

## Chapter 8: Plant Tissues and Anatomy

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### EXERCISE [PAGES 95 - 96]

#### Exercise | Q 1. (A) | Page 95

**Choose the correct option.**

Location or position of meristematic regions is divided into \_\_\_\_\_ types.

1. one
2. two
3. **three**
4. none of the above

### SOLUTION

Location or position of meristematic regions is divided into **three** types.

#### Exercise | Q 1. (B) | Page 95

**Choose the correct option.**

Cambium is also called \_\_\_\_\_.

1. apical meristem
2. intercalary meristem
3. **lateral meristem**
4. none of the above

### SOLUTION

Cambium is also called **lateral meristem**.

#### Exercise | Q 1. (C) | Page 95

**Choose the correct option.**

Collenchyma is a type of \_\_\_\_\_ tissue.

1. **living**
2. dead
3. living and dead
4. none of the above

### SOLUTION

Collenchyma is a type of **living** tissue.

#### Exercise | Q 1. (D) | Page 95

**Choose the correct option.**

\_\_\_\_\_ is a complex permanent tissue.

1. Parenchyma
2. Sclerenchyma
3. Chlorenchyma
4. **Xylem**

### **SOLUTION**

**Xylem** is a complex permanent tissue.

### **Exercise | Q 1. (E) | Page 95**

**Choose the correct option.**

Mesophyll tissue is present in \_\_\_\_\_.

1. root
2. stem
3. **leaf**
4. flower

### **SOLUTION**

Mesophyll tissue is present in **leaf**.

### **Exercise | Q 2. (A) | Page 95**

**Answer the following question.**

A fresh section was taken by a student but he was very disappointed because there were only a few green and most colourless cells. Teacher provided a pink colour solution. The section was immersed in this solution and when observed it was much clearer. What is magic?

### **SOLUTION**

The pink coloured solution given by teacher must be a safranin stain. Safranin is used to stain plant tissues, especially lignified tissues such as cell wall and xylem.

### **Exercise | Q 2. (B) | Page 95**

**Answer the following question.**

While observing a section, many scattered vascular bundles could be seen. Teacher said, in spite of this large number the stem cannot grow in girth. Why?

### **SOLUTION**

1. Students must have observed monocot stems.
2. It is because, monocot stem shows scattered vascular bundles.
3. In monocot stem, vascular bundles are closed i.e. without cambium.
4. Thus, secondary growth does not occur which is required for an increase in girth.

Hence, in spite of having large number of scattered vascular bundles, monocot stems do not grow in girth.

### **Exercise | Q 2. (C) | Page 95**

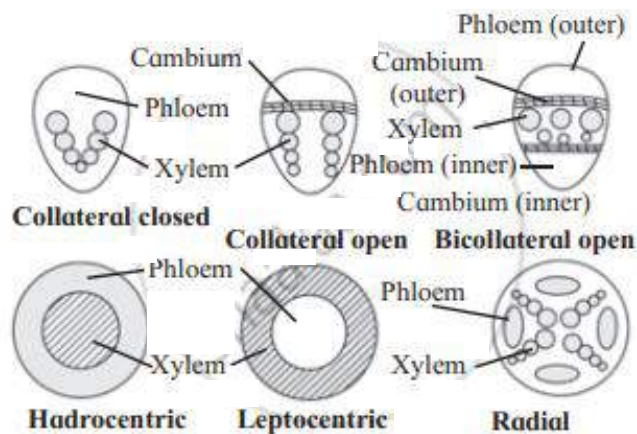
**Answer the following question.**

A section of the stem had vascular bundles, where one tissue was wrapped around the other. How will you technically describe it?

## **SOLUTION**

### **Concentric vascular bundle:**

1. When one vascular tissue is completely encircling the other, it is called a concentric vascular bundle.
2. When phloem is encircled by xylem, it is called a leptocentric vascular bundle, whereas when xylem is encircled by phloem, it is called a hadrocentric vascular bundle.
3. When xylem is encircled by phloem on both faces, it is called as amphicribral vascular bundle. When phloem is encircled by xylem on both faces it is called an amphivasal vascular bundle.



### **Exercise | Q 2. (D) | Page 95**

#### **Answer the following question.**

There were two cut logs of wood lying in the campus. One had growth rings and other didn't. Teacher said it is due to differences in their pattern of growth which is dependent on the season. How?

## **SOLUTION**

1. It is possible that one of the cut logs was of a tropical tree, whereas the other was of a temperate tree. Since tropical trees grow in a similar manner all year, growth rings are not apparent. Another explanation for this could be that the log which had growth rings must be of an old tree which has experienced many seasons, whereas the log without growth rings must be of a younger tree, that has not been subjected to seasonal changes and hence not developed prominent growth rings.

2. Growth rings are formed due to cambial activity during favourable and non-favourable climatic conditions.
3. During favourable conditions, spring wood (early wood) is formed which has broader xylem bands, lighter colour, tracheids with thin wall and wide lumen, fibres are less in number, low density. Whereas, during unfavourable conditions, autumn wood (late wood) is formed which has narrow xylem band, darker in colour, a lumen is narrow and walls are thick with abundant fibres, high density.
4. Spring wood and autumn wood that appears as alternate light and dark concentric rings, constitute an annual ring or growth ring.
5. These growth rings can be used to estimate the age of the tree. These are found more in older trees as compare to a younger tree.

### Exercise | Q 2. (E) | Page 95

#### Answer the following question.

While on the trip to Kashmir, Pinto observed that cut portions of large trees show distinct rings, which he never found in Maharashtra. Why is so?

#### **SOLUTION**

1. Cut portions of large trees show distinct rings which are annual rings formed due to activity of cambium during favourable and non-favourable climatic conditions.
2. Kashmir falls under the temperate region where the climatic conditions are not uniform through the year. In the spring season, conditions are favourable due to which cambium is active, whereas, in the autumn season, conditions are unfavourable due to which cambium is less active. This leads to the formation of spring wood and autumn wood that appears as alternate light and dark concentric rings, constitute an annual ring or growth ring.
3. Maharashtra falls under the tropical region where climatic conditions are favourable throughout the year. In tropical areas, the continuous growth of secondary xylem occurs. Thus, trees growing in tropical regions show less or no annual rings as compared to trees in the temperate region.

### Exercise | Q 2. (F) | Page 95

#### Answer the following question.

A student was observing a slide with no label under a microscope. The section had some vascular bundles scattered in the ground tissue. It is a section of a monocot stem!

He exclaimed. No! it is a section of fern rachis, said the teacher. Teacher told to observe vascular bundle again. Student agreed, Why?

### **SOLUTION**

1. In fern rachis, the number of vascular bundles is less as compared to the number of vascular bundles in monocot stem. In monocot stem, vascular bundles are numerous.
2. In fern rachis, xylem consists of only tracheids whereas in monocot stem, xylem consists of vessels (protoxylem and metaxylem) as well as tracheids. Monocot stem shows the presence of lysigenous cavity just below protoxylem.
3. In fern rachis, phloem consists of only sieve cells whereas in monocot stem, phloem consists of sieve tubes and companion cells.  
Thus, a student must have observed these differences in the given section and agreed to teacher's statement that the given section is of fern rachis and not of monocot stem.

### **Exercise | Q 2. (G) | Page 95**

#### **Answer the following question.**

Student found a wooden stopper in lab. He was told by an old lab attendant that it is there for many years. He kept thinking how it did not rot?

### **SOLUTION**

1. The wooden stopper or cork is obtained from the phellem (cork) part of a bark.
2. Phellem (cork) is impervious in nature and does not allow entry of water due to suberized walls.
3. Due to this it does not rot and remains as it is for many years.

### **Exercise | Q 2. (H) | Page 95**

#### **Answer the following question.**

Student while observing a slide of leaf section observed many stomata on the upper surface. He thought he has placed slide upside down. Teacher confirmed it is rightly placed. Explain.

### **SOLUTION**

1. In a dicot leaf, stomata are generally absent on the upper epidermis but are present on the lower epidermis. Thus, the student must have thought that he has placed slide upside down.
2. According to teacher, the section was placed rightly, thus the given section must be of monocot leaf.

3. It is because in monocot leaf stomata are present on both upper and lower epidermis.

### Exercise | Q 3. (A) | Page 95

Write a short note on Structure of stomata.

#### **SOLUTION**

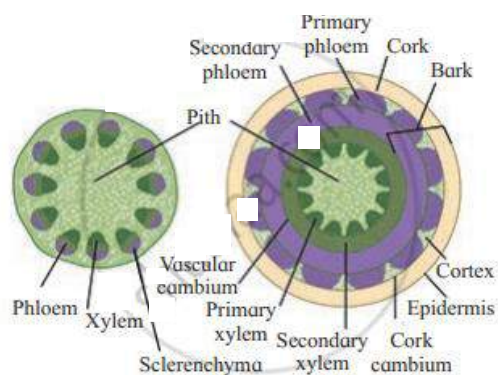
1. Small gateways in the epidermal cells are called stomata.
2. Stoma is controlled or guarded by specially modified cells called guard cells.
3. These guard cells may be kidney-shaped (dicot) or dumbbell-shaped (monocot), collectively called as stomata.
4. Guard cells have chloroplasts to carry out photosynthesis.
5. Change in turgor pressure of guard cells causes opening and closing of stomata, which enables the exchange of gases and water vapour.
6. Stomata are further covered by subsidiary cells.
7. Stoma, guard cells and subsidiary cells form a unit called stomatal apparatus.

### Exercise | Q 3. (B) | Page 95

Write a short note on secondary growth.

#### **SOLUTION**

1. Dicotyledonous plants and gymnosperms exhibit increase in girth of root and stem.
2. In dicot stem, secondary growth begins with the formation of a continuous cambium ring.
3. The cambium present between the primary xylem and primary phloem of a vascular bundle is called intrafascicular cambium.
4. The cells of medullary rays adjoining these intrafascicular cambium strips become meristematic (regain the capacity to divide) and form the interfascicular cambium.
5. Thus, a complete and continuous ring of vascular cambium is formed.
6. The cambium ring cuts off new cells, towards both inner and outer sides.
7. The cells that are cut-off towards pith (inner side) mature into secondary xylem and cells that are cut-off towards the periphery mature into secondary phloem.
8. Generally, amount of secondary xylem is more than the secondary phloem.



### Exercise | Q 3. (C) | Page 95

Write a short note on peculiarity of a sclerenchyma cell wall.

#### **SOLUTION**

1. Cell wall of sclerenchyma is evenly thickened due to uniform deposition of lignin.
2. Cell wall of sclereids is extremely thick and strongly lignified.

### Exercise | Q 4. (A) | Page 95

Differentiate between Vascular bundle of monocot and Vascular bundle of dicot

#### **SOLUTION**

	<b>vascular bundles of dicot</b>	<b>vascular bundles of monocot</b>
1.	Diarch, triarch or tetrarch condition can be observed. (Xylem bundles vary from two to six number)	Polyarch condition is observed. (xylem bundles are more than six)
2.	Cambium is formed in later stage between xylem and phloem which causes secondary growth.	Secondary growth is absent.
3.	Vascular bundles are arranged in the form of a ring.	Vascular bundles are scattered in the ground tissue.
4.	It is conjoint, collateral and open (Cambium present)	They are conjoint, collateral and closed (cambium is absent).
5.	Vascular bundle is not surrounded by a sclerenchymatous bundle sheath.	Vascular bundle is surrounded by a sclerenchymatous bundle sheath.
6.	Vascular bundles of varying size. The size of the vascular bundles is dependent on the size of the veins	Vascular bundles are nearly of similar size (Except in main veins).

	which vary in thickness in dicot leaf.	
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### Exercise | Q 4. (B) | Page 95

Differentiate between Xylem and Phloem functioning

#### **SOLUTION**

	<b>Xylem</b>	<b>Phloem</b>
1.	Dead complex tissue, thick-walled cells.	Living complex tissue, thin-walled cells.
2.	Components of xylem are vessels, tracheids, xylem fibers and xylem parenchyma.	Components of phloem are sieve tubes, companion cells, phloem parenchyma and phloem sclerenchyma.
3.	Conducts water and minerals in the plant body and also provides mechanical strength.	Conducts organic food in the plant body.
4.	It is also known as wood.	It is also known as bast.

### Exercise | Q 4. (C) | Page 95

Distinguish Between Internal or anatomical difference between monocots and dicots.

#### **SOLUTION**

	<b>Monocots</b>	<b>Dicots</b>
1.	The root shows polyarch condition with broad pith.	The root shows tetrach and hexarch condition with narrow pith.
2.	The stem shows scattered vascular bundles.	The stem shows vascular bundles that are arranged in ring-like manner.
3.	Vascular bundles are conjoint collateral closed without cambium in the stem.	Vascular bundles are conjoint collateral and without cambium in the stem. open with fascicular cambium.
4.	In stem, epidermis is without trichomes and hypodermis which is of sclerenchyma.	In stem, epidermis is with trichomes and hypodermis which is of collenchyma.
5.	The leaf is isobilateral with undifferentiated mesophyll.	The leaf is dorsiventral with mesophyll differentiated into palisade and spongy.
6.	The leaf shows stomata on both upper and lower epidermis. Amphistomatic leaf.	The leaf shows stomata which are mainly on the lower epidermis. Hypostermatic leaf.
7.	Guard cells of stomata are dumb-bell shaped.	Guard cells of stomata are kidney-shaped.

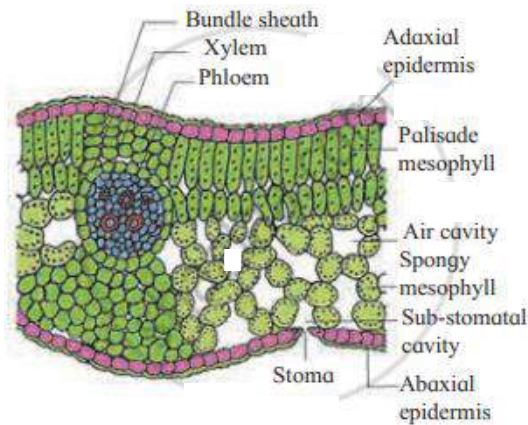


**Exercise | Q 5. (A) | Page 96**

**Draw a neat labelled diagram.**

T. S. of Dicot leaf

**SOLUTION**

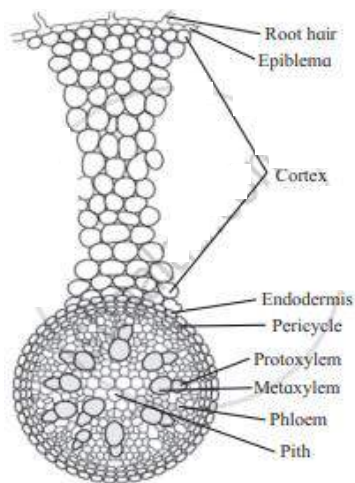


**Exercise | Q 5. (B) | Page 96**

**Draw a neat labelled diagram.**

T. S. of Monocot root

**SOLUTION**

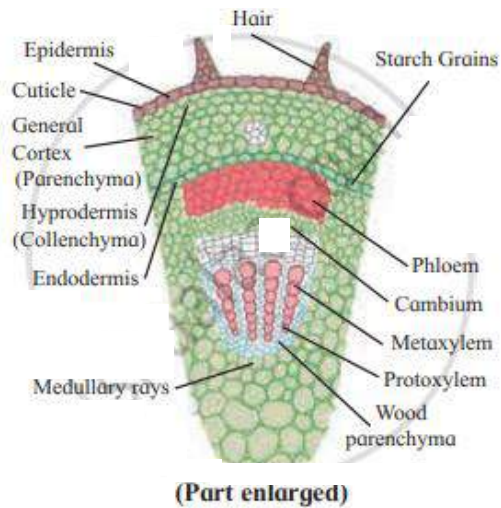


**Exercise | Q 5. (C) | Page 96**

**Draw a neat labelled diagram.**

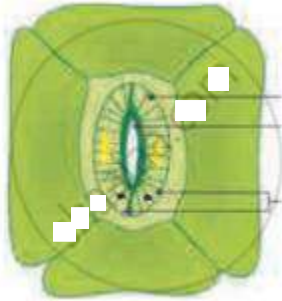
T. S. of dicot stem

## SOLUTION

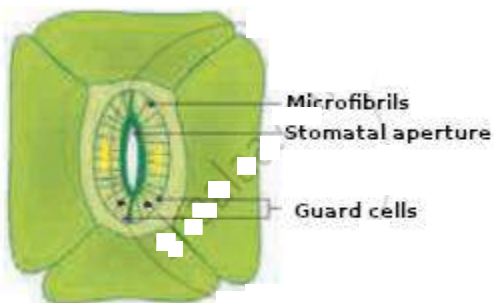


## Exercise | Q 6 | Page 96

Write the information related to the diagram given below.



## SOLUTION

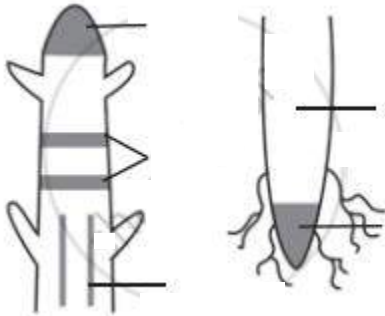


1. Small gateways in the epidermal cells are called as stomata.
2. Stoma is controlled or guarded by specially modified cells called guard cells.
3. These guard cells may be kidney-shaped (dicot) or dumbbell-shaped (monocot), collectively called as stomata.
4. Guard cells have chloroplasts to carry out photosynthesis.

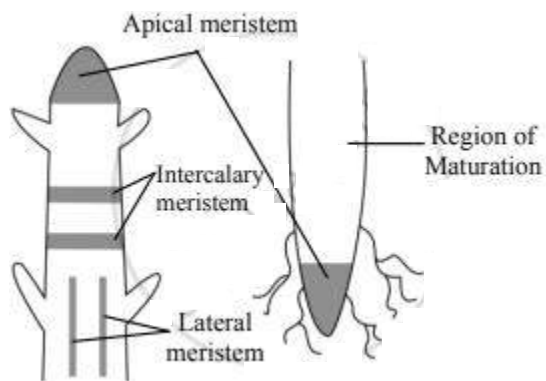
5. Change in turgor pressure of guard cells causes opening and closing of stomata, which enables exchange of gases and water vapour.
6. Stomata are further covered by subsidiary cells.
7. Stoma, guard cells and subsidiary cells form a unit called stomatal apparatus.

### Exercise | Q 6 | Page 96

Write the information related to the diagram given below.

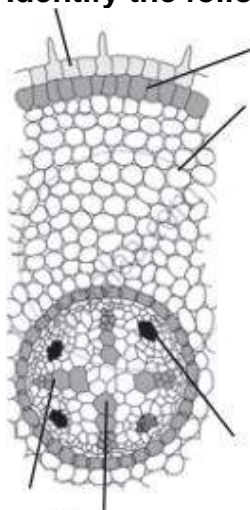


### SOLUTION



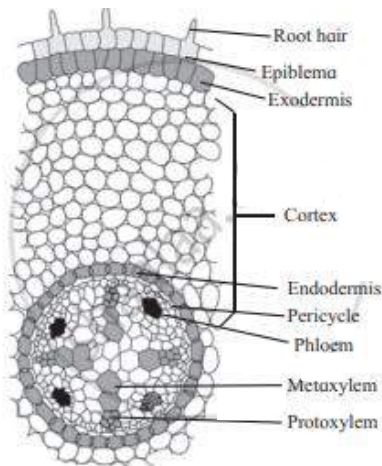
### Exercise | Q 7. (a) | Page 96

Identify the following diagram, label it and prepare a chart of characteristics.



## **SOLUTION**

### **T.S. of dicot root-**



1. **Epiblema:**

It is the outermost single layer of cells without cuticle. Some epidermal cells prolong to form unicellular root hairs.

2. **Cortex:**

It is made up of many layers of thin walled parenchyma cells. Cortical cells store food and water.

3. **Exodermis:**

After the death of epiblema, outer layer of cortex become cutinized and is called Exodermis.

4. **Endodermis:**

The innermost layer of cortex is called Endodermis. The cells are barrel-shaped and their radial walls bear Casparian strip or Casparian bands composed of suberin. Near the protoxylem, there are unthickened passage cells.

5. **Stele:**

It consists of pericycle, vascular bundles and pith.

**a. Pericycle:**

Next to the endodermis, there is a single layer of thin walled parenchyma cells called pericycle. It forms outermost layer of stele or vascular cylinder.

**b. Vascular bundle:**

Vascular bundles are radial. Xylem and Phloem occur in separate patches arranged on alternate radii. Xylem is exarch in root that means protoxylem vessels are towards periphery and metaxylem elements are towards centre. Xylem bundles vary from two to six number, i.e. they may be diarch, triarch, tetrarch, etc. Connective tissue: A parenchymatous tissue is present in between xylem and phloem.

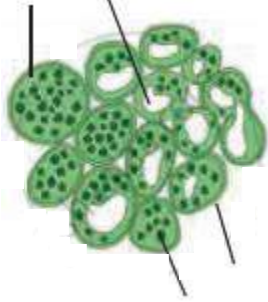
**c. Pith:**

The central part of stele is called pith. It is narrow and made up of parenchymatous cells, with or without intercellular spaces.

6. At a later stage cambium ring develops between the xylem and phloem causing secondary growth.

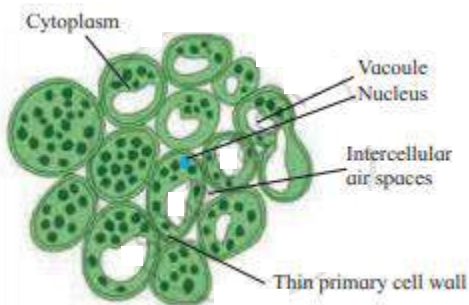
**Exercise | Q 7. (b) | Page 96**

**Identify the following diagram, label it and prepare a chart of characteristics.**



**SOLUTION**

**Simple permanent tissue (parenchyma)-**



1. It is a type of simple permanent tissue.
2. Cells in this tissue are thin walled, isodiametric, round, oval to polygonal or elongated in shape.
3. Cell wall is composed of cellulose.
4. Cells are living with prominent nucleus and cytoplasm with large vacuole.
5. Parenchyma has distinct intercellular spaces. Sometimes, cells may show compact arrangement.
6. The cytoplasm of adjacent cells is interconnected through plasmodesmata and thus forms a continuous tissue.
7. This is less specialized permanent tissue.
8. **Occurrence:**

These cells are distributed in all the parts of a plant body viz. epidermis, cortex, pericycle, pith, mesophyll cells, endosperm, xylem and phloem.

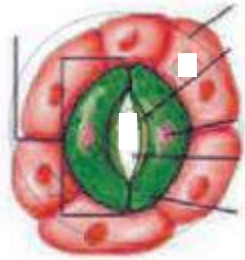
**9. Functions:**

These cells store food, water, help in gaseous exchange, increase buoyancy, perform photosynthesis and different functions in plant body.

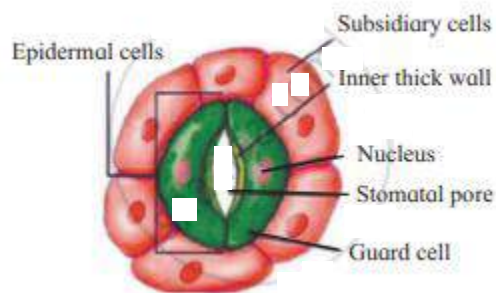
10. Dedifferentiation in parenchyma cells develops vascular cambium and cork cambium at the time of secondary growth.

**Exercise | Q 7. (c) | Page 96**

**Identify the following diagram, label it and prepare a chart of characteristics.**



**SOLUTION**

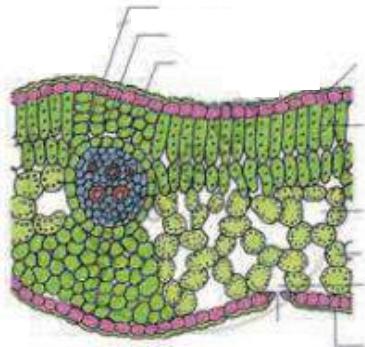


**Structure of stomata:**

1. Small gateways in the epidermal cells are called as stomata.
2. Stoma is controlled or guarded by specially modified cells called guard cells.
3. These guard cells may be kidney shaped (dicot) or dumbbell shaped (monocot), collectively called as stomata.
4. Guard cells have chloroplasts to carry out photosynthesis.
5. Change in turgor pressure of guard cells causes opening and closing of stomata, which enables exchange of gases and water vapour.
6. Stomata are further covered by subsidiary cells.
7. Stoma, guard cells and subsidiary cells form a unit called stomatal apparatus.

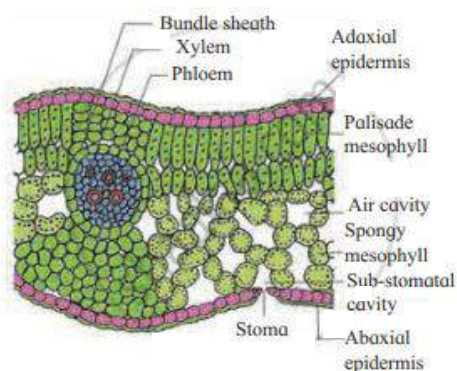
### Exercise | Q 7. (d) | Page 96

Identify the following diagram, label it and prepare a chart of characteristics.



### SOLUTION

#### V. S. of dicot leaf-



- **Structure of dorsiventral leaf:**

The mesophyll tissue is differentiated into palisade and spongy parenchyma in a dorsiventral leaf. This type is very common in dicot leaf. The different parts of this leaf are as follows:

- **Upper epidermis:**

It consists of a single layer of tightly packed rectangular, barrel shaped, parenchymatous cells which are devoid of chloroplast. A distinct layer of cuticle lies on the outside of the epidermis. Stomata are generally absent.

- **Mesophyll:**

Between upper and lower epidermis, there is chloroplast-containing photosynthetic tissue called mesophyll. It is differentiated into Palisade parenchyma and Spongy parenchyma.

1. **Palisade parenchyma:**

Palisade parenchyma is present below upper epidermis and consists of closely packed elongated cells. The cells contain abundant chloroplasts and help in photosynthesis.

2. **Spongy parenchyma:**

Spongy parenchyma is present below palisade tissue and consists of loosely



arranged irregularly shaped cells with intercellular spaces. The spongy parenchyma cells contain chloroplast and are in contact with the atmosphere through stomata.

- **Vascular system:**

It is made up of a number of vascular bundles of varying size depending upon the venation. Each one is surrounded by a thin layer of parenchymatous cells called bundle sheath. Vascular bundles are closed. Xylem lies towards upper epidermis and phloem towards lower epidermis. Cambium is absent, hence there is no secondary growth in the leaf.

- **Lower epidermis:**

It consists of a single layer of compactly arranged rectangular, parenchymatous cells. A thin layer of cuticle is also present. The lower epidermis contains a large number of microscopic pores called stomata. There is an air-space called substomatal chamber at each stoma.

### Exercise | Q 8 | Page 96

**Distinguish between dicot and monocot leaf on the basis of following characters.**

Characters	Dicot leaf	Monocot leaf
<b>Stomata</b>		
<b>Intercellular space</b>		
<b>Venation</b>		
<b>Vascular bundle</b>		
<b>Mesophyll cells</b>		

### **SOLUTION**

Characters	Dicot leaf	Monocot leaf
<b>Stomata</b>	Stomata are restricted to lower epidermis. Guard cells of stoma are kidney-shaped.	Stomata occur on both epidermis. Guard cells of stoma are dumbbell shaped.
<b>Intercellular space</b>	More intercellular spaces due to presence of spongy parenchyma	Less intercellular spaces as mesophyll is not differentiated into spongy and palisade tissue.
<b>Venation</b>	Reticulate venation	Parallel venation
<b>Vascular bundle</b>	Vascular bundles of varying size. The size of the vascular bundles is dependent on the size of	Vascular bundles are nearly of similar size (Except in main veins).



	the veins which vary in thickness in dicot leaf.	
<b>Mesophyll cells</b>	Mesophyll tissue is differentiated into palisade parenchyma and spongy parenchyma.	Mesophyll tissue is not differentiated into palisade parenchyma and spongy parenchyma.