

- Fungi are heterotrophic eukaryotes that digest food outside their bodies and absorb the nutrient molecules. A fungus consists of threadlike hyphae with chitin cell walls that form a feeding network called a mycelium. Fungi spread as spores and grow rapidly through their food. They are found nearly everywhere and are important decomposers. Parasitic fungi cause most plant diseases, and a few are human parasites. Some fungi produce food and antibiotics. Most plants have beneficial mycorrhizal fungi associated with their roots.
- Most fungi reproduce sexually via a three-phase life cycle: Spores germinate and haploid hyphae develop. When mycelia of different mating types meet, hyphae fuse but their nuclei do not, producing heterokaryotic cells with two haploid nuclei. Later, the heterokaryotic mycelium forms a reproductive structure, such as a mushroom. In certain cells, nuclei fuse, producing a diploid cells that immediately undergo meiosis, producing spores. There are five groups of fungi, classified on the basis of sexual reproductive structures.
- Many fungi typically reproduce asexually. A mold is any rapidly growing fungus that produces spores asexually. A yeast is any single-celled fungus that reproduces by fission or budding.

Review the Concepts

Work through the following exercises to review the concepts in this chapter. For additional review, check out the activities at www.mybiology.com. The website offers a pre-test that will help you plan your studies.

Exercise 1 (Module 17.1)

Structural, biochemical, and genetic evidence suggests that plants and green algae called charophytes probably evolved from a common algal ancestor. Land plants make up a clade with a set of derived characters that set them apart from algae. Most of these characters are adaptations to life on land. Complete the chart below by listing the major problems plants have to contend with and the adaptations that set plants apart from green algae. (Use a pine tree or rose bush as your plant example; in some ways simple plants such as mosses are “in between” algae and plants.) Also, note (*) which plant characteristics are the shared derived characters of the plant clade.

Differences Between Green Algae and Plants

<i>Green algae</i>	<i>Pine tree or rose bush</i>
1. Surrounded by water, unlikely to dry out	1.
2. Exchange gases through body surface	2.
3. Obtain water, gases, nutrients all from one location	3.
4. Floats in water	4.
5. Gamete-producing cells exposed to water	5.
6. Sperm swim and eggs fertilized in water	6.
7. Embryos develop in water	7.
8. No protected cells or embryos for dispersal	8.

Exercise 2 (Module 17.2)

This module summarizes the four major steps in plant evolution that gave rise to four major modern groups of plants. Each of the statements below describes one of those steps. Number the steps in order, and fill in the names of the plant groups.

- ___ A. The first plants that produced pollen and seeds evolved. The modern seed plants are _____ and _____.
- ___ B. Plants evolved from ancestral green algae; one lineage gave rise to the _____, a group that included the mosses, liverworts, and hornworts.
- ___ C. The first flowering plants, or _____, appeared.
- ___ D. Vascular plants evolved that had roots and strong stems supported by lignin-hardened vascular tissues, unlike the _____. Their modern-day representatives are the _____ and the seed plants.

Exercise 3 (Modules 17.3–17.4)

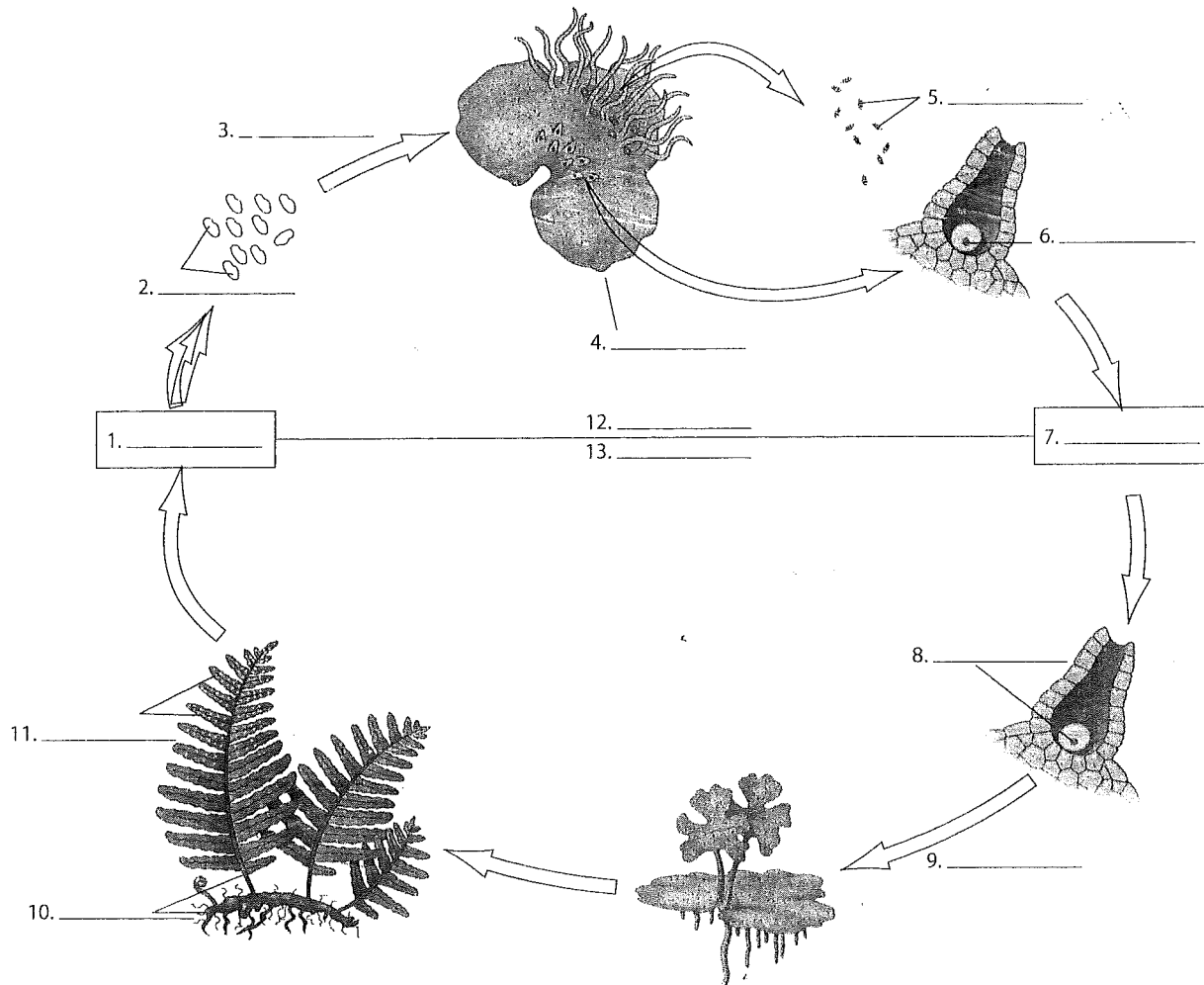
Haploid and diploid generations alternate in all plant life cycles. This is one of the defining characteristics of plants. Study the diagrams in these modules to review alternation of generations. Then fill in the blanks below to complete the description of the moss life cycle.

The moss life cycle, like that of all plants, is characterized by alternation of generations. Diploid individuals called ¹ _____ produce ² _____ plants called gametophytes, which in turn produce ³ _____ sporophytes. Since it's a cycle, we could start at any point, but let's start with a spore. A haploid moss spore grows into the haploid ⁴ _____ plant, the green, cushiony growth we see on rocks or logs in a forest or bog. ⁵ _____ (eggs and sperm) develop in the protection of special organs called ⁶ _____ that are part of the gametophytes. Moss ⁷ _____ have ⁸ _____ that enable them to swim to the eggs, given a film of moisture produced by dew or raindrops. ⁹ _____, the fusion of egg and sperm, produces a diploid ¹⁰ _____, which remains protected in the female gametophyte. The zygote divides by mitosis and develops into the sporophyte, which consists of a ¹¹ _____ attached to the gametophyte by a slender stalk. Within the sporangium, haploid ¹² _____ are produced by the process of ¹³ _____. When these spores are mature, the sporangium opens and they scatter in the wind, beginning the cycle anew.

Exercise 4 (Modules 17.5–17.6)

Ferns and lycophytes have vascular tissues, but do not produce seeds; they are often called “seedless vascular plants.”

Identify the stages of the fern life cycle by labeling this diagram. Include the following: **haploid phase**, **diploid phase**, **sporophyte**, **gametophyte**, **zygote**, **sporangia**, **spores**, **sperm**, **egg**, **meiosis**, **fertilization**, and **mitosis and development**. One answer is used twice. Color the haploid part of the life cycle yellow and the diploid part of the life cycle blue.



Exercise 5 (Module 17.7)

In seed plants, a specialized structure within the sporophyte houses all reproductive stages—spores, eggs, sperm, zygotes, and embryos. In gymnosperms such as pine trees, this special structure is the cone. Two significant plant adaptations are seen in gymnosperms—pollen and seeds. Complete the following sentences with a structure or stage in the pine life cycle. Select your answers from this list: **seed, pine tree, ovule(s), sperm, egg(s), pollen grain(s), pollen (male) cone(s), ovulate (female) cone(s), embryo, seed coat**, and **zygote**. Some answers are used more than once.

1. A _____ is the diploid sporophyte generation of the pine life cycle.
2. The haploid gametophyte generation develops within the _____ and _____.
3. The small, soft _____ contain many sporangia. Meiosis occurs in the sporangia, producing many spores that develop into _____. These are male gametophytes.
4. Each scale in the larger, woody _____ bears two _____. Each of these develops as a sporangium covered by a tough integument.
5. The wind carries pollen grains to the ovulate cones. Pollination occurs when a pollen grain lands on and enters an _____.
6. After pollination, meiosis occurs in the _____, producing a haploid spore that develops into the female gametophyte.
7. Over a period of months _____ are produced by the female gametophyte in the ovule. At the same time, the male gametophyte (the pollen grain) produces _____.
8. A tiny tube grows out of the _____, releasing a _____ to fertilize an _____.
9. A diploid fertilized egg, or _____, develops into a sporophyte _____. The whole ovule becomes a _____.
10. The _____ consists of the _____ and a food supply made from the remains of the female gametophyte, covered by a seed coat made from the ovule's integument.
11. The seed falls on the ground. When conditions are right, the seed germinates, and the embryo, over decades, grows into a _____, the adult sporophyte. It then produces cones, and the cycle begins again.

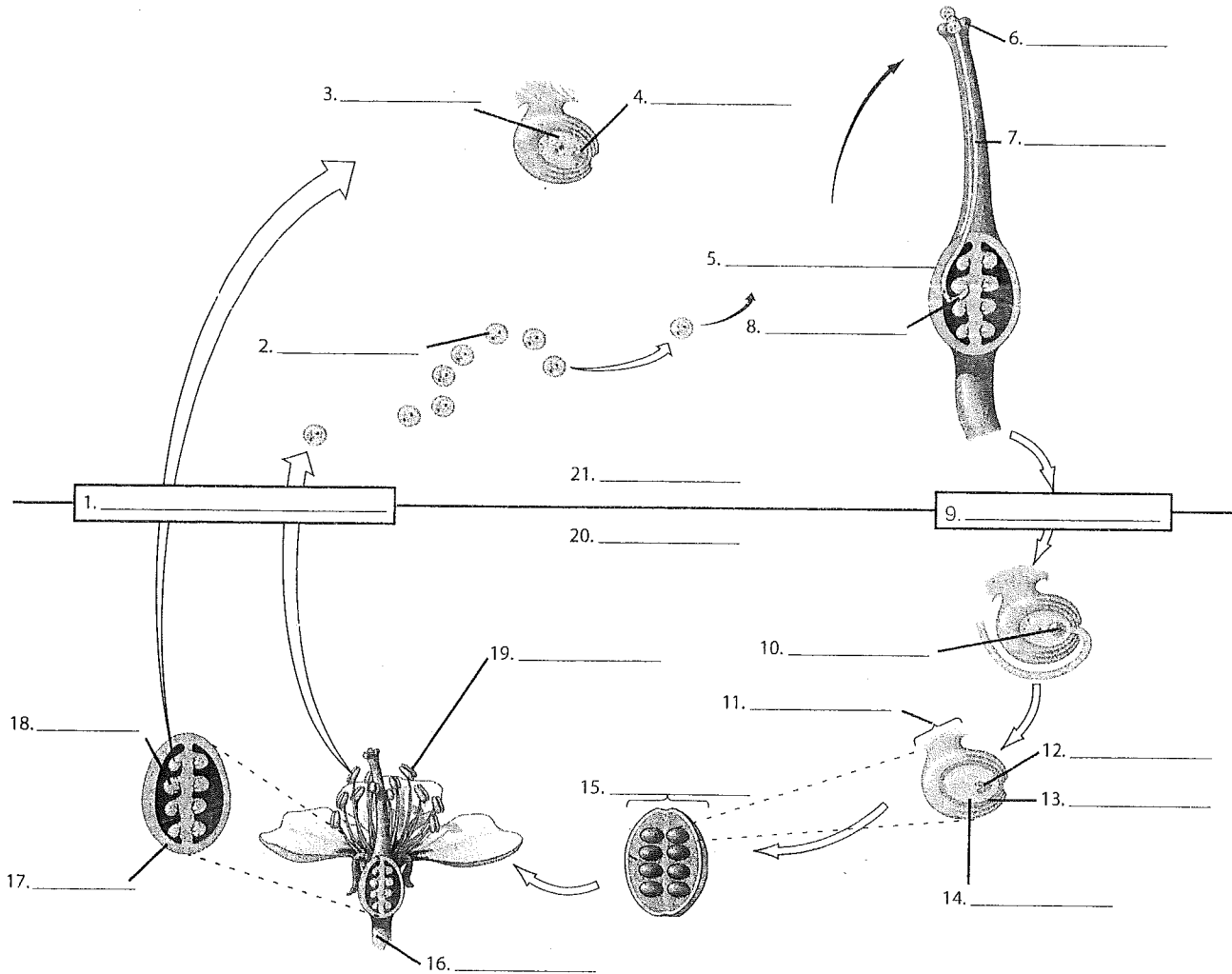
Exercise 6 (Module 17.8)

Flowers are responsible for the diversity and success of angiosperms—the flowering plants. Review the flower by matching each flower part with its function.

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| _____ 1. Ovules contained in this chamber | A. Petal |
| _____ 2. Consists of filament and anther | B. Style |
| _____ 3. Produces pollen | C. Sepal |
| _____ 4. Attracts pollinators | D. Ovary |
| _____ 5. Female structure with ovary at its base | E. Stamen |
| _____ 6. Protects the flower before it opens | F. Carpel |
| _____ 7. Sticky tip that traps pollen | G. Stigma |
| _____ 8. Stalk that supports anther | H. Filament |
| _____ 9. Between stigma and ovary | I. Anther |

Exercise 7 (Module 17.9)

Identify the stages in the life cycle of an angiosperm—a flowering plant—by labeling the diagram below. Include **haploid phase**, **diploid phase**, **sporophyte**, **anther**, **meiosis**, **ovary**, **ovule**, **female gametophyte**, **pollen grain (male gametophyte)**, **egg**, **stigma**, **pollen tube**, **sperm**, **zygote**, **seed**, **seed coat**, **fertilization**, **embryo**, **fruit**, **food supply**, and **pollination**. Then color the haploid part of the life cycle yellow and the diploid part blue.



Exercise 8 (Modules 17.7–17.9)

The life cycles of gymnosperms and angiosperms are similar, but angiosperms have added their own tricks of pollination and seed dispersal. Compare gymnosperms (conifers) and angiosperms in the chart below.

<i>Characteristic</i>	<i>Gymnosperms (Conifers)</i>	<i>Angiosperms</i>
Characteristic reproductive structures	1.	2.
Mode of pollination (wind, insects, etc.)	3.	4.
Interval between pollination and fertilization	5.	6.
Time required to produce seeds (pollination to seed dispersal)	7.	8.
Seed protection and dispersal	9.	10.

Exercise 9 (Modules 17.2–17.12)

Review your knowledge of the structure, life cycles, evolution, and uses of the major plant groups. Match each statement with a group (or groups) of plants. Some statements require more than one answer.

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|--|----------------|
| _____ 1. Flowering plants | M. Mosses |
| _____ 2. Two types of plants that produce seeds | F. Ferns |
| _____ 3. These plants and their relatives formed coal deposits. | G. Gymnosperms |
| _____ 4. Represent simple vascular plants | A. Angiosperms |
| _____ 5. Pines, firs, spruces, and cedars | |
| _____ 6. A type of plant in which the gametophyte stage is dominant | |
| _____ 7. Plants that produce fruits | |
| _____ 8. Nonvascular plants | |
| _____ 9. Two types of plants with flagellated swimming sperm | |
| _____ 10. Conifers | |
| _____ 11. Roses, apples, maples, and daisies | |
| _____ 12. Plants with horizontal stems and leaves bearing sporangia | |
| _____ 13. Plants with the shortest gametophyte and longest sporophyte stages | |
| _____ 14. Two types of plants whose spores develop into pollen and ovules | |
| _____ 15. The group that first developed good roots and rigid stems | |
| _____ 16. Source of most lumber and paper | |
| _____ 17. Plants with protected gametes and embryos | |
| _____ 18. Plants that produce seeds but not fruits | |
| _____ 19. Most species of modern plants | |
| _____ 20. Two types of plants without seeds | |
| _____ 21. Source of most of our food | |
| _____ 22. Many of these plants depend on animals for pollination and seed dispersal. | |
| _____ 23. Have walled spores protected in sporangia | |
| _____ 24. The simplest plants | |