

BOTANY, PLANT PHYSIOLOGY AND PLANT GROWTH

Lesson 4: PLANT PARTS AND FUNCTIONS

Leaves

PART 2

I. LESSON DESCRIPTION

Students attend a presentation on leaf anatomy and physiology, and then participate in some identification exercises with leaves and small branches they have collected. *Estimated time requirement for this lesson is 47 minutes.*

Curriculum Standards: Minnesota Academic Standards in Science, Minnesota Department of Education, 5-24-10, Grades 9-12:

- 9.4.1.2.4 “Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction.”

National Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards, National Council for Agricultural Education, 2009:

- Natural Resource Systems (NRS):
 - NRS.01.02.01.a. Describe morphological characteristics used to identify trees and other woody plants.
- Plant Systems (PS):
 - PS.01.02.04.a. Discuss leaf morphology and the functions of leaves.
 - PS.01.02.04.b. Explain how leaves capture light energy and allow for the exchange of gases.
 - PS.01.01.02.a. Describe the morphological characteristics used to identify agricultural plants.

The structure of leaves directly relates to their function as organs of photosynthesis.

Student Preparation:

Ask students ahead of time to bring to class 1 to 5 leaves each, and at least one small branch that is just long enough to include 5 attached leaves. Emphasize that they should obtain permission before collecting samples from their parents’ yard or a neighbor’s yard.

Student Learning Objectives: After this class students will be able to:

- (1) Identify basic leaf parts and their functions
- (2) Name three types of leaf characteristics that help in plant identification
- (3) Identify leaf and flower buds.

Instructional Methods: Informal Lecture w/PowerPoint, Learning Activity

Instructional Materials & Resources:

- Optional: If you suspect that students will not bring in leaves, then you can collect at least one leaf for each student, and at least 5 small branches that are just long enough to include 5 attached leaves.
- Optional: Consider bringing some examples of vegetables that have edible leaf parts, perhaps 2 or 3 examples of each group:
 - Leaf Blade:* chive, collard, dandelion, endive, kale, leaf lettuce, mustard, parsley, spinach, and Swiss chard.
 - Fleshy Leaf Base:* leek, onion, and Florence fennel.
 - Petiole:* celery and rhubarb.
 - Terminal Leaf Bud:* cabbage and head lettuce.
 - Axillary Leaf Buds:* Brussels sprouts
 - Flower Buds:* Broccoli

II. LESSON PLAN

Introduction

Legend:

Text in normal face - Represents teacher's words.

Text in italic face - Represents suggestions for the teacher.

Interest Approach:

- The principal function of leaves is to absorb sunlight for manufacture of plant sugars through a process called photosynthesis.
- QUESTION: A famous architect in the twentieth century, Frank Lloyd Wright, said that “Form and function are one.” If you were to design a leaf, keep in mind the function – to absorb sunlight; what leaf form would be most suitable for that function? Should a leaf be large or small? Should it be broad or narrow? Should a leaf surface orient itself perpendicular or parallel to the rays of sunlight?
- STUDENT RESPONSE: *For about 2 minutes, students can discuss theories.*
- So you see the value of a wide leaf such as a maple leaf. It has a broad surface area, like a solar panel, to collect energy from the sun.

Relevancy:

- In this lesson we’ll have a brief presentation on the appearance and structure of leaves, and then we’ll have a “Leaf Lab” to practice some of the terminology.

Learning Objectives: After this class, you will be able to:

- (1) Identify basic leaf parts and their functions
- (2) Name three types of leaf characteristics that help in plant identification, and
- (3) Identify leaf and flower buds.

- Now let's learn some basic anatomy and physiology of leaves.

Instructional Methods

Lecture: 20 minutes estimated

- Present the PowerPoint file *04_Leaves_PowerPoint.ppt*, according to the narration script file, *04_Leaves_PowerScript.doc*.

Transition:

- Was everyone able to bring some plant material? You were asked to bring to class 1 to 5 leaves each, and at least one small branch that is just long enough to include 5 attached leaves.

Learning Activity: "Leaf Lab" – 25 minutes estimated

- Have the students bring out the leaves and branches they collected.
- Ask them to identify the leaf blade and petiole on one of their leaves.
- Then create places to collect two piles of leaves, with labels marked "Parallel-veined" and "Net-veined". Make another pair of piles marked "Simple" and "Compound". Ask the students to leave their desks and sort all their leaves into the piles.
- Monitor their choices – while the students still surround the sorted piles of leaves, evaluate each pile of leaves in terms of the principles in the PowerPoint presentation.
- When they return to their desks, have them examine the short branches they collected; each student should have at least one. Ask them if they can find any terminal buds and axillary buds. Ask them if they have opposite leaves or alternate leaves.

Conclusion:

- With the new knowledge and skills, you developed, you can:
 - (1) Identify basic leaf parts and their important role in manufacturing food for plants,
 - (2) Appreciate the wide variety of leaf characteristics, and
 - (3) Locate leaf and flower buds, which will be important when you learn to manage plant growth through pruning.
- As you walk around outdoors, continue to apply your skills in recognizing patterns in leaves, and notice the similarities and differences in various groups of plants. Also, begin looking for signs of health and disease expressed in the leaves.
- In the next lesson, we'll conclude the series on Plant Parts and Functions, as we learn about roots, flowers, and fruit.

OPTIONAL ACTIVITIES

- If the school has a garden or greenhouse, then you can schedule some field time in exploring the same questions raised in the exercise, or just enjoy the time in observing the wide variety of leaf shapes.
- If you brought the raw vegetables to class, ask the students to sort them into areas marked as Leaf Blade, Fleshy Leaf Base, Petiole, Terminal Leaf Bud, Axillary Leaf Bud, and Flower Bud.
- Assign students some field study to list all the colors they see in leaves: green, blue-green, yellow, maroon, etc.
- If you have access to a microscope, examine some of the leaves that the students collected.
- Begin collecting herbarium specimens: press the collected leaves between sheets of blotter paper or thick paper towels (without an embossed pattern) and place under large heavy books for several days.

OPTIONAL RESOURCES

Books:

- *Biology of Plants*, Seventh Edition (December 17, 2004), by Peter H. Raven, Ray F. Evert, Susan E. Eichhorn. Publisher: W. H. Freeman; Hardcover: 944 pages. ISBN: 0716710072 - Comprehensive book on botany.

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