

CBSE CLASS 9 SCIENCE

Chapter 6: Tissues

Complete Concept & Question Bank

EXAM BOOSTER EDITION

SECTION 1: Chapter Overview

| What are Tissues?

A tissue is a group of cells that are similar in structure and work together to perform a specific function. In multicellular organisms, cells are highly specialized to carry out different biological activities efficiently.

| Why are Tissues Important?

Tissues enable a distinct **division of labour** in multicellular organisms. Instead of a single cell handling every vital metabolic mechanism, specific clusters of cells specialize in designated operations such as protection, structural support, internal transportation, and coordinated mechanical movement.

| Chapter Summary

- **Tissue:** A group of similar cells working together to perform a specific, focused structural or physiological function.
- **Plant Tissues:** Subdivided broadly into *Meristematic Tissue* (retains persistent division capabilities) and *Permanent Tissue* (matured, differentiated, and specialized).
- **Simple Permanent Tissues:** Uniform structures consisting of one cell type: Parenchyma, Collenchyma, and Sclerenchyma.
- **Complex Permanent Tissues:** Composite networks involving multiple cell types working collectively: Xylem (water conduction) and Phloem (translocation of food).
- **Animal Tissues:** Grouped functionally into four prime categories: Epithelial (protection), Connective (binding/support), Muscular (locomotion), and Nervous (impulse conduction).

SECTION 2: Important Concepts

| 1. Meristematic Tissue

Composed of localized, actively dividing embryonic cells found in the growth zones of plants. These cells feature very thin cellulose walls, dense cytoplasmic content, prominent nuclei, and completely lack vacuoles since their metabolic state centers on rapid division rather than long-term storage.

- **Apical Meristem:** Located at the tips of root systems and shoot systems; responsible for primary linear elongation.
- **Intercalary Meristem:** Found at leaf bases and internodes; facilitates rapid elongation of nodes and stem segments.

- **Lateral Meristem (Cambium):** Located along radial margins; drives secondary growth increasing girth/thickness.

2. Permanent Tissue & Differentiation

Formed when meristematic cells progressively lose their capacity to divide. The process through which a cell undergoes specific structural refinements to assume a permanent shape, size, and physiological role is termed **differentiation**.

3. Simple Permanent Tissue

- **Parenchyma:** Fundamental, unspecialized, living thin-walled cells with loose packing and notable intercellular gaps. Variations include *Chlorenchyma* (possesses chlorophyll for photosynthesis) and *Aerenchyma* (provides aquatic buoyancy).
- **Collenchyma:** Living cells displaying unevenly thickened corners rich in cellulose and pectin matrixes, providing flexible mechanical support.
- **Sclerenchyma:** Extremely rigid, dead tissues characterized by heavily lignified, highly uniform secondary walls with no internal cytoplasm (e.g., the fibrous outer husk of a coconut).

4. Complex Permanent Tissue

- **Xylem:** Upward conducting tissue responsible for carrying water and mineral components. Elements include dead conductive channels (*tracheids and vessels*), supportive *xylem fibres*, and living *xylem parenchyma*.
- **Phloem:** Multi-directional vascular system translocating manufactured sugars. Elements include conductive *sieve tubes* supported dynamically by *companion cells*, alongside *phloem parenchyma* and protective *phloem fibres*.

5. Animal Tissues

- **Epithelial Tissue:** Continuous sheet architecture acting as an external shield and internal lining. Classified into flat *Squamous*, secretory *Cuboidal*, absorptive *Columnar*, and sweep-action *Ciliated* variations.
- **Connective Tissue:** Cells widely separated and anchored inside an abundant extracellular matrix. Encompasses fluid transport medium (*Blood*), dense structural support (*Bone & Cartilage*), binding components (highly tensile *Tendons* and elastic *Ligaments*), and storage (fat-insulating *Adipose*).
- **Muscular Tissue:** Specialized contractile elements. Split into voluntary/striped *Striated* skeletal muscles, involuntary/spindle-shaped *Smooth* visceral muscles, and tirelessly rhythmic, branched *Cardiac* heart muscles.
- **Nervous Tissue:** Rapid communication networks composed of specialized cells called **Neurons**.

SECTION 3: Important Differences

Meristematic vs Permanent Tissue

Feature	Meristematic Tissue	Permanent Tissue
Cell Division	Divides continuously and actively	Loses the capacity to divide naturally
Vacuoles	Generally completely absent	Large prominent vacuoles are present
Cell Wall	Thin, flexible cellulose walls	Varies; can be heavily thickened or lignified

Xylem vs Phloem

Feature	Xylem	Phloem
Primary Function	Transports water and dissolved minerals	Translocates organic food/sugars
Directionality	Strictly unidirectional (Upward only)	Bidirectional flow (Upward and downward)
Cellular State	Majority components are dead cells	Majority components are living cells

Tendon vs Ligament

Feature	Tendon	Ligament
Structural Connection	Binds Skeletal Muscle to Bone	Binds Bone directly to another Bone
Fibrous Composition	Inelastic, high-tensile white fibres	Highly elastic, flexible yellow fibres

Bone vs Cartilage

Feature	Bone	Cartilage
Matrix Nature	Hard, rigid, fortified with Calcium & Phosphorus	Flexible, solid, composed of proteins & sugars
Cell Type	Osteocytes located inside lacunae	Chondrocytes widely spaced out

Muscle Tissue Comparison

Feature	Striated Muscle	Smooth Muscle	Cardiac Muscle
Control	Voluntary conscious control	Involuntary autonomic control	Involuntary self-rhythmic control
Structural Shape	Long, unbranched cylinders	Elongated, spindle-shaped	Short, highly branched network
Nuclei	Multinucleated peripheral position	Uninucleate center position	Uninucleate center position
Striations	Distinct alternating dark/light bands	No visible dark or light bands	Faint striations with intercalated discs

SECTION 4: Top 30 Frequently Repeated Questions

Very Short Answer Type (1 Mark)

Q1. Define tissue.

Ans: A group of structurally similar cells organized to perform a specialized physiological activity.

Q2. Name the tissue responsible for increase in plant height.

Ans: Apical meristem.

Q3. Name the tissue responsible for increase in plant girth.

Ans: Lateral meristem (Vascular Cambium).

Q4. Which tissue makes up the husk of coconut?

Ans: Sclerenchyma tissue (fibrous sclereids).

Q5. What are the components of xylem?

Ans: Tracheids, vessels, xylem parenchyma, and xylem fibres.

Q6. What are the components of phloem?

Ans: Sieve tubes, companion cells, phloem parenchyma, and phloem fibres.

Q7. Name the tissue that connects muscle to bone.

Ans: Tendon.

Q8. Name the tissue that connects bone to bone.

Ans: Ligament.

Q9. Which muscle type is voluntary?

Ans: Striated (skeletal) muscle tissue.

Q10. Name the functional unit of nervous tissue.

Ans: Neuron (nerve cell).

Short Answer Type (2-3 Marks)

Q11. Why do meristematic cells lack vacuoles?

Ans: Meristematic cells are actively dividing and metabolically dynamic; they do not require vacuoles for the long-term storage of nutrients, and large vacuoles could mechanically hinder quick mitotic cell division.

Q12. What is the function of stomata?

Ans: Stomata regulate the essential exchange of gases (Carbon Dioxide and Oxygen) during respiration and photosynthesis, and drive transpiration-driven water pull.

Q13. Why is xylem called complex tissue?

Ans: Xylem is comprised of more than one type of cell element (tracheids, vessels, parenchyma, and fibres) which arise from different developmental lines but coordinate closely as a single functional unit.

Q14. Which tissue provides flexibility to plants?

Ans: Collenchyma tissue, due to localized mechanical pectin-cellulose reinforcements at its cell corners, allows plants to bend without breaking.

SECTION 5: Top 20 Most Expected Questions

Q1. What is a neuron? Describe its structure.

Ans: A neuron is the structural and functional building block of nervous tissue. It comprises:

- **Cyton (Cell body):** Contains a central nucleus and granular cytoplasm.
- **Dendrites:** Short, branching projections that pick up upcoming biochemical signals.
- **Axon:** A singular elongated cytoplasmic extension that rapidly conducts outgoing electrical impulses away to terminal endings.

Q2. Why are plants and animals made of entirely different sets of tissues?

Ans:

- **Plants:** Stationary, autotrophic organisms requiring mechanical rigidity. Thus, their structural organization contains abundant dead, supportive tissues that consume minimal energy.
- **Animals:** Mobile, heterotrophic organisms requiring active locomotion for food, shelter, and survival. They require extensive living, highly metabolic tissue systems.

SECTION 7: Diagram-Based Questions

[Image of a neuron with labels]

Figure 7.1: Structure of a Neuron showing Dendrites, Nucleus, Cyton, Axon, Myelin Sheath, and Nerve Terminals.

[Image of simple permanent tissues parenchyma collenchyma sclerenchyma]

Figure 7.2: Cellular layouts of Parenchyma (thin walls, large spaces), Collenchyma (corner thickenings), and Sclerenchyma (thick lignified secondary walls).

[Image of types of muscle tissue striated smooth cardiac]

Figure 7.3: Muscle tissue variations: Striated (unbranched/cylindrical), Smooth (spindle-shaped), and Cardiac (branched network with discs).

SECTION 8: Assertion & Reason Questions

Directions: Mark (a) if both Assertion and Reason are true and Reason is the correct explanation.

Q1. Assertion (A): Meristematic cells lack vacuoles.

Reason (R): They are actively dividing and require immediate usage of cytoplasm without needing metabolic storage spaces.

Ans: (a) Both A and R are true, and R provides the correct biological reason.

Q2. Assertion (A): Xylem and phloem are classified as complex tissues.

Reason (R): Complex tissues are composed of more than one fundamental cell type coordinating as an integrated functional apparatus.

Ans: (a) Both A and R are true, and R perfectly defines the criteria for the assertion.

SECTION 9 & 10: Case Study & Common Mistakes

Case Study Analysis: Sprain Injuries

During an intense sport match, an athlete overextended their ankle joint leading to a painful localized sprain. A sprain specifically refers to the excessive stretching or complete tearing of **ligaments** (tough elastic tissue connecting bone to bone). This differs from strain injuries which affect muscle tendons.

Common Student Confusions	Scientifically Correct Concept
Confusing Tendon with Ligament functions	Tendon: Muscle to Bone linkage. Ligament: Bone to Bone articulation.
Assuming all permanent plant cells are living	Sclerenchyma cells lose their internal protoplasm completely and are dead at operational maturity.
Mixing up directional transportation paths	Xylem: Unidirectional ascent. Phloem: Multi-directional translocation.

Core Exam Strategy Tip

Whenever you are differentiating between muscle types or plant cells, always organize your answers into clear tabulated structures with explicit "Features for Comparison" columns. This helps achieve complete marks effortlessly during evaluations.