

CLASS 9 BIOLOGY

CHAPTER 3 – TISSUES IN ACTION

Handwritten-style revision notes based on the provided NCERT PDF

1. TISSUE – MEANING

- A **tissue** is a group of cells that work together to perform a specific function.
- **Organisation:** Cell → Tissue → Organ → Organ system → Organism.
- **Division of labour:** Different tissues perform different functions, increasing the efficiency of multicellular organisms.

2. PLANT AND ANIMAL TISSUES

- **Plants:** Mostly fixed in one place, require support, have rigid cell walls and specialised tissues for photosynthesis, transport and growth.
- **Animals:** Generally capable of movement; their cells lack a rigid cell wall and are adapted for movement, digestion, coordination and communication.

3. PLANT TISSUES

- Plant tissues are broadly classified into **meristematic** and **permanent** tissues.

4. MERISTEMATIC TISSUE

- Meristematic tissue consists of actively dividing cells and is responsible for plant growth.
- **Apical meristem:** Located at root and shoot tips; increases length.
- **Lateral meristem:** Located along the circumference of stems; increases girth.
- **Intercalary meristem:** Located at the base of internodes/near nodes; helps regeneration after cutting or grazing.

5. FEATURES OF MERISTEMATIC CELLS

- Small cells; thin cell walls; dense cytoplasm; large prominent nucleus; many organelles; vacuoles generally absent; tightly packed with little or no intercellular space.
- **Differentiation:** The process by which meristematic cells lose the ability to divide and become specialised permanent tissues.

6. PERMANENT TISSUES

- **Simple:** Parenchyma, Collenchyma, Sclerenchyma.
- **Complex:** Xylem and Phloem.

7. EPIDERMIS

- The epidermis forms the outermost protective layer of the plant.
- **Functions:** protection, reduction of water loss, protection against microorganisms and parasites.
- **Root hairs:** increase surface area for absorption of water and minerals.
- **Stomata:** help gaseous exchange and transpiration.

8. SIMPLE PERMANENT TISSUES

- **Parenchyma:** Living, thin-walled, loosely packed; stores food and may perform photosynthesis. Specialised air spaces help aquatic plants float.
- **Collenchyma:** Living cells with unevenly thickened corners; provides support and flexibility.
- **Sclerenchyma:** Thick lignified walls; mostly dead; provides strength. Found in stems, leaf veins and hard coverings such as coconut husk and walnut shell.

9. XYLEM AND PHLOEM

- **Xylem:** Transports water and minerals from roots to other parts and also provides strength. Components: tracheids, vessels, xylem parenchyma and xylem fibres.
- **Phloem:** Transports food from leaves to other parts. Components: sieve tubes, companion cells, phloem parenchyma and phloem fibres.
- **Memory trick:** Xylem → water/minerals; Phloem → food.

10. PLANT TISSUE SYSTEMS

- **Dermal tissue system:** outer covering and protection.
- **Ground tissue system:** main body between dermal and conducting tissues; includes parenchyma, collenchyma and sclerenchyma.
- **Vascular tissue system:** xylem and phloem.

11. ANIMAL TISSUES

- Four major types: **epithelial, connective, muscular and nervous tissues.**

12. EPITHELIAL TISSUE

- Forms the outer covering and lines internal organs. Cells are closely packed.
- **Exchange:** thin, flat single layer – lungs and blood vessels.
- **Protection:** many layers – skin, mouth and oesophagus.
- **Secretion:** specialised cells – salivary and sweat glands, stomach lining.
- **Sensory:** receptor cells with hair-like cilia – nostrils, taste buds, inner ear.

- **Absorption:** tall pillar-like cells – small intestine.

13. CONNECTIVE TISSUE

- Connective tissue connects and supports tissues and organs.
- **Blood:** fluid matrix; RBCs, WBCs and platelets are formed elements.
- **Bone:** hard, rigid matrix containing calcium and phosphorus compounds; support and protection.
- **Cartilage:** soft, flexible matrix; cushioning and shock absorption.
- **Tendon:** connects muscle to bone.
- **Ligament:** connects bone to bone and provides stability.

14. MUSCULAR TISSUE

- **Skeletal muscle:** voluntary, long cylindrical unbranched fibres, multinucleate and striated.
- **Smooth muscle:** involuntary, spindle-shaped, single nucleus, non-striated; found in organs such as stomach and intestine.
- **Cardiac muscle:** involuntary, branched, single nucleus, faint striations; found only in heart and works rhythmically.

15. NERVOUS TISSUE

- Nervous tissue forms the control and coordination network.
- **Neuron:** specialised cell that receives, processes and transmits messages.
- **Parts:** cell body, dendrites and axon.
- **Direction:** Dendrites → Cell body → Axon → Axon terminals.

16. MUSCULOSKELETAL SYSTEM

- Made up of bones, muscles, joints, cartilage, tendons and ligaments.
- Functions: movement, posture, upright support and protection of delicate organs.
- Muscles contract → tendons transmit force → bones move at joints.

17. TYPES OF JOINTS

- **Ball and socket:** shoulder; allows forward, backward, sideways and circular movement.
- **Hinge:** elbow and knee; movement mainly in one direction.
- **Pivot:** neck; allows side-to-side movement of the head.
- **Fixed:** skull; no movement, protects the brain.

18. SKELETAL SYSTEM

- Includes skull, vertebral column and rib cage.
- **Vertebral column:** made of vertebrae; supports the body. Cartilage discs cushion and provide flexibility.
- **Rib cage:** 12 pairs of ribs; protects heart and lungs and expands/ contracts during breathing.

19. TOTIPOTENCY

- Totipotency is the ability of certain mature plant cells to regain the ability to divide and develop into a complete plant under suitable conditions.
- **Process:** Dedifferentiation → Cell division → Redifferentiation → Complete plant.
- F. C. Steward demonstrated regeneration of a complete carrot plant from cultured phloem cells.

20. CROWN GALL DISEASE

- Crown gall causes tumour-like swellings due to rapid, uncontrolled cell division.
- Cause: **Agrobacterium tumefaciens**.
- The study of this bacterium helped in plant tissue culture and genetic engineering.

■ QUICK REVISION

- **Apical** → **Length**
- **Lateral** → **Girth**
- **Intercalary** → **Regeneration**
- **Parenchyma** → **Storage**
- **Collenchyma** → **Flexibility**
- **Sclerenchyma** → **Strength**
- **Xylem** → **Water + minerals**
- **Phloem** → **Food**
- **Tendon** → **Muscle to bone**
- **Ligament** → **Bone to bone**
- **Neuron** → **Control and coordination**