GRADE 10

LIFE SCIENCES

PLANT AND ANIMAL TISSUES

🔍 1. INTRODUCTION TO TISSUES

Definition:

- A **tissue** is a group of similar cells structurally adapted to perform a specific function.

Hierarchical Organisation:

Atom → Molecule → Organelle → Cell → Tissue → Organ → System → Organism → Ecosystem

🌱 2.1 MERISTEMATIC TISSUE (Dividing Tissue)

Characteristics:

- **Undifferentiated**, **actively dividing** cells
- Small cells with dense cytoplasm and large nuclei
- No/few vacuoles

Types:

Type	Location	Function
Apical Meristem	Root and shoot tips	Increases **length** (primary growth)
Lateral Meristem	Cambium in stems/roots	Increases **width** (secondary growth)

Structural Adaptations:

Feature	Function
Small cells, tightly packed	More cells in small space
Large nuclei, little cytoplasm	High DNA content for division
Few/no vacuoles	Prevents rigidity for active division

🌿 2.2 PERMANENT TISSUES

Once meristematic cells specialise, they become **permanent tissues**.

Subtypes:

1. **Simple Permanent Tissues** (one cell type)
2. **Complex Permanent Tissues** (more than one type)

🔹 SIMPLE PERMANENT TISSUES

(a) Parenchyma

- Most common ground tissue.

- Location: stems, roots, soft fruit.
- Structure:
    - Thin cell walls
    - Intercellular spaces
    - Large central vacuole
- Function:
    - **Storage**, **photosynthesis**, **wound repair**, **gas diffusion**

Chlorenchyma: parenchyma with chloroplasts for photosynthesis

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(b) Collenchyma

- Located in **stems and leaves**, especially in growing parts.
- Structure:
    - Unevenly thickened cell corners (cellulose, pectin)
    - No intercellular spaces
- Function:
    - **Support** and **flexibility**
    - Strength in growing shoots

(c) Sclerenchyma

- Two types: **fibres** (long, thick-walled) and **sclereids** (irregular, thick walls)
- Structure:
    - Dead at maturity
    - Thick lignified walls
- Function:
    - **Mechanical strength**, **protection**
    - Support in mature, non-growing areas

(d) Epidermis

- Outermost protective layer
- May have **guard cells**, **root hairs**, **cuticle**
- Function:

- Protection
- Controls water loss
- Gaseous exchange

🔸 **COMPLEX PERMANENT TISSUES**

(a) Xylem

- Transports **water and mineral salts**
- Structure:
  - **Vessels** (no cross walls, dead, lignified)
  - **Tracheids** (tapered ends)
  - **Parenchyma** (storage)
  - **Sclerenchyma fibres** (support)
- Functions:
  - Upward transport
  - Support

(b) Phloem

- Transports **organic food (sucrose)** from leaves to rest of plant.
- Structure:
  - **Sieve tube elements**: no nucleus
  - **Companion cells**: control sieve tubes
  - **Parenchyma**: food storage
  - **Fibres**: support
- Function:
  - Bidirectional movement of food

🧍♂️ **3. ANIMAL TISSUES**

🔹 **3.1 EPITHELIAL TISSUE**

Characteristics:

- Covers surfaces, lines organs and cavities.
- Tightly packed cells, often layered.

Type	Location	Function
Squamous	Lung alveoli, capillaries	Diffusion
Cuboidal	Kidney tubules	Secretion, absorption
Columnar	Stomach, intestines	Absorption, secretion
Ciliated	Trachea	Moves mucus
Stratified	Skin	Protection

🔹 3.2 CONNECTIVE TISSUE

General Features:

- Cells scattered in a **matrix**.
- Provides **support**, **structure**, and **transport**.

Type	Structure	Function
Areolar	Fibres + cells	Binds skin to muscle
Fibrous	Collagen-rich	Tendons, ligaments
Cartilage	Flexible matrix	Nose, ears, joints
Bone	Hard, mineralised	Support, movement
Blood	Fluid matrix	Transport (O_2, nutrients)
Adipose	Fat storage	Energy, insulation

🔹 3.3 MUSCLE TISSUE

Type	Structure	Location	Control	Function
Skeletal	Striated, multinucleate	Attached to bones	Voluntary	Movement
Cardiac	Striated, branched	Heart	Involuntary	Pumps blood
Smooth	Non-striated	Gut, blood vessels	Involuntary	Peristalsis, vasoconstriction

🔹 3.4 NERVE TISSUE

- Composed of **neurons** and **glial cells**
- Function:
    - Transmit impulses
    - Sensory input → Processing → Motor response

Neuron Type	Function
Sensory	Carries info to CNS

Neuron Type	Function
Interneuron	Processes in CNS
Motor	Sends signals to effectors (muscles/glands)

🌿🧪 4. INDIGENOUS KNOWLEDGE & BIOTECHNOLOGY

- **Traditional Medicine**: Use of plant tissues (e.g. bark, roots) in healing.
- **Biotechnology**:
    - **Tissue culture**: Growing cells in sterile medium
    - **Cloning**: Producing genetically identical tissue/organisms
    - **Stem cells**: Used for therapy and research
    - **Ethical concerns**: Vary across cultures and nations

🌿 5. THE LEAF AS AN ORGAN

- **Organ** = Group of tissues working together.
- Leaf tissues:
    - **Epidermis** (protection, gaseous exchange)
    - **Palisade & spongy mesophyll** (photosynthesis)
    - **Xylem & phloem** (transport)
- **Functions**:
    - Photosynthesis
    - Gas exchange (via stomata)
    - Transpiration
    - Transport of water & sucrose