Chapter 15

Plant Evolution and Classification Worksheets

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- **Lesson 15.1: Introduction to the Plant Kingdom**
- **Lesson 15.2: Four Types of Modern Plants**

15.1 Introduction to the Plant Kingdom

Lesson 15.1: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. Plants are multicelluar prokaryotes with cell walls made of cellulose.

_____ 2. In some plants, the male and female reproductive organs are on different plants.

_____ 3. Some plants have lost the ability to do photosynthesis.

_____ 4. In order to carry out photosynthesis, plants need water, carbon dioxide, and light.

_____ 5. A main purpose of roots is to absorb water and minerals.

_____ 6. During photosynthesis, plants release carbon dioxide into the air and use oxygen and argon.

_____ 7. Because plants photosynthesize, they don't need to carry out cellular respiration.

_____ 8. Plants remove water from the air and into the soil by transpiration.

_____ 9. Weeds are defined as highly desirable plants.

_____ 10. Alternation of generations refers to cycling between haploid to diploid generations.

_____ 11. In plants, gametophytes are haploid.

_____ 12. In plants, sporophytes are haploid.

_____ 13. Plants are believed to have evolved directly from prokaryotic cyanobacteria.

_____ 14. The earliest plants could easily reproduce in a dry environment with almost no water.

_____ 15. Development of a vascular system helped plants colonize dry land.

Lesson 15.1: Critical Reading

Name_____ **Class**_____ **Date**_____

Read these passages from the text and answer the questions that follow.

Magnified Pollen Grain

Bee Peppered with Yellow Pollen Grains

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Seed Plants Emerge

For reproduction, early vascular plants still needed moisture. Sperm had to swim from male to female reproductive organs for fertilization. Spores also needed some water to grow and often to disperse as well. Of course, dryness and other harsh conditions made it very difficult for tiny new offspring plants to survive. With the evolution of seeds in vascular plants, all that changed. Seed plants evolved a number of adaptations that made it possible to reproduce without water. As a result, seed plants were wildly successful. They exploded into virtually all of Earth's habitats.

Why are seeds so adaptive on land? A seed contains an embryo and a food supply enclosed within a tough coating. An embryo is a zygote that has already started to develop and grow. Early growth and development of a plant embryo in a seed is called germination. The seed protects and nourishes the embryo and gives it a huge head start in the "race" of life. Many seeds can wait to germinate until conditions are favorable for growth. This increases the offspring's chance of surviving even more.

Other reproductive adaptations that evolved in seed plants include ovules, pollen, pollen tubes, and pollination by animals.

- An ovule is a female reproductive structure in seed plants that contains a tiny female gametophyte. The gametophyte produces an egg cell. After the egg is fertilized by sperm, the ovule develops into a seed.
- A grain of pollen is a tiny male gametophyte enclosed in a tough capsule (see the figure above). It carries sperm to an ovule while preventing it from drying out. Pollen grains can't swim, but they are very light, so the wind can carry them. Therefore, they can travel through air instead of water.
- Wind-blown pollen might land anywhere and be wasted. Another adaptation solved this problem. Plants evolved traits that attract specific animal pollinators. Like the bee in the figure above, a pollinator picks up pollen on its body and carries it directly to another plant of the same species. This greatly increases the chance that fertilization will occur.
- Pollen also evolved the ability to grow a tube, called a pollen tube, through which sperm could be transferred directly from the pollen grain to the egg. This allowed sperm to reach an egg without swimming through a film of water. It finally freed up plants from depending on moisture to reproduce.

Questions

1. Why did early vascular plants need to live in environment where there was plenty of water?

2. What main advantage do seed plants have over the early spore-producing plants?

3. Define what a plant seed is.

4. What is the function of a plant ovule?

5. How did the evolution of pollen benefit land plants?

Lesson 15.1: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. The earliest plants had
   (a) leaves.
   (b) stems.
   (c) roots.
   (d) none of the above.
2. The flowers of a Venus fly trap
   (a) carry out photosynthesis in the dark.
   (b) secrete enzymes that can digest trapped insects.
   (c) thrive in temperatures below freezing.
   (d) all of the above
3. Plants need oxygen because
   (a) they carry out cellular respiration just like all other aerobic organisms.
   (b) oxygen is consumed during photosynthesis to make carbon-containing organic molecules.
   (c) the earth's atmosphere contains too much oxygen and too little carbon dioxide.
   (d) none of the above
4. Humans get which of the following kinds of products from plants?
   (a) medicines
   (b) dyes
   (c) rubber
   (d) all of the above
5. Red-eyed tree frogs
   (a) are green and do photosynthesis, so they do not need to eat or drink.
   (b) are not frogs, because frogs never have red eyes.
   (c) live in banana trees.
   (d) none of the above
6. When plants are transplanted into a new habitat that is not their native one,
   (a) they always die immediately.
   (b) due to a lack of predators and parasites in their new environment, they sometimes reproduce and spread so well that they outcompete native plants.
   (c) they stop producing seeds and start making spores.
   (d) they become parasitic plants.
7. Vegetative reproduction is
   (a) a type of asexual reproduction.
   (b) a type of sexual reproduction.
   (c) reproduction using seeds.
   (d) reproduction using spores.
8. Lignin
   (a) is needed directly for photosynthesis.
   (b) is a red pigment.
   (c) provides structural support and waterproofing to plants.

(d) is the female reproductive cell in seed plants.

Lesson 15.1: Vocabulary I

Name_____ **Class**_____ **Date**_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. a seed-containing, ripened ovary

_____ 2. the diploid generation produced by sexual reproduction

_____ 3. a reproductive structure in angiosperms; may contain pollen and egg cells

_____ 4. modern seed plants that produce seeds in cones

_____ 5. flower-producing plant

_____ 6. a reproductive structure (present in flowers) that contains the female gametophyte

_____ 7. a water-proofing and strength-providing molecule in plant cell walls

_____ 8. a type of life cycle during which plants alternate between haploid and diploid generations

_____ 9. a structure for water absorption in nonvascular plants

_____ 10. a form of asexual reproduction from stem, roots or leaves

_____ 11. seed container in gymnosperms

_____ 12. haploid individuals produced by asexual reproduction

Terms

a. alternation of generations

b. angiosperm

c. cone

d. flower

e. fruit

f. gametophyte

g. gymnosperm

h. lignin

i. ovary

j. rhizoid

k. sporophyte

l. vegetative reproduction

Lesson 15.1: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blank with the appropriate term.

1. _____ occurs when the plant embryo grows and bursts through the seed coat.
2. _____, which contains male gametes, can be transported by wind and by insects.
3. _____ transports water from the roots, through the stem, and to the leaves.
4. A _____ is considered to be an unwanted plant.
5. Plants producing flowers are classified as _____.
6. Plants producing seeds in cones are classified as _____.
7. A water-absorbing structure in nonvascular plants is the _____.
8. Production of a new plant from a stem is a form of _____.
9. In a plant such as a fern, the diploid generation is called a _____.
10. In a plant such as a fern, the haploid generation is called a _____.
11. A _____ often contains petals, pollen, and one or more ovaries.
12. A _____ is a ripened ovary that contains seeds.

Lesson 15.1: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Name and describe several factors limiting the spread of nonvascular plants such as liverworts, hornworts, and mosses.

15.2 Four Types of Modern Plants

Lesson 15.2: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. Mosses are nonvascular plants.

_____ 2. A gingko tree is a nonvascular plant.

_____ 3. Rhizoids are photosynthetic organs of bryophytes.

_____ 4. The spores of bryophytes are haploid.

_____ 5. The female gametophyte of a bryophyte produces female gametes.

_____ 6. Liverworts are much taller than a typical mature tree in the forest.

_____ 7. Mosses are adapted to grow in extremely dry climates, such as the desert.

_____ 8. Another term for vascular plants is tracheophytes.

_____ 9. Xylem transport sugars from the leaves to the roots.

_____ 10. The main function of phloem is to transport minerals such as nitrogen, from the leaves to the roots.

_____ 11. The transport cells of functional xylem are living.

_____ 12. Phloem tissue consists of living cells.

_____ 13. Water evaporates more rapidly from needle-like leaves than from broad, flat leaves.

_____ 14. The first leaf of a plant, which develops inside the seed, is called a cotyledon.

_____ 15. Seed plants existed at the same time as dinosaurs.

Lesson 15.2: Critical Reading

Name_____ **Class**_____ **Date**_____

Read these passages from the text and answer the questions that follow.

Evolution of Vascular Plants

The first vascular plants evolved about 420 million years ago. They probably evolved from moss-like bryophyte ancestors, but they had a life cycle dominated by the diploid sporophyte generation. As they continued to evolve, early vascular plants became more plant-like in other ways as well.

- Vascular plants evolved true roots made of vascular tissues. Compared with rhizoids, roots can absorb more water and minerals from the soil. They also anchor plants securely in the ground, so plants can grow larger without toppling over.
- Vascular plants evolved stems made of vascular tissues and lignin. Because of lignin, stems are stiff, so plants can grow high above the ground where they can get more light and air. Because of their vascular tissues, stems keep even tall plants supplied with water so they don't dry out in the air.
- Vascular plants evolved leaves to collect sunlight. At first, leaves were tiny and needle-like, which helped reduce water loss. Later, leaves were much larger and broader, so plants could collect more light.

With their vascular tissues and other adaptations, early vascular plants had the edge over nonvascular plants. They could grow tall and take advantage of sunlight high up in the air. Bryophytes were the photosynthetic pioneers onto land, but early vascular plants were the photosynthetic pioneers into air.

Questions

1. How and when did vascular plants evolve?

2. What advantages do roots have compared to rhizoids?

3. What advantages do stems give vascular plants?

4. Why was evolution of leaves successful?

5. If vascular plants have so many advantages, why do you think nonvascular plants still exist on earth today?

Lesson 15.2: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. Which seed structure provides the main source of food for the embryo?
   (a) endosperm
   (b) seed coat
   (c) radicle
   (d) hypocotyl
2. Which of the following is **not** a plant adaptation to cold?
   (a) a waxy cuticle on the leaves
   (b) rhizoids
   (c) woody trunks
   (d) seeds
3. The sugar-filled liquid produced by flowers is
   (a) honey.
   (b) maple syrup.
   (c) nectar.
   (d) high-fructose corn syrup.
4. The female plant structure consisting of the stigma, style, and ovary is called
   (a) a stamen.
   (b) a sepal.
   (c) a pistil.
   (d) a carpel.
5. The plant structure made of a filament and anther and which makes pollen is called
   (a) an ovary.
   (b) a stamen.
   (c) a pistil.
   (d) a sepal.
6. Fruits can be best described as
   (a) ripened ovaries.
   (b) enlarged stems.
   (c) above ground roots.
   (d) hardened pollen.
7. One advantage a plant gets from having flowers is that
   (a) flowers are smaller than spores and easier to make.
   (b) there is no sexual reproduction in plants with flowers.
   (c) flowers attract pollinators, which spread pollen to other plants and thus promote cross-fertilization.
   (d) all of the above
8. Which of the following is **not** a major class of flowering plants?
   (a) magnolids
   (b) eudicots
   (c) monocots
   (d) mosses

Lesson 15.2: Vocabulary I

Name_____ **Class**_____ **Date**_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. part of a flower that is often colorful so pollinators will be attracted

_____ 2. seed plants

_____ 3. female reproductive structure containing the stigma, style and ovary

_____ 4. the area in many seeds where food is stored

_____ 5. vascular plants

_____ 6. structure protecting the immature flower bud

_____ 7. nonvascular plants

_____ 8. pollen-producing structure

_____ 9. a structure protecting the embryo

_____ 10. vascular tissue that transports water and minerals

_____ 11. vascular tissue that transports sugars

_____ 12. a sugary liquid produced by flowers

Terms

a. bryophyte

b. endosperm

c. nectar

d. petal

e. phloem

f. pistil

g. seed coat

h. sepal

i. spermatophyte

j. stamen

k. tracheophyte

l. xylem

Lesson 15.2: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blank with the appropriate term.

1. Another name for a plant with a vascular system is a _____.
2. Another name for a seed plant is a _____.
3. Liverworts, hornworts, and mosses are all _____.
4. A _____ provides protection for an immature flower bud by covering it.
5. A plant embryo in a seed gets food from the seed's _____.
6. Sugars are transported through a vascular plant through the _____.
7. The _____ of a vascular plant transports water and minerals from the roots up through the stem and into the leaves.
8. A flower's _____ is made of a stigma, style, and ovary.
9. Many flowers produce a sugary liquid called _____ that helps attract pollinators.
10. _____ of flowers are often colorful to attract pollinators.
11. A seed is protected by the _____ that surrounds it.
12. The _____ is composed of an anther and a filament.

Lesson 15.2: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

In spermatophytes (seed plants), a fertilized egg develops into an embryo, which is contained within the seed. Describe the structure and function of each part of the embryo. What advantages do these structures give a spermatophyte compared to a bryophyte?

15.3 Plant Evolution and Classification

Chapter 15 Review Worksheet

Name_____ **Class**_____ **Date**_____

Multiple Choice

Circle the letter of the correct choice.

1. Skunk cabbage has evolved stinky flowers because
   (a) the smell prevents other plants from growing nearby all year long.
   (b) all yellow flowers smell bad.
   (c) the odor attracts pollinators.
   (d) the odor repels pollinators.
2. Which of the following is **not** a characteristic of most plants?
   (a) carries out photosynthesis
   (b) has cell walls made of cellulose
   (c) has yellow flowers
   (d) has specialized reproductive organs
3. Much of the oxygen in the earth's atmosphere
   (a) is produced as a waste product of cellular respiration in plants.
   (b) is released as a byproduct of photosynthesis.
   (c) is produced as a waste product of cellular respiration in animals.
   (d) is produced by tree frogs.
4. The mature sporophyte of a fern
   (a) produces haploid spores by meiosis.
   (b) produces diploid spores by meiosis.
   (c) produces diploid spores by mitosis.
   (d) produces haploid spores by mitosis.
5. Fusion of male and female gametes in plants produces
   (a) a eudicot stamen.
   (b) a style.
   (c) a haploid spore.
   (d) a diploid embyro.
6. Marine plants
   (a) have always been the dominant organisms of the oceans.
   (b) evolved after land plants.
   (c) are restricted to the water closer to the air, so they can get sufficient light for photosynthesis.
   (d) do not need to photosynthesize.
7. The vascular tissue that transports water and minerals from the soil to the rest of the plant is the
   (a) phloem.
   (b) phlegm.
   (c) leaf.
   (d) xylem.
8. The vascular tissue that transports sugars from photosynthetic tissues to the rest of the plant is

(a) phloem.
(b) phlegm.
(c) leaf.
(d) xylem.

9. In most land plants, the _____ generation is the dominant one.

(a) diploid sporophyte
(b) diploid gametophyte
(c) haploid sporophyte
(d) haploid gametophyte

10. In seed plants, the _____ helps transfer of sperm from the pollen grain to the egg.

(a) sepal
(b) petal
(c) tuberous ovule
(d) pollen tube

11. The scales of pine cones are

(a) always green.
(b) modified roots.
(c) modified leaves.
(d) modified stems.

12. Plants that make flowers are called

(a) gymnosperms.
(b) byrophytes.
(c) gametophytes.
(d) angiosperms.

13. The class of plants that has vascular tissue and reproduces with spores is the

(a) clubmosses.
(b) liverworts.
(c) flowering plants.
(d) conifers.

14. The embryonic stem in a seed is called the

(a) radicle.
(b) hypocotyl.
(c) seed coat.
(d) endosperm.

15. Pollen contains

(a) male gametes.
(b) female gametes.
(c) fruits.
(d) a stigma.

True or False

Write true if the statement is true or false if the statement is false.

_____ 16. Plants are a direct or indirect source of food for most organisms living on earth.

_____ 17. A ripened ovary becomes a pollen grain.

_____ 18. Cross-pollination decreases genetic diversity.

_____ 19. Monocot embryos have one cotyledon.

_____ 20. Currently on earth, there are many more gymnosperm species than angiosperm species.

Fill in the Blanks

Fill in the blank with the term that best completes the sentence.

21. Switching between a haploid gametophyte stage and a diploid sporophyte stage is called _____-_____.

22. _____ gives plant stems stiffness and helps protect plants against predators.

23. Nonvascular plants use _____ for absorbing water.

24. Asexual reproduction from stems, leaves, or roots is called _____.

25. _____ occurs when a growing plant embryo bursts through the seed coat.

26. Liverworts, hornworts, and mosses are all _____ plants.

27. Another name for vascular plants is _____.

28. _____ stores food in seed plants.

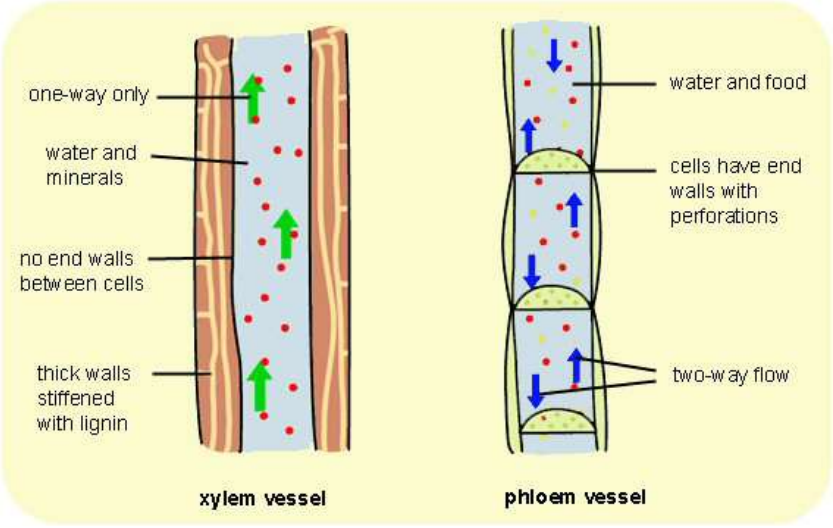
29. In a flower the _____ contains the stigma, style, and ovary.

30. The _____ protects the seed.

Short Answer

Answer each question in the space provided.

Refer to the figure below to answer questions 31 and 32.



(Xylem and phloem image is courtesy of Jesse Landy and under the Creative Commons license CC-BY-SA 3.0.)

31. What is the function of xylem vessels? How does their structure support their function?

32. What is the function of phloem vessels? How does their structure support their function?

33. How did plants and pollinators co-evolve? Describe a specific example.