Chapter 2

Plant Tissues

I7A4S5

You have already learnt about different cell organelles and their functions in the previous chapter ***"Cell - Structure and Functions".*** In unicellular organisms, a single cell performs all the functions. But in multi-cellular organisms there are numerous cells, performing various functions.

Plants that we observe around us are usually multi-cellular. They perform several life processes such as growth, respiration, excretion, etc, similar to those performed by animals. In addition to these they can perform photosynthesis and prepare food not only for themselves but also for all the other living organisms dependent on them, either directly or indirectly.

Let us recall the information about different parts of the plants and the functions they are associated with.

Activity-1

Parts of the plant and their functions.

We have studied about the functions of the parts of the plant in the earlier classes. Read the functions given below and write the names of the parts involved in performing the respective function.

S.No	Function	Name of the parts
1	Absorption of water from soil	
2	Exchange of gases (air)	
3	Photosynthesis	
4	Transpiration	
5	Reproduction	

- How can the plants perform all the life processes?
- Is there any specific arrangement of cells in the plants that help in carrying out these processes?

Let us try to find out more about the arrangements of cells in the plants and their functions by the following activities. You have observed the check cells in Class VIII.

Do the following activities once again with the help of your teacher.

Activity-2

Cells in onion peel

- Take a piece of an onion peel.
- Now place it on the slide.
- Put a drop of water and then a drop of glycerine on it.

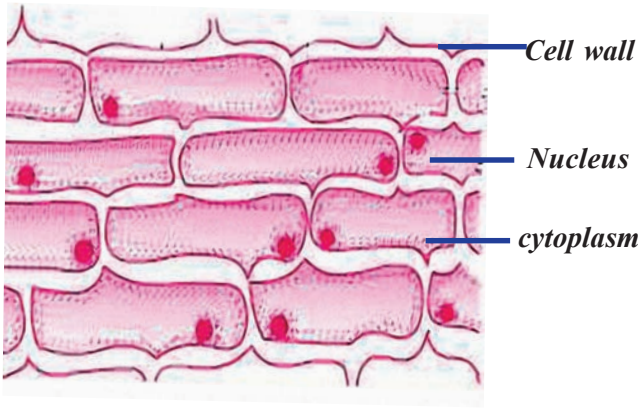


Fig-1 : Onion peel

- Gently cover it with a cover -slip.
- Observe it under the microscope.
- Draw and label the diagram that you have observed under the microscope.

Compare your drawing with figure-1 to find out labelled parts.

- Are all the cells similar?
- How are the cells arranged?

Activity-3

Cells in a leaf peel.

- Take a betel leaf or *Tradescantia* or *Rheo* leaf.
- Tear it with a single stroke. So that a thin edge be seen at the torn end.
- Observe the thin edge where the leaf has been torn under the microscope in the same manner as you had observed the onion peel.

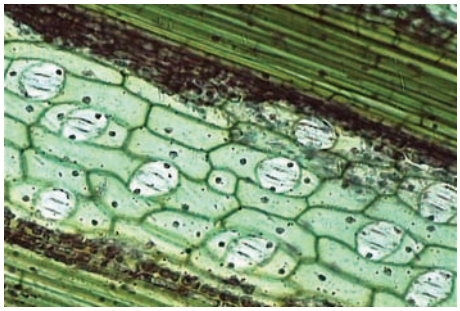


Fig-2 : Betel leaf peel

Draw a diagram of what you have observed and compare it with figure-2.

- Are all the cells similar?
- Is there any difference in their arrangement?
- What can we infer from the above activities?
- Have you noticed that the cells are in groups in both the activities?
- Compare and write a note on the arrangements of the cells that you have observed in both of the activities.

You may have observed that the cells are present in groups with certain arrangement. With the help of the following activities we shall try to find out whether these arrangements have special roles to play in the plant body.

Activity-4

(a) Cells in root tip

- Are the cells in the root similar to that of a leaf. Let us find out how the cells are arranged in the root. For this we need onion root tips.

- Take a transparent (plastic/glass) bottle filled with water. Take an onion bulb slightly larger than the mouth of the bottle.
- Put the onion bulb on the mouth of the bottle as shown in the Fig-3.

Fig-3 : Onion roots

- Observe the growth of roots for a few days till they grow to nearly an inch.
- Take the onion out and cut some of the root tips.
- Take an onion root tip.
- Place it on the slide.
- Put a drop of water and then a drop of glycerine on it.
- Cover it with a cover-slip.
- Remove excess water with the help of blotting paper.
- Tap the cover-slip gently and press with the blunt end of the needle or brush to spread the material.
- Observe the structure and arrangement of the cells.
- Draw the diagram of that you have observed under the microscope.

· Are all the cells similar?

· How is the arrangement of cells?

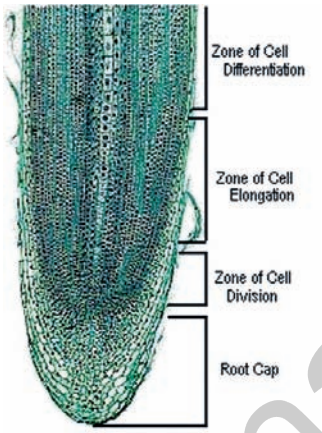


Fig-4 : Cells in an Onion Root Tip

Activity-5

(b) Growing roots

- Take the onion used in the previous activity and mark the cut end of the roots with a permanent marker.
- Put the onion bulb on the mouth of the bottle in the same way as you did in the previous activity.
- Leave the set up aside for at least four to five days. Take care that there is enough water in the glass so that the roots are submerged.

- Did all the roots grow in a same manner?
- What happened to the roots which had been cut off ?
- Write down your findings, regarding the cut roots and those that were not?

We observe that by removing the tip of the onion root, having a particular arrangement of cells, the growth of the root in length is stopped.

You have observed that cells are present in groups. Cells in groups which are nearly similar in structure perform similar functions. Such groups of cells are called tissues.

Fig-5 : Growth of roots in onion bulb

One day Haritha went to a park with Latha. There she saw a gardener cutting the tips of the plants with a cutter. She had a doubt and asked the gardener to clear it.

Let us read the conversation

"How do the plants grow if the tips have been cut off?"

He said "Branches will grow from the sides".

Later she saw another gardener, watering a stump. She went there and asked.

"Why are you watering the stump?"

"The stump will soon bear leaves" He said

Haritha had a question in her mind, "How will the leaves come?" Do you know the answer?

Now we will study about those tissues that bring about growth, repair and other functions in a plant body.

Types of plant tissues.

There are four basic types of tissues in the plants. They are :

1. Tissues that bring about overall growth and repair are called **Meristematic tissues**.
2. Tissues that form outer coverings are called as **Dermal tissues.**
3. Tissues that form the bulk of the plant body, helping in packing other tissues are called as **Ground tissue**s.
4. Tissues that help in transport of materials are called as **Vascular tissues**.

You have already observed some types of tissues. To observe various types of plant tissues we need to know some techniques for preparing slides and cutting sections. (See annexure for the same).

1. Meristematic tissues

Observe the given figure of a stained section of a shoot tip.

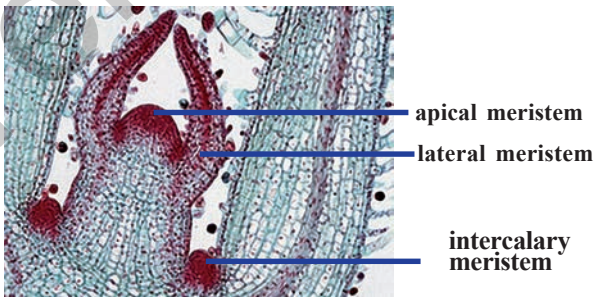


Fig-6 : L.S. of a Shoot tip

From the above figure you can infer that meristematic tissues are present on the tip, sides and in between layers of other tissues. Meristematic tissues at the growing tip that bring about growth in length are called as **apical meristematic** tissues.

Tissues present around the edges in a lateral manner and giving rise to growth in the girth of stem are called **lateral meristematic** tissues (also called Cambium).

Areas from which branching takes place or a leaf or a flower stalk grows, we find a kind of meristematic tissue called **intercalary meristematic** tissue.

We had already observed the tissues present in the root tip in earlier activities.

Can we find the above tissues in the root tip as well?

Activity-6

Comparison of Meristematic tissue in root and shoot tips:

Carefully observe the figures of root tip and shoot tip. Do you find any similarities or differences between the two? Note down your observations in the following table-2

Table -2

Arrangement of the cells (Tissues)	Shoot tip	Root tip
At the tip At the lateral sides At the point of branching		

From all this we can conclude that different types of meristematic tissues are present both in the root tip and shoot tip.

Cells in the meristematic tissues are

- Small and have thin cell wall.
- Living with prominent nucleus and abundant cytoplasm.
- Compactly arranged without intercellular spaces.
- Continuously dividing cells.

Let us learn about the other types of tissues.

Activity-7

Dicot Stem tissues

- Prepare a temporary mount of the Transverse Section (TS) of a dicot stem.
- Observe it under the microscope.
- Draw and label the diagram.
- Compare it with figure given below

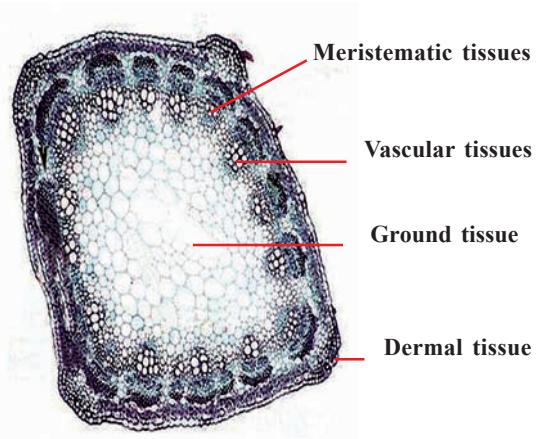


Fig-7 : Dicot stem (TS) - Tissues

- What are the similarities between the tissues in root and in shoot as shown in the above figure?
- Are all the cells similar in shape and structure?

- How many types of arrangement of cells (in the form of tissues) could you see in the given figure?

You have already studied about the meristematic tissues. The other major groups that we shall study now are dermal tissue, ground tissue and vascular tissue. These develop from the cells of the meristematic tissues during the growth and repair of the plants parts.

2. Dermal Tissue

- What kind of arrangements do you observe in the outer layer of the TS of stem?

We can find the dermal tissue over the entire surface of the plant body.

We will do the following activity to observe the dermal tissue more closely.

Activity-8

Rheo leaf - Dermal tissue.

- Take a fresh leaf of *Rheo* or Betel plant
- Tear it in a single stroke, so that a thin whitish edge can be seen at the torn end.
- Slowly remove it and observe that peel under the microscope (by preparing a temporary mount).

See the arrangement of cells .Are all cells similar? Are there any spaces between the cells?

This activity shows a part of the dermal tissue of the plants.

Dermal tissue usually consists of a single layer of cells showing variations in the types of cells on the basis of their functions and location. These tissues are divided into three different types. They are epidermis (outer most layer), stomatal gaurd cells and epidermal hairs.

The walls of the cells of dermal tissue are comparatively thicker than the cells of meristematic tissues. In desert plants it may be even more thick and waxy. Small pores are seen in the epidermis of the leaf, called stomata. They are enclosed by two kidney shaped cells, called guard cells. Cells of the roots have long-hair like parts, called root hair.

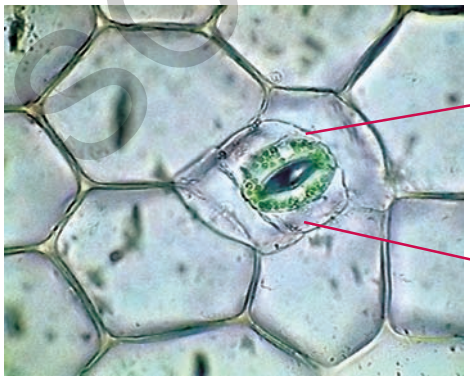


Fig-8(a) : Peel of Rheo leaf – Dermal tissue

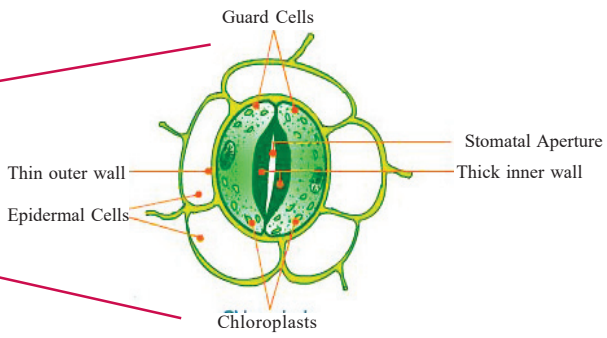


Fig-8(b) : Stomatal complex

Do you know?

Plants have the ability to store certain substances that are either their excretory products or accumulated food or some secretory substances in different ways. Gum is secreted from the dermal layer of gum tree.

Have you ever seen a sticky substance on the trunk or branches of trees like *Acacia*, Neem, etc,. What is it? Where is the gum secreted from?

The dermal tissue protects the plants from loss of water, mechanical damage like breaking and splitting of branches and invasion by parasitic and disease causing organisms. In big trees the dermal tissue forms several layers above the epidermis. It is called bark.

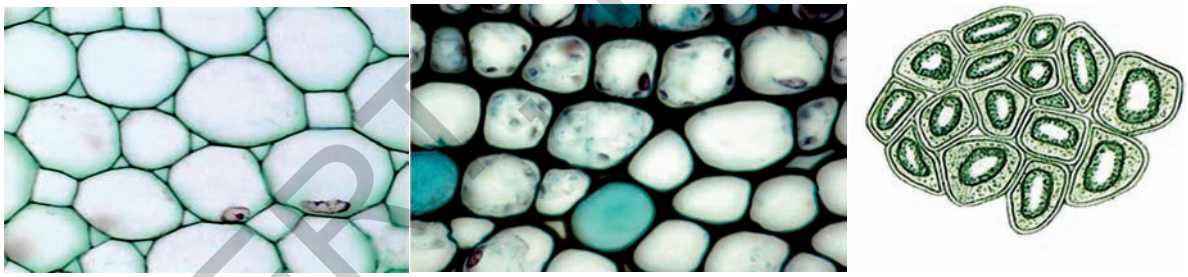
Stomata and root hair are also dermal tissues that are essential for gaseous exchange, transpiration as well as absorption of water and minerals. Photosynthesis is also carried out by certain cells of this tissue.

3.Ground Tissue

You have seen the ground tissue in the T.S. of stem (Figure 7). Make a sketch of the arrangement of cells you have seen.

You can observe that cells appear larger with a nucleus that appears prominent

The cells of the ground tissue forms the bulk of the plant body. It is useful for storing food and providing physical support to the plant body. There are mainly three types of ground tissues. They are parenchyma, collenchyma and sclerenchyma.



Parenchyma *Collenchyma* *Sclerenchyma*

Fig-9 : Ground tissue- Types

The cells of the parenchyma are soft, thin walled and loosely packed. The Parenchyma which contains chloroplasts is called "Chlorenchyma". The Parenchyma which contains large air cavities or spaces is called "Aerenchyma". The Parenchyma which stores water or food or waste products is called "Storage Parenchyma".

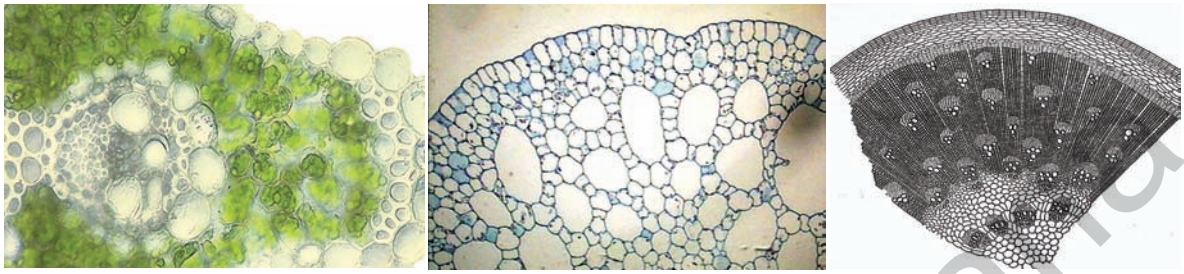
Collenchyma tissues are thick walled and longer in size when compared with parenchyma. Collenchyma cells are living and provide structural support.

In the sclerenchyma, the cells are thick walled and tightly packed without spaces. So when compared with dermal tissue, the ground tissue is of various types. And some of the ground tissues help in photosynthesis.

Let us observe the ground tissue of some other stems.

Activity-9

Take permanent slides of Chlorenchyma, Aerenchyma, Storage parenchyma from your laboratory and observe them under the microscope. Find out the characteristic differences and record them in your notebook.



Chlorenchyma *Aerenchyma* *Storage parenchyma*

Fig -10

Do you know?

Nehemiah Grew (1641-1712) was a practicing physician and worked as the secretary of the Royal Society, London. He began his work on the study of internal structure of the plants in the year 1664.

Grew's fundamental inference was "Every plant organ consists of two types of organical parts. One is pithy and other is ligneous part".

Grew gave the term **"parenchyma"** for the pithy part. Grew initiated the study of tissues (Histology) in plant bodies and published his work as the book 'Anatomy of Plants' in the year 1682.

Nehemiah Grew (1641-1712)

4. Vascular Tissue

We know that roots can absorb water from the soil and send it to other parts of the plant. The leaves and other green parts prepare food and supply it to all the parts of the plant.

Let us study the tissues involved in transportation.

We have done an experiment on transportation in class VII, in the chapter on plant nutrition. We have observed that when a plant is kept in red coloured water, Some of the parts of the plant turned red. Do the same experiment again by keeping a small plant (with roots) in red coloured water. Leave it for two hours. Now cut a T.S. of the stem and observe it under the microscope.

- Which part of the plant is responsible for this transport?
- Draw a rough sketch of that part and mark the part that appears red.

- What do you conclude from your observations?

The tissues involved in transportation are vascular tissues. They are composed of different types of cells which show specific arrangements.

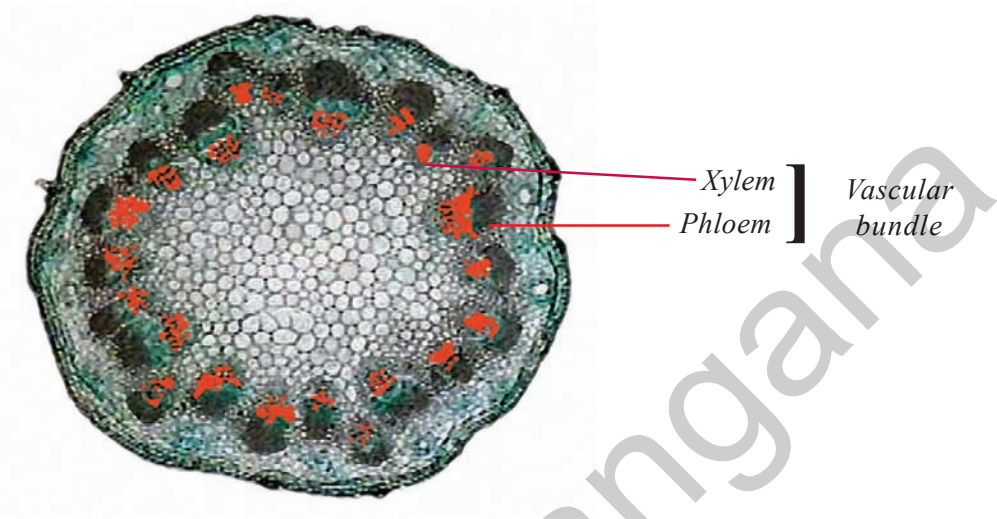


Fig-11 : TS of stem

The tissues that appeared red are Xylem tissue, and the cells adjacent to these (As shown in the Fig-11) are phloem tissue. Xylem is responsible for the transportation of materials like water and salts from the root. And phloem helps in the transportation of the food materials prepared during photosynthesis to the other parts of the plant. Hence they are known as conducting or vascular tissues. Xylem and Phloem together form the vascular bundles.

The vascular tissue gives mechanical support to the plant as well.

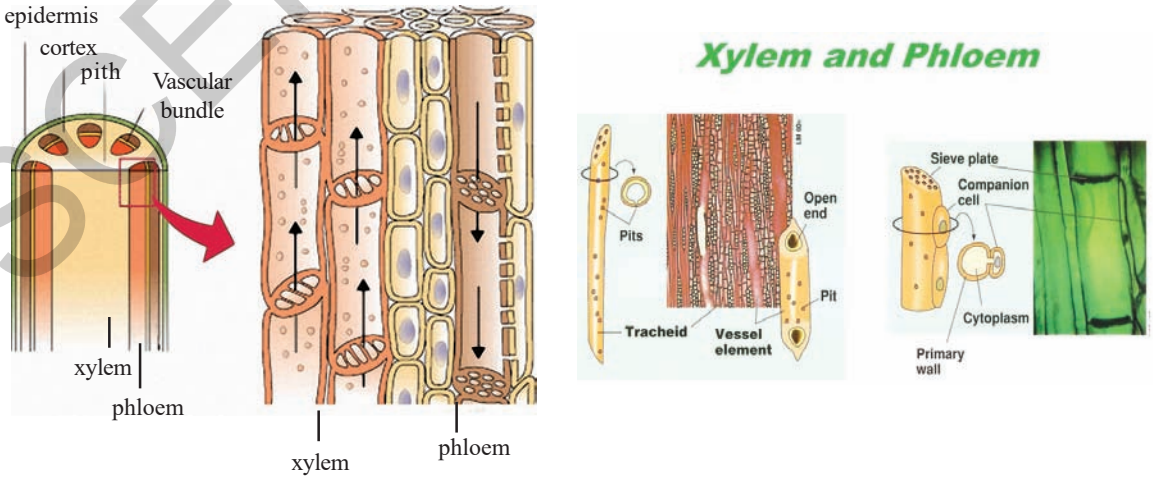


Fig-12 : Different Cells of Xylem and Phloem

Xylem contains elongated tracheid cells, tubular vessels, fibres and parenchyma. Phloem contains long sieve cells and sieve tubes, companion cells, fibres and parenchyma.

Do you know how the vascular tissues carry water to great heights in the plant body. It is up to nearly 200 ft in Eucalyptus plants and up to nearly 330 ft in the Red wood trees.

We have seen in this lesson that plants have different types of tissues which are arranged in specific manner to carry out different functions in the plant body.

Key words

Tissue, Meristematic tissue, Apical meristem. Lateral meristem, Intercalary meristem. Dermal tissue, Epidermis, Bark, Ground tissue, Parenchyma, Collenchyma, Sclerenchyma, Vascular tissue, Xylem, Phloem, Vascular bundles, Vessels.

What we have learnt?

- Tissue is a group of cells similar in structure, and performing similar functions.
- Meristematic tissue is the dividing tissue, present in the growing regions.
- Meristematic tissue is mainly of three types. They are Apical meristem, Lateral meristem and Intercalary meristem.
- Dermal tissue covers the plant body and gives protection.
- Ground tissue is abundant in all the parts of the plant and gives support and stores food. It is of three types - Parenchyma, Collenchyma and Sclerenchyma.
- Vascular tissue helps in transportation. It is mainly of two types - Xylem and Phloem.

Improve your learning

F2W8M8

1. Define the terms (AS 1)
   - Tissue
   - Meristematic tissue
   - Dermal tissue

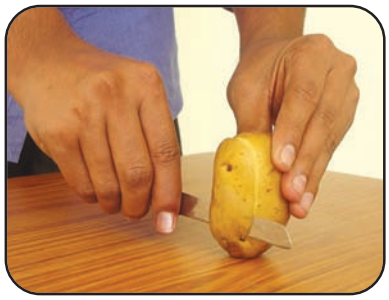
2. Differentiate the following (AS 1)
   - Meristematic tissue and Ground tissue
   - Apical meristem and lateral meristem
   - Parenchyma and collenchyma
   - Sclerenchyma and parenchyma
   - Xylem and phloem
   - Epidermis and bark
3. Name the following (AS 1)
   - Growing tissue, which causes growth in the length of the plant.
   - Growing tissue, which causes growth in the girth of the plant.
   - Large air cavities in the aquatic plants.
   - Food material in pharenchyma.
   - Pores essential for gaseous exchange and transpiration.
4. Compare the following (AS 1)
   - Xylem and phloem
   - Meristematic tissue and Dermal tissue.
5. Justify the following (AS 1)
   - Xylem is a conductive tissue
   - Epidermis gives protection
6. Though Chlorenchyma, Arenchyma and storage tissues are parenchymatous in nature . Why do they have different (specific) names? (AS 1)
7. Describe the functions of - Meristem, Xylem and phloem (AS 1)
8. If you want to know more about tissues in plants what questions are you going to ask? (AS 2)
9. "Bark cells are impervious to gases and water". What experiment will you perform to prove this? (AS 3)
10. Collect information about how dermal tissues help the plants. Display it on wall magazine. (AS 4)
11. Draw and label the diagram of the T.S. of stem (AS 5)
12. While observing internal parts of plants, how do you feel about its structure and functions? (AS 6)

ANNEXURE

In this technique fine sections of the material are cut. Figures in the next page will help you to understand this technique.

- To get section cuttings pith material is to be taken as support. A slit is made in the pith material longitudinally.
- The specimen (root or stem or leaf or bud) is inserted in the slit for section cutting.
- To get longitudinal section (LS) the specimen should be inserted in the pith material transversely.
- To get transverse section (TS) the specimen should be inserted in the pith material longitudinally.
- Thin sections should be cut, using the blade as a tool.
- Collect the cuttings in a watch glass with water.
- Select one thin section and put it on a glass slide with the help of a small brush.
- Put a drop of glycerine on it.
- Stain with a drop of safranin.
- Gently cover with the cover-slip using needle.
- Use blotting paper to remove the excess water or glycerine or stain.
- Then observe under the microscope.

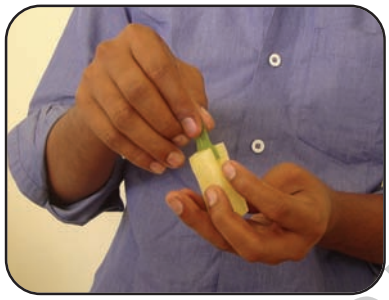
(a) Material



(b) Making the pith material from potato

(c) Making slit in the pith material

(d) Cutting specimen to get TS

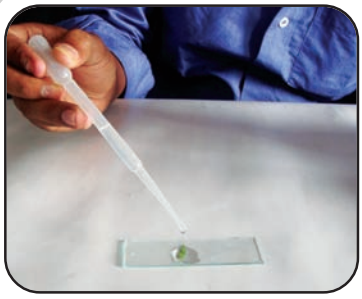


(e)Inserting the Specimen to get TS

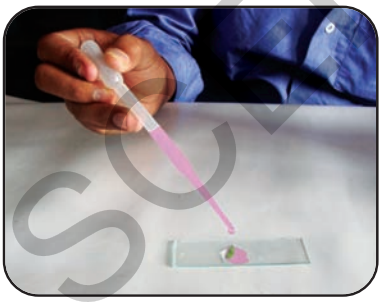
(f) Section cutting with blade

(g) Taking the thin section with brush

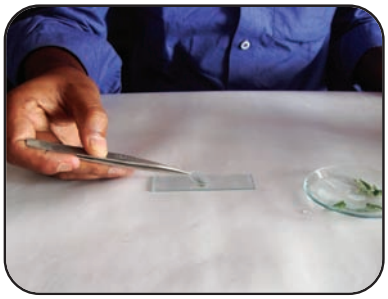
(h) Keeping the section on the slide



(i) Putting a drop of water, Glycerine



(j) Staining with safranin



(k) Covering with cover-slip

(l) Observing under the Microscope