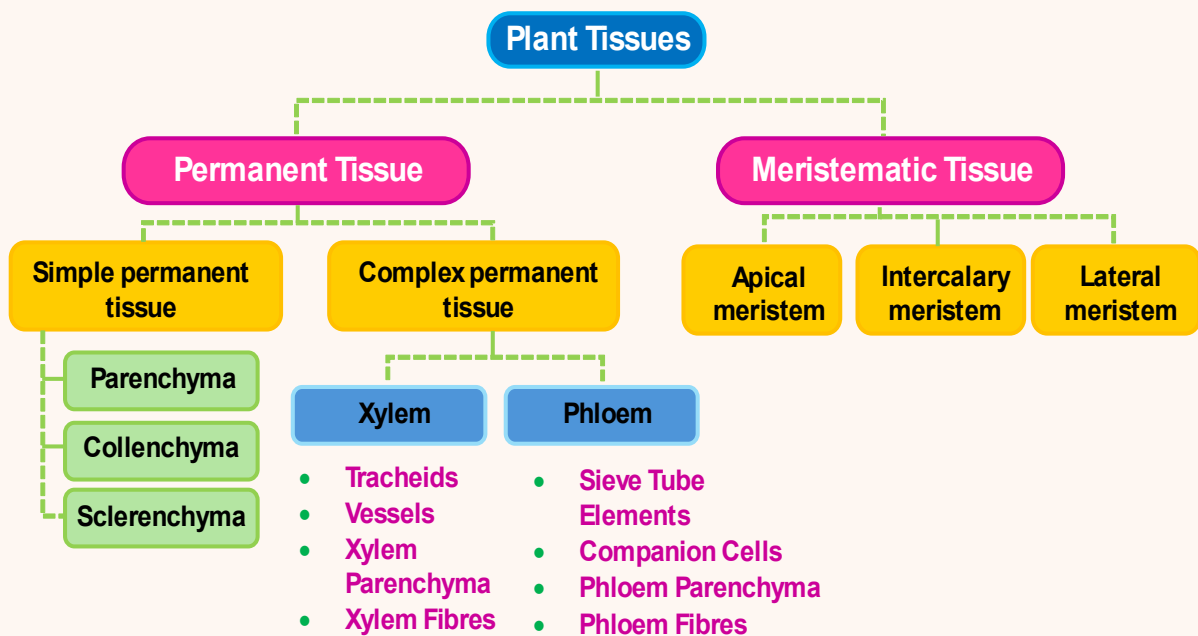


THE TISSUES

Nehemiah Grew was an English botanist, physician, and microscopist. Along with the Italian microscopist Marcello Malpighi, he is considered one of the founders of plant anatomy. Grew's first book on plant anatomy, *The Anatomy of Vegetables Begun*, was presented to the Royal Society of London at the same time as Malpighi's manuscript on the subject. In his work, Grew noted the existence of cells and introduced several botanical terms, including 'radicle' for the embryonic root, 'plume' for what is now known as the plumule (the primary bud of a plant embryo), and 'parenchyma' for unspecialized plant cells.



CONCEPT MAP



CONCEPT 1.1

Cell:

A cell is the basic structural and functional unit of a living organism. **Example:** A muscle cell.

Tissue:

A tissue is a group of cells that have a common origin, similar structure, and function, and are held together by a cementing substance. **Example:** Meristematic tissue.

Organ:

Different types of tissues work together and contribute to specific functions in the body to form an organ. Example: Kidney.

Organ System:

Different organs coordinate to perform a specific life process, forming an organ system. Example: Excretory system.

Organism:

Various organ systems working together simultaneously constitute an organism. Example: Animal.

Living beings are either unicellular (e.g., diatoms, bacteria, yeast, protozoans, etc.) or multicellular (e.g., frog, earthworm, dog, human, mango tree, money plant, peepal, etc.). Most cells are specialized to carry out different functions. Each specialized function is performed by a different group of cells, as these cells are adapted to carry out only a particular function.

For instance, in human beings, muscle cells work together to contract and relax, enabling movement. Nerve cells coordinate to carry messages, while blood cells and plasma transport oxygen, carbon dioxide, food, hormones, and waste materials. Similarly, in plants, different cells perform specific functions, such as transporting food and water, synthesizing food, and storing reserve nutrients. Thus, a kind of division of labour exists in the cells of multicellular organisms, allowing them to perform specialized functions efficiently.

Plant and Animal Tissues are Different:

Plants and animals both have similar life processes. However, they do not have the same types of tissues due to differences in their organization, mode of living, and lifestyles

Plant Tissues:

Plant cells exhibit great variation in size and structure. A group of cells that are similar in structure and function and share a common origin is called a tissue. In living organisms, each tissue has a specific function. Vital activities are carried out with the help of different tissues.

Based on their development, plant tissues are primarily classified into two main groups.

Meristematic Tissue:

Meristematic tissues consist of thin walled, closely packed, immature cells that continuously divide. The new cells formed are initially meristematic in nature. Over time, they gradually differentiate and mature into permanent tissues.

Characteristics of Meristematic Tissues:

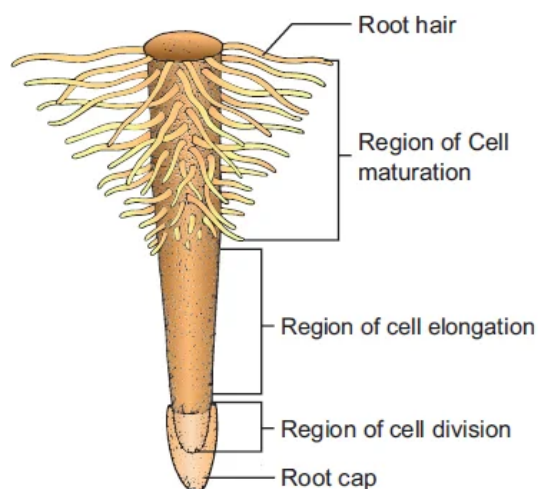
- The cells of these tissues are similar in structure and have thin and elastic primary cell walls made up of cellulose.
- The cells are rounded, oval, polygonal or rectangular in appearance.
- They have large and prominent nuclei.
- Vacuoles small or rare absent.
- Cells are closely packed.
- Intercellular spaces are absent.
- The cell division occurs actively to produce new cells.
- 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 division, they get transformed into mature permanent tissues.

Classification:

Based on their location in the plant body, meristems are of three types:
(1) Apical meristem (2) Lateral meristem (3) Intercalary meristem

Apical Meristem:

- Occurs at the tips of roots and shoots.
 - Brings about an increase in length of the plant.
- Example: root apical meristem and shoot apical meristem.

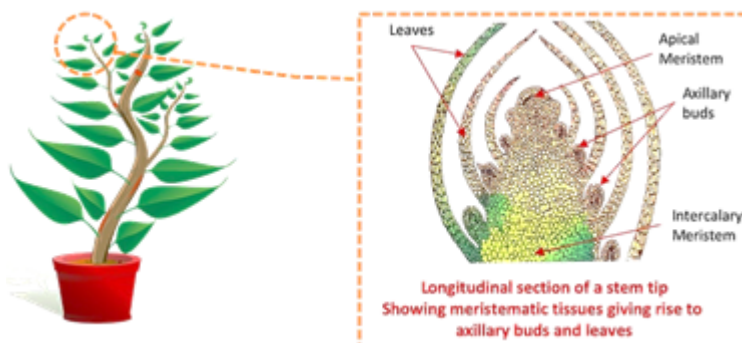


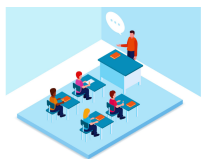
Lateral Meristem:

- Occurs on the sides almost parallel to the long axis of the root, stem and its branches.
- Brings about an increase in the width or girth of roots and stems, also called secondary growth.
- 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:

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





CLASSROOM DISCUSSION QUESTIONS

CDQ
1.1

1. Which of the following is the basic structural and functional unit of a living organism?
(A) Tissue
(B) Organ
(C) Organism
(D) Cell
2. What is the main function of meristematic tissue in plants?
(A) Transporting water and nutrients
(B) Providing structural support
(C) Carrying out photosynthesis
(D) Actively dividing to promote growth
3. Where are meristematic tissues primarily found in a plant?
(A) In mature leaves
(B) At the tips of roots and shoots
(C) Surrounding the stem
(D) Within flower petals
4. Which type of tissue is characterized by cells having a common origin, similar structure, and function?
(A) Meristematic tissue
(B) Muscle tissue
(C) Nerve tissue
(D) Organ tissue
5. What is the function of an organ system in living organisms?
(A) Providing structural support
(B) Regulating body temperature
(C) Coordinating specific life processes
(D) Facilitating cellular communication
6. Which type of tissue is responsible for contraction and relaxation in animals?
(A) Nerve tissue
(B) Meristematic tissue
(C) Muscle tissue
(D) Epithelial tissue
7. What distinguishes plant tissues from animal tissues?
(A) The size of the cells
(B) The presence of meristematic tissue
(C) The mode of living
(D) The structure of the cells
8. Which type of meristem is responsible for increasing the length of a plant?
(A) Apical meristem
(B) Lateral meristem
(C) Intercalary meristem
(D) Vascular meristem
9. What is the main role of organ tissues in multicellular organisms?
(A) Carrying out specific functions
(B) Dividing continuously to promote growth
(C) Providing structural support
(D) Transporting nutrients and gases
10. In which part of a plant are meristematic tissues typically located?
(A) Older leaves
(B) Stem internodes
(C) Root tips
(D) Flower petals

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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

CONCEPT 1.2**Permanent Tissue:**

Tissues consisting of cells that have lost the ability to divide and have attained a definite form and size are called permanent tissues.

Characteristics of Permanent Tissues:

- The permanent tissue cells may be thin or thick walls.
- These cells have undergone differentiation and have attained a definite size and function.
- The Nucleus is small in relation to cell size and cytoplasm is peripheral with a central vacuole.
- The cells of permanent tissues normally do not divide.
- Permanent cells perform specific function.
- The cells may be living or dead.

Classification of Permanent Tissues in Plants:

The permanent tissues are classified into three groups-

- A) Simple permanent tissues
- B) Complex permanent tissues
- C) Special tissues

A. 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. They are

- Parenchyma • Collenchyma • Sclerenchyma

Parenchyma:

- The cells of these tissues may be spherical, irregular or columnar in appearance. They have thin 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.
- Parenchyma performs various functions like photosynthesis, storage and secretion.
- They occur in epidermis, cortex, pith, pericycle, 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 is called as aerenchyma.

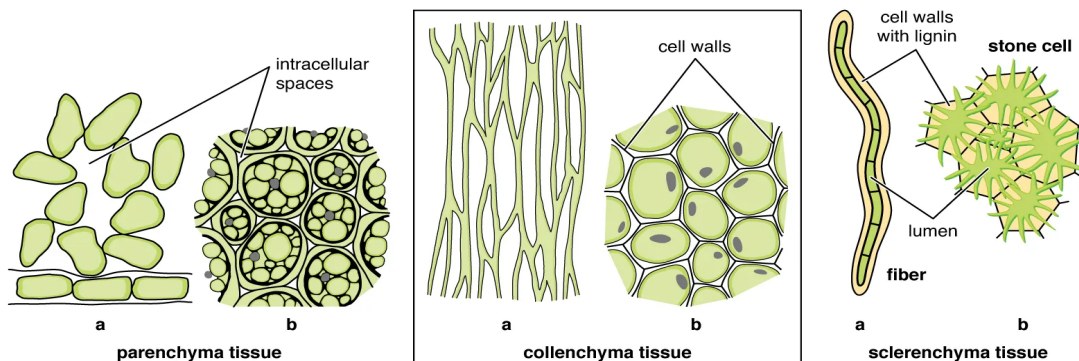
Collenchyma:

- Collenchyma is a living tissue found in the primary plant 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.
- 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.

Sclerenchyma:

- 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:** Thick walled, elongated and pointed cells, generally occurring in groups in various parts of the plant.
- **Sclereids:** Oval or cylindrical, highly thickened dead cells.
- 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.

Examples: Fruit walls of nuts, pulp of fruits like guava



Difference between Parenchyma, Collenchyma and Sclerenchyma:

Parenchyma	Collenchyma	Sclerenchyma
Cell walls are relatively thin, and the cells in parenchyma tissue are loosely packed.	The cell wall is irregularly thickened at the corners and there is very little space between the cells.	The cell walls are uniformly thickened and there are no intercellular spaces.
The cell wall in this tissue is made up of cellulose and hemicellulose.	Pectin and hemicellulose are the major constituents of the cell wall.	An additional layer of the cell wall composed mainly of lignin is found.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.2

- Which characteristic distinguishes permanent tissues from other types of tissues?**
 - Large nucleus in relation to cell size
 - Ability to divide continuously
 - Definite form and size
 - Presence of a central vacuole
- What is the main function of simple permanent tissues?**
 - Providing structural support
 - Facilitating cell division
 - Transporting nutrients
 - Initiating growth processes
- Which type of permanent tissue consists of cells that may be living or dead and have thick walls for support?**
 - Parenchyma
 - Collenchyma
 - Sclerenchyma
 - Meristematic tissue
- How are simple permanent tissues classified based on their structure?**
 - By the presence of a central vacuole
 - By the thickness of their cell walls
 - By the shape and size of their cells
 - By their ability to perform photosynthesis
- What is the Greek origin of the term "parenchyma"?**
 - Para-beside; enchyma=filling
 - Kollaglw, enchyma = filling
 - Scleros-h8ird; cnchyma=tissue
 - None of the above
- Which type of simple permanent tissue is characterized by cells with unevenly thickened cell walls and provides mechanical support to young plant parts?**
 - Parenchyma
 - Collenchyma
 - Sclerenchyma
 - Epidermal tissue
- What is the main function of complex permanent tissues in plants?**
 - Providing structural support
 - Facilitating cell division
 - Transporting water and nutrients
 - Protecting the plant from pathogens
- Which characteristic is common to all types of permanent tissues in plants?**
 - Continuous cell division
 - Large central vacuole
 - Definite form and size
 - Thin-walled cells
- Which group of permanent tissues consists of cells with similar shape, size, and structure?**
 - Simple permanent tissues
 - Complex permanent tissues
 - Special tissues
 - Meristematic tissues
- What is the primary function of sclerenchyma tissue in plants?**
 - Facilitating photosynthesis
 - Providing mechanical support
 - Transporting water and nutrients
 - Facilitating cell division

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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

CONCEPT 1.3

Protective Tissue:

Some cells cover plant parts such as root, stem, leaves, flowers, fruits etc. and provide protection against pathogens and adverse environmental factors. Hence these cells form a protective tissue. Protective tissue includes epidermis and cork.

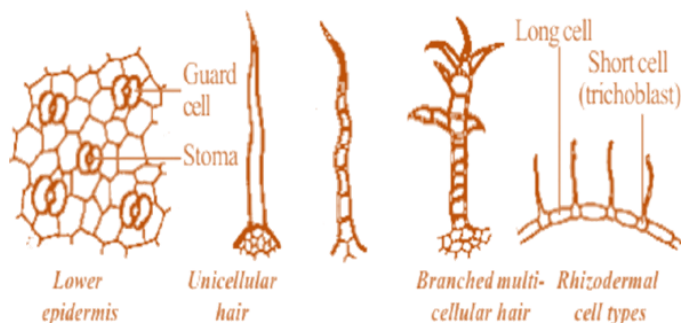


Fig. Epidermal tissue system

Type	Characteristics	Location	Function
Epidermis: Epidermis is usually made of a single layer of cells	Cells are elongated and flattened with no intercellular spaces between them.	Present in the outermost layer of leaves, flowers, stem and roots.	Protects the plant from desiccation and infection.
Cork: They also have a substance called suberin in their walls.	Cells are rectangular with vacuolated protoplasts.	It is the outermost layer formed after the epidermis undergoes certain changes.	Prevents desiccation, infection and mechanical injury.

B. Complex Permanent 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.

Classification: The conducting tissues are of two types:

(a) Xylem

(b) Phloem

Xylem:

Xylem is the chief conducting tissues of vascular plants, responsible for the transportation of water and inorganic solutes to the various parts of the plant body.

These consists of four types of cells

- **Tracheids**
- **Vessels**
- **Xylem fibres**
- **Xylem parenchyma**

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 form a system of long tubes and channels through which water can move easily. The tracheids are dead cells.

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.

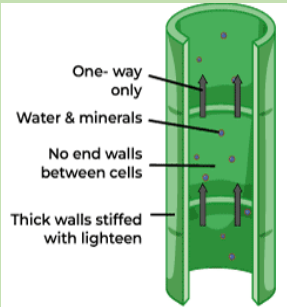
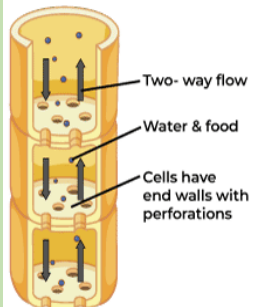
Xylem fibres are supportive in nature and provide mechanical strength to the plant body.

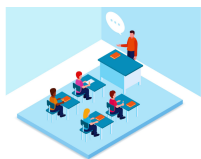
Xylem parenchyma are the only living components of xylem. These are connected with the storage of food and sideways conduction of water.

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.

Difference between Xylem and Phloem: .

S No	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, downward.
3	Conducting channels (tracheary elements) are tracheids and vessels.	Conducting channels are sieve tubes.
4	Its components tracheids, vessels, include xylem parenchyma and xylem fibres.	Its components include sieve tubes, companion cells, 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.
7	 <p>One-way only Water & minerals No end walls between cells Thick walls stiffed with ligniteen</p>	 <p>Two-way flow Water & food Cells have end walls with perforations</p>



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.3

1. **What is the primary function of protective tissue in plants?**
 - (A) Facilitating photosynthesis
 - (B) Providing mechanical support
 - (C) Protecting against pathogens and environmental factors
 - (D) Transporting water and nutrients
2. **Which cells form the protective tissue in plants?**
 - (A) Xylem and phloem
 - (B) Parenchyma and collenchyma
 - (C) Epidermis and cork
 - (D) Sclerenchyma and meristematic tissue
3. **Which part of a plant is covered by the epidermis and cork, forming the protective tissue?**
 - (A) Conducting region
 - (B) Roots
 - (C) Stem, leaves, flowers, and fruits
 - (D) Meristematic regions
4. **Why are epidermis and cork considered as protective tissues?**
 - (A) They facilitate water and nutrient transport
 - (B) They conduct photosynthesis
 - (C) They provide structural support
 - (D) They protect against pathogens and adverse environmental factors
5. **What distinguishes complex permanent tissues from simple permanent tissues in plants?**
 - (A) Presence of multiple cell types
 - (B) Ability to undergo rapid cell division
 - (C) Similarity in cell shape and size
 - (D) Location within the plant
6. **What is the main function of xylem and phloem, which constitute complex permanent tissue?**
 - (A) Providing structural support
 - (B) Facilitating photosynthesis
 - (C) Conducting water and nutrients
 - (D) Protecting against pathogens
7. **Which type of permanent tissue is responsible for transporting water and nutrients within a plant?**
 - (A) Epidermis
 - (B) Cork
 - (C) Xylem and phloem
 - (D) Parenchyma
8. **What is the primary role of the epidermis in plants?**
 - (A) Facilitating gas exchange
 - (B) Producing hormones
 - (C) Protecting against water loss and pathogens
 - (D) Storing nutrients
9. **Which term best describes the characteristic of epidermal and cork cells in plants?**
 - (A) Ability to divide continuously
 - (B) Definitive shape and size
 - (C) Central vacuole presence
 - (D) Conductivity of electrical signals
10. **In what way do epidermis and cork contribute to plant survival?**
 - (A) By facilitating reproduction
 - (B) By supporting mechanical structures
 - (C) By protecting against physical damage and pathogens
 - (D) By regulating internal temperature

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

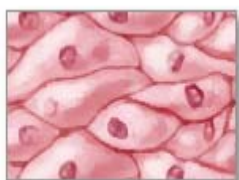
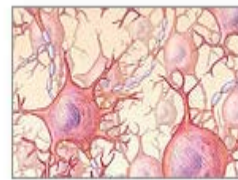
1 A B C D	2 A B C D	3 A B C D	4 A B C D	5 A B C D
6 A B C D	7 A B C D	8 A B C D	9 A B C D	10 A B C D

CONCEPT 1.4**Animal Tissues:**

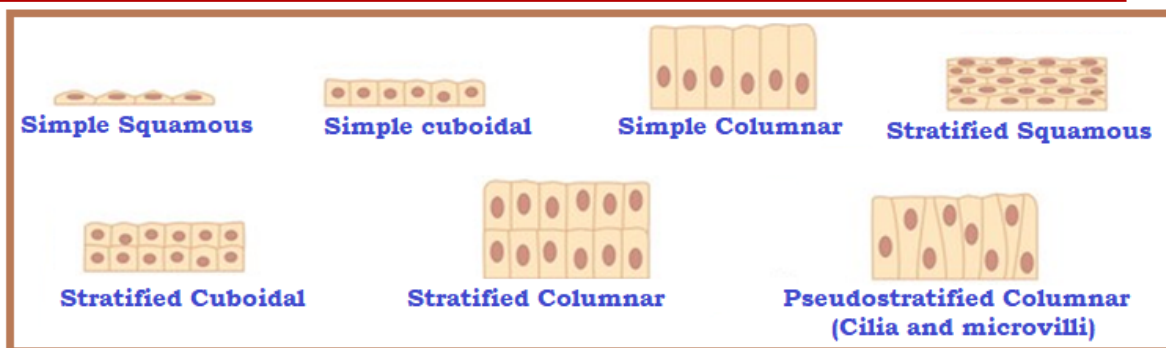
Tissue is a collection of cells of similar structure organized to carry out one or more particular functions. Examples are connective tissue, epithelial tissue, muscular tissue and nervous tissue. Several different tissues are often incorporated in the structure of each organ of the body. For example, in animals nervous tissue is specialized to perceive and transmit stimuli. An organ, such as a lung or kidney, contains many different types of tissues. Tissue is an association of cells of multicellular organism, with a common embryological origin or pathway and similar structure and function.

Depending on the basis of their structure and function, animal tissues are of four types-

1. Epithelial tissue
2. Muscular tissue
3. Connective tissue
4. Nervous tissue

**Epithelial****Muscular****Connective****Nervous****Epithelial Tissues (epi - upon, thelia - growing):**

Epithelial tissue or epithelium is a simplest type of animal tissue. It consists of one or more layers of tightly packed sheets of cells which covers the external surface of the body and viscera (internal organs) and also lines all the body cavities and hollow organs.

Types of Epithelial tissue-Characteristics, Location and Functions:

Type	Characteristics	Location	Function
Simple squamous epithelium	Cells are large, extremely thin and flat	Lining of blood vessels, lung alveoli, esophagus and the lining of the mouth and cheek	Facilitates the transport of substances through a selectively permeable membrane
Stratified squamous epithelium	Cells are arranged in multiple layers. Keratinized - Found in skin Non-Keratinized - Found in internally	Outer protective covering of the entire body surface	Provides protection to underlying tissue and prevents water loss
Columnar Epithelium	Cells are tall and Cylindrical, resembling pillars with nuclei	Inner lining of the stomach and intestines	Aids in the absorption of nutrients from digested food
Ciliated columnar epithelium	Cells have fine hair-like cilia	Inner lining of the trachea, lungs, respiratory system and buccal chambers	In the respiratory tract, the movement of cilia pushes mucus forward to clear it
Cuboidal Epithelium	Cells are cube-shaped and rest on a basement membrane	Lining of the kidney tubules, ducts of the salivary glands and sweat glands	Helps in the absorption of useful material from urine before it is passed out. Ex: Kidney tubules
Glandular Epithelium	A type of epithelial tissue that folds inwards to form multicellular gland	Present in the stomach, intestine and pancreas	Involved in the synthesis and secretion of hormones and digestive enzymes

Muscular Tissue:

Muscular tissues are mesodermal in origin. Muscle-forming cells, called myoblasts, contract and relax to cause movement. These myoblasts give rise to all the muscles in an animal's body. Muscle cells are highly elongated and contractile. Muscle tissue consists of elongated cells, also known as muscle fibres.

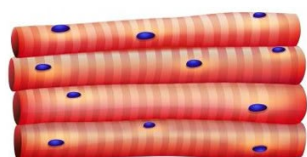
Types of Muscle Tissues:

Type	Characteristics	Location	Function
Striated/skeletal/striped/voluntary muscles	Muscle fibres are long, cylindrical, unbranched and multinucleate	Found attached to the Bones	Help in voluntary muscle movement and locomotion
Non-striated/smooth/non-striped/involuntary muscles	Muscle fibres are smooth and lack striations	Found in the uterus, digestive tract, urinary bladder, iris of the eye, bronchi of the lungs and other internal organs	Responsible for movements that cannot be controlled consciously.
Cardiac/heart Muscles (Involuntary Muscles)	Muscle cells are short, cylindrical and have a single, centrally placed nucleus	Found only in the walls of the heart	Rhythmic contraction and relaxation of cardiac muscles helps to pump blood to various parts of the body

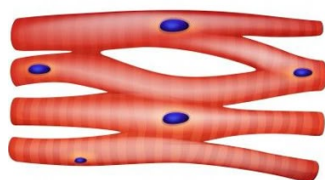
Differences between Smooth, Skeletal & Cardiac Muscles:

SMOOTH MUSCLE	SKELETAL MUSCLE	CARDIAC MUSCLE
1. Not striated	1. Striated	1. Striated
2. Spindle-shaped	2. Cylindrical	2. Cylindrical
3. Not branched	3. Not branched	3. Branched
4. Nucleus – central	4. Nuclei - peripheral	4. Nuclei - central
5. No discs	5. No discs	5. Intercalated discs
6. Involuntary	6. Voluntary	6. Involuntary
7. Slow	7. Fast	7. Fast
8. Contraction not inherent	8. Contraction not inherent	8. Contraction inherent

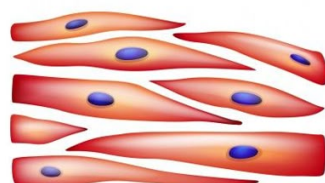
Types of Muscles:



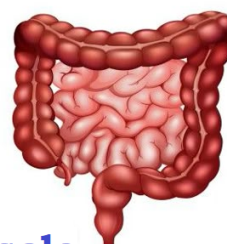
Skeletal muscle

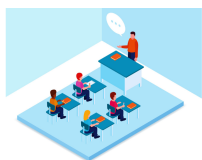


Cardiac muscle



Smooth muscle





CLASSROOM DISCUSSION QUESTIONS

CDQ
1.4

1. **What is the primary function of epithelial tissue in animals?**
 - (A) Providing structural support
 - (B) Facilitating muscle movement
 - (C) Covering body surfaces and lining cavities
 - (D) Conducting electrical signals
2. **Where is epithelial tissue primarily found in the animal body?**
 - (A) Attached to bones
 - (B) Found in the walls of the heart
 - (C) Covering body surfaces and lining cavities
 - (D) Distributed throughout the digestive tract
3. **Which characteristic distinguishes epithelial tissue from other types of animal tissues?**
 - (A) Long, cylindrical shape
 - (B) Presence of intercalated discs
 - (C) Highly elongated and contractile cells
 - (D) Tightly packed sheets of cells
4. **What is the main function of striated muscle tissue in animals?**
 - (A) Pumping blood throughout the body
 - (B) Facilitating involuntary muscle movements
 - (C) Carrying out movements under conscious control
 - (D) Providing rhythmic contractions in the heart
5. **In which type of muscle tissue are muscle fibers multinucleate and attached to bones for voluntary movement?**
 - (A) Smooth muscle tissue
 - (B) Skeletal muscle tissue
 - (C) Cardiac muscle tissue
 - (D) Connective tissue
6. **Where are non-striated muscle tissues primarily found in the animal body?**
 - (A) Attached to bones
 - (B) Walls of the heart
 - (C) Digestive tract and internal organs
 - (D) Skeletal muscles
7. **Which type of muscle tissue exhibits rhythmic contractions to pump and distribute blood throughout the body?**
 - (A) Smooth muscle tissue
 - (B) Skeletal muscle tissue
 - (C) Cardiac muscle tissue
 - (D) Connective tissue
8. **What distinguishes skeletal muscle tissue from smooth and cardiac muscle tissues?**
 - (A) Presence of intercalated discs
 - (B) Branched structure
 - (C) Voluntary control
 - (D) Slow contraction speed
9. **Which characteristic is common to all types of muscle tissues in animals?**
 - (A) Involuntary control
 - (B) Presence of intercalated discs
 - (C) Fast contraction speed
 - (D) Ability to generate force through contraction
10. **What is the primary role of cardiac muscle tissue in the animal body?**
 - (A) Facilitating voluntary muscle movement
 - (B) Pumping and distributing blood throughout the body
 - (C) Providing structural support to internal organs
 - (D) Initiating and conducting electrical impulses

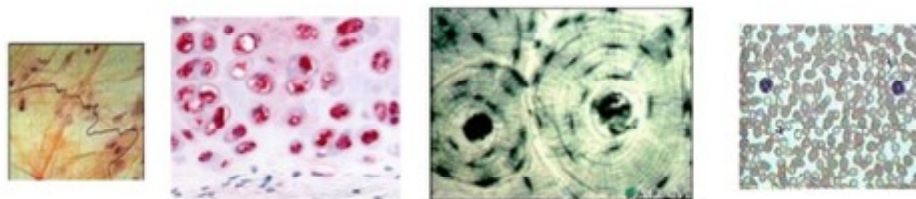
MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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

CONCEPT 1.5

Connective Tissue:

Connective tissue is the most abundant and widely distributed tissue in higher animals, it is named for its primary function of binding and supporting other tissues and organs derived from the mesoderm, connective tissue consists of specialised cells embedded in a large extra cellular matrix. This matrix contains different types of fibres that provide strength elasticity and support (collagen).

**Loose Connective Tissues:**

- **Connective tissue cells:** The cells are of different types:
 - (a) **Fibroblasts:** Inactive fibroblasts are called fibrocytes.
 - (b) **Adipose cells:** Adipose cells also known as adipocytes or lipocytes, store fat
 - (c) **Plasma cells:** Synthesize antibodies.
 - (d) **Mast cells:** Produce histamine, heparin and serotonin which are involved in the inflammation of infected areas.
 - (e) **Macrophages:** Ingest cell debris and foreign bodies. They are phagocytic in function and act as internal scavengers.
 - (f) **Immunocytes:** Produce antibodies that play crucial role in the immune response by identifying neutralising harmful pathogens.
- **Connective tissues fibres:** These are of three types:
 - Collagen fibres (white fibre): Occurs in bundles and they are strong.
 - Elastin fibres (yellow fibres): Branched elastic cartilage, elastic ligaments.
 - Reticular fibres: Strength and support to certain tissues such as bone marrow.
- **Dense connective tissue:** This tissue consists of more fibres but fewer cells. It has very little ground substance.
- **Dense regular connective tissue:** In this tissue, collagen fibres are arranged parallel to one another in bundles. Tendons attach skeletal muscles to bones, while ligaments connect bones to other bones.
- **Dense irregular connective tissue:** In this type of connective tissue, bundles of collagen fibres are irregular arranged. Periosteum, endosteum, pericardium heart valves.

The Tissues - VII

- **Elastic connective tissue:** It is mainly of yellow elastic fibres. Example: vocal cords, trachea.

Types of Connective Tissues:

It is composed of irregular cells scattered and embedded in a soft matrix and encompasses all internal organs and body cavities.

It acts as a binding and supporting structure within the body.

Type	Characteristics	Location	Function
Areolar Tissue	Composed of a gelatinous matrix with cells and irregularly arranged fibres	Located between the skin and muscles, around the blood vessels, nerves and in the bone marrow	Supports and strengthens the internal organs and help in the repair of tissues
Adipose Tissue	Cells are filled with fat Globules	Located beneath the skin, around the kidneys, and surrounding internal organs such as intestines	Insulates the body and prevents the loss of heat
Fibrous Tissue	Mainly composed of fibro forming cells, which produce tendons and ligaments	Located in the spaces between the bones and muscles	Tendons help to attach muscles to the bones. They are also made up of collagen. Ligaments serve to hold structures together and keep them strong and stable. These fibres are made up of a protein called collagen.

Supportive/Skeletal Tissue:

It is composed of fibres as its main matrix element and is found in bones and cartilages. It connects different tissues.

Type	Characteristics	Location	Function
Cartilage	Non-porous, semitransparent, flexible tissue	Present in the nose, external ear, trachea, larynx, ends of long bones and between the vertebrae	Smoothens the bone surface at joints, allowing smooth Movement
Bone	Hard, strong and non-flexible porous tissue that consists of living cells	Forms a rigid part of the skeletal system	Forms the supporting framework of the body. Gives shape and rigidity to the body

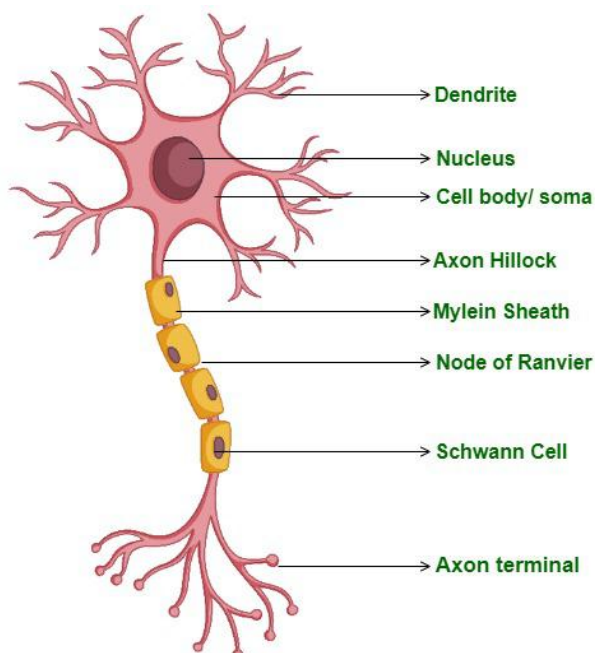
Fluid Connective Tissue:

It consists of liquid as the ground substance and is present throughout the body. It provides nutrition, helps in transport of nutrients and gets rid of waste matter.

Type	Characteristics	Location	Function
Blood	Red-coloured fluid matrix which consisting of plasma and cells such as RBCs, WBCs and platelets	Present throughout the body	Connects different parts of the body establishes continuity within it
Lymph	Fluid surrounding the body cells and contains WBCs	Present throughout the body	Transports nutrients while providing protection against diseases

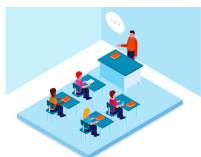
Nervous Tissue:

Neural or nervous tissue is ectodermal in origin and is responsible for receiving stimuli and conducting impulses to control and coordinate body functions. The brain, spinal cord, and nerves are all composed of nervous tissue. Nerve cells, or neurons, are the fundamental units of nervous tissue and are highly specialized, excitable cells. Neurons have the ability to receive stimuli from within or outside the body and conduct impulses to different parts of the body. These impulses (signals) travel from one neuron to another. Neurons are the longest cells in the body, reaching up to a meter in length. Each neuron is made up of two main parts: the cell body and neurites. Neurites are of two types: dendrites and axons.



Function:

Nervous tissue pickup sensation such as sight, sound, taste, smell, pain and other stimuli and provides response to all type of stimuli. It exerts control over all body activities. Nervous tissue or system coordinates the functioning of different body parts.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.5

1. **What is the primary function of connective tissue in animals?**
 - (A) Conducting electrical impulses
 - (B) Providing structural framework and support
 - (C) Carrying out voluntary muscle movements
 - (D) Absorbing nutrients from the environment
2. **Which component of connective tissue consists mainly of carbohydrates and proteins?**
 - (A) Connective tissue fibers
 - (B) Connective tissue cells
 - (C) Intercellular medium (ground substance)
 - (D) Plasma cells
3. **What is the main function of adipose tissue in animals?**
 - (A) Supporting and strengthening internal organs
 - (B) Smoothing bone surfaces at joints
 - (C) Insulating the body and preventing heat loss
 - (D) Transmitting electrical signals
4. **Where is fibrous tissue primarily found in the animal body?**
 - (A) Surrounding blood vessels
 - (B) Between bones and muscles
 - (C) Beneath the skin
 - (D) In the bone marrow
5. **Which type of connective tissue helps attach muscles to bones and holds structures together?**
 - (A) Areolar tissue
 - (B) Adipose tissue
 - (C) Fibrous tissue
 - (D) Cartilage
6. **What is the main function of cartilage in animals?**
 - (A) Transmitting electrical signals
 - (B) Providing insulation and heat retention
 - (C) Smoothing bone surfaces at joints
 - (D) Forming a rigid part of the skeletal system
7. **Where is blood primarily found in the animal body?**
 - (A) Present between bones and muscles
 - (B) Present beneath the skin
 - (C) Throughout the body
 - (D) Within the bone marrow
8. **Which characteristic distinguishes nervous tissue from other types of animal tissues?**
 - (A) Ability to store fats
 - (B) Excitability and conduction of impulses
 - (C) Production of antibodies
 - (D) Formation of tendons and ligaments
9. **What is the main function of nervous tissue in animals?**
 - (A) Providing structural support
 - (B) Transmitting and coordinating impulses for controlling body functions
 - (C) Insulating the body and preventing heat loss
 - (D) Synthesizing hormones
10. **What is the primary role of neurons in nervous tissue?**
 - (A) Conducting impulses to control body functions
 - (B) Synthesizing antibodies for immune response
 - (C) Providing structural support to organs
 - (D) Storing and releasing fats for energy

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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

REVIEW OF KEY CONCEPTS

1. Multicellular organisms consist of many groups of specialised cells making up their tissues and organs.
2. Differentiation is the process by which unspecialised structures become modified and specialised for performing specific functions.
3. Differentiation results in division of labour.
4. The study of the structure of tissues and organs is known as histology.
5. Based on ability to divide, plant tissues may be classified as meristematic tissue and permanent tissue.
6. Meristematic cells possess the power of cell division.
7. Permanent tissues are those which have lost the capacity to divide.
8. Plant tissues differentiate into three main tissue types: dermal, vascular, and ground tissue. Each plant organ (roots, stems, leaves) contains all three tissue types: Dermal tissue covers and protects the plant and controls gas exchange and water absorption (in roots).
9. Based on function, permanent tissues are classified as protective tissues, supporting tissues, conducting tissues and secretory tissues.
10. Parenchyma is a widely distributed, simple plant tissue.
11. Collenchyma is a strong and flexible mechanical tissue.
12. Like collenchyma, sclerenchyma is also a strengthening and protective tissue.
13. Xylem and phloem are the conducting tissues or vascular tissues/ also called complex tissues. Xylem is popularly known as wood. Xylem is composed of tracheids, vessels, xylem parenchyma and xylem fibres. In higher plants, xylem and phloem usually occur together forming vascular bundle.
14. The epithelial cells lie close together with little or no intercellular substances. The main function of epithelium is to give protection to the underlying tissues.
15. Blood is a bright, red-coloured fluid connective tissue consisting of plasma and blood cells (erythrocytes, leucocytes and platelets).
16. Muscular tissue is a contractile tissue which possesses myofibrils, sarcoplasm, sarcolemma, etc. The main function of muscular tissue is to bring about movement of body parts and locomotion of individual.
17. Nervous tissue is a very specialised tissue for receiving stimuli or sensations and transmitting messages. Nerve cells or neurons form the most important elements of nervous tissue. The three main parts of a neuron are cell body or cyton, Dendron and the axon.

ADVANCED WORKSHEET



Single Correct Answer Type (S.C.A.T)

- 'X' is a conducting tissue that is involved in bidirectional transport of materials in a plant. 'X' is ____.**
 - Phloem
 - Xylem
 - Meristem
 - Sclerenchyma
- Which of the following tissues provides mechanical strength and flexibility to plants?**
 - Parenchyma
 - Collenchyma
 - Aerenchyma
 - Sclerenchyma
- Tiny pores present on the surface of leaves through which gaseous exchange occurs are called:**
 - Stomata
 - Guard cells
 - Food holes
 - Gas holes
- Identify the tissue that transports water to the plant body.**
 - Xylem
 - Phloem
 - Cambium
 - All of these
- Which of the following tissues lines body cavities and covers the body surface?**
 - Nervous
 - Epithelial
 - Muscle
 - Connective
- Which of the following tissues includes bone and cartilage?**
 - Muscle tissue
 - Nervous tissue
 - Epithelial tissue
 - Connective tissue
- Which of the following organs contain(s) smooth muscles?**
 - Iris of eye
 - Uterus
 - Bronchi
 - All of the above
- Which of the following is/are connective tissues?**
 - Bone
 - Cartilage
 - Blood
 - All of the above
- Which of the following tissues supports, defends, and transports food in the body?**
 - Epithelial
 - Connective
 - Nervous
 - Muscular

- 10. Which of the following epithelial tissues lines the inner surface of the trachea?**
 - (A) Squamous
 - (B) Cuboidal
 - (C) Hyaline cartilage
 - (D) Ciliated
- 11. Which of the following tissues is responsible for receiving, interpreting and producing response to stimulus?**
 - (A) Muscle tissue
 - (B) Connective tissue
 - (C) Nervous tissue
 - (D) Epithelial tissue
- 12. Which of the following substances is present in the cell walls of sclerenchyma?**
 - (A) Cellulose
 - (B) Pectin
 - (C) Lignin
 - (D) Hemicellulose
- 13. Which of the following does not lose its nucleus at maturity?**
 - (A) Bast fibre
 - (B) Companion cell
 - (C) Red blood cell
 - (D) Sieve tube cell
- 14. Which of the following tissues is present in kidneys?**
 - (A) Squamous epithelium
 - (B) Cuboidal epithelium
 - (C) Columnar epithelium
 - (D) Compound epithelium
- 15. Which of the following is the characteristic feature of cardiac muscles?**
 - (A) Cylindrical, branched and uninucleate
 - (B) Long, pointed and uninucleate
 - (C) Long, cylindrical and unbranched
 - (D) Cylindrical, unbranched and multinucleate
- 16. Which of the following tissues helps in the transport of food?**
 - (A) Collenchyma
 - (B) Chlorenchyma
 - (C) Phloem
 - (D) Xylem
- 17. Which of the following is the characteristic feature of sclerenchyma tissue?**
 - (A) Living cells with hard, rigid secondary walls.
 - (B) Dead cells with uneven thickness in their walls.
 - (C) Dead cells with hard, rigid secondary walls with intercellular spaces.
 - (D) Living cells with uneven thickness in their walls.
- 18. Which of the following muscle tissues is long and thread like and provides body movements under conscious control?**
 - (A) Striated
 - (B) Un-striated
 - (C) Cardiac
 - (D) Smooth

- 19. Which of the following parts of a plant have the water carrying tubes and the food carrying tubes?**
- (A) Leaves
 - (B) Stem
 - (C) Roots
 - (D) All of these
- 20. Which of the following cells secretes calcium carbonate and calcium phosphate?**
- (A) Adipocyte
 - (B) Osteocyte
 - (C) Monocyte
 - (D) Thrombocyte
- 21. Which of the following connects bones and muscles?**
- (A) Tendons
 - (B) Ligament
 - (C) Collagen
 - (D) Cartilage
- 22. Which of these tissues transmits stimuli?**
- (A) Nervous
 - (B) Epithelial
 - (C) Connective
 - (D) Muscle
- 23. Which of the following is NOT a function of connective tissue?**
- (A) The production of blood cells
 - (B) Binding and supporting body parts
 - (C) Lining of body surfaces and cavities
 - (D) Storing energy in the form of fats
- 24. Which of the following is/are voluntary muscles?**
- (A) Skeletal
 - (B) Cardiac
 - (C) Smooth
 - (D) All of the above
- 25. Which of the following are complex tissues?**
- (A) Parenchyma and collenchyma
 - (B) Collenchyma and sclerenchyma
 - (C) Xylem and phloem
 - (D) Xylem and Parenchyma
- 26. Which of the following is the dividing tissue in plants?**
- (A) Meristematic
 - (B) Collenchyma
 - (C) Parenchyma
 - (D) Sclerenchyma
- 27. Girth of stem increases due to: (NCERT)**
- (A) Apical meristem
 - (B) Lateral meristem
 - (C) Intercalary meristem
 - (D) Vertical meristem
- 28. Aerenchyma provides:**
- (A) Mechanical strength to plants
 - (B) Extra space for photosynthesis and storage of food
 - (C) Flexibility to plants
 - (D) Buoyancy to hydrophytic plants

29. Flexibility in plants is due to: (NCERT)

- (A) Collenchyma
- (B) Sclerenchyma
- (C) Parenchyma
- (D) Chlorenchyma

30. Which of the following tissues has dead cells? (NCERT)

- (A) Parenchyma
- (B) Sclerenchyma
- (C) Collenchyma
- (D) Epithelial tissue

31. Which of the following is not a part of epidermal tissue system?

- (A) Companion cells
- (B) Guard cells
- (C) Root hairs
- (D) Subsidiary cells

32. Which is not a function of epidermis? (NCERT)

- (A) Protection from adverse condition
- (B) Gaseous exchange
- (C) Conduction of water
- (D) Transpiration

33. Which of the following is an example of an organ?

- (A) Muscle cell
- (B) Meristematic tissue
- (C) Kidney
- (D) Excretory system

34. Which type of meristematic tissue is responsible for the increase in the thickness of the stem or root?

- (A) Apical meristem
- (B) Lateral meristem
- (C) Intercalary meristem
- (D) Vascular tissue

35. Which characteristic is true for cells of permanent tissue?

- (A) They divide continuously
- (B) They have a large central nucleus
- (C) They have undergone differentiation and assumed a definite size and function
- (D) They are only found in the roots

36. What is the primary function of collenchyma tissue?

- (A) Photosynthesis
- (B) Storage of nutrients
- (C) Providing mechanical support and elasticity to young dicotyledonous plants
- (D) Transport of water

37. Which two types of tissue are included in protective tissue?

- (A) Xylem and Phloem
- (B) Parenchyma and Collenchyma
- (C) Epidermis and Cork
- (D) Sclerenchyma and Meristematic

38. Which tissues are considered complex permanent tissues in plants?

- (A) Epidermis and Cork
- (B) Parenchyma and Collenchyma
- (C) Xylem and Phloem
- (D) Sclerenchyma and Meristematic

39. What characteristic is specific to ciliated columnar epithelium?

- (A) Cells are cube-shaped
- (B) Cells possess fine hair-like cilia
- (C) Cells are arranged in layers
- (D) Cells are extremely thin and flat

40. Which type of connective tissue cells store fats?

- (A) Fibroblasts
- (B) Adipocytes
- (C) Plasma cells
- (D) Mast cells

41. Which of the following is NOT a part of a neuron?

- (A) Axon
- (B) Dendrite
- (C) Sarcomere
- (D) Cell body



Analytical Approach Type (A.A.T.)

42. 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

43. Which of the following contains both living and dead cells conducting tissue that provides mechanical strength in plants?

- (i) Meristem
- (ii) Phloem
- (iii) Xylem
- (iv) Collenchyma
- (A) I and II
- (B) II and III
- (C) III and IV
- (D) I and IV

44. Smooth muscles are:

- (i) Involuntary, cylindrical, straited**
- (ii) Voluntary, spindle shaped, uninucleate**
- (iii) Involuntary, fusiform, non-straited**
- (iv) Voluntary, multinucleate, cylindrical**

- (A) (i) only
- (B) (ii) & (iii)
- (C) (ii) only
- (D) (iii) & (iv)

45. Tissue is made up of group of:

- (i) Living cells only**
- (ii) Dead cells only**
- (iii) Provided with simple pits**
- (iv) It is present with (or) without intercellular spaces**

- (A) (i) & (ii)
- (B) (i) & (iii)
- (C) (ii) & (iv)
- (D) (iii) & (iv)



Matrix Matching Type (M.M.T.)

SET-I

Column I

- 46. Bones
- 47. Neurons
- 48. Cardiac muscles
- 49. Cuboidal epithelium

Column II

- (A) Nervous tissue
- (B) Epithelial tissue
- (C) Connective tissue
- (D) Muscular tissue

SET-II

Column-I

- 50. Epidermis
- 51. Cuticle
- 52. Stomatal apparatus
- 53. Guard cells

Column-II

- (A) Bean shaped cells
- (B) Stomatal aperture guard cells and subsidiary cells
- (C) Thick waxy layer
- (D) Outermost layer

Assertion Reason Type (A.R.T.)

- (A) Both A and R are true and R is the correct explanation of A.
- (B) Both A and R are true but R is not the correct explanation of A.
- (C) A is true but R is false.
- (D) A is false but R is true.

54. Assertion(A): Blood is a fluid connective tissue.

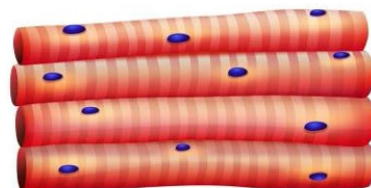
Reason(R): It is a motile connecting tissue which connects all the tissues, organs with each other.

55. Assertion(A): In dicot stem, the vascular bundles are open.

Reason(R): Cambium is present between xylem and phloem of vascular bundle in dicot stem.

Figure Based (F.B.)

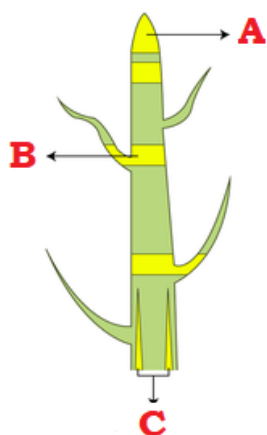
56. Identify the given diagram.



- (A) Cardiac muscle
- (B) Skeletal muscle
- (C) Smooth muscle

(D) None of the above

57. Observe the given diagram and label the parts.



- (A) A-Apical meristem; B-Lateral meristem; C-Intercalary meristem
- (B) A-Apical meristem; B-Intercalary meristem; C-Lateral meristem
- (C) A-Intercalary meristem; B-Lateral meristem; C-Apical meristem
- (D) A-Lateral meristem; B-Apical meristem; C-Intercalary meristem

Previous Contest Questions (P.C.Q.)

58. Intestines absorb the digested food materials. What type of epithelial cells are responsible for that?

(NCERT)

- (A) Stratified squamous epithelium
- (B) Columnar epithelium
- (C) Spindle fibres

(D) Cuboidal epithelium

59. The type of tissue lining of the nasal passage, bronchioles and Fallopian tubes is:

- (A) Cuboidal epithelium
- (B) Ciliated columnar epithelium
- (C) Stratified squamous epithelium
- (D) Simple squamous epithelium

60. Bone matrix is rich in:

(NCERT)

- (A) Fluoride and calcium
- (B) Calcium and phosphorus
- (C) Calcium and potassium
- (D) Phosphorus and potassium

61. Cartilage is not found in:

(NCERT)

- (A) Nose
- (B) Ear
- (C) Kidney
- (D) Larynx

62. Which of the following helps in repair of tissue and fills up the space inside the organ?

(NCERT)

- (A) Tendon
- (B) Adipose tissue
- (C) Areolar tissue
- (D) Cartilage

63. Fats are stored in human body as:

(NCERT)

- (A) Cuboidal epithelium
- (B) Adipose tissue
- (C) Bones
- (D) Cartilage

64. Voluntary muscles are found in:

(NCERT)

- (A) Alimentary canal
- (B) Limbs
- (C) Iris of the eye
- (D) Bronchi of lungs

65. The muscular tissue which function throughout the life continuously without fatigue is:

(NCERT)

- (A) Skeletal muscle
- (B) Cardiac muscle
- (C) Smooth muscle
- (D) Voluntary muscle

66. Axon and dendrites are special features of:

- (A) Cardiac muscle
- (B) Cartilage
- (C) Specialised epithelium
- (D) Neuron

67. Which of the following is not a function performed by epidermis?

- (A) Protection against mechanical injury
- (B) Protection against insects
- (C) Protection against waterless
- (D) Regulation of gaseous exchange

68. Which of the following is not the function of nervous tissue?

- (A) Nerve impulse allows us to move muscles
- (B) It enables rapid response to stimuli
- (C) It transmits stimulus within the body
- (D) It helps in repairing of tissues

69. Which among the following is not an animal tissue?

- (A) Epithelial tissue
- (B) Blood
- (C) Glandular epithelium
- (D) Epidermal tissue

70. is not a simple permanent tissue.

- (A) Sclerenchyma
- (B) Collenchyma
- (C) Parenchyma
- (D) Xylem

71. The tissue responsible for the growth of plants is called:

- (A) Permanent Tissue
- (B) Phloem
- (C) Xylem
- (D) Meristematic Tissue

NOTES

[illegible]