individual Needs

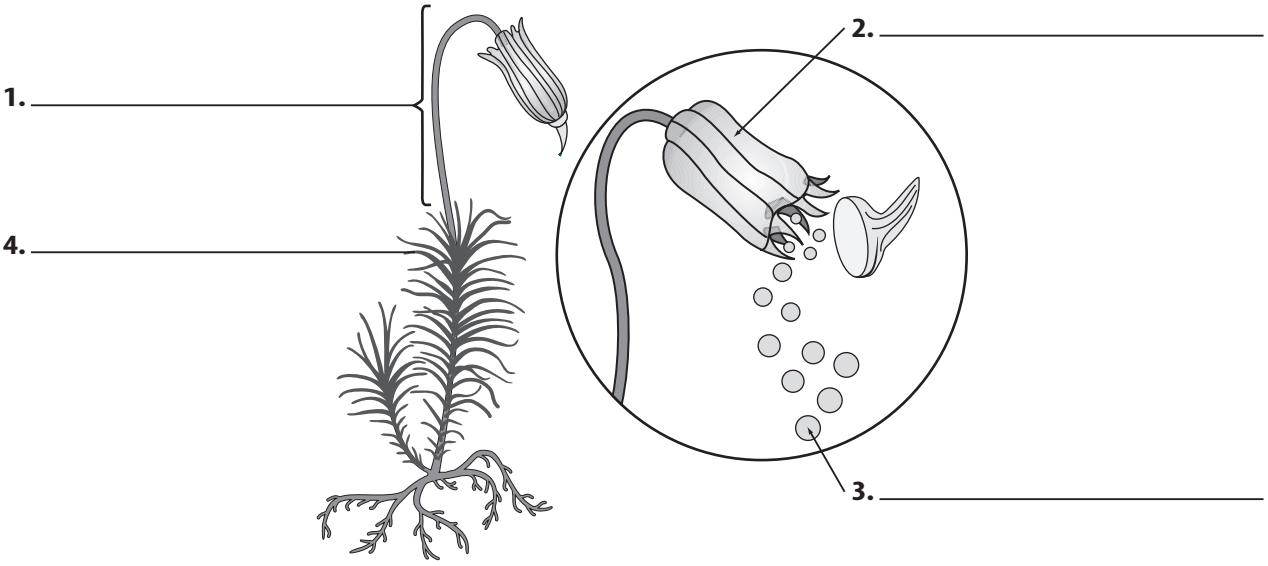
Name Date Class

Directed Reading for Content Mastery

Section 1 ▪ Introduction to Plant Reproduction
Section 2 ▪ Seedless Reproduction

Directions: *Study the following diagram of the moss sporophyte stage. Then label the parts using the terms listed below.*

spore **gametophyte** **sporophyte** **capsule (or spore case)**



Directions: *Complete the following sentences using the terms listed below.*

rhizome **prothallus** **sori** **fronds**
nonvascular **chlorophyll** **cell**

5. Fern leaves are called _____.
6. Fern leaves grow from an underground stem called a _____.
7. Fern spores are produced in structures called _____.
8. A fern spore can grow into a small, green heart-shaped gametophyte plant called a _____.
9. Mosses are _____ plants.
10. In nonvascular plants water and substances move from cell to _____.
11. A prothallus contains _____ and can make its own food.

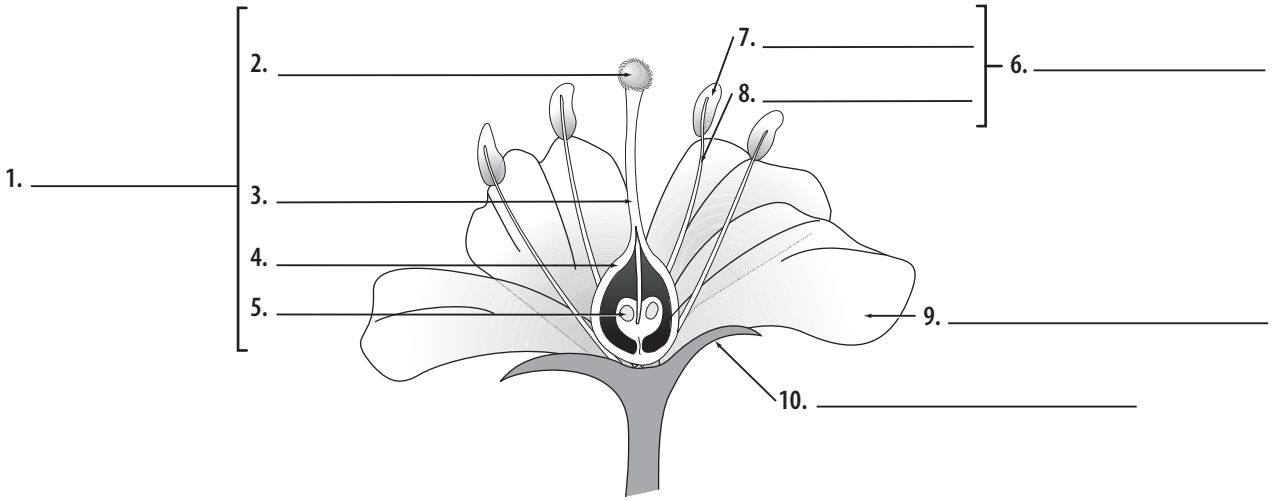
Name Date Class

Directed Reading for Content Mastery

Section 3 ▪ Seed Reproduction

Directions: *Use the following terms to label the parts of the flower.*

ovary	**stigma**	**style**	**ovule**	**stamen**
pistil	**anther**	**petal**	**sepal**	**filament**



Directions: *Use the following terms to complete the paragraph about pollination below. One term is used two times.*

ovary	**seed**	**stigma**	**pollen**	**stamen**
sperm	**wind**	**animals**	**egg**	**pistil**

Pollination involves the transfer of **11.** _____ grains from a flower's stamen to its stigma. The **12.** _____ is the male reproductive organ. The **13.** _____ is the female reproductive organ. The grains are carried by rain, **14.** _____, or **15.** _____. They land on the sticky **16.** _____ of a plant's pistil. A pollen tube grows from the **17.** _____ grain down through the style and into the **18.** _____ to an ovule. The **19.** _____ travels down the pollen tube and fertilizes the **20.** _____. Following fertilization, the female part develops into a(n) **21.** _____.

Meeting Individual Needs

Name Date Class

Directed Reading for Content Mastery

Key Terms
Plant Reproduction

Directions: *Draw a line to connect the term on the left to its description on the right.*

1. prothallus

2. gametophyte stage

3. ovary

4. germination

5. pistil

6. pollen grain

7. pollination

8. rhizome

9. stamen

10. sporophyte stage

11. spore

12. frond

13. sori

14. ovule

a. when cells form having a haploid number of chromosomes

b. the start of the growth of a plant

c. where eggs are produced

d. a small, green, heart-shaped plant that grows from a fern spore

e. part of the plant's male reproductive organ that contains sperm

f. structures in which fern spores are produced

g. the swollen base of the pistil where ovules are formed

h. female reproductive organ of flowering plants

i. fern leaf

j. male reproductive organ of flowering plants

k. when cells form having a diploid number of chromosomes

l. haploid cells produced when cells in reproductive organs undergo meiosis

m. transfer of pollen grains from the male to female reproductive organs of plants

n. underground stems of plants such as ferns

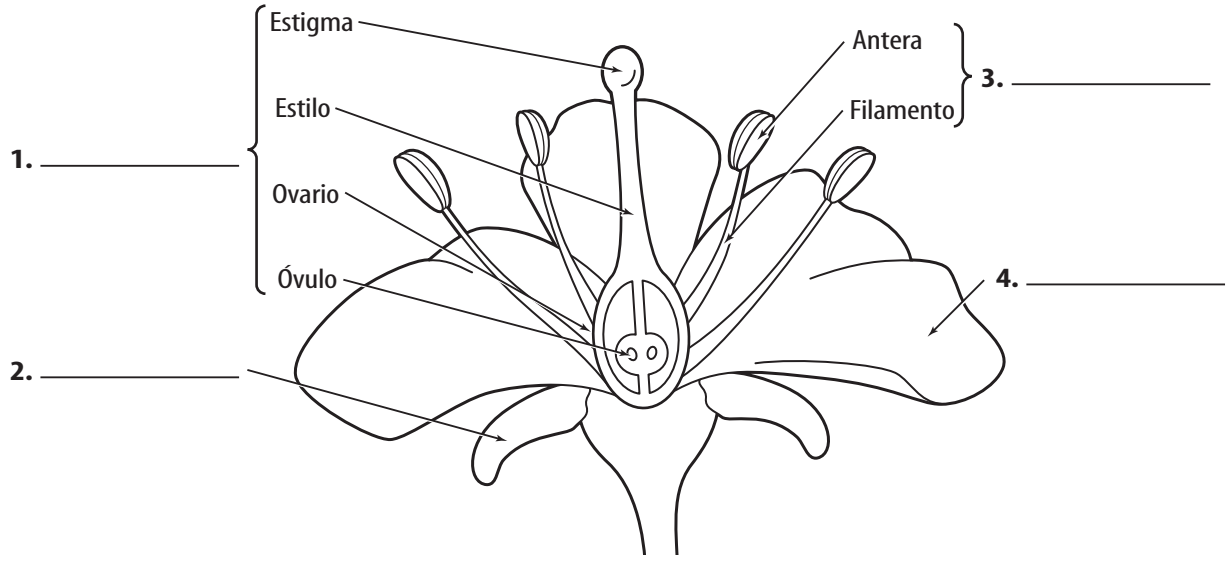
Meeting Individual Needs

Lectura dirigida para Dominio del contenidio

Sinopsis Reproducción de las plantas

Instrucciones: *Lee la siguiente información y luego rotula la flor.*

Las flores contienen los órganos reproductores de las gimnospermas. El órgano masculino es el estambre, que incluye la antera y el filamento. El órgano femenino es el pistilo, que se compone de tres partes: el estigma, el estilo y el ovario; éste último contiene el óvulo. Los pétalos coloreados atraen insectos y los sépalos protegen la flor en crecimiento.



Instrucciones: *Usa la información anterior para responder las preguntas.*

5. ¿Qué parte del estambre contiene los granos de polen? _____

6. ¿Qué parte del pistilo es pegajosa y atrae los granos de polen? _____

Instrucciones: *Completa las siguientes oraciones usando los términos correctos.*

7. Las nuevas papas que crecen a partir de ojos de papa son un ejemplo de reproducción _____.

8. Las(Los) _____ son plantas vasculares sin semillas. Las(Los) _____ son plantas no vasculares.

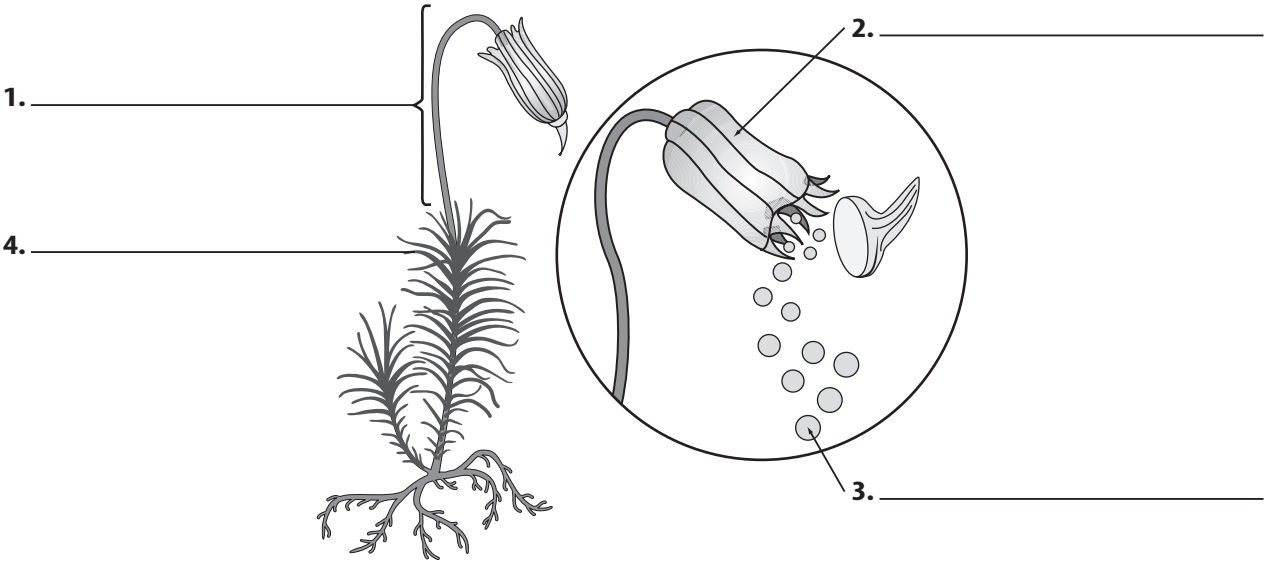
Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 1 ▪ Introducción a la reproducción vegetal
Sección 2 ▪ Reproducción sin semillas

Instrucciones: *Estudia el diagrama de la etapa esporofítica de un musgo. Rotula luego las partes con los términos siguientes.*

espora **gametofito** **esporofito** **cápsula (o cubierta de las esporas)**



Instrucciones: *Completa las oraciones usando los términos siguientes.*

rizoma **prótalo** **soro** **frondas**
no vasculares **clorofila** **célula**

5. Las hojas de los helechos se conocen como _____.
6. Las hojas de los helechos nacen de un tallo subterráneo llamado _____.
7. Las esporas de los helechos se producen en estructuras llamadas _____.
8. La espora de un helecho crece y forma un gametofito verde, pequeño y con forma de corazón llamado un(a) _____.
9. Los musgos son plantas _____.
10. En las plantas no vasculares, el agua y las sustancias se mueven de célula a _____.
11. El prótalo contiene _____, por lo que puede producir su propio alimento.

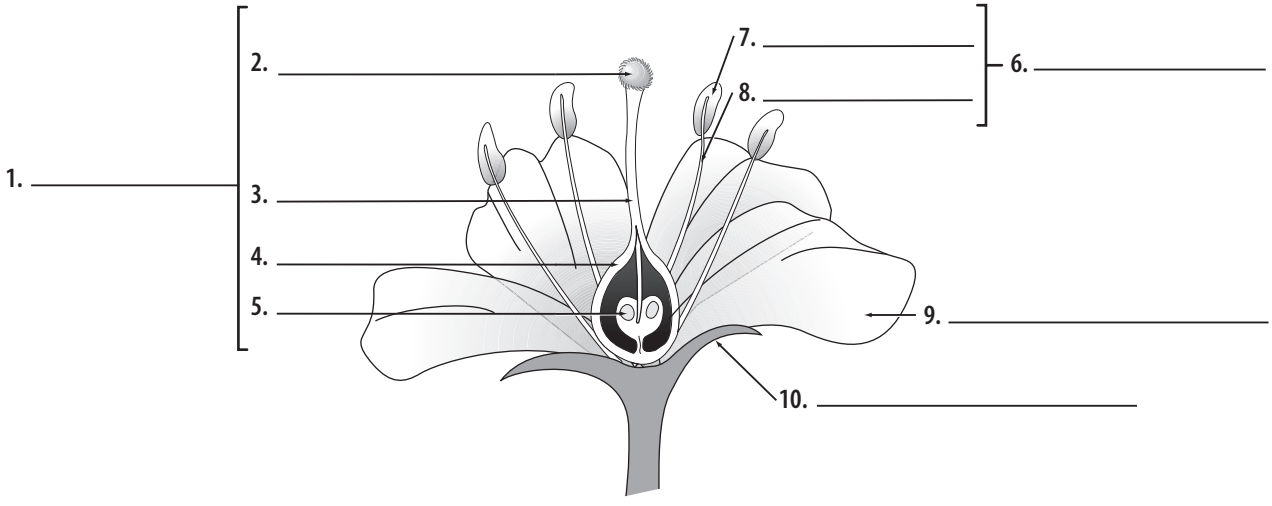
Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Sección 3 ▪ Reprodución con semillas

Instrucciones: *Usa los términos para rotular las partes de la flor.*

ovario	**estigma**	**estilo**	**óvulo**	**estambre**
pistilo	**antera**	**pétalo**	**sépalo**	**filamento**



Instrucciones: *Usa los términos para completar el párrafo sobre la polinización. Uno de los términos se usa dos veces.*

ovario	**semilla**	**estigma**	**polen**	**estambre**
espermatozoide	**viento**	**animales**	**huevo**	**pistilo**

La polinización implica la transferencia de granos de **11.** _____ del estambre de una flor al estigma. El(La) **12.** _____ es el órgano reproductor masculino. El(La) **13.** _____ es el órgano reproductor femenino. Los granos pueden ser llevados por la lluvia, el(la) **14.** _____, o el(la) **15.** _____. Caen sobre el(la) **16.** _____ pegajoso(a) del pistilo de la planta. Un tubo del polen crece desde el grano de **17.** _____ a lo largo del estilo hasta el(la) **18.** _____ del óvulo. El(La) **19.** _____ viaja a lo largo del tubo del polen y fertiliza el(la) **20.** _____. Después de la fertilización, la parte femenina se desarrolla y forma un(a) **21.** _____.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenido

Términos claves
Reproducción de las plantas

Instrucciones: *Une con una línea el término a la izquierda con su descripción a la derecha.*

1. prótalo

2. etapa gametofítica

3. ovario

4. germinación

5. pistilo

6. grano de polen

7. polinización

8. rizoma

9. estambre

10. etapa esporofítica

11. espora

12. fronda

13. soros

14. óvulo

a. cuando se forman células que tienen un número haploide de cromosomas

b. inicio del crecimiento de una planta

c. donde se producen los huevos

d. planta pequeña, verde, con forma de corazón que crece de la espora de un helecho

e. parte del órgano reproductor masculino de una planta que contiene espermatozoides

f. estructuras en las que se producen las esporas de los helechos

g. base henchida del pistilo en donde se forman los óvulos

h. órgano reproductor femenino de las plantas que producen flores

i. hojas de los helechos

j. órgano reproductor masculino de las plantas que producen flores

k. cuando se forman células con un número diploide de cromosomas

l. células haploides producidas cuando las células en los órganos reproductores sufren meiosis

m. transferencia de granos de polen del órgano masculino al órgano femenino de las plantas

n. tallos subterráneos de plantas como los helechos

Satisface las necesidades individuales

Name Date Class

SECTION 1 Reinforcement

Introduction to Plant Reproduction

Directions: *Write the correct term in the spaces beside each definition. Unscramble the boxed letters to answer question 10.*

1. sex cells formed by meiosis with only half of the chromosomes ___ ___ ___ ☐ ___ ___ ___
2. plants release these into their surroundings to produce offspring ___ ___ ___ ___ ☐ ___
3. the joining of two haploid cells begins this stage ___ ___ ___ ___ ___ ___ ___ ☐ ___ ___
4. when an egg and sperm combine ☐ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
5. depending on the species of plant, these organs can be on the same or different plants ___ ___ ___ ___ ___ ___ ___ ☐ ___ ___ ___ ___
6. after fertilization, this plant produces berries ___ ___ ___ ☐ ___
7. this stage is begun when cells in reproductive organs undergo meiosis and produce haploid cells ___ ___ ___ ☐ ___ ___ ___ ___ ___ ___ ___
8. asexual _____ does not require the production of sex cells ___ ___ ___ ___ ___ ___ ___ ___ ___ ☐ ___ ___
9. have a full set of chromosomes ___ ___ ___ ___ ___ ___ ___ ☐ ___ ___ ___ ___
10. something all organisms have in common _____

Directions: *Answer the following questions on the lines provided.*

11. Describe sexual reproduction in plants.

_____

_____

_____

_____

12. Describe asexual reproduction in plants.

_____

_____

_____

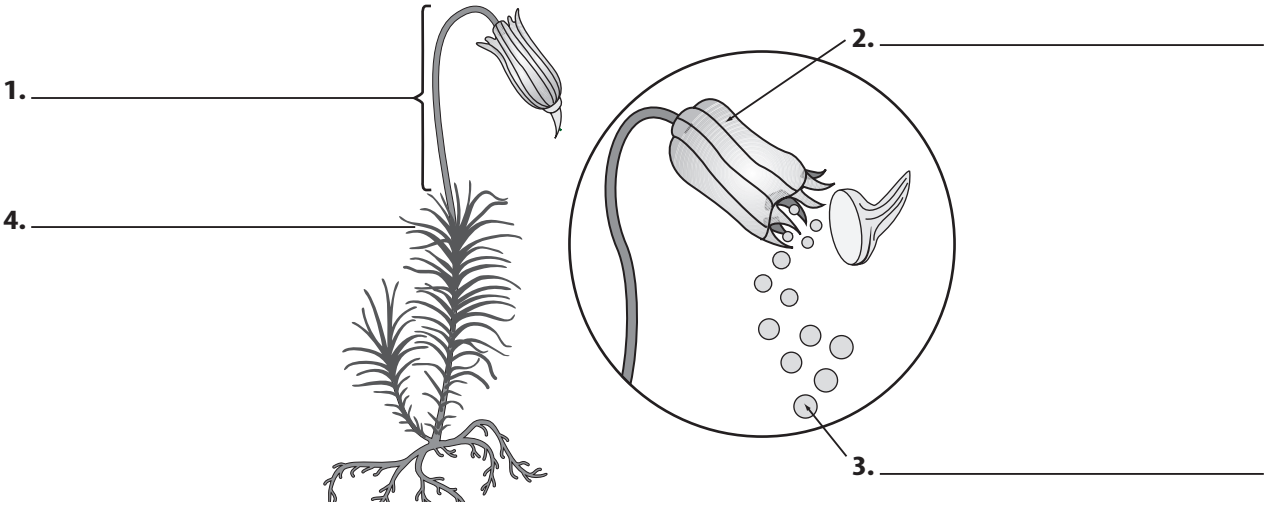
Meeting Individual Needs

Name Date Class

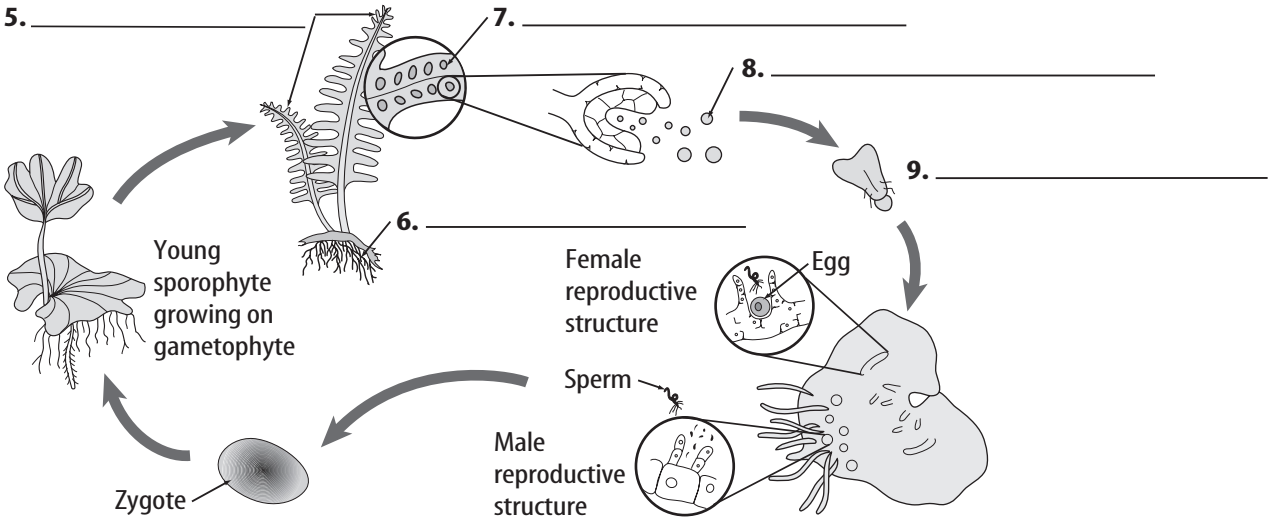
SECTION 2 Reinforcement

Seedless Reproduction

Directions: *Label the structures related to moss reproduction.*



Directions: *Label the structures in the fern's reproductive cycle.*



Directions: *Answer the following questions on the lines provided.*

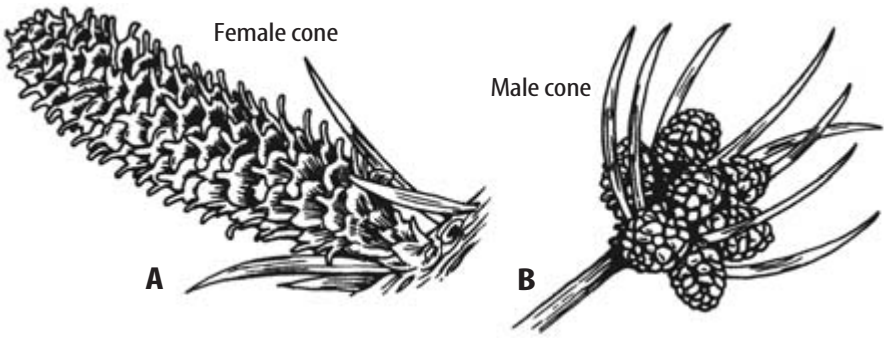
10. Why do mosses need water for fertilization?

11. Describe how ferns can reproduce asexually.

Name Date Class

SECTION 3 Reinforcement

Seed Reproduction



Directions: *Use the illustrations above to answer the questions.*

1. Which cone produces pollen grains?

_____

2. Which cone produces seeds?

_____

3. In which cone is the egg fertilized?

_____

4. What type of seed plant produces the above cones?

_____

Directions: *Write the term that matches the following descriptions.*

5. transfer of pollen from stamen to ovules: _____

6. the male reproductive organ of angiosperms: _____

7. the female reproductive organ of angiosperms: _____

8. produces pollen grains: _____

9. part of the flower in which sperm form: _____

10. the top of the pistil that catches the pollen grains: _____

11. grows from the pollen grain to the ovule: _____

12. a young plant growing within the seed: _____

13. part of the flower that becomes part of the fruit: _____

14. a seed that does not germinate for a period of time: _____

15. organisms that aid in the pollination of flowers: _____

16. ways that seeds get from the flower to the ground for germination: _____

17. the early growth of a plant from a seed: _____

SECTION 1 Enrichment

The Ancient Cycads

Cycads are probably the most ancient seed-bearing plants on Earth. Scientists know that they lived long before the dinosaurs—almost 300 million years ago—and that they made up a good percentage of the forests where dinosaurs lived. But unlike the dinosaurs, cycads aren't extinct.

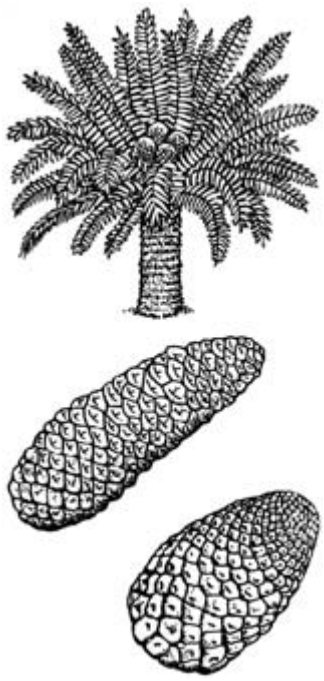
Not a Palm Tree

People often call cycads palms, because that's what they look like. They have a long trunk, no branches, and a plume of feather-like leaves at the top. But palms have no growth rings while cycads do.

In fact, no matter what a cycad looks like, botanists say that cycads are most closely related to cone-bearing plants like pines. That's because cycads produce male and female cones. Unlike most cone-bearing plants, cycad male cones and female cones are on separate plants. A plant that produces separate male and female plants is called *dioecious.* (You may be familiar with another dioecious plant, mistletoe.)

Spreading Pollen

Once botanists thought that cycads depend on the wind to spread pollen. However, cycads grow in the lower levels in forests, where there would be little wind, so that idea didn't sound correct. Today, botanists hypothesize that cycads depend on small beetles and bees to carry the pollen from one cycad to another.



Operation Jurassic

Cycads can thrive in many places. Nonetheless, cycads are endangered. They take a long time to reproduce and then grow slowly. (That may be one reason why they live so long—some as long as 2,500 years!) Their biggest threat is loss of habitat. Another is poaching. In South Africa, steps are being taken to protect cycads and the places where they grow. In 1998, the government set up Operation Jurassic to stop people from stealing wild cycads and selling them illegally. Smuggling and collecting cycads has become a huge business.

1. What is meant by dioecious?

_____

2. Explain why the cycads are endangered.

_____

_____

Meeting Individual Needs

SECTION 2 Enrichment

Spore Banks

Although ferns are fairly easy to grow from spores, destruction of rain forests and other natural habitats is threatening their survival. That's why the American Fern Society, the Royal Botanic Garden Edinburgh (RBGE) in the United Kingdom, and the British Pteridological Society, among others, have established fern spore banks. Growing ferns is the goal of these organizations.

How Spore Banks Work

These spore banks not only safeguard endangered fern species, they also make available hundreds of species of ferns to people who want to grow ferns. Fern owners collect and donate fern spores to the spore bank. Then, for a small fee, people purchase spore packets and cultivate them.

Collecting Spores

To collect spores for donation, take a mature fern frond with sori and place it on a piece of clean, white paper. Put it in a dry, room-temperature place. Within a few days the spores fall onto the paper. Some collectors also use a dry paintbrush to release any remaining spores from the frond. The spores will look like black, brown, or yellow powder. The powder contains both spores and sporangia as well as chaff or waste.

The most common way of collecting spores is to hold the paper at an angle and gently tap it until the chaff is released. The spores will stay stuck to the paper. They can then be removed from the paper, placed in a paper packet, labeled, and mailed to the spore bank. Some societies recommend sterilizing the spores by pouring boiling water over them. They say this kills the spores of other plants or fungi that might be included with the fern spores. Others say to briefly soak the frond in a mild bleach solution before collecting the spores.

Pros and Cons

Since spore banks operate on a donation-only basis, the packet label might not be reliable. Well-meaning donors can make mistakes in identifying fern species. In addition, the sterilization process isn't always correctly done. If a cultivator purchases a spore bank packet and tries to grow a fern without success, it's probably because the spores contained too much chaff. However, the advantage of getting spores from a spore bank can outweigh the disadvantages. Many spore banks have rare and unusual species. The RBGE has close to 6,000 species of ferns from around the world. The RBGE cultivates the rarest species for conservation and research purposes, as well as for possible reintroduction of the ferns into other habitats.

1. Why have spore banks been established?

2. What would happen if you tried to grow a fern from spores but the spores contained too much chaff? Explain.

3. Why do you think spore banks sell their spores for a "nominal fee"?

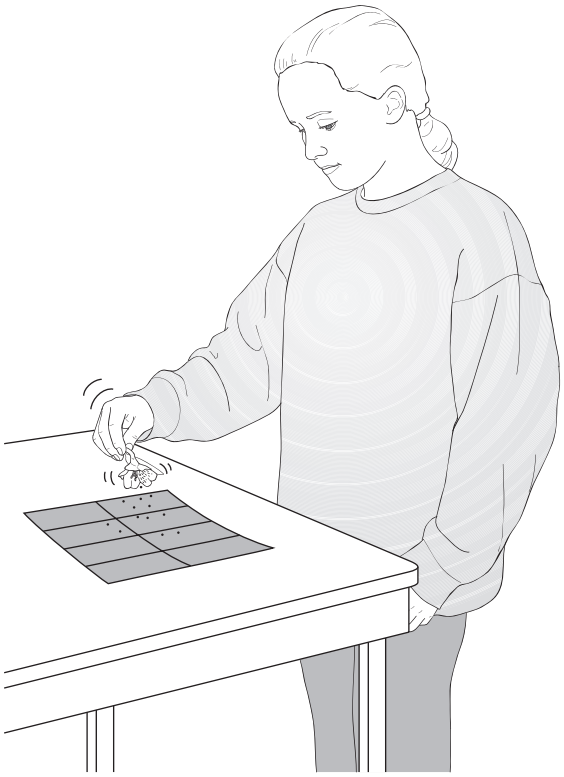
Name Date Class

SECTION 3 Enrichment

How much pollen does a flower make?

Materials

dark construction paper (3 sheets)
ruler
pencil
flowers (3)
magnifying lens



Procedure

1. Use your ruler to divide each sheet into eight equal parts.
2. Obtain three flowers from a local flower shop or from your yard.
3. Take one flower and one sheet of divided construction paper. Place the paper on a table. Turn the flower upside down and shake the pollen from the flower over the entire paper.
4. With the magnifying lens, count the number of grains of pollen in one section of the sheet. Then multiply that number by eight to get the estimated total number of grains that fell from the flower.
5. Repeat this process for each of the other two flowers.
6. Add the three totals together and then divide by three to obtain the average number of pollen grains that fell from each flower.

Conclude and Apply

1. What was the average number of pollen grains that fell from each flower?

_____

2. From what part of the flower did these pollen grains fall?

_____

3. Why would a flower make so many pollen grains?

_____

_____

_____

Meeting Individual Needs

Name Date Class

Note-taking Worksheet

Plant Reproduction

Section 1 Introduction to Plant Reproduction

A. Plants can _____ both sexually and asexually.

1. In _____ reproduction a new plant can be grown from a leaf, stem, or root.

2. In _____ reproduction a sperm cell fertilizes an egg cell to form a zygote.

a. Some plants have both male and female _____ organs; these plants can reproduce by themselves or with sex cells from other plants of the same type.

b. Some plant species have male and female organs on _____ plants.

B. Plants have a _____-stage life cycle.

1. The _____ begins when sex cells produce haploid cells called **spores**.

2. The _____ begins with fertilization.

Section 2 Seedless Reproduction

A. Seedless plants do not produce _____.

1. The _____ of seedless plants grow into plants that produce sex cells.

2. All nonvascular and some vascular plants are _____.

B. _____ plants have a life cycle that illustrates typical sexual reproduction in nonvascular seedless plants.

1. The gametophyte stage produces _____.

2. The sporophyte stage produces _____.

3. When spores are _____ and land in an appropriate environment, they can grow into new gametophyte stage plants.

4. Nonvascular plants can also reproduce _____ if a piece of gametophyte stage plant breaks off and settles in an appropriate environment.

C. Most vascular seedless plants are _____.

1. Fern sporophyte plants have leaves called _____, which grow from an underground stem called a _____.

2. Fern _____ are produced in **sori**, which are usually on the underside of fronds.

Meeting Individual Needs

Note-taking Worksheet (continued)

3. A fern spore that lands in a favorable environment grows into a gametophyte plant called a _____.
4. _____ form in the prothallus.
5. When fertilization occurs, the _____ starts the sporophyte stage.
6. Ferns may reproduce _____ when rhizomes form new branches and are separated from the main plant.

Section 3 Seed Reproduction

A. Pollen and _____ help many plants reproduce.

1. A **pollen** _____ has a covering and contains gametophyte parts that can produce sperm.
2. _____ occurs when pollen grains are transferred to the female part of the plant.
3. Following fertilization, the female part produces a _____ which contains an embryo, stored food, and a protective coat.
4. Plants can develop more quickly from a seed than from a spore because a seed contains a(n) _____ and stored _____.

B. _____ develop seeds in cones.

1. A pine tree or shrub is a sporophyte plant that produces male and female _____.
2. A female cone has two _____ which produce eggs.
3. _____ cones produce and release pollen.
4. When pollen blows into a _____ cone, fertilization and seed formation can occur.
5. Seed release by a female cone can take two or three years.

C. _____ produce flowers which are used for sexual reproduction.

1. The _____ is the male reproductive organ.
2. The _____, the female reproductive organ, contains the **ovary** at its base.
3. The _____ of a plant's flowers can give clues about how the plant is pollinated.

Note-taking Worksheet (continued)

4. After pollination and _____, a zygote forms and grows into the plant embryo.
5. Parts of the _____ develop into the seed coat and store food for the embryo.
   a. Some seeds store food in _____.
   b. Other seeds store food in _____ tissue.

D. Seeds are _____ by wind, gravity, animals, and water.

1. _____ occurs when the seed coat swells and breaks open and a plant grows from the seed.
2. Environmental conditions affect germination.

Assessment

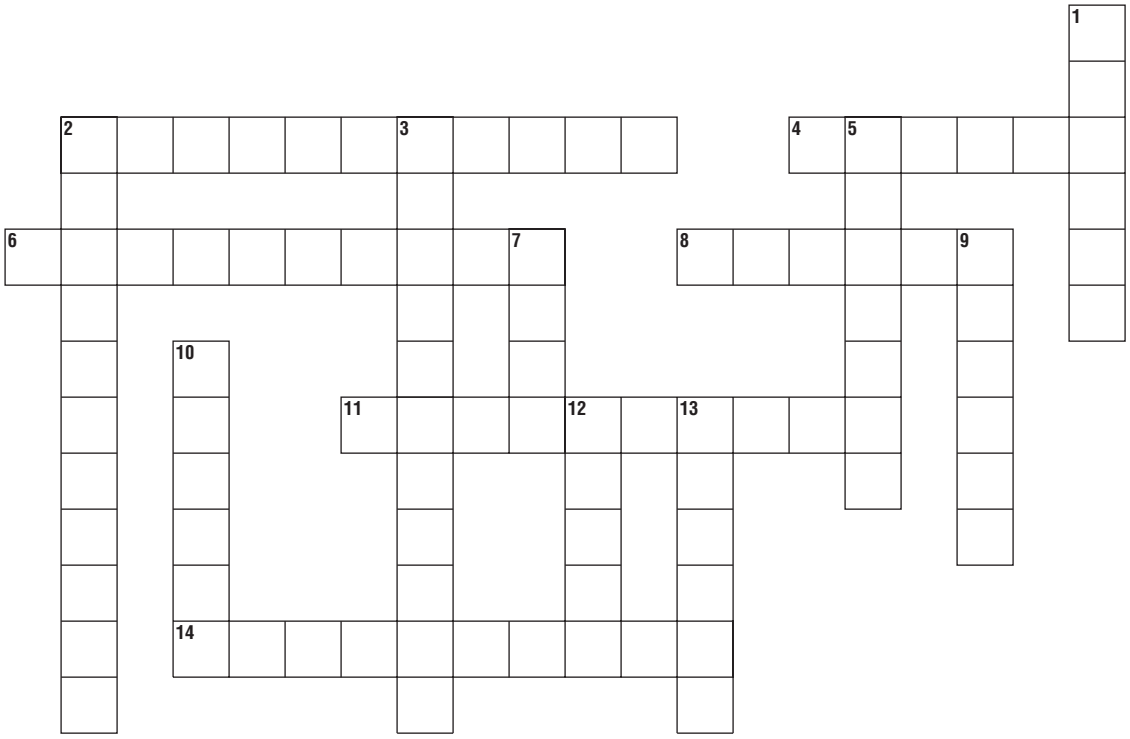
Name Date Class

Chapter Review

Plant Reproduction

Part A. Vocabulary Review

Directions: *Use the clues below to complete the puzzle.*



Across

2. The form of a moss plant that produces sex cells

4. The leaves of a fern

6. Gametophyte of a fern

8. Pollen _____—develop from some spores in seed plants

11. Plant that produces flowers

14. Includes stalk and capsule where spores are produced

Down

1. Female reproductive organ of a flower

2. Process that a seed undergoes to become a plant

3. Transfer of pollen grains from the stamen to the ovules

5. The underground stem on a fern

7. The structures where a fern produces spores

9. Male reproductive organ of a flower; consists of an anther and a filament

10. Contain an egg cell, food-storage tissue, and a sticky fluid

12. Swollen base of pistil; where ovules form

13. _____ grains—contain the sperm-producing parts in seed plants

Chapter Review (continued)

Part B. Concept Review

Directions: *Complete the life cycles of gymnosperms and angiosperms by filling in the blanks.*

Gymnosperms

1. _____ develop, and release a sticky fluid.

2. _____ develop on male cone. **3.** _____ is blown by the wind. A **4.** _____ grows to an ovule. **5.** _____ unites with an ovule, and a **6.** _____ forms. The **7.** _____ mature open, and release seeds.

Angiosperms

Stigma and **8.** _____ develop, and the male organ forms **9.** _____. **10.** _____ gets to the **11.** _____ by wind, insects, birds, and mammals. The **12.** _____ grows to an ovule, and **13.** _____ unites with an ovule. **14.** The _____ part of the seed develops. The seeds develop into **15.** _____ and are dispersed.

Directions: *Study the diagram of the flower below and write the name of the structure after its function.*

16. brightly colored part _____

17. covers the bud _____

18. male reproductive organ _____

19. stalk of male organ _____

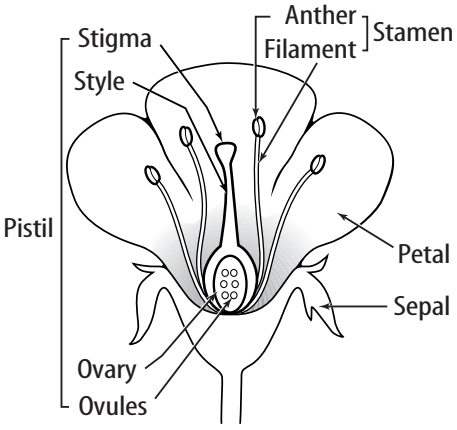
20. where pollen grains form _____

21. female reproductive organ _____

22. sticky area _____

23. stalk of female organ _____

24. where ovules are formed_____



Directions: *Answer the following question on the lines provided.*

25. Why is it important to a plant's life cycle for it to produce flowers that are colorful and smell good and to produce sweet-tasting fruit?

_____

_____

Assessment

Name Date Class

Chapter Test

Plant Reproduction

I. Testing Concepts

Directions: *In the blank at the left, write the letter of the term that best completes each statement.*

_____ **1.** Each _____ contains an egg cell, food-storage tissue, and a sticky fluid.
a. embryo **b.** egg **c.** ovule **d.** rhizome

_____ **2.** When all plant structures have a _____ set of chromosomes, it is called the gametophyte stage.
a. haploid **b.** diploid **c.** large **d.** similar

_____ **3.** A stamen consists of a(n) _____.
a. flower
b. stem
c. pistil and an anther
d. anther and a filament

_____ **4.** For mosses, the _____ supplies the _____ with nutrients.
a. gametophyte; sporophyte
b. sporophyte; gametophyte
c. root; frond
d. sun; sporophyte

_____ **5.** The leaves of ferns are called _____.
a. rhizomes **b.** sori **c.** fronds **d.** petals

_____ **6.** A _____ is the underground stem of a fern.
a. rhizome **b.** sori **c.** frond **d.** petal

_____ **7.** The process that a seed undergoes to become a plant is _____.
a. asexual reproduction
b. germination
c. prothallus
d. fertilization

_____ **8.** Some seeds have _____, which attach to fur and feathers.
a. pollen grains **b.** tiny hooks **c.** thick husks **d.** spores

_____ **9.** _____ all produce flowers.
a. Rhizomes **b.** Sori **c.** Angiosperms **d.** Gametophytes

_____ **10.** The _____ is the male reproductive organ of a flower.
a. filament **b.** stamen **c.** anther **d.** ovary

_____ **11.** Reproduction during which one organism produces genetically identicle offspring is called _____.
a. sexual reproduction
b. asexual reproduction
c. seeding
d. pollination

_____ **12.** Millions of years ago, most plants on Earth were _____.
a. vascular seedless plants
b. gymnosperms
c. angiosperms
d. rhizomes

Chapter Test (continued)

Directions: *Match the description in the first column with the item in the second column by writing the correct letter in the space provided. Some items in the second column may not be used.*

_____ **13.** underground stem of a fern

_____ **14.** leaf of a fern

_____ **15.** spore-producing structures on the underside of fern fronds

_____ **16.** phase in which spores are produced by meiosis

_____ **17.** a fern gametophyte

_____ **18.** the swollen base of the pistil in angiosperms, where ovules form

_____ **19.** the supply of stored food in the embryo of beans or peanuts

_____ **20.** form the outside of a bud and cover the petals

_____ **21.** a mature ovule

a. sori
b. cotyledons
c. ovary
d. rhizome
e. environmental conditions
f. gametophyte
g. ovule
h. sporophyte
i. sepals
j. haploid cells
k. frond
l. seed
m. prothallus

II. Understanding Concepts

Skill: Sequencing

Directions: *Complete the following by filling in the blanks.*

A moss sporophyte includes a stalk and capsule where numerous spores are produced by the process of **1.** _____. When a haploid spore lands on wet soil or rocks, it germinates into a threadlike structure. Within a few days, a small **2.** _____ moss plant begins to grow here. Sometimes it produces only male or female sex cells, but often both types are produced. During a heavy dew or rain the male sex cells swim to the egg. When they unite, they form a diploid zygote. It develops into an embryo, which in turn develops into a **3.** _____, and the cycle begins again.

In the life cycle of a fern, the gametophyte and sporophyte are independent of each other and can produce their own food. Ferns produce spores in structures called **4.** _____ on the lower sides of mature fronds. A spore lands on damp soil or rocks and grows into a **5.** _____, which is the gametophyte plant. It produces **6.** _____ that unite to form the **7.** _____. It then develops into the sporophyte, as in the mosses. But in ferns, the gametophyte also produces new **8.** _____, which grow into the separate sporophyte fern plants that you are familiar with.

Chapter Test (continued)

Skill: Classifying

Directions: *Study the life cycles shown below, and write the organism's name in the title.*

9. The _____ Life Cycle
- Sorus releases spores.
- Spores germinate into gametophytes.
- Gametophytes produce sex cells.
- Sex cells unite to form zygote.
- Zygote is the beginning of the sporophyte stage.

10. The _____ Life Cycle
- Sporophytes produce spores.
- Spores land in wet soil or rocks.
- Gametophytes grow.
- Male sex cells swim to female sex cells.
- Zygote divides to form embryo.
- Embryo develops into sporophyte.

III. Applying Concepts

Directions: *Sequence the life cycle stages of gymnosperms and angiosperms by numbering them in order, beginning with the development of sexual organs, which is already numbered 1.*

Gymnosperms

1 **1.** ovules develop, release sticky fluid; pollen grains develop on male cone

_____ **2.** sperm swims to ovule, fertilizing it

_____ **3.** pollen blown by wind to stigma

_____ **4.** pollen tube grows to ovule

_____ **5.** zygote forms

_____ **6.** cones mature, open, release seed

Angiosperms

1 **7.** ovules develop; male organ forms pollen grain

_____ **8.** seeds develop into fruit and are dispersed

_____ **9.** pollen gets to stigma by wind, insects, birds, mammals

_____ **10.** sperm unites with ovule

_____ **11.** pollen tube grows to ovule

_____ **12.** embryo part of seed develops

Chapter Test (continued)

Directions: *Match each reproductive organ of a flower with its description by writing the correct letter in the space provided.*

_____ **13.** female reproductive organ	**a.** anther
_____ **14.** sticky area where pollen grain lands	**b.** filament
_____ **15.** stalk of female reproductive area	**c.** ovary
_____ **16.** forms the ovules	**d.** pistil
_____ **17.** male reproductive organ	**e.** stamen
_____ **18.** stalk of male reproductive organ	**f.** stigma
_____ **19.** forms the pollen grains	**g.** style

IV. Writing Skills

Directions: *Answer the following questions using complete sentences.*

1. Describe the methods of seed dispersal in plants.

2. Describe a plant that you think would be beneficial if its germination period were short and a plant that you think would be harmful if its germination period were short. Include why you think one would be beneficial, while the other might be harmful.

3. Why are flowers important to the life cycle of some plants, but not others?

Transparency Activities

Name Date Class

SECTION 1 Section Focus Transparency Activity

It's a Jungle Out There

If you traveled from Alaska to Key West, Florida, you would expect to see many different plants. There's one place, however, where you could see more plants per square kilometer than any place else on Earth—a tropical rain forest.

1. **What factors make the rain forest a good environment for plant growth and reproduction?**
2. **Why are the upper layers of a rain forest so dense, while the lowest levels may be almost bare?**
3. **Why is the destruction of rain forests an important concern?**

Name Date Class

SECTION 2 Section Focus Transparency Activity

It's Raining, It's Sporing

While flowering plants use seeds to reproduce, mosses use a different strategy. As seen below, one part of moss reproduction involves releasing spores into the environment. Each spore is capable of growing into a new plant.

1. **Judging from the picture, how are moss spores dispersed?**
2. **Why does the moss produce so many spores?**

Name Date Class

SECTION 3

Section Focus Transparency Activity

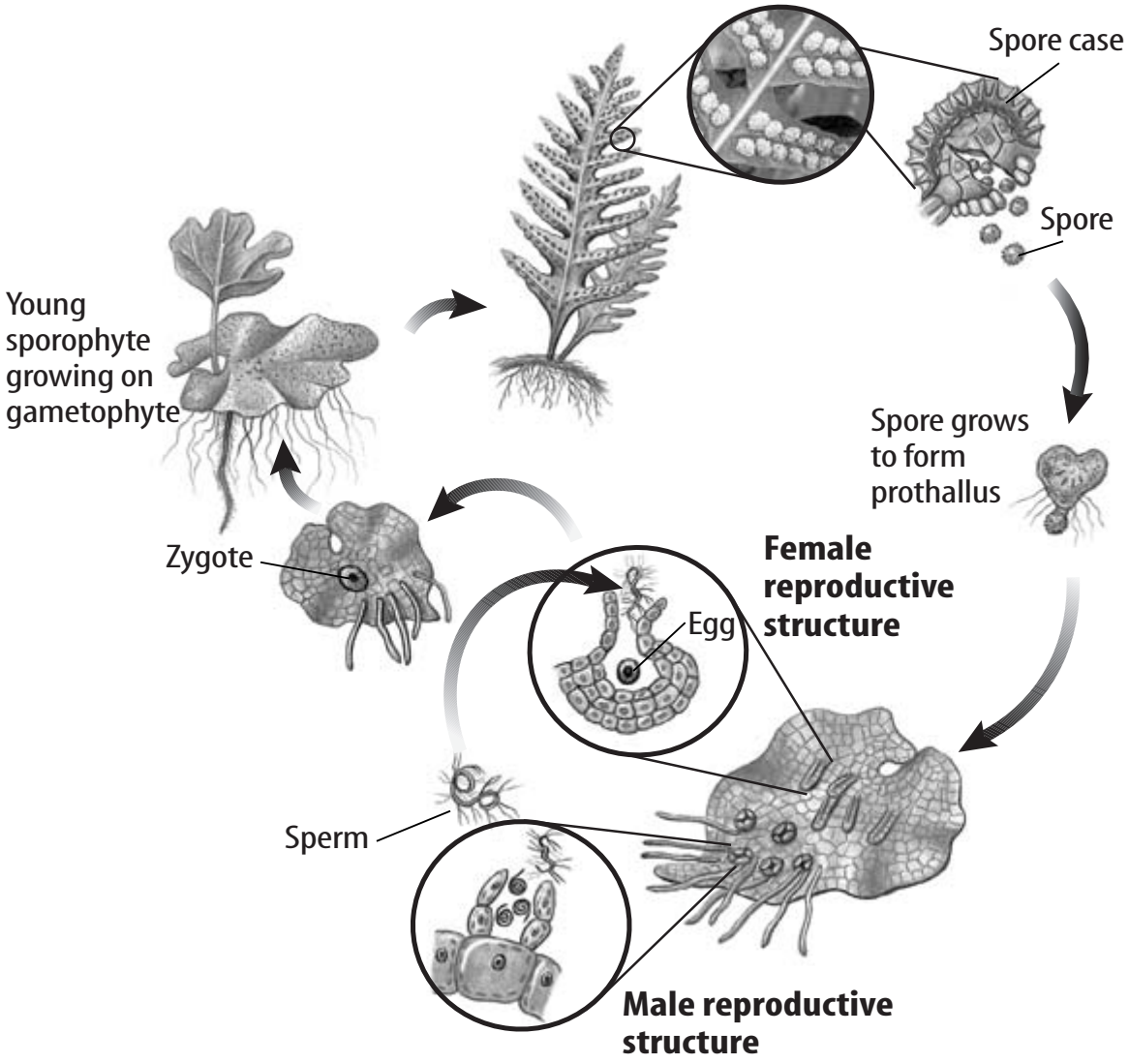
A Bee's-Eye View

A beautiful bright yellow flower you might notice in a field looks different to a bee. Bees can see ultraviolet light. To them the flower includes markings not visible to the human eye.

1. How do the bee's actions benefit the flower?
2. How do the ultraviolet markings help the bee? The flower?

SECTION 2 Teaching Transparency Activity

Fern Life Cycle



Teaching Transparency Activity (continued)

1. What does nonvascular mean?

2. Into what do fern spores form during the initial stage of their life cycle?

3. What does the prothallus contain?

4. What is the underground stem called?

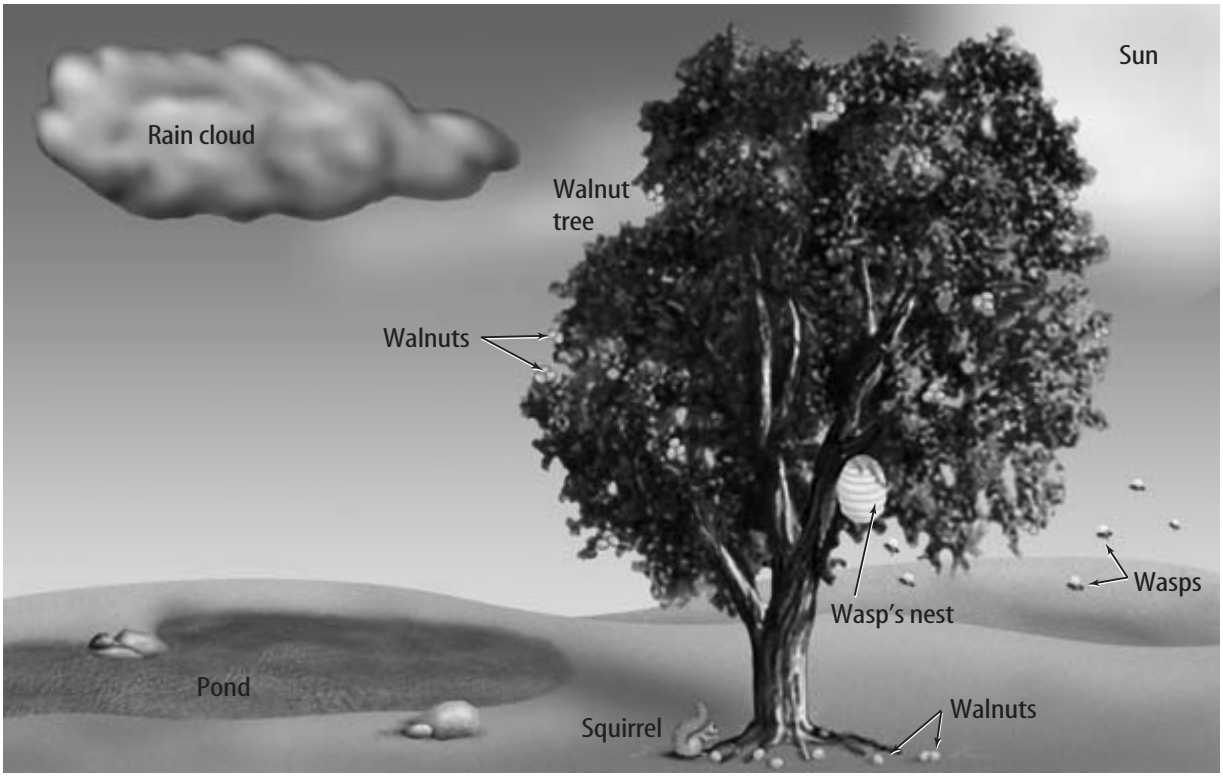
5. How do sporophytes make food?

6. What are the two reproductive structures of the fern plant?

Assessment Transparency Activity

Plant Reproduction

Directions: *Carefully review the diagram and answer the following questions.*



1. Which component of the ecosystem above is least likely to aid in germination of the walnuts?

A Rain **B** Squirrel **C** Wasps **D** Sunlight

2. Which component of the ecosystem shown above is most likely to aid in seed dispersal of the walnut tree?

F Rain **G** Squirrel **H** Wasps **J** Sunlight

3. If there were no squirrels in this ecosystem, the ratio of young walnut trees growing far from the main tree to those growing close to the main tree would most likely ___.

A increase
B stay the same
C increase, then decrease
D decrease

Teacher Support and Planning

Teacher Support and Planning

Content Outline for Teaching

Plant Reproduction

Section 1 Introduction to Plant Reproduction

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

A. Plants can reproduce both sexually and asexually.

1. In asexual reproduction a new plant can be grown from a leaf, stem, or root.

2. In sexual reproduction a sperm cell fertilizes an egg cell to form a zygote.

a. Some plants have both male and female reproductive organs; these plants can reproduce by themselves or with sex cells from other plants of the same type.

b. Some plant species have male and female organs on separate plants.

B. Plants have a two-stage life cycle.

1. The **gametophyte stage** begins when sex cells produce haploid cells called **spores**.

2. The **sporophyte stage** begins with fertilization.

DISCUSSION QUESTION:

Explain the two ways plants can reproduce. *Plants reproduce sexually when a sperm cell fertilizes an egg cell. They reproduce asexually when a new plant is grown from a leaf or a portion of the stem or root.*

Section 2 Seedless Reproduction

A. Seedless plants do not produce seeds.

1. The spores of seedless plants grow into plants that produce sex cells.
2. All nonvascular and some vascular plants are seedless.

B. Moss plants have a life cycle that illustrates typical sexual reproduction in nonvascular seedless plants.

1. The gametophyte stage produces sex cells.
2. The sporophyte stage produces spores.
3. When spores are released and land in an appropriate environment, they can grow into new gametophyte stage plants.
4. Nonvascular plants can also reproduce asexually if a piece of gametophyte stage plant breaks off and settles in an appropriate environment.

C. Most vascular seedless plants are ferns.

1. Fern sporophyte plants have leaves called **fronds,** which grow from an underground stem called a **rhizome**.
2. Fern spores are produced in **sori**, which are usually on the underside of fronds.
3. A fern spore that lands in a favorable environment grows into a gametophyte plant called a **prothallus**.
4. Sex cells form in the prothallus.
5. When fertilization occurs, the zygote starts the sporophyte stage.
6. Ferns may reproduce asexually when rhizomes form new branches and are separated from the main plant.

DISCUSSION QUESTION:

What are the two phases of sexual reproduction by seedless plants? T*he gametophyte stage and sporophyte stage*

Content Outline for Teaching (continued)

Section 3 Seed Reproduction

A. Pollen and seeds help many plants reproduce.

1. A **pollen grain** has a covering and contains gametophyte parts that can produce sperm.
2. **Pollination** occurs when pollen grains are transferred to the female part of the plant.
3. Following fertilization, the female part produces a seed which contains an embryo, stored food, and a protective coat.
4. Plants can develop more quickly from a seed than from a spore because a seed contains a(n) embryo and stored food.

B. Gymnosperms develop seeds in cones.

1. A pine tree or shrub is a sporophyte plant that produces male and female cones.
2. A female cone has two **ovules** which produce eggs.
3. Male cones produce and release pollen.
4. When pollen blows into a female cone, fertilization and seed formation can occur.
5. Seed release by a female cone can take two or three years.

C. Angiosperms produce flowers which are used for sexual reproduction.

1. The **stamen** is the male reproductive organ.
2. The **pistil**, the female reproductive organ, contains the **ovary** at its base.
3. The appearance of a plant's flowers can give clues about how the plant is pollinated.
4. After pollination and fertilization, a zygote forms and grows into the plant embryo.
5. Parts of the ovule develop into the seed coat and store food for the embryo.
   - **a.** Some seeds store food in cotyledons.
   - **b.** Other seeds store food in endosperm tissue.

D. Seeds are dispersed by wind, gravity, animals, and water.

1. **Germination** occurs when the seed coat swells and breaks open and a plant grows from the seed.
2. Environmental conditions affect germination.

DISCUSSION QUESTION:
What is the difference between gymnosperms and angiosperms? *Gymnosperm plants produce seeds in cones; angiosperm plants use flowers for reproduction and seed making.*

Spanish Resources

Reproducción de las plantas

Sección 1 Introducción a la reproducción vegetal

Lo que aprenderás

- **A distinguir** entre los dos tipos de reproducción vegetal.
- **A describir** las dos etapas en el ciclo de vida de una planta.

Vocabulario

gametophyte stage / etapa gametofita: etapa del ciclo de vida vegetal que comienza cuando las células de los órganos reproductores pasan por la meiosis y producen células haploides.

spores / esporas: células haploides producidas en la etapa gametofita que se puede dividir por mitosis y formar estructuras vegetales o una planta nueva completa, o que se puede desarrollar en células sexuales.

sporophyte stage / etapa esporofita: etapa del ciclo de vida vegetal que comienza cuando un espermatozoide fecunda un huevo.

Por qué es importante

Puedes hacer crecer plantas nuevas sin usar semillas.

Sección 2 Reproducción sin semilla

Lo que aprenderás

- **A examinar** los ciclos de vida de un musgo y un helecho.
- **A explicar** por qué las esporas son importantes para las plantas sin semilla.
- A identificar algunas estructuras especiales que usan los helechos para la reproducción.

Vocabulario

frond / fronda: hoja de helecho que crece desde el rizoma.

rhizome / rizoma: tallo subterráneo de un helecho.

sori / soros: estructuras de los helechos en los cuales se producen las esporas.

prothallus / protalo: forma vegetal gametofita de un helecho, pequeña, verde y en forma de corazón, capaz de producir su propio alimento y absorber agua y nutrientes del suelo.

Por qué es importante

Los helechos ayudan a producir tierra nueva en las rocas peladas o en la lava enfriada, haciendo posible que otras plantas echen raíces.

LABORATORIO Compara las plantas sin semilla

Todas las plantas sin semilla tienen estructuras especializadas que producen esporas. Aunque estas estructuras llamadas esporofitos tienen una función similar, se ven diferentes. Las plantas gametofitas también son diferentes entre sí. Haz este laboratorio y observa las semejanzas y diferencias entre los tres grupos de plantas sin semilla.

Preguntas del mundo real

¿En qué se parecen y en qué se diferencian las etapas gametofitas y las etapas esporofitas de las hepáticas, musgos y helechos?

Materiales

musgos, hepáticas y helechos vivos con gametofitos y esporofitos
lupa
pinzas
gotero
laminillas y cubreobjetos (2)
microscopio
aguja de disección
lápiz con borrador

Metas

- **Describir** la forma gametofítica y esporofítica de las hepáticas, musgos y helechos.
- **Identificar** las estructuras productoras de esporas de las hepáticas, musgos y helechos.

Medidas de seguridad 

Procedimiento

1. Obtén un gametofito de cada planta. Con una lupa, observa los rizoides, las frondas y las partes que parecen tallos, si están presentes.

2. Obtén un esporofito de cada planta y usa una lupa para observarlo.
3. En el musgo, localiza y remueve una estructura con las esporas. Ponla en una gota de agua en una laminilla.
4. Coloca el cubreobjetos en la laminilla. Usa el borrador para empujar suavemente el cubreobjetos para sacar las esporas. **PRECAUCIÓN:** *no quiebres el cubreobjetos.* Observa las esporas en bajo y alto poder.
5. Haz dibujos rotulados en tu Diario de ciencias de todas las observaciones.
6. Repite los pasos 3 y 4 usando un helecho.

Concluye y aplica

1. **Compara** la apariencia del gametofito con la apariencia del esporofito en cada planta.
2. **Enumera** las estructuras comunes a las tres plantas.
3. **Formula una hipótesis** acerca de por qué cada planta produce un gran número de esporas.

Comunica tus datos

Prepara un boletín informativo que muestre las diferencias entre las etapas de esporofito y gametofito de los musgos, helechos y hepáticas. **Para más ayuda, consulta el Science Skill Handbook.**

SECCIÓN 3 Reproducción con semilla

Lo que aprenderás

- **A examinar** los ciclos de vida de gimnospermas y angiospermas típicas.
- **A describir** la estructura y función de la flor.
- A discutir los métodos de dispersión de las semillas en plantas con semilla.

Vocabulario

pollen grain / grano de polen: estructura pequeña producida por los órganos reproductores masculinos de una planta de semilla; posee un revestimiento resistente al agua, se puede desarrollar a partir de una espora y contiene partes gametofitas que producen espermatozoides.

pollination / polinización: traspaso de los granos de polen a la parte femenina de una planta de semilla efectuado por agentes como la gravedad, el agua, el viento y los animales.

ovule / óvulo: en las gimnospermas, la parte reproductora femenina que produce huevos y tejidos que almacenan de alimento.

stamen / estambre: órgano reproductor masculino que se encuentra dentro de la flor de las angiospermas; consta de una antera (donde se forman los granos de polen) y de un filamento.

pistil / pistilo: órgano reproductor femenino que se encuentra dentro de la flor de las angiospermas; consta de un estigma pegajoso (donde aterrizan los granos de polen) y de un ovario.

ovary / ovario: base hinchada del pistilo de una angiosperma donde se hallan los óvulos productores de huevos.

germination / germinación: serie de eventos que dan como resultado el crecimiento de una planta a partir de una semilla.

Por qué es importante

Las semillas de los conos y de las flores producen la mayoría de las plantas terrestres.

LABORATORIO *Diseña tu propio* Tasa de germinación de semillas

Muchos factores ambientales afectan la tasa de germinación de las semillas. Entre estas están la temperatura del suelo, la temperatura del aire, el contenido de humedad del suelo y el contenido de sal del suelo. ¿Qué pasa con la tasa de germinación cuando una de estas variables se cambia? ¿Puedes determinar una forma de predecir las mejores condiciones para la germinación de las semillas?

Preguntas del mundo real

¿Qué efecto tienen los factores ambientales en la germinación de las semillas?

Formula una hipótesis

Con base en tu conocimiento de la germinación de las semillas, formula una hipótesis sobre cómo los factores ambientales afectan las tasas de germinación.

Posibles materiales

semillas
agua
sal
tierra para macetas
bandejas para plantas o tazas plásticas
**cables de calentamiento para semilleros*
termómetro
probeta
vaso de precipitados
**Materiales alternativos*

Metas

- **Diseñar** un experimento para probar el efecto de un factor ambiental en la tasa de germinación de las semillas.
- **Comparar** las tasas de germinación bajo condiciones diferentes.

Medidas de seguridad

PRECAUCIÓN: *Algunas semillas son venenosas. No pongas ninguna semilla en tu boca. Ten cuidado al usar cualquier equipo eléctrico para evitar peligros de descargas.*

Prueba tu hipótesis

Diseña un plan

1. Ponte de acuerdo con tu grupo y escriban su hipótesis; decidan cómo la van a probar. Identifiquen cuáles resultados van a confirmar su hipótesis.
2. Enumera los pasos que necesitas seguir para probar la hipótesis. Sé específico y describe exactamente lo que vas a hacer en cada paso. Enumera los materiales.
3. Prepara un cuadro de datos en tu Diario de ciencias para registrar tus observaciones.
4. Relee todo tu experimento para estar seguro de que todos los pasos están en orden lógico.
5. Identifica todas las constantes, variables y controles del experimento.

Sigue tu plan

1. Asegúrate de que tu maestra(o) aprueba tu plan y tu cuadro de datos antes de continuar.
2. Usa el mismo tipo y cantidad de tierra en cada bandeja.
3. Mientras el experimento continúa, registra tus observaciones con precisión y completa el cuadro de datos en tu Diario de ciencias.

Analiza tus datos

1. **Compara** la tasa de germinación en los dos grupos de semillas.
2. **Compara** tus resultados con los de otros grupos.
3. ¿El cambio de variable afectó las tasas de germinación? Explica.
4. Haz una gráfica de barras con los resultados de tu experimento.

Concluye y aplica

1. **Interpreta** tu gráfica para estimar las condiciones que dan la mejor tasa de germinación.
2. **Describe** los factores afectan la tasa de germinación.

Comunica tus datos

Escribe un breve artículo sobre este experimento para un periódico local. Da algunas ideas sobre cómo y cuándo sembrar semillas en el jardín y las condiciones necesarias para su germinación.

Guía de estudio

Repasa las ideas principales

Sección 1 Introducción a la reproducción vegetal

1. Las plantas se reproducen sexual y asexualmente. La reproducción sexual involucra la formación de células sexuales y la fertilización.
2. La reproducción asexual no involucra células sexuales y produce plantas genéticamente idénticas a la planta paterna. *¿Se parecen genéticamente los helechos producidos por el mismo rizoma?*

Spanish Resources (continued)

3. Los ciclos de vida de las plantas incluyen una etapa gametofita y una esporofita. La etapa gametofita empieza con la meiosis. La etapa esporofita empieza cuando el huevo es fertilizado por un espermatozoide.
4. En algunos ciclos de vida vegetales, las etapas esporofita y gametofita están separadas y no dependen una de la otra. En otros ciclos de vida de las plantas, son parte del mismo organismo.

Sección 2 Reproducción sin semilla

1. Para las hepáticas y musgos, la etapa gametofita es la forma vegetal familiar. La etapa esporofita produce esporas.
2. En los helechos, la etapa esporofita, no la gametofita, es la forma vegetal familiar.
3. Las plantas sin semilla, como los musgos y los helechos, usan reproducción sexual para producir esporas. *¿Por qué las plantas sin semilla tales como ésta producen tantas esporas pequeñas?*

Sección 3 Reproducción con semilla

1. En las plantas con semilla los órganos reproductores masculinos producen granos de polen que contienen esperma. Los huevos se producen en los óvulos de los órganos reproductores femeninos.
2. Los órganos reproductores masculino y femenino de las gimnospermas se llaman conos. El viento usualmente mueve el polen del cono masculino al cono femenino para la polinización.
3. Los órganos reproductores de las angiospermas están en una flor. El órgano reproductor masculino es el estambre y el órgano reproductor femenino es el pistilo. La gravedad, el viento, la lluvia y los animales pueden polinizar una flor. *¿Cómo se polinizarían estas flores?*
4. Las semillas de las gimnospermas y angiospermas se dispersan de muchas formas. El viento, el agua y los animales dispersan las semillas. Algunas plantas pueden lanzar sus semillas.
5. La germinación es una serie de eventos que resultan en el crecimiento de una planta a partir de una semilla.

Hands-On Activities

MiniLAB (page 3)

1. Drawings should show the growth of a new plant in the soil. Plants should have roots, stems, and leaves.
2. The plants are genetically identical.

MiniLAB: Try at Home (page 4)

1. Answers will vary depending on the button chosen and methods tried.
2. Answers will vary depending on the button chosen and methods tried.

Lab (page 5)

Lab Note: Direct students to keep the plants away from their face and mouth. Have students wash their hands after handling the plants. Some students may be sensitive or allergic to the plants used in the lab. Allow those who prefer to wear disposable gloves when handling the plants.

Lab Note: Review with students how to operate the compound light microscope and make a wet-mount slide. Glass slides and coverslips can break and cut the skin. Show students how to dispose of broken glass. Do not allow students to use direct sunlight as a light source with microscopes lacking their own light source.

Lab Preview

1. Coverslips are fragile and easily broken.
2. low power and high power

Conclude and Apply

1. Moss gametophyte: green, low-growing structure with leaves in a whorl around a stalk; liverwort gametophyte: green, flat, leaflike form. Sporophytes of mosses are a nongreen stalk with a spore-containing capsule at the top. Liverwort sporophytes form on the gametophytes as nongreen umbrella-like structures with spores in cases underneath. Fern gametophytes: green, heart-shaped structures; their sporophytes are familiar green plants.
2. gametophyte, sporophyte, rhizoids, spores, leaflike structures
3. Many spores do not land where conditions are right for growth. The greater the number of spores produced, the greater the chances that some will grow.

Lab: Design Your Own (page 7)

Lab Note: Direct students to keep the seeds away from their face and mouth. Have students wash their hands after handling the seeds and soil.

Lab Note: Provide students with red-liquid or other non-mercury thermometers for this lab.

Lab Preview

1. Answers will vary, but might include the following: temperature, wetness, amount of sunlight, amount of shade.
2. eye protection, clothing protection, disposal, biological, and electrical

Analyze Your Data

1. One group should have had a higher germination rate than the other.
2. Groups testing the same variable should have similar results.
3. Amount of time for germination and germination rates vary with environmental conditions and species of plant tested.
4. Graphs should accurately reflect experimental data.

Conclude and Apply

1. Graphs will vary, but each should indicate a range for best germination of the variable tested.
2. Answers may include water quality, amount of water, planting depth, and other similar variables.

Laboratory Activity 1 (page 9)

Lab Note: You might wish to buy loose tobacco or remove tobacco from cigarettes instead.
Lab Note: Use denatured ethyl alcohol.
Lab Note: Supervise students so that no errors are made in placing the wrong soaked seed type into the properly marked dish.

Data and Observations

Lab Note: No special temperature or light conditions are needed for seed storage. Room temperature conditions are suitable.
Table 1 Students' observations will vary.

Questions and Conclusions

1. **a.** radish and pinto beans
   b. aspirin, alcohol, nicotine, caffeine
2. to determine how different drugs affect the growth of seeds
3. Answers will vary.
4. **a.** yes
   b. Answers will vary.
5. Answers will vary.
6. **a.** yes
   b. Answers will vary.
7. Water does not prevent or limit the ability of radish and pinto seeds to grow. However, if these two seed types are soaked in alcohol, aspirin, nicotine, or caffeine, their growth is either slowed or prevented from occurring in five days. It appears that these four drugs do have a harmful effect on seed growth. (Accept all reasonable paragraphs.)
8. **a.** no
   b. Answers will vary.
   c. Answers will vary.

Lab Note: You might wish to expand this experiment using other drugs that are easily available and/or using different seeds and/or by extending the time for observations from 5 to 10 days.

Laboratory Activity 2 (page 13)

Lab Note: All of these seeds are available in grocery stores. Purchase unshelled sunflower seeds and peanuts in their shells. Students with peanut allergies should not handle the peanuts.

Lab Note: Corn is the only seed coat that should be difficult to open.

Data and Observations

Table 1

1. soft; yes; two; dicotyledon; yes
2. soft; yes; two; dicotyledon; yes
3. hard; no; one; monocotyledon; yes
4. hard; yes; two; dicotyledon; yes
5. soft; yes; two; dicotyledon; yes

Questions and Conclusions

1. The seed coat protects the seed. Cotyledons contain stored food for the growth of the new plant.
2. Plants cannot make their own food until they emerge from the soil.
3. Monocotyledon seeds cannot be easily split into equal halves. Two parts are not present.
4. No. All seeds contain a plumule and radicle.
5. Nothing, because the plumule and the radicle are the tiny plant. No new plant would result if they were not present.

Meeting Individual Needs

Directed Reading for Content Mastery (page 17)

Overview (page 17)

1. pistil
2. sepal
3. stamen
4. petal
5. anther
6. stigma
7. asexual
8. ferns, mosses

Sections 1 and 2 (page 18)

1. sporophyte
2. capsule (or spore case)
3. gametophyte
4. spore
5. fronds
6. rhizome
7. sorl
8. prothallus
9. nonvascular
10. cell
11. chlorophyll

Section 3 (page 19)

1. pistil
2. stigma
3. style
4. ovary
5. ovule
6. stamen
7. anther
8. filament
9. petal
10. sepal
11. pollen
12. stamen
13. pistil
14. wind
15. animals
16. stigma
17. pollen
18. ovary
19. sperm
20. egg
21. seed

Key Terms (page 20)

1. d
2. a
3. g
4. b
5. h
6. e
7. m
8. n
9. j
10. k
11. l
12. i
13. f
14. c

Lectura dirigida para Dominio del contenido (pág. 21)

Sinopsis (pág. 21)

1. pistilo
2. sépalo
3. estambre
4. pétalo
5. antera
6. estigma
7. asexual
8. helechos, musgos

Secciones 1 y 2 (pág. 22)

1. esporofítica
2. cápsula (o cápsula de esporas)
3. gametofítica
4. espora
5. frondas
6. rizoma
7. soro
8. prótalo
9. no vascular
10. célula
11. clorofila

Sección 3 (pág. 23)

1. pistilo
2. estigma
3. estilo
4. ovario
5. óvulo
6. estambre
7. antera
8. filamento
9. pétalo
10. sépalo
11. polen
12. estambre
13. pistilo
14. viento
15. animales
16. estigma
17. polen
18. ovario
19. espermatozoide
20. huevo
21. semilla

Términos claves (pág. 24)

1. d
2. a
3. g
4. b
5. h
6. e
7. m
8. n
9. j
10. k
11. l
12. i
13. f
14. c

Reinforcement (page 25)

Section 1 (page 25)

1. haploid
2. spores
3. sporophyte
4. fertilization
5. reproductive
6. holly
7. gametophyte
8. reproduction
9. diploid cells
10. life cycle
11. A plant's female reproductive organs produce eggs and male reproductive organs produce sperm. If a plant has both organs it usually can reproduce by itself. When cells in reproductive organs undergo meiosis and produce spores, the gametophyte stage begins. Some plants release spores, which undergo cell division to form plant structures.
12. Growers can produce new plants by asexual reproduction because many plant cells have the ability to grow into a variety of cell types. Under the right conditions, an entire plant can grow from one leaf or just a portion of the stem or root.

Section 2 (page 26)

1. sporophyte
2. spore case
3. released spores
4. gametophyte
5. frond
6. rhizome
7. sorus or spore case
8. spore
9. prothallus
10. Water from dew or rain transports the sperm to the female reproductive structure.
11. Rhizomes can form new branches. Fronds develop from the new branches. If the new rhizome branches and fronds are separated from the original plant, they can grow as a new plant.

Section 3 (page 27)

1. B
2. A
3. A
4. gymnosperms
5. pollination
6. stamen
7. pistil
8. anther
9. pollen
10. stigma
11. pollen tube
12. embryo
13. ovary
14. dormant
15. insects
16. seed dispersal
17. germination

Enrichment (page 28)

Section 1 (page 28)

1. Dioecious refers to a plant that produces the male and female reproductive organs on different plants.
2. their long reproductive periods, the long length of time it takes for them to grow, and habitat loss

Section 2 (page 29)

1. Spore banks have been created to help protect species of fern, as well as to encourage research and study into fern species.
2. If fern spores contain too much chaff, the fern will not grow.
3. Answers will vary, but might include the following: Spore banks want to encourage fern growers, and keep costs low to do so. However, they must pay for operating expenses, and therefore need to charge a "nominal fee."

Section 3 (page 30)

1. Answers will vary widely. A flower can produce millions of pollen grains.
2. from the anther on the stamen
3. The pollen grains are carried by insects or wind to other flowers of the same kind to pollinate those flowers. There must be a great number of pollen grains because that process is very random.

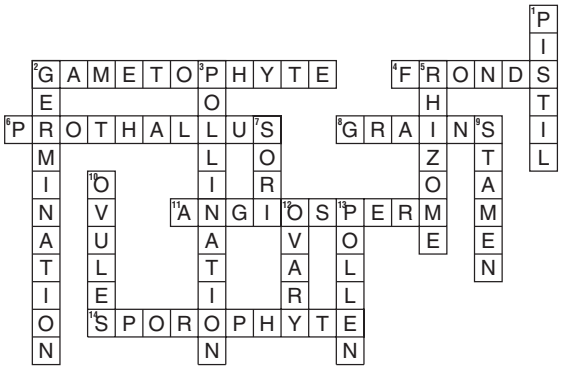
Note-taking Worksheet (page 31)

Refer to Teacher Outline, student answers are underlined.

Assessment

Chapter Review (page 35)

Part A. Vocabulary Review



Across

2. (4/2)
4. (3/2)
6. (4/2)
8. (5/2)

11. (6/3)
14. (7/3)

Down

1. (7/3)
2. (2/1)
3. (7/3)
5. (5/2)
7. (5/2)
9. (7/3)
10. (7/3)
12. (7/3)
13. (7/3)

Part B. Concept Review

1. Ovules (6/3)
2. Pollen grains (6/3)
3. Pollen (6/3)
4. pollen tube (6/3)
5. Sperm (6/3)
6. zygote (6/3)
7. cones (6/3)
8. ovules (6/3)
9. pollen grains (6/3)
10. Pollen (6/3)
11. stigma (6/3)
12. pollen tube (6/3)
13. sperm (6/3)
14. embryo (6/3)
15. fruit (6/3)
16. petal (7/3)
17. sepal (7/3)
18. stamen (7/3)
19. filament (7/3)
20. anther (7/3)
21. pistil (7/3)
22. stigma (7/3)
23. style (7/3)
24. ovary (7/3)
25. It is important for plants to produce colorful and sweet smelling flowers so that insects and other animals will be attracted to them. Animals play an important role in the plant's life cycle by helping with pollination and seed dispersal. Animals that are attracted to a plant's fruit aid the plant in dispersing its seeds. (7,8/3)

Chapter Test (page 37)

I. Testing Concepts

1. c (7/3)
2. a (2/1)
3. d (7/3)
4. a (3/2)
5. c (5/2)
6. a (5/2)
7. b (6/3)
8. b (8/3)
9. c (6/3)
10. b (7/3)
11. b (1/1)
12. a (4/2)
13. d (5/2)
14. k (5/2)
15. a (5/2)
16. h (4/2)
17. m (5/2)
18. c (7/3)
19. b (6/3)
20. i (7/3)
21. l (7/3)

II. Understanding Concepts

1. meiosis (3/2)
2. gametophyte (3/2)
3. sporophyte (3/2)
4. sori (3/2)
5. prothallus (3/2)
6. sex cells (3/2)
7. zygote (3/2)
8. rhizomes (3/2)
9. Fern (3/2)
10. Moss (3/2)

III. Applying Concepts

1. 1 (6/3)
2. 4 (6/3)
3. 2 (6/3)
4. 3 (6/3)
5. 5 (6/3)
6. 6 (6/3)
7. 1 (6/3)
8. 6 (6/3)
9. 2 (6/3)
10. 4 (6/3)
11. 3 (6/3)
12. 5 (6/3)
13. d (7/3)
14. f (7/3)
15. g (7/3)
16. c (7/3)
17. e (7/3)
18. b (7/3)
19. a (7/3)

IV. Writing Skills

1. Some seeds are fruit. As they are eaten by animals, the seeds are moved to new locations, where they may be able to germinate. Some seeds, like maple trees and dandelions, are dispersed by the wind. Some will stick to anything that touches them, like fur or feathers, and are moved that way. Other seeds, which are less dense than water, are dispersed by floating on water. (8/3)
2. A plant that is a food source would be beneficial if it had a short germination period. It would be beneficial because we could grow more of it and feed more people. A plant that causes problems for people, like poison ivy and poison oak, would be harmful if it had a shorter germination period. It would be harmful because more people could potentially be exposed to it. (2/1)

3. Flowers are important to those plants that cannot rely on gravity, wind, or other environmental factors to help fertilize another plant. Flowers and fruit attract animals that then transport the pollen to another plant. However, plants that live in areas of high wind, near water, or with similar environmental factors do not need to attract animals to help them fertilize other plants. (7/3)

Section Focus Transparency 1 (page 42)

It's a Jungle Out There

Transparency Teaching Tips

- Plant reproduction is introduced here. Ask students to explain the processes by which plants reproduce. One type of reproduction is asexual, while the other is sexual. Many plants are capable of reproducing sexually and asexually.
- In asexual reproduction, a new plant grows from a piece of the old plant. A cutting, stem, leaf, or root section falls from the parent plant and takes root in the soil. A new plant then grows from the fragment.
- Other plants reproduce sexually. These plants possess male or female organs or both. Insects, bats, birds, other animals, and the wind transfer sperm from one plant to another plant of the same species.
- The warm, humid environment of a tropical rain forest is especially conducive to plant growth and reproduction. Composed of distinct layers, a tropical rain forest may have as many as 280 plant species in one one-hundredth of a square kilometer.

Content Background

- Asexual plant reproduction is also called vegetative propagation.
- The rain forest is divided into four layers—the sparse forest floor, the understory just above the forest floor, the canopy, and the emergent layer of growth sprouting through the canopy.
- More than half of all species of plants and animals on Earth live in rain forests.
- In a rain forest, only about one percent of the sunlight filters through the canopy layers and reaches the ground. This also applies to a lesser extent to rainfall. This is why few plants survive on the dark rain forest floor.
- In more open areas of the rain forest, where light and moisture reach the lower levels, vegetation grows as thick as the upper layers. Such areas are called jungles.
- Rain forests are aptly named. Rain may fall more than 200 days a year, with yearly accumulations of 125 to 660 cm (50 to 260 inches).
- Rain forests play an important role in Earth's ecosystem, providing the habitat for over half of Earth's plants and animals. In addition, they process enormous amounts of carbon dioxide, turning it into oxygen. Ongoing destruction of tropical rainforest is a continuing concern, even for those far removed from the forests. Destruction of rain forests increases carbon dioxide concentrations. These concentrations are the most important greenhouse gas, which means that rain forest deforestation may lead to higher global temperatures.

Answers to Student Worksheet

1. Tropical rain forests are humid and warm.
2. The upper layers receive most of the sunlight and rainfall, blocking or absorbing these resources and preventing them from reaching the ground.
3. Half the world's plants and animals live in rain forests. Also, without rain forest plants to convert carbon dioxide, global temperatures could rise due to the greenhouse effect.

Section Focus Transparency 2 (page 43)

It's Raining, It's Sporing

Transparency Teaching Tip

- The transparency may be used to introduce seedless plant reproduction. Ask students if they have ever seen mosses and ferns growing in the woods. Explain that such plants reproduce by releasing spores into their usually damp environment. This is the second stage of their reproductive cycle.

Content Background

- There are 9,000 species of moss, worldwide. In the first stage of life, the one usually seen in the wild, the moss is called a gametophyte. When the gametophyte matures, it produces female egg cells or male sperm cells (about half of all mosses can produce both on the same plant). The sperm cells are released (that's not what you see in the picture.) If the sperm unites with an egg, it forms a zygote, thus beginning the second phase of its life cycle. During this phase, the zygote matures into a sporophyte, which attaches itself to the original gametophyte. The sporophyte is the long stalk and capsule seen in the picture. Spores, from four to more than a million in number, depending on the species, are formed in the capsule and released when ripe. If it falls in a damp area, a spore may sprout and grow into a gametophyte. The entire process is then repeated.

Answers to Student Worksheet

1. They are dispersed through the air. When the spores are ripe and environmental conditions are favorable, the capsule will open, allowing the wind to carry the dustlike spores.
2. The more it releases, the better chance that one of the spores will land in an environment (such as an open, moist area of soil) that will allow it to grow.

Teacher Guide & Answers (continued)

Section Focus Transparency 3 (page 44)

A Bee's-Eye View

Transparency Teaching Tip

- You may use this transparency to introduce the concept that flowers contain both female and male reproductive parts. Pistils are the female parts of the flower. They produce seeds and are located in the center of a flower's petals. The male parts of the plant, called stamen, produce pollen. Also placed near the flower's center, the stamen consists of a thin stem with an enlarged tip that opens to release ripe pollen. Certain flower parts, such as the petals (corolla), are attractive to different kinds of pollinating animals, particularly the bee, which is drawn to the ultraviolet markings on most flowers. These animals are attracted to the colors and the smell produced by oily substances in the flower's petals.

Content Background

- Explain that the ultraviolet light seen by bees is a part of the electromagnetic spectrum (ask them about "black lights" and "black light" posters). Using ultraviolet light, bees can see lines or nectar guides that lead them to the nectar, but also bring them into contact with pollen.
- Seeds form in the female part of the plant, the ovary, an opening at the base of the flower. Pollen, containing the male sex cells, must be carried from the male parts of one plant to the female parts of another in order to fertilize the seeds.
- Most flowers are pollinated by bees. Butterflies, birds, moths, bats, beetles, flies and the wind also help in pollination.

Answers to Student Worksheet

1. The flower can pollinate. Bees perform the majority of flower pollination.
2. In search of nectar, the bee is drawn to the flower by ultraviolet markings and smell. As the bee goes for the nectar, it brushes up against and collects pollen on its body. On the next flower (of the same type) it may accidentally deposit this pollen in the flower's ovary. This is how flowers reproduce.

Teaching Transparency (page 45)

Fern Life Cycle

Section 2

Transparency Teaching Tips

- Point out that ferns are vascular plants that produce spores. Explain each reproductive step shown on the transparency.
- Remind students that ferns are the largest group of seedless vascular plants.

Reteaching Suggestion

- Compare the life cycle of a fern with the life cycle of a moss. Discuss similarities and differences.

Extensions

Demonstration: Bring several different species of ferns to class to show the different leaf types and spore placements. You may be able to obtain these from a local plant nursery.

Concept Mapping: Have students prepare a concept map detailing the life cycle of one species of moss.

Answers to Student Worksheet

1. It means the plant lacks structures to transport water and substances throughout the plant.
2. prothallus
3. male and female reproductive structures
4. rhizome
5. photosynthesis
6. gametophyte and sporophyte

Assessment Transparency (page 47)

Plant Reproduction

Section 3

Answers

1. **C.** This question requires students to recognize the environmental stimuli that trigger the process of germination.
2. **G.** This question asks students to use their knowledge of ecosystems to infer that dispersal of a large seed such as a walnut is most likely to occur via the squirrel. None of the other factors are likely to assist significantly.
3. **D.** This question tests students' practical understanding of seed dispersal. Without the squirrel to relocate the walnuts farther from the main tree, they are likely to sprout where they fall, directly beneath the main tree.

Test-Taking Tip

Encourage students to look at the four choices before answering the question.