

Montogue

Quiz BI101



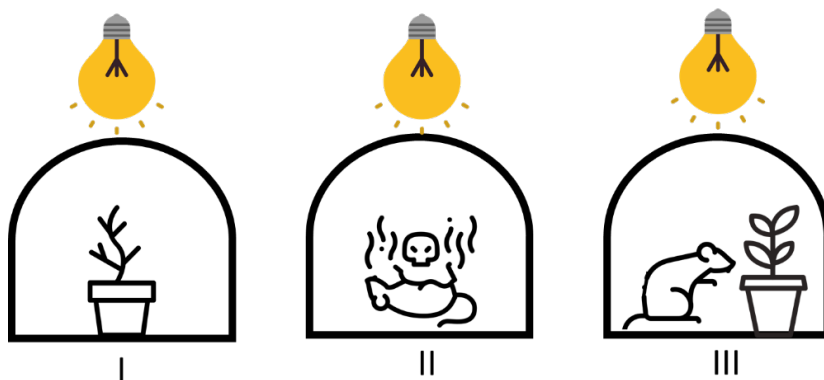
Plant Biology Pt. 1

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► PROBLEMS

► Problem 1

One early experiment on photosynthesis involved a small plant, a mouse and a light source, as illustrated below. Three configurations were prepared. In the first configuration, labeled I, the plant was exposed to the light source and sealed from the atmosphere; the plant died soon after the beginning of the experiment. In the second configuration, labeled II, the mouse was exposed to the light source and sealed from the atmosphere; the mouse died soon after the beginning of the experiment. In the third configuration, labeled III, both the mouse and the plant were placed together, exposed to the light source, and sealed from the atmosphere; both remained alive long after the beginning of the experiment. This experiment leads us to conclude that:



- A) The mouse cannot survive in a sealed environment.
- B) The plant requires light to carry out photosynthesis.
- C) In closed environments, there can be neither respiration nor photosynthesis.
- D) The plant produces a gaseous substance that benefits the mouse and vice-versa.

► Problem 2

During a biology class, a teacher stated that bryophytes can be considered the “amphibians of the plant kingdom.” This observation is valid because, like many amphibians, bryophytes:

- A) Have a system of water conduction based on cell-to-cell osmosis.
- B) Reproduce by alternation of generations.
- C) Live in moist environments and require water for fertilization.
- D) Undergo a metamorphosis process in which the oxygen-absorption mechanisms are altered.

► **Problem 3**

The small size of bryophytes is mainly a consequence of their lack of:

- A) Structures for the absorption of water and ions from the soil.
- B) Vascular tissues.
- C) Alternation of generations.
- D) Sexual reproduction.

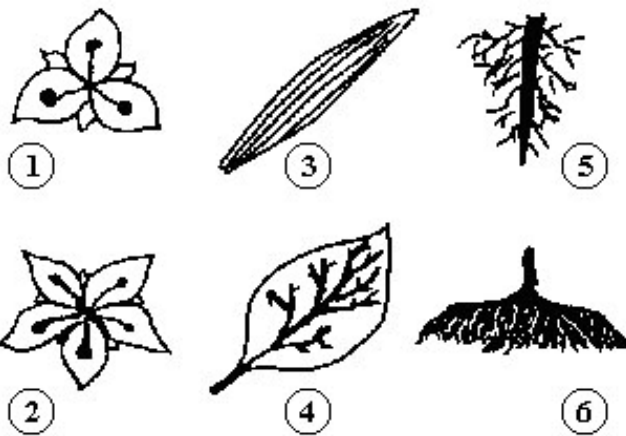
► **Problem 4**

One evolutionary advantage of pine trees relative to ferns is:

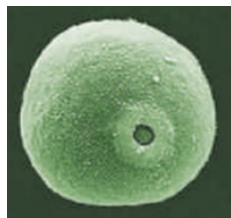
- A) Pine trees require water to reproduce.
- B) Pine trees have vascular tissues.
- C) Pine trees produce seeds.
- D) Pine trees produce fruits.

► **Problem 5**

Refer to the following illustrations. True or false?



- 1. () Monocots have flowers similar to (1).
- 2. () Monocots have leaves similar to (3).
- 3. () Monocots have roots similar to (5).
- 4. () Monocots and eudicots can also be distinguished with respect to the structure of their pollen grains. A typical monocot has pollen grains with one pore or furrow, as illustrated by microscope magnification (7) below.



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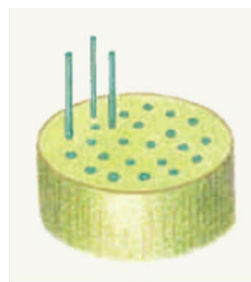


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- 5. () Monocots and eudicots can also be distinguished on the basis of the longitudinal arrangement of vascular bundles in vascular tissue. A typical monocot has vascular bundles organized in a ring, as illustrated by drawing (9) below.



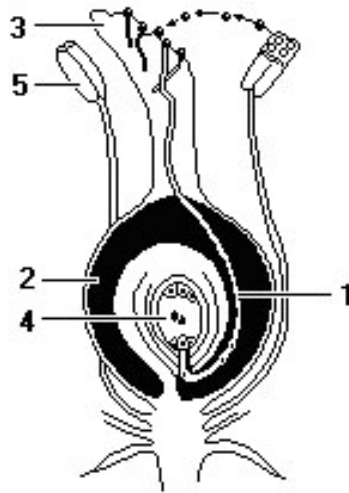
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► **Problem 6**

The following figure illustrates the fertilization process of a typical angiosperm flower. The male and female gametophytes are respectively represented by:



- A) 5 and 4.
- B) 1 and 2.
- C) 2 and 4.
- D) 1 and 4.
- E) 5 and 1.
- F) 5 and 2.

► **Problem 7**

Sperm cell behavior during double fertilization in *Arabidopsis thaliana*, a typical angiosperm dicot, is characterized by the following statements, **except**:

- α) Sperm cells produce pollen tubes and enter the female gametophyte.
- β) The receptive antipodal cells break down when pollen tube enters the female gametophyte.
- γ) One sperm nucleus fuses with the egg and the other fuses with the central cells.

► **Problem 8**

Referring to the following table, find the terms that correctly fill the blank spaces in statements 8.1 to 8.6.

A. Sperm cell
B. Pollen grain
C. Megaspore
D. Microspore
E. Ovule
F. Seed

- 8.1. The immature male gametophyte of gymnosperms and angiosperms is contained inside the _____.
- 8.2. The haploid cell that gives rise to the masculine gametophyte in heterosporic plants is called _____.
- 8.3. The _____ is a haploid cell that gives rise to the female gametophyte in spermatophyte plants.
- 8.4. The male gamete *per se*, in gymnosperms and angiosperms, is the _____.
- 8.5. The ensemble formed by the young sporophyte contained within the megagametophyte and surrounded by the tegument is called _____.
- 8.6. The multicellular structure constituted by the diploid tissue obtained from the sporophyte (tegument) and the megagametophyte, including the egg cell, is the _____.

► **Problem 9**

The somatic chromosome number of a potato species is $2n = 48$. Regarding a typical such potato plant, true or false?

- 1. () The number of chromosomes in a pollen mother cell is 24.
- 2. () The number of chromosomes in an egg cell is 48.
- 3. () The number of chromosomes in an endosperm cell is 72.

► Problem 10

The immense biodiversity of angiosperms was only made possible by the various strategies adopted by these plants to achieve sexual reproduction. Referring to the following table, associate column 1 (flower traits) with column 2 (usual pollinators).

Column 1	Column 2
P. Colorful corolla	I. Wind
Q. Plumose stigma	II. Birds
R. Flowers that open at night	III. Flies
S. Putrid smell	IV. Bats

- A)** P-I; Q-II; R-IV; S-III;
B) P-II; Q-I; R-IV; S-III;
C) P-III; Q-IV; R-I; S-II;
D) P-II; Q-IV; R-III; S-I;

► Problem 11

Various aspects of plant biology are discussed in the following statements. True or false?

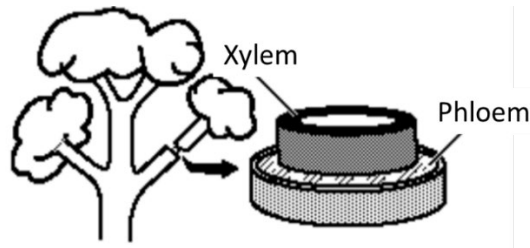
- 1. ()** In evolutionary terms, bryophytes are some of the earliest plants to conquer the land environment. However, mosses and other species that constitute this phylum are still dependent on moist environments, because, for example, their surfaces lack the waxy plant cuticle layer that shields higher plants from desiccation.
- 2. ()** All the oxygen liberated in photosynthesis comes from split water molecules.
- 3. ()** A cresol red solution is pink when in contact with the normal atmospheric concentration of CO₂, purple when placed in contact with low CO₂ concentrations, and yellow when placed in contact with high concentrations of this gas. A leaf of a day-neutral plant species was placed in a transparent test tube partially filled with cresol red, as illustrated below. The ensemble was then placed in contact with sunlight, starting at 6 AM, and then through the morning, the afternoon, and the night. We expect the solution to turn purple during the day and gradually become yellow during the night.



- 4. ()** The development of a typical plant can be divided in four stages: the seedling phase, the juvenile phase, the reproductive phase, and the senescence phase. For most species, growth is most rapid in the reproductive phase.
- 5. ()** The main carbohydrate transported in the phloem is glucose, C₆H₁₂O₆.
- 6. ()** In vascular plants, transport of nutrients such as water and minerals follows the path root → phloem → leaf → xylem.
- 7. ()** A flower is said to be *complete* if it contains all four sets of modified leaves – sepals, petals, stamens, and carpels. A cherry blossom is an example of complete flower.
- 8. ()** The vascular cambium is a secondary meristem that forms in stems and roots after the tissues in the primary plant body have differentiated. This structure is responsible for increasing the diameter of stems and roots and for forming woody tissue. Monocots have no vascular cambium, and for that reason exhibit no secondary growth.
- 9. ()** When soil is dry, abscisic acid acts on guard cells and initiates closure of stomata.
- 10. ()** Formation of mycorrhizae, symbiotic associations between nitrogen-fixing bacteria such as *Rhizobium* and the roots of plants, is one of the most effective methods for a vascular plant to increase its radicular water input.

► **Problem 12**

If we remove a ring from the outer section of a plant's lateral branch, thereby removing the phloem tissue but keeping the xylem intact, as illustrated below, we expect that:



- A)** The branch will die, because the vessels that transport water and minerals will be eliminated and the leaves will no longer carry out photosynthesis.
- B)** The branch will die, because the vessels that transport organic compounds will be eliminated and its leaves will no longer receive nutrients from the root.
- C)** The branch will remain alive, because the vessels that transport water and minerals will not be eliminated and its leaves will continue to carry out photosynthesis.
- D)** The branch will remain alive, because the vessels that transport organic substances will not be eliminated and its leaves will continue to receive nutrients from the root.

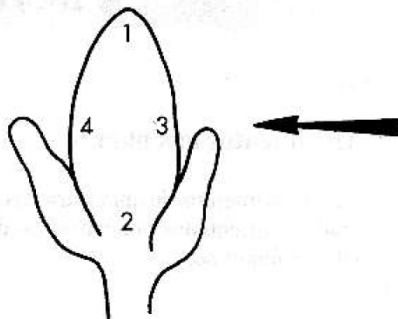
► **Problem 13**

In gardening, the practice of pruning plants favors the formation of lateral branches, flowers and fruit. This process is directly related to the phenomenon of:

- A)** Apical dominance, controlled by auxins.
- B)** Apical dominance, controlled by ethylene.
- C)** Abscission, controlled by gibberellin.
- D)** Dormancy, controlled by abscisic acid.

► **Problem 14**

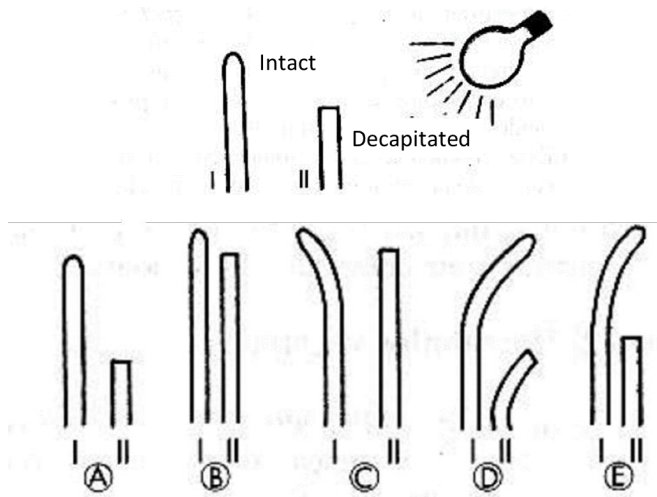
The following figure illustrates the apical region of a plant stem. The black arrow indicates the direction of a light source. We can surmise that the stem's auxin concentration will be greater in:



- A)** 1, maintaining the upward growth of the stem.
- B)** 2, due to negative geotropism of the stem.
- C)** 3, in accordance with the stem's positive phototropism.
- D)** 4, causing the stem to bend toward the light source.

► **Problem 15**

The following figure shows two seedlings. Choose the alternative that illustrates these seedlings after a day.



► Problem 16

Referring to the following table, find the plant hormone names that correctly fill the blank spaces in statements 16.1 to 16.4.

A. Abscisic acid
B. Auxin
C. Cytokinin
D. Ethylene

16.1. A farmer interested in obtaining fruits without seeds should pulverize the plants with _____.

16.2. A fruit trader interested in stimulating the ripening of the fruit he's selling could use _____.

16.3. A biologist interested in stimulating the multiplication of plant cells in a tissue culture may use _____.

16.4. A horticulturist interested in preventing an angiosperm seed from germinating could administer _____ to the seed coat.

► Problem 17

Suppose a plant mutant shows normal gravitropic bending but does not store starch in its plastids. This would require a reevaluation of the role of _____ in gravitropism.

- A)** Auxins.
- B)** Statoliths.
- C)** Gibberelins.
- D)** Differential growth.

► Problem 18

A horticulturist wants to obtain genetically identical individuals (clones) of a commercially valuable fern. To achieve this goal, he should:

- A)** Cultivate spores produced by the fern.
- B)** Artificially induce self-fertilization of the fern.
- C)** Extract rhizome fragments from the fern and cultivate them.
- D)** Introduce DNA extracted from leaves of this fern in zygotes of other individuals.

►► SOLUTIONS

P.1 → Solution

The plant in configuration I dies because the CO₂ in the container is eventually depleted and the plant can no longer carry out photosynthesis, whereas the rat in configuration II dies because the oxygen in the container is fully consumed so he can no longer respire. When the two specimens are placed together and sealed from the atmosphere, the rat remains alive because the plant continuously replenishes the container with oxygen produced by photosynthesis, while the plant itself is given a steady supply of CO₂ on part of the mouse.

- ◆ The correct answer is **D**.

P.2 → Solution

Most bryophytes inhabit humid environments and require water for the male gamete, a flagellate antherozoid, to swim toward the archegonium. Unlike spermatophytes, bryophytes have no pollen tube to serve as a direct link between male and female reproductive structures.

- ◆ The correct answer is **C**.

P.3 → Solution

Bryophytes have structures to absorb water and ions from the soil (namely, roots), exhibit a development cycle based on alternation of generations, and can achieve sexual reproduction. They do not, however, have vascular tissues to transport nutrients over considerable distances, and for that reason display limited size when compared to tracheophytes.

- ◆ The correct answer is **B**.

P.4 → Solution

Pine trees are gymnosperms, and as such produce seeds, structures that host, protect, and nourish the zygote after fertilization. Ferns are

pteridophytes, which share with pine trees characteristics such as the presence of vascular tissues, but form no seeds; the water-dependent reproductive cycle of ferns is more akin to that of bryophytes. Some have proposed the term “cryptogam” to distinguish pteridophytes and bryophytes, which have hidden reproductive structures, from “phanerogams” such as pine trees and angiosperms, which have visible sexual organs.

◆ The correct answer is **C**.

P.5 → **Solution**

1. True. Most monocots have floral elements organized in threes or multiples of three, which agrees with illustration (1).

2. True. The leaves of most monocots have parallel veins, much like illustration (3).

3. False. The roots of monocots are arranged in a network of fibrous segments similar to the one illustrated in (6). The taproot system (5) is inherent to eudicots.

4. True. The pollen grains of monocots are more or less spherical and have a single pore or furrow, as illustrated by the foregoing microscope magnification.

5. False. A typical monocot has vascular bundles loosely scattered in the ground tissue cross-section, much like illustration (10). The ring arrangement (9) is inherent to eudicots.

P.6 → **Solution**

The male gametophyte is the pollen grain, represented by (1), while the female gametophyte is the embryo sac, represented by (4).

◆ The correct answer is **D**.

P.7 → **Solution**

The pollen tube is the conduit that links the sperm cells and the female gametophyte. Sperm cells do not “produce” pollen tubes.

◆ The incorrect statement is **α**.

P.8 → **Solution**

The correct answers are summarized below.

Statement	Answer	Term
8.1	B	Pollen grain
8.2	D	Microspore
8.3	C	Megaspore
8.4	A	Sperm cell
8.5	F	Seed
8.6	E	Ovule

P.9 → **Solution**

1. False. The mother cell is a diploid cell, and hence must exhibit $2n = 48$ chromosomes.

2. False. It goes without saying that an egg cell is haploid, and hence must exhibit $n = 24$ chromosomes.

3. True. The endosperm cells are triploid, which is to say that an endosperm cell has $3n = 72$ chromosomes.

P.10 → **Solution**

A colorful corolla attracts birds; a plumose stigma, in addition to the release of pollen grains by the millions at a time, is typical of flowers pollinated by wind; some flowers open at night to match their circadian rhythm to that of most bats; finally, the foul smell of some flowers is used to attract flies and select species of beetles.

◆ The correct answer is **B**.

P.11 → **Solution**

1. False. While it is true that bryophytes lack the adaptations to terrestrial environments offered by higher plants (e.g., vascular tissues, pollen tubes), their epidermal cells usually are, in fact, capable of producing a waxy cuticle. The cuticle consists of epidermal cell secretions: a mixture of waxes, pectin, and cellulose fibers embedded in cutin, an insoluble lipid polymer.

2. True. The oxygen liberated at the outset of photosynthesis comes from split water molecules. During photosynthesis, the plant absorbs water and

carbon dioxide. After the absorption process, water molecules are split into oxygen and hydrogen, and the latter (hydrogen) is joined to carbon dioxide to create sugar molecules.

3. True. During a regularly illuminated day, photosynthesis should overcome respiration and the concentration of CO₂ in the tube should decrease, causing the solution to turn purple. During the night, respiration outstrips photosynthesis and the concentration of CO₂ should increase, causing the solution to become yellow.

4. False. Plants generally grow most rapidly during the seedling phase. Most plant mortality occurs in the seedling phase through the interactive effects of environmental stress, competition, pathogens, and herbivory, so rapid growth in this stage is particularly beneficial.

5. False. Experiments with plant-sucking insects demonstrated that the disaccharide sucrose, C₁₂H₂₂O₁₁, is the main carbohydrate transported in phloem. Aphids feeding on the juices in the conducting tubes of phloem were anesthetized with high levels of carbon dioxide. Then their bodies were detached from their mouthparts, which remained attached to the plant. Researchers collected and analyzed fluid exuded from the aphids' mouthparts. For most of the plants studied, sucrose was the most abundant carbohydrate in the fluid. Some species also store sucrose in cell vacuoles.

6. False. The route most frequently followed in transport of water and minerals is root → xylem → leaf → phloem.

7. True. Indeed, cherry blossoms exhibit the four sets of modified leaves inherent to a complete flower.

8. False. Some monocots, such as palms and the Joshua tree, do exhibit secondary growth even though they have no vascular cambium. The secondary growth of these plants is induced by a thickening meristem that produces secondary ground tissue.

9. True. Abscisic acid can reach guard cells and promote the closure of stomata. ABA can also inhibit seed germination and stimulate the formation of dormant buds.

10. False. Mycorrhizae are associations between plants and fungi, not *Rhizobium* bacteria. As much as 9 out of every 10 species of known vascular plants are compatible with some form of root-fungus association. Nevertheless, the genus of bacteria in question does have a beneficial role of its own, as *Rhizobium* microbes can form nodules in the roots of leguminous plants and supply them with nitrogen compounds other than gaseous N₂, whose triple bond makes it exceedingly stable to be incorporated in plant metabolism.

P.12 ➔ **Solution**

Removal of the phloem implies that sugars produced by the leaves of the branch will not reach other parts of the plant. Since the xylem remains unscathed, the leaves of the branch will continue to receive water and nutrients, and the structures downstream of the cut will continue to be functional. The branch will remain alive.

◆ The correct answer is **C**.

P.13 ➔ **Solution**

Apical dominance is a hormonal relationship in which an actively growing apical bud prevents lateral buds from growing. Pruning the apical meristem eliminates this phenomenon and allows lateral growth to occur. Apical dominance is mainly controlled by auxins.

◆ The correct answer is **A**.

P.14 ➔ **Solution**

When the stem is subjected to a directional light source, auxin concentration rises in the shaded area, causing the cells therein to lengthen and ultimately bending the stem towards the light source. Auxin concentration will rise in region 4 of the plant.

◆ The correct answer is **D**.

P.15 ➔ **Solution**

Light streaming in from one direction causes auxin to be transported to the shaded side, promoting growth toward the light source. Accordingly, plant I will bend rightward. Plant II is decapitated and has no apical source of auxins,

so its stem will remain unchanged when exposed to the light source. Illustration E correctly represents the two seedlings after some time.

◆ The correct answer is **E**.

P.16 ➔ **Solution**

The correct answers are summarized below.

Statement	Answer	Term
16.1	B	Auxin
16.2	D	Ethylene
16.3	C	Cytokinin
16.4	A	Abscisic acid

P.17 ➔ **Solution**

It is said that plants respond to gravity by dint of statoliths, dense cytoplasmic components that settle under the influence of gravity to the lower portions of the cell. The statoliths of vascular plants are specialized plastids containing dense starch grains. If a plant exhibited no such plastids but nonetheless displayed gravitropic growth in its stem and roots, the role of statoliths would come into question.

◆ The correct answer is **B**.

P.18 ➔ **Solution**

One of the quickest methods to promote asexual reproduction of a small plant such as a fern is to extract a sample of its rhizome and plant it in nutrient-rich soil.

◆ The correct answer is **C**.

➔ **ANSWER SUMMARY**

Problem 1	D
Problem 2	C
Problem 3	B
Problem 4	C
Problem 5	T/F
Problem 6	D
Problem 7	α
Problem 8	Associative
Problem 9	T/F
Problem 10	B
Problem 11	T/F
Problem 12	C
Problem 13	A
Problem 14	D
Problem 15	E
Problem 16	Associative
Problem 17	B
Problem 18	C

➔ **REFERENCES**

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