FLOWERING PLANTS

Learning outcomes:

By the end of this chapter, you should be able to:

(a) *Show knowledge of the external parts of a flowering plant.*

(b) Demonstrate the understanding of how the structures of monocotyledonous and dicotyledonous roots, stems, leaves, flowers and fruits suit their functions.

(c) Classify leaves.

Key Words

- Adaptation
- Shoot system
- Monocotyledonous
- Dicotyledonous
- Leaf venation

INTRODUCTION

Flowering plants are vascular plants that produce flowers. The flowers develop into fruits that bear seeds within them. Flowering plants grow all around us and they are called **angiosperms.**

This topic focuses on the structural features of flowering plants, the function they perform and adaptations of the structures to their functions.

EXTERNAL PARTS OF A TYPICAL FLOWERING PLANT.

Flowering plants are made up of two systems i.e. **root system** (part of the plant below the ground) and a **shoot system** (part of the plant above the ground).

The root system absorbs and transport water and dissolved mineral salts from the soil. The shoot system is composed of the stem, leaves, flowers and fruits. The leaves are the organs responsible for making food for the plant, whereas flowers are organs for sexual reproduction for the plant.

Both the root system and shoot system work together to enable flowering plants survive. The two systems contain vascular tissue (vessels) that run from the roots to the shoot.

Activity (a): Parts of a flowering plant.

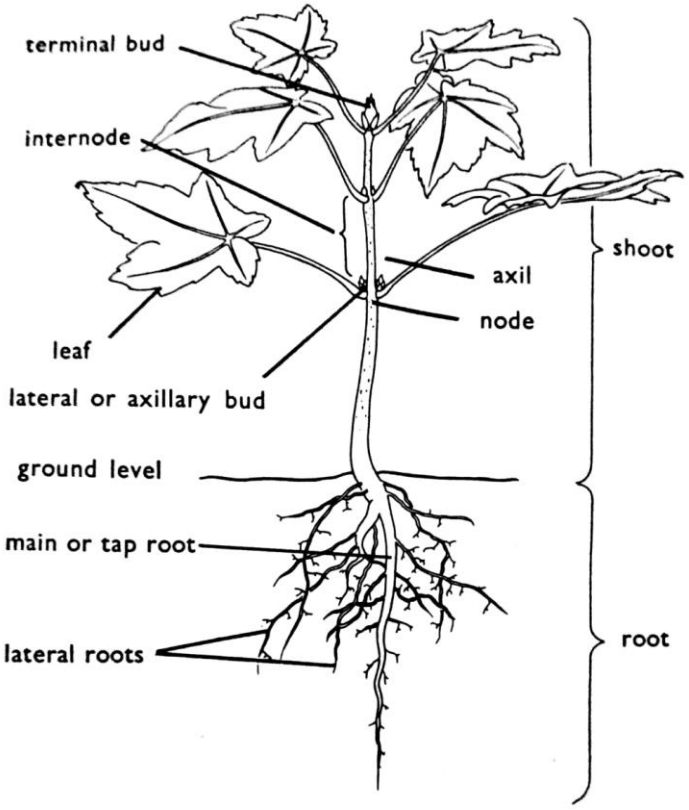
Key question: What are the different parts of a flowering plant?

Tasks:

1. In groups, carefully observe the mature dicotyledonous plant provided.
2. Using a hand lens where necessary, observe draw and label the parts of the whole plant on the manila paper provided.
3. Repeat instructions 1 and 2 using a mature monocotyledonous plant.

Discussion Notes

Drawing showing the structure of a flowering plant.



STRUCTURE OF MONOCOTYLEDONOUS AND DICOTYLEDONOUS PLANTS.

Monocots and dicots differ in their root system, leaf venation and leaf shape, leaf attachment to the stem, flower colour, size and structure.

Activity (b): Comparing structural features of a monocotyledonous and dicotyledonous plant.

Key question: What are the similarities and differences between the features of a monocotyledonous and a dicotyledonous plant?

What you need:

- A mature dicotyledonous plant and a mature monocotyledonous plant, a notebook and a pen.

Task:

In groups, carefully observe the root system, leaf venation, leaf shape, and leaf attachment to the stem of the plants provided with. Note down the similarities in the features above for the two plants.

Discussion Notes

Similarities

Both have; roots, stems, leaves, fruits, flowers and buds.

Differences

Dicotyledonous plants	Monocotyledonous plants
Have a broad leaf lamina.	Have a narrow leaf lamina.
Leaves have network venation.	Leaves have parallel venation.
Have tap root system.	Have a fibrous root system.
Leaves have a leaf stalk attached to the stem.	Leaf stalk is modified into a leaf sheath.
Flower parts are in threes or multiples of three.	Flower parts are in fours or multiples of four.

Examples of Monocotyledonous plants: Millet, sorghum, guinea grass, elephant grass, nut grass, round grass, round grass and spear grass.

Dicotyledonous plants include: Peas, avocado, soya beans, black jack, tick berry, pig weed.

Activity (c): Relating the structure of the parts of a flowering plant to their function(s).

Key question: How do the different parts of a flowering plant relate to their function(s)?

Task

1. Research, discuss and write a report with explanatory notes on how the structure of each part lapelled in the drawing you made in activity (a) is adapted to carry out its function(s).
2. Present your findings to the class.

Discussion Notes

Part	Feature	Dicot plant	Monocot plant
Leaves	Size	Broad lamina	Narrow lamina
	Thickness	Thin	Thin
	Arrangement of veins	Net veined	Parallel veined
	Nature of surface	Hairless	Hairy
Flowers	Arrangement	Single flower at the terminal end of the branch of the plant.	Many small flowers clustered together found at the terminal end of the stem.
	Colour	Bright	Dull

	Size	Large and conspicuous	Small and inconspicuous
Stem	Rigidity	Hard and rigid	Hard but flexible.
Roots		One main root from which several alternately arranged roots are attached reducing in size downwards. Root modules on the lateral roots.	Several small sized roots originating from the base of the stem.

CONCLUSION AND APPLICATION

1. Which of the two plant groups is likely to survive best in dry conditions? Why?
2. How does the appearance of flowers in a dicotyledonous plant give it an advantage over that in monocotyledonous plants?
3. Which of the plants is likely to survive best in soils with low nitrogen levels? Why?
4. Present your findings.

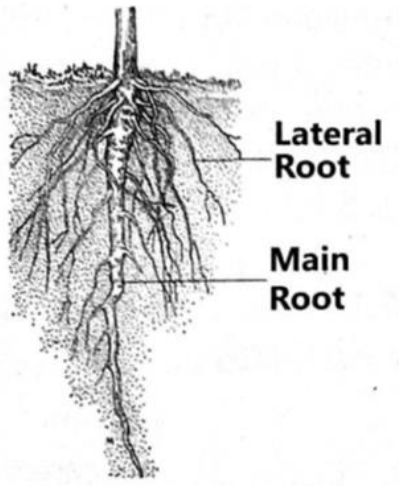
Solutions

1. A monocot; has narrow leaves reducing the surface area for water loss; has numerous wide spread fibrous roots to increase the surface area for absorption of water and minerals from the soil.
2. They are large and brightly coloured so they can easily pe seen by pollinators (insects) from a distance increasing chances of pollination compared to monocots that are small and dull coloured hence not easily by insects.
3. Dicots because they have root nodules that harbour bacteria to fix nitrogen in the soils.

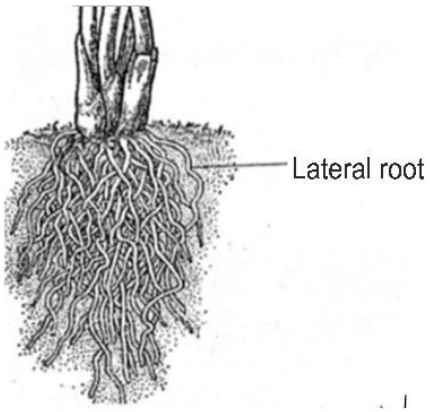
ROOT SYSTEM

The root system in plants is exists in two types i.e a tap root system consisting of a main root (tap root) thinning in size downwards, from which several secondary (lateral) roots branch at different points and a fibrous root system consists of several secondary roots of almost equal size and length, originating from the same point at the base of the stem.

Tap root system



Fibrous root system



Note

Adventitious roots are a type of plant roots that form from any non-root tissue and are produced both during normal development (crown roots on cereals and nodal roots on strawberry; Fragaria spp) and in response to hard conditions, such as flooding, nutrient deprivation and wounding.

Roots absorb water and minerals from the soil and anchor the plant firmly in the soil.

ROOTS

The root system consists of only one organ of a plant and this is obviously the root. The arrangement of roots may differ in different types of plants but they still perform related functions.

Functions of roots

- Supporting the plant firmly in the soil.
- Absorbing water and dissolved mineral salts from the soil.
- Transporting water and mineral salts to the shoot.

MODIFIED ROOTS

The primary functions of roots to a plant are for anchorage and absorption of water and nutrients from the soil. However, in certain plants, roots perform additional functions. Consequently, the root morphology and structure undergo certain modifications to perform these additional functions in the plant.

Activity (d): Understanding modifications of roots.

Key question: What are the functions performed by modified roots?

What you need:

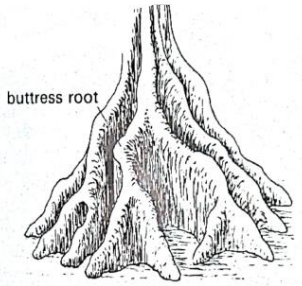
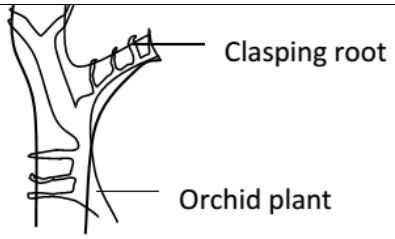
- Pictures of different root modifications:

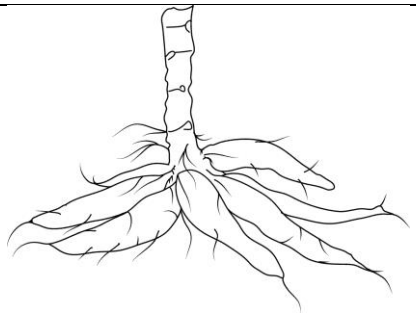
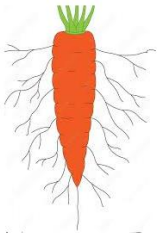
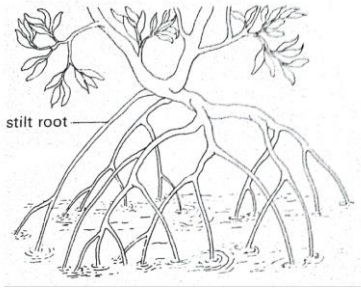
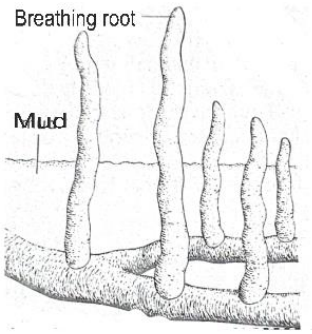
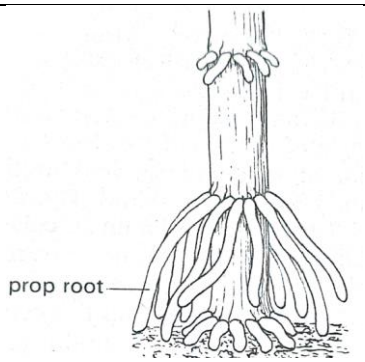
What to do:

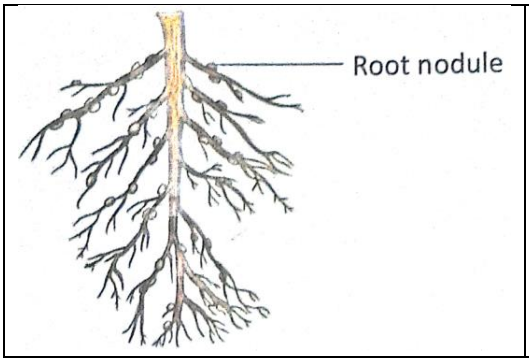
1. In groups, carefully observe the shape and the external structure of each root in the figure above.
2. Identify the special feature(s) each root has and note the modification and special function(s) it performs in the table below.

Discussion Notes

(R.H Stone & A.B Cozens (2010) New Biology for Tropical Schools 3rd Edition, Pges 82 to 83)

Drawing (root)	**Modification**	**Special function(s) performed**
	Epiphytic roots (Aerial roots)	Absorption of moisture and nutrients from the air. Example; Mangrove, Ficus
	Buttress roots	They provide extra support to the plant by anchoring it firmly in the soil. Examples in; Mango, Jack fruit tree, ficus etc.
	Clasping roots	Attaching parasitic plants firmly to their support. Example; vanilla, figs, orchid

	Swollen fibrous roots (Storage roots)	Storage of water and dissolved food materials. Examples: cassava, sweet potato
	Swollen tap root (storage roots)	Storage of water and dissolved food materials. Example; carrot tuber
	Stilt roots raised above water level.	Increasing support for plants growing in changing water levels. Example: Red mangrove
	Breathing roots emerging out of muddy soils	Trapping oxygen in air for respiration of roots in waterlogged soils. Examples: Roots of Ficus, rubber plant
	Prop roots	Providing extra support to plants with weak stems. Examples: Maize , Banyan

	Root nodules	Harbouring rhizobium for fixing nitrogen into the soil. Examples: Beans, peas , soya and ground nuts

Conclusive questions;

1. Why can roots of a sweet potato be used for vegetative propagation, while those of maize cannot be used for the same? (Hint: food storage)
2. In which way do the roots of cassava differ from those of a carrot?

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SHOOT SYSTEM

Leading question:
Outline the organs/parts/structures that make up the shoot system

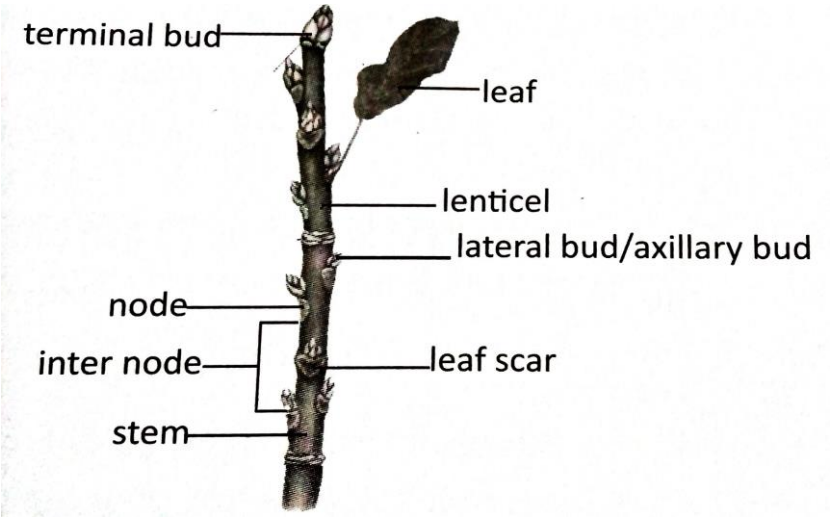
The shoot system of a plant is made up of the following organs:

- ❖ Stem
- ❖ Leaves
- ❖ Flowers
- ❖ Fruits
- ❖ Seeds

STEMS

The stem is the erect, cylindrical ascending portion of the plant that develops from the plumule of the embryo.
In young plants the stems are green. The lower part of the stem is made of wood while the upper part of the plant is made of tender, green and ridged structure. The stem forms the largest part of a plant. It is comprised of different parts that have different functions.

Drawing of a plant stem with its labelled parts.



Functions of parts of a stem

Branch: This is the side stem that develops from an axillary bud and holds leaves in better for maximum absorption of sunlight energy.
Axillary or lateral bud: This part is found between a leaf stalk and stem. It develops into a branch, leaf or flower.
Terminal bud: This arises from the tip of the stem or branch. It increases the length of the stem forming new leaves and axillary buds.
Inter-node: This is the space or section of the stem between two successive nodes.
A node: is the region of the stem where the leaves, buds and flowers develop.
Lenticel: A raised pore in the stem of a woody plant that allows gas exchange.

a) *Discuss the functions of the stem to the plant.*

PRIMARY FUNCTIONS OF THE STEM

- Stems hold leaves and branches upright in the position to be able to receive sufficient sunlight and carry out photosynthesis.
- It holds flowers in the suitable position to be able to carry out pollination.
- It holds the fruits in the suitable or better position for dispersal.
- It conducts/transports water and dissolved mineral salts from the roots to the leaves of the plant through the xylem vessel.

- The phloem vessels carry manufacture food from the leaves through the stem to other parts of the plant.
- Stems enable formation of buds, leaves and flowers.

MODIFIED STEMS

Apart from the general functions of stems discussed in the previous activity, there are some plants that have stems adapted to carrying out specialized functions. Such stems are called **modified stems.** These stems have features that are different from "***ordinary"*** stems studied earlier.

Activity (e) : Identifying modified stems and their functions to a plant.

Key question: ***What are the modified stems and their functions to a plant?***

What to do:

(a) ***Find out the special modifications on each stem above.***

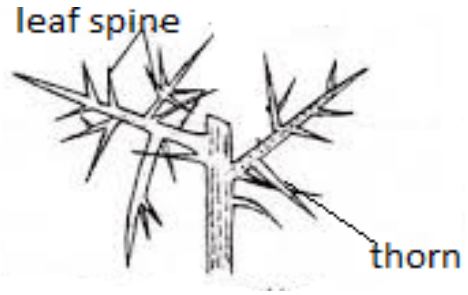
- The stem tuber of irish potato has eyes with buds.
- The cassava stems have nodes.
- The acacia stems have thorny structures.
- The sugar cane is straight and upright.

(b) ***Give the special functions of each modified stem to the plant. And give other examples of plants with such modification stems.***

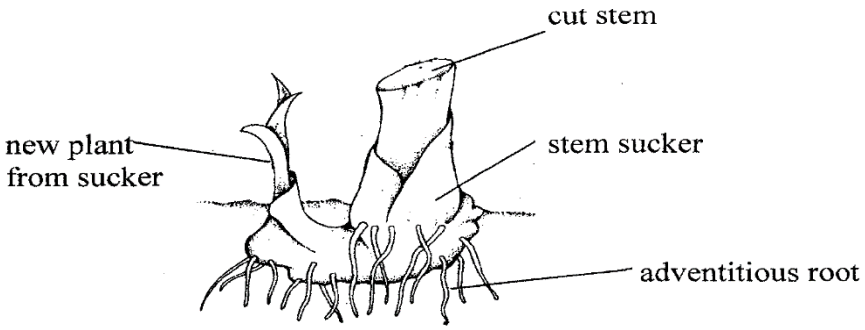
The special functions of the modified stems carry out.

1. Stems with thorns are used to protect the plant from browsing animals and aids in climbing e.g. acacia and bougainvillea.

Illustrations of stem modified into thorns

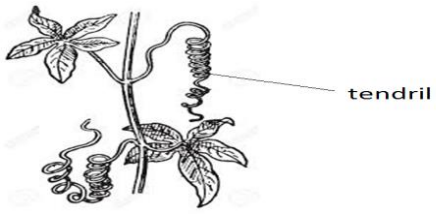


2. Stems with buds can be used for vegetative reproduction e.g. Irish potatoes, cassava, sugar cane, sweet potatoes.
   Vegetative reproduction is a form of asexual reproduction which occurs in plants in which a new young plant grows from other parts of the parent plant.



3. To give support by developing tendrils. Plants with weak stems climb around a support by attaching themselves to it by ***tendrils*** or hairs in order to keep upright.
Tendrils are spirally coiled leafy structures which twin around the neighbouring plant. Various parts of the stem are modified into tendrils. e.g. For example, passion fruit, pumpkin and water melon plants are supported by tendrils.

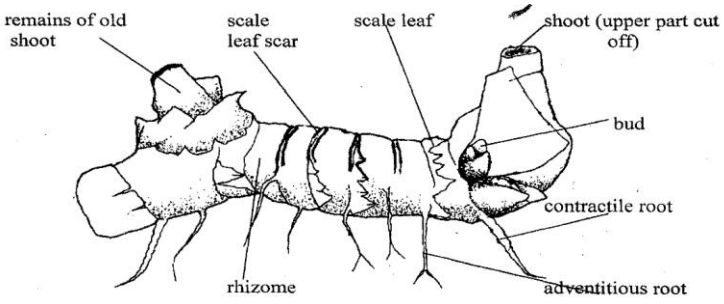
Illustrations of the plant stems with tendrils



4. If the stems are green, they can be used for photosynthesis e.g. in young plants
5. If stems have air spaces, they aid in keeping the plant afloat/buoyant e.g. water lily
6. Have the breathing pores called lenticels thus it is important as organs of gaseous exchange.
7. Some stems are used for storage of food and water e.g. sugar canes, rhizomes and stem tubers in Irish and yams.

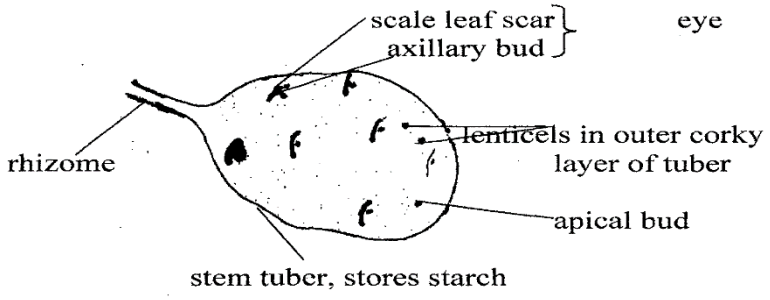
❖ **Rhizomes**: These are thick fleshy underground stems that grow horizontally below the soil surface e.g. Ginger, Spear grass, coach grass, turmeric and canalilies.

Illustration of the Rhizome



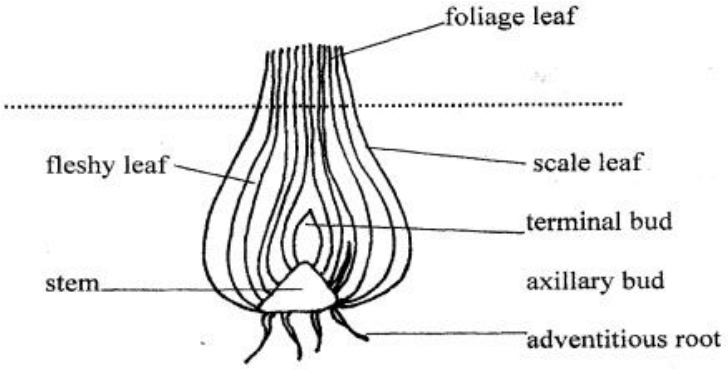
❖ **Stem tuber:** This is a swollen underground stem that grow horizontally to the surface of the ground and swells at the apex due to accumulation of large quantities of food.
It has the "**eyes**" or the buds which grow into the new plants and has the scaly leaves represented as the scars for protection. e.g. irish potatoes and cocoyam.

Illustration of the stem tuber



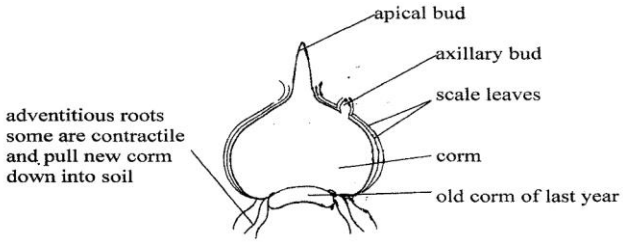
- **Bulb:** This is a condensed underground short flattened cornical stem covered by fleshy leaves on the inside for storage of food and dry scale leaves on the outside for protection. E.g. onion, gallic and lilies.

Illustration of the bulb



- **CORMS:** The corm is a condensed solid fleshy underground stem growing in a vertical direction. It contains heavy deposits of food materials thus it is a storage organ for food. e.g cocoyam**.**

Illustration of the corm



Understanding modifications of the stem.

Key question: What modifications do stems have?

You have been provided with pictures of the following plants;

Pictures or specimens of different types of stems: passion fruit stem, sprouting irish potato, stem of bamboo plant, pea shoot, banana sucker, bougainvillea stem, cactus shoot, sugarcane stem, ginger rhizome.

What to do:

1. Carefully observe the external features of each stem.
2. *Sort the stems into different groups, basing on their observable features and record your findings in the table below.*
3. Read the characteristics of modified stems to their functions.

Notes

Table of characteristics of modified stems

Group	Stem(s)/ specimen(s)	Characteristics
1. Food storage	Sprouting irish potato, sugar cane, ginger rhizome.	Fleshy or swollen with food materials.
2. Vegetative propagation	Sprouting irish potato, sugar cane, ginger rhizome, banana sucker.	They have buds. They are swollen with water and food reserves.
3. Protection	Bougainvillea, cactus.	They have thorns.
4. Support	Passion plant stem, bamboo, Bougainvillea, bean stems.	They have hooks/thorns for attachment. They have stem tendrils. They have hard and rigid stem.
5. Photosynthesis	Passion plant stem, bamboo, bean, banana and cactus.	They have green stems.

Conclusions and applications

1. **How do the stems of some plants enhance leaves in their function of photosynthesis?**
   They are also green in colour increasing the surface area over which photosynthesis takes place manufacturing more food for the plant.

2. **Why do farmers place ginger stems in the soil and not any other parts when planting ginger?**

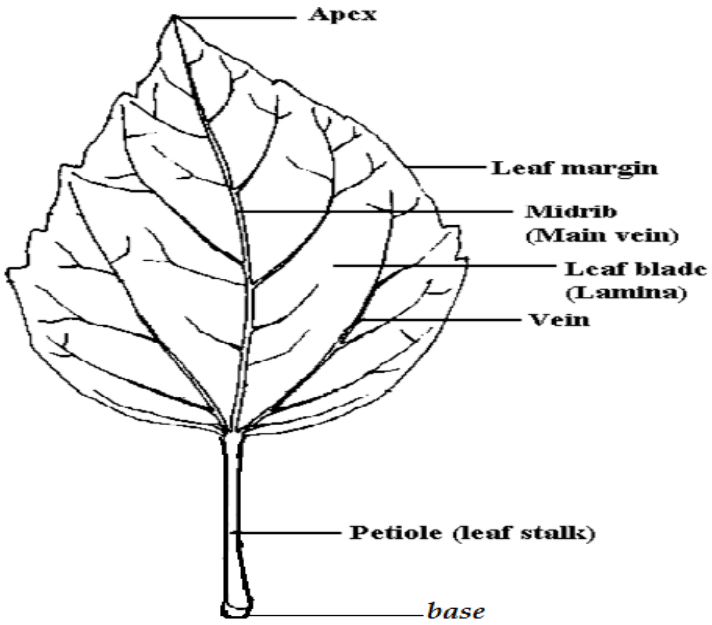
   Ginger stems have buds which can sprout into new plants using the water and dissolved food materials they store.

THE LEAF

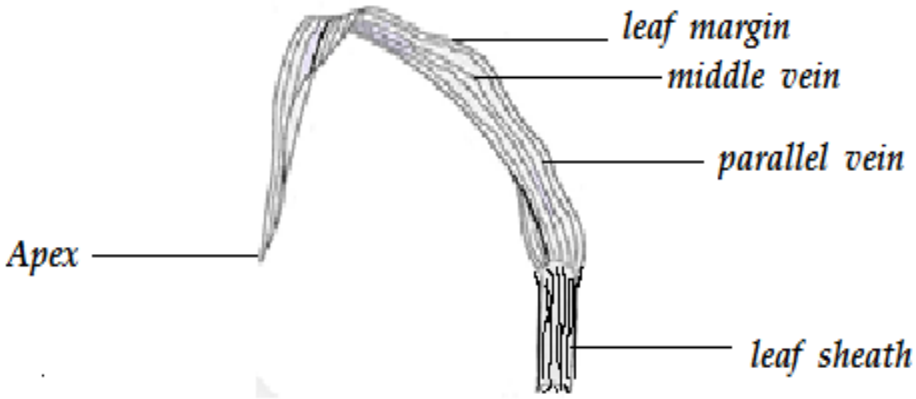
A leaf is a flattened structure of a plant typically green and blade-like, that is attached to a stem directly or via a stalk. Leaves are the main vegetative organs of photosynthesis and transpiration process in the plant.

THE EXTERNAL STRUCTURE OF THE LEAVES

The dicot leaf



The monocot leaf



A typical leaf consists of three main parts i.e leaf base, petiole or leaf stalk and lamina.

Functions of each part of a leaf.

Lamina/leaf blade: This is the broad part of the leaf also called the **leaf blade**. It holds the green making cells chlorophyll in green plants. However, the leaf blades/laminae of different leaves are not the same.

Leaf base: It is the lower most part of the leaf that attaches the leaf to the stem. In monocots it is expanded in form of a sheath.

Leaf stalk/petiole: This is the stalk of the leaf by which the leaf is attached to the stem. It connects the leaf base to the leaf lamina. It exposes the leaf lamina to receive maximum sunlight for the process of photosynthesis.
It also carries food made by the leaf to all parts of the plant.

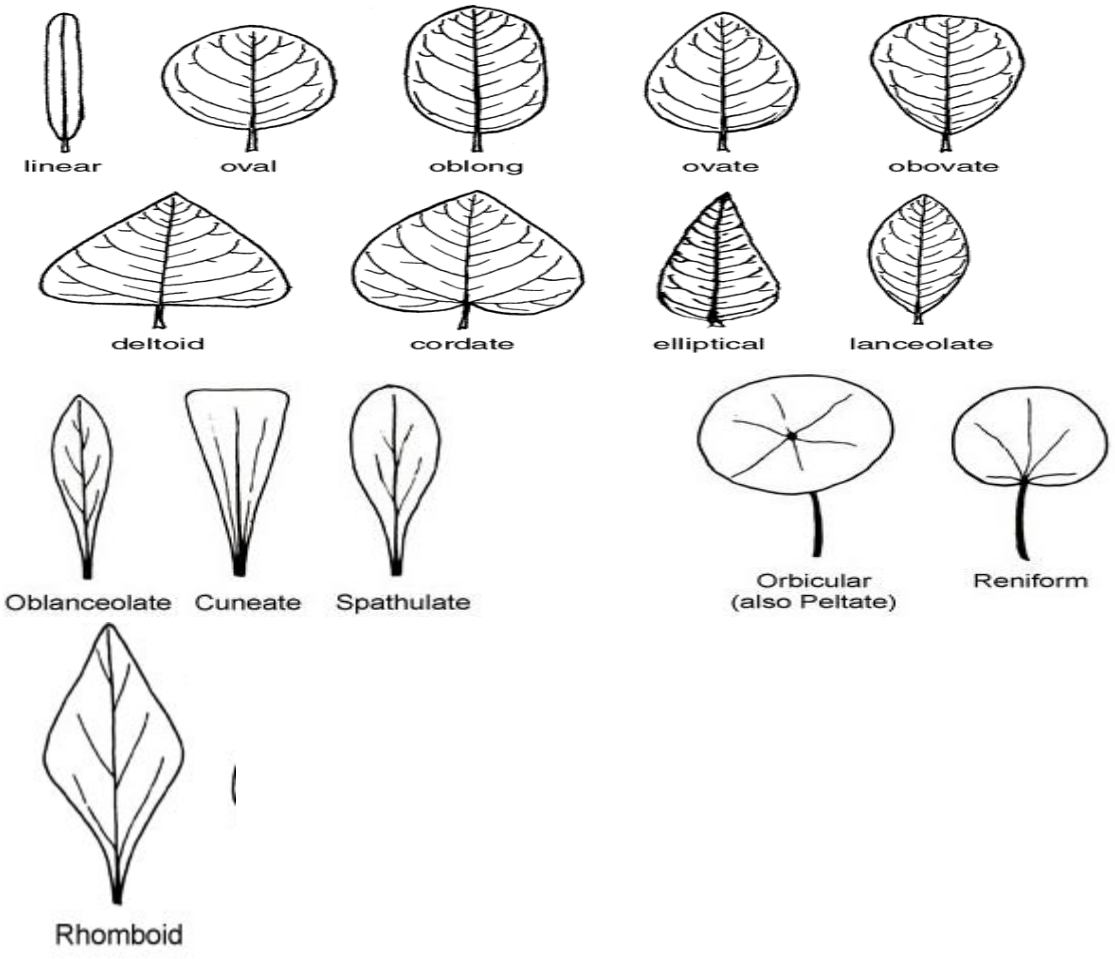
Leaf midrib: it stretches from the base to the apex of the leaf and has a number of branching veins that have the xylem and phloem tissues that conduct water and manufactured food respectively. The arrangement of veins in a leaf is called the ***venation***.

Leaf margin: This is the edge of the leaf called the **margin.** They are thin which reduces the distance of diffusion of gases between the atmosphere and inner leaf cells.

Leaf apex: This is the tip of a leaf where water droplets accumulate and droplet separation occurs.

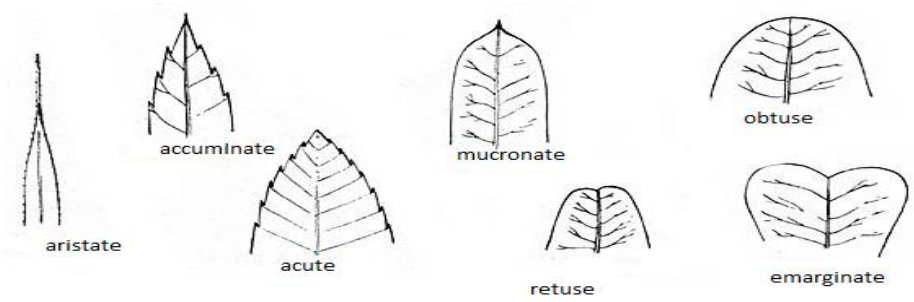
Different leaves have got different leaf shapes of the lamina. The following are some of the leaf shapes

ILLUSTRATIONS OF THE LEAF SHAPES



Different leaves have the lamina ending with different leaf apex. The following are some of the different leaf apex

ILLUSTRATIONS OF THE DIFFERENT LEAF APEX



The lamina ends in the edge of the leaf called **margin. Margin** is referred as the leaf rim of the leaf blade. The different leaves have different forms of margins. The following are some of the different leaf margins

- **Entire margin:** The margin is smooth and without indentation of any kind. E.g. mango leaves.
- **Serrate margin:** The margin is with indentations pointing towards the apex. This type of margin can be singly-toothed, doubly-toothed or clasps.
- **Dentate margin:** The margin has indentations pointing towards the petiole.
- **Crenate margin:** The margin has round indentations.
- **Lobed margin:** The margin has relatively few and shallow indentations.

Illustrations of leaf margins

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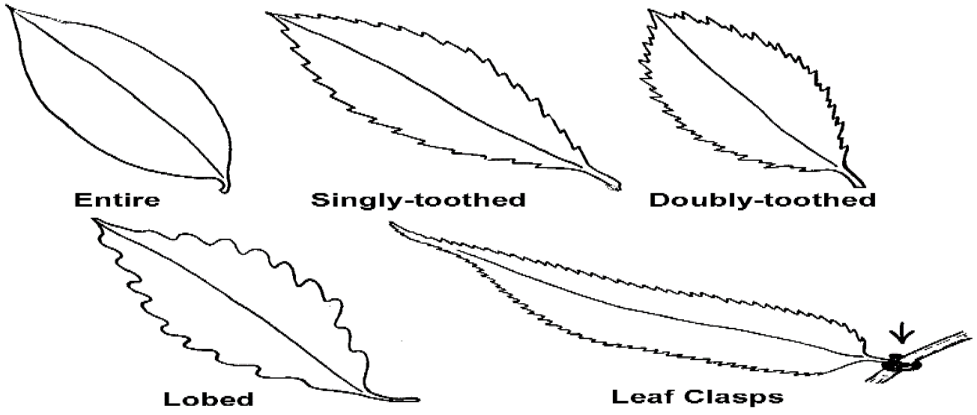
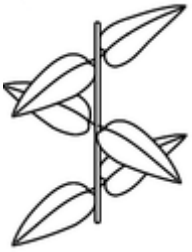


NOTE: The leaf margin, leaf apex and leaf shapes are the important features in classification of flowering plants. They are however used during the construction of the dichotomous key

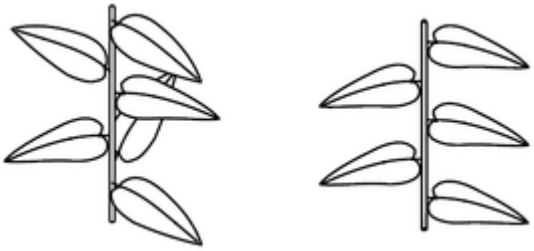
LEAF ARRANGEMENT (PHYLLOTAXY)

Leaf arrangement refers to the way the leaves are distributed on the stem. The leaves maybe alternate in a single plain. They may be arranged in opposite pairs in the nodes or they may be arranged in circles at the nodes (whorls).

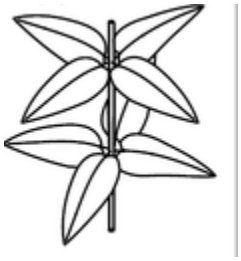
i) **Opposite leaf arrangement:** this is where two leaves arise from one node and lie opposite to each other e.g. coffee.



ii) **Alternate arrangement:** this is where one leaf grows from a single node but alternate with others along the stem.



iii) **Whorled arrangement:** this is where more than two leaves arises from a single node and form a whorl.



TYPES LEAF VENATION

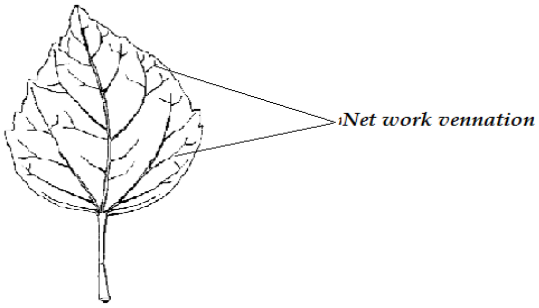
When you critically observe the veins of a given leaf, they form a pattern. This pattern or arrangement of veins in a leaf is called **venation.**

There are two types of venation

- Network or reticulate venation
- Parallel venation

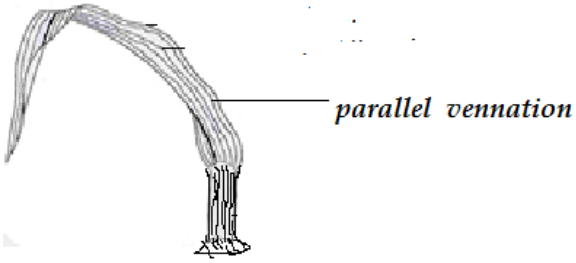
Network leaf venation: In network venation, the veins in the lamina branch while intersecting to form a network. Therefore, wire meshes like veins are formed on the surface of the leaf. It is a characteristic of the dicotyledonous plants e.g. beans, soya beans etc.

Illustration of



Parallel leaf venation: In this venation, the veins run side by side without branching**.** Therefore, veins are parallel to each other. It is the characteristic of the monocotyledonous plants e.g. maize, grass etc.

Illustration



Description of the petiole:

A petiole is a **leaf stalk.** When you closely observe the number of leaves, you will discover that their leaf stalks or petioles are different.

Some petioles may be solid, short, long or spongy. The stalk may be smooth or hairy. Some leaf stalks are hollow for example the leaf of a paw-paw.

Normally, dicotyledonous plant leaves have a leaf stalk, whereas monocotyledonous plant leaves like couch grass have a ***leaf sheath*** which may be hairy or non-hairy.

CLASSIFICATION OF LEAVES

Leaves are attached on plant stems and their classification is based on their characteristics. The main features used to distinguish leaves include: the nature of their lamina, types of venation, type of margin, description of the leafstalk and shape of the leaf apex. They are however used during the construction of the dichotomous key.

Activity (f) : Classification of leaves.

What you need: *Fresh leaves or pictures of a mango, maize, bean, cassava, banana and cassia***.**

What to do:

1. *Move around the school to look for the fresh leaves of the following plants: mango, maize, bean, cassava and cassia.*
2. *Complete the table below by places a Yes where you have identified a matching feature to a plant leaf.*

Leaf feature/ characteristics	Plant leaves					
		Maize	Mango	Cassava	Cassia	Bean
Venation	Parallel					
	Network					
Leaf margin	Entire					
	Serrated					
	Wavy					
Leaf stalk	Petiole					
	Sheath					
Lamina	Undivided, simple					
	Divided, pinnate					
	Bi-pinnate					
	Trifoliate					

Task

Using the characteristics of leaves, construct a dichotomous key for identifying different leaves.

_____

_____

_____

_____

_____

_____

TYPES OF LEAVES

There are two types of leaves. i.e.

- Simple leaves
- Compound leaves

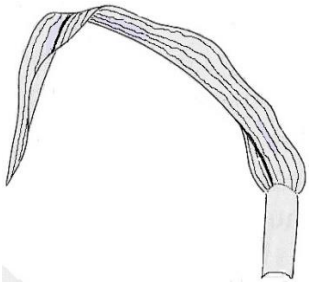
SIMPLE LEAVES:

A simple leaf is a leaf whose lamina is not divided into leaflets as in the leaves of a mango, avocado or banana. However, some simple leaves have divided lamina but its separation does not reach the midrib. For example, cassava, paw-paw and sweet potato leaves.

They include:

i) Simple monocotyledonous leaf E.g. maize leaf, banana

Illustration

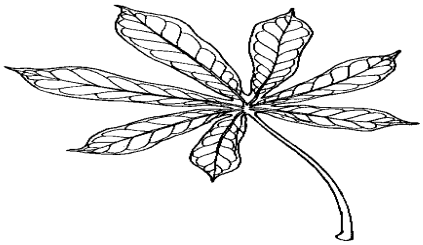


ii) Simple serrated leaf e.g. lantana camera

Illustration

iii) Simple palmate or digitate leaf e.g. cassava leaf

Illustration



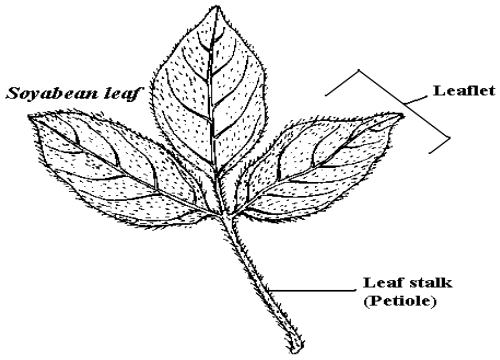
COMPOUND LEAVES

A simple leaf is a type of leaf with the lamina or leaf blade completely divided into several leaflets. In some plants, each leaflet may have its own stalk but attached on the same midrib. They are divided into the following forms:

(a) *Compound trifoliate:*

This is a type of compound leaf where the lamina is divided into three leaflets emerging from the same point i.e joined at the petiole E.g. legume leaves.

Illustration

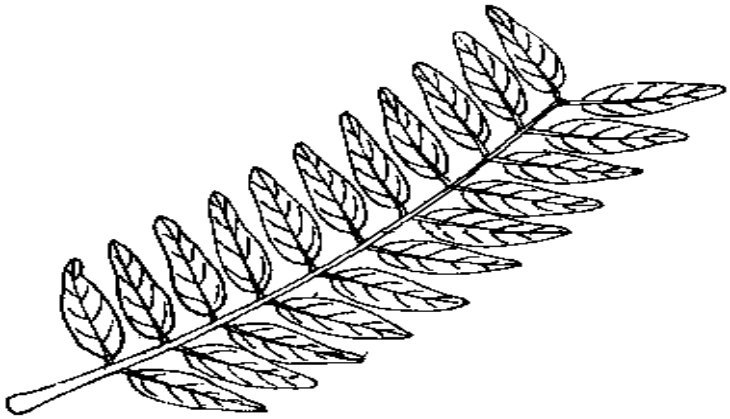


(b) *Compound pinnate leaves:*

These are compound leaves with leaflets arranged either in pairs, opposite one another or alternately along the midrib called rachis of the leaf. For example, cassia.

If the terminal leaflet is present, the leaf is said to be ***imparipinnate*** and if the terminal leaflet is absent, the leaf is said to be ***paripinnate.***

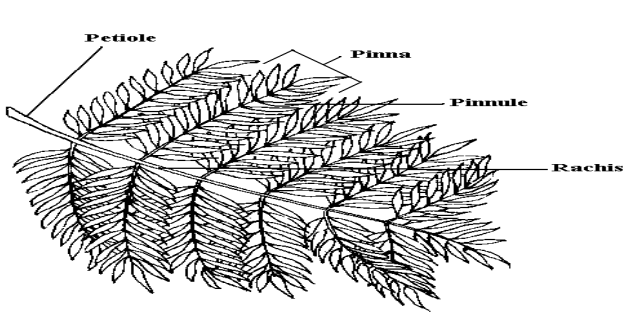
Illustration

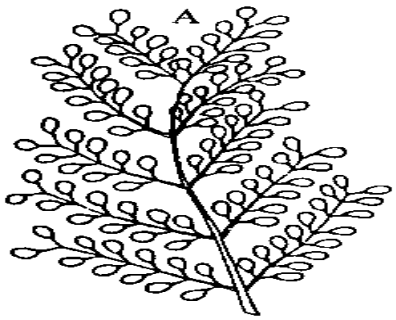


(c) ***Compound bi-pinnate:***

This is the type of compound leaf where the leaflets are further divided into pinnules. The mid rib gives out a number of secondary axis **E.g**. jacaranda leaf.

Illustration





(d) *Compound palmate / digitate*

This is the type of compound leaf where more than three leaflets radiate from the end of the petiole like fingers of the palm. They are joined at the common point E.g. silk cotton leaf, *Gynandropsis gynandra.*

Illustration

PRIMARY FUNCTIONS OF LEAVES

- They are the sites for manufacture of food for the plant through photosynthesis due to the presence of green pigment (chlorophyll) that traps light.
- Leaves have stomata which allow exchange of gases i.e. oxygen and carbon dioxide.
- Leaves facilitate transpiration which sometimes helps the plant to get rid of excess water within the plant due to presence of stomata on the leaves. Transpiration cools the plant, brings about water and mineral salt absorption and transportation.

MODIFICATIONS OF LEAVES

Some leaves are modified into distinct forms to perform other functions other than photosynthesis, transpiration and exchange of gases which are key functions to all plant leaves.

Activity (g) : Finding out modifications of leaves.
Key question: *What are the various modifications of leaves*?

What you need:
Pictures of modified leaves (sprouting Bryophyllum, onion leaves, pitcher plant leaf, cow pea leaf, solanum leaves with spines, Venus fly trap leaves, bracts of bougainvillea and cactus leaves).

What to do:

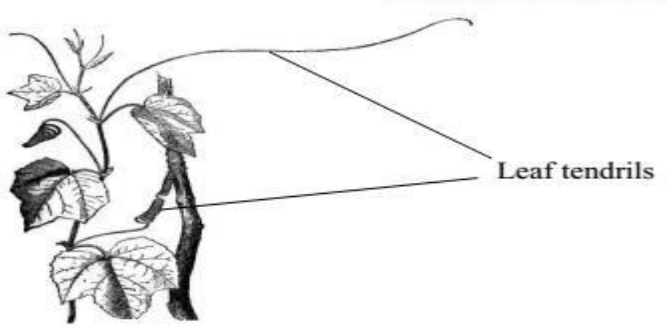
*Discuss and find out the special modifications each of the leaves has. Relate the modifications to its functions***.**

Modified leaf	Modification	Function
Sprouting Bryophyllum	Has buds in notches. Freshy and swollen	Vegetative propagation. Storage of water and food materials.
Onion	Scaly leaves. Swollen and freshy	Protection from desiccation Storage of water and food materials.
Pitcher	Pouch with digestive enzymes	Capturing and digesting organisms to obtain nitrogen.
Cow pea	Leaf tendrils	Provide extra support to the plant.
Solunum	Thorns	Protection from browsers and grazers.
Venus fly trap	Short, stiff trigger hairs	Trapping insects and digesting then to obtain nitrogen.
Bracts of bougainvillea	Bright coloured	Attracting insects to pollinate flowers.
Cactus leaves	Have thorns Freshy and swollen	Protection Storage of water.

From the table above, you observe that some plants have modified leaves to suit their special functions.

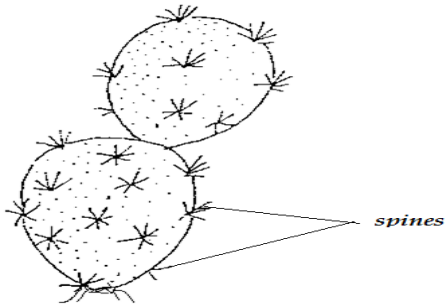
- Some leaves are modified into tendrils to provide support to plants with weak stems to climb by twining around it. E.g. cow peas.

Illustration



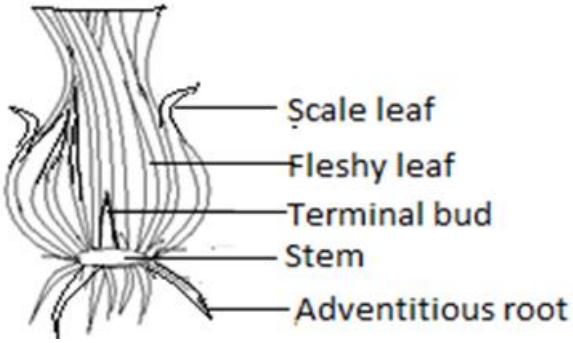
- Some leaves are modified into leaf spines. Leaf spines are sharp pointed structures which reduce the rate of transpiration and protect the plant from browsing animals e.g. asparagus

Illustration



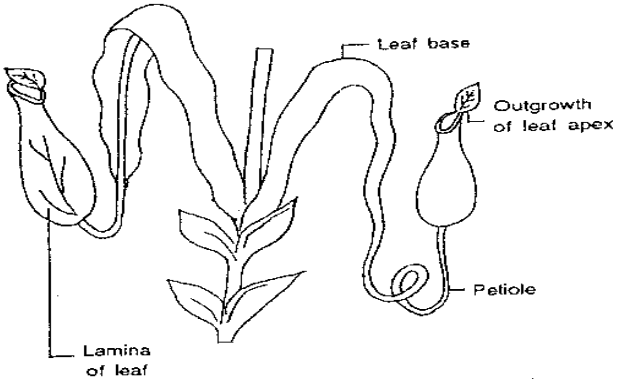
Some leaves are modified into **scaly leaves**. These are dry brown membranous leaves that reduce the rate of transpiration and offer protection to the internal parts of the plant e.g. onion leaves.

Illustration of an onion with dry leaves



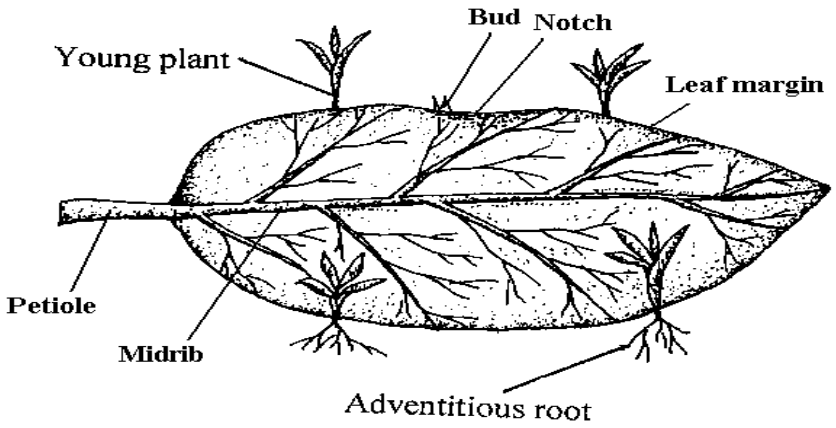
- Some leaves are modified into **food storage organs** of the plant e.g. freshy leaves of the onions, cabbage leaves, Amaranthus spp. etc.
- **Insectivorous plants** have their leaves modified into structures that attract, capture and digest insects e.g. the pitcher plant. Such plants are found in the soils lacking nitrogen.

Illustration



- Some leaves are modified to carry out vegetative reproduction in plants e.g. Bryophyllum leaf. The Bryophyllum leaf has buds from which new plants can grow.

NB: Young plantlets develop from buds along the notches at the leaf at the margin. These plantlets fall off and develop into independent plant**.**



THE FLOWER

A flower is the reproductive organ of a flowering plant. Plants are classified on the basis of presence of flowers into ***flowering*** and ***non-flowering plants***. The function of a flower on a plant is to bear pistil and stamen which enable the plant to carry out the reproduction process.

Flowers have different shapes, sizes and colours. However, most of them have a similar basic structure.

Activity (h): **Drawing and labelling parts of a flower**

Key question: Can you draw and label the parts of a flower?

What you need: A note book, a large flower like hibiscus, a razor blade.

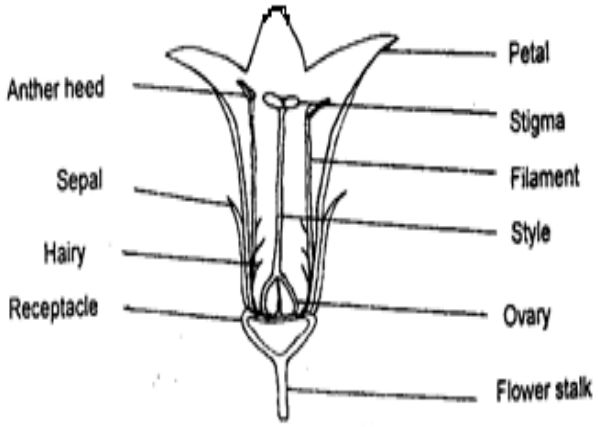
What to do:

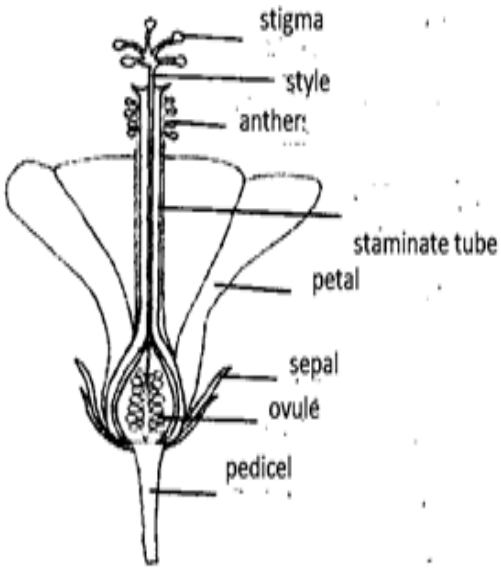
(a) In groups carefully observe the parts of the flower you have been provided with. You can use a hand lens where necessary. Identify and list down the different parts of the flower.

(b) Using a razor blade, cut the flower longitudinally (from the stigma downwards through the ovary) into two equal halves. Make a well labelled drawing of the parts one half of the flower.

(c) Discuss how each part of the flower suits its functions.

b) **Drawing of a longitudinal section of a flower**





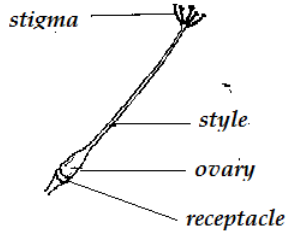
c) How is each part of the flower suits its function?

The flower consists of the essential and non-essential parts. Essential parts are those involved in producing the male and female gametes e.g. stamens and pistil (carpels). Non-essential pats are those that do not produce gametes but protect the flower and attract the pollinators to the flower e.g. the flower stalk, receptacle, petals and sepals.

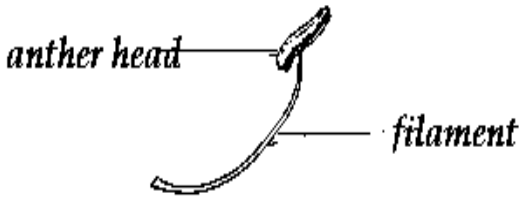
Atypical flower is made up of four special parts. The floral parts are arranged in rings called whorls. These four parts include: -

1. **Calyx:** This is a group of sepals. Sepals are small, leaf-like parts growing at the base of the petals.
2. **Corolla:** This is a group of petals commonly brightly coloured to attract pollinating agents such as insects to the flower.
3. **Stamens:** this is the male part of a flower consisting of filaments, anthers and pollen grains.
4. **Pistil/carpel:** This is the female part of the flower consisting of stigma, style, ovary and ovules.

Carpel/ pistil



Stamen



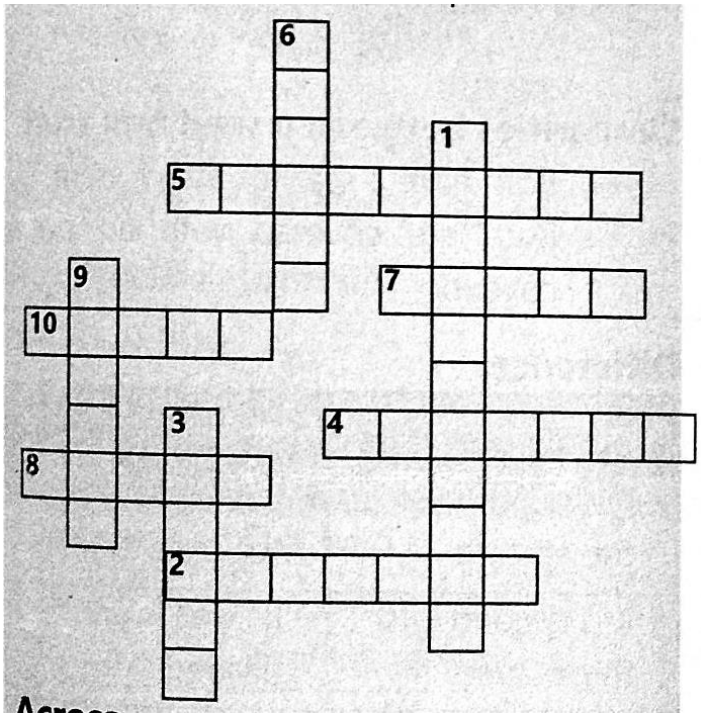
Functions of the main parts of a flower

Parts	Function(s)
Anthers:	This is the male part of the flower The anthers produce pollen grains which are male gametes that fuse with ovules.
Filament	This is long and slender. It functions to attach the anther to the flower.
Stigma:	This is the female part of the flower. This receives the pollen grains from the anthers during pollination and allows their germination.
Style:	This supports the stigma and connects it to the ovary. It is where the pollen tube passes.
Ovary:	It contains and protects the ovules which contains the female reproductive cells (gametes). Ovaries develop into the fruit.
Ovules:	Each ovule contains a female gamete. Ovules fuse with male gametes to form the zygote during fertilization. Ovules develop into seeds.
Flower stalk (pedicel):	This attaches the flower to the stem and also holds the flower in position for pollination.
Receptacle:	It is the point of attachment for the floral parts.
Sepals:	The sepals are generally leaf like though in some flowers they may be coloured. This protects the floral parts when the flower is still in the bud stage /still young.
Petals:	These are large brightly coloured floral parts of the flower. They produce sweet scent which together with their bright colours attracts the insects that pollinate the flowers.

Exercise:

1. Which parts of the flower form?
   (a) Male and female parts
   (b) Non-essential parts

2. Which parts of the flower ensure that fertilization takes place? Suggest the roles the parts play in the process.
3. On examining flowers of plants in your compound, you find all their stigmas damaged. How do you think this will affect the plant?
4. How can you use a flower structure to distinguish a monocotyledonous plant from a dicot?
5. Pesticides are designed to kill harmful insects sometimes however; useful insects are killed as well. What effect could this have on organisms?
6. Complete the crossword puzzle.



Across

2. The stalk of the flower
4. Forms the male reproductive organs of a flower.
5. Thread-like structure that hold up the anther.
7. The portion of the flower used to visually attract insects.
8. Leaf-like structure outside the petals.
10. Where ferritization takes place.

Down

1. Expanded structures on which flower structures are attached.
3. A combination of ovary, style and stigma.
6. Tube-like structures that hold the stigma.
9. When fertilized, these become seeds.

SEEDS AND FRUITS

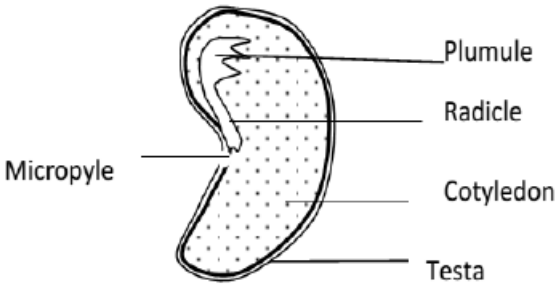
Fruits and seeds are two important structures found in certain plant groups. A fruit is the seed-bearing structure in flowering plants. A fruit is formed from the ovary after fertilization whereas seeds are formed from fertilized ovules.
When a fruit or seed is dispersed and falls in an environment with favourable conditions, they develop into a new plant.

Comparing a seed and a fruit.

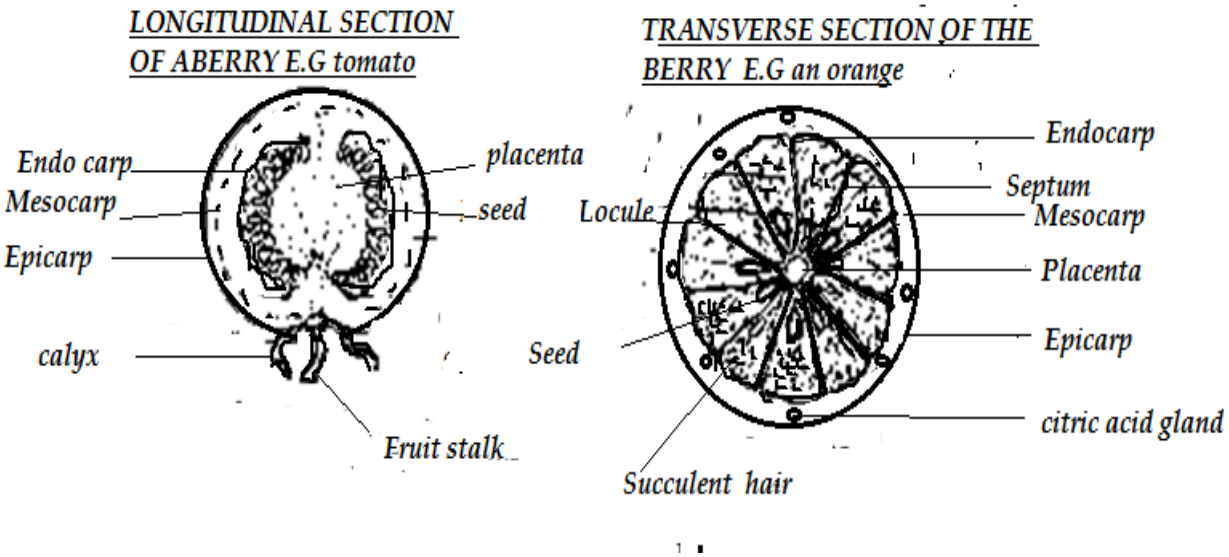
***Key question*:** What are the similarities and differences between a fruit and a seed?

(R.H Stone & A.B Cozens (2010) New Biology for Tropical Schools 3rd Edition, Pges 82 to 83)

Drawing of a seed (internal parts)



Drawing of a fruit



Similarities between a seed and fruit

Both have a scar for attachment.

Both are covered with an outer covering.

They are both results of sexual reproduction in flowering plants (angiosperms).

Fruits and seeds are important

Differences between a seed and a fruit

Fruit	Seed
Its outer layer is the epicarp.	Its outer layer is the testa.
It is divided into three layers	Its wall is undivided
It contains high moisture and its more succulent.	It is dry or it contains low moisture content.
It has two scars for attachment	It has one scar for attachment
It consists of seeds	It consists of an embryo

CHARACTERISTICS OF A FRUIT

- Presence of two scars.
- Presence of a pericarp made up of three layers. The layers include: epicarp (outer layer), mesocarp (middle layer) and endocarp (inner layer)

Additional notes (Content also found in S.4 first term, Sexual reproduction in plants)

Refer to (R.H Stone & A.B Cozens (2010) New Biology for Tropical Schools 3rd Edition, Pges 100 to 101)

The fruits are sub-divided into three groups;

- ✓ Simple fruits
- ✓ Aggregate fruits
- ✓ Multiple fruits

1. SIMPLE FRUIT:

This is the fruit that is derived from the single ovary or compound ovary /several fused ovaries of the single flower.

Simple fruits are sub divided into two types:

i) Fleshy /succulent fruit

ii) Dry fruit

(i) **FLESHY/SUCCULENT FRUIT:**

This is the fruit that has its pericarp fully fleshy or partially flesh. The fleshy pericarp can easily be eaten. The pericarp consists of three layers:

- ✓ Pericarp; this is the outer most layer
- ✓ Mesocarp; this is the middle layer
- ✓ Endocarp; this is the inner layer

The fleshy simple fruit is sub-divided into:

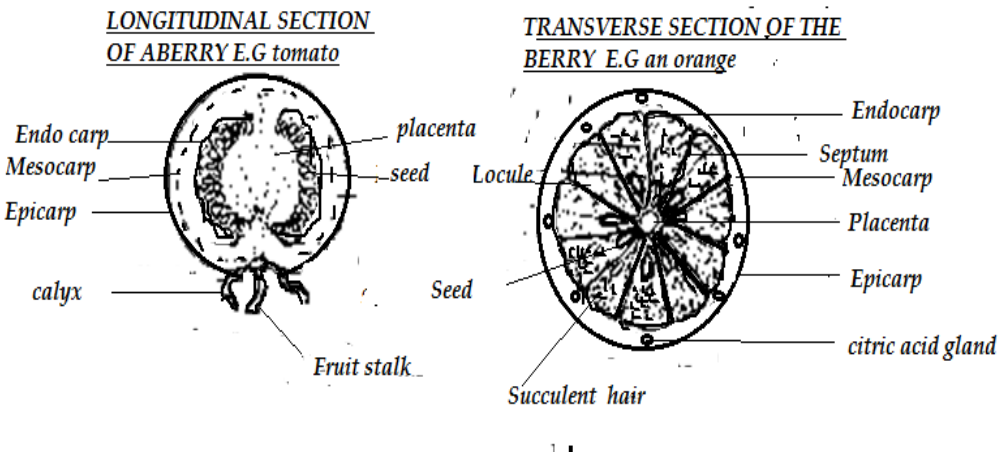
- Berry
- Drupe
- Pome

a) BERRY:

A berry is a succulent fruit which contains many seeds attached to the placenta at the Centre of the fruit. The pericarp is divided into three layers i.e.

- ✓ Epicarp: it is thin, leathery and fleshy in some berry fruits and hard in some berry fruit
- ✓ Mesocarp: it is thick, fleshy, juicy, spongy and succulent layer of a berry fruit
- ✓ Endocarp: thin and fleshy.

Examples include: Oranges, Tomatoes, Guavas, Bananas and Passion fruit etc.

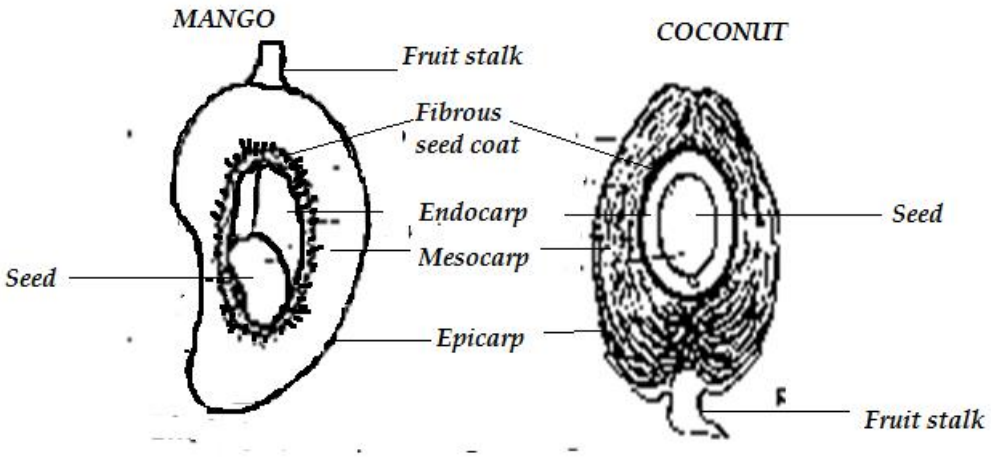


b) DRUPE

This is a partially succulent fruits which contains a single seed attached to the placenta. The drupe has three layers consisting of a thin partially succulent epicarp, fleshy or fibrous mesocarp and hard, stony or woody endocarp.

Examples include: Mangoes, oil palm, avocados and coconut.

Illustration



(ii) **DRY FRUIT:**

This is a fruit whose pericarp is dry. The dry fruit is divided into:

- ✓ Dry dehiscent fruit
- ✓ Dry indehiscent fruit

(a) DRY DEHISCENT FRUIT:

This is a type of dry fruit whose pericarp splits along the line of weakness to release the seeds. The number of lines along which the pericarp splits to release the seeds categorizes the dry dehiscent fruit into different types and they are as follows:

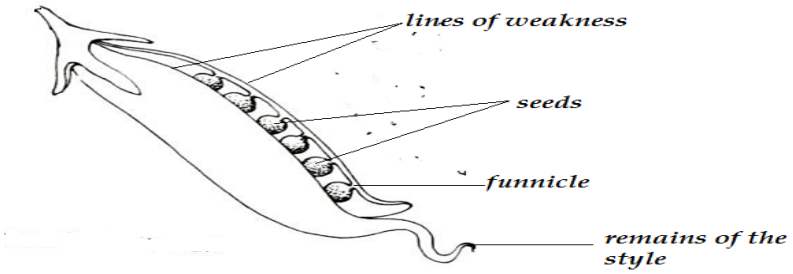
- ❖ legume
- ❖ follicle
- ❖ capsule

♥ **Legume:**

This is the type of dry dehiscent fruit that splits and opens along two lines of weakness to release the seeds. It is also a fruit formed from a single flower with one carpel.

Examples include: Beans, cowpeas and soya beans.

Illustration

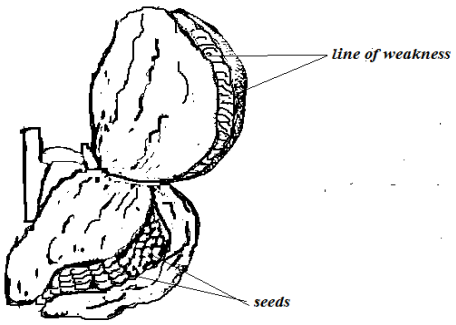


♥ **Follicle:**

This is the type of dry dehiscent fruit with many seeds and splits along one line of weakness to release the seeds.

Examples include: Sodom apple and cassia.

Illustration

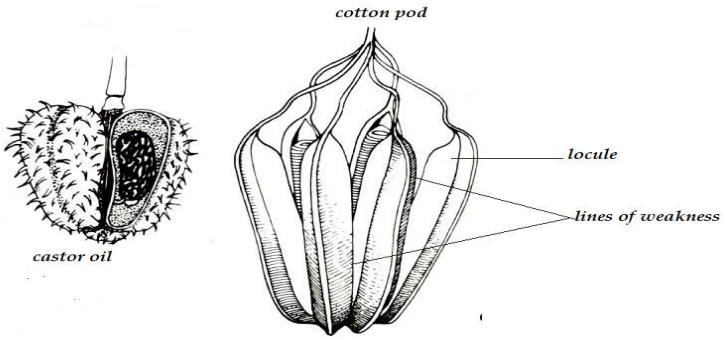


♥ **Capsule:**

This is a type of fruit which splits and opens along many lines of weakness on the pericarp to release the seeds.

Examples include: Cotton, okra, dutchman's pipe, castor oil and poppy.

Illustration



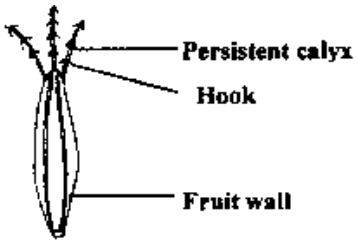
(b) DRY INDEHISCENT FRUIT:

This is the type of dry fruit whose pericarp does not split and open. It is usually hard. Dry dehiscent fruit is further sub- divided into:

- ❖ Achene
- ❖ Nut
- ❖ Samara
- ❖ Caryopsis
- ❖ Cypsela
- ❖ Schizocarp
- ❖

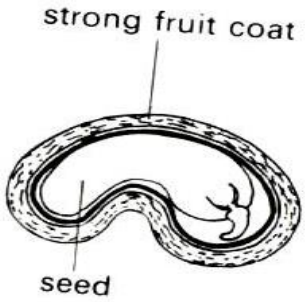
Achene: This is a simple fruit formed from a flower with one carpel. There is only one locul which contains one seed located at the base.
Examples include: Biden's Pilosa and Sunflower fruit

Illustration



Nut: this is similar to the achene but the pericarp is very hard and tough. Examples include: Cashew nut and Coconut

Illustration



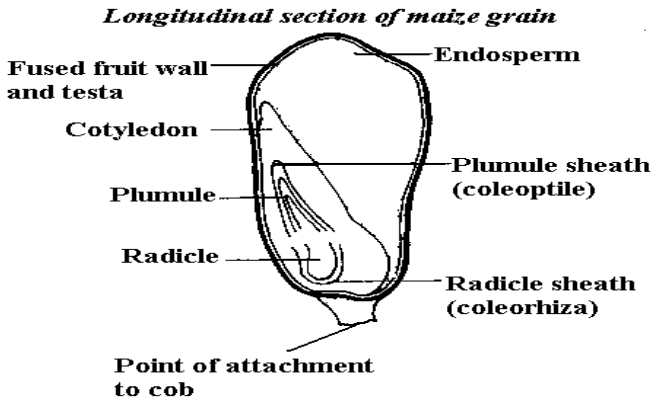
Samara: the samara nearly similar to an achene, the fruit pericarp of a samara is extensively extended to form the wings.
Examples include: Pterocarpus and Stigmophyllon

Illustration

Caryopsis: this is an achene like fruit in which the pericarp and the seed coat have become fused together
Examples include:

- Maize

Illustration

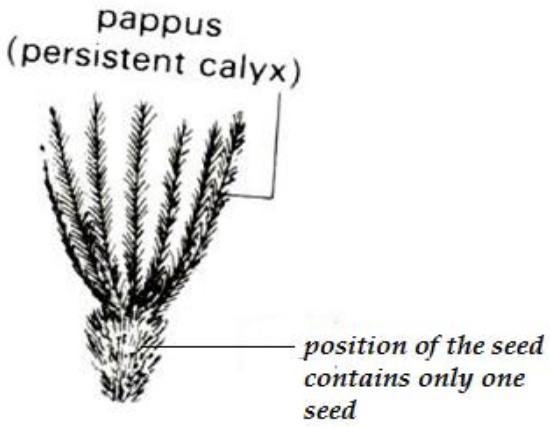


Cypsela: this is an achene in which the calyx above an inferior ovary persists and become modified to form a parachute-like structure of hair called pappus. This pappus is very important during the fruit's dispersal.

Examples include:

- Tridax
- Dandelion

Illustration



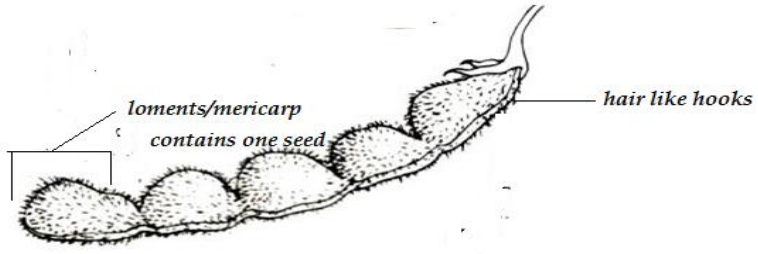
Schizocarp:

This is a fruit formed from a flower with only one carpel with only one carpel. The fruit has many separate locules and each locule contains one seed. However, when ripe the fruit breaks up into separate parts with each part containing one seed.

Examples include:

- Desmodium
- cassia

Illustration



2. Aggregate fruits

This is a type of fruit where the numerous carpels of the single flower develop independently to form fruits**.** The fruit is clump of many simple fruits having a common base.

- ❖ blackberries
- ❖ rasp berries

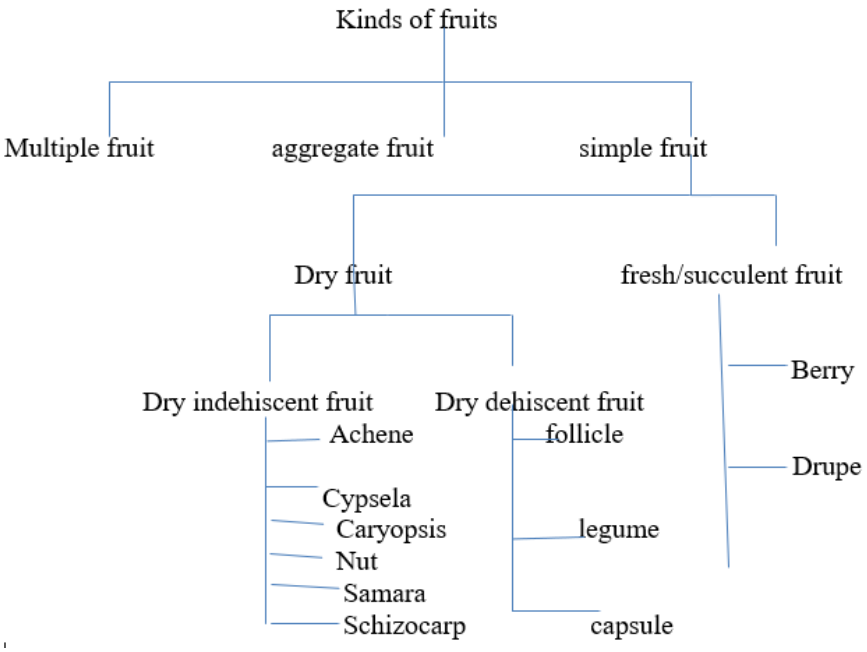
3. Multiple fruits:

These are fruits formed from many flowers or inflorescence. Here the ovaries fuse after fertilization to form a fruit.

Examples include:

- ❖ pineapple
- ❖ jackfruit

Summary of the classification of the fruits



TO GOD BE THE GLORY