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TISSUE

It is a well-known fact that all living organisms are made up of cells. They are either unicellular (e.g., bacteria, diatoms, yeasts, protozoans, etc.) or multicellular (e.g., man, lion, dog, cockroach, neem, peepal, etc). Each unicellular organism (e.g., Amoeba) is made up of single cell, which acts " as a site for diverse life activities such as intake of food (digestion), intake of oxygen (respiration), excretion, reproduction, etc. That means, all the activities of the organism are performed by the single cell. The multicellular organism, on the other hand, is composed of a millions of different types of cells. These cells cluster together in order to perform specific functions of the body.

The multicellular organisms usually develop from single 'initial cell' (i.e., zygote, spore or any other cell). This initial cell divides by the process of cell division. The cell division continues and a large number of cells are formed. These cells then undergo cellular differentiation. Differentiation is the process of qualitative changes in the cells to perform different functions in the living organisms. The process of cell division and cell differentiation leads to the development of specific organs consisting of specific groups of cells to perform specific functions in the body. The cluster of cells (or group of cells) specially-positioned and designed to perform a particular function efficiently is called a **tissue.**

A tissue may be defined as a group or collection of similar or dissimilar cells that perform or help to perform a common function and have a common origin.

PLANT AND ANIMAL TISSUES

Plants and animals have different structures and functions. Thus, the tissues which they possess, are also different. A comparison between plant and animal tissue is given in the table. (Refer page no. 48)

PLANT TISSUES

Like all other organisms, in all plants (with the exception of some lower plants), cells of similar origin are grouped together to perform some specific functions. Such a group of cells is called tissue. Each tissue, has a specific function to perform but at the same time different types of tissues of a plant function in co-ordination with one another.

On the basis of their ability to divide, plant tissues are of two main types:

(i) **Meristematic tissues** which consist of undifferentiated actively dividing cells and

(ii) **Permanent tissues,** consisting of differentiated cells which have lost the ability to divide.

Meristematic tissues (Meristems)

Meristematic tissues are found at all growing points of a plant, such as the tip of roots, stems and branches where growth in length occurs. These meristems are called apical meristems. These tissues occur right from the birth of the plant and are, therefore, called primary meristems. Characteristics of meristematic tissues. :

(i) The cells of these tissues are similar in structure and have thin and elastic primary cell walls made up of cellulose.

Table: Differences between the tissues of plant and animals

	Plant tissues	Animal tissues
1.	Most of the plants are stationary and remain fixed at one place, *i.e.,* they do not move from place to place. They need comparatively less energy. Therefore, most of the tissues of plants are supportive in function and provide mechanical strength. These tissues are thick-walled, lignified and dead, *i.e.,* they do not contain living protoplasm. Examples, sclerenchyma, xylem, tracheid's and vessels, cork, etc.	Animals are not stationary and move from one place to another in search of food, mates and shelter. They need more energy as compared to plants. Therefore, animal tissues are made up of living cells. Examples, nervous tissues, muscular tissues, connective tissues, etc.

2.	Growth of plants is indefinite. Plants grow throughout their life with the help of certain tissues located in certain regions in the body. For example, they possess meristematic tissues in root apex and shoot apex which divide throughout the life and add new cells to the body. These cells differentiate to become permanent tissues which stop dividing. Thus, there are dividing and non-dividing tissues in plants located at specific regions.	Growth of animals is definite. It is not confined to certain regions in the body. The animal organs grow more or less uniform. Thus, the animals do not possess dividing and non-dividing regions in the body. In other words, they do not possess specific regions of dividing and non-dividing tissues.
3.	The structural organization of plants is not complex as compared to that of animals. Plant tissues are also not much complicated.	The structural organization of organs and organ systems of animals is much more complicated as compared to that of plants.

(ii) The cells are rounded, oval, polygonal or rectangular in appearance.
(iii) They have large and prominent nuclei.
(iv) Vacuoles small or are absent.
(v) Cells are closely packed.
(vi) Intercellular spaces are absent.
(vii) The cell division occurs actively to produce new cells.
(viii) New cells are produced, take up specific role and lose the ability to divide. They form the permanent tissue by the process of differentiation, as a result of division, they get transformed into mature permanent tissues.

Based on their location in the plant body, meristems are of three types:
(a) Apical meristem
(b) Lateral meristem
(c) Intercalary meristem

Apical meristem

(i) Occurs at the tips of roots and shoots.
(ii) Brings about an increase in length of the plant. Examples: root apical meristem and shoot apical meristem.

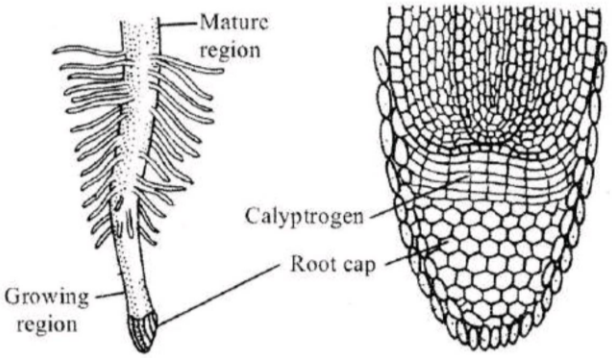


Fig.: Root tip, showing the internal structure (apical meristem)

Lateral meristem

(i) Occurs on the sides almost parallel to the long axis of the root, stem and its branches.
(ii) Brings about an increase in the width or girth of roots and stems, also called secondary **growth.**
(iii) Lateral meristem is of two types, i.e., beneath the bark in the form of cork cambium and in vascular bundles of dicots in the form of vascular cambium. The activity of this cambium results in the formation of secondary growth.

Intercalary meristem

(i) Occurs at the base of the internodes (in monocots) or at the base of nodes (mint plant) or at the base of leaves (Pinus).
(ii) Brings about elongation/growth of that part of the plant where they are present.

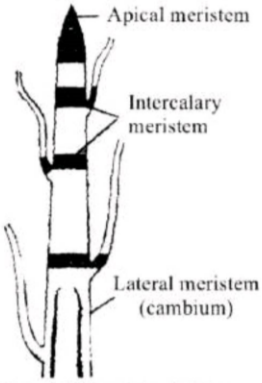


Fig.: Location of different meristems in the plant body (shoot apex)

ACTIVITY CORNER

To study the tissues responsible for growth of plants in certain specific region.
Materials required: Two glass jars, two onion bulbs, water, scale, record file.
Produce: Take two wide mouth glass jars and fill them with tap water. The mouth of jars should b4e such

that they can hold the onion bulbs. Now, place one onion bulb at the mouth of one jar (jar a) and another onion bulb at the mouth of another jar (jar B). Place the bulbs in such a way that stem and root parts of each bulbs remain in contact with water. Allow the roots to emerge out and grow in water. Observe the growth of roots on day 1, 2 3 on your record book. On fourth day, cut the tips of roots (upto1 cm) in jar B. Again place the onion of jar B with roots hanging in water. Now observe the growth of roots in both eth jars for a few more days. Measure and record the growth of roots in both the jars for five more days. Record your observations.

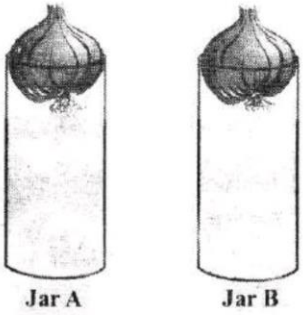


Fig.: Growth of roots in onion bulbs

Observation: It **is** observed that

- The roots of onion bulb in jar A kept on growing and, thus, were longer than the roots of onion bulb in jar B.
- In jar B, the roots stopped growing when the tips of growing roots were cut on 4th day.

Conclusion: The roots tips stopped growing in jar-B because the dividing cells, located "at roop tips, were remove. It is concluded that growth of roots occurs due to the activity of dividing cells present at the root apex (apical meristem). The cells of meristematic tissue have the ability to divide continuously and add new cells to the plant body. The daughter cells derived from dividing meristematic tissue differentiated to become permanent tissue and stopped dividing

Permanent tissues

Meristematic tissues, after differentiation, give rise to permanent tissues. These constitute the major portion of the plant body.

Characteristics of permanent tissues

(i) They constitute the major portion of the plant body.

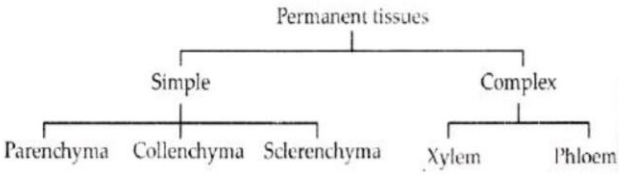
(ii) The cells of these tissues do not multiply.

(iii) They take permanent shape to perform permanent functions.

(iv) They may be living or dead.

(v) The cells may be thin walled or thick walled

The permanent tissues can be grouped into following categories on the basis of functions they perform.



Simple permanent tissues

These permanent tissues are called simple because they are composed of similar type of cells which have common origin and function. They are further grouped under three categories - parenchyma collenchyma and sclerenchyma.

(i) Parenchyma: The cells of these tissues may be spherical, irregular or columnar in appearance. They have thin cell walls but large vacuoles. The cell wall is made up of cellulose or calcium pectate. Each cell has a prominent nucleus. All the soft parts of the plant body are composed of parenchyma. It forms the basic packing tissue of plant body. It is the most abundant tissue of plants. Parenchyma is widely distributed in various plant organs, viz, roots, stem, leaves, flowers and fruits. They constitute the major vegetative ground tissue. They occur in epidermis, cortex, pith, pericycle, and mesophyll of leaves, pulp of fruits and endosperm of seeds. Parenchymatous cells are also found in xylem and phloem. In storage tissues, the parenchymatous cells enlarge to store nutrients and water. These are called storage parenchyma. In aquatic plants, large air cavities are present in the ground tissue. These cavities store gases and provide buoyancy to aquatic plants to help them float. Such parenchyma are called **as aerenchyma.**

Functions of parenchyma:

- The main function of parenchymatous tissue is storage of food, e.g., starch in the parenchyma of cortex of potato tuber.
- In fleshy stems and leaves, parenchyma cells serve as water storage tissue, e.g., Euphorbia, Opuntia.
- Parenchyma forms the framework of all the plant organs and tissues like cortex, pith, mesophyll of leaf and floral parts.

- Parenchymatous tissue stores waste materials of plants, such as gum, crystals, resins, tannin, etc.
- The intercellular air spaces of parenchyma cells allow gaseous exchange.
- If chloroplast is present in parenchyma cells (i.e., chlorenchyma), it performs photosynthesis, e.g., the mesophyll of leaves.

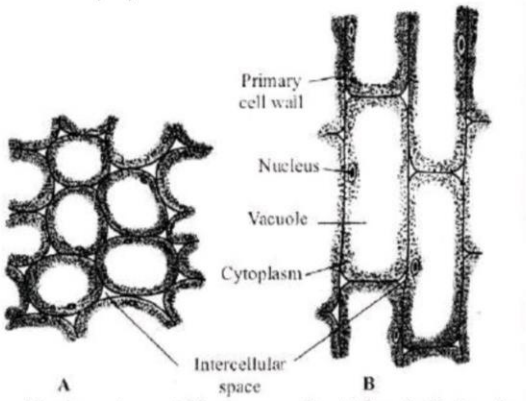


Fig.: Parenchyma; A. Transverse section; B. Longitudinal section

(ii) **Collenchyma (Colla : glue):** Collenchyma is a living tissue of primary body. The cells are thin walled but possess thickenings of cellulose and pectic substances at the corners where number of cells join together. The tissue provides flexibility to soft aerial parts (e.g., leaves, young stems) of plant so that they can bend without breaking. The cells are compact and the intercellular spaces are absent.

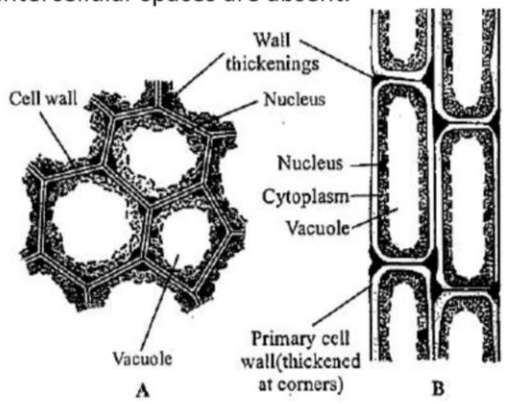


Fig.: Collenchyma; A. Transverse section; B. Longitudinal section

Collenchyma is usually found in 3-4 layers beneath the epidermis in stem, petioles and leaves of herbaceous dicot plants. It is usually absent in monocot stems, roots and leaves.

Functions of collenchyma:

- It provides mechanical support, protection and elasticity to the plant organs.
- Due to its peripheral position in stem, it helps leaves in bending and pulling action of wind.
- Chloroplast containing collenchyma cells are responsible for photosynthesis and manufacture of sugar and starch.

(iii) **Sclerenchyma (Scleros: hard):** The cells of this tissue are dead. The cells are long narrow with tapering ends. Their cell walls are thickened. This thickness is due to the deposition of a water resistant material lignin. The thickening of the cell wall is so great that sometimes the cell contents are completely lost and cell cavities obliterated. Central cavity of the cell is greatly reduced due to the thickening. Sclerenchyma tissues are of two types fibres and sclereids. Sclerenchyma acts as a mechanical tissue giving support and strength to the organ. They protect the plant from environmental forces like strong winds. They make the plant hard and stiff. The husk of coconut is made up of sclerenchyma tissue.

The examples of this tissue are the hard grit of a pear fruit, the hard walls of nuts and the brittle coats of seeds. These tissues occur in the veins of leaves. They form the major part of walnut shells and of other nuts. They form an important part of the bark of trees.

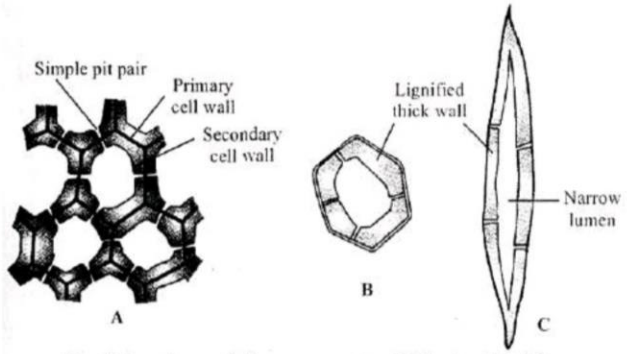


Fig.: Sclerenchyma; A. Transverse section; B. Single cell in T.S. C. L.S. of single fibre

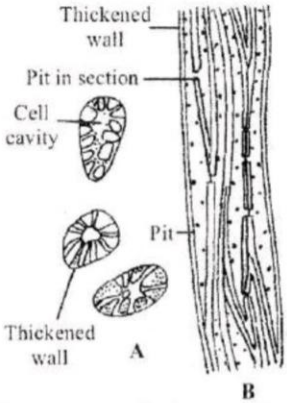


Fig.: A. Stone cells from the gritty portion of a pear fruit; B. Longitudinal section of fibres

ACTIVITY CORNER

To study the structure and function of epidermis and other protective tissues.

Materials required: Leaf of Rhoeo discolor, petri dish, glass slide, cover slip, microscope, safranin, water.

Procedure: Take a freshly plucked leaf of Rhoeo discolor. Peel out the lower skin of leaf. Cut the epidermal peel and place it in a petridish containing water. Stain the peel with the help of a few drops of safranin. Transfer the peel on a glass slide and cover it gently by placing a coverslip over it. Observe it under the microscope. **Observation:** Under the microscope, a sheet of cells is seen. These are epidermal cells. The layer of epidermal cells is called epidermis. Other types of structures seen under the microscope are- stomata (sing, stoma) and trichomes (hairs). **Conclusion:** From the above observation it can be concluded that all the plant parts have a protective covering, called protective tissue. The epidermis provides protection to the underlying cells and forms the protective tissue. This layer remains in direct contact with the environment. Any substance, whether solid, liquid or gas, can enter into the plant or move outside only after passing through this layer. It provides protection to various plant organs and helps in absorption, secretion, excretion, gaseous exchange and transpiration.

Protective plant tissue

Epidermis is the outermost protective layer of plant organs. It is usually single-layered but in the leaves of some plants growing in dry habitats, it is multi-layered and thick. This is to protect the plant from water loss. Epidermis protects all the parts of plant. Cells of epidermis form a continuous layer without intercellular spaces to protect the plant tissues. Epidermal cell of aerial parts of the plant secrete a waxy, water resistant layer on their outer surface. It protects them against loss of water, mechanical injury and any attack by pathogenic fungi. In desert plants, outer walls of the epidermis are usually thick and covered with organic substances like cutin. The thick cutinized wall of epidermis greatly reduces loss of water by transpiration. The epidermal cells of the roots contain long hair-like structures called root hairs. The root hairs increase surface area for absorption of water and nutrients from soil. The epidermis of the leaf contains small pores called stomata. The stomata helps in exchange of gases with the atmosphere. They also help in loss of water in the form of water vapour known as transpiration.

Cork

As plants grow older with times, protective tissues at the periphery undergoes certain changes. In them a strip of secondary meristem replaces the epidermal layer of the stem forming a many layered thick bark of the tree called cork. Cork in mature woody stem is made up of dead, thick- walled cells. The cork cells are compactly arranged without any intercellular spaces. The walls of cork cells also contain suberin (a chemical substance) which is impervious to gases and water.

Functions of cork:

Cork performs protective functions in the following ways:

- Cork cells being highly suberized and thick walled protect the inner tissues.
- It provides insulation from freezing temperatures.
- It protects the inner tissues from the attacks of microorganisms and prevents water loss also

ILLUSTRATION

1. What is the utility of tissues in multicellular organism? (NCERT)

Ans.: The utility of tissues in multicellular organism is given below:

(i) Division of labour: Tissues bring about division of labour in multicellular organisms. It increases efficiency.

(ii) Higher organization: Tissues become organized to form organs and organ systems.

(iii) Individual cells: Work load of individual cells has decreased.

(iv) Higher survival: Because of division of labour, higher efficiency and organization, the multicellular organisms have high survival.

2. Name the types of simple tissues. (NCERT)

Ans. There are three types of simple tissues these are parenchyma, collenchyma and sclerenchyma

3. Where is apical meristem found? (NCERT)

Ans. Apical meristem occurs at root and stem tips.

4. Which tissue makes up the husk of coconut

5. What is the function of meristematic tissue?

Ans. Meristematic tissues are responsible for the growth of plants. These tissues are present at growing regions like tips of roots and shoots.

6. Name the tissue which allows easy bending in various parts of a plant.
Ans. Collenchyma.
7. Define organ.
Ans. A number of tissues together form an organ.
8. What does the root tip contain that helps in root elongation?
Ans. The root tip contains apical meristematic tissues which are responsible for elongation of roots.

Complex permanent tissues (Conducting tissues)

Complex tissues are made up of more than one type of cells which work in close coordination to perform a common function. These tissues are also called vascular tissues. They transport water and dissolved food material up and down in the plant parts. The conducting tissues are of two types:
(a) Xylem (b) Phloem

(a) Xylem: Xylem is the chief conducting tissues of vascular plants. These are responsible for the transportation of water to the various parts of the plant body. These consist of four types of cells- tracheids, vessels, xylem fibres and xylem parenchyma.

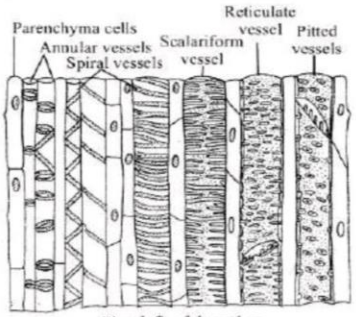


Fig.: L.S. of the xylem.

(i) Tracheids: A tracheid is an elongated hollow cell with its both ends tapering. The walls of these cells are thick due to the deposition of lignin. At certain spots, lignin is not present. These spots are termed as pits. These cells are arranged in such a fashion that they too form a system of long tubes and channels through which water can move easily. The tracheids are dead cells.

(ii) Xylem vessels (or tracheae): The cells of vessels are placed one upon the other and their end walls are either absent or possess perforations. They form long tubes or channels for conduction of water and minerals.

(iii) Xylem fibres are supportive in nature and provide mechanical strength to the plant body.

(iv) Xylem parenchyma are the only living components of xylem. These are concerned with the storage of food and sideways conduction of water.

(b) Phloem: Phloem tissue is regarded as living conducting tissue which is concerned with the translocation of food in the plants. The phloem is composed of four elements: Sieve tubes, companion cells, phloem parenchyma and phloem fibres.

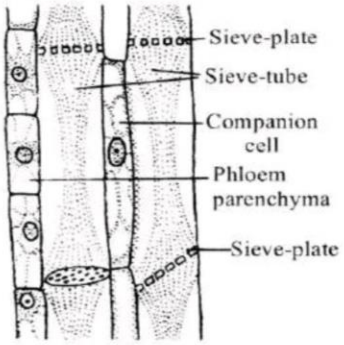


Fig.: L.S. of the phloem.

(i) Sieve tubes: The main conducting part of the phloem is sieve tube which is formed of elongated cylindrical cells arranged in vertical rows. The terminal walls of each sieve tube have many minute pores (perforated walls) through which food material passes very easily. The entire porous plate is termed as sieve plate.

(ii) Companion cells: Each sieve tube member is supported by a long parenchymatous cell called the Companion cells: which helps the sieve tube in the conduction of food material. Companion cells are living cells usually always associated with the sieve tubes. The sieve tube elements and companion cells arise from the same initial cell and therefore, form a single functional unit. Each companion cell is living cell with thin cellulose wall and active protoplast. The common wall between sieve tube and companion cell shows presence of fine pits which are traversed by plasmodesmata.

(iii) Phloem parenchyma are ordinary living parenchyma cells associated with phloem. They store food.

(iv) Phloem fibres are dead sclerenchyma fibres. They provide mechanical strength. The textile fibres of flax, hemp and jute are phloem fibres.

ACTIVITY CORNER

To study the structure and function of various types of permanent plant tissues.

Materials required: Piece of freshly plucked dicotyledonous (dicot) stem, sharp razor, glass slide, cover slip, safranin stain, glycerine, and microscope.

Procedure: Cut a very thin transverse section of a dicot stem with the help of a sharp razor, Stain the section with safranin and wash extra stain with the help of water. Now mount the stained section using a drop of glycerine on a glass slide. Cover the section with a cover slip and observe under the microscope.

Observations: Place the slide under a compound microscope and observe the various types of cells and their arrangement in the section of stem. Compare the cells with figure. Now answer the following questions on the basis of your observations:

(a) Are all cells similar in structure?

(b) How many types of cells can be seen?

(c) Can we think of reasons why there would be so many types of cells?

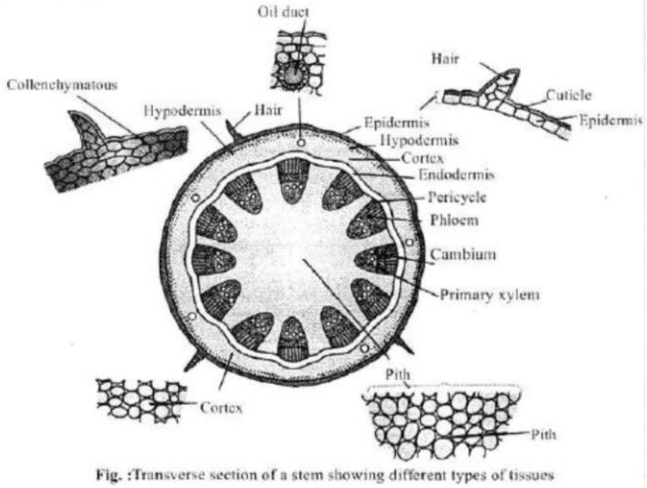


Fig. :Transverse section of a stem showing different types of tissues

Conclusion: On the basis of microscopic examination and observations of a stem, we can answer the above questions as follows:

(a) All the cells are not similar in structure.

(b) In all, 9 types of cells can be seen. They are-

(i) Epidermal cells (Parenchyma

(ii) Hypodermal cells (Collenchyma)

(iii) Cortex(parenchyma)

(iv) Endodermis (Parenchyma)

(v) Pericycle (Sclerenchyma)

(vi) Pholem

(vii) Cambium (Lateral meristem)

(viii) Xylem (ix) Pith (Parenchyma).

Thus, the type of tissues present in the section are: Meristematic tissue. Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem.

(c) There are so many types of cells which carry out different functions. Such as

(i) Protection (Epidermal cells)

(ii) Mechanical support (Collenchyma)

(iii) Storage of food (Cortex and pith)

(iv) Transport of water and minerals (Xylem)

(v) Translocation of organic food (Phloem)

(vi) Growth (Cambium).

Thus, the different types of cells and tissues perform different functions.

The xylem and phloem in plants occur together and are collectively called vascular bundle.

Table: Differences between xylem and phloem

	Xylem	Phloem
1.	It conducts water and inorganic solutes in vascular plants.	It conducts organic solutes in vascular plants.
2.	Conduction mostly occurs in one direction *(i.e.,* upward).	Conduction may occur in both directions, *i.e.,* upward or downward.
3.	Conducting channels (tracheary elements) are tracheids and vessels.	Conducting channels are sieve tubes.
4.	Its components include tracheids, vessels, xylem parenchyma and xylem fibres.	Its components include sieve tubes, companion cells, and phloem parenchyma and phloem fibres.
5.	Tracheids, vessels and xylem fibres are dead and only xylem parenchyma is living.	Sieve tubes, companion cells and phloem parenchyma are living and only phloem fibres are dead.
6.	Xylem provides mechanical strength also.	Phloem does not provide mechanical strength.

ILLUSTRATION

9. What are the constituents of the phloem? (NCERT)

Ans. The constituents of the phloem are sieve tubes, companion cells, phloem parenchyma and phloem fibres.

10. Name two conduction (vascular) tissues in plants

Ans. Xylem and phloem.

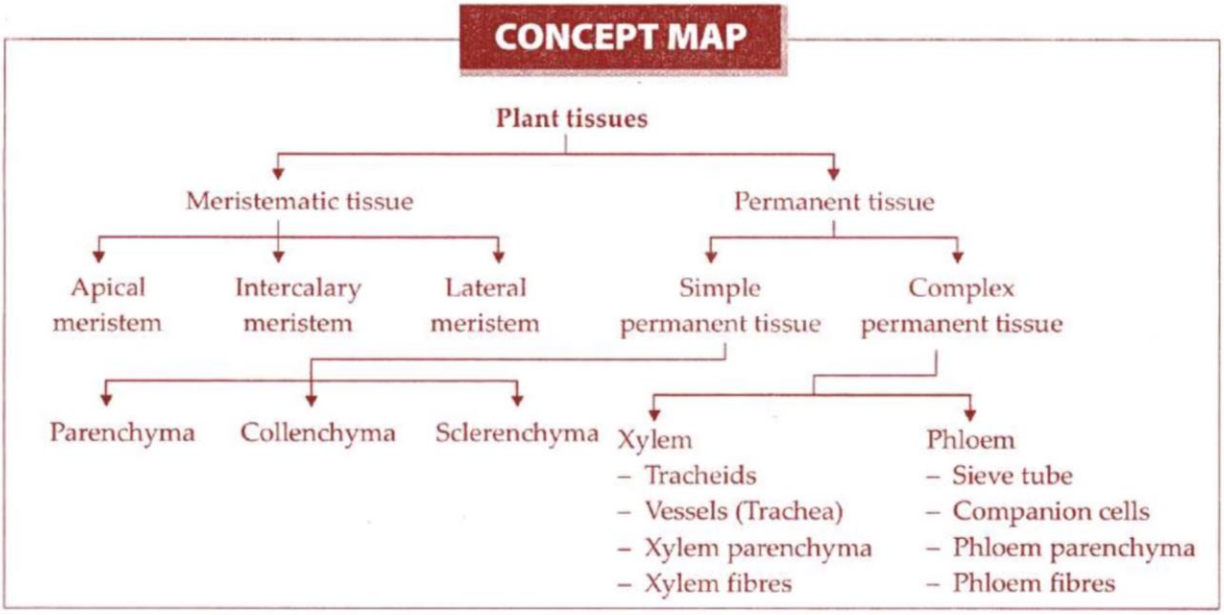
11. What is a vascular bundle?

Ans. The xylem and phloem in plants occur together and are collectively called vascular bundle.

12. Write the function of xylem and phloem.

Ans. Xylem is mainly concerned with the conduction of water and minerals. It also provides mechanical support to the plant. Phloem is responsible for transport of food prepared by leaves to other parts of the plant.

CONCEPT MAP



ANIMAL TISSUES

In animals, four basic types of tissues are found. These are as follows:

- Epithelium or epithelial tissue (covering tissue)
- Connective tissue (supporting tissue)
- Muscular tissue (contractile tissue)
- Nervous tissue.

Epithelial tissue

Epithelium forms the outer protective covering all over the body, and lines the inside of all cavities such as those of the mouth, throat, stomach, intestine, wind pipe and lungs. The epithelial cells lie close together with little or no intercellular substance or matrix between them. There is no blood or lymph supply. Nerve supply is present. Epithelial cells are attached to the underlying tissues by a basement membrane, which is made of a network of white, non-elastic collagen fibres. Epithelium may be one-cell thick, that is, single layered (simple epithelium), or it may be several-cell thick, that is, many-layered (compound or stratified epithelium).

Functions of epithelial tissue:

(i) Protection

(a) Most epithelia protect the underlying tissues against mechanical injury such as abrasion.

(b) Some epithelia protect against water loss and dehydration, and against infection by micro-organisms.

(ii) Role in physiological processes

Some epithelia are involved in physiological processes such as (a) respiratory gas exchange, (b) elimination of waste products, and (c) some cells become glandular in nature and per- form secretory function.

(iii) Sensory role by sensory epithelium.

(iv) Transport of materials by ciliated epithelium.

Types of epithelial tissue

Depending upon the shape and function of the constituent cells, epithelial tissues are of following types:

- Squamous (cells flattened)
- Columnar (cells tall, columnar or pillar-like)
- Cuboidal (cells cube-like)
- Ciliated (cells with cilia)
- Glandular (cells secretory in nature)
- Sensory (cells have nerve endings; sensory function)
- Stratified (cells many layered)

Squamous epithelium

The cells in this epithelium are extremely thin and flat and are arranged edge to edge forming a delicate lining or covering.

It forms the lining of cavities of ducts and blood vessels, lines the chambers of the heart, covers the skin, and lining of the mouth. It also lines pharynx, oesophagus, anal canal, vagina and lower part of urethra. It provides protection to the underlying parts against abrasion (mechanical injury) and entry of germs or chemicals. It also helps in excretion, gas exchange and secretion of coelomic fluid.

Columnar epithelium

This epithelium consists of cells which are much longer than broad; looks like a column. It forms the lining of stomach and intestines; also found in salivary glands in the mouth, sweat glands and oil glands of the skin. It also lines mammary gland ducts and parts of urethra. It helps in protection, absorption and secretion. Columnar epithelium of intestine is specialized for the absorption of water and digested food.

Cuboidal epithelium

Cells are as long as broad and appear cube-like; a centrally located nucleus is present. The cuboidal epithelium lines the small salivary ducts, pancreatic ducts, sweat glands, salivary glands and thy- roid glands. It also covers the ovaries and lines the sperm-producing tubules.

It helps in protection, secretion, absorption, excretion and gamete formation.

Ciliated epithelium

This epithelium, usually consisting of cuboidal or columnar cells, has numerous, thin, delicate, hair-like projections called cilia arising from the outer free surface of the cells. It is found lining the wind-pipe (trachea), kidney tubules, oviduct (Fallopian tubes) and ventricles of the brain. This epithelium helps in the movement of mucus, urine, eggs, sperms and cerebrospinal fluid in a particular direction.

Glandular epithelium

This epithelium consists of columnar cells modified to secrete chemicals. It lines the glands such as gastric glands, pancreatic lobules, intestinal glands, etc.

Sensory epithelium

In some cases, the epithelial cells become modified to receive external stimuli. Such sensory cells have nerve endings so that they can perceive various stimuli. It is found in the nasal pas- sages, taste buds, retina of eyes, and epidermis of earthworm.

Stratified epithelium

This is a compound epithelium in which cells are arranged in many layers one above the other. It is found in places where there is much wear and tear, such as the epidermis of skin, lining of the mouth cavity.

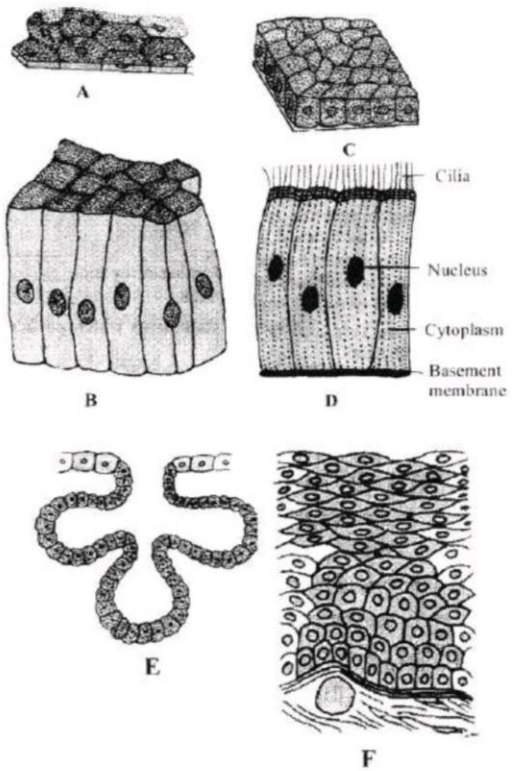


Fig. : Epithelial tissues **A.** Squamous **B.** Columnar **C.** Cuboidal **D.** Ciliated **E.** Galndular **F.** Stratified

Connective tissue

As the name suggests, this tissue serves to "connect" or bind the cells of other tissues in the body, and gives them rigidity and support. It is composed of cells and numerous, thick structures called fibres. The cells are living and are embedded in a non-living, intercellular matrix.

Functions of connective tissue:

- Connective tissue binds different structures with one another, e.g., muscles with skin, muscles with bones.
- These form a supporting framework of cartilage and bones in the body.
- Adipose connective tissue helps in storage of fats. It also forms shock-proof cushions around kidneys, ovaries and eyeballs.
- White blood corpuscles of blood and lymph act as phagocytes and they provide protection against bacterial infections.
- These form protective sheaths around delicate organs such as spleen, kidneys, testes, etc.
- Collagen fibres of connective tissue help in the repair of injured tissues. Based on the nature of matrix, the connective tissue is divided into three general types-
- **Connective tissue proper:** where the matrix is relatively less rigid.
- **Supportive connective tissue (Skeletal tissue):** where the matrix is rigid.
- **Fluid connective tissue:** where the intercellular matrix is a fluid called plasma.

Connective tissue proper

It is of four types: areolar connective tissue, adipose connective tissue, tendon, ligaments.

(i) Areolar connective tissue: It is the most widely distributed connective tissue in the body having jelly-like sticky matrix, irregular-shaped cells and two kinds of fibres- white fibres (made of collagen) and yellow fibres (made of elastin).

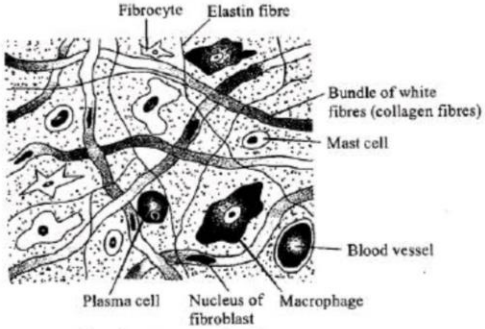


Fig.: Areolar connective tissue

Functions: The areolar tissues is connective in function. It fixes the skin with the muscles, fills the spaces inside the organs, attaches the blood vessels and nerves with the surrounding tissues, fastens the peritoneum to the body wall and viscera. It is commonly called 'packaging tissue' of the body. Examples, bone periosteum, muscle perimysium, nerve perineurium, etc.

(i) **Adipose connective tissue:** It occurs below the skin, around internal organs and yellow bone marrow. Cells are modified to store fat; each cell consists of a large vacuole filled with fat which is surrounded by a small amount of cytoplasm containing a nucleus towards the periphery.

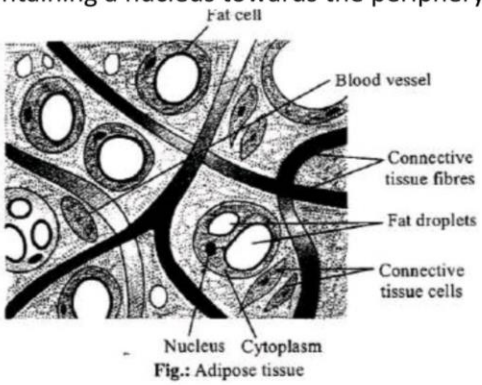


Fig.: Adipose tissue

Functions: The adipose tissue is found beneath the skin, in the covering of the heart, around the blood vessels and kidneys and in yellow bone marrow. This tissue stores fat and insulates the body against heat loss.

(iii) **Tendon:** Tendons are cord-like, very tough, inelastic bundle of white collagen fibres bound together by areolar tissue. The cells present in the tendons are elongated fibroblasts which lie in almost continuous rows here and there. The tendons connect the skeletal muscles with bones.

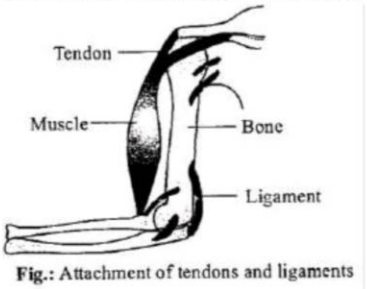


Fig.: Attachment of tendons and ligaments

(iv) **Ligaments:** Ligaments are cords formed by yellow elastic tissue in which many collagen fibres are bound together by areolar tissue. The fibroblasts are irregularly scattered. This tissue combines strength with great flexibility. The ligaments serve to bind the bones together.

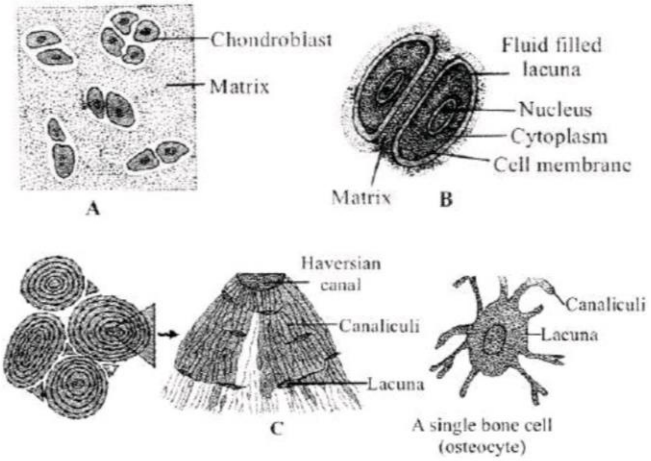
Supportive connective tissue (Skeletal tissue)

It consists of cartilage and bone.

(i) **Cartilage:** Cartilage is a non-porous tissue. Cells of the cartilage called chondroblasts are embedded in the matrix in groups of two, four or more in fluid-filled spaces called lacunae. Cartilage is usually covered by a tough fibrous membrane called perichondrium.

Cartilage is found in nose tip, ear pinna, rings of wind-pipe (trachea), end of long bones, lower ends of ribs. In shark fish, the whole skeleton is cartilaginous. Cartilage performs the function of providing support and flexibility in the vertebrate body.

(ii) **Bone:** Bone is a very strong, rigid and porous tissue. A compact bone consists of living bone cells, called osteoblasts, embedded in a firm, calcified matrix. The osteoblasts are contained in lacunae (spaces) which are arranged in concentric circles present throughout the matrix. The lacunae are also traversed by nerves and blood vessels. The blood vessels passing through them provide nutrients to osteoblasts and help exchange of materials. The matrix is composed of about 30% organic materials (chiefly collagen fibres and glycoproteins) and 70% inorganic bone salts (mainly phosphates and carbonates of calcium and magnesium, hydroxyapatite, etc.). These inorganic salts are responsible for hardness of the bone. Bones form endoskeleton of vertebrates. They provide levers for movement and support for soft parts of the body. Bones also protect many delicate tissues and organs.



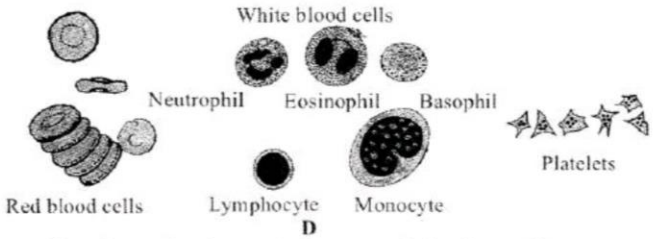


Fig.: Connective tissues: **A.** Structure of a hyaline cartilage **B.** Cell of a cartilage magnified. **C.** T.S. of a part of bone. **D.** Three types of blood cells in human.

Table: Differences between cartilage and bone

	Cartilage	Bone
1.	Cartilage is soft, elastic and flexible.	Bone is hard, tough and inelastic.
2.	Matrix of cartilage consists entirely of organic	Matrix of bone is both organic and inorganic.
3.	matter. Cartilage do not have blood supply (except in	Bones have rich blood supply.
4.	erichondrium). Growth of cartilage is unidirectional.	Growth of bone is bidirectional.

Fluid connective tissue

Blood and lymph constitute the fluid connective tissue and consists of cells and matrix without fibres. Matrix is in a fluid state, and is called **plasma.**

(i) **Blood:** Blood is a bright-red coloured fluid connective tissue. It consists of a straw-colored fluid called plasma in which various kinds of cells or corpuscles are present. The blood cells are-

(a) **Erythrocytes** (red blood cells or RBCs in short),

(b) **Leucocytes** (white blood cells or WBCs in short), and

(c) **Blood platelets.**

The red blood corpuscles of mammals are small, circular, biconcave discs and lack nuclei when mature. There about five million red blood cells per mm3 of blood. They are packed with iron-rich, red-coloured, oxygen-carrying protein pigment, and the hemoglobin. Haemoglobin combines reversibly with oxygen to form oxyhaemoglobin (blood-red in colour). Red blood corpuscles also contain the enzyme carbonic anhydrase which regulates carbon dioxide transport.

The white blood corpuscles are large-sized, nucleated cells present in much smaller number (about 7000 per mm^3 of blood). They are capable of amoeboid movement and play an important

role in the body's defence mechanism. The white blood corpuscles belong to two main categories phagocytes (carry out the function of body defense by engulfing pathogen) and immunocytes (they are responsible for immunity and carry out immune responses by producing antibodies). Phagocytes are further divided into two types- granulocytes (having cytoplasmic granules) and agranulocytes (having non-granular cytoplasm). Granulocytes include- Neutrophils (they engulf and digest disease causing pathogens); Eosinophils (they show allergic responses and antihistamine properties); and Basophils (they release histamine and heparin).

Agranulocytes include- **Monocytes** (they engulf bacteria and cellular debris at injured site). Immunocytes include- **Lymphocytes** (they secrete antibodies to destroy microbes and also help in healing of injuries).

The **platelets** are irregularly shaped, non-nucleated fragments of giant cells. They play a role in blood clotting.

The plasma makes up about 55 per cent of the blood by volume while blood cells make up 45 per cent of the blood by volume.

The body of an adult human being contains about 6 litres of blood.

Major functions of blood:

- Transports food materials.
- Transports oxygen and carbon dioxide.
- Transports excretory products to the kidneys, from where they are eliminated.
- Regulates temperature by distributing heat within the body.
- WBCs protect the body from diseases and help in wound healing.

(ii) Lymph: Lymph is another colourless fluid connective tissue consisting of plasma and mainly white blood cells. RBCs and platelets are absent. It is a fluid that surrounds the body cells.

It mainly helps in the exchange of materials between blood and tissue fluids. The lymph also protects the body against infection by destroying invading microorganisms.

ILLUSTRATION

13. (i) What are chondroblasts?
(ii)Write the function of cartilage.

Ans.: (i) chondroblasts are the cells of me cartilage which are embedded in its matrix in groups of two, four or more in fluid-filled spaces called lacunae.

(ii) Cartilage performs the function of providing support and flexibility in the vertebrate body.

14. What are the functions of areolar tissue? (NCERT)

Ans.: Areolar tissue fills the space inside the organs, support internal organ and helps in repair of tissues. It binds the skin with underlying parts.

15. Name the kind of tissue which forms inner lining of the blood vessels.

Ans.: Squamous epithelium

16. Which type of animal tissue covers the external surfaces of body?

Ans.: Epithelial tissue.

17. are the three types of cells found in areolar tissue

Ans.: The three types of cells found in areolar tissue are mast cells, macrophage and fibroblasts.

18. Which tissue stores fat globules?

Ans.: Adipose tissue.

19. Name three different types of blood cells and cells and give their functions.

Ans.: The three types of blood cells and their functions are as follows:

(a) Red blood cells (RBCs) or Erythrocytes: The chief function of RBCs is the transport of respiratory gases, i.e., oxygen and carbon dioxide.

(b) White blood cells (WBCs) or Leucocyes: These cells perform various functions like engulfing germs, secretion of heparin, histamine and antibodies.

(c) Blood platelets: These cells help in clotting of blood.

20. Name the proteins found in white fibre and yellow fibre.

Ans.: Collagen protein is found in white fibres whereas elastin protein is found in yellow fibres.

21. Which tissue is called middle man between tissue cells and blood?

Ans.: Lymph is called the middle man between tissue cells and blood.

Muscular tissue

Muscular tissue is a contractile tissue consisting of large elongated muscle cells or fibres. The muscle cells are able to shorten to a half or even a third of their "resting" length, and return to their original state.

Contractility is the special property of this tissue. The cytoplasm of a muscle cell (or fibre) contains a large number of fine longitudinally running fibrils called myofibrils. The myofibrils are contractile. The cytoplasm is called the sarcoplasm. Sometimes the muscle fibre is externally covered by a sheath or membrane called **sarcolemma.**

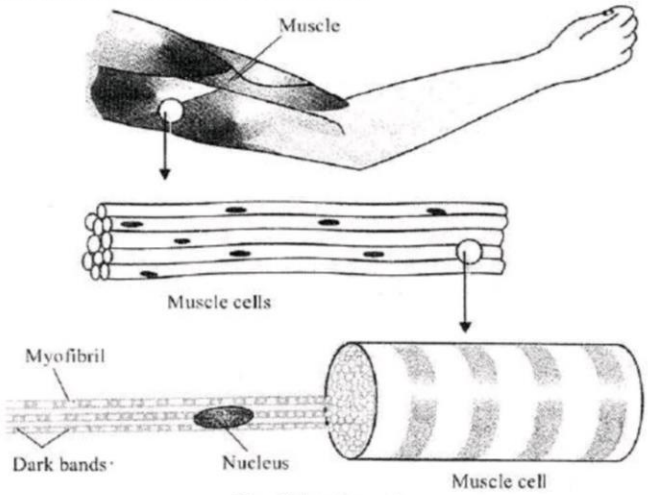


Fig.: Striated muscles

Types of muscular tissue

There are three types of muscular tissue- Striated or striped or skeletal or voluntary muscles, Unstriated or no striated or smooth or involuntary muscles, and Cardiac muscles.

(i) Striated muscles: These are also known as striped, skeletal or voluntary muscles. These occur in bundles, normally attached to the bones and help in body movement. Each muscle fibre is long, cylindrical, unbranched and non-tapering, with multinucleate (coenocytic) condition. Under the microscope, each striated muscle fibre shows **striations.**

The striated muscles are found in the body wall and the limbs (biceps and triceps of the arm). They also occur in tongue, pharynx and beginning of oesophagus.

These muscles can contract rapidly and are responsible for quick movements. These muscles are called voluntary because their contraction is under the control of brain or will.

(ii) Unstriated muscles: These are also known as smooth or involuntary muscles. Each unstriated muscle fibre is a long, flattened, spindle-shaped, tapering and uninucleate cell. The muscle fibres do not show striations. These muscles contract and relax very slowly. These are called involuntary muscles as their movements are not controlled by the brain. Such muscles are found in the walls of all tubular organs such as the stomach, intestines, blood vessels, breathing pas- sages and the organs concerned with urination and reproduction (urinogenital ducts). Rhythmic contraction of smooth muscle in malls of tubular organs (peristaltic contraction) result in the rhythmic progressive wave of muscular contraction and relaxation. These movements occurs in gastrointestinal tract and male genital tract.

In some organs, the smooth muscles make the organs short and thick by its contraction or long tin by its relaxation. They contract throughout the organ as a single unit and produce extrusive movements as in urinary bladder, gallbladder, ureters, uterus.

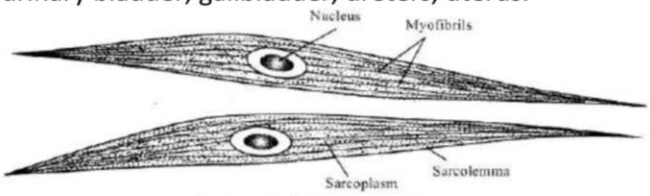


Fig.: Nonstriated (smooth) muscle fibres

(iii) Cardiac muscles: Cardiac muscles are com- posed of branching and anastomosing network of fibres. The fibres have centrally located one or two nuclei and faint transverse striations with light and dark bands. Special electrical junctions called intercalated discs are present at intervals in the fibres. Each fibre is surrounded by sarcolemma. Cardiac muscles show characters of both striated and unstriated muscles. Cardiac muscles are richly supplied with blood. **These muscles occur only in the walls of the heart.**

Cardiac muscles contracts and relaxes rapidly and continuously with a rhythm, but it never gets fatigued. Contraction and relaxation of cardiac muscles cause pumping of blood out of the heart and into the heart regularly.

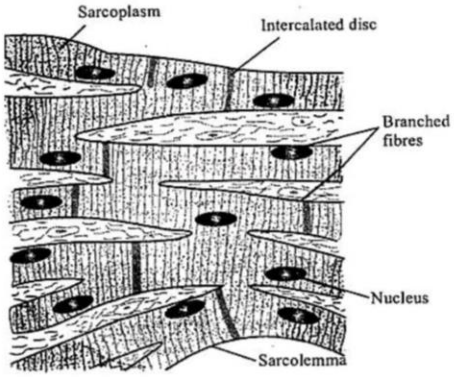


Fig.: Cardiac muscles

Nervous tissue

Nervous tissue is a very specialized tissue for receiving stimuli or sensations and transmitting messages. It is present in brain, spinal cord and

nerves. Nerve cells or neurons form the most important elements of the nervous tissue. Each neuron consists of three parts-

- the main body called the cell body or cyton,
- the dendrons, and
- the axon.

(i) Cyton or cell body: The cell body contains the major concentration of the cytoplasm and the central nucleus of the neuron. The cell body also contains Nissl's granules, which are groups of ribosomes and rough endoplasmic reticulum.

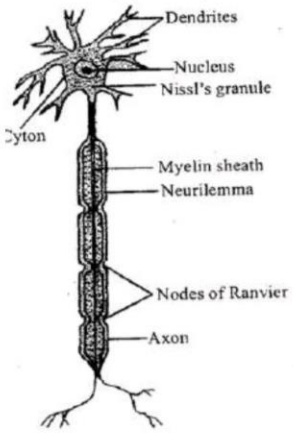


Fig.: Structure of a neuron.

(ii) Dendrons or dendrites: The dendrons are one or more short processes arising from the cyton. Dendrons branch further into many thin dendrites. The dendrites receive impulses.

(iii) Axon: The axon is a single, long, cylindrical process arising from the cyton. The axon forms fine branches at its terminal end. Each branch ends in a swollen structure, called synaptic knob or bouton. The axons carry impulses away from the cell body to other neurons. The synaptic knobs of terminal branches of neuron are connected with dendrite branches of an adjacent neuron. Each such junction, in fact, has minute gap called synapse. It is meant for the transmission of nerve impulse from one neuron to the other.

Nerve cells are joined end to end forming long nerve fibres. Nerve fibres branch out to every part of the body.

ILLUSTRATION

22. Name the tissue responsible for movement in our body. (NCERT)

Ans. Muscular tissue is responsible for movement in our body.

23. What does a neuron look like? (NCERT)

Ans. Neuron is a thread or hair like structure, with palm leaf shaped structure at one end.

24. "Muscle cells are called muscle fibres." Why?

Ans. Muscle cells are thin and elongated having thread-like structures, so these are called muscle fibres.

25. Name the term used for plasma membrane of muscle cell.

Ans. Sarcolemma

26. What is a synapse? Explain.

Ans. The junction between the terminal part of one axon and the dendrite of the adjacent neuron is called a synapse. Synapses help in the transmission of impulses from one neuron to another.

27. What is medullary sheath? Mention its significance.

Ans. Medullary sheath is the covering of nerve fibre. It insulates the nerve fibre and prevents the leakage of ions.

28. Give three features of cardiac muscle. (NCERT)

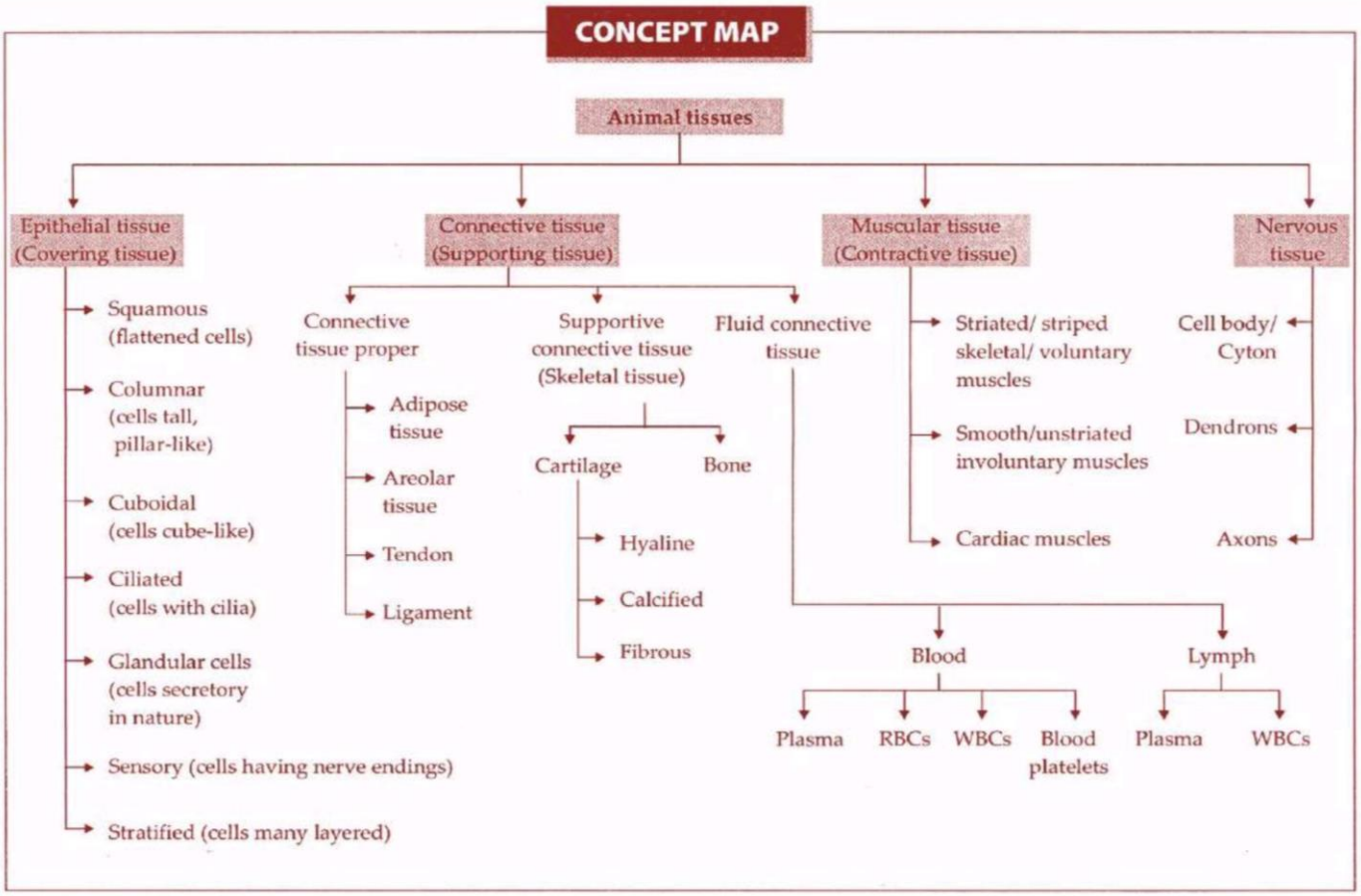
Ans.: The three features of cardiac muscle are given below:

(i) Cardiac muscles show characteristics of both striated and unstriated muscles.

(ii) Intercalated discs are present in the cardiac muscle fibres.

(iii) The muscles show rhythmic contractions.

CONCEPT MAP



ESSENTIAL POINTS For COMPETITIVE EXAMS

THE TISSUE SYSTEM

- Tissues vary depending on their location in the plant body. Their structure and function would also be dependent on location. On the basis of their structure and location, there are three types of tissue systems. These are the epidermal tissue system, the ground or fundamental tissue system and the vascular or conducting tissue system.

Epidermal tissue system

- The epidermal tissue system forms the outer-most covering of the whole plant body and comprises epidermal cells, stomata and the epidermal appendages- the trichomes and hairs.

Ground tissue system

- The tissue present between epidermis and vascular tissue system constitutes ground tissue system. In the stems and roots, vascular bundles are present in a central cylinder which is known as stele. Outside this stele, ground tissues are called extrastelar ground tissues (cortex) and the ground tissues within the stele are known as intrastelar ground tissues (pericycle, medullary rays, pith).
- Different components of ground tissue systems are hypodermis, cortex, endodermis (starch sheath), pericycle and pith or medulla.

Vascular tissue system

- Vascular tissue system is composed of a number of vascular bundles, present in the central cylinder or column of the axis of root and stem which is known as stele. The members of vascular bundle are derived from the procambium of apical meristem.
- The vascular bundle is composed of primary xylem, primary phloem and cambium. Cambium is not the utmost necessary element of vascular tissue system. It is present in dicot plants and absent in monocots.

ANATOMY OF DICOT AND MONCOT PLANTS

- For a better understanding of tissue organization of roots and stems, it is convenient to study the transverse sections of the mature zones of these organs.

Dicot stem

- The primary structure of a dicotyledonous stem may be well understood by using sunflower as an example. The transverse section of the young sunflower stem shows the following structure:
- **Epidermis -** Epidermis is the outermost layer of the stem. It consists of a single layer of cells. The epidermis bears multicellular, uniseriate trichomes. A thin layer of cuticle is present on the epidermis as well as trichomes.

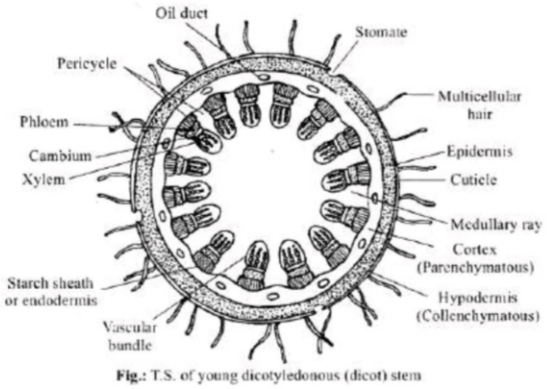


Fig.: T.S. of young dicotyledonous (dicot) stem

- **Hypodemns** - This is just below the epidermis and of 3 to 4 layers of collenchymatous cells. The collenchyma cells contain chloroplasts. This tissue serves to strengthen the youno stem.
- **Endodermis -** It is the innermost layer of the cortex, and consists of a single layer of barrel shaped cells.
- **Pericycle -** The pericycle is in the form of semilunar patches of sclerenchyma cells, which are lignified.
- **Medullary rays -** In between the vascular bundles there are a few layers of parenchymatous cells that constitute medullary rays.
- **Vascular bundles -** The vascular bundles are situated in a ring on the inside of the pericycle of the plant. Each vascular bundle is conjoint, collateral, endarch and open. It is composed of Xylem, phloem and cambium.
  - **Phloem:** This is situated on the outer side of the vascular bundle. The cells are thin-walled and polygonal. Phloem is a complex tissue and is composed of sieve tube elements, companion cells the phloem parenchyma and phloem fibres.
  - **Xylem:** The xylem tissue lies below the phloem. This is composed of the vessels, tracheids, xylem parenchyma and the fibres.
  - **Cambium:** This is present in between the xylem and the phloem. It consists of 2- 3 layers of thin-walled, rectangular cells. The cambium, divides to produce new xylem.

Monocot stem

In the stems of monocotyledonous plants, the vascular bundles are scattered and no distinct corte or pith can be delimited. The internal structure of the young maize (Zea mays) stem shows various layers in a transverse section.

- **Epidermis -** It is single layered with, compact, rectangular, living cells. It is covered with a thick cuticle and have a few stomata. There are no hairs,

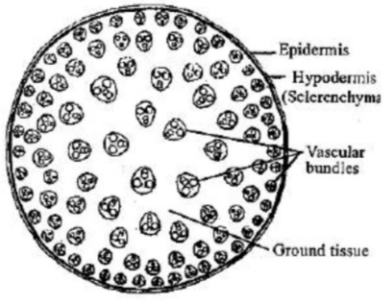


Fig.: Transverse section of monocot stem of *Zea mays* (maize)

- **Hypodermis -** The cells of hypodermis are sclerenchymatous. This layer is located just below the epidermis.
- **Vascular bundles -** The vascular bundles are found scattered throughout the ground tissue the vascular bundles contain no cambium and consequently secondary thickening does not occur. Each vascular bundle is oval and usually surrounded by a sheath of sclerenchymatous cells, the bundle sheath. The bundle consists of two parts, xylem and phloem.

  The xylem consists of 3-4 distinct vessels, which are arranged, in the form of a "Y" One or two smaller vessels lying at the arm base constitute the protoxylem. The two bigger vessels lying laterally constitute the metaxylem. The lower most protoxylem vessels open into a cavity called water containing cavity. The phloem lies outer-to the xylem. It consist of sieve tube elements and companion cells. Phloem parenchyma is absent.

Table: Differences between dicot and monocot stem

	Dicot stem	Monocot stem
1.	Epidermis is single layered with hair (trichome).	It is single layered without hair.
2.	Collenchymatous hypodermis	It is sclerenchymatous.
3.	Cortex is made up of several layers of parenchymatous tissue.	It is absent but parenchymatous ground tissue present from hypodermis to centre of stem.
4.	Endodermis is single layered which is usually not well differentiated.	It is absent.
5.	Pericycle is made up of one or more layers of parenchymatous or sclerenchymatous cells.	It is absent.
6.	Medullary ray is found between the vascular bundles.	It is absent.
7.	Pith is made up of parenchymatous cells situated hollow in the centre of stem.	It is absent (pith cavity is present in stems).
8.	Vascular bundles arranged in ring. Conjoint, collateral or bicollateral, endarch and open. Almost all of them uniform in size.	Scattered, throughout the ground tissue. Conjoint, collateral, exarch and closed. Larger towards centre and smaller towards outer side.

Dicot root

- The primary structure of a typical dicotyledonous root can be studied by examining the transverse section of a young root of sunflower, pea or gram.
- A transverse section of a young dicotyledonous root shows three regions, namely, the epiblema, cortex and stele.
- **Epiblema -** Epiblema is also known as the piliferous layer. It is characteristically single layered, comprising tubular living components. There is no cuticle on the epidermis. Some cells of the epidermis show tubular outgrowths known as root hairs.
- **Cortex -** The cortex is uniform and simple. It consists of several layer of thin walled parenchyma cells with conspicuous intercellular spaces. The cells contain storage materials like starch. The innermost layer of cortex is the endodermis, which completely surrounds the stele. It is structurally and physiologically different from the cells on either side of it. The radial and transverse walls of the endodermal cells contain a band of lignin and suberin, known as the Casparian strip and considered to control the movement of materials in the roots. Later in the development of the root, all cells of the endodermis become thick walled, except at positions opposite the protoxylem. This thin walled cells are known as passage cells.
- **Stele -** All tissues inside of the endodermis comprise the stele of the root. These include pericycle, vascular bundles, and pith.
- **Vascular bundles** are radial, that is xylem and phloem that occur in separate patches, are arranged on alternate radii. Xylem consists of both protoxylem and metaxylem. It is exarch, since the protoxylem lies towards the epidermis. Based on the number of xylem arch, the roots are known as the **monarch, diarch, triarch, tetrarch,** and so on. The root of the bean plant possesses a tetrach condition, while that in the sunflower plant is triarch. In the dicotyledonous plants, the xylem plates usually extent into the centre to form a solid centre core without any pith. Phloem patches are rather small. They form oval groups under the pericycle. These oval masses are separated from the xylem by parenchymatous cells that are known as the conjunctive tissue.

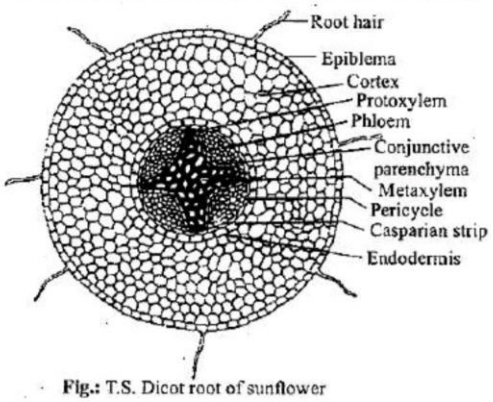


Fig.: T.S. Dicot root of sunflower

Monocot root

- A transverse section of a monocotyledonous root also shows three regions, the epiblema, cortex and stele.

- **Epiblema or piliferous layer -** It is the outermost layer consisting of a single row of thin-walled cells without any intercellular spaces. The structure and fate of this layer is more or less similar to that of dicot roots. It becomes disintegrated after the root hairs are shed.
- **Cortex -** The cortex consists of several layers of parenchymatous cells with intercellular spaces. The cortex is smaller than in the dicotyledonous root. The endodermis or inner boundary of the cortex is characterized by the presence of Casparian strip. As the epiblema dies off, a few outer layers of the cortex become cutinized and form the exodermis. Certain endodermal cells, which are present opposite to the xylem bundles, remain thin walled. These are known as passage cells. Their functions is to transfer water and dissolved salts from cortex directly into the xylem.
- **Stele -** All tissues inside of the endodermis comprise the stele. These include pericycle, vascular bundles and pith.

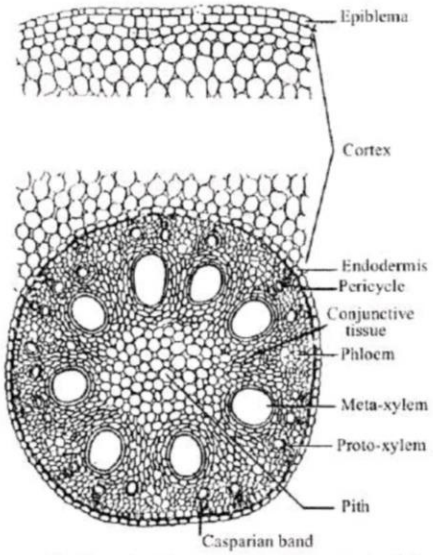


Fig.: A portion of monocot root of *Zea mays* (maize) in transverse section.

Table: Differences between dicot and monocot root

	Dicot root	Monocot root
1.	Cortex is comparatively narrow.	It is very wide.
2.	Endodermis is less thickened, Casparian strips are more prominent and no passage cells.	It is highly thickened, Casparian strip visible only in young root and passage cells occur.
3.	Pericycle gives rise to secondary (lateral) roots and lateral meristem.	It gives rise to lateral roots only.
4.	Vascular bundles are diarch to hexarch (2 to 6).	Polyarch (more than 6).
5.	Conjunctive tissue is parenchymatous.	May be parenchymatous or sclerenchym atous.
6.	Cambium present (at the time of secondary growth).	Absent.
7.	Secondary growth takes place.	Absent.
8.	Pith is small or absent.	Large and well developed.

TRANSITIONAL EPITHELIUM (=UROTHELIUM)

- This epithelium consists of 4 to 6 layers of cells. The cells of deepest (= basal) layer are columnar or cuboidal. The cells of middle layer are polyhedral or pear shaped. The cells of the surface layer are large and globular or umbrella shaped. There is no germinative layer or basement membrane but shows mitosis. The cells of inner most (= basal) layer rest on underlying connective tissue.
- This epithelium is found in the renal calyces, renal pelvis, ureters, urinary bladder and part of the urethra. Because of its distribution, transitional epithelium is also called urothelium (epithelium present in the urinary system).
- It permits distention. The transitional epithelium of the urinary bladder can be stretched considerably without being damaged.

TYPES OF CARTILAGE

- The cartilage is of three types –

Hyaline cartilage (hyalos = glass)

- It contains clear, large amount of transluscent, slightly elastic matrix with less fibres.
- It is the most prevalent cartilage. It forms articular surfaces at the joints of long knees, where it is called articular cartilage. It also forms part of larynx and sternum (breast bone), rings of trachea

and bronchi, sternal parts of ribs (= costal cartilages), hyoid apparatus and nasal cartilages.

- Most of the embryonic skeleton consists of hyaline cartilage.
- Hyaline cartilage forms the skeleton of elasmobranch fishes (cartilaginous fishes) and the embryonic skeleton in bony vertebrates.

Fibrous cartilage

- It has well developed fibres in the matrix. It is of two types: white fibrocartilage and yellow elastic fibrocartilage.
- This type of cartilage is found in the pinna and external auditory canal of the ear, Eustachian tube, epiglottis and tip of the nose.

Calcified cartilage

- Sometimes matrix contains granules of calcium carbonate, then the cartilage is called calcified cartilage. Calcium carbonate makes the cartilage hard and inelastic. This cartilage is found in suprascapula of pectoral girdle of frog and vertebrae of shark.

BONE CELLS

(i) **Osteoprogenitor cells:** They are mesenchymal stem cells which occur in periosteum and endosteum.

(ii) **Osteoblasts:** They are bone forming cells which occur in monolayers on the forming surface of the bones.

(iii) **Osteocytes:** They are bone cells that occur entrapped inside the matrix. Osteocytes lie inside fluid-filled spaces or lacunae and their canaliculi.

(iv) **Osteoclasts:** They are polymorphic cells which develop by fusion of several monocyte type of phagocytic cells developed by bone marrow. An osteoclast may have 15-20 nuclei. Osteoclasts are specialized to cause **resorption of bone.**

TYPES OF NEURON

Apolar neuron

- The nerve cell is without any process, neither dendron nor axon. The condition is found in neuroblasts or immature embryonic nerve cells.

Unipolar neuron

- It is a neuron with a single process. The single process is generally axon but can also be dendron. Unipolar neuron occurs in invertebrates and in embryonic state in vertebrates.

Bipolar neuron

- The neuron has two processes, arising from the two ends of a cell body or cyton.
- Bipolar neurons occur in olfactory cells, retina and sensory cells of ear.

Multipolar neuron

- The neuron possesses more than two processes. Multipolar neurons are the common type of neurons being present in grey matter of central nervous system and ganglia of autonomic nervous system.

NERVE FIBRES

- They are elongated and slender processes of the neurons which are formed by ensheathing of axons. These are of given types:

Myelinated or Medullated nerve fibres

- Myelin or medullary sheath is secreted by Schwann cells in peripheral nerve fibres and oligodendrocytes in central nervous system.
- The area of myelinated nerve fibres devoid of myelin sheath are called **nodes of Ranvier.**
- Area of nerve fibre between two adjacent nodes of Ranvier is called internode.

Nonmyelinated or Nonmedullated nerve fibres

- The fibres lack myelin sheath. They are covered by only one sheath, that of neurilemma.
- Nonmedullated or nonmyelinated nerve fibres form about 75% of nerve supply to skin and dorsal spinal roots, 50% of nerve supply to muscles and majority of nerve fibres of autonomic system. They are greyish in fresh state.

Afferent and efferent nerve fibres

- Nerve fibres bringing information from sense organs to central nervous system are called

afferent or sensory nerve fibres. Nerve fibres taking information from central nervous system to muscles, glands and other effector organs are called efferent **or motor nerve fibres.**

SYNAPSE

- Synapse is an area of specialized apposition between two neurons for transmission of impulse. A narrow gap of about 200 A synaptic cleft occurs in the synapse. One neuron develops a number of synapses.
- Chemicals used for neurotransmission are called neurotransmitters, e.g., acetylcholine (Ach), adrenaline, noradrenaline, dopamine, serotonin, histamine, gamma amino butyric acid (GABA), nitrogen oxide and several types of neuropeptides.

SOLVED EXAMPLES

1. Name a plant which does not have tissues.

Ans.: Chlamydomonas (unicellular plant).

2. What is sclerenchyma? What are its types?

Ans.: Sclerenchyma is a strengthening (mechanical) tissue. It is a simple tissue. Its cells are dead and possess hard, rigid and very thick lignified walls. Its cells are of two types—fibres and sclereids.

3. Write one point of difference between the following:
(a) Xylem and phloem.
(b) Collenchyma and Sclerenchyma.

Ans.: (a) Xylem transports water and minerals, phloem transports food to the different parts of the plants.
(b) Collenchyma consists of living cells whereas sclerenchyma is formed of dead cells.

4. Where do you find hyaline cartilage?

Ans.: At the extremity of larynx, trachea and long bones.

5. Write the differences between simple and complex tissues. Give examples of each.

Ans.:

	Simple tissue	Complex tissue
1.	They are made up of only one type of cells with uniform mass.	They are composed of different types of cells.
2.	The cells are similar in structure and function.	The cells are different in structure and function.
3.	Examples are parenchyma, collenchyma	Examples are xylem and phloem.
4.	sclerenchyma. Parenchyma store food material, collenchyma manufacture sugar and sclerenchyma give mechanical support.	Xylem transports water while phloem transports food.

6. Name the epithelium that lines inner surface of urinary bladder.

Ans.: Transitional epithelium.

7. Which two types of cells make myelin sheath?

Ans. (i) Schwann cells and (ii) Neuroglia cells.

8. Where does areolar tissue occur?

Ans.: Areolar tissue occurs beneath the epithelia of hollow visceral organs, skin and on the walls of veins and arteries.

9. What will happen if heparin is absent in blood?

Ans.: Heparin is a blood anticoagulant. In the absence of heparin, blood will clot inside the blood vessels and the person will die.

10. An organism has actively dividing cells at its growing apices which continue to divide and add new cells throughout the life. To which group does it belong-plants or animals?

Ans.: It belongs to plants.

11. Why is blood considered to be connective tissue?

Ans.: Blood is considered as mobile connective tissue because during circulation it passes through all the organs of the body and, in doing so, it connects different tissues and organs of the body.

12. What will happen if apical meristem is damaged or cut?

Ans.: Apical meristems are present at the tips of roots, shoots, branches and leaves. They form the growing parts of the roots and stems. If they are damaged or cut, the growth in length of that part will cease to occur.

13. Sieve tube cells of phloem tissue do not possess nuclei in mature state. Still they remain alive. Give the reason.

Ans.: Sieve tube cells of phloem tissue do not possess nuclei in mature state. Still they remain alive because sieve tube cells are dependent on the adjacent companion cells which develop from the same original meristematic cells. The two cells, i.e., sieve tube cells and companion cells together form a functional unit.

14. Cardiac muscles continuously work throughout the life of an organism. Why does it not undergo sustained contraction, i.e., tetanus?

Ans.: Tetanus is a state of sustained contraction of muscles due to continuous nerve stimulation. Although, the heart works continuously it undergoes alternate contraction and relaxation with an intermediate resting or

refractory period. For this reason, the cardiac muscle cannot go into sustained contraction (tetanus).

15. Gautam is asked to prepare a temporary mount of meristematic tissue. Which part of the plant should he take so as to cut a section and prepare the mount?

Ans.: Gautam should cut a section of either the root tip or the shoot tip because meristems are located in the growing regions only.

2. How many types of elements together make up the xylem tissue? Name them.

Ans.: Four types of elements together make up the xylem tissue. These elements are-
(a) tracheids,
(b) vessels,
(c) xylem parenchyma and
(d) xylem fibres.

3. How are simple tissues different from complex tissues in plants?

Ans.: Simple tissues are made up of only one type of cells, which look like each other. On the other hand, complex tissues are made up of more than one type of cells. Parenchyma, collenchymas and are the examples of simple plant tissue whereas xylem and phloem are complex tissue.

NCERT SECTION

1. Define the term "tissue".

Ans.: Group of cells which **are similar in** structure that work together to achieve a particular function forms a tissue.

4. Differentiate between parenchyma, collenchyma and sclerenchyma on the basis of their cell wall.

Ans.: On the basis of the cell wall, differences between parenchyma, collenchyma and sclerenchyma are-

	Parenchyma	Collenchyma	Sclerenchyma
1.	Cell wall is thin.	Cell wall is thick.	Cell wall hard, rigid, very thick.
2.	Made up of cellulose.	Made up of cellulose and pectin.	Made up of lignin-a water proof material.

5. What are the functions of stomata?

Ans.: Stomata are necessary for exchanging gases with the atmosphere. Transpiration (loss of water in the form of water vapour) also takes place through stomata.

6. Diagrammatically show the difference between the three types of muscle fibres.

Ans.:

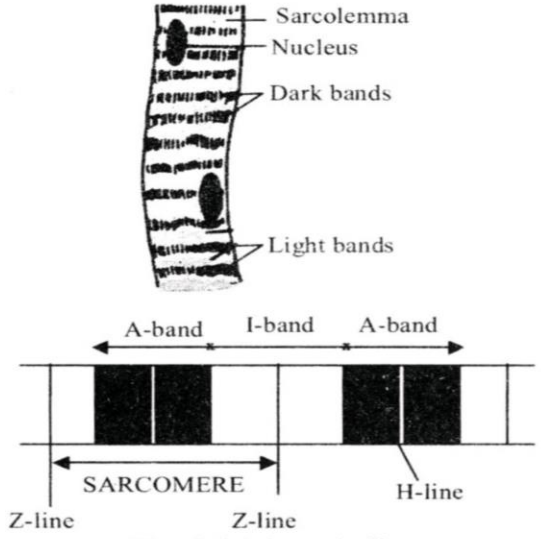


Fig.: Striated muscle fibre

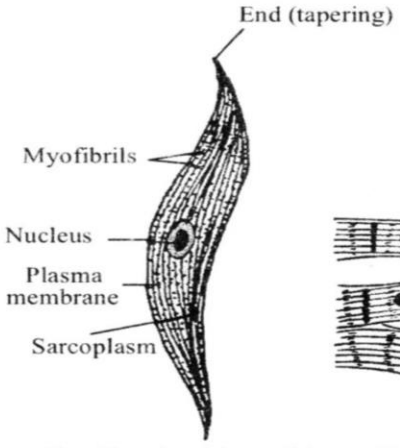


Fig.: Unstriated (smooth)

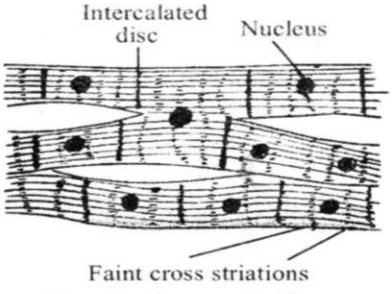


Fig.: Cardiac muscle fibre

7. What is the specific function of the cardiac muscle?

Ans.: The specific function of the cardiac muscle is rhythmic contraction and relaxation simultaneously throughout life without getting fatigued.

8. Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body.

Ans.: The differences between striated, unstriated and cardiac muscles are given below;

Table: Differences between striated, unstriated and cardiac muscles.

	Striated muscles	Unstriated muscles	Cardiac muscles
1.	Each muscle is long, cylindrical, non-tapering and multi-nucleate.	Each muscle fibre is long, flattened, spindle shaped, tapering and uninucleate.	The fibres have centrally located one or two nuclei and transverse striations with light and dark bands. They are branched.
2.	Shows striations	Does not show striations.	Shows transverse striations.
3.	Occur in the limbs, body wall and neck.	Occur in the walls of all tubular organs such as the stomach, intestines, blood vessels, breathing passages and the urinogenital ducts.	Occur only in the walls of the heart.

9. Draw a labeled diagram of a neuron.

Ans.:

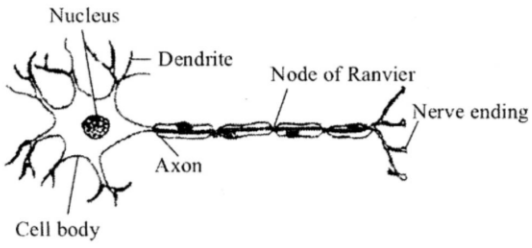


Fig.: Nerve cell or Neuron.

10. Name the following:

(a) Tissue that forms inner lining of our mouth.
(b) Tissue that connects muscle to bone in humans.
(c) Tissue that transports food in plants.
(d) Tissue that stores fat in our body.
(e) Connective tissue whose matrix is fluid.
(f) Tissue present in the brain.

Ans.: (a) Epithelial tissue—Squamous epithelium, (b) Tendon, (c) Phloem, (d) Adipose tissue, (e) Fluid connective tissue — Blood, (f) Nervous tissue.

11. Identify the type of tissue in the following: skin, bark of tree, bone, lining of kidney tubule, vascular bundle.

Ans.: Skin—Squamous epithelium
Bark of tree—Epidermal tissue/cork
Bone—Supportive connective tissue/skeletal tissue
Lining of kidney tubule—Ciliated epithelium
Vascular bundle—Xylem and phloem (conducting tissue).

12. Name the regions in which parenchyma tissue is present.

Ans.: In small herbivorous plants, parenchyma makes up the bulk of the plant body. It is mainly found in the cortex, pith, ground tissue of petioles, mesophyll of leaves and also in vascular bundles.

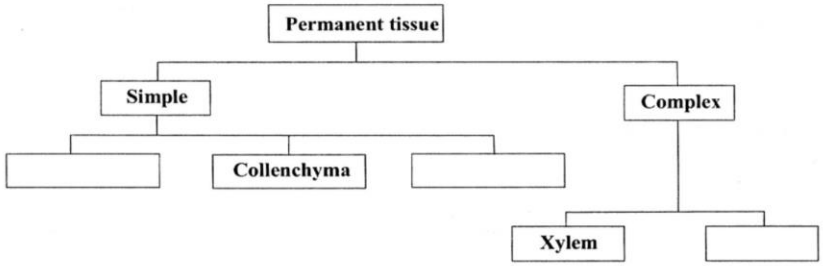
13. What is the role of epidermis in plants?

Ans.: It protects internal tissues against mechanical injury, parasitic fungi, bacteria, and also cold or heat. Thick cuticle, wax, epidermal hair and multiple epidermis reduce loss of water from internal tissue. Epidermal cells of roots have hairs that greatly increase the absorptive surface areas for the absorption of water and nutrients.

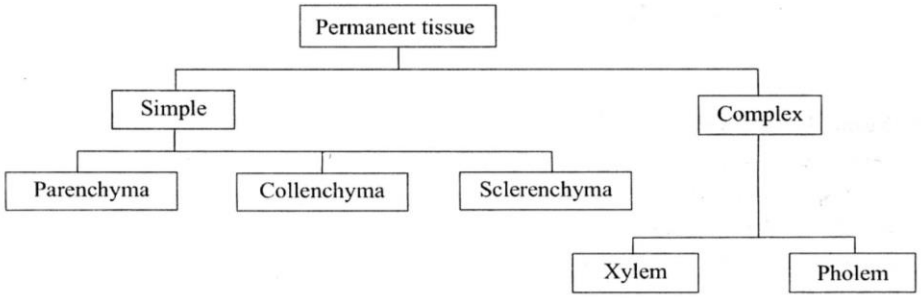
14. How does the cork act as a protective tissue?

Ans.: The walls of cork cells are heavily thickened by the deposition of sobering. This structural characteristic helps the cork to protect and prevent itself from infection and mechanical injury. It also prevents desiccation, by preventing loss of water from the plant body.

15. Complete the table



Ans.:



NCERT EXEMPLAR PROBLEMS-SOLUTIONS

Multiple Choice Questions (MCQs)

1. Which of the following tissues has dead cells?
(a) Parenchyma (b) Sclerenchyma
(c) Collenchyma (d) Epithelial tissue

Ans. **(b)** Sclerenchyma cells are the permanent tissues present in the plants. They provide hardness and stiffness to the plant and are composed of dead cells. This tissue is present in stems around vascular bundles in the veins of leaves and in hard covering of seeds and nuts.
e.g., the husk of coconut is made up of sclerenchymatous tissues. The cells of Sclerenchyma are long narrow and thickened due to lignin.

2. Find out incorrect sentence
(a) Parenchymatous tissues have intercellular spaces.
(b) Collenchymatous tissues are irregularly thickened at corners.
(c) Apical and intercalary meristems are permanent tissues.
(d) Meristematic tissues, in its early stage, lack vacuoles.

Thinking Process
Apical and intercalary meristem as the name suggest cannot be a permanent tissue. They help in the growth of plants.

Ans. **(c)** Parenchyma serves as a packing tissue in plants therefore they do not have intercellular spaces. Collenchymatous tissues are mechanical tissues in the plants and are characterized by deposition of cellulose at the corners of the cell, which leads to localized thickenings of the cell wall.
Apical and intercalary merited bring primary growth (increase in height) and secondary growth (increase in diameter) respectively and are classified under meristematic tissues. Meristematic tissue are dividing units of the plants and contain dense cytoplasm and large nucleus with few or no vacuoles at all.

3. Girth of stem increases due to
(a) apical meristem (b) lateral meristem
(c) intercalary meristem (d) vertical meristem

Ans. (b) Girth of the stem increases due to lateral meristematic tissues. They are found beneath the bark (called cork cambium) and in vascular bundles of dicot roots and stems (called vascular cambium) as thin layers. This increase in the diameter and girth of the plant is called secondary growth.
The apical meristem is situated at the growing tip of stems, root and also at the apices of leaf. They bring about elongation, i.e.,

increase in height (primary growth) of the plant. Intercalary meristem are located at base of leaf and internode and produces an increase in the length of an organ.

4. Which cell does not have perforated cell wall?
(a) Tracheids (b) Companion cells
(c) Sieve tubes (d) Vessels

Thinking Process

Companion cells are associated with sieve tubes and connected to them by numerous plasmodesmata. They help in maintaining pressure gradient in sieve tubes. These are not perforated.

Ans. (b) Tracheids and vessels are xylem elements and are concerned with the transport of water. They are long tube-like structures with partially or completely dissolved walls to form water pipes (in vessels) and pits in cell wall (in tracheids) for conducting water.
Sieve tubes are slender tube-like structures with their end walls perforated by numerous pores and are called sieve plates. They are phloem elements and are main food conducting elements. Companion cells possess numerous mitochondria and ribosomes and are supporting units of sieve tubes.

5. Intestine absorb the digested food materials. What type of epithelial cells are responsible for that?
(a) Stratified squamous epithelium
(b) Columnar epithelium
(c) Spindle fibres
(d) Cuboidal epithelium

Thinking Process

Columnar epithelium are brush bordered as they contain microvilli. This increases the surface area, which is helpful for absorption processes.

Ans. **(b)** Columnar epithelium consists of pillar-like cells with their nuclei towards the base. They form the lining of stomach, small intestine and colon, forming the mucous membrane.
Their main function is absorption (e.g., stomach, intestine) and secretion (e.g., mucous by goblet cells).
Stratified squalors epithelium, also known as pavement epithelium is covered by fibrous protein, (keratin) that covers the skin. This epithelium is waterproof and resistant to mechanical injury, Cuboidal epithelium is found in kidney tubules, thyroid vesicles and in glands.

6. A person met with an accident in which two long bones of hand were dislocated. Which among the following may be the possible reason?
(a) Tendon break
(b) Break of skeletal muscle
(c) Ligament break
(d) Areolar tissue break

Ans. **(c)** Dislocation of joint occurs when there is an abnormal separation in joint, which are held together by ligament. Therefore ligament break and may result in dislocation of bone.
Areolar tissues join skin to muscles, fills spaces inside organs and is found around muscles, blood vessels and nerves. Hence are not concerned with bones,
Tendon break may cause inflammation and occurs due to factors including age, body weight, nutrition, sports, etc.
Note Tendons join skeletal muscles to bones and ligaments join bones to bones.

7. While doing work and running, you move your organs like hands, legs, etc.
Which among the following is correct?
(a) Smooth muscles contract and pull the ligament to move the bones
(b) Smooth muscles contract and pull the tendons to move the bones
(c) Skeletal muscles contract and pull the ligament to move the bones
(d) Skeletal muscles contract and pull the tendon to move the bones

Thinking Process

Smooth muscles are involuntary, i.e., they do not work according to our will, therefore option (a) and (b) cannot be the answer. Ligament connects bone to bone but it is the tendons which connect muscles to bones.

Ans. **(d)** Skeletal muscles are striped, voluntary muscles, due to presence of alternate dark and light bands. They are called voluntary as they work according to our will. While doing work and running skeletal muscles contract and pull the tendon (which connects muscles to bones) to move the bone.

8. Which muscles act involuntarily?
(i) Striated muscles (ii) Smooth muscles
(iii) Cardiac muscles (iv) Skeletal muscles
(a) (i) and (ii) (b) (ii) and (iii)
(c) (iii) and (iv) (d) (i) and (iv)

Ans. **(b)** Smooth muscles are found in the walls of hollow visceral organs. They do not work according to our will. They are involved in

peristaltic movements of gastro intestinal tract and male genital tract. Cardiac muscles are present in the heart. They contract and relax rapidly, rhythmically and tirelessly. They help to pump the blood to various parts of the body. The working of both smooth and cardiac muscles is involuntary while skeletal or straited muscles move according to our will and are voluntary in action.

9. Meristematic tissues in plants are
(a) localized and permanent
(b) not limited to certain regions
(c) localized and dividing cells
(d) growing in volume

Ans. **(c)** Meristematic tissues consists of actively dividing cells and is present in the growing regions of plants, e.g., the tips of roots and stems. The cells of meristematic tissue are round, oval, polygonal or rectangular. They are packed closely without intercellular spaces, have thin cellulose walls, dense cytoplasm and prominent nuclei. Vacuoles are almost absent in such cells because they are completely filled with sap.

10. Which is not a function of epidermis?
(a) Protection from adverse condition
(b) Gaseous exchange
(c) Conduction of water
(d) Transpiration

Ans. **(c)** Epidermis is present as outermost layer of plant body such as leaves, flowers, stem and root. It is covered with cuticle (a waterproof layer of waxy substance cutin)
The main function of epidermis is to protect the plant from desiccation and infection. In fact, cuticle of epidermis helps to reduce water loss by evaporation from the plant surface and also helps in preventing the entry of pathogen (bacteria, fungi etc.). The aerial surface of many plant bear cutinized hair (trichomes) to reduce transpiration.

11. Select the incorrect sentence.
(a) Blood has matrix containing proteins, salts and hormones.
(b) Two bones are connected with ligament.
(c) Tendons are non-fibrous tissue and fragile.
(d) Cartilage is a form of connective tissue.

Ans. **(c)** Tendons are cord-like, strong, inelastic, structures that join skeletal muscles to bones.
A tendon is a white fibrous tissue which has great strength but limited flexibility. It. consists of parallel bundles of collagen fibres, between which are present, rows of fibroblasts (called tendinocytes).

12. Cartilage is not found in
(a) nose (b) ear
(c) kidney (d) larynx

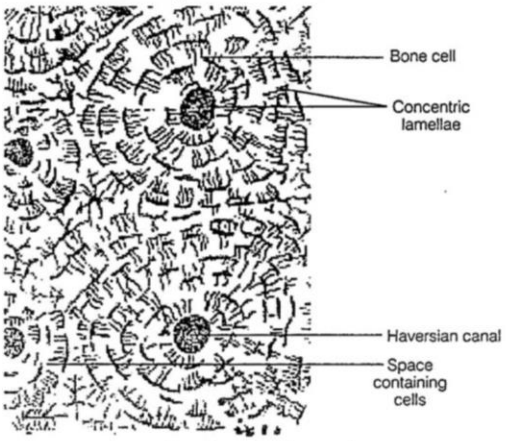
Ans. **(c)** Cartilage is specialized connective tissue, which is compact and less vascular. The cartilage cells (chondroblasts) are widely spaced and the matrix is reinforced by fibres. Cartilage occurs at the joints of bones, in the nose, ear, trachea and larynx. It helps in smoothening the surface at the joints. It lends support and provides flexibility to the body parts.

13. Fats are stored in human body as
(a) cuboidal epithelium (b) adipose tissue
(c) bones (d) cartilage

Ans. **(b)** Adipose tissue consists of oval and round cells filled with fat globules, scattered in the matrix. This tissue is found below the skin, between internal organs and in the yellow bone marrow. It stores fat and acts as an insulator.
Cuboidal epithelium help in absorption, excretion and secretion, whereas bones and cartilage are specialized connective tissue and they provide support to the internal organs.

14. Bone matrix is rich in
(a) fluoride and calcium
(b) calcium and phosphorus
(c) calcium and potassium
(d) phosphorus and potassium

Ans. **(b)** Bone cells are embedded in a hard matrix, which is strengthened by fibers, and hardened by calcium and phosphorus salts. The matrix is deposited in form of concentric layers of lamellae formed around a central Aversion canal,
The bone cells occupy small spaces between the concentric layers of matrix.



Section of a human bone

15. Contractile proteins are found in

(a) bones (b) blood
(c) muscles (d) cartilage

Thinking Process

Bones, blood, and cartilage all are different types of connective tissue and are not responsible for movement of any of the body parts.

Ans. **(c)** Contractile proteins are found in muscles, as they are associated with the movement of body or limbs. The contraction and relaxation of contractile proteins, present in muscles bring about movements of limbs, internal organs, etc.

The bones are the major supporting tissue which form the endoskeleton of a vertebrate body.

Blood is a fluid connective tissue responsible for transport of oxygen, nutrients, hormones etc., and for producing antitoxins and antibodies, etc.

Cartilage provides support and flexibility to the body parts and smoothens surface at joints.

16. Voluntary muscles are found in
(a) alimentary canal (b) limbs
(c) iris of the eye (d) bronchi of lungs

Thinking Process

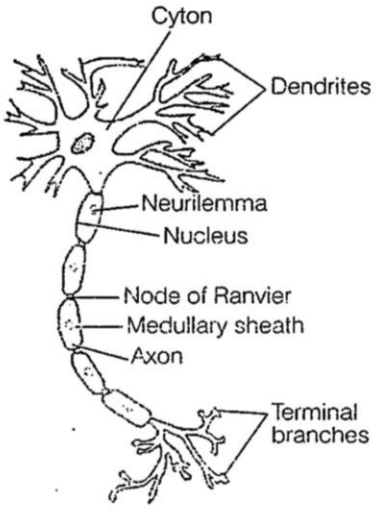
Alimentary canal, is of the eye and bronchi of lungs, the movements of the above organs are not under our will.

Ans. **(b)** Voluntary muscles are the muscles, which are under our complete control for, e.g., the working and movement of limbs. On the other hand involuntary muscles are controlled by hypothalarnus, i.e., they are regulated rhythmically, e.g., alimentary canal, iris of the eye and bronchi of lungs.

17. Nervous tissue is not found in
(a) brain (b) spinal cord
(c) tendons (d) nerves

Ans. **(c)** Tendons are the connective tissue, which join skeletal muscles to bones, hence nervous tissue is absent is them. Nervous tissue is specialized to transmit messages within our body. It contains highly specialized unit cells called nerve cells or neurons.

They have the ability to receive stimuli from within or outside the body and to conduct (send) impulses (signals) to different parts of the body. Brain, spinal cord are all associated with the regulation of body activity and are composed of nervous tissue.



A neuron

18. Nerve cell does not contain
(a) axon (b) nerve endings
(c) tendons (d) dendrites

Ans. **(c)** Each nerve cell or neuron is composed of three parts

(i) Cyton or cell body it contains central nucleus and cytoplasm with characteristic deeply stained particles called Nissl's granules (i.e., clumps of ribosome).

(ii) Dendron These are short processes' arising from cyton and further branching into dendrites.

(iii) **Axon** It is a single long cylindrical process of uniform diameter which forms fine branches terminally. The dendrites receives impulses and the axon takes impulses away from the cell body.

19. Which of the following helps in repair of tissue and fills up the space inside the organ?
(a) Tendon (b) Adipose tissue
(c) Areolar (d) Cartilage

Ans. (c) Areolar tissue is a loose and cellular connective tissue. Its matrix consists of two kinds of fibres, i.e., the white collagen fibres (which changes into gelatin on boiling in water) and the yellow elastic fibres or elastin. Several other kinds of irregular cells, (e.g., fibroblasts), which can engulf bacteria and prevent infection (e.g., macrophages) are also present in the matrix.

It is the simplest and most widely distributed connective tissue. It joins skin to muscles, fills spaces inside organs and is found around muscles, blood vessels and nerves. It acts as a supporting and packing tissue between organs lying in the body cavity. Matrix of this tissue is

important in diffusion of oxygen and nutrients from small blood vessels.
It helps in repairing of tissues and to combat foreign toxins.

20. The muscular tissue which function throughout the life continuously without fatigue is
(a) skeletal muscle (b) cardiac muscle
(c) smooth muscle (d) voluntary muscle

Ans. **(b)** Cardiac muscles show characteristics of both smooth and striated muscles. These muscles are striated, cylindrical, branched and involuntary in nature. In addition to the light and dark bands, these muscles show densely stained cross bands called intercalated dises.
These act as impulse boosters. Cardiac muscles contract and relax rapidly rhythmically and tirelessly throughout a lifetime, from early embryonic stage until death.
Voluntary muscles are under our control and act accordingly to our need, e.g., skeletal muscles, Smooth muscles also known as striated, viscera or involuntary muscles are found in walls of hollow tubular organs like alimentary canal, ducts of glands, urogenital ducts and blood vessels except heart. They show slow contractions but remain contracted for a long period of time.

21. Which of the following cells is found in the cartilaginous tissue of the body?
(a) Mast cells (b) Basophils
(c) Osteocytes (d) Chondrocytes

Ans. **(d)** The matrix of cartilage has delicate-network of collagen fibres and chondrocytes (living cells). These are present in fluid-filled spaces called lacunae. Chondrocytes multiply by mitosis and help in internal growth of cartilage.
A mast cell is a resident granulocyte of several type of tissue. It contains granules rich in histamine and heparin. They play a key role in allergy and are involved in wound healing and defense against pathogens.
Basophils are granulocytes of white blood cells (WBCs) and are involved in function of body defence by engulfing bacteria and other foreign substances.
Osteocytes are the bone cells.

22. The dead element present in the phloem is
(a) companion cells (b) phloem fibres
(c) phloem parenchyma (d) sieve tubes

Ans. **(b)** Phloem fibres are thick walled, elongated spindle shaped dead cells which possess narrow lumen. They provides mechanical support to the tissue. Phloem parenchyma are thin walled-living cells of parenchyma. They have two functions, storage and lateral food conduction.

23. Which of the following does not lose their nucleus at maturity?
(a) Companion cells (b) Red blood cells
(c) Vessel (d) Sieve tube cells

Ans. **(a)** Companion cells are present along the sieve tube are connected to them via plasmodesmata. These cells are metabolically active and sieve tube elements are dependent on these cells they do not lose nucleus at maturity. RBC vessels and sieve tube cells lose their nucleus at maturity.

24. In desert plants, rate of water loss gets reduced due to the presence of
(a) cuticle (b) stomata
(c) lignin (d) suberin

Ans. **(a)** Cuticle are protective, hydrophobia waxy covering produced by epidermal cells of leaves, young shoots and other aerial parts. It minimizes the water loss through transpiration (with the help of stomata) and also reduces pathogen entry.
Lignin hardens the cell wall and provides flexibility, tensile and compressional strength to the cell wall. Suberin is present in cork cells and makes the cell impervious to water.

25. A long tree has several branches. The tissue that helps in the sideways conduction of water in the branches is
(a) collenchyma (b) xylem parenchyma
(c) parenchyma (c) xylem vessels

Ans. **(d)** Xylem vessels are very long tube-like structures formed by a row of cells placed end to end. The transverse wails between these cells are partially or completely dissolved to form continous water channels.

26. If the tip of sugarcane plant is removed from the field, even then it keeps on growing in length. It is due to the presence of
(a) cambium (b) apical meristem
(c) lateral meristem
(d) intercalary meristem

Ans. **(a)** If the tip of sugarcane plant is removed the apical meristem is also removed as it is situated in the apices of growing roots and stem.
Intercalary meristem are located at the base of leaves or nodes and leads to the increase in the length of an organ such as leaves and internodes.

27. A nail is inserted in the trunk of a tree at a height of 1 metre from the ground level. After 3 years the nail will
(a) move downwards
(b) move upwards
(c) remain at the same position
(d) move sideways

Ans. **(c)** When a nail is inserted in the trunk of a tree at a height of 1 metre from the ground, even after 3 year the nail remains at same level. It does not moves upwards as the apical meristem responsible for growth (length) is present in the apices only and lateral meristem responsible of increase in girth will lead to no change in length.

28. Parenchyma cells are
(a) relatively unspecified and thin walled
(b) thick walled and specialized
(c) lignified
(d) None of the above

Ans. **(a)** Parenchyma cells from the bulk of the plant body. Its cells are living and they possess the power of division. The cells are rounded or is diametric, i.e., equally expanded on all sides. The cells are oval round, polygonal or elongated in shape with a thin cell wall. It encloses a dense cytoplasm, which contains small nucleus and surrounds large central vacoule.

29. Flexibility in plants is due to
(a) collenchyma (b) sclerenchyma
(c) parenchyma (d) chlorenchyma

Ans. **(a)** Coilenchyma consist of living cells and are characterized by the presence of cellulose.
Collenchyma is a mechanical tissue in young dicotyledonous stems and provides mechanical support and elasticity. It provides great tensile strength with flexibility to those organs. In which it is found. It allows easy bending in various parts of a plant mainly young growing stem without breaking them.

30. Cork cells are made impervious to water and gases by the presence of
(a) cellulose (b) lipids
(c) suberin (d) lignin

Ans. **(c)** Cellulose is the basic of the cell wall present in plants. The cell wall of almost all the organism are made up of cellulose whereas lipids along with some proteins forms the basic building blocks of plasma membrane. Plasma membrane is semi permeable and it is not impervious to water.
Lignin is a complex polymer which acts as a cement and hardens the cell wall. It provides flexibility, great tensile and compression strength to the cell wall and makes the cell wall impermeable. It is present in scierenchyma cells and not in cork cells. The walls of cork cells are heavily thickened with an organic substance, suberin, Suberin makes these cells impervious to water and gases.

31. Survival of plants in terrestrial environment has been made possible by the presence of
(a) intercalary meristem
(b) conducting tissue
(c) apical meristem
(d) parenchymatous tissue

Ans. **(b)** The conducting tissues in plants conduct different saps and have different structures.
The primary conducting tissues or plants are xylem and phloem. Xylem conducts water from roots to the other parts of the plant, whereas phloem transports food and other material from the leaves to other parts of plants.

32. Choose the wrong statement
(a) The nature of matrix differs according to the function of the tissue.
(b) Fats are stored below the skin and in between the internal organs.
(c) Epithelial tissues have intercellular spaces between them.
(d) Cells of striated muscles are multinucleate and unbanked.

Ans. **(a)** The nature of matrix differs according to their function for, e.g., cartilage has calcium salts as it provides support to bones whereas muscles passes contractile proteins for their function of movement. (Also, refer to Q. 13)

33. The water conducting tissue generally present in gymnosperm is
(a) vessels (b) sieve tube
(c) tracheids (d) xylem fibres

Ans. (c) The gymnosperms are characterized by the presence of tracheids as their major conducting tissue. These are elongated dead cells with hard lignified walls. They conduct water and do not have open ends like the vessels.

34. Animals of colder regions and fishes of cold water have thicker layer of subcutaneous fat. Describe why?

Ans. The subcutaneous fat or adipose tissue lies just below the skin surface or in between internal organs. Being poor conductor of heat it acts as a a good insulator. It reduces the heat loss from the body, i.e., regulates the body temperature.

35. Match the column I with the column II

	Column I	Column II
A.	Fluid connective tissue	1 Subcutaneous layer
B.	Filling of space inside the organs	2. Cartilage
C.	Striated muscle	3. Skeletal muscle
D.	Adipose tissue	4. Areolar tissue
E.	Surface of joints	5. Blood
F.	Stratified squamous epithelium	6. Skin

Ans. The correct matching is

	Column I	Column
A.	Fluid connective tissue	1. Subcutaaneous layer
B.	filling of space inside the organs	2. cartilage
C.	Striated muscle	3.Skeletal muscles
D.	Adipose tissue	4. Areolar tissue
E.	Surface of joints	5. Blood
F.	Stratified squamous epithelium	6. Skin

Blood is a fluid connective tissue as it transports nutrients, hormones and vitamins to the tissue and excretory products from tissues to the liver and kidney. Areolar tissue is the simplest and most widely distributed connective tissue. It acts as a supporting and packing tissue and joins muscles to skin and fills spaces inside organs.

Skeletal muscles are also called striated muscles due to the presence of alternate dark and light bands called striations. Adipose tissue is fat reservoir and is present just below the skin and is called subcutaneous layer. Surface of joints is covered by cartilage. It provides support and flexibility to the body parts and smoothens the surface at joints.

Stratified squamous epithelium is characterized by the presence of keratin, it lines the skin and covers the external surface.

36. Match the column I with the column II

Column I	Column II
A. Parenchyma	Thin walled, packing
B. Photosynthesis	cells Carbon fixation
C. Aerenchyma	Localised thickenings
D. Collenchyma tissue	Buoyancy
E. Permanent tissue	Sclerenchyma

Ans. The correct matching is

Column I	Column II
A. Parenchyma	Thin walled, packing
B. Photosynthesis	cells Carbon fixation
C. Aerenchyma	Buoyancy Localised
D. Collenchyma	thickeninos
E. Permanent tissue	Sclerenchyma

Parenchyma are thin wailed cells found in soft parts of the plant. In hydrophytes such as water hyacinth, Hydrilla etc., large air cavities are present in parenchyma to give buoyancy to plant. Such type of parenchyma is called aerenchyma.

37. If a potted plant is covered with a glass jar, water vapours appear on the wall of glass jar. Explain why?

Ans. Epidermis of a leaf is not continuous at all the places due to the presence of small pores, called stomata. Each stoma is bounded by a pair of specialized epidermal cells or two kidney-shaped cells called guard cells. The concave sides of these guard cells face each other and have a space forming the stomatal opening.

The stoma allows gaseous exchange to occur during photosynthesis and respiration.

During transpiration water vapour escapes through stomatal opening, this results in appearance of water vapour on the wall of glass jar, if a potted plant is covered with it.

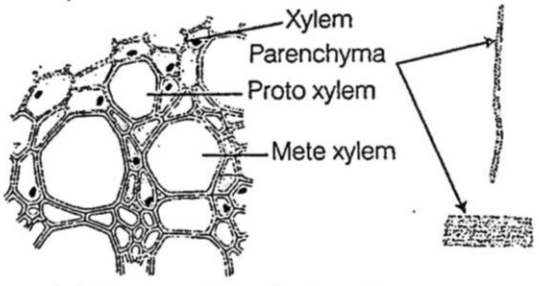
38. Name the different components of xylem and draw a living component?

Ans. Xylem is made up of four different types of cells or elements

(a) Tracheids (b) xylem vessels

(c) xylem fibre (d) xylem parenchyma

Xylem parenchyma is the living component of xylem.

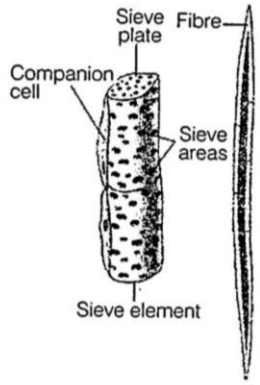


(a) Gross-section of xylem **tissue**

(b) Xylem parenchyma ceils (living)

39. Draw and identify different elements of phloem.

Ans. The different elements of phloem are as below



40. Write true (T) or false (F)
(a) Epithelial tissue is protective tissue in animal body.
(b) The lining of blood vessels, lung alveoli and kidney tubules are all made up of epithelial tissue.
(c) Epithelial cells have a lot of intercellular spaces.
(d) Epithelial layer is permeable layer.
(e) Epithelial layer does not allow regulation of materials between body and external environment.

Ans. (a) True (b) True
(c) False (d) False
(e) True
Epithelial tissue in the protective layer of cells, which covers the surface of body and lines the internal organs. It is present as lining of blood vessels (squamous epithelial tissue), lung alveoli and kidney tubules (columnar ciliated epithelial tissue). These cells are closely packed together and regulate the movement of materials between body and external environment.

41. Differentiate between voluntary and involuntary muscles. Give one example of each type.

Ans. The voluntary muscles are called so, as they can be regulated by our will. The functions carried by voluntary muscle cells is regulated by our own conscious control, e.g., movement of leg or arm by striated muscles.
The involuntary muscles cannot be controlled by our conscious (will). The actions of these muscles are controlled by the hypothalamus, e.g., cardiac muscles regulate the beating of heart.

42. Differentiate the following activities on the basis of voluntary (V) or involuntary (IV) muscles.
(a) Jumping of frog
(b) Pumping of the heart
(c) Writing with hand
(d) Movement of chocolate in your intestine

Ans. (a) Jumping of frog is the activity of voluntary muscles as it is controlled by skeletal muscles
(b) Pumping of heart involuntary, i.e., it is controlled by cardiac muscles
(c) Writing with hand is voluntary muscles action.
(d) Movement of choclate in your intestine is involuntary muscles.

43. Fill in the blanks
(a) Lining of blood vessels is made up of .....
(b) Lining of small intestine is made up of .....
(c) Lining of kidney tubules is made up of.....
(d) Epithelial cells with cilia are found in..... of our body.

Ans. (a) squamous epithelial tissue,
(b) columnar ciliated epithelial tissue
(c) columnar ciliated epithelial tissue
(d) alimentary canal

44. Water hyacinth float on water surface. Explain.

Ans. Water hyacinth floats in water due to presence of large air cavities in the parenchyma tissue. These specialized parenchyma tissue are called parenchyma.

45. Which structure protects the plant body against the invasion of parasites?

Ans. Epithelial tissue is the protective covering of our body.

46. **Fill in the blanks**
(a) Cork cells possesses ..... on their walls that makes it impervious to gases and water.
(b) ..... have tubular cells with perforated walls and are living in nature.
(c) Bone possesses a hard matrix composed of..... and ..... .

Ans. (a) suberin
(b) Sieve tubes of phloem
(c) proteins and minerals

47. Why is epidermis important for the plants?

Ans. Epidermis is the protective covering of plant body. It protects the plants from desiccation and infection.

48. Fill in the blanks
(a) ..... are forms of complex tissue.
(b) ..... have guard cells.
(c) Cells of cork contain a chemical called.....
(d) Husk of coconut is made of ..... tissue.
(e) ..... gives flexibility in plants,
(f) ..... and ..... are both conducting tissues.

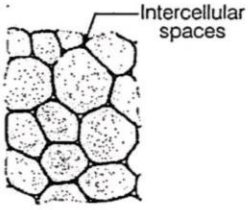
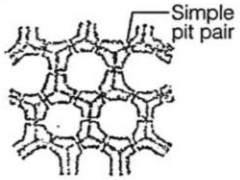
(g) Xylem transports ..... and ..... from soil.
(h) Phloem transport..... from ..... to other parts of the plant.

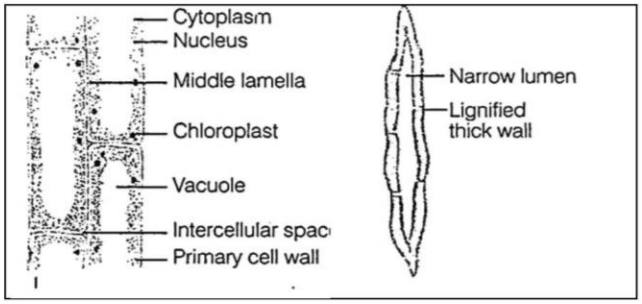
Ans. (a) Xylem and phloem (b) Stomata
(c) suberin (d) sclerenchyma
(e) collenchyma (f) xylem and phloem
(g) water and minerals (h) food from leaves

Short Answer Type Questions

49. Differentiate between sclerenchyma and parenchyma tissues. Draw well labelled diagram.

Ans. The major difference between sclerenchyma and parenchyma tissues are

Parenchyma	**Sclerenchyma**
1. Parenchyma tissue consist of living cells.	Sclerenchyma is composed of dead cells.
2. It consist of thin walled cells.	Its cell walls are uniformly thickened.
3. The cell wall is made up of cellulose.	The cell wall is made up or complex polymer lignin.
4. Parenchyma tissue is found in soft parts of the plans such as cortex of roots, ground tissues in stems and mesophyll of leaves.	Sclerenchyma tissure is found in roots, veins of levaes and hard covering of seeds and nuts.
5. Parenchyma serves as packing tissue serves as food storage tissue and performs photosynthesis (chlorenchyma).	Sclerenchyma is mechanical and protective in function. It gives strength, rigidity, flexibility and elasticity to the plant body.
Perenchyma tissue (a) Transverse section 	**Sclerenchyma tissue** (a) Transverse section 
(b)Longitudinal section	(b) Longitudinal section



50. Describe the structure and function of different types of epithelial tissues. Draw diagram of each type of epithelial tissue.

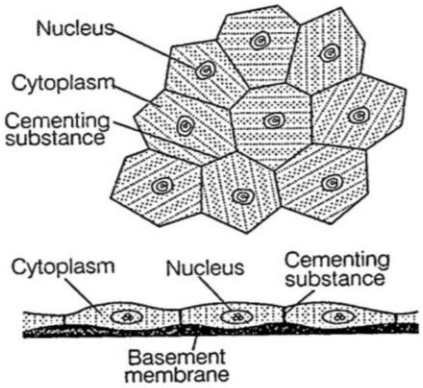
Ans. Epithelial tissue is the thin protective layer of cells which covers the surface of the body and lines the internal organs. The cells of this tissue are generally packed close together. The shape of the cells depends on the location and function of the tissue. Epithelial tissue originates from the ectoderm. But, epithelial tissue lining the intestine originates from the endoderm.

Epithelial tissue may be simple, i.e., composed of single layer of cells or stratified, i.e., made up of several layers of cells. Depending upon the shape and function of cells epithelial tissues are classified as

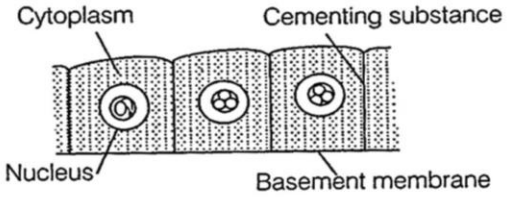
(i) **Squamous epithelial tissue** This tissue is composed of a single layer of thin and fiat, plate-like cells. The cells fit closely, like the bricks in a wall, to form a smooth membrane.

It is also known as tessellated and pavement epithelium. It is found in the outer layer of the skin, and covers internal cavities and ducts. Tongue, esophagus and the lining of the mouth are made up of squamous epithelium.

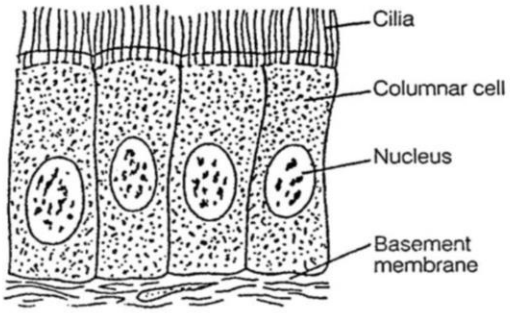
It is also found in blood vessels and alveoli. It protects the underlying parts of body from mechanical injury, entry of germs, chemicals and drying. It also forms a selectively permeable surface through which filtration occurs.



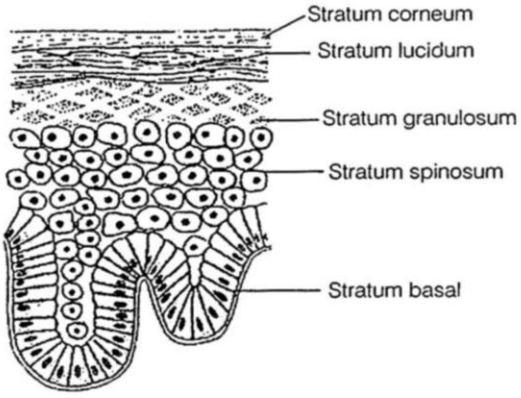
(ii) **Cuboidal epithelial tissue**
This tissue is composed of cube-like cells that fit closely. The cells look like squares in section, but the free surface appears hexagonal. This tissue lines the inside of the kidney tubules (the tubes leading from the cups of nephrons) thyroid vesicles and in glands like sweat glands, exocrine pancreas and the salivary glands.
It forms germinal epithelium of gonads (testes and ovaries). It helps in absorption, excretion and secretion. It also provides mechanical support,



(iii) **Columnar ciliated epithelial tissue** This tissue is generally composed of a single layer of column like cells. The presence of a conspicuous striated border of microvillus at the free surface end of each cell increases the surface area of the cell for absorption and secretion, It is generally found in the inner lining of the alimentary canal.
It also forms the lining of gall bladder and oviducts. The major functions of this tissue includes secretion (e.g., mucus of goblet cells) and absorption (e.g., stomach and intestine).
In some parts of the body, columnar epithelium develops protoplasmic outgrowths called cilia. The constant lashing movements of the cilia help to move substances.
It is found in the sperm ducts. It also lines the trachea (wind-pipe), bronchi (lungs), kidney tubules and oviducts (Fallopian tubes). Ciliated epithelium helps the movement of ova in the fallopian tubes and the movement of mucus in the respiratory tract.



(iv) **Stratified squamous epithelial tissue** This tissue is found in skin and covers the external dry surface of the skin. Cells of this tissue are arranged in many layers, but the cells forming different layers of this epithelium are not similar. Deeper layers of the tissue have cuboidal cells which become polygonal and finally flattened (squamous) towards the free surface.
The flattened cells of superficial layer may contain a fibrous protein, the keratin and become dead cells and are called keratinized stratified squamous epithelium. This epithelium is water proof and highly resistant to mechanical injury.



(v) **Glandular epithelial tissue** Epithelial tissue often acquire additional specialization as gland cells, which can secrete substances at the epithelial surface.
Sometimes, a portion of epithelial tissue folds in wards and a multicellular gland is formed. This is called glandular epithelium.

51. Draw well labelled diagrams of various types of muscles found in human body.

Ans. Human body consist of three types of muscles
Skeletal muscle It has striated, tubular, multinucleated fibres and is usually attached to skeleton. These are voluntary (under the control of our will). Often called striated muscles due to presence of alternate dark and light bands (straitions).

Smooth muscle it has spindle-shaped, non-striated uninucleated fibres and occurs in walls of internal organs. It is involutary in action.

Cardiac muscle It has striated, branched, uninucleated fibres and occurs only in the walls of the heart. It is involuntary in action.

52. Give reasons for
(a) Meristematic cells have a prominent nucleus and dense cytoplasm but they lack vacuole,
(b) Intercellular spaces are absent in sclerenchymatous tissues.
(c) We get a crunchy and granular -reeling, when we chew pear fruit.
(d) Branches of a tree move and bend freely in high wind velocity.
(e) It is difficult to pull out the husk of a coconut tree.

Ans. (a) Meristematic cells are the continuously dividing cells of the plant body i.e., they remain metabolically active and as we know that vacuoles serve the purpose of storage in plant cells. Therefore meristematic cells do not require vacuole.
(b) **Sclerenchyma** tissue are dead simple permanent tissue of the plant. The cells of sclerenchyma are closely packed without intercellular spaces, like tiles in mosaic floor so that, it can provide the strength, rigidity, flexibility and elasticity to the plant to withstand various strains.
(c) The get a crunchy and granular feeling when we chew pear fruit due to the presence of **sclerenchyma tissue.** The cell walls of sclerenchyma are greatly thickened due to the presence of lignin. Lignin is a complex polymer with high tensile strength i.e., it does not breaks easily on stretching and a high compressional strength, it does not buckle easily.
(d) **Collenchyma** cells are characterized by the deposition of extra cellulose at corners of the cell. In collenchyma intercellular spaces are absent and cells are elongated. It is a mechanical tissue which provides support and elasticity to the branches of a tree so that, they move and bend freely in high wind velocity.
(e) It is difficult to pull out the **husk of a coconut** tree due to the presence of **sclerenchyma tissue.** The cells of sclerenchyma tissue are closely packed without intercellular spaces, a middle lamella exists between them. Middle lamella is a thin layer of connecting substance containing pectin, lignin and protein.

53. List the characteristics of cork. How are they formed? Mention their role.

Ans. As the plants grow older, the outer protective tissue (i.e., epidermis) undergoes certain changes. A strip of secondary moisten, called halogen or cork cambium replaces the epidermis of the stem.
Cork cambium is a simple tissue, the cells are rectangular and their protoplast are vacuolated and contain tannins and chloroplasts. Cork cambium gives off new cells on its both sides, thus, forming cork (phellem) on the outer side and the secondary cortex or phelloderm on the inner side.
The layer of cells which is cut by cork cambium on the outer side ultimately becomes several layered thick cork (bark) of trees. Cells of cork are dead and compactly arranged without intercellular spaces. The walls of cork cells are heavily thickened with an organic substance (a fatty substance), called suberin, which makes these cells impermeable to water and gases.
Cork is protective in function. It's cells prevent desiccation (loss of water from plant body), infection and mechanical injury. It is light and does not catch fire easily. Due to these properties, cork is used as insulators, shock-absorbers, linoleum (used as flooring) and sports goods (in making of shuttle cocks, cricket balls, wooden paddles of table tennis, etc.). Commercial cork is obtained from the stem surface of cork oak tree (Quercus suber) found in Southern Europe and North Africa.

54. Why are xylem and phloem called complex tissues? How are they different from one other?

Ans. A complex tissue consist of more than one type of cells having a common origin which coordinate to perform a common function. Xylem and phloem are called complex tissues

as, they are made up of different types of cells.

Xylem is composed of four different types of cells (elements), namely

(i) tracheids
(ii) vessels
(iii) xylem parenchyma
(iv) xylem sclerenchyma (or fibre)

Phloem is also composed of four different types of elements

(i) sieve tubes
(ii) companion cells
(iii) phloem parenchyma
(iv) phloem fibre

The basic difference between xylem and phloem is listed below

Xylem	Phloem
It conduct water and minerals.	It conducts organic solutes or food materials
Conduction is mostly unidirectional, i.e., from roots to apical parts of the plant.	In it conduction may be bidirectional, i.e., from leaves to storage organs or growing parts or from storage organs to growing parts of plants.
Conducting channels or treachery elements are tracheids and vessels.	Conducting channels are sieve tubes.
Three of the four elements of xylem are dead (i.e., tracheids, vessels and fibre). Only xylem parenchyma is the living elements.	Three of four elements are living i.e., sieve tubes, companion cells and phloem parenchyma while phloem fibre are dead elements.
In addition to conduction, xylem provides mechanical strength to the plant.	Phloem performs no mechanical function for the plants.

55. (a) Differentiate between meristematic and permanent tissues in plants.
(b) Define the process of differentiation.
(c) Name any two simple and two complex permanent tissues in plants.

Ans. (a) The basic differences between meristematic and permanent tissues of plants are tabulated below

Meristematic tissue	Permanent tissue
Its component cells are living, small, spherical or polygonal and un-differentiated	Its components cells may be living or dead. They are large, differentiated with different shapes.
Cytoplasm is dense and vacuoles are nearly absent as they are metabolically active.	Large central vacuole occurs in living permanent cells as, they are less metabolically active.
Intercellular spaces are absent.	Intercellular spaces are often present.
Cell wall of its cells is thin and elastic.	Cell wall of its cells may either thin or thick.
Nucleus of each cell of this tissue is large and prominent.	Nucleus of each cell of this tissue is less conspicuous.
Its cells grow and divide regularly.	Its cells do not normally divide.
It is a simple tissue.	It can be simple, complex or specialized,
Cell organelles of its cells are simple	Cell organelles of its cells are well developed.
Cell of this tissue do not contain crystals and other inclusions.	Cells of this tissue possess crystals and other inclusions.
It provides growth to the plant.	It provides protection. Support, conduction photosynthesis, storage, etc.

(b) Cells derived from the division of meristematic tissues take up specific roles and gradually lose their ability to divide. Thus, they form permanent tissue. The process by which the cells divide meristematically to take a permanent shape, size and function is called differentiation.
(c) Two simple permanent tissue in plants are parenchyma and collenchymas while two complex permanent tissue in plants are xylem and phloem.

EXERCISE

Multiple Choice Questions

1. Which of the following tissues has dead cells?
(a) parenchyma (b) sclerenchyma

(c) collenchyma (d) epithelial tissue

2. Find out the incorrect statement.
(a) Parenchymatous tissue have intercellular spaces.
(b) Collenchymatous tissues are irregularly thickened at comers.
(c) Apical and intercalary meristems are permanent.
(d) Meristematic tissues, in its early stage, lack vacuoles.

3. Girth of stem increases due to
(a) apical meristem (b) lateral meristem
(c) intercalary meristem (d) vertical meristem.

4. Which cell shows presence of fine pits?
(a) tracheids (b) companion cells
(c) sieve tubes (d) both (b) & (c).

5. Intestine absorbs the digested food materials. What type of epithelial cells are responsible for that?
(a) stratified squamous epithelium
(b) columnar epithelium
(c) spindle fibres
(d) cuboidal epithelium.

6. A person met with an accident in which two long bones of hand were dislocated. Which among the following may be the possible reason?
(a) tendon break
(b) break of skeletal muscle
(c) ligament break
(d) areola tissue break

7. While doing work and running, you move your organs like hands, legs etc. Which among the following is correct?
(a) Smooth muscles contract and pull the ligament to move the bones.
(b) Smooth muscles contract and pull the tendons to move the bones.
(c) Skeletal muscles contract and pull the ligament to move the bones.
(d) Skeletal muscles contract and pull the tendon to move the bones.

8. Which muscles act involuntary?
(i) Striated muscles (ii) Smooth muscles
(iii) Cardiac muscles (iv) Skeletal muscles
(a) (i) & (ii) (b) (ii) & (iii)
(c) (iii) & (iv) (d) (i) & (iv)

9. Meristematic tissues in plants are
(a) localized and permanent
(b) not limited to certain regions
(c) localized and dividing cells
(d) growing in volume

10. Which is not a function of epidermis?
(a) protection from adverse condition
(b) gaseous exchange
(c) conduction of water
(d) transpiration

11. Select the incorrect sentence
(a) Blood has matrix containing proteins, salts and hormones.
(b) Two bones are connected with ligament
(c) Tendons are non-fibrous tissue and fragile.
(d) Cartilage is a form of connective tissue.

12. Cartilage is not found in
(a) nose (b) ear
(c) kidney (d) larynx

13. Fats are stored in human body as
(a) cubical epithelium (b) adipose tissue
(c) bones (d) cartilage

14. Bone matrix is rich in
(a) fluoride and calcium
(b) calcium and phosphorus
(c) calcium and potassium
(d) phosphorus and potassium

15. Contractile proteins are found in
(a) bones (b) blood
(c) muscles (d) cartilage

16. Voluntary muscles are found in
(a) alimentary canal (b) limbs
(c) iris of the eye (d) bronchi of lungs

17. Nervous tissue is not found in
(a) brain (b) spinal cord
(c) tendons (d) nerves

18. Nerve cell does not contain
(a) axon (b) nerve endings
(c) tendons (d) dendrites

19. Which of the following helps in repair of tissue and fills up the space inside the organ?
(a) tendon (b) adipose tissue
(c) areola (d) cartilage

20. The muscular tissue which function throughout The life continuously without fatigue is
(a) skeletal muscle (b) cardiac muscle
(c) smooth muscle (d) voluntary muscle

21. Which of the following cells is found in the cartilaginous tissue of the body?
(a) mast cells (b) basophils
(c) osteocytes (d) chondrocytes

22. The dead element present in the phloem is
(a) companion cell (b) phloem fibres
(c) phloem parenchyma (d) sieve tube

23. Which of the following does not lose their nucleus at maturity?
(a) companion cells (b) red blood cells
(c) vessel (d) sieve tube cells

24. In desert plants, rate of water loss gets reduced due to the presence of

(a) cuticle (b) stomata
(c) lignin (d) suberin

25. A long tree has several branches. The tissue that helps in the sideways conduction of water in the branches is
(a) collenchyma (b) xylem parenchyma
(c) parenchyma (d) xylem vessels

26. It the tip of sugarcane plant is removed from the field, even then it keeps on growing in length. It is due to the presence of
(a) cambium
(b) apical meristem
(c) lateral meristem
(d) intercalary meristem

27. A nail is inserted in the trunk of a tree at a height of 1 metre from the ground level. After 3 years the nail will
(a) move downwards
(b) move upwards
(c) remain at the same position
(d) move sideways

28. Parenchyma cells are
(a) relatively unspecified and thin walled
(b) thick walled and specialized
(c) lignified
(d) none of these

29. Flexibility in plants is due to
(a) collenchymas (b) sclerenchyma
(c) parenchyma (d) chlorenchyma

30. Cork cells are made impervious to water and gases by the presence of
(a) cellulose (b) lipids
(c) sobering (d) lignin

31. Adipose tissue is
(a) connective tissue (b) supporting tissue
(c) vascular tissue (d) epithelial tissue

32. Which of the following is a voluntary muscle?
(a) skeletal muscle (b) cardiac muscle
(c) smooth muscle (d) all of these

33. A striated involuntary muscle from the following is
(a) skeletal muscle (b) cardiac muscle
(c) visceral muscle (d) all of these

34. Connective tissue is derived from
(a) mesoderm (b) ectoderm
(c) endoderm (d) all of these

35. Cardiac muscles are
(a) striated (b) untreated
(c) both (a) & (b) (d) none of these

36. The structural and functional unit of striated muscle fibre is
(a) sarcolemma (b) sarcomere
(c) sarcoplasm (d) myofibril

37. Strain is caused by excessive pulling of
(a) muscles (b) ligaments
(c) tendons (d) nerves

38. Cardiac muscles are
(a) smooth, spindle shaped and involuntary
(b) striated, syncytial and involuntary
(c) striated, syncytial and voluntary
(d) striated, cross connected and involuntary

39. Cartilage is produce by
(a) osteoblasts (b) fibroblasts
(c) epithelium (d) chondrocytes

40. The myofibrils contain
(a) myosin (b) actin
(c) chlorine (d) both (a) & (b)

41. The major constituent of vertebrate bone is
(a) calcium phosphate (b) sodium chloride
(c) potassium hydroxide (d) calcium carbonate

42. Nails, hooves and horns are examples of
(a) bony tissue (b) cartilage tissue
(c) connective tissue (d) epidermal tissue

43. Mast cells are found in
(a) adipose tissue
(b) dense connective tissue
(c) white fibrous tissue (d) areolar tissue

44. Nerve fibres differ from muscle fibres in having
(a) myofibrils (b) striations
(c) sarcolemma (d) dendrites

45. Sheath nuclei, Schwann cells and nodes of Ranvier are found in
(a) neurons (b) osteoblasts
(c) chondroblasts (d) gland cells

46. Nissl's granules are present in
(a) nerve cells (b) mast cells
(c) bone cells (d) cartilage cells

47. Sarcolemma is the membrane that covers
(a) nerve fibres (b) muscle fibres
(c) visceral fibres (d) tendons

48. The ends of long bones are composed of____ cartilage.
(a) fibrous (b) hyaline
(c) elastic (d) calcified

49. Which of the following is a connective tissue?
(a) bone (b) cartilage
(c) blood (d) all of these

50. A characteristic feature of cardiac muscle is its
(a) fatigue (b) rhythm city
(c) spindle shape (d) frigidity

51. Myelin sheath is present on
(a) cell body (b) dendrite
(c) axon (d) all of these

52. Synapse is
(a) junction of two axons
(b) junction of two dendrites
(c) junction of axon and dendrite

(d) junction of cell bodies

53. The epithelium capable of reception of stimulus is
(a) germinal (b) sensory
(c) glandular (d) pigmented

54. Parenchyma cells containing air cavities are called
(a) aerenchyma (b) sclerenchyma
(c) chlorenchyma (d) prosenchyma

55. The most common connective tissue is
(a) adipose tissue (b) reticular tissue
(c) fibrous tissue (d) areolar tissue

56. Which of the following is not true for meristematic tissue?
(a) It has living, thin walled cells.
(b) Cells have dense protoplasm,
(c) They have no intercellular spaces.
(d) They store reserve food material.

57. Parenchyma cells containing chloroplasts are called
(a) parenchyma (b) sclerenchyma
(c) chlorenchyma (d) prosenchyma

58. Cell walls of sclerenchyma are rich in
(a) cellulose (b) pectin
(c) lignin (d) hemicelluloses

59. Tendon connects
(a) cartilage with muscles
(b) bone with muscles
(c) ligament with muscles
(d) bone with bone

60. The skeletal tissue present in the pinna of a mammal is
(a) elastic cartilage (b) fibrous cartilage
(c) calcified cartilage (d) hyaline cartilage

61. Collenchyma differs from parenchyma having
(a) cellulose walls
(b) vacuoles
(c) pectin deposits at corners
(d) living protoplasm

62. The thickening of cell wall, lignification's specialization for mechanical function characteristic of
(a) collenchyma (b) sclerenchyma
(c) chlorenchyma (d) parenchyma

63. Bone forming cells are
(a) osteoblasts (b) osteoclasts
(c) chondroblasts (d) chondroclasts

64. Besides calcium phosphate the bones contain
(a) calcium chloride
(b) magnesium carbonate
(c) sodium chloride
(d) both (b) & (c)

65. Bast fibres in woody stem belongs to
(a) cork (b) cortex
(c) xylem (d) phloem

66. A bone left in the dilute HCl for about three days will
(a) crack into pieces
(b) become soft and elastic
(c) dissolve completely
(d) remain as it is

67. Triceps and biceps are examples of
(a) voluntary muscle
(b) involuntary muscle
(c) sphincter muscles
(d) smooth muscles

68. The strongest muscle in the body is present in
(a) arm (b) jaw
(c) thigh (d) neck

69. Sarcolemma is found over
(a) heart
(b) skeletal muscle fibre
(c) nerve fibre
(d) none of these

70. Smooth muscle fibres are
(a) spindle-shaped, unbanked, non-striated, multinucleate and involuntary
(b) spindle-shaped, unbanked, untreated uninucleate and involuntary
(c) cylindrical, striated, unbanked, multi-nucleate and voluntary
(d) cylindrical, unbanked, non-striated, multinucleate and involuntary.

71. Which type of tissue changes the diameter of a Mood vessel?
(a) connective (b) nervous
(c) muscle (d) epithelial

72. Smooth muscles occur in
(a) vein (b) artery
(c) uterus (d) all of these

73. Cardiac muscle is made of branched fibres that are
(a) no striated and under voluntary control
(b)striated and not under voluntary control
(c) nonstriated and not under voluntary control
(d) striated and under voluntary control

74. Muscles, which are immune to fatigue, are
(a) unstrapped muscles (b) cardiac muscles
(c) jaw muscles (d) skeleton muscles

75. Muscles develop from
(a) mesoderm (b) ectoderm
(c) endoderm (d) all of these

76. Nerve impulses are conducted towards the cell body by
(a) axons (b) ganglia
(c) dendrites (d) neurons

77. Afferent nerve fibre carries impulses from

(a) effectors to central nervous system
(b) receptor to central nervous system
(c) central nervous system to muscle
(d) central nervous system to receptors

78. The surface of nerve fibres bears narrow areas called
(a) Schwann cells (b) Schwann nodes
(c) nodes of Ranvier (d) Nissl's granules

79. Most of the human neurons are
(a) multipolar (b) bipolar
(c) unipolar (d) pseudo-unipolar

80. Units of nervous system are
(a) axons (b) neurons
(c) dendrites (d) cytons

81. A trachea differs from a vessel in having
(a) scalar form thickenings
(b) discontinuous lumen, which are separated by end wall
(c) lack of bordered pits
(d) thick walls without contents

82. Vessels and companion cells are characteristic of xylem and phloem of
(a) pteridophytes (b) gymnosperms
(c) angiosperms (d) bryophytes

83. Fats are stored in human body as
(a) cubical epithelium (b)adipose tissue
(c) bones (d) cartilage

84. Trachea, tracheas, wood fibres, and parenchymatous tissues are found in
(a) xylem (b) cambium
(c) cortex (d) phloem

85. Sieve tubes have
(a) simple oblique wall
(b) perforated and longitudinal plates
(c) perforated and oblique septa
(d) apical and oblique plates

86. Sieve tubes are better suited for translocation because these
(a) are broader than long
(b) possess bordered pits
(c) possess no end walls
(d) possess a broader lumen and perforated cross walls

87. Companion cells are usually seen associated with
(a) fibres (b) parenchyma
(c) xylem vessels (d) sieve tubes

88. Grass stem elongates by the activity of
(a) secondary meristem
(b) intercalary meristem
(c) apical meristem
(d) primary meristem

89. Cork cells are
(a) photosynthetic
(b) elongated and participate in movement
(c) meristematic
(d) dead

90. A tissue is a
(a) a group of separate organs that are coordinated in their activities
(b) group of similar cells that function together in a specialized activity
(c) layer of cells surrounding an organ
(d) sheet of cells, one layer thick

91. Lateral meristem is responsible for
(a) growth in parenchyma
(b) growth in thickness
(c) growth in cortex
(d) growth in length

92. Which of these types of cells is most likely to divide?
(a) epidermis
(b) parenchyma
(c) merited
(d) xylem

93. Simple mechanical tissue devoid of lignin is represented by
(a) parenchyma (b) sclerenchyma
(c) collenchyma (d) tracheids

94. Which is not a tissue?
(a) xylem (b) phloem
(c) collagen (d) cambium

95. You have been provided with narrow thick-walled living cells, elongated in shape and possessing thickenings of cellulose and pectin. These cells belong to
(a) parenchyma
(b) collenchyma
(c) sclerenchyma
(d) periderm

96. The husk of coconut is made up of
(a) collenchymas tissue
(b) parenchyma tissue
(c) parenchyma tissue
(d) sclerenchyma tissue.

97. Cork is a/an
(a) intercalary meristem
(b) lateral meristem
(c) protective animal tissue
(d) apical meristem

98. Parenchyma occurs in
(a) mesophytes (b) xerophytes
(c) hydrophytes (d) sciophytes

99. Choose the wrong statement
(a) The nature of matrix differs according to the function of the tissue,
(b) Fats are stored below the skin and in between the internal organs.

(c) Epithelial tissues have large intercellular spaces between them.
(d) Cells of striated muscles are multinucleate and unbanked.

100. The water conducting tissue generally present in gymnosperm is
(a) vessels (b) sieve tube
(c) tracheas (d) xylem fibres

FILL IN THE BLANKS

1. _____ are forms of complex tissue.
2. Xylem transports _____ and _____from soil.
3. Phloem transport _____ from ____ to other parts of the plant.
4. _____have tubular cells with perforated walls and are living in nature.
5. Epithelial cells with cilia are found in _____of our body.
6. Lining of small intestine is made up of _____
7. Lining of blood vessels is made up of _____
8. The two types of skeletal connective tissue are _____ and _____.
9. Dense regular connective tissue consists of _____ and ligaments.
10. Squalors epithelium forms the _____ of the skin and lines cavities and ducts.

TRUE OR FALSE

1. Epithelial tissue is protective tissue in animal body.
2. The lining of blood vessels, lung alveoli and kidney tubules are all made up of epithelial tissue.
3. Epithelial cells have a lot of intercellular spaces.
4. Epithelial layer is permeable layer.
5. Epithelial layer does not allow regulation of materials between body and external environment.
6. Phloem is composed of tracheids and vessels.
7. Meristematic tissue is made of cells that are incapable of cell division.
8. Vacuoles are present in abundance in meristematic cells.
9. Xylem is made of tracheas and vessels.
10. Phloem is made of sieve tube and companion cells.
11. Phloem conducts prepared food from the leaves to storage organs and growing parts of the body.
12. Protective tissues are usually present in the Innermost layer of the plant body.
13. Cork cells are living.
14. Bone and cartilage are two types of areolar connective tissue.
15. Squamous and cuboidal are types of nervous tissue.

ASSERTION & REASON QUESTIONS

Directions: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below it. Of the four statements, given below, Mark one as the correct answer
(a) *if both Assertion and Reason are true and Reason is not the correct explanation of Assertion*
(b) *if both Assertion and Reason are true hut Reason is not the correct explanation of Assertion*
(c) *if Assertion is true but Reason is false*
(d) *if both Assertion and Reason are false*

1. **Assertion:** Non-striated muscles are said to be voluntary in nature.
Reason: Non-striated muscles can be moved according to will.
2. **Assertion:** Presence of connective tissue inside the brain is essential for conduction of nerve impulse.
Reason: Connective tissue hold together the nerve cells of brain.
3. **Assertion:** Smooth muscle fibres do not appear I to be striated.
Reason: This is due to regular alternate arrangement of thick and thin filaments in smooth muscle fibre.
4. **Assertion:** Compound epithelium covers surfaces exposed to mechanical or chemical abrasions.
Reason: Protection of underlying tissues is the major function of simple epithelium.
5. **Assertion:** Materials are exchanged between epithelial and connective tissues by diffusion.
Reason: Blood vessels are absent in epithelial tissue.
6. **Assertion:** Sclerenchyma fibres constitute the major mechanical tissue of the plants.
Reason: The cells are thick walled and is made up of cellulose or lignin or both.
7. **Assertion:** Death of sieve tube member results in the death of its adjacent companion cells.
Reason: Both are derived from the same mother cell.
8. **Assertion:** Xylem and phloem are complex tissues.

Reason: Complex tissue is collection of different types of cells.

9. **Assertion:** Permanent tissue is composed of mature cells.
Reason: Meristematic tissue is a group of actively dividing cells.

10. **Assertion:** The rigidity in leaf is due to sclerenchyma.
Reason: Sclerenchyma are dead tissue and provide mechanical strength.

SUBJECTIVE PROBLEMS

VERY SHORT ANSWER TYPE QUESTIONS

1. Name the two types of meristematic tissues.
2. Write one important character of permanent tissues.
3. Name the two types of simple permanent tissues.
4. Name the two types of cells found in sclerenchymatous tissue.
5. What is the function of phloem?
6. Write the 4 types of animal tissues.
7. Write the name of most abundant muscular tissue found in our body.
8. Which tissue is called loose connective tissue?
9. Name the fat storing tissue in our body.
10. Name the two parts of a neuron.

SHORT ANSWER TYPE QUESTIONS

1. Animals of colder regions and fishes of cold water have thicker layer of subcutaneous fat. Describe why?
2. Differentiate between epithelial and connective tissues.
3. Water hyacinth floats on water surface. Explain.
4. Which structure protects the plant body against the invasion of parasites?
5. Why is epidermis important for the plants?
6. Give reasons for:
(a) Meristematic cells have a prominent nucleus and dense cytoplasm but they lack vacuole.
(b) Intercellular spaces are absent in sclerenchymatous tissues.
(c) We get a crunchy and granular feeling, when we chew pear fruit.
(d) Branches of a tree move and bend freely in high wind velocity.
(e) It is difficult to pull out the husk of a coconut tree.
7. Why are xylem and phloem called complex tissues? How are they different from each other?
8. (a) Define the process of differentiation.
(b) Name any two simple and two complex permanent tissues in plants.
(c) Differentiate between meristematic and permanent tissues in plants.
9. (a) Define meristematic tissue.
(b) Where is the intercalary merited located?
10. (a) Name the plant tissue found in the husk of a coconut and also identify the chemical which is responsible for its stiffness.
(b)What types of cells are found in sclerenchyma and parenchyma? Write their functions also.
11. A student of standard IX gave the functions of the following cells/tissues wrongly. Correct these answers:
(a) Muscle cells: Carry messages
(b) Vascular tissues in plants: Transport oxygen, food, hormones and waste material.
(c) Nerve cells: Contract and relax to cause movement.
(d) Blood: Conduct water, mineral and organic solutes from one part of the organism to other parts.
12. What will happen if
(a) The skin epithelium is not stratified?
(b) Stratified squamous epithelium lines the blood vessels?
13. Give one reason why
(a) The blood is called connective tissue?
(b) Muscles contain contractile proteins?
(c) Muscles of heart are involuntary?
14. What will happen if
(a) Ligaments are over stretched?
(b) Striated muscles contract rapidly for a long time?
15. What will happen if
(a) Apical meristem is damaged or cut?
(b) Cork is not formed in older stems and roots?
(c) Bone marrow gets destroyed?
(d) Muscle receives nerve impulses in succession?

LONG ANSWER TYPE QUESTIONS

1. Answer the following:
   (a) State two differences between tendon and ligament.
   (b) What are the constituents of phloem tissue?
   (c) Give the specific function of cardiac musde.
   (d) Name the tissue that
   (i) forms the inner lining of our mouth.
   (ii) forms the hard parts of fruits.
   (e) State the function of ciliated columnar epithelium in the respiratory tract.
2. Draw untreated muscle tissue and mention its occurrence, features and function.
3. Give the characteristics and role of the following:
   (a) Cutin (b) Suberin
   (c) Sclereids (d) Lignin
   (e) Packaging tissue (f) Lymph
4. Give the role of the following:
   (a) Parenchyma (b) Chlorenchyma
   (c) Cork or phellem (d) Collenchymas
5. Draw the diagram of cubical epithelium. Write its occurrence, features and functions.
6. What are the various types of animal tissues? Mention briefly the location and one main function of each class of tissues.
7. Describe the structure, position and function different types of epithelial tissues.
   List the characteristics of cork. How are they formed? Mention their role.

ANSWER – KEY

Multiple Choice Questions

1.	B	2.	C	3.	B	4.	D	5.	B	6.	C	7.	D
8.	B	9.	C	10.	C	11.	C	12.	C	13.	B	14.	B
15.	C	16.	B	17.	C	18.	C	19.	C	20.	B	21.	D
22.	B	23.	A	24.	A	25.	D	26.	D	27.	C	28.	A
29.	A	30.	C	31.	A	32.	A	33.	B	34.	A	35.	A
36.	B	37.	C	38.	D	39.	D	40.	D	41.	A	42.	D
43.	D	44.	D	45.	A	46.	A	47.	B	48.	B	49.	C
50.	B	51.	C	52.	C	53.	B	54.	A	55.	D	56.	D
57.	C	58.	C	59.	B	60.	A	61.	C	62.	B	63.	A
64.	B	65.	D	66.	B	67.	A	68.	B	69.	B	70.	B
71.	C	72.	D	73.	B	74.	B	75.	A	76.	C	77.	B
78.	C	79.	A	80.	B	81.	B	82.	C	83.	B	84.	A
85.	C	86.	D	87.	D	88.	B	89.	D	90.	B	91.	B
92.	C	93.	C	94.	C	95.	B	96.	D	97.	B	98.	C
99.	C	100.	A										

Fill in the Blanks

1.	Xylem and phloem
2.	Water, mineral
3.	food, leaf
4.	Sieve tubes
5.	respiratory tract
6.	columnar epithelium
7.	squamous epithelium
8.	bone, cartilage
9.	tendons
10.	epidermis

True or False

1. True	2. True
3. False	4. True
5. False	6. False
7. False	8. False
9. True	10. True
11. True	12. False
13. False	14. False
15. False	

Assertion and Reason Type

1. D	2. D	3. C	4. C	5. A
6. B	7. A	8. A	9. B	10. A