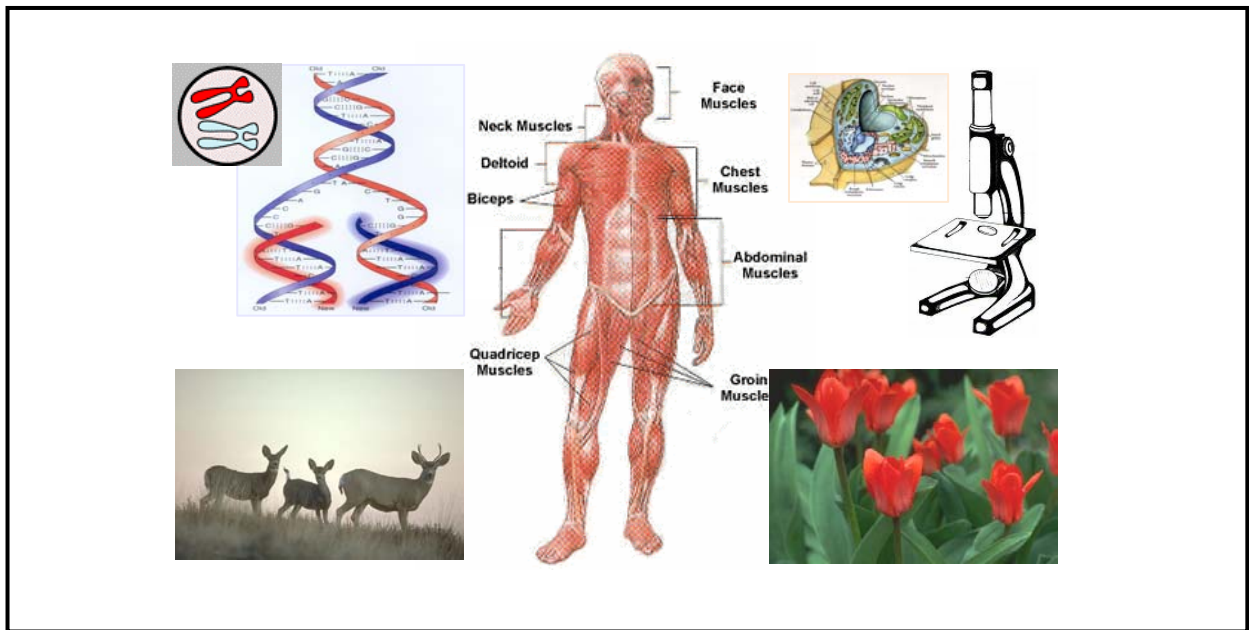


Project EASE

(Effective Alternative Secondary Education)

BIOLOGY



MODULE 7

Plant Parts and Functions



BUREAU OF SECONDARY EDUCATION

Department of Education
DepED Complex, Meralco Avenue
Pasig City



Module 7

Plant Parts and Functions



What this module is about

In the study on the growth and development of plants, you need to be familiar with the parts of plants and their functions. There are three lessons prepared for you in this module:

- **Lesson 1 – The Vegetative Parts of Plants**
- **Lesson 2 – The Reproductive Parts of Plants**
- **Lesson 3 – Seed Germination**



What you are expected to learn

After going through this module, you are expected to:

1. differentiate between the vegetative and reproductive parts of a plant;
2. identify the vegetative and reproductive parts of plants;
3. describe how plants are structurally designed to perform the different life processes; and,
4. explain the requirement of plants for growth and development.



How to learn from this module

1. Read carefully the instructions given.
2. Answer the pre-test first.
3. If you are told to go out and visit a garden, do not hesitate to do so. You maybe asked to go to a place nearby. It may be a backyard, school ground or any vacant lot where plants grow.
4. Fill up the designated boxes for any drawing/labels required.
5. Compare the drawings and diagrams in this module with actual specimens.



What to do before (Pretest)

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. The following are vegetative parts of a plant **except**:
 - a. stem
 - b. roots
 - c. leaves
 - d. flowers
2. The root system of monocot plants typically consists of:
 - a. tap roots
 - b. fibrous roots
 - c. modified roots
 - d. adventitious roots
3. Leaves are responsible for:
 - a. absorption
 - b. adsorption
 - c. precipitation
 - d. transpiration
4. Photosynthesis, the production of sugar and the release of oxygen in plants, takes place in:
 - a. stem
 - b. roots
 - c. leaves
 - d. flowers
5. Nutrients from the soil enter the plants through:
 - a. stem
 - b. roots
 - c. flowers
 - d. leaves
6. Adventitious roots are found in the following **except**:
 - a. stems
 - b. leaves
 - c. branches
 - d. primary root
7. The vascular bundles are responsible for the distribution of nutrients to all parts of the plant. These are made up of the following:
 - a. endodermis only
 - b. xylem and phloem
 - c. xylem and endodermis
 - d. phloem and endodermis
8. Water vapor is released by the plants through the process of:
 - a. osmosis
 - b. plasmolysis
 - c. evaporation
 - d. transpiration
9. The shoot system does not include the:
 - a. stem
 - b. roots
 - c. leaves
 - d. flowers

10. The dicot root system is typically a/an:
- a. tap root
 - b. fibrous root
 - c. modified root
 - d. adventitious root
11. The age of the tree can be detected by counting the number of:
- a. annual rings
 - b. number of leaves
 - c. number of branches
 - d. diameter of the trunk
12. Structures seen traversing the leaves of plants are:
- a. veins
 - b. blade
 - c. lamina
 - d. stomata
13. Primary roots arise from the:
- a. embryo of seeds
 - b. radicle of seeds
 - c. cotyledon of seeds
 - d. endosperm of seeds
14. The male reproductive part of the flower is:
- a. pistil
 - b. petal
 - c. sepal
 - d. stamen
15. The female reproductive part of the flower is:
- a. sepal
 - b. petal
 - c. pistil
 - d. stamen
16. The following are parts of the pistil **except**:
- a. style
 - b. ovary
 - c. anther
 - d. stigma
17. Seeds originate from the:
- a. style
 - b. ovary
 - c. stigma
 - d. ovules
18. Leaves contain small openings called:
- a. pores
 - b. lenticels
 - c. stomata
 - d. none of the above
19. Seeds are capable of germinating if given the following:
- a. water and soil
 - b. water and heat
 - c. temperature and pH
 - d. temperature and soil
20. Pollen grains are produced in the:
- a. anther
 - b. stigma
 - c. ovary
 - d. filament



Key to answers on page 19.

Lesson 1. The Vegetative Parts of Plants

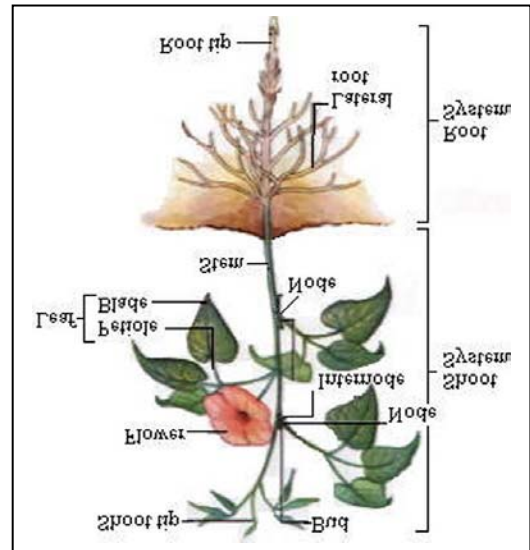
Just like animals, plants are also provided with organs. These organs are distinct in form, structure and function. Roots, stems and leaves are **vegetative** organs of plants that could be used for asexual reproduction. This means that they do not produce sex cells or play a direct role in sexual reproduction. Nevertheless, these organs play an important role in the life cycle of plants. Flowers, fruits and seeds comprise the other half of the plant and are involved in sexual reproduction.

Roots

Have you ever imagined plants without roots? What do you think will happen? Plants cannot stand without roots. The roots anchor the plants and hold the stem upward. They also absorb water and nutrients from the soil, which are then passed on to the stem and leaves. The leaves, in turn, carry out the process of **photosynthesis** and **transpiration**.

The root is a typically underground organ of the plant that functions principally for anchorage and absorption of water and minerals from the soil. The first formed root is the **primary root**, which develops from the **radicle** of the seed embryo.

There are different types of root system, namely the **fibrous root system** which consists of numerous, long, slender lateral roots of about the same size typical of monocots, and the **taproot system** with a well developed primary root that gives rise to smaller lateral roots, typical of dicot plants. Still some roots may arise from other plant organs like stems and leaves and are consequently called **adventitious** roots.



Root and Shoot System of a Plant

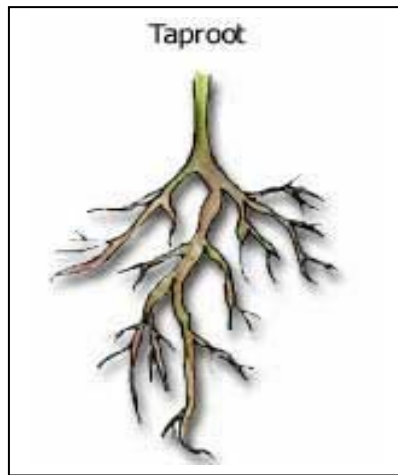
<http://personal.nbnet.nb.ca/trevgall/biology/plant.html>



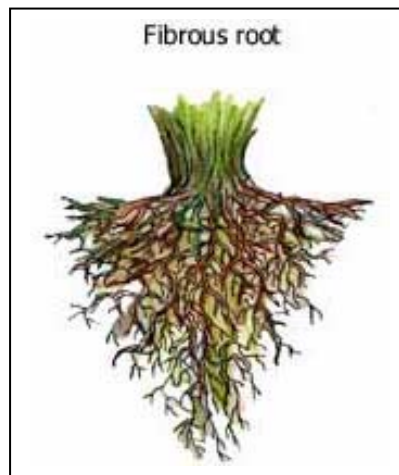
What you will do

Activity 1.1

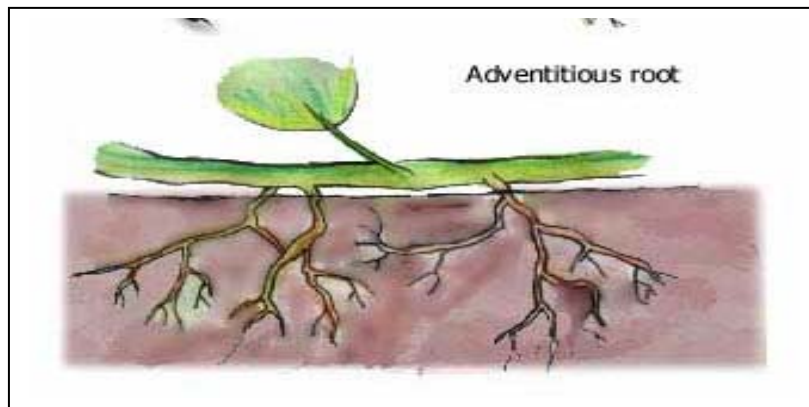
Go around your backyard. Look for seedlings or young plants and slowly pull them from the soil. Clean the roots and take note of the different structures that you can see. Look for the structures similar to the diagrams on the next page. If the primary root is evident like in diagram A, the plant is said to be a **dicot** plant. On the other hand if it is similar to diagram B, the plant is a monocot plant.



A



B



C




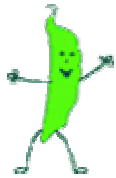
Randomly pick some plants from the field and compare them with the diagrams. How many plants have root systems similar to A? B? C? Can you write them down by giving their common name?

Common Name of Plant	Tap Root	Fibrous Root	Adventitious Root

Answer the following questions:

1. Differentiate the three types of root systems.
2. What is the advantage of a taproot over the other types of root system?
3. Is a carrot a vegetable or a root? Why do you say so? What about radish? Sweet potato (camote)?

 Key to answers on page 19.

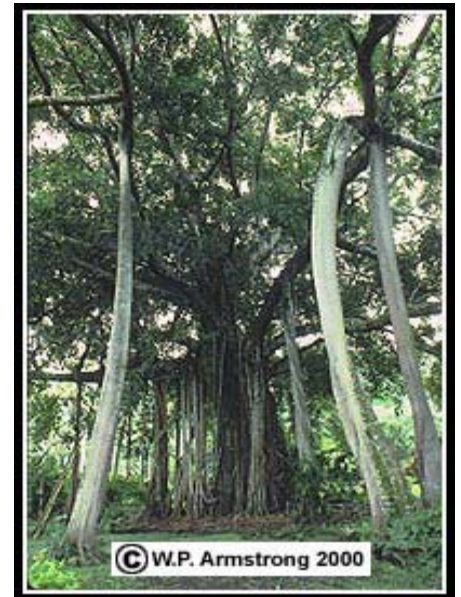


After observing the underground system of the plant, let us move upward the body and try to identify the next organ, the stem.

Stem

Just above the ground next to the root is the **stem**. It is the organ of the plant that supports the leaves and flowers in the best position. It is the passageway of nutrients from the soil to the different parts of the plant. The stem is very important to man. Lumber for our houses comes from this part of the plant.

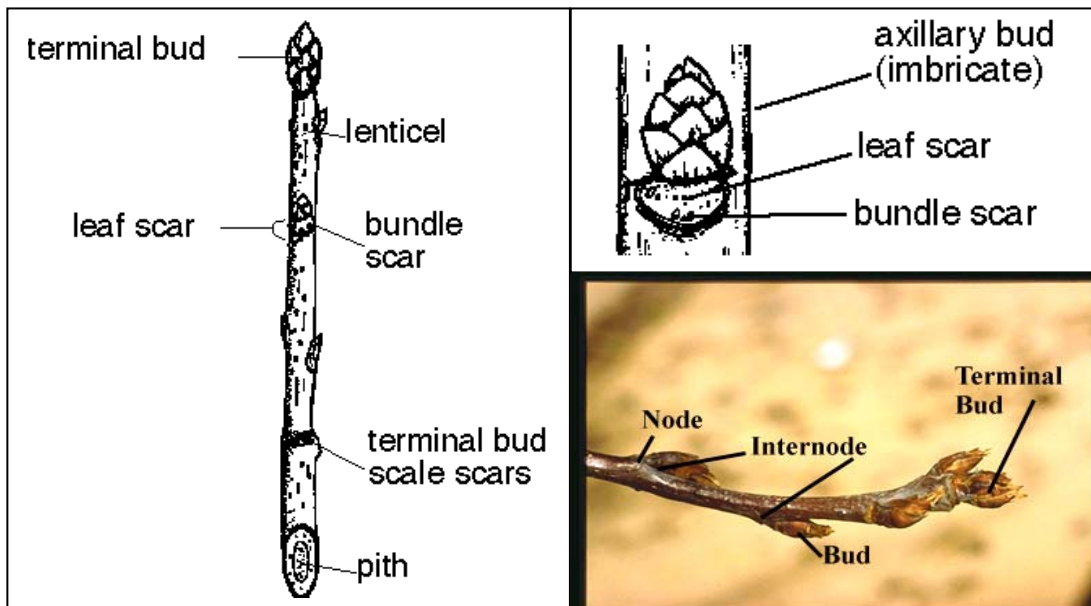
Get a portion of the stem of a gumamela plant. Notice the external parts. It has nodes and internodes. This is the prime difference between a root and a stem. Roots do not have nodes. Likewise, note the presence of **lenticels**, a small elevation on the stem. They serve for gas exchange. There are also buds in your specimen, the **axillary buds** and the **apical (terminal) bud**. These are soft parts of the stems composed of young cells. Examine the diagram below. It shows the external parts of a dicot stem.



Ficus benghalensis or balete.

Take note of the stem.

<http://waynesword.palomar.edu/trjune99.htm>



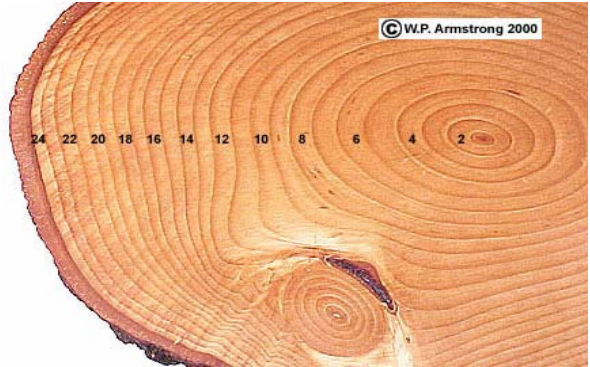
<http://www.csd.tamu.edu/FLORA/201Manhart/veg/stems&buds/stems&buds.html>



What you will do Activity 1.2

Find out!

Go to the market and look for a butcher. Did you see one? It is interesting to note that these butchers use cross-sectioned stems of big trees as chopping board. Some households use the same. If you have this at home, there is no need for you to go to the market. Did you notice the big woody stump? Have a closer look at a cut stem and observe the circular lines formed. Compare them with the diagram at the right. They are the **annual rings**, which are used to determine the age of the tree. It can also tell you whether the amount of rainfall was sufficient or not for that year or growing season. The greater the distance between rings, the greater is the amount of rainfall received by the plant.

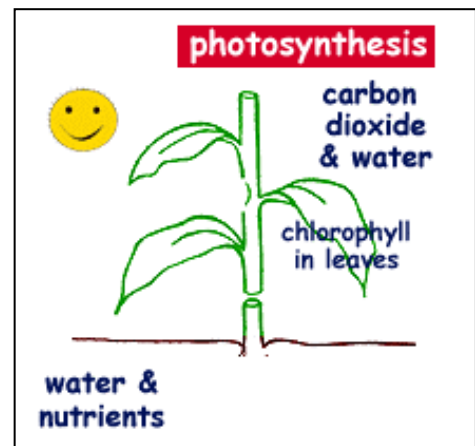


Stem of a tree showing the annual rings
<http://waynesword.palomar.edu/trjuly99.htm>

Leaf

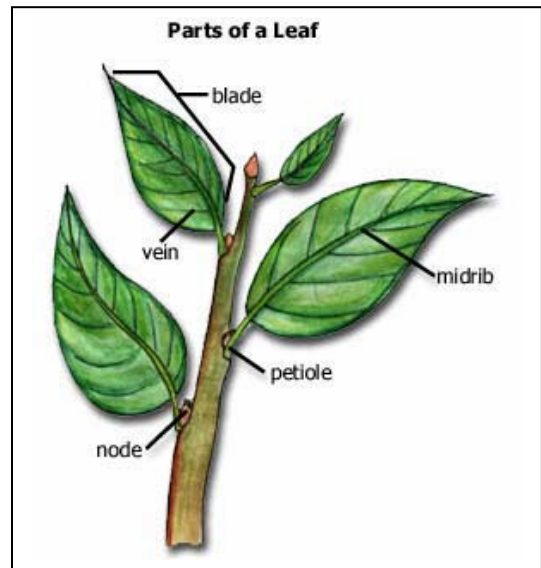
The diagram at the right shows light absorption by the plant through the process of **photosynthesis**. The process is involved in converting solar energy to chemical energy or food. This process takes place in the **leaves** of plants.

A leaf is a flattened, green, lateral appendage that carries out the functions of photosynthesis and transpiration. It is responsible for taking in carbon dioxide and releasing oxygen and water vapor. Gases pass through small openings found on the leaf called **stomata**. Chlorophyll gives the leaf its green color. Other structures traversing the blade of the leaf are the **veins**. These are responsible for the distribution of food to the different parts of the plant. They are connected to the stem by means of the **petiole** at the nodes of the stem.



Photosynthesis and food intake of plants
<http://www.urbanext.uiuc.edu/gpe/case3/c3brief.html>

In the diagram at the right, you can find some of the important structures found on the leaves.



<http://www.urbanext.uiuc.edu/gpe/case3/c3brief.html>



What you will do Activity 1.3

Try this!

Go to the garden and observe the leaves of the plants. Check out the veins traversing the leaf. Do you notice any difference on the arrangement of the veins? This arrangement is called **venation**. If the veins originate from one or more large veins forming and expanding to form a network, the venation is said to be **netted or diffused type**. This arrangement is typical of dicot plants. On the other hand, if the arrangement has one main vein extending from the base to the tip of the blade, and bears lateral or parallel veins, it is said to be a **parallel venation**, which is typical of monocot plants. Now, how many plants in your garden have netted venation? Have parallel venation? What group of plants do you have in your backyard - monocots, dicots or both?

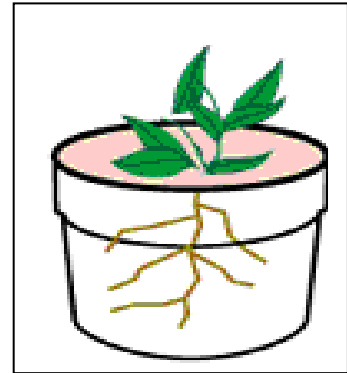
So far we have already studied the roots, stems and leaves that comprise the vegetative parts of the plant. Are you now ready to identify these parts? Try this activity below:



What you will do Activity 1.4

This simple activity will show you how water and nutrients are transported from the roots to the leaves. Secure a powdered dye (jobos) of any color and mix it with water. Get a new seedling preferably a herbaceous plant like mayana or pansit-pansitan and clean the roots. Separate the roots from the shoot using a razor blade by cutting just above the roots.

Soak the cut seedlings in the bottle with the dye and wait for an hour. Observe what happens to the stem, leaves and flowers. The leaves will have some colored lines along its veins. The stems will have traces of the dye since they are the passageways of nutrients. The dye is specially visible if you make a cross-section of the stem. Stems support the leaves and flowers physically, hold them in the best position for food gathering and reproduction. Now, summarize your observations.



<http://www.urbanext.uiuc.edu/gpe/case3/c3brief.html>



Answer the following questions:

1. What changes did you observe on the stem and leaves?
2. How would you account for the changes in the color of plant parts?



Key to answers on page 19.

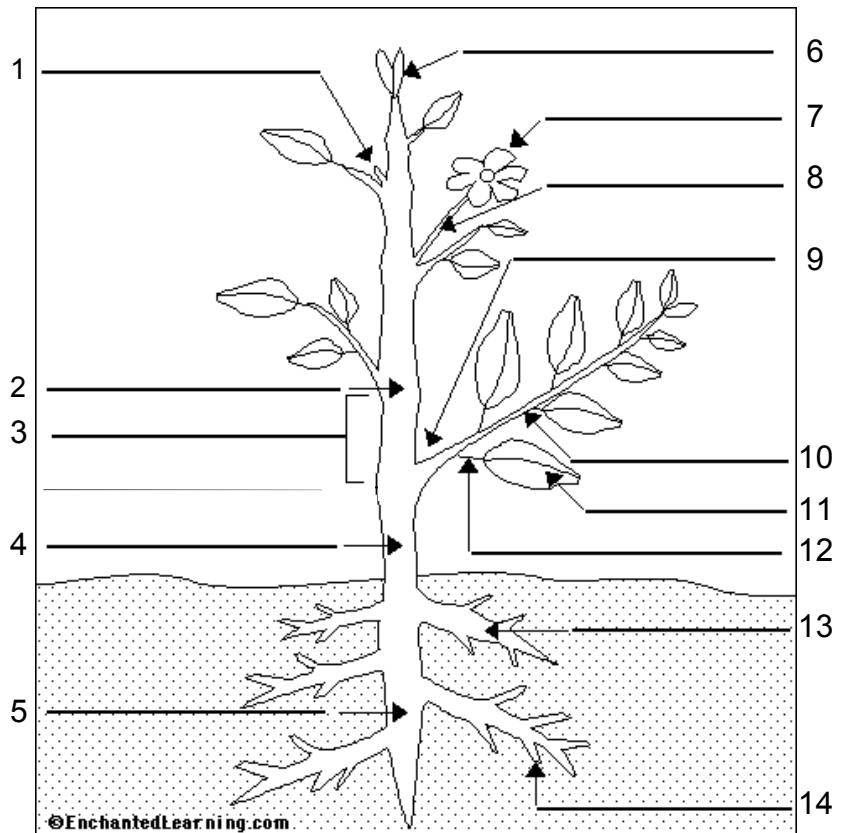


What you will do

Self-Test 1.1

To check your knowledge about plant parts further, try to label the diagram using the descriptions found below:

- **axil** - the angle between the stem and a leaf, branch, or petiole
- **axillary bud** - a bud that develops in the axil
- **flower** - the reproductive unit of angiosperms
- **flower stalk** or Peduncle- the structure that supports the flower
- **internode** - the area of the stem between any two adjacent nodes



<http://www.enchantedlearning.com/subjects/plants/label/plant/>

- **branch** - an extension of the stem of a plant
- **leaf** - their main function is to convert energy from sunlight into chemical energy (food) through photosynthesis
- **node** - the part of the stem of a plant from which a leaf, branch, or aerial root grows
- **petiole** - a leaf stalk; it attaches the leaf to the plant
- **root** - a root is a plant structure that obtains food and water from the soil, stores energy, and provides support for the plant. Most roots grow underground
- **stem** - (also called the axis) is the main support of the plant
- **tap root** - the main root of some plants; the tap root extends straight down under the plant
- **terminal bud** - a bud located at the tip of the stem



Key to answers on page 20.

This is the end of lesson 1. Did you enjoy it? There are more to explore about plants, just be ready for the start of the next lesson!

Lesson 2. The Reproductive Parts of Plants

Plant parts that are involved in sexual reproduction are called reproductive parts. These parts produce sex cells or gametes in the form of ovules and pollen grains. Since you have just learned about the vegetative parts of plants, now is the right time to know the reproductive parts.

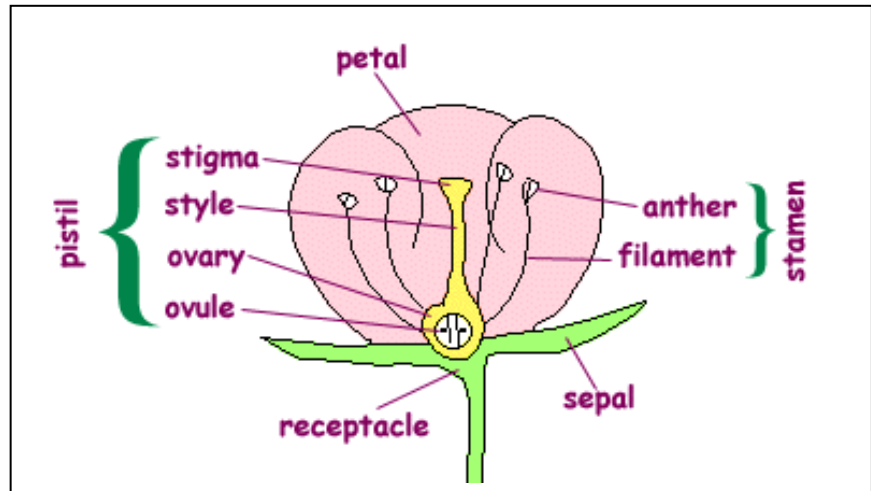
Flower

Try walking along the garden and observe the flowers. What is the most attractive part that you can see? Is it the petals or the other floral parts? Well, generally speaking, petals are the most attractive of all floral parts, purposely so to attract insects. The flower is the reproductive organ of a plant that produces the egg and sperm. Sex organs are formed during the reproductive stage of plant development. In flowering plants, sex cells are produced in certain floral organs. Look at the diagram on the next page and examine the floral parts.

The male reproductive organ is called the stamen. It is made up of two parts: the **anther** and **filament**. The anther produces the pollen, which contains the male sperm cells

and the filament that holds or supports the anther up.

The female reproductive organ is the **pistil**. Can you locate it from the drawing? Starting from the top, it is composed of the following parts: stigma, style, ovary and the ovules. The ovules are equivalent to the pollen grains of the male reproductive organ. They are the sex cells produced in the ovary.



<http://www.urbanext.uiuc.edu/gpe/case3/c3brief.html>



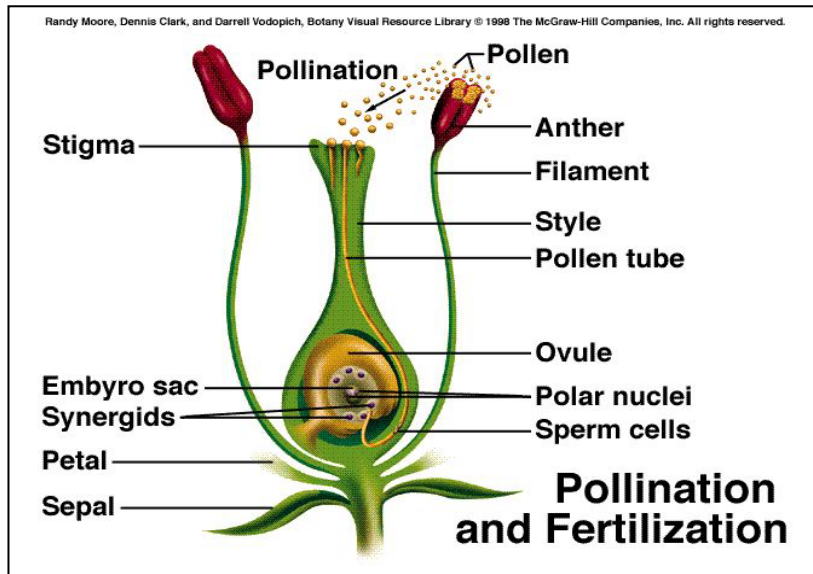
What you will do Activity 2.1

Go around and look for a gumamela flower. Hold the flower and identify the different parts. Do you notice the yellowish portion at the center? It is a group of **anther** that contains the pollen. The anther is held up by a structure known as the **filament**. Anther and filament comprise the **stamen**. Locate the **pistil**. It is composed of the **stigma**, **ovary** and **style**. The red colored part at the center is the sticky stigma, which receives the pollen during pollination. It has a tube called the **style** and ends up in the ovary of the plant.



Gumamela or
Hibiscus rosa-sinensis Flower

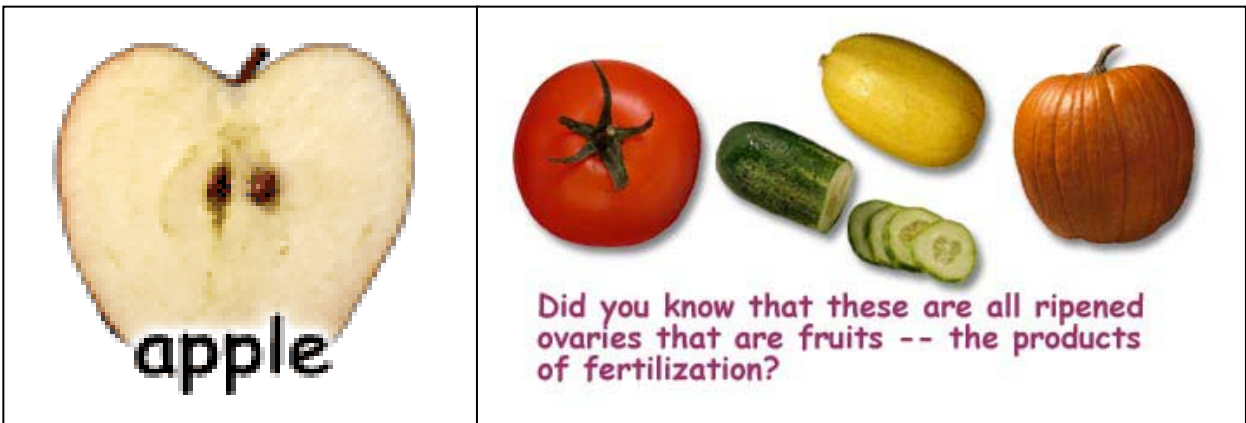
When a pollen lands on the **stigma** during the process of fertilization, a tube grows down the **style** and enters the **ovary**. Male sperm cells travel down the tube and join with the **ovule**, fertilizing it. The fertilized ovule becomes the **seed**, and the ovary becomes the **fruit**.



<http://www.science.siu.edu/plant-biology/PLB117/JPEGs%20CD/0518.JPG>

Fruits

Have you tasted an apple? Tomato? Cucumber? What part of the plant are these? These organs are called **fruits**. A fruit is the ripened ovary of a plant containing the seeds. After fertilization, the ovary swells and becomes either fleshy or hard to protect the developing seeds. Most of the items prepared as vegetables are actually fruits such as tomato, cucumber, beans and squash.



<http://www.urbanext.uiuc.edu/gpe/case3/c3brief.html>

Fruits have originated from the ovary of the flower, which means that they are products of sexual reproduction. Cut the fruit and check for some hard structures inside. How many do you find inside? These are the fertilized **ovules** or popularly referred to as **seeds**. Once seeds germinate, they are capable of growing into another young plant.



What you will do

Activity 2.2

Let us check if you can identify the different parts of the flower by examining sample specimens as follows:

- a. Collect a kalachuchi flower. Do you see the different reproductive structures? What do you notice about the location of the stamen and pistil?
- b. Visit a flower shop and look for *Anthurium*. The attractive part of the plant is not the flower but a modified leaf. They vary in color to attract insects. Where are the flowers? Get a magnifying glass and look at the candle - like portion at the end. This represents the inflorescence where the male and female flowers are found. Observe and compare this with a common flower like the gumamela.



What you will do

Self-Test 2.1

Direction. Identify the term (s) being described.

- _____ 1. The part of the flower where the ovules or egg cells are found
- _____ 2. A fertilized ovule
- _____ 3. The part of stamen where the pollen grains are produced
- _____ 4. It gives support to the anther
- _____ 5. The sticky part of the pistil where pollen grains land during pollination
- _____ 6. It refers to the mature ovary
- _____ 7. The male reproductive organ in plants
- _____ 8. The female reproductive organ in plants
- _____ 9. The transfer of pollen grain from the anther to the stigma of the flower
- _____ 10. The female sex cell



Key to answers on page 20.

What a tough job! It really takes time and patience to learn all these things. Remember no pain, no gain! So, continue until all the lessons are finished. Remember, only one lesson is left. Goodluck!

Lesson 3. Seed Germination

New Plants from Seeds

What happens to the fruits and seeds after sometime? Usually, the fruit dries up and the seeds escape. Some seeds maybe carried to far distances through different agents like water, wind and man. It may be carried away and grown into another new plant far from the parent.

What does a seed look like when it is opened up? Look at the diagram on the next page. It shows what the inside of bean and corn seeds look like. Notice that a baby plant has been formed from the embryo. It already has a young root, stem and leaves. The main part however, is the stored food or cotyledons. This will be used by the new plant as it starts to grow.

What happens next? If the seed lands on the soil that has moisture and proper temperature, it may **germinate**. Germination is the growth of a young plant from a seed. Sometimes we use the term sprout.

Seeds of plants can remain dormant or inactive for sometime. However, they can be induced to germinate by supplying the right external factors such as oxygen, water, temperature and light. **Oxygen** and **water** supply the needed materials for cellular functions of the plants. **Light** supplies the necessary energy the plants need to carry out photosynthesis. However, some plants need darkness for them to germinate, so they are planted by farmers deeper in the soil.




What you will do

Activity 3.1

Soak ten seeds of mongo beans in water for around 3 hours. Observe the size and structure of the seed. Did you see some cracks on the outer covering, the seed coat? These cracks are caused by the absorption of water by the seeds. Put half of the seeds in a tissue paper and cover them with aluminum foil leave the other half on tissue paper unwrapped. Moisten the seeds daily and observe their growth. Be sure that no light penetrates the seeds with foil.

Which seed germinated first? Which has longer stems? Using the table below, describe the external features (color, thickness etc.) of the plant after 5 days.

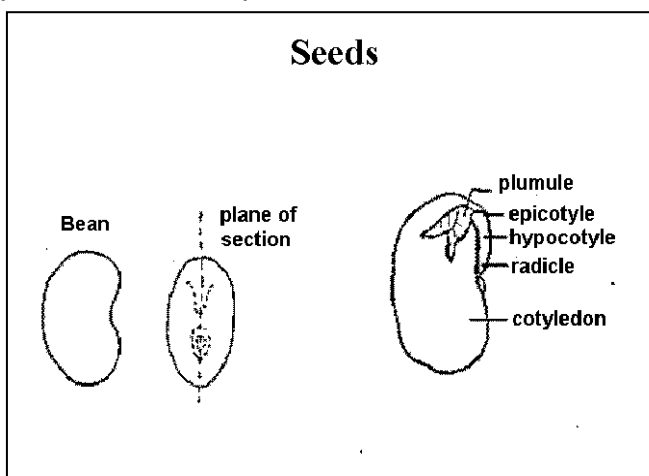
Number of Days	Wrapped in Aluminum Foil	Without Aluminum Foil
2		
3		
4		
5		
6		
7		

 Key to answers on page 20.

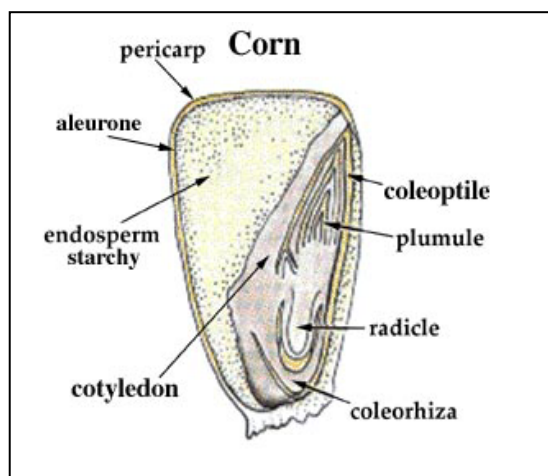
The process involved in the above activity is **germination**. With water, right temperature and right location (soil), the seed will start to germinate.

Every seed is a tiny plant (embryo) with leaves, stems, and root parts waiting to germinate and grow. It is protected by a coat, which could either be thin or thick and hard to protect the embryo from tough conditions.

The seed also contains a short-term food supply called **endosperm**. This is found in the plant's cotyledons. Plants with one cotyledon (like corn) are called **monocots**. If they have two cotyledons (like beans), they are called **dicots**. Seeds are a plant's way of being dispersed from one place to another.



<http://io.uwinnipeg.ca/~simmons/lb4pg12.htm>

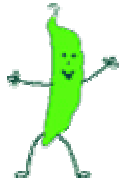


http://www.cin.butte.cc.ca.us/~rslavich/info/demclass/pls15dem/diagrams/seed_c_3.htm



What you will do

Activity 3.2



Collect seeds of beans and corn. Soak them in water for around three hours and place them on a moistened tissue paper. Be sure the tissue paper does not dry up. Observe what happens to the seeds daily. Can you make a drawing of the germinating seeds? Do it on a separate sheet of bond paper. Is there a difference between how corn and beans grow?

You are almost finished, now:



Let's Summarize

1. Plant parts are grouped into vegetative and reproductive parts. Vegetative parts are involved in asexual reproduction while reproductive parts are involved in sexual reproduction.
2. The plant parts involved in vegetative growth are the roots, stems, and leaves. Those involved in the reproductive growth are the flowers, fruits and seeds.
3. Plants can be classified based on the number of cotyledons, venation and type of roots system.
4. Monocot plants have one cotyledon, while dicots have two cotyledons.
5. Photosynthesis, which is the transformation of solar energy to chemical energy, takes place in the leaves.
6. Roots anchor the plants to the ground, and absorb water and nutrients while stems give support to the plant.
7. Asexual reproduction does not involve the sex cells whereas sexual reproduction takes place in the flower containing the male (stamen) and female (pistil) organs of the plant.
8. After the flowers have been pollinated, they are capable of producing a new structure called the fruit. The fruits contain the seeds, which are responsible in producing a new individual.
9. Given the right environment such as water, temperature and soil or any similar substrate seeds are capable of breaking their dormancy and start to germinate.
10. Germination is the process of producing a new plant having the characteristic of the mother plant.

Congratulations for finishing this module! Everything is over except for the Post-Test next page. Don't fail to answer this part of the module. This will check how much you learned.



Posttest

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

- Which of the following is not a vegetative part of a plant?
 - stem
 - leaves
 - roots
 - flowers
- What kind of root system does monocot plants have?
 - tap roots
 - fibrous roots
 - modified roots
 - adventitious roots
- In what part of the plant does transpiration takes place?
 - stem
 - leaves
 - roots
 - branches
- In which part of the plant do photosynthesis or the production of sugar and release of oxygen occur?
 - roots
 - flowers
 - stem
 - leaves
- In what parts of the plant do the nutrients from the soil enter?
 - roots
 - flowers
 - stem
 - leaves
- In what part of the plant can you find the adventitious roots?
 - taproot
 - primary root
 - radicle
 - branches
- The vascular bundles are responsible for the distribution of nutrients to all parts of the plant. What makes up the vascular bundle?
 - xylem and phloem
 - phloem and endodermis
 - endodermis only
 - xylem and endodermis
- What process involves the release of water vapor by the plant?
 - osmosis
 - plasmolysis
 - evaporation
 - transpiration
- Which of the following does not belong to the plant's shoot system?
 - stem
 - flowers
 - roots
 - leaves



Key to Answers

Pretest

- | | | | |
|------|-------|-------|-------|
| 1. d | 6. d | 11. a | 16. c |
| 2. b | 7. b | 12. a | 17. d |
| 3. d | 8. d | 13. b | 18. c |
| 4. c | 9. b | 14. d | 19. a |
| 5. b | 10. a | 15. c | 20. a |

Lesson 1

Activity 1.1

Common Name of Plant	Tap Root	Fibrous Root	Adventitious Root
Cogon		/	
Bermuda grass		/	
Kawayan		/	
Ipil-ipil	/		
Sampalok	/		
Makaiya	/		
Santol	/		
Balete	/		/
Mangga	/		
Bayabas	/		

- Tap roots – has well developed primary roots that gives rise to smaller roots or secondary roots
Fibrous roots – has more or less the same size of radiating roots
Adventitious roots – originates from other parts of the plants such as leaves, stems and branches
- Tap root is capable of supporting taller plants than those having fibrous roots. They are usually deeply rooted and can withstand strong winds.
- Carrot is a primary root. Vegetable is a term used for any plant being utilized as food.
Radish is the same as carrot. Both of them are primary roots which are typical characteristics of dicot plants.
Sweet potato is a specialized root modified for storage specifically starch.

Activity 1.4

- There were some colored circular lines formed on the stem and leaves of the plant.

- The change in the color of the plant is attributed to the absorption of nutrients by the plant, in this case, the colored solution. The solution passed through the xylem of the stem to the leaves of the plant.

Self-Test 1.1

- | | | |
|-----------------|-----------------|--------------------|
| 1. axillary bud | 6. terminal bud | 11. leaf |
| 2. node | 7. flower | 12. petiole |
| 3. internode | 8. peduncle | 13. secondary root |
| 4. stem | 9. axil | 14. root hairs |
| 5. primary root | 10. branch | |

Lesson 2

Self-Test 2.1

- | | |
|-------------|----------------|
| 1. Ovary | 6. Fruit |
| 2. Seed | 7. Stamen |
| 3. Anther | 8. Pistil |
| 4. Filament | 9. Pollination |
| 5. Stigma | 10. Egg |

Lesson 3

Activity 3.1

Possible observations:

Number of Days	Wrapped in Aluminum Foil	Without Aluminum Foil
2	Seeds cracked	Seeds cracked
3	Radicle starts to come out of the cracked seed	Radicle starts to come out of the cracked seed
4	Radicle continues to elongate (approx. 0.5 cm)	Radicle continues to elongate (approx. 0.5 cm)
5	Radicle continues to elongate (approx. 1 cm)	Radicle continues to elongate (approx. 0.75 cm)
6	Radicle continues to elongate (approx. 2 cm); epicotyl emerges with a light yellowish plumule becoming evident	Radicle continues to elongate (approx. 1.25 cm); epicotyl emerges with a greenish plumule becoming evident
7	Radicle continues to elongate (approx. 3-4 cm); secondary roots continuously growing; epicotyl extends with a light yellowish plumule approx 2 cm	Radicle continues to elongate (approx. 2.5 cm); secondary roots continuously growing; eoucityl extends with dark greenish plumule approx. 1 cm

Posttest

- | | | | |
|------|-------|-------|-------|
| 1. d | 6. d | 11. d | 16. a |
| 2. b | 7. a | 12. c | 17. b |
| 3. b | 8. d | 13. b | 18. c |
| 4. d | 9. c | 14. d | 19. d |
| 5. a | 10. b | 15. d | 20. c |

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