

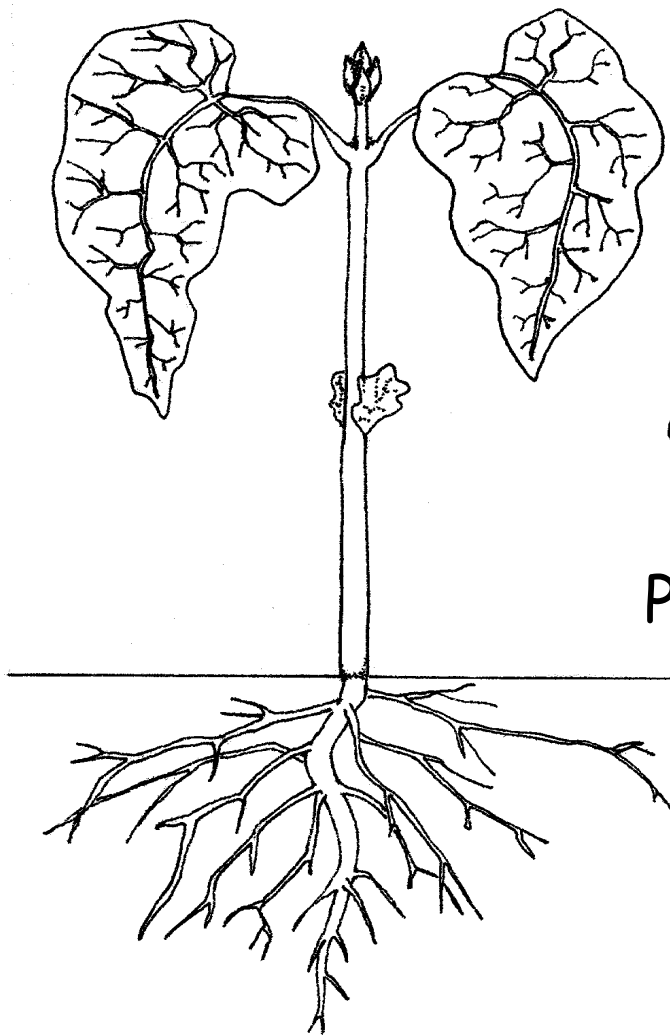
Plant Structure and Function

Teacher's Guide Grades 5-9

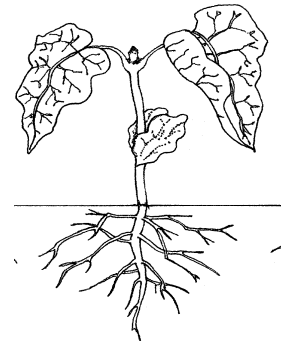
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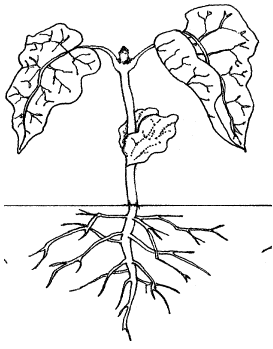
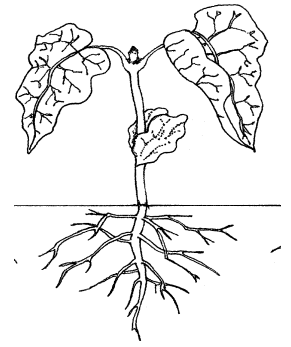


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Viewing Clearances

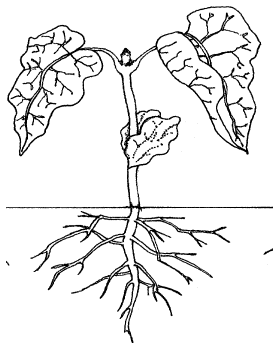
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A Message from our Company . . .

Dear Educator:

Thank you for your interest in the educational videos produced by the *Visual Learning Company*. We are a Vermont-based, family owned and operated business specializing in the production of quality educational science videos and materials.

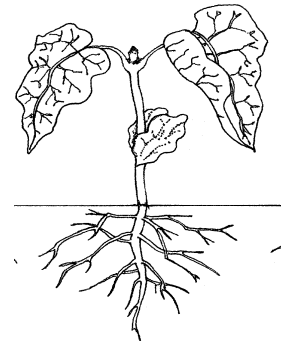
We have a long family tradition of education. Our grandmothers graduated from normal school in the 1920's to become teachers. Brian's mother was an elementary school teacher and guidance counselor, and his father was a high school teacher and superintendent. This family tradition inspired Brian to become a science teacher, and to earn a Ph.D. in education, and lead Stephanie to work on science education programs at NASA.

In developing this video, accompanying teacher's guide, and student activities, our goal is to provide educators with the highest quality materials, enabling students to be successful. In this era of more demanding standards and assessment requirements, supplementary materials need to be curricular and standards based - this is what we do!

Our videos and accompanying materials focus on the key concepts and vocabulary required by national and state standards and goals. It is our mission to help students meet these goals and standards, while experiencing the joy and thrill of science.

Sincerely,

Brian and Stephanie Jerome



National Standards Correlations

National Science Education Standards

(Content Standards: 5-8, National Academy of Sciences, c. 1996)

Science as Inquiry - Content Standard A:

As a result of activities in grades 5-8, all students should develop:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Life Science - Content Standard C:

As a result of their activities in grades 5-8, all students should develop an understanding of:

- Structure and function in living systems
- Regulation and behavior
- Diversity and adaptations of organisms

Benchmarks for Science Literacy

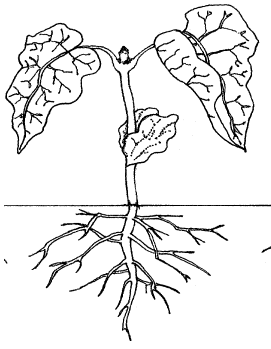
(Project 2061 - AAAS, c. 1993)

The Living Environment

By the end of the eighth grade, students should know that:

- One of the most general distinctions among organisms is between plants, which use sunlight to make their own food, and animals, which consume energy-rich foods.
- Animals and plants have a great variety of body plans and structures that contribute to their being able to make or find food and reproduce.
- All living things are composed of cells, from just one to many millions, whose details usually are visible only through a microscope.
- Food provides the fuel and building material for all organisms.

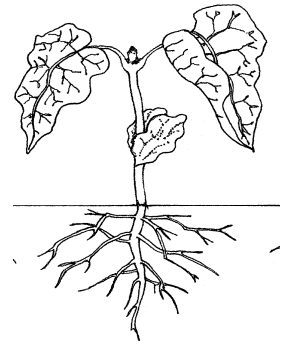
Plants use the energy from light to make sugars from carbon dioxide and water.



Student Learning Objectives

Upon viewing the video and completing the enclosed student activities, students should be able to do the following:

- Differentiate between vascular and nonvascular plants;
- Define vascular tissue and identify its function;
- Understand the functions of roots;
- Differentiate between a fibrous root system and a taproot structure;
- Differentiate between woody and herbaceous stems;
- Describe the function of stems;
- Identify the functions of xylem, phloem, and cambium;
- Differentiate between simple, compound, smooth, and toothed leaves;
- Describe the different structures of a leaf, including the cuticle, epidermis, palisade layer, spongy layer, stomata, and guard cells; and
- Differentiate between annual, biennial, and perennial plants.



Assessment

Preliminary Test:

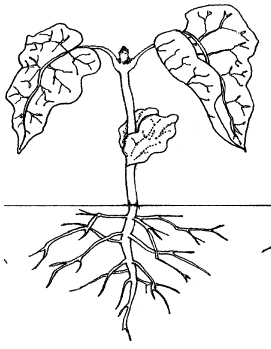
The Preliminary Test, provided in the Student Masters section, is an assessment tool designed to gain an understanding of student preexisting knowledge. It can also be used as a benchmark upon which to assess student progress on the objectives stated on the previous pages.

Video Review:

The Video Review, provided in the Student Masters section, can be used as an assessment tool or as a student activity. There are two main parts. The first part contains questions titled “You Decide” that can be answered during the video. The second series of ten questions consists of video review questions to be answered at the conclusion of video.

Post-Test:

The Post-Test, provided in the Student Masters section, can be utilized as an assessment tool following student completion of the video and student activities. The results of the Post-Test can be compared against the results of the Preliminary Test to assess student progress.



Introducing the Video

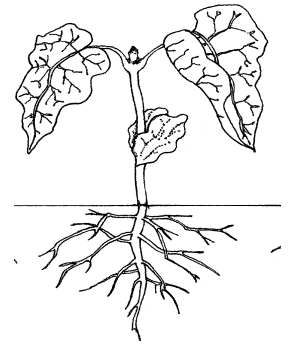
Divide the class into small groups. Ask each group to make a list of the different plant structures they see everyday, such as bark, stem, leaf, and root, and then describe the function of each. Next, have students make a second list of the ways in which plant structures are used in everyday life. Allow the students five to ten minutes to discuss the topic. When the discussion has ended, have a representative from each group write their lists on the chalkboard. Discuss the examples as a class. Leave the lists on the board during the video. After completing the program, ask the students to identify any new information about plant structure and function that they may have learned from the video.

Video Viewing Suggestions

You may want to photocopy and distribute to students the video review provided in the Student Master. You may choose to have your students complete this Master while viewing the program or following its conclusion.

The program is approximately 20 minutes in length and includes a ten-question video quiz. Answers are not provided to the Video Quiz on the video, but can be found in the teacher's guide. You may want to grade student quizzes as an assessment tool, or review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.



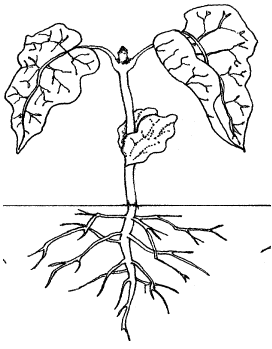
Student Assessments and Activities

Assessment Masters:

- Preliminary Test
- Video Review
- Post-Test

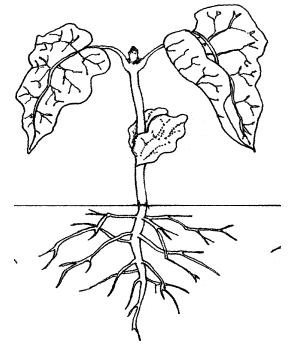
Student Activity Masters:

- Leaf Structure
- Exploring Ethnobotany
- Leaf Lab
- A Record in the Rings
- Plant Vocabulary
- Vascular Tissue Lab
- Root Growth Lab



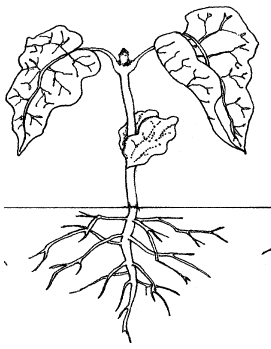
Video Script: ***Plant Structure and Function***

1. (Title)
2. As you may know, there are hundreds of thousands of different kinds of plants in this world.
3. Some plants, like these trees, produce wood to build furniture...
4. ...and houses.
5. Other plants produce valuable medicine. For example, this foxglove produces an important heart medication called digitalis.
6. We even heat our homes with oil - a by-product of decayed plants and animals.
7. And of course, we eat plants. In fact, we eat many different plants or structures of plants everyday.
8. For example, when we eat spinach, we are eating leaves.
9. When we eat carrots, we are eating roots.
10. When eating asparagus, we are eating stems.
11. And when eating cauliflower, we are actually eating flowers!
12. As you can see, plant structures or plant parts are very important to us and to other animals.
13. During the next few minutes we are going to explore what these structures do and how they function.
14. **Graphic Transition- Plant Characteristics**
15. Plants are found in nearly every environment on earth - In moist forests,...
16. ...in dry deserts, . . .
17. ...in water...
18. ...and high in tree tops.
19. What structures enable plants to live in such a wide variety of environments and with such great success?
20. First, plants are made up of many cells, as seen in this leaf viewed under the microscope.
21. All green plants also carry out the process of photosynthesis...
22. ...and contain a pigment called chlorophyll.
23. Most plants, like these mangroves, also have roots or root-like structures that anchor them to the earth.
24. As you know, there are two major groups of plants- nonvascular plants, such as mosses,...
25. ... and vascular plants, such as these onions.
26. Remember that non-vascular plants such as liverworts do not contain conducting tissues to transport liquids and nutrients.
27. Therefore, they need to live in moist environments and are often near the ground.
28. Nonvascular plants are simple plants and lack many of the structures, such as true stems, leaves, and roots, that are seen in more advanced vascular plants.
29. Vascular plants have tissues that allow them to conduct liquid and nutrients,
30. ...even to the tops of tall trees like this one.
31. During the next few minutes we are going to discuss some of the structures of vascular plants and explore their functions.
32. **Graphic Transition- Vascular plants**
33. There are over 250,000 species of vascular plants throughout the world.
34. The flowering vascular plants are the most successful and prevalent.
35. Vascular plants possess roots, stems, and leaves.
36. These plants also possess vascular tissue, a system of tiny tubes that move food and water throughout the plant.
37. These tissues act like the arteries and veins that transport blood in your body.
38. There are two main types of vascular tissue - phloem and xylem. We will discuss these types of vascular tissues later.
39. **Graphic Transition- Roots**
40. **You Decide!**
41. From what part of the plant does ginger ale derive its flavor?



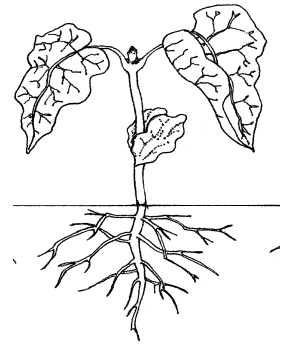
Script

42. Ginger ale originally derived its flavor from the root of the ginger plant seen here.
43. If you like vegetables, you also probably eat other types of roots, such as the beets seen here,...
44. ...and carrots.
45. While we find plant roots useful as food, they also provide vital functions for plants.
46. **You Decide!**
47. What provides this large maple tree with water?
48. That's right, the roots of the tree absorb water from the ground and direct it up the tree.
49. If you were to measure the length of all the roots from the tree they would be miles long!
50. Roots take in water and other nutrients from the soil that the plant needs to survive.
51. Another important job that roots have is anchoring plants. Roots are what holds the tree in the ground during a strong windstorm.
52. The root system of this tree failed, causing the tree to fall over.
53. There are two main types of root systems of flowering plants - taproots and fibrous roots.
54. Carrots are a good example of a plant that has a taproot structure with one main, long root.
55. Whereas plants, such as grass, have a fibrous root system that is composed of many thin roots.
56. Some plants may also grow different types of adventitious roots.
57. Adventitious roots do not originate from roots but from stems or leaves.
58. For example, corn plants develop adventitious roots called prop roots. Prop roots help brace the plant.
59. Ivy also often has adventitious roots called...
60. ...climbing roots that grow from the stem and fasten to this wall.
61. And other plants, such as this Spanish moss, possess aerial roots that absorb moisture directly from the air.
62. A very interesting characteristic of roots relate to their growth.
63. While a single root can be very long, growth occurs at a small portion of the root called the root tip.
64. This root diagram shows the root tip where the growth for root lengthening occurs.
65. While roots may thicken, they lengthen at the root tip.
66. **Graphic Transition- Stems**
67. Now let's take a look at stems,...
68. ...the above-ground structure to which roots are connected.
69. This baseball player is swinging a part of a stem...
70. ...from the trunk of an ash tree.
71. Tree trunks are actually the stems of trees.
72. Plant stems vary greatly in size and shape.
73. There are two basic types of plant stems: woody stems and herbaceous stems.
74. Some plants, like these flowers, have herbaceous stems.
75. Herbaceous stems tend to be softer and are often green.
76. Trees and shrubs tend to have woody stems. Some woody stems, like oak, are used in making furniture.
77. Woody stems are made of tough, thick tissue we refer to as wood.
78. Similar to the roots, stem growth occurs at the tip of the stem.
79. **Graphic Transition-Stem Functions**
80. Cookies and cake are two favorite sweet foods for most of us.
81. Sugar is the cooking ingredient used to sweeten these foods.
82. **You Decide!** Where does sugar come from?
83. Sugar is derived from the stem of the sugar cane plant seen here.
84. Sugar cane is a tall plant most commonly found in warm climates.
85. Plants, like sugar cane, celery, and even the hay this horse is eating, store food in their stems.
86. One of the most important jobs of a stem is to support leaves and flowers.
87. This tree stem and its branches allow leaves to be suspended in the air where they absorb light to make food.
88. **Graphic Transition- Vascular Tissue**
89. Earlier we mentioned that vascular plants contain tube-like structures called vascular tissue...



Script

90. ...and that there are two types of vascular tissue- phloem and xylem.
91. Vascular tissue extends from the roots, up through the stem, and to the leaves.
92. This diagram illustrates the vascular tissue in the stem of a tree.
93. On the outside of the tree stem is a layer of bark.
94. Bark protects the stem of the tree.
95. Underneath the bark is a layer of phloem. Phloem tissue consists of tubular cells that move food from both the leaves and the stem throughout the body of the plant.
96. Another tissue is called cambium. Cambium is located between the xylem and phloem and is responsible for making new xylem and phloem.
97. A second type of vascular tissue is called xylem. Xylem moves water and nutrients from the roots upward through the stem to the leaves.
98. **You Decide!**
99. Which type of tissue is responsible for making the annual growth rings in trees?
100. The xylem is responsible for making the annual growth rings in trees.
101. By counting the annual growth rings, you can estimate the age of a tree.
102. This tree has 26 annual growth rings which means it is about 26 years old.
103. **Graphic Transition- Leaves**
104. Leaves come in many different shapes,...
105. ...sizes,...
106. ...and colors.
107. Leaves may be classified as simple or compound.
108. Simple leaves have a blade that is in one piece, such as this apple tree leaf.
109. Compound leaves have a blade that are separated into a number of separate, leaf-like parts.
110. Palm trees have compound leaves, . . .
111. . . as does this black locust tree.
112. Leaves are largely responsible for capturing the sun's energy to create food for the plant.
113. And leaves are an extremely important structure in creating oxygen...
114. ..that we all need to breathe.
115. This is a leaf from a maple tree.
116. This thin piece is called the stalk, or petiole, and it connects the leaf to the stem or branch.
117. At the other end of the stalk is the leaf blade- the main flat part of the leaf.
118. **You Decide!** What important process takes place in leaves?
119. Leaves are extremely important in carrying out the process of photosynthesis.
120. As you know, photosynthesis is the process of plants producing food and oxygen from light, carbon dioxide and water.
121. In this apple tree, most of the photosynthesis is occurring in the leaves.
122. How are leaves designed to carry out photosynthesis?
123. This is a diagram of a leaf cross-section. Most leaves have an outer layer called the epidermis that protects and covers the leaf.
124. In the case of this maple leaf, the upper epidermis has a waxy coating called the cuticle. This waxy coating helps keep moisture in, preventing the plant from drying out.
125. Below the epidermis is the mesophyll which is made of 2 layers. The first layer is the palisade layer, made up of cells instrumental in carrying out photosynthesis.
126. Below the palisade area is the spongy layer. This layer has many air cavities in which gases from the plant and air are able to mix.
127. Also located in the spongy layer is vascular tissue - xylem and phloem.
128. These tubes can be seen as veins on the outside of the leaf.
129. Air spaces located in the epidermis are called stomata. Stomata are small holes that allow gases to flow in and out of the leaf.



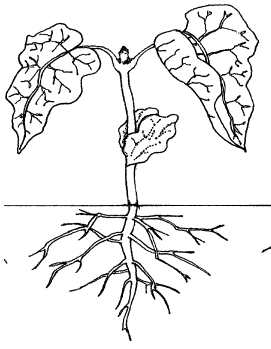
Script

130. Remember that in the process of photosynthesis, carbon dioxide, oxygen, and water vapor enter and escape from the leaf.
131. These gases enter and exit through the stomata.
132. The stomata are surrounded by guard cells that open and close the small holes.
133. If a plant does not have enough water, it wilts...
134. ...and the guard cells close to prevent further water vapor loss.
135. **Graphic Transition - Plant Groupings**
136. There are many ways to group flowering plants. One method of grouping, familiar to gardeners, divides flowering plants into three main groups:
137. annuals,
138. biennials, and
139. perennials.
140. Plants that grow from a seed, produce a flower, create seeds and die every year are called annuals.
141. Many common garden plants, such as marigolds and petunias, are annuals.
142. Some plants take two years to complete this life cycle. These are called biennials.
143. Plants like cabbage are biennials.
144. In the first growing season, most biennials grow roots, stems and leaves. The stems and leaves often die in the winter but the roots survive.
145. This is a first year hollyhock.
146. During the second year, the hollyhock flowers and produces seeds before the entire plant dies.
147. Perennials are plants that live for many years. Most trees are perennials.
148. Many perennials, such as these shrubs, have woody stems.
149. **Graphic Transition - Summing Up**
150. During the past few minutes we have explored some of the general characteristics of plants.
151. We have studied the vascular tissues of plants, including phloem and xylem.
152. We have also explored specific plant structures and how they function, including roots. . . .
153. . . . stems, . . .
154. . . . and leaves.
155. Finally we took a look at how flowering plants can be classified as annuals, biennials, or perennials.
156. Next time you look at a plant, remember the different plant structures and functions we discussed. You just might look at plants a little differently.

Video Quiz

Fill in the correct word when you hear this tone _____. Good luck, and let's get started.

1. All green plants carry out the process of _____.
2. The system of tiny tubes that carry water and nutrients throughout a plant is called _____ tissue.
3. A carrot is an example of a _____.
4. Plants are anchored into the ground by their _____.
5. Trees and shrubs tend to have _____ stems.
6. The annual growth rings of a tree are formed by _____.
7. Photosynthesis occurs in the _____ of plants.
8. Xylem and phloem are found in the _____ layer of the leaf.
9. The small openings in leaves that allow gasses from the plant and air to mix are called _____.
10. Plants that complete one life cycle in one year are called _____.



Answers to Student Assessments

Preliminary Test

1. chlorophyll
2. vascular
3. roots
4. fibrous
5. herbaceous
6. bark
7. cambium
8. compound
9. stomata
10. perennial
11. True
12. False
13. False
14. False
15. True
16. True
17. True
18. True
19. False
20. True

Video Review

You Decide:

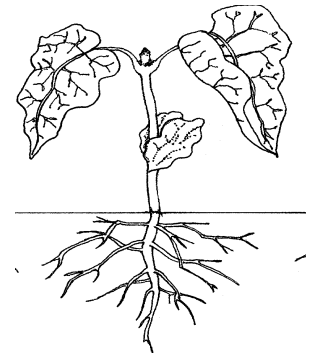
- A. Ginger ale originally derived its flavor from the roots of the ginger plant.
- B. The roots of the maple tree absorb water from the ground and direct it up the tree.
- C. Sugar is derived from the stem of the sugar cane plant.
- D. The xylem is responsible for making the annual growth rings in trees.
- E. Photosynthesis takes place in the leaves.

Video Quiz:

- | | |
|--------------------|-------------|
| 1. photosynthesis | 6. xylem |
| 2. vascular tissue | 7. palisade |
| 3. taproot | 8. spongy |
| 4. roots | 9. stomata |
| 5. woody | 10. annuals |

Post Test

1. False
2. False
3. False
4. True
5. True
6. True
7. False
8. True
9. True
10. True
11. stomata
12. fibrous
13. vascular
14. perennial
15. herbaceous
16. cambium
17. roots
18. compound
19. bark
20. chlorophyll



Answers to Student Activities

Leaf Structure

1. guard cells
2. stomata
3. palisade layer
4. cuticle
5. epidermis
6. vascular tissue
7. spongy layer

Exploring Ethnobotany

Answers will vary.

Leaf Lab

Answers will vary.

A Record in the Rings

1. 7
 2. 7 years old
 3. between rings 4 and 5
 4. between rings 5 and 6
 5. The weather was most likely dry and cold.
- A. phloem
B. bark
C. xylem
D. cambium

Vocabulary Lesson

1. photosynthesis - h
2. vascular tissue - c
3. xylem - e
4. phloem - j
5. cambium - d
6. taproot - i
7. fibrous roots - b
8. epidermis - f

9. perennial - a
10. palisade layer - k
11. stomata - m
12. biennial - l
13. guard cells - n
14. annual - o
15. spongy layer - g

Vascular Tissue Lab

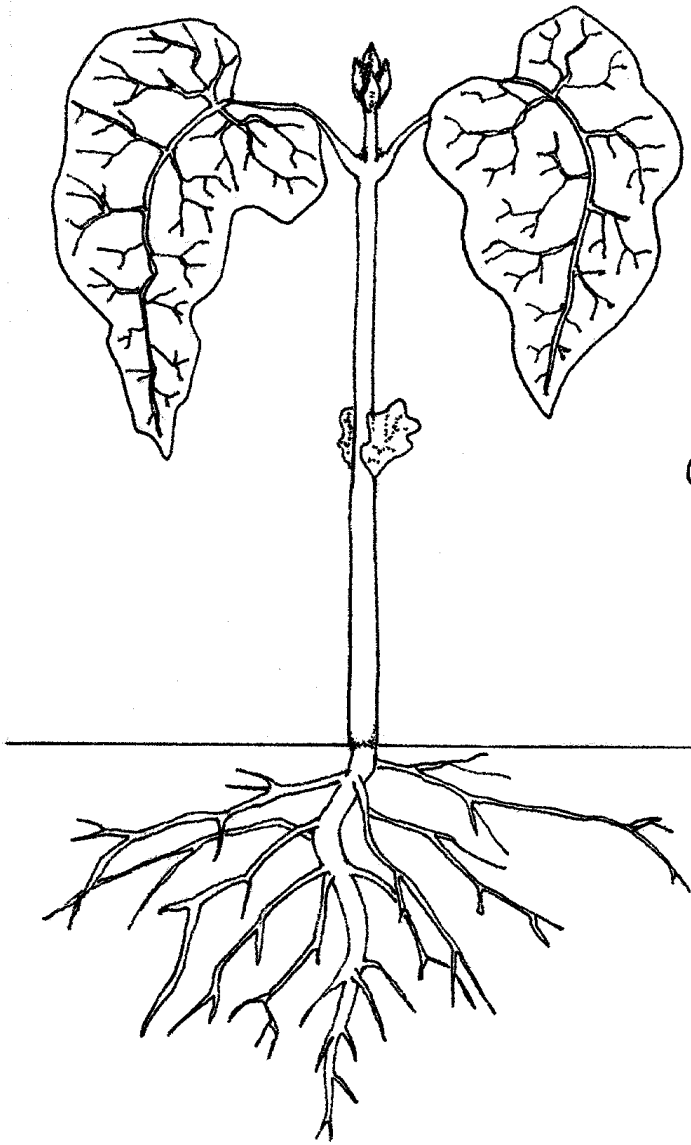
1. The red food coloring travels up the celery stalk.
2. The red food coloring would reach all parts of the celery stalk.
3. Answers will vary.

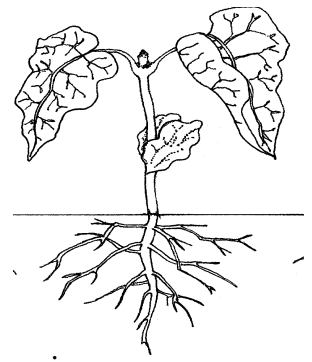
Conclusions: Xylem and phloem transport fluids and nutrients throughout a plant and its structures. These tissues allow vascular plants to live in a wider variety of environments than non-vascular plants, which require moist environments to obtain water. Non-vascular plants survive without vascular tissue by living in places where their survival does not rely on water and nutrients transportation, such as near the ground and in moist environments.

Root Growth Lab

Conclusions: Root growth occurs at the root cap. As cells behind the root cap build up, the cap breaks and releases a fluid that helps the root make its way down into the soil.

Assessment and Student Activity Masters





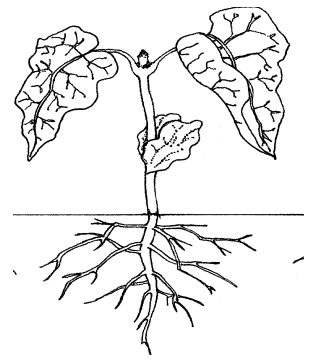
Preliminary Test

Directions: Fill in the blank with the correct word. A list of possible answers is provided at the bottom of the page.

1. Green plants have a pigment called _____.
2. _____ plants have tissues that allow them to conduct liquids and nutrients throughout their structures.
3. The _____ of a tree absorb water and direct it up the tree.
4. A _____ root system is composed of many thin roots.
5. _____ stems tend to be soft and green.
6. The stem of a tree is protected by a layer of _____.
7. _____ is responsible for making new xylem and phloem.
8. Leaves may be classified as simple or _____.
9. Guard cells control the opening and closing of the _____ in leaves.
10. A plant that lives for many years is called a _____ plant.

stomata
chlorophyll
fibrous
vascular
perennial
compound

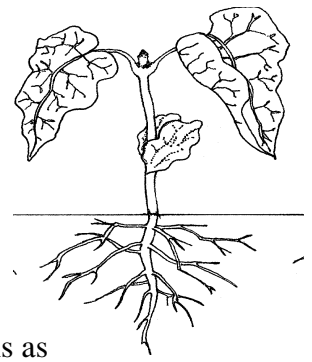
roots
bark
cambium
herbaceous
woody
meristematic



Preliminary Test

Directions: Decide if the answer is true (T) or false (F).

- | | | |
|---|---|---|
| 11. Plants and plant structures can be used to produce medicine. | T | F |
| 12. Only some green plants carry out photosynthesis. | T | F |
| 13. Xylem, phloem and cambium are tissues found in non-vascular plants. | T | F |
| 14. The roots of all plants are inedible. | T | F |
| 15. Plants sometimes store food in their stems. | T | F |
| 16. Annual growth rings allow us to approximate the age of a tree. | T | F |
| 17. Xylem moves water and nutrients from the roots upward throughout the structures of the plant. | T | F |
| 18. The cells in the palisade layer of a leaf are very important in carrying out photosynthesis. | T | F |
| 19. The stomata are found in the spongy layer of leaves. | T | F |
| 20. Biennials are plants that take two years to complete their life cycle. | T | F |



Video Review

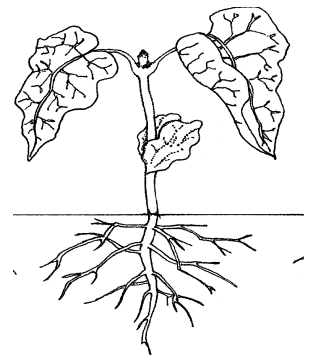
Directions: During the course of the program answer the “You Decide” questions as they are presented in the video.

You Decide

- A. From what part of the plant does ginger ale derive its flavor? Answer: _____
- B. What provides this large maple tree with water? Answer: _____
- C. Where does sugar come from? Answer: _____
- D. Which type of vascular tissue is responsible for making the annual growth rings in trees? Answer: _____
- E. What important process takes place in leaves? Answer: _____

Video Quiz

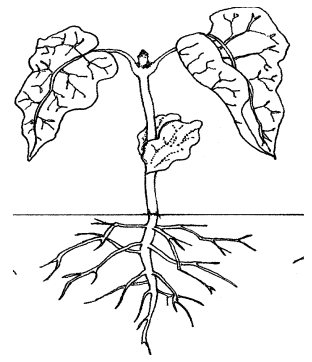
1. All green plants carry out the process of _____.
2. The system of tiny tubes that carry water and nutrients throughout a plant is called _____.
3. A carrot is an example of a _____.
4. Plants are anchored into the ground by their _____.
5. Trees and shrubs tend to have _____ stems.
6. The annual growth rings of a tree are formed by _____.
7. Photosynthesis occurs in the _____ layer of plants.
8. Xylem and phloem are found in the _____ layer of the leaf.
9. The small openings in leaves that allow gasses from the plant and the air to mix are called _____.
10. Plants that complete one life cycle in one year are called _____.



Post Test

Directions: Decide if the answer is True (T) or False (F).

1. The stomata are found in the spongy layer of leaves. T F
2. Only some green plants carry out photosynthesis. T F
3. The roots of all plants are inedible. T F
4. Biennials are plants that take two years to complete their life cycle. T F
5. Annual growth rings allow us to approximate the age of a tree. T F
6. Plants and plant structures can be used to make medicine. T F
7. Xylem, phloem and cambium are tissues found in non-vascular plants. T F
8. The cells in the palisade layer of a leaf are very important in carrying out photosynthesis. T F
9. Plants sometimes store food in their stems. T F
10. Xylem moves water and nutrients from the roots upward throughout the structures of the plant. T F



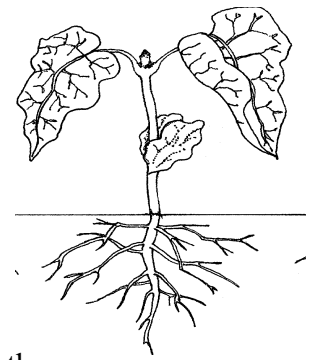
Post Test

Directions: Fill in the blank with the correct word. Choose from the list of possible answers at the bottom of the page.

11. Guard cells control the opening and closing of the _____ in leaves.
12. A _____ root system is composed of many thin roots.
13. _____ plants have tissues that allow them to conduct liquids and nutrients throughout their structures.
14. A plant that lives for many years is called a _____ plant.
15. _____ stems tend to be soft and green.
16. _____ is responsible for making new xylem and phloem.
17. The _____ of a tree absorb water and direct it up the tree.
18. Leaves may be classified as simple or _____.
19. The stem of a tree is protected by a layer of _____.
20. Green plants have a pigment called _____.

fibrous
perennial
woody
compound
stomata
chlorophyll

bark
roots
herbaceous
vascular
cambium
meristematic



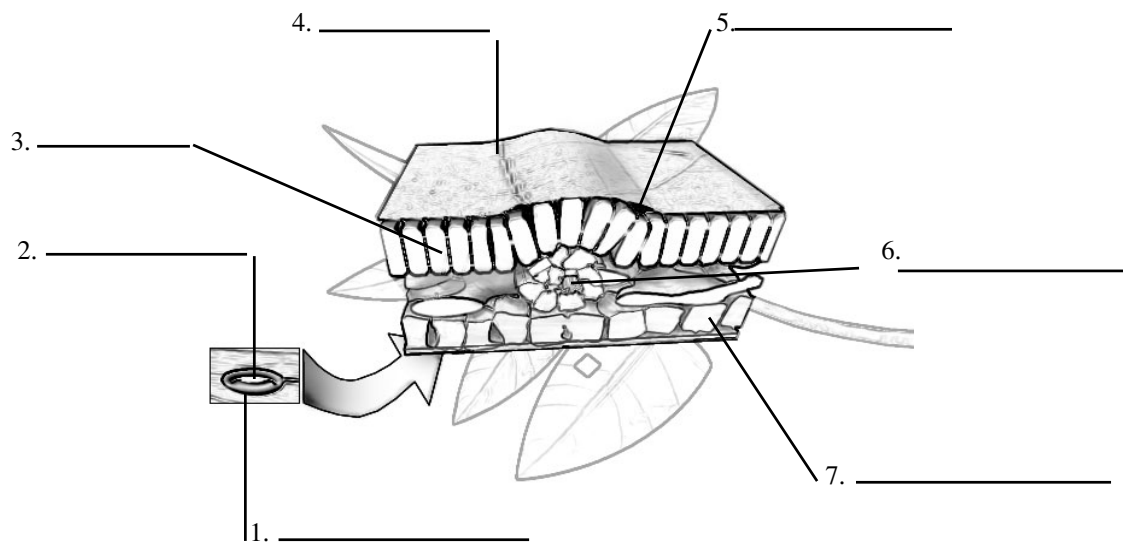
Leaf Structure

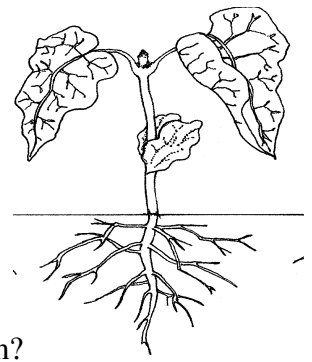
Directions: Using the information provided below, label the parts of a leaf using the following terms: *vascular tissues*, *spongy layer*, *cuticle*, *stomata*, *epidermis*, *guard cells*, and *palisade layer*.

Background:

We see leaves around us everyday. Did you realize that leaves are vital to human survival? Photosynthesis is the process plants use to make sugar from water and carbon dioxide. This process takes place primarily in the leaves of plants. During this process, oxygen is released. Almost all the oxygen we breathe results from photosynthesis in plants. Without the oxygen produced by plants, life as we know it would cease. So now that we know why plant leaves are so important, let's explore their structure.

The outermost layer of the upper and lower surfaces of a leaf is called the **cuticle**. The cuticle is a waxy layer that provides protection for the tissues of the leaf and prevents excessive water loss. Just below the cuticle is the **epidermis**. This is a thin layer of cells that provides further protection for the leaf. The stomata are found in the epidermal layer. The **stomata** are small openings through which gasses may flow in and out of the leaf. Water also escapes the leaf through these openings. Each stomate is protected by a group of **guard cells**. These cells control the opening and closing of the stomate according to the needs of the leaf. Below the epidermis is the **palisade layer**. This layer of cells plays a large role in the process of photosynthesis. Just below the palisade layer is the **spongy layer**. This layer has many air cavities where gasses from the plant and the air can mix. **Vascular tissues**, such as xylem and phloem, are found in this spongy layer. They appear as veins on the outside of the leaf.





Exploring Ethnobotany

Objective: In this lab you will learn about the field of ethnobotany.

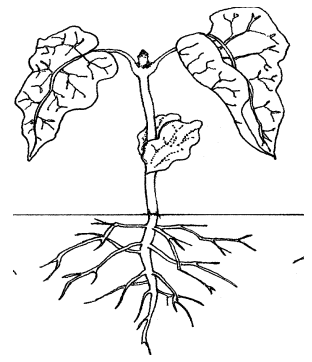
Background: Have you ever wondered where the medicine you take comes from? Although it is most likely made from chemicals in laboratories, this may not have been where it first originated. Many medicines we take originally come from plants. For example, although aspirin is now made from chemicals, it originated in the bark of a willow tree. It's strange to imagine that the bark of a tree could be just what you need to relieve a throbbing headache!

While most of the medicines we take are made from chemicals, many native cultures throughout the world continue to rely on the plants in their environment to relieve pain and to cure illnesses. The medicinal properties of plants are of great interest to the field of ethnobotany. Ethnobotany is the study of how people from a particular culture or region use the plants in their environment. Ethnobotanists work with indigenous, or native groups to learn about the healing powers of the plants in their region. The rainforests of South America are a center of research because of their great diversity of plants. While ethnobotanists continue to learn about the medicinal properties of more and more plants, only a small portion of plant species have actually been researched. This means that potential cures for diseases that plague our world may exist in an undiscovered plant. This is one reason why it is so important to stop the destruction of the rainforest - we may be destroying plant species that hold the cure to many diseases.

While the use of plants for medical purposes is of interest to ethnobotanists, they also study the way in which other cultures use plants for shelter, food, clothing, hunting, and religious purposes. Many ethnobotanists have studied the plant use of the Aborigines, Australia's native population. The Aboriginal peoples migrated to Australia at least 40,000 years ago. The Aborigines were hunters and gatherers and did not grow any crops or raise any animals. For this reason, they depended on their natural environment in order to survive. They used plants in a variety of ways, such as for a source of food. Plants were also used to aid in hunting. The crushed leaves of Austral Indigo were added to water to kill fish and eels, while the hard wood of Gum trees was used to make spears, boomerangs, and shields. Plants also played a role in transportation, as the Aborigines crafted canoes from the bark of Gum trees. Like the many different cultures in South America, the Aborigines also used plants for their medicinal properties. For example, they relied on the leaves of mistletoe for healing. As you can tell, plants were crucial to the survival of the Aboriginal people.

Directions: Imagine that an ethnobotanist from another culture has chosen to interview you to learn about the unique use of plants in your region of the world. Write a page describing an interesting way in which you use plants. Be creative! Try to think of something that is unique - for example, plants are an important source of food for every culture in the world and therefore may not be of interest to the ethnobotanist.

*The information on Aboriginal plant use was gathered from the Australian National Botanic Garden webpage at <http://155.187.10.12/anbg.html>.



Leaf Lab

Objective:

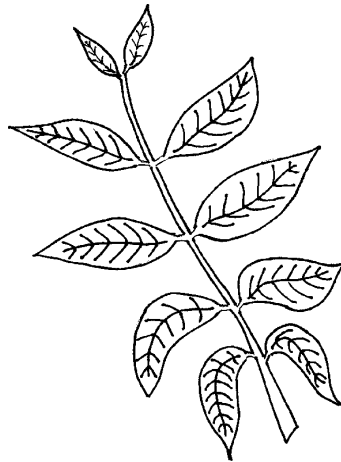
In this activity you will learn about the different characteristics of leaves in your local ecosystem.

Background:

Leaves come in all shapes, sizes and colors. A leaf must first be characterized as simple or compound. Simple leaves have a blade that is composed of one piece, while compound leaves have blades that are separated into a number of parts. Leaves may also be smooth or toothed. A smooth leaf has margins that form a smooth line with no point-like projections. The margins of a toothed leaf have small, pointed projections.

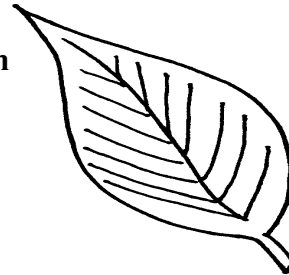


simple

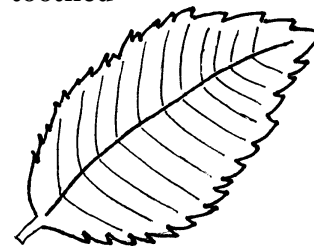


compound

smooth



toothed



Material:

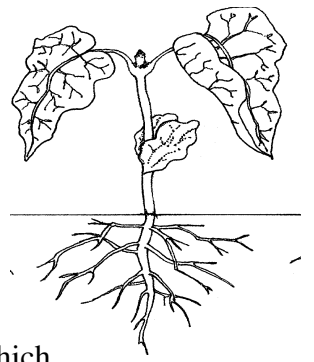
Pencil and paper
Small collecting bag

Procedure:

1. Divide into small groups.
2. Hike around the area surrounding your school or nearby park. Observe the different types of plants and trees in your ecosystem.
3. Each group should collect 15-20 fallen leaves from as many different species of trees as possible.
4. Back in the classroom, observe the structure of each leaf. Characterize them as either simple or compound, and as either smooth or toothed.

Conclusions:

Discuss the types of leaves most commonly found around your school. How does the ecosystem around your school affect the types of trees which grow there? If time permits, use plant and tree guides to determine the exact species of each leaf.



A Record in the Rings

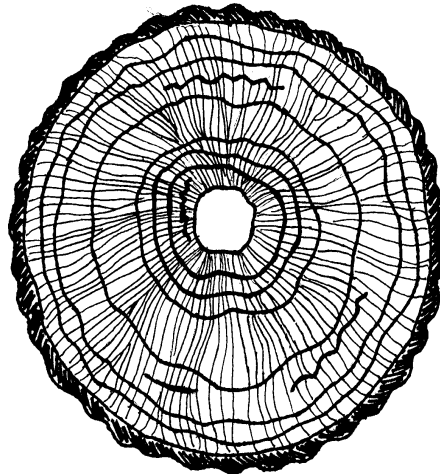
Background:

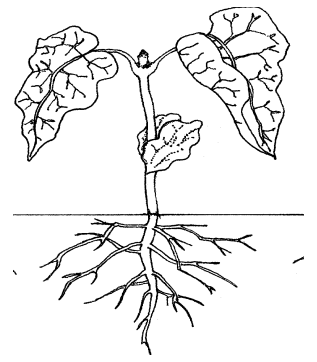
All trees are classified as vascular plants because they contain vascular tissues which transport water and nutrients throughout their structures. These vascular tissues are called xylem and phloem. All trees are also woody plants. The stems of woody plants thicken due to the function of another type of tissue called cambium.

Cambium produces new xylem and phloem. It is located between the xylem and phloem in the stem. The phloem is located to the outside of the cambium, towards the bark. As new phloem is produced, the old phloem flakes off. The xylem is located beneath the cambium, toward the center of the tree stem. The tree stem grows as new xylem produced by the cambium builds up. New xylem forms the annual growth rings on a tree. These rings help us to estimate the age of a tree. The width of each ring reflects the environmental conditions during the previous year. When water and nutrients are plentiful, a tree will grow a lot and the ring formed that year will be wide. If the next year happens to be very dry, the tree will grow less and the ring formed will be very narrow. Other factors can leave scars on a tree stem. Large fires or earthquakes can leave permanent marks in a tree stem. Tree rings serve as a living record of the past.

Directions: Using the tree cross-section below, answer the following questions:

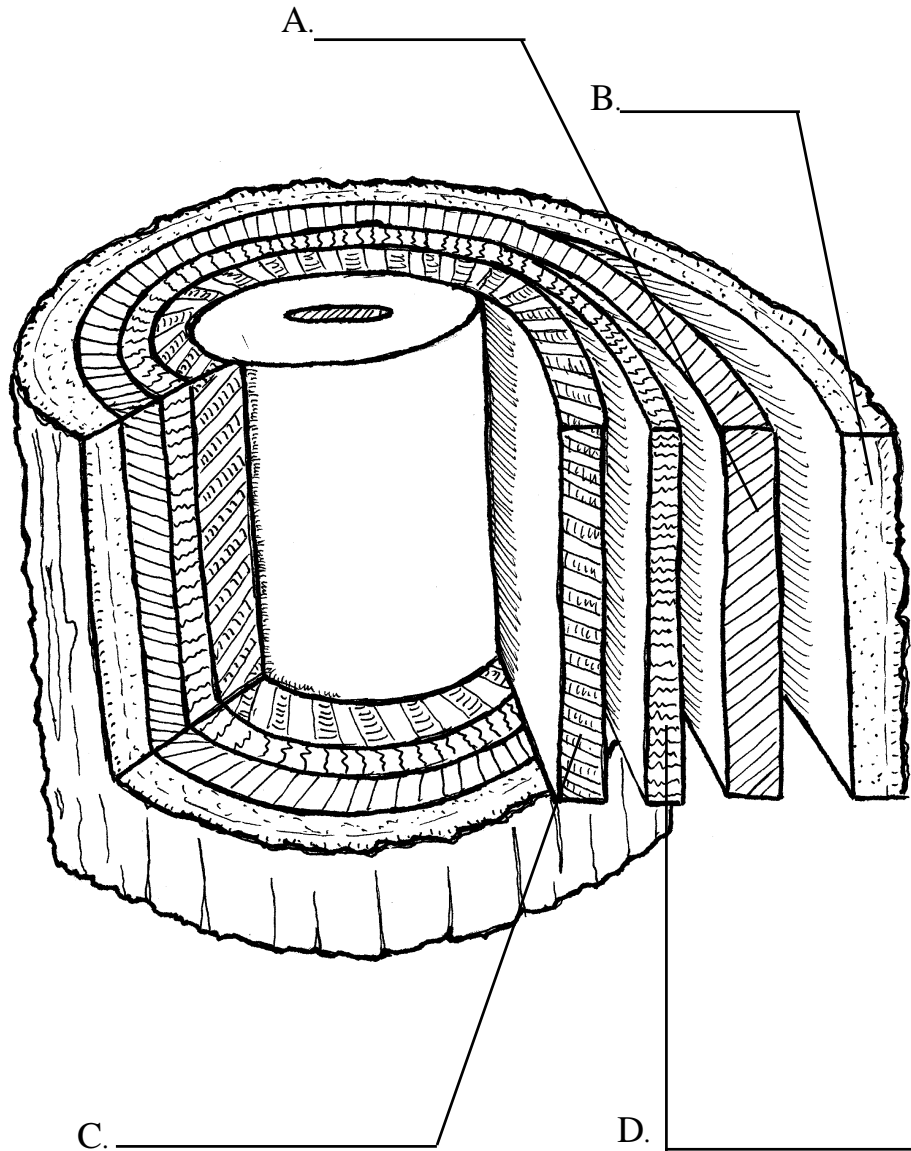
1. How many rings does this tree have?
2. How old is this tree?
3. One year in this tree's life was particularly warm and wet. Between which rings is the largest amount of growth?
4. This tree has experienced two very large forest fires. Between which rings are these scars evident?
5. The first three growth rings on this tree are relatively small. What do you think the weather conditions were like during those years?

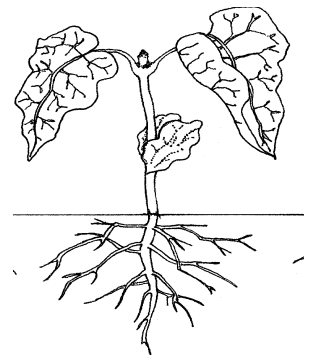




A Record in the Rings

Directions: Label the parts of the tree stem below using the following terms: *xylem*, *bark*, *cambium*, and *phloem*.

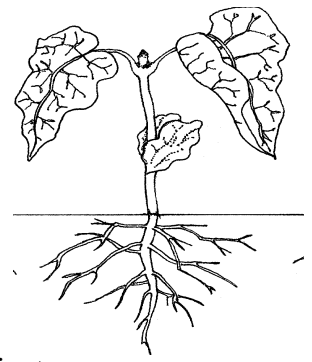




Plant Vocabulary

Directions: Match the vocabulary words with the correct definition.

- | | |
|--------------------------|--|
| _____ 1. otosynphthesis | a. plant that lives for many years. |
| _____ 2. culrasav ssiuet | b. system of many thin roots. |
| _____ 3. melxy | c. system of tiny tubes that moves food and water throughout a plant. |
| _____ 4. oemlhp | d. vascular tissue responsible for making new xylem and phloem. |
| _____ 5. buimmca | e. vascular tissue that transports water and nutrients from the roots upward through the stem and into the leaves. |
| _____ 6. ootrtap | f. outermost layer of a leaf. |
| _____ 7. roufibs ootrs | g. layer of cells with air cavities where gasses from the plant and the air can mix. |
| _____ 8. derepimis | h. the process plants carry out to make glucose and oxygen from water and carbon dioxide. |
| _____ 9. nnailrepe | i. root system with one main, long root. |
| _____ 10. alidsape yerla | j. vascular tissue that moves fluids from the leaves and stems throughout the body of the plant. |
| _____ 11. satatom | k. layer of cells that is instrumental in photosynthesis. |
| _____ 12. liannebi | l. plant that takes two years to complete its life cycle. |
| _____ 13. duarg llecs | m. small openings in the epidermis that allow gasses to flow in and out of the leaf. |
| _____ 14. launna | n. cells that control the opening and closing of stomata. |
| _____ 15. gyspon yerla | o. plant which completes its life cycle in one year. |



Vascular Tissue Lab

Objective:

In this activity you will observe the roles of xylem and phloem in water and nutrient transport throughout a plant.

Background:

We have already learned that vascular plants have the ability to transport water and nutrients throughout their structures. Now it is time to understand how this transport system works. The vascular tissues responsible for transporting materials throughout the plant are xylem and phloem. The xylem transports water from the ground up through the roots and into the plant. The phloem transports the water in the plant throughout its structures. Together, these vascular tissues ensure that the plant receives the liquids and nutrients it needs to survive.

Materials:

Celery stalk
Clear container
Ruler
Red food coloring
Knife

Procedure:

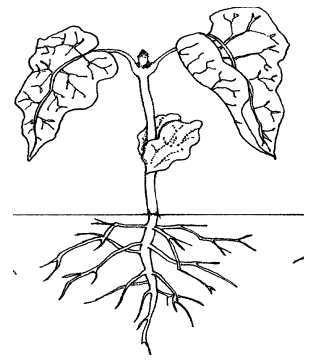
1. Cut approximately 1 centimeter off the bottom of the celery stalk. **Be careful!**
2. Fill half of the clear container with water.
3. Add enough red food coloring to turn the water a deep red color.
4. Place the bottom of the stalk, where the cut was made, into the solution.
5. After 5 minutes, measure and record how high the food coloring has traveled up the celery stalk.
6. Repeat step 5 after 10, 15 and 20 minutes.
7. Make a graph of your data.

Observations:

1. What happens to the food coloring?
2. What do you think would happen to the celery if you left it in the solution over night?
3. Is the food coloring moving fast or slow? (Use the data you collected!)

Conclusions:

Describe the function of xylem and phloem. Why are these tissues so important to plants? What types of plants survive without vascular tissues? How are they able to survive?



Root Growth Lab

Objective:

In this activity you will observe the growth of roots. This lab will allow you to determine the rate of growth, as well as where the actual growth is occurring.

Background:

Plants have numerous structures which allow them to survive. One of the most important parts of the plant is one often you can't see! The roots play a vital role in plant survival. Roots are responsible for anchoring plants into the ground. They also absorb the water and nutrients from the soil that are necessary for the plant to live and grow. With all this work, the roots still have time to grow themselves! Roots grow from their root caps. A **root cap** is a group of cells shaped like a thimble that covers each root tip. When cells behind this cap build up, the cap breaks. A fluid is released to help the root make its way through the soil. A new root cap is quickly formed and the growth process continues.

Materials:

Wheat, rye or barley seeds
Paper towels
Clear plastic container
Ruler
Permanent marker

Procedure:

1. Fill the plastic container with dampened, crumpled paper towels.
2. Place a seed between the wall of the container and the paper towels. This will allow you to observe root growth.
3. Observe the seeds at the same time every day for a week, making sure to always keep the paper towels damp.
4. When roots begin to grow, choose one root to measure daily. Mark one centimeter increments on this root with a permanent marker during each observation.

Conclusions:

Discuss the rate of growth of the root you observed. Did the rate vary or did it stay the same? Using the marks you made on the root, determine where root growth was occurring and attempt to identify the root tip.