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UNIT - V

THE LEAF

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5.1 INSTRUCTIONAL OBJECTIVES

1. a. Given the figure of a stem with terminal bud, the pupil will be able to recognise the small leaves surrounding the terminal bud. (U)

   b. The pupil will be able to state the function of the small leaves surrounding the terminal bud. (K)

   c. The pupil will be able to recall what happens to these small leaves when the terminal bud opens. (K)

2. Given the figure of a leaf, the pupil will be able to recognise the parts of the leaf. (U)

3. The pupil will be able to recall the function of the leaf base, lamina and petiole. (K)

4. Given leaves with or without petioles, the pupil will be able to classify them. (U)

5. a. The pupil will be able to recall that lamina has small pores on it. (K)

   b. The pupil will be able to recall the function of the pores on the lamina. (K)

6. Given the figure of a leaf, the pupil will be able to recognise the main vein and the smaller veins. (U)

7. Given figures of leaves, the pupil will be able to classify leaves according to their arrangement of veins. (U)

8. Given figures of leaves, the pupil will be able to classify between leaves according to their margins. (U)

9. Given figures of leaves, the pupil will be able to classify between leaves according to their apices. (U)

10. Given figures of leaves, the pupil will be able to classify between leaves according to their shape. (U)

11. Given figures of plants, having stipules the pupil will be able to recognise the stipules. (U)

12. Given figures of plants, the pupil will be able to discriminate between the plants with/without stipules. (U)

13. The pupil will be able to recall the name of the two types of leaves. (K)

14. The pupil will be able to discriminate between the two types of leaves. (U)

15. Given figures of leaves, the pupil will be able to classify between simple and compound leaves. (U)

16. The pupil will be able recall the basic functions of the leaf. (K)

17. The pupil will be able to state the definition of photosynthesis. (K)

18. The pupil will be able to recall the conditions necessary for the production of food by green coloured plants. (K)

19. The pupil will be able to recall the products of photosynthesis. (K)

20. The pupil will be able to state the definition of transpiration. (K)

21. The pupil will be able to reason out that transpiration causes cooling. (A)

22. The pupil will be able to recall that water vapour is given out through the pores present on the leaf. (K)

23. The pupil will be able to recognise the relationship between the rate of transpiration and the number of leaves. (A)

24. The pupil will be able to recall how respiration takes place in plants. (K)

25. The pupil will be able to recall that carbondioxide is released through respiration by plants. (K)

26. The pupil will be able to recall that plants respire through leaves. (K)

27. The pupil will be able to interpret leaves as food producing centres. (A)

28. The pupil will be able to explain why photosynthesis cannot take place in darkness. (A)

29. The pupil will be able to explain why leaves are green in colour. (U)

5.2 INITIAL INSTRUCTION

S1. All of you know that animals require food and they directly or indirectly get their food from plants. Do the plants require food?

The plants require food.

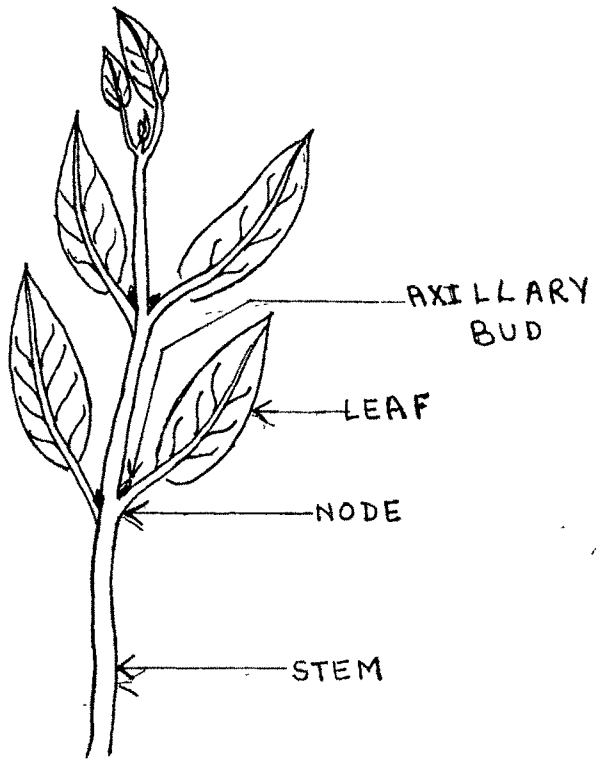
How does the plant get the food?

The plant prepares its own food.

Which part of the plant prepares its food?

The leaf prepares the good.

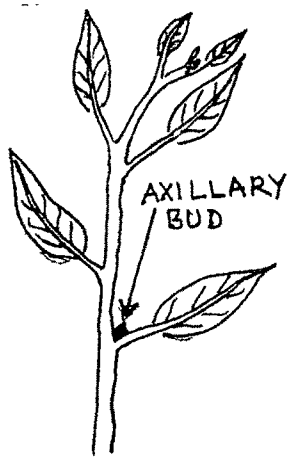
The leaf is an important part of the plant as it carries out many functions for the plant. Today we will study about the leaf and its functions.



Observe the figure of the plant.

Which part of the stem do the leaves grow from?

The leaves grow from the node of the stem.



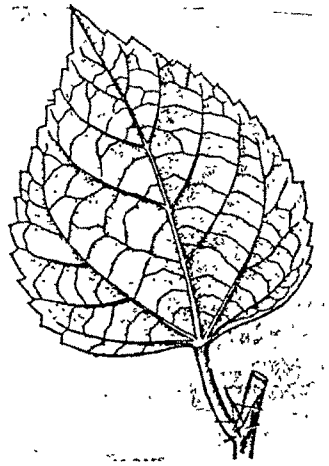
What do you see between the stem and the stalk of the leaf?

A bud is seen between the stem and the stalk of the leaf. This is called the axillary bud since it is found in the axil of the leaf.

What do you see at the top most part of the stem?

At the topmost part of the stem, you will see small leaves one above the other. If you take off the small leaves one by one, you will observe a bud on the tip of the stem. Since it is on the terminal point of the stem, it is called the terminal bud. These small leaves surrounding the terminal bud protect it by covering it. But, when the terminal bud opens, these leaves grow bigger till they attain a definite shape and size.

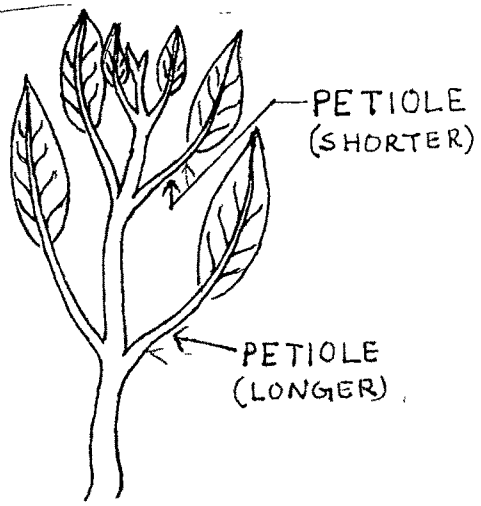
You must have seen a leaf and observed its parts.
Let us observe the parts of a leaf.



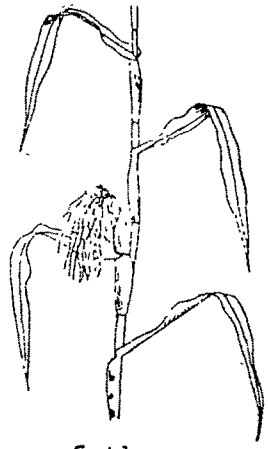
List out how many parts the leaf has and point out these parts in the figure of the leaf.

The following are the parts of a leaf:

1. Stalk of the leaf which is called petiole.
2. The petiole is attached to the stem at the node. This part of the leaf which is attached to the petiole and node is called the leaf base.
3. The lamina is the main part of the leaf. It is flat, green and broad.



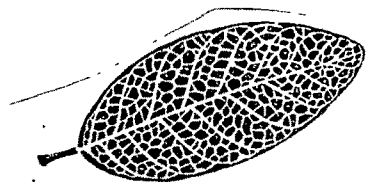
Look at the figure of the plant. You will observe that the length of the petioles are not the same. The petioles of the leaves in the lower part are longer.



Observe the figure of the grass leaf. It does not have the petiole. In this plant, the lower part of the leaf is tubular in shape and it sheathes the stem.

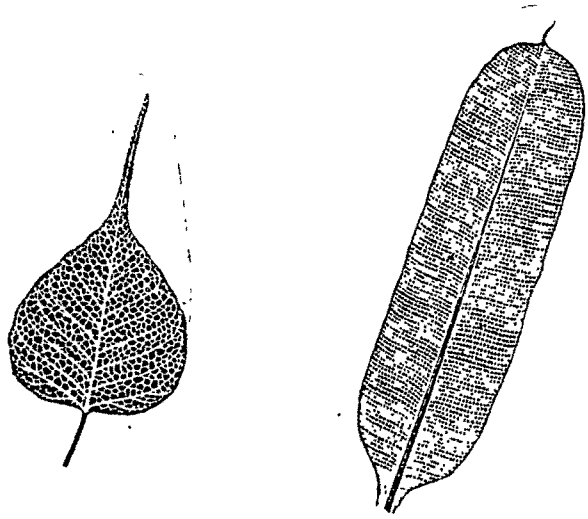
Look at the leaf of vinca (E-Periwinkle, H-Sadabahar). It has the petiole. Some leaves have petioles and some do not have petioles.

The lamina has minute pores on it. These pores play an



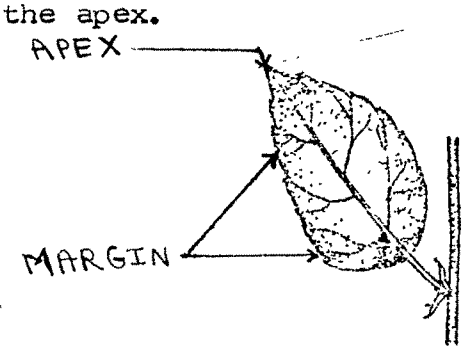
important role in photosynthesis and respiration. If the lamina is held against light you will see some lines spreading all over its surface. They are called veins.

Look at the figure of the leaf. There is a main vein passing through the middle of the leaf. From it arise small veins which spread all over the leaf.

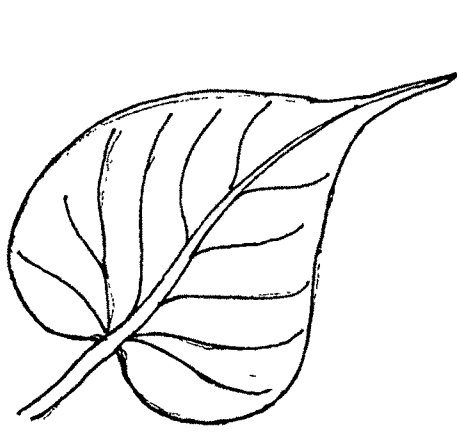


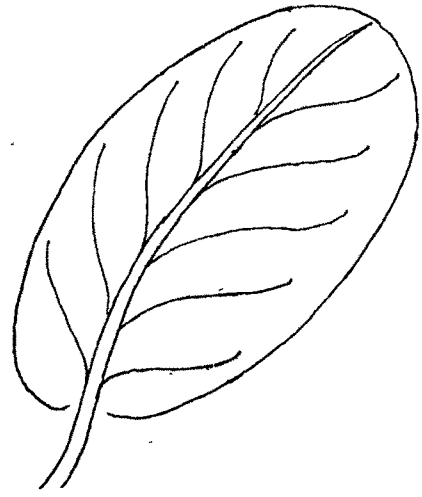
Look at the figures of the two leaves given above. Observe the arrangement of veins. The two leaves have different types of arrangement of veins. The peepal leaf has the veins arranged in the form of a network. This arrangement is called the reticulate arrangement of veins. The banana leaf has the veins arranged in the parallel form. This arrangement of veins is called parallel arrangement of veins.

SS 2. Look at the figure of the leaf given below. Observe the margin and the apex.

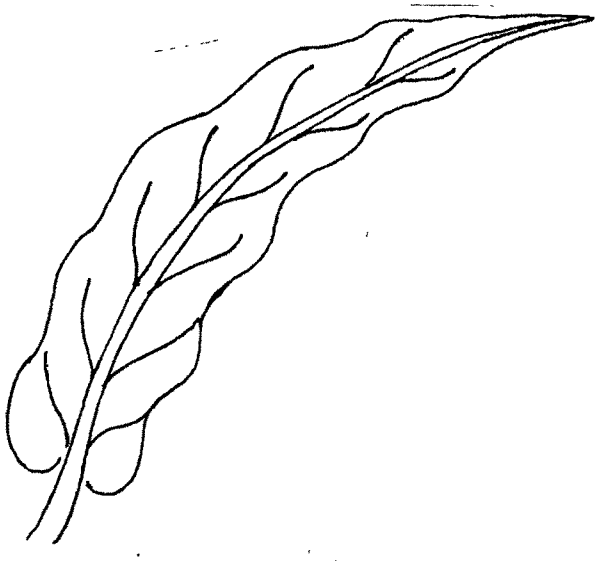


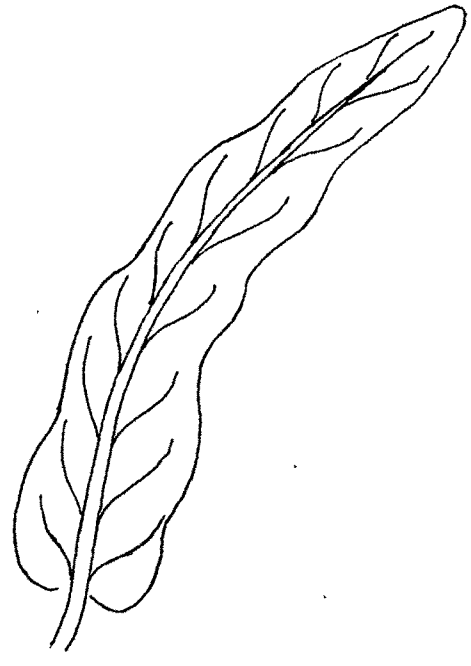
You must have observed the leaves of different plants. The leaves have different types of margin, shape and apex. These differences are very useful in identifying different plants.





Look at the leaves of banyan and peepal trees. They have simple and entire margin.

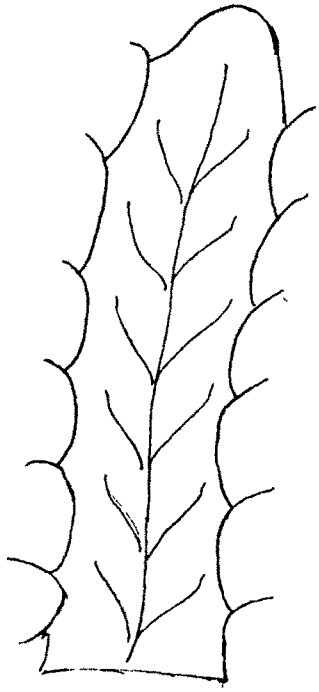




Look at the leaves of Mango and Ashoka trees. They have a wavy margin.

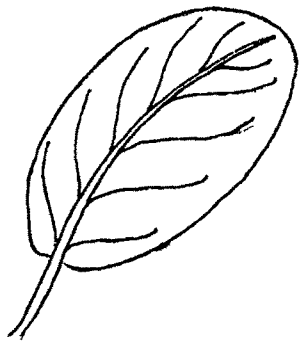
Observe the leaves of Neem and Rose plants. They have serrate margin.

Certain leaves like Solanum Xanthcarpum (E-prickly poppy, H-Phildhutura, G-Darudi) have spiny margin.



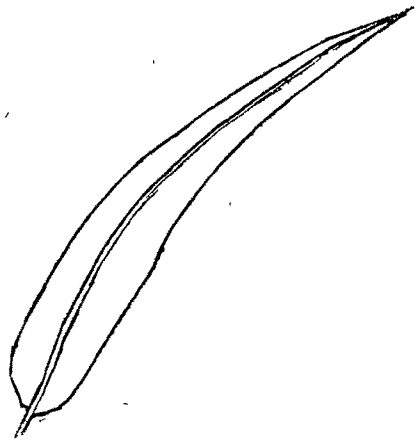
Different leaves have different types of apex.

The leaf of almond tree has round apex. Some leaves have such type of round apex.

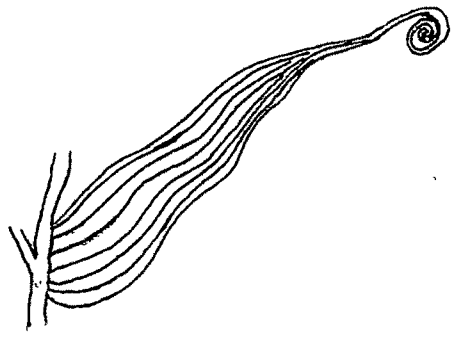


The leaf of Mango tree has pointed apex. Some leaves have such type of pointed apex.

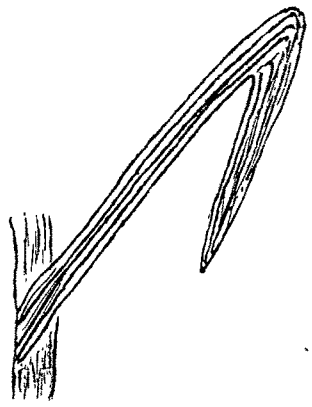
The apex of datepalm is spiny.



The apex of the leaves of Gloriosa (glory lily) is tendrillar.

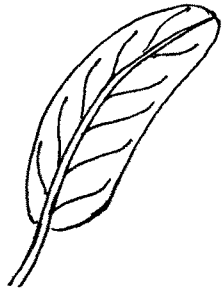


Different plants have leaves of different shapes. The leaves of maize and bamboo are narrow and long.

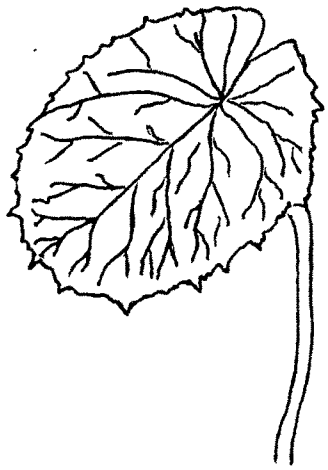


Mast tree and Oleander have leaves narrow at the ends and broad in the middle.

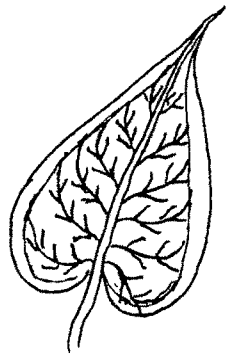
Jambul and Vinca plants have oval leaves.



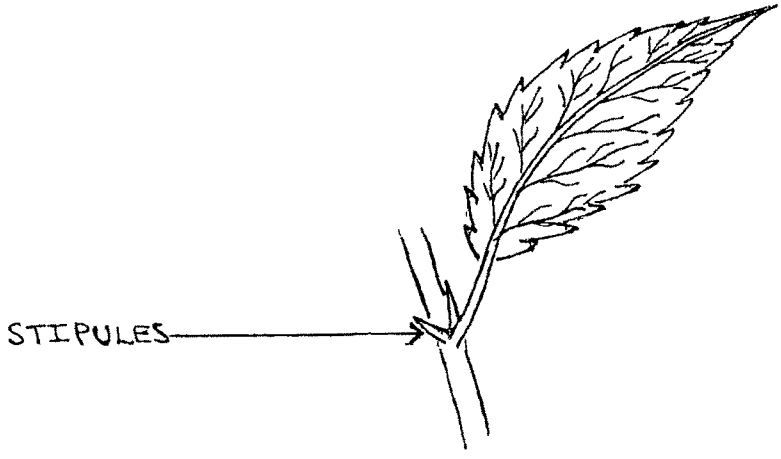
The leaves of a lotus plant are round.



Peepal and Tinospora plants have heart-shaped leaves.



Plants like Jasud have small green outgrowths near the leaf base. These are called stipules.



Look at the figures of the plants. Some of them have stipules near the leaf base and some do not have stipules.

Look at the figures of these leaves.

You will observe that these leaves are of two different types. The leaves A & D are of one type and the leaves B & C are of another type. The first type of leaves are called simple leaves. The second types of leaves are called compound leaves.

In the simple leaf, the lamina is undivided. There is a terminal bud at the apex of a branch and an axillary bud in the axil of the leaf.

In the compound leaf, the lamina is divided into small separate parts. Each part is called a leaflet. There is no terminal bud at the apex of a compound leaf nor is there an axillary bud in the axils of leaflets.

The leaf performs some functions for the plant. They are 1. Photosynthesis 2. Transpiration 3. Respiration.

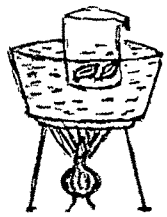
§§ 3 Photosynthesis : As mentioned earlier, you know that the leaf prepares the food for the plant. The leaf contains a green pigment called chlorophyll. The chlorophyll traps the energy of the sun. The carbondioxide present in the air is absorbed by the leaves through the pores present on the leaves. The leaf prepares the food with the help of carbondioxide, water and chlorophyll in the presence of sunlight.

In order to find out whether sunlight is necessary for photosynthesis the following experiment can be conducted.

Experiment :

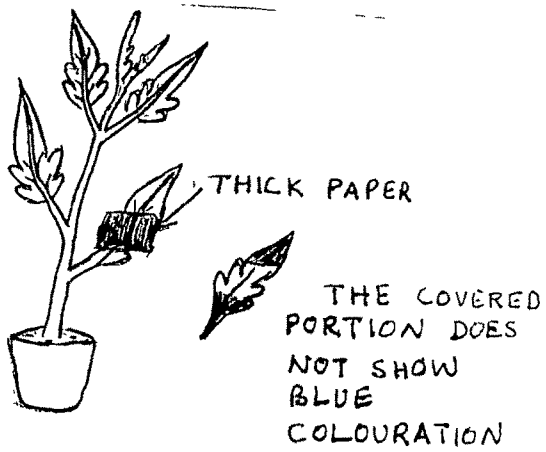
Take a potted plant. Keep it in the darkroom for 2 or 3 days. The leaf stores food in the form of starch. This food will be used up during this time.

Remove 2 or 3 leaves from the plant and boil them in water for some minutes. Put these leaves in a beaker containing spirit and heat it. (Put the beaker containing spirit in a water bath and heat it)



When the leaves are decolourised take them out and wash them with water. Place them in a flat dish and pour a little iodine solution over them. The leaves do not show blue colouration. It means that they do not contain starch.

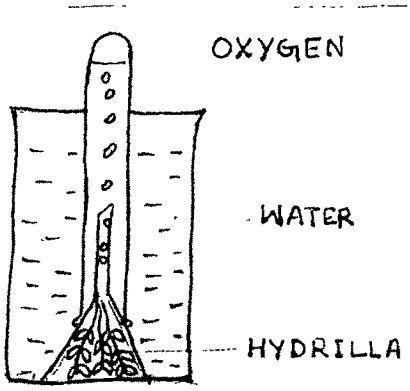
In some region of a leaf of such a plant kept in darkness, now tie a tin foil or a thick piece of cardboard on both the surfaces of the leaf, so sunlight will not fall on that region. Place the pot with the plant in sunlight for 4 to 5 hours. Remove the covered leaf from the plant and test for starch as described above.



You will see that starch is not present in the covered portion of the leaf but it is formed in the part that is exposed to sunlight. This shows that sunlight is necessary for starch formation.

During photosynthesis, the plant gives out oxygen. This fact can be proved by conducting an experiment.

Experiment :



Fill a beaker with water and boil it. Allow it cool. Add a little sodium bicarbonate and stir till it dissolves in water. Get a few branches of an aquatic plant like hydrilla. Hold these branches in the water of the beaker with their cut ends pointing upwards. Cover them with an inverted glass funnel. The end of the funnel must be underwater. Take a test-tube. Fill it completely with water. Invert it under water and place it over the end of the funnel taking care that no air bubbles enter the test-tube. Place this arrangement in sunlight. Soon tiny bubbles of gas will be seen collecting in the upper part of the test-tube. When the test-tube is half filled with gas, carefully lift it covering its mouth with the thumb. Cover the mouth of the test-tube with a glass plate and make it erect. Remove the plate and introduce a burning match stick in it. The match stick will begin to burn very brightly. This shows that the gas in the test-tube is oxygen.

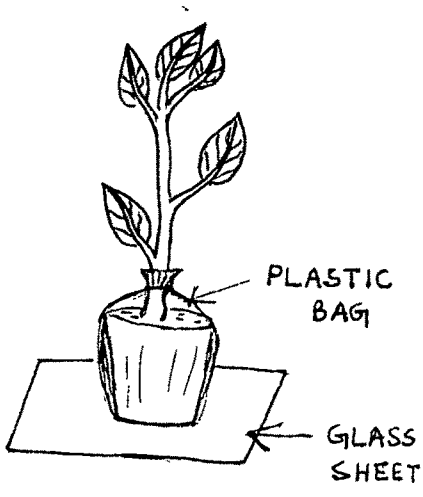
Green plants prepare starch with the help of chlorophyll in the presence of sunlight. Plants use this starch as food. The process is known as photosynthesis.

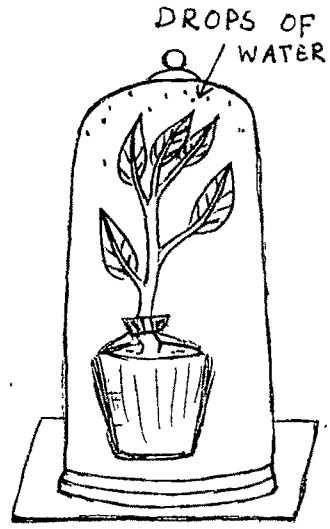
§§ 4 Transpiration :

The extra water absorbed by the roots from the soil is given out by the leaves in the form of water vapour. This water is given out through the pores present on the surface of the leaves. This process is called transpiration. The process of transpiration can be observed by conducting an experiment.

Experiment :

Take a potted plant. Wrap the pot in a plastic bag. Close the open end of the bag with a string and tie it to the stem. Place the pot on a glass sheet. Cover it with a large, clean dry belljar. Apply vaseline to the rim of the belljar; so air from outside will not enter the belljar. Observe the belljar after one or two days.





You will find water drops on the inner surface of the belljar. This water is given out by the plant. The leaves of the plant give out water vapour. It is given out through the pores present on the surface of the leaves. This process is called transpiration. Ordinarily the extra water absorbed by the roots from the soil is given out in the atmosphere by plants.

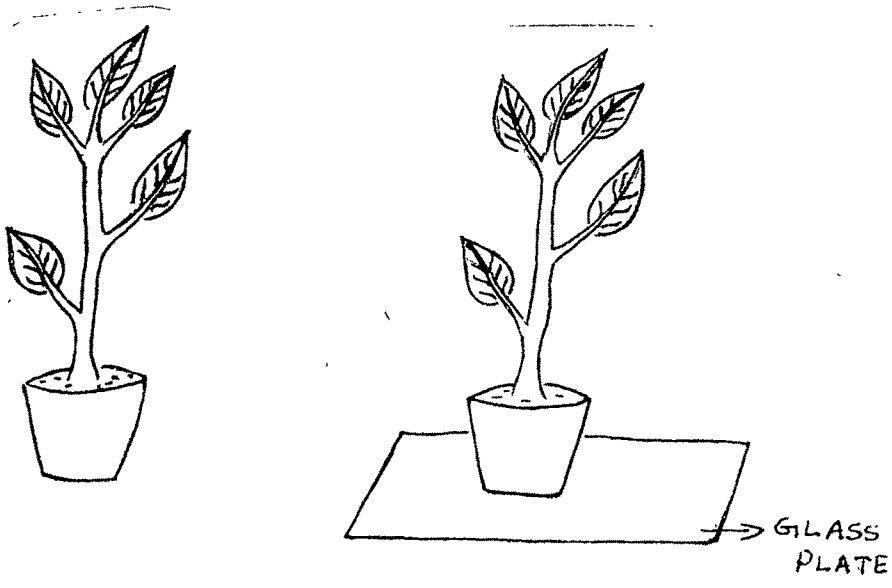
The water given out during transpiration has a cooling effect in the surroundings. The transpiration in plants depends on the number of leaves, the plant possess i.e. greater the number of leaves higher is the rate of transpiration.

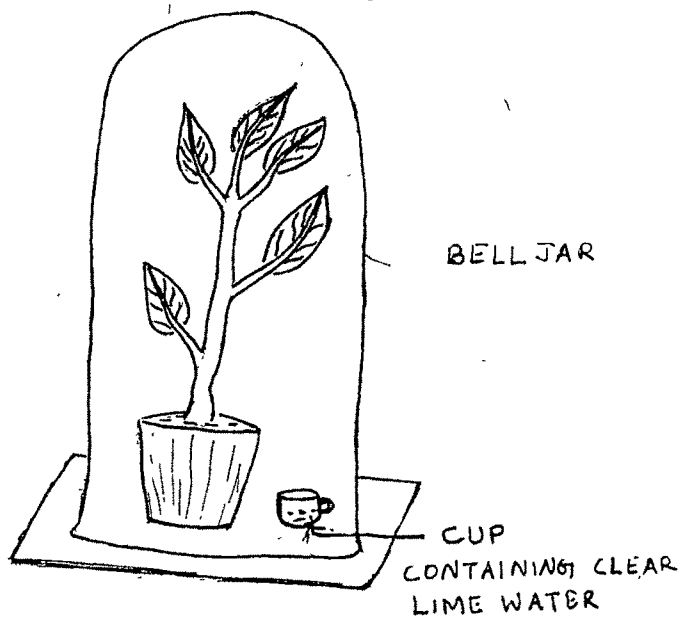
Respiration :

The plant takes in the oxygen from the air through the pores present on the surface of the leaves. The plants give out carbondioxide through these pores. Thus, the respiration in plants takes place through the leaves and respiration takes place in the cells of the leaves.

In order to verify that carbondioxide is given out during respiration, the following experiment can be conducted.

Experiment :





Take a potted plant with leaves. Place it on a glass-plate. Keep a small cup containing clear lime water near the pot. Cover the pot with a bell jar and make the arrangement airtight. Now cover the bell jar with a black cloth or black paper. After about 30 minutes remove the black cloth/black paper and also remove the bell jar. You will find that the lime water kept in the cup has become milky. From this experiment, it can be said that the leaves of the plant give out carbondioxide during respiration.

Summary

The leaves grow at the nodes on the stem. Each leaf has the axillary bud in its axil. The terminal bud is covered by small leaves. These leaves protect it till it opens. These leaves then grow bigger in size till they attain definite shape and size.

The leaf has three parts. They are the leaf base, petiole and lamina. The part of the leaf by which it is attached to the stem at the node is called leaf base.

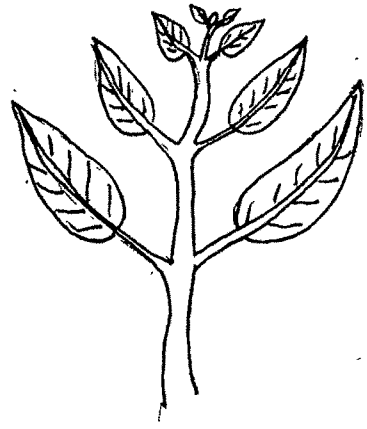
The stalk of the leaf is called petiole. The broad, green and flat portion of the leaf is called lamina. The petiole supports the leaf. The lamina is the main part of the leaf. It has minute pores on it which play an important role in photosynthesis and respiration. The leaves have small tube-like structures running on their surface. These are called the veins. There is a large vein which passes in the middle which is the main vein and there are smaller veins which arise from it. The small veins are arranged either in the form of a network as in peepal leaf or they run parallel to each other. The former arrangement is called reticulate arrangement of veins and the latter is called parallel arrangement of veins. Leaves differ in the type of margin they have. Some leaves have simple entire margin, some leaves have wavy margin, some leaves have serrate margin and some have spiny margin. Similarly leaves differ in the type of apex they have. Some leave have round apex, some pointed, some spiny and some tendrillar. Leaves also differ in their shape. Some leaves are narrow and long, some are narrow at ends and borad in the middle. Some are oval, some are round and some are heart shaped. In some plants, just near the leaf base there are small green outgrowths called the stipules.

Leaves are of two main types. The simple leaf and compound leaf. In the simple leaf, the lamina is undivided. In the compound leaf, the lamina is divided into small parts. Each part is called a leaflet. There is an axillary bud in the axil of a simple leaf and there is terminal bud on the tip of the branch bearing the simple leaf. There is no axillary bud in the axil of a leaflet and there is no terminal bud on the branch bearing the leaflets.

The leaf performs certain basic functions. They are photosynthesis, respiration and transpiration. During photosynthesis food is prepared by the leaf. The leaf contains chlorophyll - a green coloured substance. With the help of it, in the presence of sunlight, the leaf uses water and carbondioxide to prepare starch. The leaf absorbs carbondioxide from the atmosphere through the pores present on it. During this process, oxygen is released. The leaves release out this oxygen through the pores. Photosynthesis takes place only in sunlight. During respiration, the leaves take in air through the pores and pass this to the cells of the plant. These cells take oxygen and release carbon-dioxide which is sent to the leaf. The leaf eliminates it through its pores. During transpiration, the leaves eliminate the extra water absorbed by the root, through the pores in the form of water vapour.

5.3 FORMATIVE EVALUATION

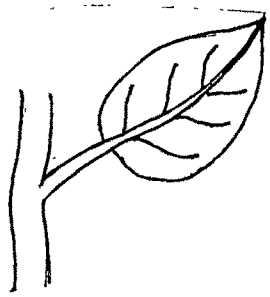
1. a. In the figure drawn below, label the small leaves surrounding the terminal bud.



b. State what these small leaves do.

c. State what happens to these small leaves when the terminal bud opens.

2. In the figure drawn below, label the three parts of the leaf.



3. Match the following by writing the appropriate number from Column A in the bracket given in Column B.

Column A		Column B	
i)	Leaf base	- Supports the leaf	( )
ii)	Lamina	- Supports the plant	( )
iii)	Petiole	- The part which joins the leaf to the stem	( )
		- The main part for photosynthesis and respiration	( )

4. In packet 4, some leaves are placed, some of them have petioles and some have no petioles. Pick out the leaves which have petioles and place them in packet 4.a. and pick out the leaves which do not have petioles and place them in packet 4.b.

5. a. <u>Fill in the blank</u> :

_____part of the leaf has small pores on it.

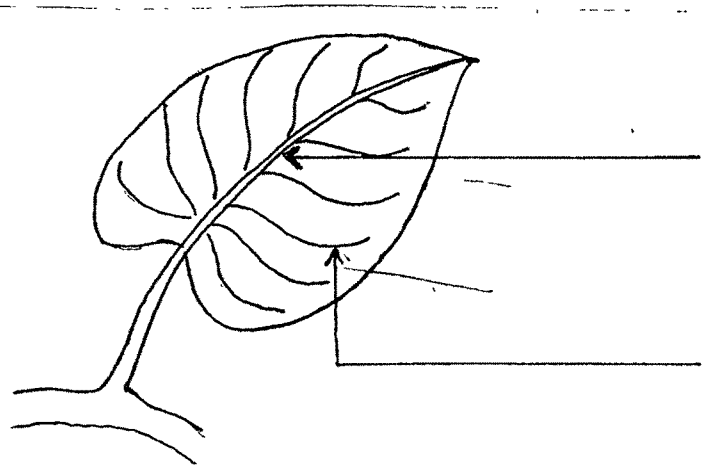
b. What is the function of these pores?

_____

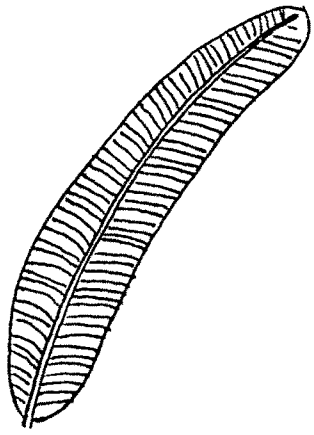
_____

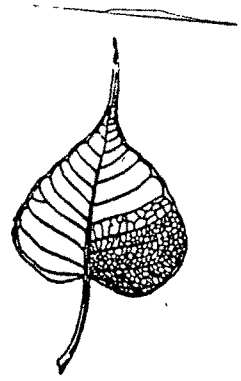
_____

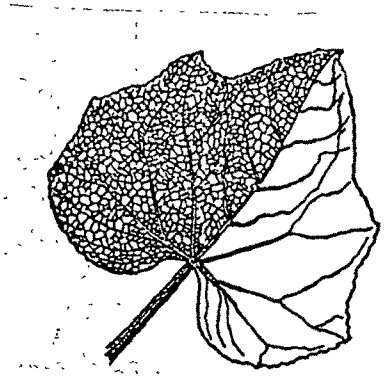
6. In the figure drawn below, label the parts that have been pointed by the arrow marks.

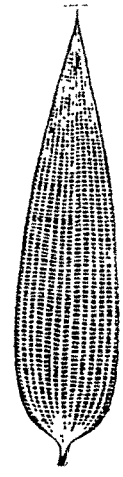


7. Figures of leaves have been drawn below. Name the arrangement of veins in each of the leaves.

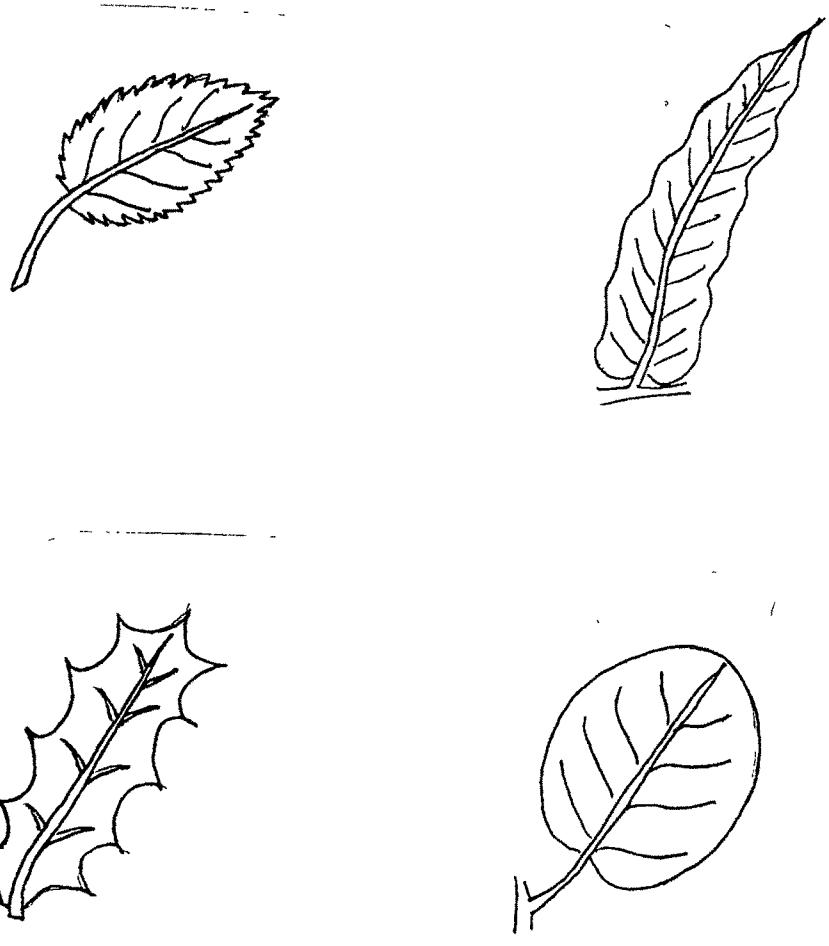




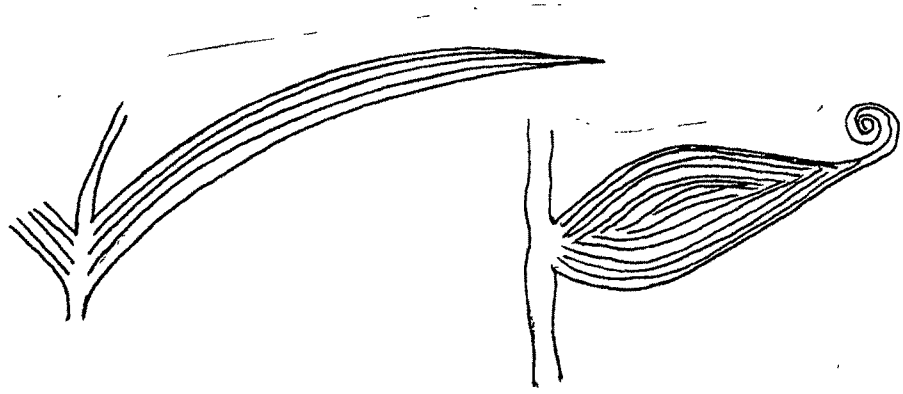




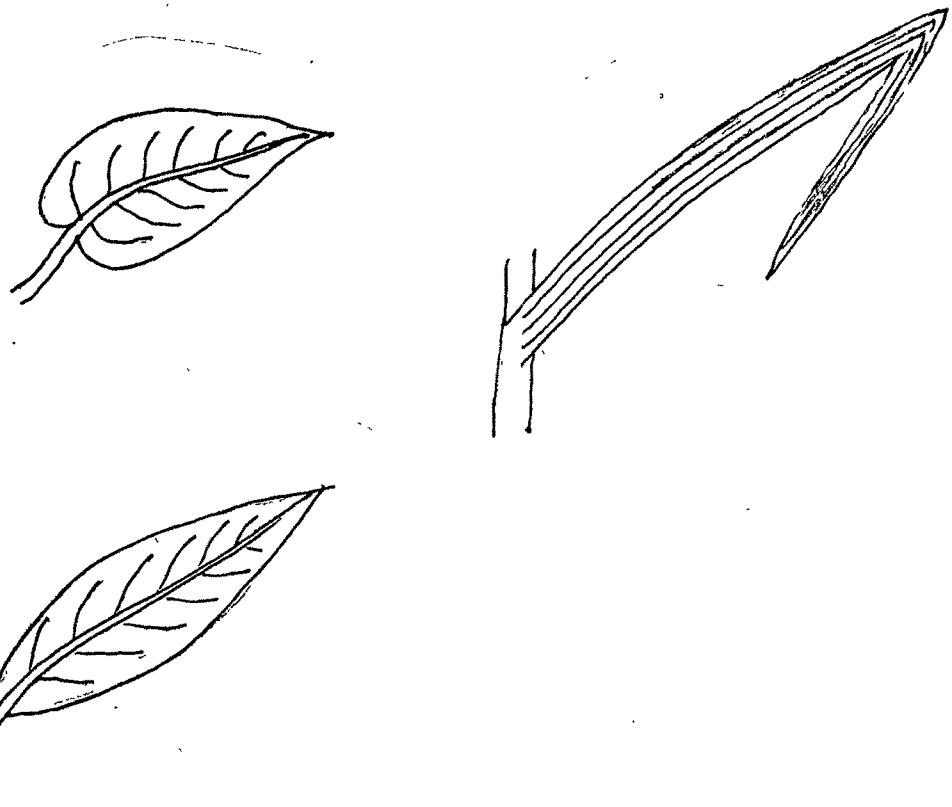
8. Figures of leaves have been drawn below. Name the margin in each of the leaves.

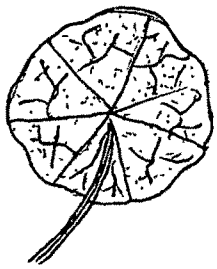


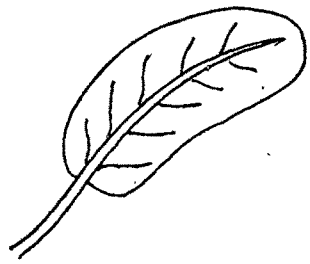
9. Figures of leaves have been drawn below. Name the apex in each of the leaves



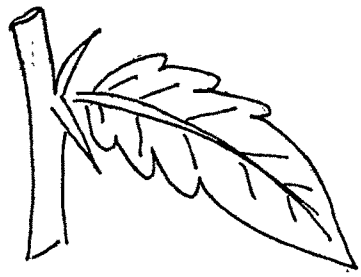
10. Figures of leaves have been drawn below. Name the shape of each of these leaves.







11. In the figure drawn below, label the stipules.



12. Figures of plants have been drawn below. Tick mark (✓) those plants which have stipules near the leaves.

13. <u>Fill in the blanks</u> :

The two types of leaves are _____ and _____leaves.

14. Write down two differences between these two types of leaves.

15. Figures of leaves have been drawn below. Name the type of leaf.

16. State the three basic functions of the leaf.

17. What is photosynthesis?

18. State the conditions necessary for the production of food by green coloured plants.

19. Name the products of photosynthesis.

20. What is transpiration ?

21. When you go to the village where there are a lot of trees around, you will feel cooler than the city where the buildings are around. Why is it so?

22. Fill in the blank :

The excess of water present in the plants is given out through the _____ of the leaves.

23. There are two plants A and B of the same type. Plant A had more leaves than Plant B. Which of the two plants shows more transpiration? Give reason.

_____

_____

_____

_____

24. Fill in the blank :

The process by which the leaf exchanges gases is called _____.

25. Fill in the blank :

_____ is given out through respiration by plants.

26. Fill in the blank :

Plants respire through _____ of the plant.

27. Give reason why the leaf is called the kitchen of a plant.

_____

_____

_____

_____

28. Give reason why photosynthesis cannot take place in darkness.

_____

_____

_____

_____

29. Give reason why leaves are green in colour.

_____

_____

_____

5.4 REMEDIAL INSTRUCTION

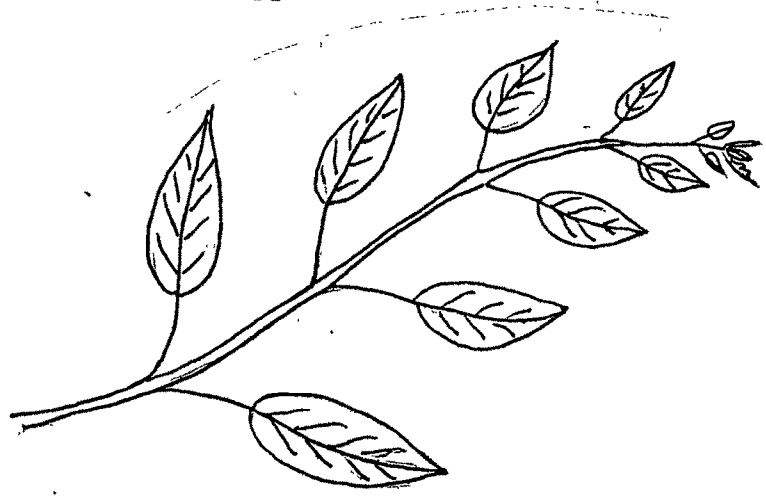
5.4.1(a) Instructional Objective.1a.

Location of the young leaves

(i) P.L.M. (Deviated form)

Section A

Look at the leaves on the figure of this stem. You can see that the larger leaves are present in the lower region of the stem, while the leaves are smaller in size towards the tip of the stem. In other words, as the distance of the leaves grows closer to the tip of the stem, their size too appears smaller.



Now observe the tip of the stem given in packet 1.a. There are small leaves one above the other. Pluck each leaf carefully. Finally when all the leaves have been plucked you will find a bud like structure. Since this bud is at the terminal point of the stem, it is called the terminal bud

Turn to Section B

Section B

In this stem 1.a., point out the small leaves surrounding the terminal bud.

What difference do you find between the leaves growing at the lower part of the stem and those growing near the tip of the stem.

(ii) Oral Verbal Elaboration

Teacher (investigator) shows a small plant and points out to the upper tip of it and describes it as follows "Look at the tip of this stem. It is covered by small leaves. Let us take off each of these leaves one by one. Now you find no more leaves but instead a small bud. This bud is called the terminal bud and these small leaves cover the terminal bud."

5.4.1(b) Instructional Objective 1.b

Function of the young leaves surrounding the terminal bud

(i) P.L.M. (Deviated form)

Section A

Look at these small leaves surrounding the terminal bud. These small leaves that cover the terminal bud actually perform a function. They protect the terminal bud until the bud opens.

Fill in the blanks :

a. The small leaves covering the terminal bud _____ it till it opens.
b. The _____ _____ that cover the terminal bud protect it till it opens.
c. The small leaves that _____ the terminal bud protect it till it opens.
d. The small leaves that cover the _____ _____ protect it till it opens.
e. The small leaves that cover the terminal bud protect it till _____ _____.

Turn to Section B

Section B

Look at the stem 1.b. and observe the small leaves surrounding the terminal bud. What is the function of these leaves?

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) shows a small plant and points out to the upper tip of it and describes it as follows "Look at the tip of this stem. It is covered by small leaves. Let us take off each of these leaves one by one. Now you find no more leaves but instead a small bud. This bud is called the terminal bud and these small leaves cover the terminal bud. These leaves protect the terminal bud till it opens."

5.4.1(c) Instructional Objectivel.c.

Stage of growth in the young leaves surrounding the terminal bud

You must have observed small leaves surrounding the terminal bud. Do these small leaves remain the same size?

No, They grow.
When do they start to grow?

They start to grow once the bud opens.
Do these leaves go on growing?

No, They stop growing after sometime.
When do they stop growing?

They stop growing when they attain the shape and size that is definite for all the leaves of that plant. Thus when the terminal bud opens, these leaves grow bigger till they have a definite shape and size.

Turn to Section B

Section B

What happens to the small leaves surrounding the terminal bud when the bud opens?

_____

_____

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) points out the small leaves covering the terminal bud and states "When the terminal bud opens, these small leaves covering the terminal bud, grow bigger in size till they attain the shape and size that is definite for that plant."

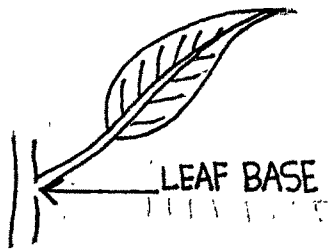
5.4.2 Instructional Objective.2

Parts of the leaf

(i) P.L.M. (Deviated form)

1) Section A

The leaf is attached to the stem at the node. This part of the leaf is called the leaf base.



Fill in the blanks :

a. The part of the _____ which is attached to the stem is called the leaf base.

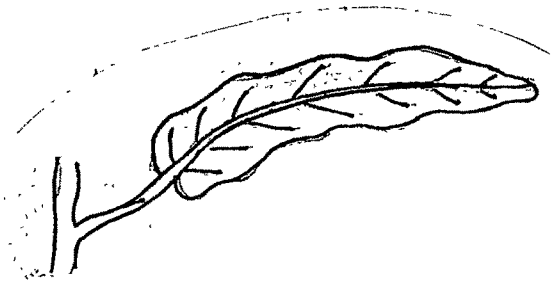
b. The part of the leaf which is attached to the _____ is called the leaf base.

c. The part of the leaf which is attached to the stem is called the _____ _____.

Turn to Section B

Section B

Point the leaf base in the figure.



Turn to Section C

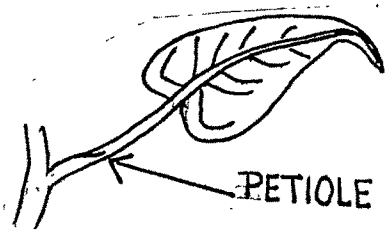
Section C

Fill in the blanks :

The part of the leaf that is attached to the stem is called _____ _____.

2) **Section A**

The stalk of the leaf is called the petiole. Look at the petiole in the following figure.



Fill in the blanks :

a. The _____ of the leaf is called the petiole.

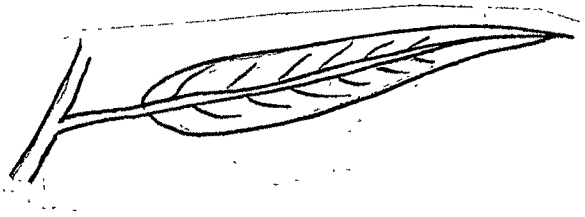
b. The stalk of the _____ is called the petiole.

c. The stalk of the leaf is called the _____.

Turn to Section B

Section B

Colour the petiole in the figure below.



Turn to Section C

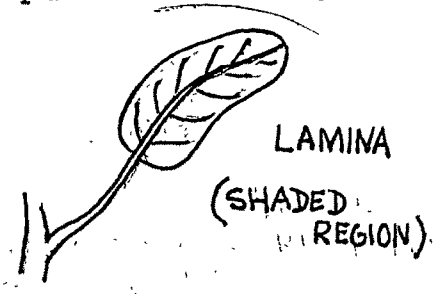
Section C

Fill in the blank :

The stalk of the leaf is called the _____.

3) **Section A**

The flat, broad and green portion of the leaf is called the lamina. Look at the shaded region of the leaf in the figure given below. This region is the lamina. It is the main part of the leaf.



Fill in the blanks :

a. The _____, broad and green portion of the leaf is called the lamina.

b. The _____, broad and _____ portion of the leaf is called the lamina.

c. The flat, _____ and green portion of the leaf is called the lamina.

d. The _____ _____ and _____portion of the leaf is called the lamina.

e. _____ is the main part of the leaf.

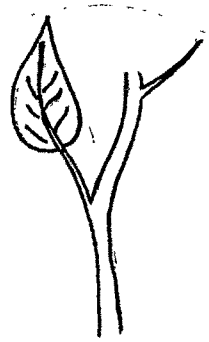
f. Lamina is the _____ _____ of the leaf.

g. Lamina is the main part of the _____

Turn to Section B

Section B

Colour the lamina in the figure of the leaf given below.



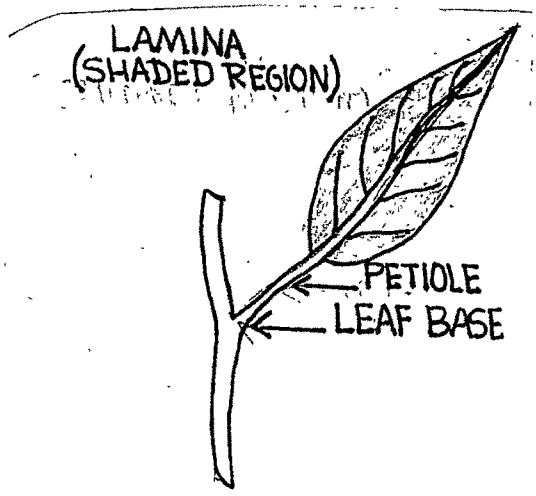
Fill in the blanks :

a. Lamina is the _____part of the leaf.

b. The lamina is _____ _____ and _____ part of the leaf.

4) Section A

Look at the figure of the leaf.



The leaf has three parts. They are the leaf base, petiole and lamina.

Fill in the blanks :

a. The leaf has _____ parts.

b. The three parts of the leaf are _____, petiole and lamina.

c. The three parts of the leaf are _____, lamina and leaf base.

d. The three parts of the leaf are leaf base, petiole and _____.

e. The three parts of the leaf are leaf base, _____ and _____.

f. The three parts of the leaf are the petiole, _____ and _____.

g. The three parts of the leaf are the lamina, _____ and _____.

Turn to Section B

Section B

Look at the figure of the leaf. How many parts does the leaf have?

Point out these parts with an arrow and label them.

(ii) Oral Verbal Elaboration

Teacher (investigator) shows a leaf and points out to its parts and describes it as follows "The leaf has three parts. They are the stalk of the leaf called the petiole, the region of the leaf where it joins to the node of the stem called the leaf base and the broad, flat and green portion of the leaf called the lamina."

5.4.3 Instructional Objective.3

Functions of the parts of the leaf

(i) P.L.M. (Deviated form)

Section A

1) The leaf base attaches the leaf to the stem. This forms the function of it.

Fill in the blanks:

a. The leaf base _____ the leaf to the stem.

b. The _____ _____ attaches the leaf to the stem.

c. The leaf base attaches the leaf to the _____

d. The leaf base attaches the _____ to the stem.

(2) The petiole performs the function of supporting the leaf.

Fill in the blanks :

a. The _____ supports the leaf.
b. The petiole supports the _____.
c. The petiole _____the leaf.

(3) The lamina plays an important role in photosynthesis and respiration.

Fill in the blanks :

a. The lamina plays an important part in _____ and respiration.
b. The lamina plays an important part in photosynthesis and _____.
c. The _____ plays an important part in photosynthesis and respiration.

Turn to Section B

Section B

Mention the function of (a) Leaf base (b) Petiole (c) Lamina.

Turn to Section C

Section C

Match the following by writing the appropriate number from Column A in the bracket given in Column B.

A		B	
1.	Petiole	– Plays an important role in respiration and photo-synthesis.	( )
2.	Leaf base	– Attaches the leaf to the stem.	( )
3.	Lamina	– Supports the leaf.	( )

(ii) Oral Verbal Elaboration

Teacher (investigator) shows a leaf and points out its parts and explains their function as follows "Each of the parts of the leaf perform a function. The petiole supports the leaf, the leaf base attaches the leaf to the stem while the lamina plays an important role during respiration and photosynthesis."

5.4.4 Instructional Objective.4

Leaves with or without petioles

(i) P.L.M. (Deviated form)

Section A

Look at the leaves given in packet 4. Classify them into two types. What is the difference between the two types?

One type of them has petioles and the other type does not have petioles.

Turn to Section B

Section B

A packet of leaves with and without petioles is given. Put them in separate packets. Label the packets according to the leaves they contain.

(ii) Oral Verbal Elaboration

Teacher (investigator) shows some leaves with petioles and some without petioles and points out this difference between them and states "Look at these leaves. They are of two kinds. Some of them have petioles and some do not have petioles."

5.4.5 Instructional Objective.5

Presence of pores on the lamina

P.L.M. (Deviated form)

Section A

The lamina has very small pores on it. These pores help a lot in photosynthesis and respiration. This forms the function of these pores.

Fill in the blanks :

a. _____ has very small pores on it.
b. Lamina has very _____ _____ on it.
c. The pores help in _____ and respiration.
d. The function of the pores is to help in photosynthesis and _____

Turn to Section B

Section B

a. On which part of the leaf do you find small pores?

_____

b. What is their function?

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The lamina of the leaf has small openings called pores on it. These pores play an important role in photosynthesis and respiration."

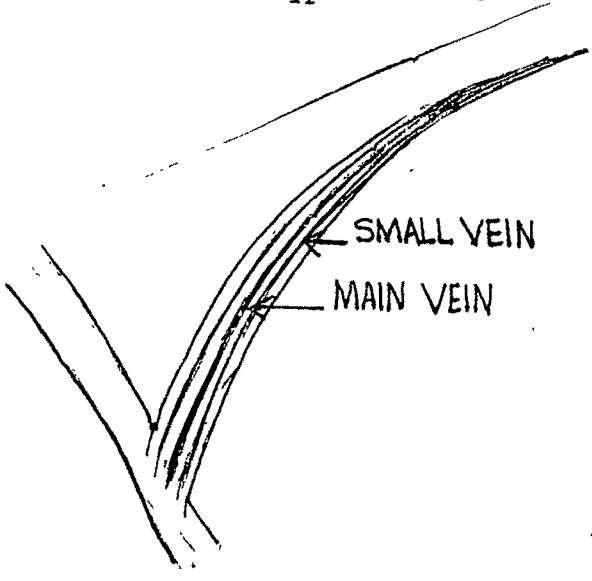
5.4.6 Instructional Objective.6

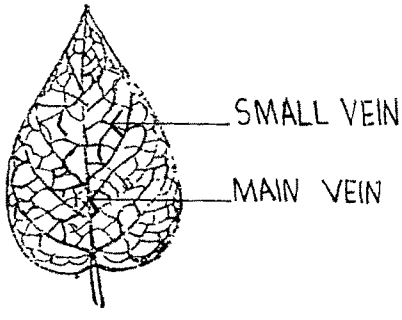
Type of veins in the leaf

(i) P.L.M. (Deviated form)

Section A

Look at the two types of leaves



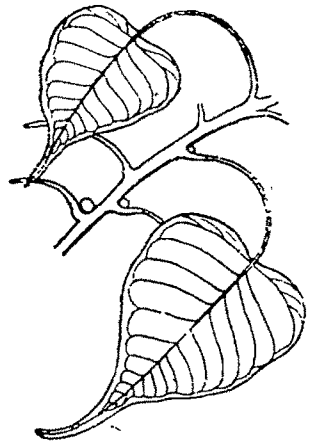


Both the leaves have a main vein which passes through the middle of the leaf. It gives out small veins which are present all over the leaf.

Turn to Section B

Section B

Point out the main vein and the small vein in the figure of the leaf given below and label them.



(ii) Oral Verbal Elaboration

Teacher (investigator) takes a peepal leaf and a banana leaf and holds them against sunlight and states "Look at the lamina of these leaves. You will see lines spreading all over its surface. They are called the veins."

Teacher points the main vein and states "Look at this vein. It is large compared to the other veins. It is the main vein. It passes through the middle of the leaf."

Teacher points to the small veins and states "From the main vein arise these smaller veins which spread all over the leaf."

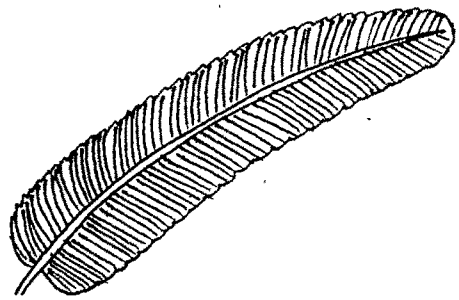
5.4.7 Instructional Objective.7

Type of arrangement of veins

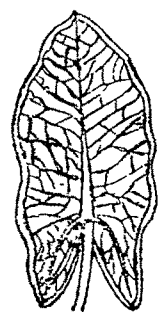
(i) P.L.M. (Deviated form)

Section A

In some leaves, the small veins run parallel to each other as in the banana leaf.

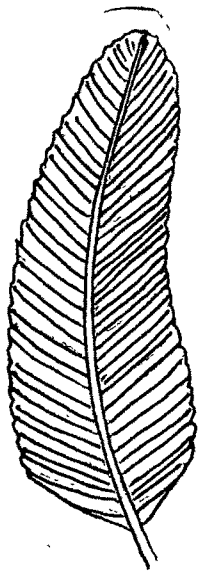


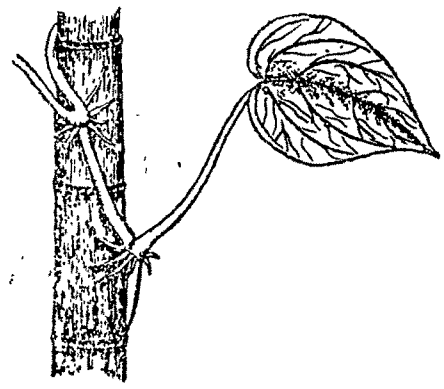
In some leaves, these veins form a network for e.g. peepal leaf.



The banana leaf is said to have parallel arrangement of veins and the peepal leaf is said to have reticulate arrangement of veins.

Figures are drawn below. Label 'A' to the leaf where the smaller veins run parallel to each other. Label 'B' to the leaf which has the small veins in the form of a network. Name the 'A' type of arrangement of veins. Name the 'B' type of arrangement of veins.



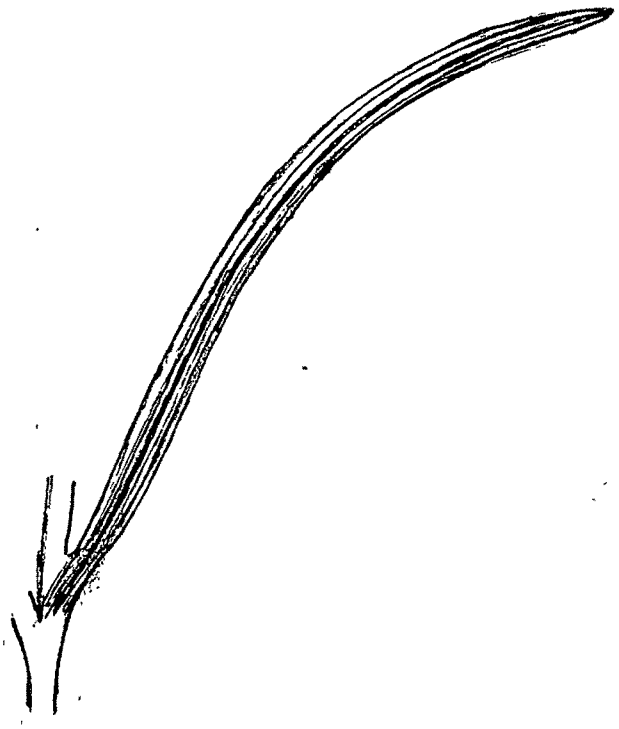


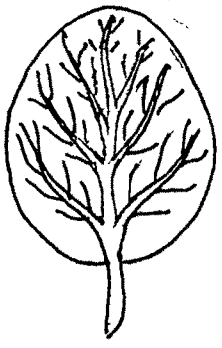
Turn to Section B

Section B

Point out the main vein and the smaller veins in the figures of leaves shown.

Classify these leaves into two types 'A' and 'B'





How did you classify them?

How do these two types of leaves differ?

Name the type of arrangement of the veins in each of these type of leaves 'A' & 'B'.

(ii) Oral Verbal Elaboration

Teacher (investigator) takes the peepal leaf and the banana leaf and holds them against sunlight and states "Look at the arrangement of the small veins. In the peepal leaf they form a network while in the banana leaf they run parallel to each other. The peepal leaf is said to have reticulate arrangement of veins whereas the banana is said to have parallel arrangement of veins."

5.4.8 Instructional Objective.8

Types of margin in leaves

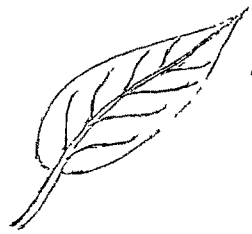
(i) P.L.M. (Deviated form)

(1) Section A

We can differentiate between leaves by their shape, apex and margin. These differences help to identify the different plants.

Look at the margin of the leaf in the following figure.

N.B. : The margin is coloured green to help you recognise it.



Turn to Section B

Section B

Look at the figure of the leaf given below. Colour its margin with blue colour.

Turn to Section C

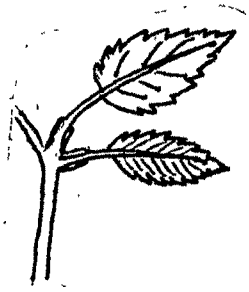
Section C

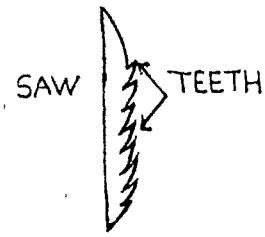
Label the part coloured green.

(2) Section A

Look at the leaves of Neem and Rose. They have serrate margin.

Serrate - means like teeth of the saw.

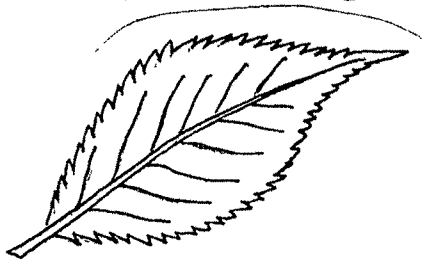




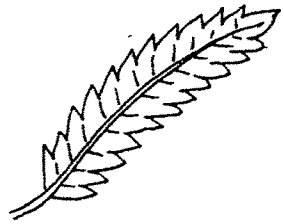
Turn to Section B

Section B

In the figures of leaves given below, tick mark (✓) the leaves which have serrate margin.



( )

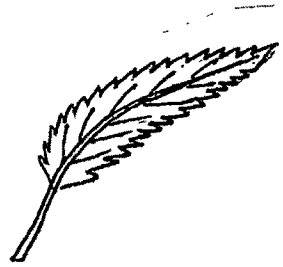


( )

Turn to Section C

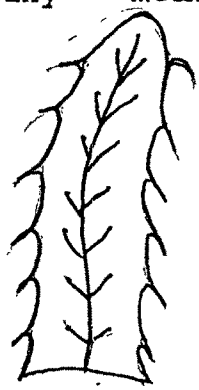
Section C

Name the sort of margin these leaves have.



(3) Section A

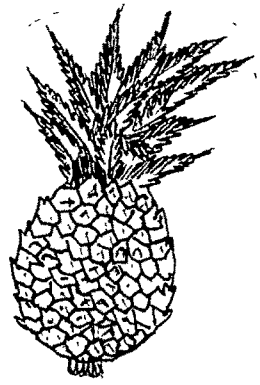
The leaves of bhoiringani (Solanum yanthcarpum) have spiny margins (Spiny - means long rigid sharp point).

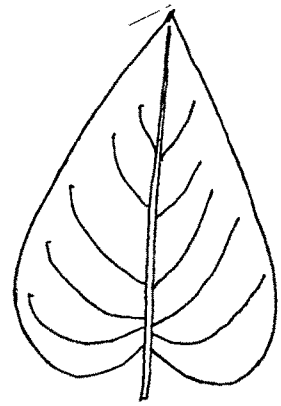


Turn to Section B

Section B

In the figures of the leaves given, tick mark (✓) the leaf with spiny margin.

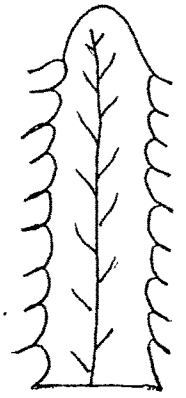




Turn to Section C

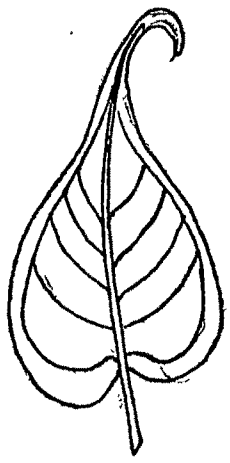
Section C

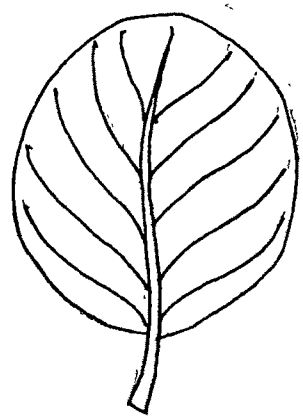
Name the sort of margin these leaves have.



(4) Section A

Peepal leaf and Banyan leaf have simple and entire margin.





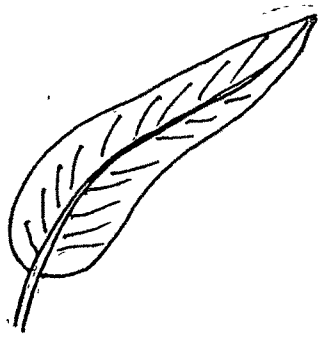
Turn to Section B

Section B

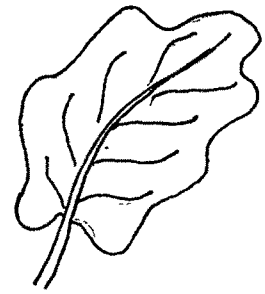
In the figures of leaves given below, tick mark (✓) the leaves which have simple and entire margin.

( )

( )



( )

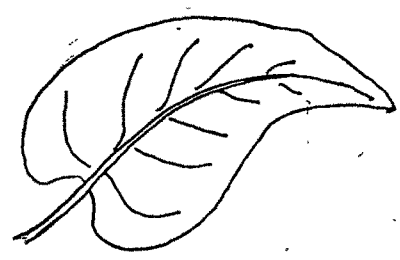


( )

Turn to Section C

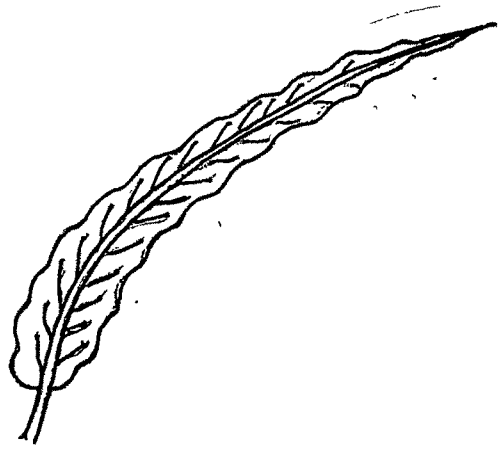
Section C

Name the sort of margin these leaves have.



(5) Section A

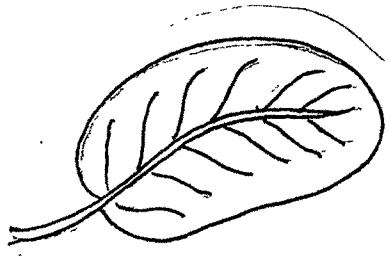
The leaves of some plants e.g. mast tree (Ashok) have wavy margin.



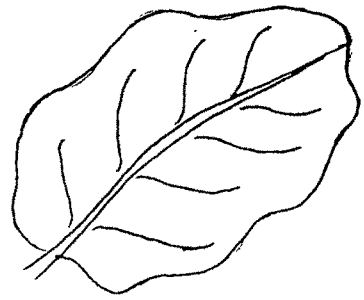
Turn to Section B

Section B

In the figures of the leaves given, tick mark (✓) the leaves with wavy margin.



( )



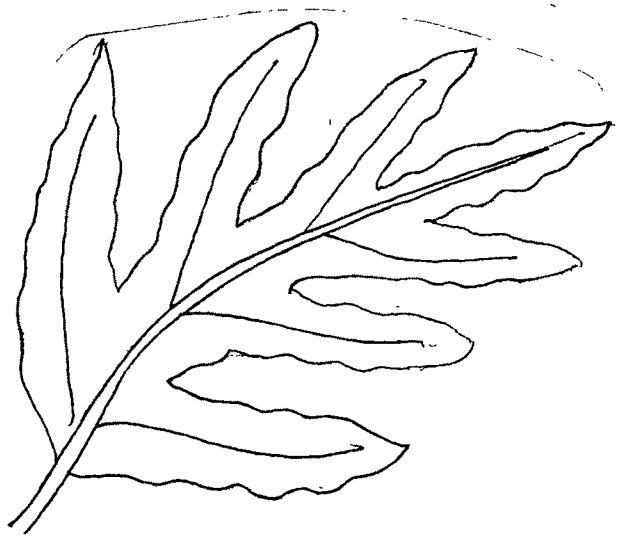
( )

( )

Turn to Section C

Section C

Name the sort of margin this leaf has.



(ii) Oral Verbal Elaboration

Teacher (investigator) points out to the margin of the leaf and states "This region of the leaf is called the margin of the leaf. Not all leaves have the same type of margin."

Teacher takes the leaf of Ashok plant and points to its margin and states "Look at this margin. It is wavy. Some leaves have wavy margin."

Teacher takes the leaf of neem and points to its margin and states "Look at this margin. It is like the teeth of a saw. Such type of margin is called serrate margin. Some leaves have serrate margin."

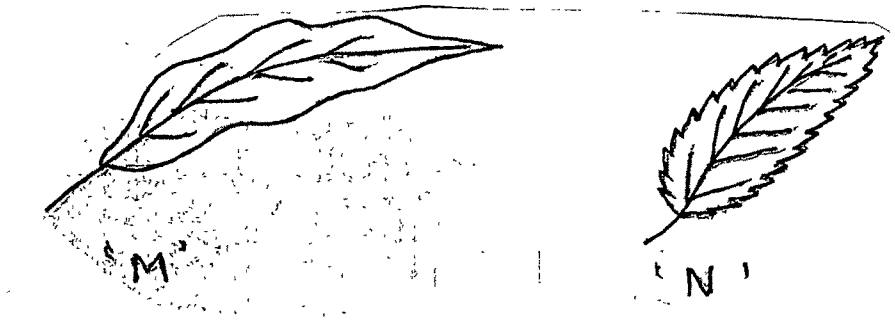
Teacher takes the leaf of Solanum Xanthcarpum (Bhoiringani) and points to its margin and states "Look at this margin. It has spines. Some leaves have such spiny margin."

Teacher takes the leaf of peepal and points to its margin and states "Look at this margin. It is simple and entire. Some leaves have simple and entire margin."

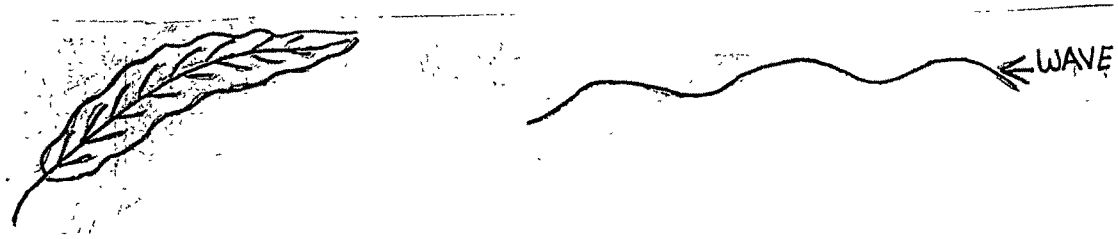
(iii) Kinesthetic Exercise

Touch the margin of this leaf. It is like the teeth of a saw. So it is said to be serrate.

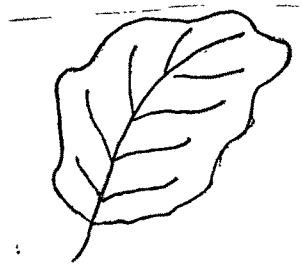
Two leaves M and N are given to you. Mention which leaf has serrate margin.



Examine this margin. It is wavy.



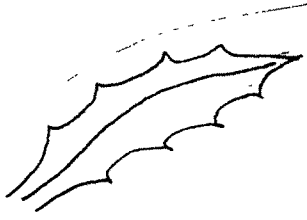
Two leaves Pand Q are given to you. Mention which leaf has wavy margin.



P

Q

Touch this margin. It pricks you and so it is spiny.



Leaves have been given to you. Pick out the leaf that has spiny margin.

Touch this margin. It is complete or entire. It is neither wavy, serrate or spiny.

Two leaves P and Q are given to you. Mention which leaf has simple and entire margin.

'P'

'Q'

5.4.9 Instructional Objective.9

Types of apices in leaves

(i) P.L.M. (Deviated form)

Section A

Look at the apex of the leaf in the following figure.

N.B. : The apex is coloured red to help you recognise it.

Turn to Section B

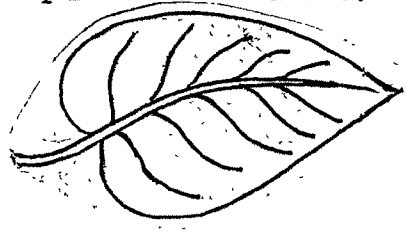
Section B

Look at the figure of the leaf given below. Colour its apex with blue colour.

Turn to Section C

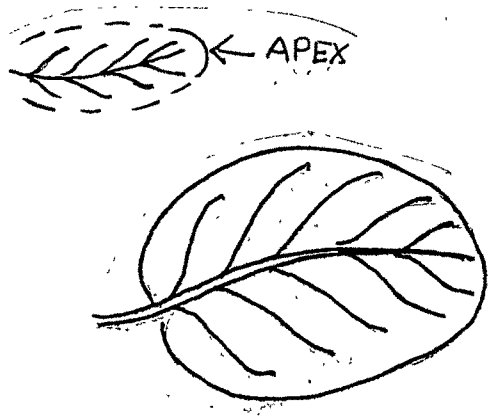
Section C

Label the part coloured red.



(2) **Section A**

Look at the apex of banyan.



It is round.

Turn to Section B

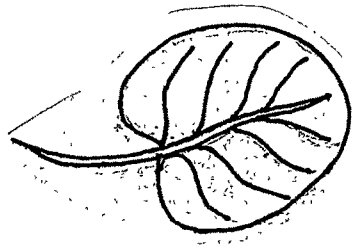
Section B

Leaves are given to you in packets. Put the leaves with round apex in packet A.

Turn to Section C

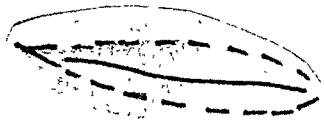
Section C

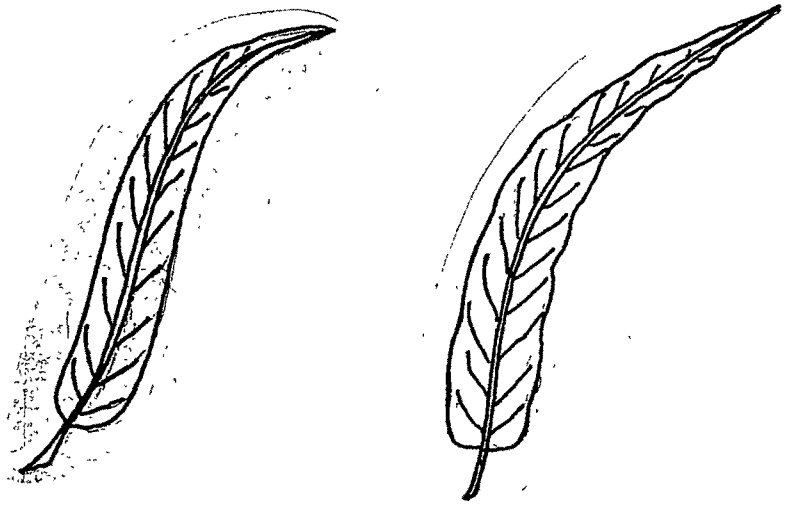
Name the sort of apex this leaf has.



(3) Section A

Look at the apices/the leaves of Mango and Ashok trees. They are pointed.





Turn to Section B

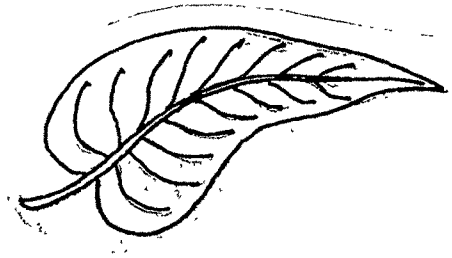
Section B

Leaves are given to you in packet. Put the leaves with pointed apex in packet B.

Turn to Section C

Section C

Name the sort of apex this leaf has.



(4) **Section A**

The apex of datepalm is spiny.

Turn to Section B

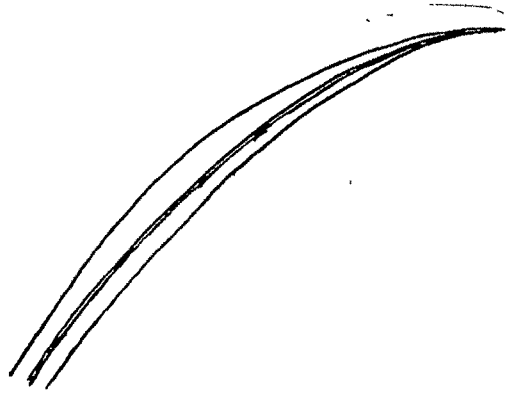
Section B

Leaves are given to you in packet. Put the leaves with spiny margin in packet.

Turn to Section C

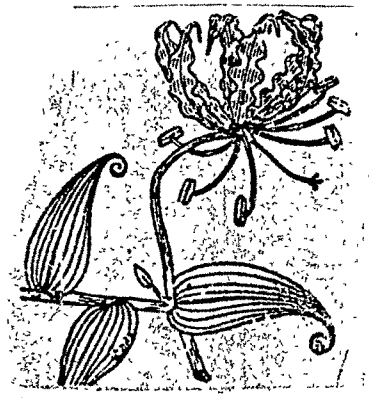
Section C

Name the sort of apex this leaf has.



(5) Section A

The apex of Gloriosa (glory lily) is tendrillar.
(tendrillar —thread-like)

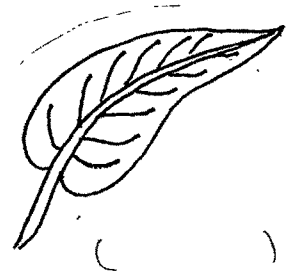


Turn to Section B

Section B

Figures of leaves have drawn below. Tick mark (✓) those leaves that have tendrillar apex.

( )



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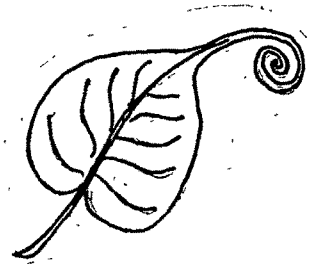


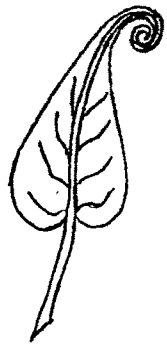
( )

( )

Turn to Section C

Section C

Name the sort of apex these leaves have.



(ii) Oral Verbal Elaboration

Teacher (investigator) points out to the apex of the leaf and states "This region of the leaf is called the apex of the leaf. Not all leaves have the same type of apex."

Teacher takes the leaf of banyan and points to its apex and states "Look at this apex. It is round. Some leaves have round apices." (apices is the plural of apex).

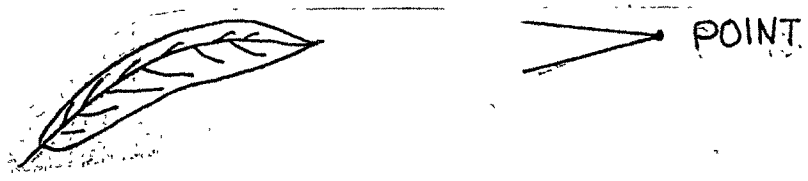
Teacher takes the mango leaf and points to its apex and states "Look at this apex. It is pointed. Some leaves have pointed apices."

Teacher takes the datepalm leaf and points to its apex and states "Look at this apex. It is spiny. Some leaves have spiny apices."

Teacher takes the Gloriosa (glory lily) leaf and points to its apex and states "Look at this apex. It is tendrillar. Some leaves have tendrillar apices."

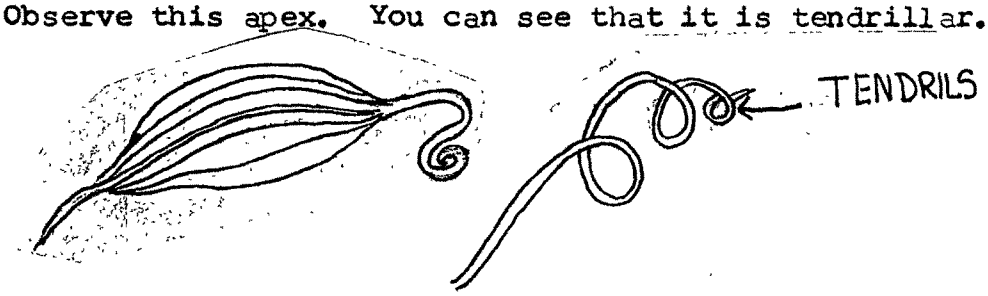
(iii) Kinesthetic Exercises

Touch this apex. You can feel it is pointed.



Two leaves X and Y are given to you. Mention which leaf has pointed apex.

Observe this apex. You can see that it is tendrillar.



Two leaves S and M are given to you. Mention which leaf has tendrillar apex.

5.4.10

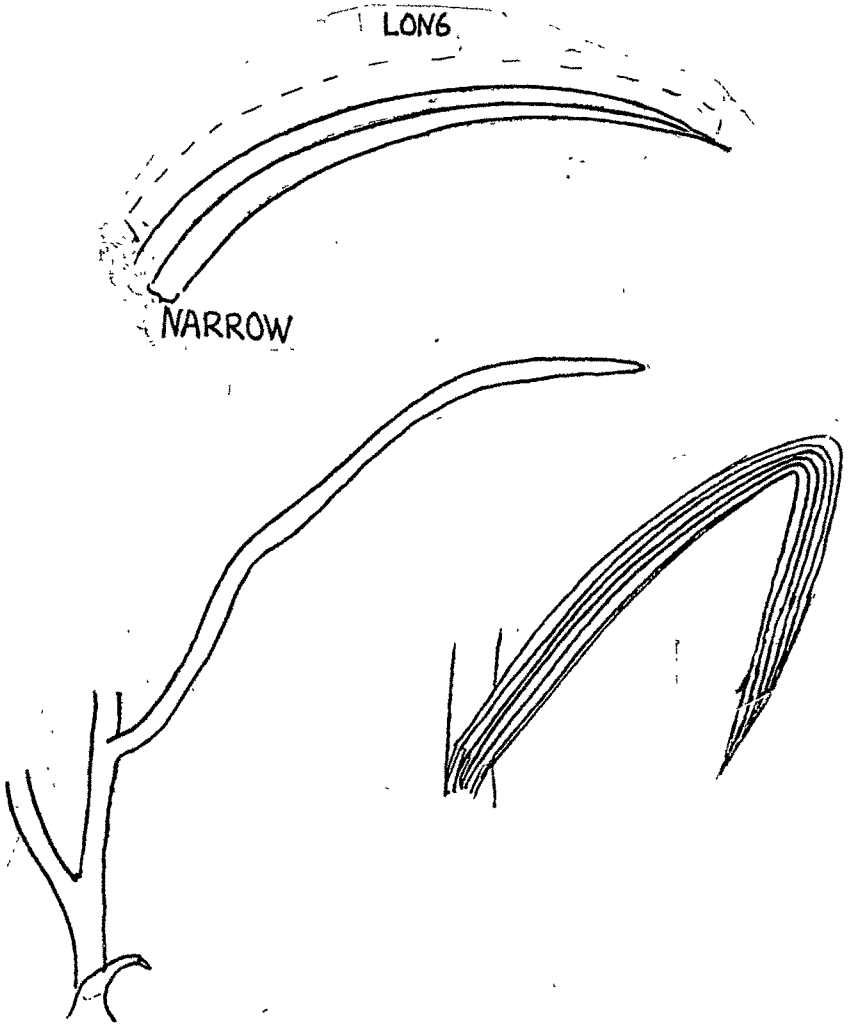
5.4.10 Instructional Objective.10

Different shapes of leaves

(i) P.L.M. (Deviated form)

(1) Section A

The leaves of onion and maize are narrow and long.



Turn to Section B

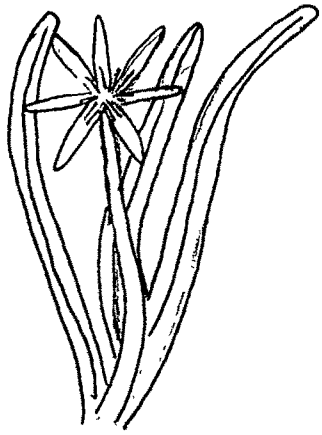
Section B

Leaves of different shapes are supplied in pocket 10(1).
Put the leaves that are narrow and long in packet 10(1).

Turn to Section C

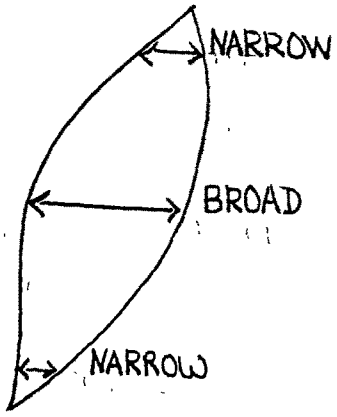
Section C

Name the sort of shape that the leaves of this figure of the plant have.



(2) Section A

Mast tree has leaves narrow at the ends and broad in the middle.



Turn to Section B

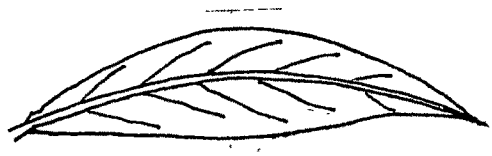
Section B

Leaves of different shapes are supplied in packet 10(2). Put the leaves that are narrow at the ends and broad in the middle, in packet 10(2).

Turn to Section C

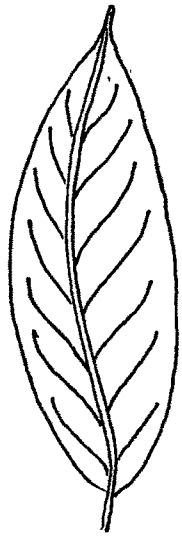
Section C

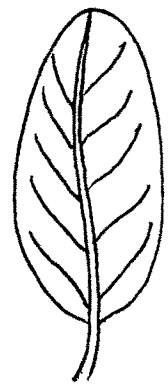
Name the sort of margin the figure of this leaf has.



(3) **Section A**

The leaves of Jambul and Vinca (Periwinkle, Sadabahar) are oval in shape.





Turn to Section B

Section B

Leaves of different shapes are supplied in packet 10(3).
Put the leaves which are oval in shape, in packet 10(3).

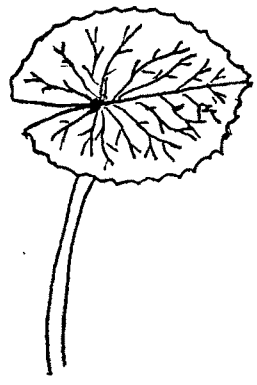
Turn to Section C

Section C

Name the sort of shape that this figure of the leaf has.

(4) Section A

The leaves of lotus are round.



Turn to Section B

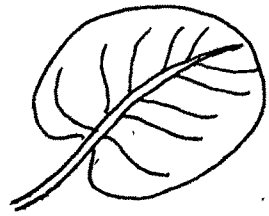
Section B

Leaves of different shapes are supplied in packet 10(4).
Put the leaves which are round in packet 10(4).

Turn to Section C

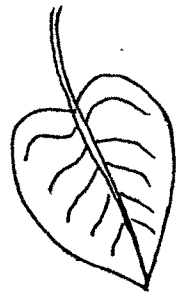
Section C

Name the sort of shape this figure of the leaf has.



(5) **Section A**

Peepal and Tinospora (Gurcha, Gado) have heart shaped leaves.



Turn to Section B

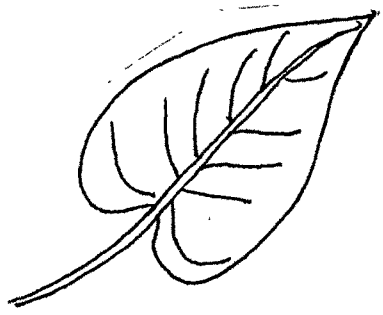
Section B

Leaves of different shapes are supplied in packet 9.
Put the leaves which are heart shaped in packet 9.

Turn to Section C

Section C

Name the sort of shape this figure of the leaf has.



(ii) Oral Verbal Elaboration

Teacher (investigator) shows different leaves and then points to two leaves which are different in shape and states "Look at these leaves, they differ in shape."

Teacher points to two other leaves which are similar in shape and states "Look at these leaves, they have almost the same size. Thus it can be seen that leaves of different plants may show the same shape or different shapes."

Teacher shows the leaf of grass and points out the narrow width of it and its long length and states "Look at this leaf. Its width is narrow and it is long in length. Some leaves have such type of narrow and long shape."

Teacher shows the leaf of oleander and points out its narrow ends and its broad middle region and states "Look at this leaf. It is narrow at its ends but it is broad in the middle. Some leaves have such type of shape."

Teacher shows the leaf of vinca and points out to its oval shape and states "Look at this leaf. It resembles the shape of an egg. It is said to have oval shape. Some leaves have such oval shapes."

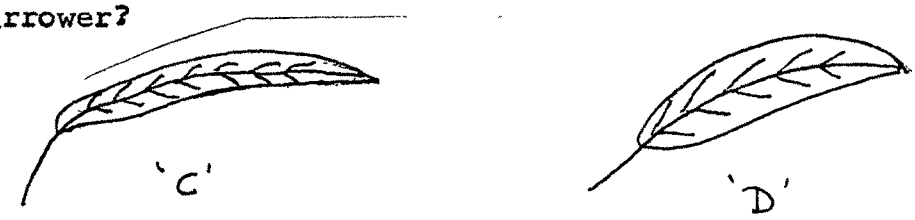
Teacher shows the leaf of lotus and points out to its almost round shape and states "Look at this leaf. It almost looks round in shape. Some leaves are round in shape."

Teacher shows the peepal leaf and points to its heart shape and states "Look at this leaf. It has a heart shape. Some leaves have heart shape."

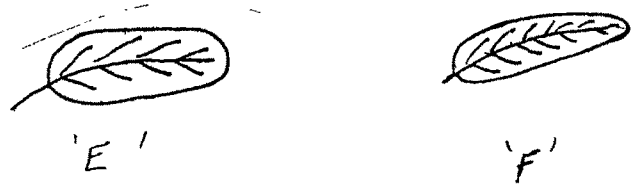
(iii) Visual Perceptual Exercise

Look at these two leaves. Leaf A is narrow compared to leaf B.

Look at these two leaves-leaf C and leaf D. Which is narrower?

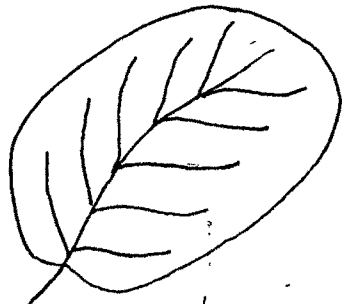


Look at these two leaves. Leaf E is broader compared to leaf F.



Look at these two leaves - leaf G and leaf H. Which is broader?

'G'



'H'

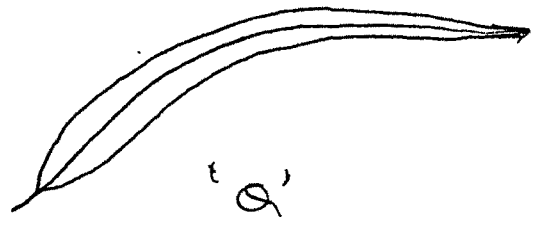
Look at these two leaves. Leaf M is longer to leaf N.

'M'

'N'

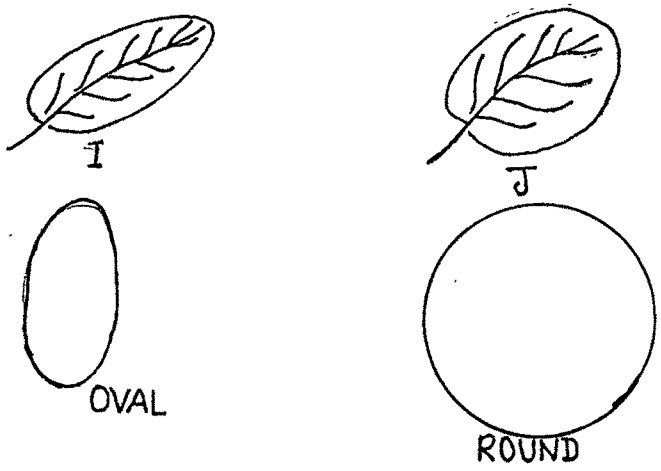
Look at these two leaves, leaf P and leaf Q. Which is longer?

'P'



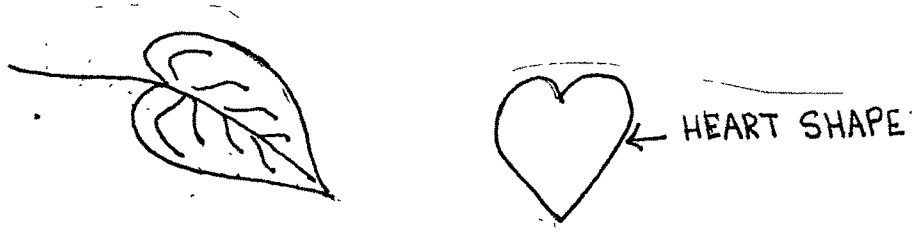
'Q'

Look at these leaves, leaf I and leaf J. Leaf I is oval in shape whereas leaf J is round.

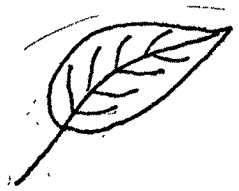


Look at these two leaves, leaf P and leaf Q. Mention their shape.

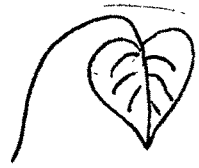
Look at this leaf. It is heart shaped.



Look at the leaves B and C. State which has heart shape.

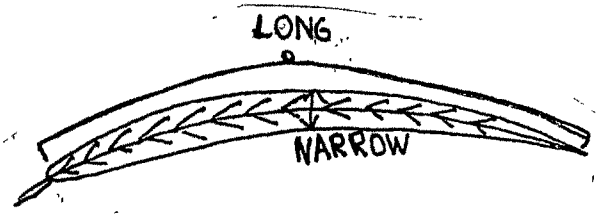


'B'



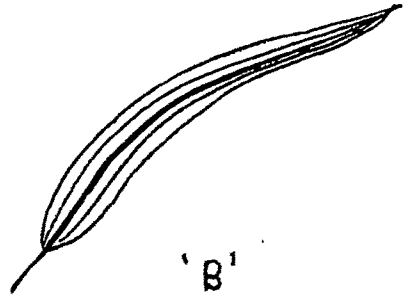
'C'

Look at this leaf. It is narrow and long.



Look at these leaves A & B. State which leaf is both long and narrow.

'A'



'B'

5.4.11 Instructional Objective.11

Stipules - their location

(i) P.L.M. (Deviated form)

Section A

In plants like hibiscus (shoe-flower) and jasud just near the leaf base there are small green out growths. These are called the stipules.

Fill in the blanks :

1. The small green out growths just near the leaf base are called _____.
2. The small green out growths just near the _____ _____ are called stipules.

Turn to Section B

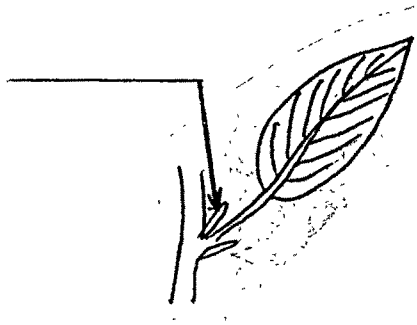
Section B

Point out the stipules in this figure.

Turn to Section C

Section C

Name the part that has been pointed out in the figure.



(ii) Oral Verbal Elaboration

Teacher (investigator) takes a shoeflower and points out to the green outgrowths near the leaf base and states "Look at these small green outgrowths (things) near the leaf base. They are called the stipules."

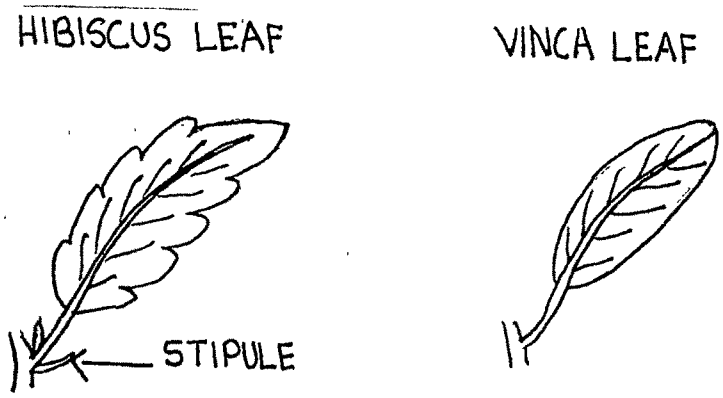
5.4.12 Instructional Objective.12

Stipules-their presence in only some plants

P.L.M. (Deviated form)

Section A

In the plant of hibiscus (Shoeflower) there are small green out growths near the leaf base. These are called the stipules. However, in the plant of Vinca (Sadabahar) there are no stipules present near the leaf base.



Turn to Section B

Section B

Leaves have been provided to you in packet 12. Pick out those which have stipules and place them in packet 12.

(ii) Oral Verbal Elaboration

Teacher (investigator) shows four leaves. Two with stipules and two without stipules and states "Look at these four leaves. Two of them have stipules and two of them do not have stipules. Some plants have stipules and some do not have stipules."

5.4.13 Instructional Objective.13

Types of leaves

(i) P.L.M. (Deviated form)

Section A

There are two types of leaves. They are the simple leaf and the compound leaf.

Fill in the blanks :

1. There are _____ types of leaves.
2. The two types of leaves are the _____ leaf and the compound leaf.
3. The two types of leaves are the simple leaf and the _____ leaf.
4. The two types of leaves are the _____ leaf and the _____ leaf.

Turn to Section B

Section B

How many types of leaves are there?

_____

Name these types of leaves.

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "All the leaves are divided into two main types. Those leaves whose lamina are undivided and those leaves whose lamina are divided. The former leaves are called simple leaves and the latter are called compound leaves."

5.4.14 Instructional Objective.14

Difference between simple leaf and compound leaf

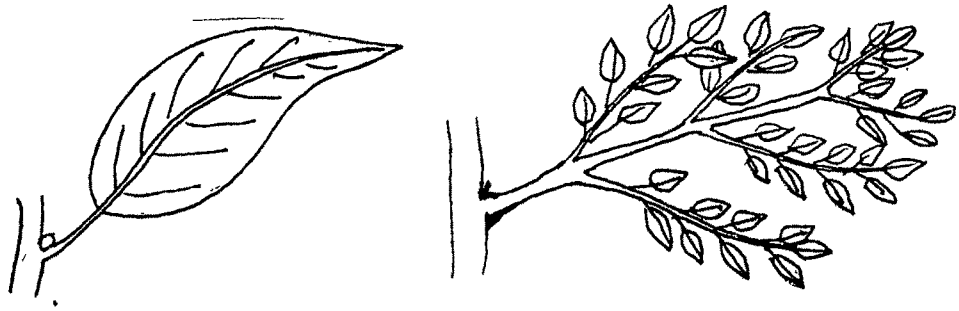
(i) P.L.M. (Deviated form)

Section A

In leaves of jasud, banyan, cotton and peepal plants, the lamina is undivided. Generally in them the margin is entire. Eventhough the margin of cotton leaf has incisions, the lamina is not divided into separate parts.

In plants like rose, gold mohur, (Gulmohr), neem the lamina is divided into small separate parts. Each part is called a leaflet. Such a leaf is called a compound leaf.

There is a terminal bud at the apex of a branch having simple leaf and an axillary bud in the axil of each leaf. But there is no terminal bud at the apex of a compound leaf nor are there any axillary bud in the axils of leaflets.



Fill in the blank :

1. In the _____ leaf, the lamina is divided into leaflets.
2. In the _____ leaf, the lamina is undivided.
3. There is a terminal bud at the apex of a branch having _____ leaf.
4. There is no terminal bud at the apex of a _____ leaf.
5. There is an axillary bud in the axil of a _____ leaf.
6. There is no axillary bud in the axil of a _____ leaf.

Turn to Section B

Section B

Write down the differences between the simple and compound leaf.

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The lamina in the simple leaf is undivided. Generally the margin is entire. Some leaves have incisions in their margin but the lamina is not divided into separate parts. Such type of leaves are called simple leaves. The lamina in the compound leaf is divided into small separate parts. Each part is called a leaflet."

Teacher shows the compound leaf and states "Look at the leaflets of this compound leaf."

Teacher states "Since the terminal bud is found in the apex of a leaf and axillary bud is found in the axil of the leaf, the branch of a simple leaf has a terminal bud at its apex and the axillary bud in the axil of its leaf.

Teacher shows the terminal bud and axillary bud of a simple leaf and states "Look at the terminal bud and axillary bud in this simple leaf."

Teacher shows a compound leaf and states "Look at this compound leaf. There is no terminal bud at the apex of a compound leaf nor is there an axillary bud in the axil of its leaflet."

Teacher states "Thus we can see how these two types of leaves differ from each other."

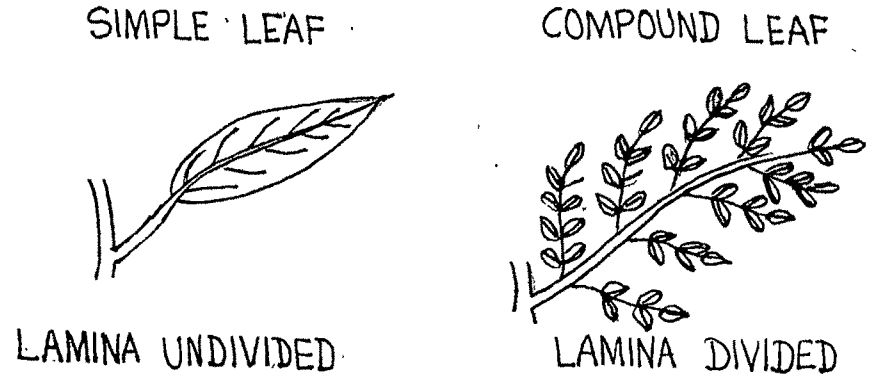
5.4.15 Instructional Objective.15

Difference between simple leaf and compound leaf

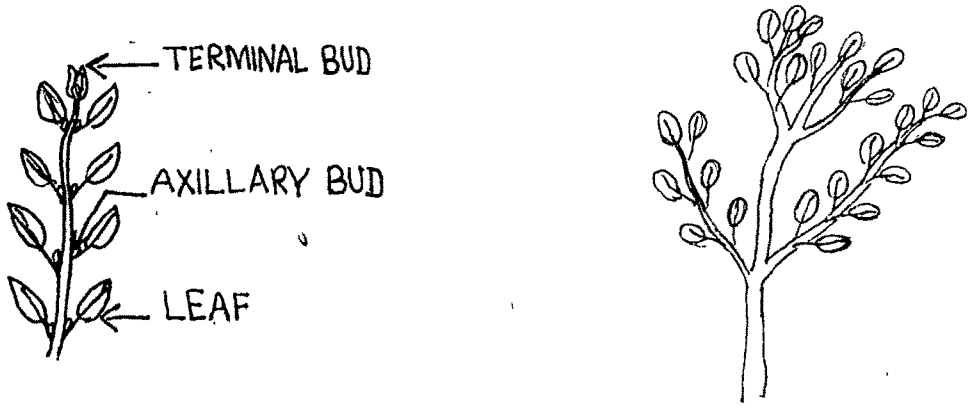
(i) P.L.M. (Deviated form)

Section A

In the simple leaves, the lamina is undivided. In the compound leaves, the lamina is divided into leaflets.



The branch having a simple leaf has the terminal bud at its apex. There is no terminal bud at the apex of the branch bearing the leaflets of a compound leaf. In the axil of a simple leaf, the axillary bud is found. There are no axillary buds in the axils of leaflets of a compound leaf.

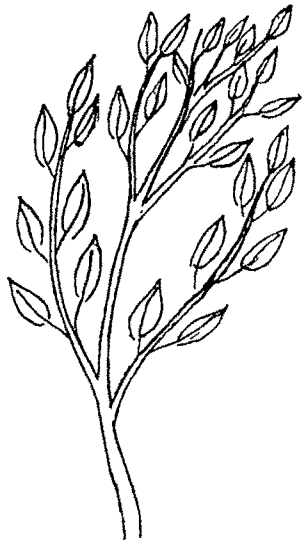


Turn to Section B

Section B

Figures of leaves have been given below. Tick mark (✓) the compound leaves

( )



( )

( )

(ii) Oral Verbal Elaboration

Teacher (investigator) states "We can classify the leaves into simple leaves and compound leaves by observing the following differences among them. The lamina in the simple leaf is undivided. Generally the margin is entire. Some leaves have incisions in their margin but the lamina is not divided into separate parts. These leaves are also simple leaves. The lamina in the compound leaf is divided into small separate parts. Each part is called a leaflet."

Teacher shows the terminal bud and axillary bud on the branch of a simple leaf and states "Look at the terminal bud at the apex of the branch of this simple leaf Look at the axillary bud at the axil of the leaf."

Teacher shows the compound leaf and states "Look at the apex of the compound leaf. It has no terminal bud. Look at the axil of the leaflet of a compound leaf. There is no axillary bud in its axil."

5.4.16 Instructional Objective.16

Functions of the leaf

(i) P.L.M. (Deviated form)

Section A

The three basic functions of the leaf are photosynthesis, respiration and transpiration.

Fill in the blanks :

1. The three basic functions of the leaf are _____, respiration and transpiration.
2. The three basic functions of the leaf are photosynthesis, respiration and _____.

3. The three basic functions of the leaf are _____, transpiration and photosynthesis.

4. The three basic functions of the leaf are respiration, _____ and _____.

5. The three basic functions of the leaf are photosynthesis, _____ and _____.

6. The three basic functions of the leaf are transpiration, _____and _____.

7. The three basic functions of the leaf are _____, _____ and _____.

8. The three _____functions of the leaf are photosynthesis, respiration and transpiration.

Turn to Section B

Section B

State the basic functions of the leaf.

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "Generally the leaves of all the plants perform certain functions for the plant. They help the plant to prepare its food and the process by which they prepare the food is called photosynthesis. They also help the plant to respire and this process is called respiration. Sometimes the roots absorb excessive water which is not needed by the plants. These leaves play a function here too. They help in eliminating this excessive water and this process of giving out extra water is called transpiration. Thus we can see that the basic functions of the leaf are photosynthesis, respiration and transpiration."

5.4.17 Instructional Objective.17

Photosynthesis - Definition

(i) P.L.M. (Deviated form)

Section A

The process by which the leaf prepares the food for the plant is called photosynthesis.

Fill in the blanks :

1. The process by which the leaf prepares _____ for the plant is called photosynthesis.
2. The process by which the leaf prepares food for the plant is called _____.

Turn to Section B

Section B

What is photosynthesis?

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaf prepares the food for the plant with the help of chlorophyll in the presence of sunlight, corbondioxide and water. The process by which the leaf prepares the food is called photosynthesis."

5.4.18 Instructional Objective.18

Conditions necessary for photosynthesis

(i) P.L.M. (Deviated form)

Section A

The plants can prepare food only under the following conditions. The plant should contain a green coloured substance called chlorophyll. Therefore it is essential that the plant has leaves which are green in colour as the leaves prepare the food.

The sunlight should be available to the leaves as photosynthesis takes place only in sunlight. Water and Carbondioxide are also essential for the production of food.

Thus plants require carbondioxide, chlorophyll, sunlight and water for the production of food. All these form the conditions under which the plant prepares food.

Fill in the blanks :

1. Plants require sunlight, _____, chlorophyll and water for production of food.
2. Plants require _____, carbondioxide, sunlight and water for production of food.
3. Plants require chlorophyll, _____, water and carbondioxide for production of food.
4. Plants require chlorophyll, carbondioxide, sunlight and _____for production of food.
5. Plants require _____ , _____, sunlight and water for production of food.
6. Plants require sunlight, _____, _____ and carbondioxide for production of food.

7. Plants require sunlight, _____ , _____ and chlorophyll for production of food.

8. Plants require water, carbondioxide _____ and _____for production of food.

9. Plants require water, chlorophyll, _____ and _____for production of food.

10. Plants require carbondioxide, chlorophyll, _____ and _____ for production of food.

11. Plants require chlorophyll, _____, _____ and _____ for production of food.

12. Plants require sunlight, _____ , _____ and _____for production of food.

13. Plants require water, _____, _____ and _____for production of food.

14. Plants require carbondioxide, _____, _____and _____for production of food.

15. Plants require _____, _____ and _____for production of food.

Turn to Section B

Section B

Name the conditions under which the plant can prepare food.

_____

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaf requires water, carbondioxide, chlorophyll and sunlight for carrying out photosynthesis."

5.4.19 Instructional Objective.19

Products of Photosynthesis

(i) P.L.M. (Deviated form)

Section A

During photosynthesis, starch is prepared and oxygen is produced during this process. Therefore the products of photosynthesis are starch and oxygen.

Fill in the blanks :

1. The products of photosynthesis are _____ and oxygen.
2. The products of photosynthesis are _____ and starch.
3. The _____ of photosynthesis are oxygen and starch.
4. The products of _____ are oxygen and starch.

Turn to Section B

Section B

Name the products of photosynthesis.

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "Photosynthesis goes on continuously and during this process starch (food) is prepared by the leaf. Besides starch, oxygen is also released as an additional product. Thus the products of photosynthesis are starch and oxygen."

5.4.17/18/19 Instructional Objective.17, 18 & 19

Drill exercise for use of certain terms

Conditions, Process, Product and Function

When you prepare 'nescafe' coffee, you mix sugar, coffee, hot water and milk. Without these substances you cannot make your coffee. These substances form the conditions that are necessary to prepare coffee. Thus water is boiled, sugar, coffee and milk are added. This is the process by which coffee is prepared. Coffee is the product formed.

When you prepare curds, you put a tablespoon of curds into a glass of milk and keep it for 5-6 hours. Thus a little curd and some milk are conditions necessary for preparing the curds. The process occurs when the two are mixed and kept for 5-6 hours. During this process the milk is converted to curds. Curds forms the product.

Function

You may be performing some functions at home like dusting the furniture, sweeping etc. In the same way the leaf also performs some functions for the plant. Thus it helps the plant.

5.4.20 Instructional Objective.20

Definition of Transpiration

(i) P.L.M. (Deviated form)

Section A

The extra water absorbed by the roots from the soil is given out in the atmosphere by plants through the leaves in the form of water vapour. This water varpour is given out through pores present on the surface of the leaves. This process is called transpiration.

Thus the process by which the plant gives out excessive water is called transpiration.

Fill in the blanks :

1. During _____ the plant gives out excessive water.
2. The excessive water is given out through the _____ of the leaf.
3. _____ is given out during transpiration.
4. The excessive water is given out by the leaves in the form of _____.

State whether True or False

1. The excessive water is given out in the soil through the roots. ( )
2. The excessive water is given out in the atmosphere through the leaves ( )

Turn to Section B

Section B

What is transpiration?

(ii) Oral Verbal Elaboration

Teacher (investigator) states "Sometimes the roots absorb more water from the soil. The plants give out this water through the leaves in the form of water vapour."

5.4.21 Instructional Objective.21

Effect of transpiration on the surrounding

P.L.M. (Deviated form)

Section A

During transpiration water is given out by leaves into the atmosphere. This water is in the form of water vapour. Since it is in the gaseous state, this water remains in the atmosphere and cools it. We are surrounded by the atmosphere hence the water vapour present in our atmosphere cools our surrounding. Thus we can say that transpiration causes cooling in its surroundings.

Fill in the blanks :

1. _____ has a cooling effect on the surroundings.

2. During transpiration the water which is given out in the atmosphere _____ the surrounding.

Turn to Section B

Section B

What is the effect of transpiration in the surrounding?

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "During transpiration, water vapour is given out in the atmosphere by the leaves. This water cools the surrounding. Thus transpiration causes cooling."

5.4.22 Instructional Objective.22

Region of transpiration

(i) P.L.M. (Deviated form)

Section A

The surface of the leaves have small pores. The leaves give out the water through these pores. The water is given out in the form of water vapour.

Fill in the blanks :

1. Water vapour is given out through the _____ of the leaves.
2. During transpiration _____ _____is given out through the pores of the leaves.

Turn to Section B

Section B

Tick mark (_/_) the most appropriate answer.

1. The water vapour is given out through the margin of the leaf. ( )
2. The water vapour is given out through the apex of the leaf. ( )
3. The water vapour is given out through the lamina of the leaf. ( )
4. The water vapour is given out through the pores of the leaf. ( )

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaves have very small pores on their surface. During transpiration, water vapour is given out through these pores."

5.4.23 Instructional Objective.23

Relationship between number of leaves and rate of transpiration

(i) P.L.M. (Deviated form)

Section A

Transpiration takes place through the pores of the leaves.If fhe number of leaves are more, the amount of transpiration also increases. Thus transpiration in a plant depends upon the number of leaves the plant possesses.

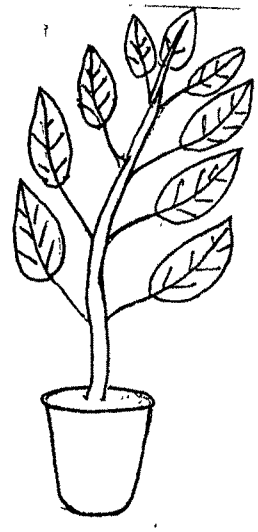
Fill in the blanks :

1. Transpiration _____upon the number of leaves present.
2. The greater the number of leaves, the _____ is the rate of transpiration.

Turn to Section B

Section B

Among the figures of plants drawn, tick mark (✓) the plant that would transpire more.



(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaves have very small pores through which transpiration occurs. If a plant has more leaves, the amount of transpiration is also more. Thus the rate of transpiration depends upon the number of leaves."

5.4.24 Instructional Objective.24

Respiration - Description of this process

(i) P.L.M. (Deviated form)

Section A

The plant respires through the pores in the leaves. The atmospheric air enters the leaves through these pores and is conveyed to the various parts of the plant. The cells of the plants use the oxygen of the air and release carbondioxide through the pores of the leaves. Thus during respiration the cells of the leaves absorb oxygen and give out carbondioxide.

Fill in the blanks :

1. During respiration, _____ is absorbed by the cells of leaves and carbondioxide is given out.
2. During respiration, _____ is given out by the cells of leaves.
3. During _____, oxygen is absorbed by the cells of leaves and carbondioxide is given out.
4. Respiration takes place through the _____ of the leaves.
5. During respiration, the leaves convey the oxygen to _____ of the plant.
6. The _____ of the plant use oxygen and release carbondioxide.

Turn to Section B

Section B

Explain how respiration take place in plants.

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaves have small pores on its surface. The atmospheric air enters the leaves through these pores and is then sent to the other parts of the plant. The cells of the plants use the oxygen of the air and release carbondioxide. This carbondioxide is passed to the leaves from where it is given out through the pores in the leaves. In this way, respiration takes place in plants."

5.4.25 Instructional Objective.25

Respiration - Description of this process

(i) P.L.M.(Deviated form)

Section A

During respiration, the cells of the plant absorb oxygen and release carbondioxide. The carbondioxide is then given out into the atmosphere through the leaves.

Fill in the blanks :

1. During respiration, _____ is given out by the plant.
2. During _____, carbondioxide is given out by the plant.
3. During respiration, carbondioxide is _____ _____ by the plant.

Turn to Section B

Section B

Fill in the blank :

_____is given out by the plant during respiration.

(ii) Oral Verbal Elaboration

Teacher (investigator) states "During respiration the cells of the plant release carbondioxide."

5.4.26 Instructional Objective.26

Respiration - Description of this process

(i) P.L.M. (Deviated form)

Section A

The oxygen from the atmosphere is absorbed by the leaves through the pores present on its surface. This oxygen is then passed to the various cells of the plant. These cells give out carbondioxide which is passed to the leaves. The leaves in turn give out the carbondioxide into the atmosphere through the pores present on their surface. Thus it can be clearly seen that plants respire through their leaves.

Fill in the blank :

Plant respire through their _____.

Turn to Section B

Section B

Fill in the blank :

Plants respire through their _____.

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaves have small pores on its surface. During respiration, the oxygen is taken in and carbondioxide is given out through these pores. Thus respiration takes place through the leaves of the plants."

5.4.27 Instructional Objective.27

Leaves - Food producing centre for plants

(i) P.L.M. (Deviated form)

Section A

The leaves absorb energy from sunlight with the help of chlorophyll. The leaves absorb carbondioxide through the pores present on their surface. The leaves prepare starch (food) with the help of chlorophyll in the presence of sunlight, carbondioxide and water. Since the leaf of the plant prepares the food for the entire plant it is called as the food producing centre or the kitchen of the plant.

Fill in the blanks :

1. The _____ of the plant prepares food for the plant.
2. Since the leaf _____ the food for the plant, it is called the kitchen of the plant.

Turn to Section B

Section B

Why is the leaf called the food producing centre of the plant?

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "The leaves of the plant trap in energy from the sunlight with the help of chlorophyll (green coloured pigment) that is present in

it. The carbondioxide from the air is also taken in through the pores of the leaves. The water that is absorbed by the roots is sent to the leaves. The leaves with the help of chlorophyll utilise the energy of the sunlight, water and carbondioxide for preparing starch (food). Since the starch is prepared in the leaves, the leaves are called as the food producing centres."

5.4.28 Instructional Objective.28

Non-occurence of photosynthesis in darkness

(i) P.L.M. (Deviated form)

Section A

During photosynthesis, energy of sunlight is trapped by the chlorophyll of the leaf in order to use it for preparing starch. Without sunlight, photosynthesis cannot take place. Therefore, photosynthesis does not occur in darkness.

Fill in the blanks :

1. Photosynthesis require _____.
2. _____ takes place only in the presence of sunlight.
3. During photosynthesis the chlorophyll of the leaves _____ _____of sunlight.

Turn to Section B

Section B

Why does photosynthesis not occur in darkness?

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "In order to prepare starch, one of the essential substances needed is the energy of the sunlight. Since photosynthesis is the process by which starch is prepared, it cannot occur without sunlight. Therefore photosynthesis cannot take place in darkness."

5.4.29 Instructional Objective.29

Presence of Chlorophyll in leaves

(i) P.L.M. (Deviated form)

Section A

The leaves contain a green coloured substance called chlorophyll and hence they are green in colour.

Fill in the blanks :

1. The leaves are green in colour due to the presence of _____.
2. Chlorophyll is _____in colour.

Turn to Section B

Section B

Why are the leaves green in colour?

_____

_____

_____

(ii) Oral Verbal Elaboration

Teacher (investigator) states "Leaves contain a green coloured pigment called chlorophyll and therefore they are green in colour."

5.5 ENRICHMENT ACTIVITIES

I. Prepare an album of pressed specimens of

1. Typical leaf
2. Leaf without petiole.
3. Leaf showing reticulate arrangement of veins.
4. Leaf showing parallel arrangement of veins.
5. Leaf having simple entire margin.
6. Leaf having wavy margin.
7. Leaf having serrate margin.
8. Leaf having spiny margin.
9. Leaf having round apex.
10. Leaf having pointed apex.
11. Leaf having spiny apex.
12. Leaf having tendrillar apex.
13. Leaf that is narrow and long in shape.
14. Leaf that is narrow at the ends and broad in the middle.
15. Leaf that is oval.
16. Leaf that is round.
17. Leaf that is heart shaped.
18. Leaf with the stipule.
19. Simple leaf.
20. Compound leaf.

N.B. Label what each of them display.

II. Carry out the following experiment at home:

Experiment :

Take a jam bottle. Pour water in the bottle. You must have noticed a cover between the lid and the bottle. If there is no cover then you can cut out a cardboard and make a cover for this bottle. Now make a small hole in this cover and pass a small plant through this hole. Seal this hole with gummed paper. Apply vaseline

to the cover on both the sides and around the stem to make sure it is airtight. Now invert carefully a dry jam bottle over the cover so that it encloses the leaves of the plant. Observe this inverted jar after some hours. Note down what you observe.

Reading Material

I. Parts of a Leaf

A. A leaf has three parts : the lamina, petiole and the leaf base.

1) The lamina is the flat, thin, green part of the leaf.

2) The petiole is the stalk of the leaf, and is attached to the stem of the plant at a node.

3) The leaf is attached to the stem at the node. This region of the leaf which attaches to the stem is the leaf base.

B. The lamina of the leaf has veins in it.

1) The veins are tiny, hollow tubes that carry water, dissolved minerals, and food between the leaf and the stem.

2) The veins also help to strengthen the leaf and make it firm.

3) Leaves that do not have a petiole (stalk) are fastened directly to the stem by the veins.

II. Kinds of Leaves

C. If the lamina of a leaf is all in one piece, it is called a simple leaf.

1) It is still a simple leaf, even if the leaf is lobed or greatly indented.

2) Mango, Guava (Amrut), Hibiscus (Shoe-flower) and Tulsi plants have simple leaves.

D. If the lamina of the leaf is divided into three or more separate parts, called leaflets, the leaf is called a compound leaf.

1) Tamarind, Drumstick (Sainjna), Gold Mohur (Gulmohr) and Rose leaves are compound leaves.

III. The Leaf and Photosynthesis

A. The main function of the leaf is to make food for the plant.

B. Only green plants are able to make their own food.

1) Green plants have a green material in the leaf, called chlorophyll.

2) Chlorophyll gives the leaf its green colour.

3) Chlorophyll also makes it possible for the leaf to make food for the plant.

4) This food making process in the plant is called photosynthesis.

(a) "Photo" means "light"
(b) "Synthesis" means "putting together."

5) Green stems that have chlorophyll in them can also make food for the plant.

IV. The Leaf and Transpiration

A. Although the plant needs water to make food and for other uses, the plant usually takes in more water than it needs.

B. The excess water passes through the stomata (pores/ small openings in the leaf) into air as water vapour.

1) This evaporation of water from the plant is called transpiration.

2) The amount of water that a plant gives off by transpiration is very great.

C. Although transpiration takes place mostly in the leaves, other parts of the plant can allow transpiration to take place as well.

V. Some leaves change colour in the fall

A. During the late spring and summer the leaves keep making chlorophyll and stay green.

B. In the fall, when it becomes cold enough, the leaves stop making chlorophyll and the green colour in the leaves disappears.

C. The hidden yellow and orange colours in some of the leaves now begin to appear.

D. The cool weather and the increase in the amount of moisture in the air also produce red colour in other leaves.

E. When the weather become still colder, the leaves die and turn brown, and then fall to the ground.

VI. Respiration in plants

A. Plants, as well as animals need energy to live.

B. They get this energy by using oxygen from the air to burn the food they have made and stored.

1) The air enters the plants chiefly through the small openings (stomata) in the leaves.

2) The oxygen combines with the food to form carbondioxide and water, and at the same time energy is set free.

3) The carbon dioxide and water are waste products and pass off into the air through the stomata.

C. This energy-freeing process is called respiration.

D. Photosynthesis and respiration are quite different from each other.

1) Photosynthesis is a food-making process; respiration is a food-using process.

2) Photosynthesis stores energy; respiration sets energy free.

3) Photosynthesis uses carbon dioxide from the air and gives off oxygen; respiration uses oxygen from the air and gives off carbondioxide.

4) Photosynthesis takes place only in cells that have chlorophyll in them; respiration takes place in all cells.

5) Photosynthesis goes on only in sunlight; respiration goes on day and night.

5.6 FINAL EVALUATION

1. a. In packet 1.a., you are supplied with an adhesive tape and a shoot of a plant. Observe it carefully. Stick the tape around the small leaves surrounding the terminal bud. Then place the shoot in the same packet.

b. What is the function of these small leaves?

_____

_____

c. When the terminal bud opens, what happens to these leaves ?

_____

_____

2. In packet 2, you are supplied with a shoot of a plant and three adhesive tapes coloured black, red and green. Observe it carefully. Stick each of the tapes on each of the three parts of the leaf. Name the part of the leaf on which the (a) Black tape is stuck, (b) Red tape is stuck (c) Green tape is stuck. Then place the shoot in the same packet.

   a. The part of the leaf on which the black tape is stuck is the _____.

   b. The part of the leaf on which the red tape is stuck is the _____.

   c. The part of the leaf on which the green tape is stuck is the _____.

3. Fill in the blanks :

   a. The part which joins the leaf to the stem is called _____.

   b. _____ supports the leaf.

   c. _____ is the main part of the leaf for photosynthesis and respiration.

4. In packet 4, some of the leaves have petioles and some have no petioles. Pick out the leaves which have petioles and place them in packet 4.a, and pick out the leaves which do not have petioles and place them in packet 4.b.

5. In packet 5, you are supplied with a leaf and an adhesive tape. Observe the different parts of the leaf carefully. Stick the tape on that part of the leaf where small pores are present. Name this part of the leaf. Then place this leaf in the same packet.

   a. This part of the leaf is called the _____.

b. Mention the function of these pores.

_____

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_____

6. a. Look at the leaf in packet 6.a. . Name the part which is marked.

The part which is marked is _____

b. Look at the leaf in packet 6.b. Name the part which is marked.

The part which is marked is _____

7. Leaves have been placed on table . Name the arrangement of veins in 7.a. Leaf, 7.b. Leaf, 7.c. Leaf and 7.d. Leaf.

The arrangement of veins in 7.a. leaf is _____

The arrangement of veins in 7.b. leaf is _____

The arrangement of veins in 7.c. leaf is _____

The arrangement of veins in 7.d. leaf is _____

8. In packet 8, leaves having different types of margins have been supplied to you. Packet 8.a., 8.b., 8.c., 8.d., are also supplied. Classify the leaves according to their margins. Place each type in a separate packet and label the type of margin the leaves in that packet have.

9. In packet 9, leaves having different types of apex have been supplied to you along with packet 9.a., 9.b., 9.c., 9.d., 9.e., Classify the leaves according to their apex. Place each type in a separate packet. Label the type of apex, the leaves in that packet have.

10. In packet 10, leaves having different types of shape have been supplied to you along with packets 10.a., 10.b., 10.c., and 10.d., Classify the leaves according to their shape. Place each type in a separate packet and label the type of shape the leaves in that packet have.

11. In packet 11, a leaf and an adhesive tape has been supplied to you. Stick the tape on the stipule and then place this leaf in the same packet.

12. Leaves are supplied to you in packet 12, along with two other packets 12.a, and 12.b., Put the leaves with stipules in packet 12 and the leaves without stipules in packet 12.b.

13. Leaves are supplied to you in packet 13 along with two other packets 13.a, and 13.b., Classify the leaves into two types. Place each type in a separate packet and label the packet by the type of leaves it contains.

14. Write down two points of differences between these two types of leaves.

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15. State the three basic functions of the leaf.

16. What is photosynthesis?

17. What are the conditions necessary for the production of food by green coloured plants?

18. Name the products of photosynthesis.

19. What is transpiration?

20. It is cooler in jungles where plenty of leafy trees are present as compared to the city where less trees are present. Give reason.

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_____

21. Tick mark (✓) the most appropriate answer.

The excess of water present in the plants is given out through the

a) veins of the leaves ( )
b) margin of the leaves ( )
c) pores of the leaves ( )

22. Look at both the plants 22.a, and 22.b, on table Which of these would show more transpiration?

_____plant would show more transpiration.

Give reason why it would show more transpiration.

_____

_____

_____

23. What is respiration ?

_____

_____

_____

24. Fill in the blank :

_____is given out through respiration by plants.

25. Fill in the blank :

Plants respire through the _____ of the leaves.

26. Why is the leaf called the food producing centre of the plant ?

_____

_____

_____

27. Why photosynthesis cannot take place in the dark?

_____

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28. Why are leaves green in colour.

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