

# CLASS 9 SCIENCE — CHAPTER 3

## TISSUES IN ACTION

 Based on the new *Exploration Science Textbook* | 2026–27 Curriculum

Chapter 3 explains how groups of cells organise themselves into **tissues**, how plant and animal tissues are different, and how tissues work together to carry out complex life processes.

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### 1. What Is a Tissue?

A **tissue** is a group of cells that are similar in structure and work together to perform a specific function.

In multicellular organisms, there is a hierarchy:

 **Cells**



 **Tissues**



 **Organs**



 **Organ Systems**



 **Organism**

Different tissues perform different jobs. This is called **division of labour** and allows multicellular organisms to perform complex life processes efficiently.

## Examples

 **Xylem** → transports water and minerals.

 **Phloem** → transports food.

 **Muscular tissue** → produces movement.

 **Nervous tissue** → carries messages.

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## 2. Why Are Plant and Animal Tissues Different?

Plants and animals have different lifestyles, so their tissues are adapted differently.

### Plants

Most plants remain fixed in one place.

Therefore, they need:

- Strong structural support
- Rigid tissues
- Tissues for photosynthesis
- Specialised tissues for transporting water and food

Plant cells have a **cell wall**, which provides rigidity and strength.

### Animals

Animals generally move from place to place.

Their cells do not have rigid cell walls, allowing greater flexibility.

Animals also have specialised tissues for:

- Movement
- Digestion
- Coordination
- Transport
- Protection



## 3. Plant Tissues

Plant tissues are broadly classified according to their ability to divide into:

### 1 Meristematic Tissues

and

### 2 Permanent Tissues

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## 4. Meristematic Tissue

Meristematic tissues consist of **actively dividing cells**.

They are responsible for plant growth.

Plants grow by:



Increasing in length



Increasing in girth



Regenerating after cutting or grazing

These changes depend on actively dividing meristematic cells.

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## 5. Characteristics of Meristematic Cells

Meristematic cells generally have:

- Small size
- Thin cell walls
- Dense cytoplasm
- Large, prominent nucleus
- Many organelles

- Very small or absent vacuoles
- Little or no intercellular space

These characteristics allow them to divide continuously and rapidly.

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## 6. Types of Meristematic Tissue

There are three major types:

**1. Apical Meristem**

**2. Lateral Meristem**

**3. Intercalary Meristem**

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## 7. Apical Meristem — Growth in Length

Apical meristems are present at:

-  Root tips
-  Shoot tips

They contain actively dividing cells.

**Main function:**

### **Increase in length**

For example, onion roots continue growing because cells at their tips keep dividing.

When the root tip is cut, growth stops in that region.

Therefore:

**Apical meristem → Increase in length**

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## 8. Lateral Meristem — Growth in Girth

Some plants, especially dicot plants, increase not only in height but also in:

### Girth / Diameter

Lateral meristematic cells are arranged in rings within the stem.

They divide and produce new cells, increasing the diameter of the stem.



### Annual Growth Rings

Trees often show ring-like patterns when their trunks are cut.

These are called:

### Annual growth rings

They can help scientists estimate the age of a tree and study its growth conditions.



### Remember:

**Lateral meristem → Lateral growth → Girth**

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## 9. Intercalary Meristem — Regrowth After Cutting

Intercalary meristems occur near:

- Nodes
- Bases of internodes

They are particularly important in plants such as:



Grasses

When grass is:

-  Cut
-  Grazed
-  Mowed

it can grow again because of intercalary meristematic tissue.

★ **Remember:**

**Intercalary meristem → Regeneration after cutting**

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## 10. Three Meristems at a Glance

| Meristem                                                                                       | Location                 | Main Function          |
|------------------------------------------------------------------------------------------------|--------------------------|------------------------|
|  Apical       | Root & shoot tips        | Increase in length     |
|  Lateral      | Along stem circumference | Increase in girth      |
|  Intercalary | Base of internodes/nodes | Regrowth after cutting |

 **Memory Trick**

**A → Apical → Above/at apex → Length**

**L → Lateral → Large girth**

**I → Intercalary → In grasses → Regrowth**

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## 11. Differentiation

Meristematic cells divide continuously.

Some newly formed cells remain meristematic.

Others lose their ability to divide and become specialised for particular functions such as:

- Support
- Transport

- Storage

This process is called:

## Differentiation

## Meristematic tissue

↓ Differentiation

## Permanent tissue

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# 12. Permanent Tissues

Permanent tissues consist of cells that have become specialised and generally have lost the ability to divide.

They may be:

### Simple Permanent Tissues

Made of **one type of cell**.

Examples:

- Parenchyma
- Collenchyma
- Sclerenchyma

### Complex Permanent Tissues

Made of **more than one type of cell** working together.

Examples:

- Xylem
  - Phloem
- 

# 13. Epidermis — Protective Tissue

The **epidermis** forms the outermost layer of the plant body.

It protects plants from:

- Mechanical injury
- Water loss
- Harmful microorganisms
- Extreme environmental conditions

Epidermal cells are closely packed.

They are often covered by a waxy layer called:

### **Cuticle**

The cuticle helps reduce water loss.

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## **14. Epidermis in Dry Habitats**

Plants living in very dry environments may have a:

### **Thick cuticle**

This reduces water loss through transpiration.

### **Root hairs**

In roots, epidermal cells can form root hairs.

Root hairs:

**Increase surface area for absorption of water and minerals.**

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## **15. Stomata**

Leaves contain tiny pores called:

### **Stomata**

They help in:

-  Gas exchange
-  Transpiration

Transpiration is the evaporation of water vapour through stomata.

It also contributes to water transport through the plant by creating:

### Transpiration pull

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## 16. Simple Permanent Tissues

There are three major simple permanent tissues:

- 1 **Parenchyma**
- 2 **Collenchyma**
- 3 **Sclerenchyma**

They mainly provide support, storage and other specialised functions.

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## 17. Parenchyma

Parenchyma consists of:

- Living cells
- Thin cell walls
- Loosely packed cells
- Intercellular spaces

### Main functions:

 Food storage

 Photosynthesis in green parts

 Formation of air spaces in aquatic plants

Specialised parenchyma with large air spaces helps aquatic plants float.

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## 18. Collenchyma

Collenchyma consists of living cells whose corners have unevenly thickened walls.

The thickening is associated with **pectin**.

**Main function:**

### **Flexibility + Support**

It allows plant parts such as:

-  Stems
-  Tendrils

to bend without breaking.

★ **Remember:**

**Collenchyma = Flexible support**

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## 19. Sclerenchyma

Sclerenchyma cells have:

**Thick, lignified walls**

Most sclerenchyma cells are:

**Dead at maturity**

They provide:

- Hardness
- Strength

- Mechanical support

## Examples

 Coconut husk

 Walnut shell

 Leaf veins

Plant stems

★ **Remember:**

**Sclerenchyma = Strong + Hard + Mostly dead**



## 20. Parenchyma vs Collenchyma vs Sclerenchyma

| Feature             | Parenchyma             | Collenchyma         | Sclerenchyma     |
|---------------------|------------------------|---------------------|------------------|
| Cells               | Living                 | Living              | Mostly dead      |
| Cell wall           | Thin                   | Unevenly thickened  | Thick, lignified |
| Main function       | Storage/photosynthesis | Flexible support    | Strength         |
| Intercellular space | Usually present        | Small               | Very little      |
| Example             | Storage tissue         | Leaf stalk/tendrils | Coconut husk     |



## 21. Conducting Tissues

Plants need specialised tissues to transport materials.

Two major conducting tissues are:

 **Xylem**

and

## **Phloem**

Together they are called:

### **Complex Permanent Tissues**

because they contain different types of cells working together.

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## **22. Xylem**

**Main function:**

### **Transport of water and minerals**

Xylem mainly transports water and minerals:

**Roots → Stem → Leaves and other parts**

It also provides mechanical strength.

### **Components of Xylem**

- Tracheids
- Vessels
- Xylem parenchyma
- Xylem fibres

Xylem parenchyma is the main living component; the other major conducting/supporting components are primarily sclerenchymatous.

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## **23. Phloem**

**Main function:**

## Transport of food

Phloem transports food prepared in leaves to other parts of the plant.

### Components

- Sieve tubes
- Companion cells
- Phloem parenchyma
- Phloem fibres

### Companion Cells

They regulate the functions of sieve tube cells and help in the loading and unloading of sugars.

### ★ Remember

**Xylem → Water + Minerals**

**Phloem → Food**

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## 24. Plant Tissue Systems

Plant tissues are organised into three major tissue systems:

### 1 Dermal Tissue System

### 2 Ground Tissue System

### 3 Vascular Tissue System

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### Dermal Tissue System

Forms the outer covering of the plant.

#### Function:

- Protection

- Reduces water loss

It includes the epidermis.

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## **Ground Tissue System**

Forms the main body of the plant between dermal and conducting tissues.

It includes:

- Parenchyma
  - Collenchyma
  - Sclerenchyma
- 

## **Vascular Tissue System**

Consists of:

- Xylem
- Phloem

**Function:**

Transport of water, minerals and food.

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## **25. Animal Tissues**

Animal tissues are mainly classified into four types:

- 1 Epithelial Tissue**
- 2 Connective Tissue**
- 3 Muscular Tissue**
- 4 Nervous Tissue**

Each performs specialised functions.

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## 26. Epithelial Tissue

Epithelial tissue forms:

- Outer covering of the body
- Lining of internal organs

Examples include lining of:



Mouth



Lungs



Blood vessels



Intestine

The cells are closely packed with very little space between them.

### Functions

- Protection
  - Absorption
  - Secretion
  - Exchange
  - Sensory functions
- 



## 27. Types of Epithelial Tissue



### 1. Thin, Flat Epithelium

**Function:** Rapid exchange of gases and liquids.

**Location:** Blood vessels and lungs.

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### 2. Protective Epithelium

Multiple layers of cells protect underlying tissues.

**Location:**

- Skin
  - Mouth
  - Oesophagus
- 

### **3. Secretory Epithelium**

Produces and releases substances such as:

- Mucus
- Enzymes
- Hormones
- Sweat
- Saliva

**Location:**

- Salivary glands
  - Sweat glands
  - Stomach lining
- 

### **4. Sensory Epithelium**

Contains specialised receptor cells.

Helps with:

- Smell
  - Taste
  - Sound
  - Balance
- 

### **5. Absorptive Epithelium**

Efficiently absorbs:

- Nutrients

- Water
- Other substances

**Location:** Small intestine

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## 28. Connective Tissue

Connective tissue:

**Connects and supports different tissues and organs.**

Examples:

-  Blood
-  Bone
-  Cartilage
-  Tendon
-  Ligament

A major difference between connective tissues is their:

**Matrix**

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## 29. Blood

Blood is a **fluid connective tissue**.

It consists of:

**Plasma**

and

**Formed Elements**

including:

-  RBCs
-  WBCs

-  Platelets
- 

## 30. Red Blood Cells — RBCs

RBCs contain:

### **Haemoglobin**

Haemoglobin is an iron-rich protein responsible for the red colour of blood.

### **Function:**

 Transport oxygen.

RBCs live for approximately:

**4 months**

and are continuously replaced.

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## 31. White Blood Cells — WBCs

WBCs are involved in:

### **Defence against infection**

During infection, WBCs gather at affected areas.

This contributes to:

- Redness
  - Swelling
  - Inflammation
  - Pus formation
-

## 32. Platelets

Platelets help in:

### **Blood clotting**

When a blood vessel is injured, platelets contribute to formation of a clot.

This prevents excessive blood loss.

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## 33. Bone

Bone is a connective tissue with a:

### **Hard and rigid matrix**

The matrix contains compounds of:

- Calcium
- Phosphorus

### **Functions**

- Support
- Strength
- Protection

Bones form the framework of the body.

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## 34. Cartilage

Cartilage has a:

### **Soft, flexible matrix**

### **Functions**

- Provides flexibility.
- Cushions the ends of bones.
- Helps absorb shocks.

## Examples

Cartilage is found in structures such as:

- 👂 Ear
  - 👃 Nose
  - 🦴 Ends of bones
- 

## 35. Tendons

Tendons connect:

**Muscle → Bone**

They transmit the force generated by muscles to bones.

This produces movement.

### ★ Memory Trick

**Tendon = Muscle to Bone**

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## 36. Ligaments

Ligaments connect:

**Bone → Bone**

They:

- Provide stability.
- Limit excessive movement.
- Help prevent dislocation.

## ★ Memory Trick

Ligament = Bone to Bone

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## 37. Connective Tissues at a Glance

| Tissue                                                                                      | Main Function            |
|---------------------------------------------------------------------------------------------|--------------------------|
|  Blood     | Transport                |
|  Bone      | Support & protection     |
|  Cartilage | Flexibility & cushioning |
|  Tendon    | Muscle to bone           |
|  Ligament  | Bone to bone             |

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## 38. Muscular Tissue

Muscular tissue is specialised for:

### Contraction and movement

There are three main types:

1. Skeletal muscle
  2. Smooth muscle
  3. Cardiac muscle
- 



## 39. Skeletal Muscles

Skeletal muscles are responsible for:

### Voluntary movements

Examples:



Running



Writing



Lifting objects

They are attached to the skeleton.

Their cells are:

- Long
- Cylindrical
- Unbranched
- Multinucleate
- Striated

★ **Remember:**

**Skeletal muscle** → **Voluntary movement**

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## 40. Smooth Muscles

Smooth muscles are responsible for many:

### **Involuntary movements**

They are found in organs such as:

- Stomach
- Intestines

Their cells are:

- Spindle-shaped
- Single-nucleated
- Non-striated

They help produce slow, continuous movements such as movement of food during digestion.

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## 41. Cardiac Muscles

Cardiac muscles are found only in:

### Heart

They:

- Contract rhythmically.
- Work continuously.
- Do not fatigue easily.

Their fibres are:

- Cylindrical
- Branched
- Usually single-nucleated
- Faintly striated

### ★ Remember:

**Cardiac → Cardio → Heart**

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## 42. Three Types of Muscles

| Feature    | Skeletal          | Smooth            | Cardiac     |
|------------|-------------------|-------------------|-------------|
| Control    | Voluntary         | Involuntary       | Involuntary |
| Location   | Attached to bones | Internal organs   | Heart       |
| Striations | Present           | Absent            | Faint       |
| Shape      | Long, cylindrical | Spindle-shaped    | Branched    |
| Main role  | Body movement     | Internal movement | Heartbeat   |

### Memory Trick

**Skeletal → Skeleton → Voluntary**

**Smooth → Stomach → Involuntary**

**Cardiac → Cardio → Heart**

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## **43. Nervous Tissue**

Nervous tissue forms the body's:

### **Control and coordination network**

It helps the body:

- Receive information.
- Process information.
- Transmit messages.
- Respond to changes.

The main cells are:

### **Neurons**

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## **44. Structure of a Neuron**

A neuron has three major parts:

### **1 Cell Body**

Contains the nucleus.

### **2 Dendrites**

Receive signals from other neurons.

### **3 Axon**

Carries messages away from the cell body.

The axon ends in:

## Axon terminals

which transmit messages to other cells.

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## 45. Musculoskeletal System

The musculoskeletal system includes:

-  Bones
-  Muscles
-  Joints
-  Cartilage
-  Tendons
-  Ligaments

It helps us:

- Stand upright.
- Move.
- Maintain posture.
- Protect internal organs.

The nervous system controls and coordinates its activities.

### How does movement occur?

**Brain → Nervous tissue → Muscle contraction → Tendon → Bone → Joint movement**

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## 46. Joints

A **joint** is a junction between two or more bones.

Joints allow bones to move relative to one another.

Different joints allow different types of movement.

The major types in this chapter are:

1. Ball and socket joint

2. Hinge joint
  3. Pivot joint
  4. Fixed joint
- 



## 47. Ball-and-Socket Joint

### Example:

#### Shoulder

The rounded end of one bone fits into a hollow of another bone.

It allows:

- Forward movement
- Backward movement
- Sideways movement
- Circular movement

### ★ Remember:

**Ball and socket → Movement in many directions**

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## 48. Hinge Joint

### Examples:

- Elbow
- Knee

It works somewhat like a door hinge.

### Main movement:

**Bending and straightening in one direction**

### ★ Remember:

Hinge → One main plane

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## 49. Pivot Joint

**Example:**

**Neck**

A pivot joint allows the head to rotate from side to side.



**Remember:**

**Pivot → Rotation**

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## 50. Fixed Joints

**Example:**

**Skull**

The bones of the skull are joined by fixed joints.

They allow essentially no movement.

**Function:**



Protect the brain.

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## 51. Types of Joints at a Glance

| Joint                                                                                             | Example  | Movement        |
|---------------------------------------------------------------------------------------------------|----------|-----------------|
|  Ball & socket | Shoulder | Many directions |

|                                                                                         |             |                       |
|-----------------------------------------------------------------------------------------|-------------|-----------------------|
|  Hinge | Elbow, knee | Bending/straightening |
|  Pivot | Neck        | Rotation              |
|  Fixed | Skull       | No movement           |

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## 52. Skeletal System

The skeletal system provides:

### **Support + Strength + Protection**

It includes:

- Skull
  - Vertebral column
  - Rib cage
  - Other bones
- 

## 53. Vertebral Column

The backbone or vertebral column consists of many small bones called:

### **Vertebrae**

It:

- Supports the body.
- Helps us stand upright.
- Protects the spinal cord.

Between vertebrae are cartilage discs.

These discs:

- Cushion the vertebrae.
- Provide flexibility.
- Allow bending and twisting.



## 54. Rib Cage

Humans have:

**12 pairs of ribs**

The ribs form the:

**Rib cage**

It protects vital organs such as:

❤️ Heart

🫁 Lungs

The ribs are connected to the spine at the back and sternum at the front.

Flexible cartilage allows the rib cage to expand and contract during breathing.

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## 55. Yoga and Musculoskeletal Health

The chapter connects science with daily life through yoga.

Yoga includes:

- Physical postures
- Breathing
- Meditation

It can contribute to:

- Flexibility
- Posture
- Breathing
- Stress reduction
- Overall well-being



**International Yoga Day**

21 June

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## 56. Totipotency in Plants

One of the fascinating concepts in this chapter is:

### **Totipotency**

It is the ability of certain mature plant cells to:

**Lose their specialised state → Divide → Become specialised again → Form a complete plant**

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## 57. F. C. Steward's Carrot Experiment

In **1958**, **F. C. Steward** demonstrated that even single cells obtained from carrot phloem could regenerate into complete plants.

The cells were grown in a nutrient medium containing:

- Simple sugars
- Hormones
- Appropriate nutrients

The cells:

**Divided → Formed a mass of cells → Differentiated → Developed roots and shoots → Formed a complete plant**

This demonstrated the remarkable regenerative ability of plant cells.

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## 58. Dedifferentiation and Redifferentiation

## **Dedifferentiation**

A specialised cell regains the ability to divide and becomes less specialised.

## **Redifferentiation**

The resulting cells become specialised again to perform particular functions.

## **Overall:**

**Mature cell → Dedifferentiation → Cell division → Redifferentiation → New plant**

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# **59. Plant Tissue Culture**

Totipotency forms the basis of:

## **Plant Tissue Culture**

Plant cells can be grown under controlled laboratory conditions using suitable:

- Nutrients
- Growth chemicals
- Light
- Air
- Temperature

This has important applications in:

- Agriculture
  - Crop improvement
  - Plant propagation
  - Genetic engineering
- 



# **60. Crown Gall Disease**

Plants can also develop tumour-like growths.

## **Crown gall disease**

is caused by:

### **Agrobacterium tumefaciens**

It produces tumour-like swellings due to rapid and uncontrolled cell division.

Scientists discovered that the bacterium can transfer genetic material into plant cells.

This knowledge has been used in:

-  Plant tissue culture
  -  Genetic engineering
  -  Crop improvement
  -  Disease-resistant crops
  -  Production of useful phytochemicals
- 

## **61. Complete Plant Tissue Classification**

### **PLANT TISSUES**

#### **1. Meristematic Tissues**

- Apical
- Lateral
- Intercalary

#### **2. Permanent Tissues**

- Simple
    - Parenchyma
    - Collenchyma
    - Sclerenchyma
  - Complex
    - Xylem
    - Phloem
-

## ★ 62. Complete Animal Tissue Classification

### 🐾 ANIMAL TISSUES

#### 1. Epithelial

- Protection
- Exchange
- Absorption
- Secretion
- Sensory functions

#### 2. Connective

- Blood
- Bone
- Cartilage
- Tendon
- Ligament

#### 3. Muscular

- Skeletal
- Smooth
- Cardiac

#### 4. Nervous

- Neurons

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## 🧠 63. Important Differences

### 🌱 Meristematic vs Permanent Tissue

| Meristematic      | Permanent               |
|-------------------|-------------------------|
| Actively dividing | Generally do not divide |

|                        |                               |
|------------------------|-------------------------------|
| Small cells            | Often larger/specialised      |
| Dense cytoplasm        | More specialised structure    |
| Prominent nucleus      | Structure varies              |
| Vacuoles absent/small  | Vacuoles may be present       |
| Responsible for growth | Perform specialised functions |

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## **Xylem vs** **Phloem**

| <b>Xylem</b>                         | <b>Phloem</b>               |
|--------------------------------------|-----------------------------|
| Water & minerals                     | Food                        |
| Mainly roots → upper parts           | Leaves → other parts        |
| Provides support                     | Mainly transport            |
| Contains several cell types          | Contains several cell types |
| Major conducting elements often dead | Mostly living cells         |

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## **Tendon vs Ligament**

**Tendon → Muscle to bone**

**Ligament → Bone to bone**

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## **64. Important Exam Questions**

### **Q1. What is a tissue?**

A tissue is a group of similar cells that work together to perform a specific function.

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**Q2. Why are plant tissues different from animal tissues?**

Plants are generally fixed in one place and need strong supporting tissues, while animals generally move and require flexible tissues and specialised tissues for locomotion and coordination.

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**Q3. What is meristematic tissue?**

Meristematic tissue consists of actively dividing cells and is responsible for plant growth.

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**Q4. What is the function of apical meristem?**

It increases the length of roots and shoots.

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**Q5. What is the function of lateral meristem?**

It increases the girth or diameter of stems.

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**Q6. Why can grass grow again after being mowed?**

Grass contains intercalary meristematic tissue near the nodes, which can continue dividing and produce new growth.

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**Q7. What is differentiation?**

Differentiation is the process by which meristematic cells become specialised in structure and function and form permanent tissues.

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**Q8. What is the function of parenchyma?**

Parenchyma mainly stores food and can also perform photosynthesis in green plant parts. In aquatic plants, specialised parenchyma can help plants float.

---

### **Q9. What is the function of collenchyma?**

Collenchyma provides support while allowing flexibility, enabling plant parts to bend without breaking.

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### **Q10. Why is sclerenchyma hard and strong?**

Its cells have thick walls containing lignin, which makes the tissue hard and strong.

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### **Q11. What is the function of xylem?**

Xylem transports water and minerals from roots to other parts of the plant and also provides support.

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### **Q12. What is the function of phloem?**

Phloem transports food from leaves to other parts of the plant.

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### **Q13. What are the four major types of animal tissues?**

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

### **Q14. What is the difference between tendon and ligament?**

A tendon connects **muscle to bone**, whereas a ligament connects **bone to bone**.

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### Q15. What is the function of nervous tissue?

Nervous tissue receives, processes and transmits signals and helps coordinate activities of the body.

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### Q16. What is a ball-and-socket joint?

It is a joint that allows movement in many directions, such as the shoulder joint.

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### Q17. What is a hinge joint?

A hinge joint allows mainly bending and straightening in one direction, such as the elbow or knee.

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### Q18. What is totipotency?

Totipotency is the ability of certain plant cells to regain the ability to divide and develop into a complete plant under suitable conditions.

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## 65. Competency-Based Question

### Situation

A farmer cuts the grass in a field. After some time, the grass grows again.

### Questions

1. Which tissue is responsible?

👉 Intercalary meristem

2. Where is it found?

👉 Near the nodes/base of internodes.

3. Why does it help grass regenerate?

👉 Its cells remain capable of active division and produce new cells after cutting.

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## 66. Competency-Based Question

A tall tree has a trunk that becomes wider every year.

**Q1. Which tissue causes this increase?**

👉 Lateral meristem

**Q2. Where is it located?**

👉 In a ring along the circumference of the stem.

**Q3. What are annual rings?**

👉 Ring-like patterns formed during growth that can help estimate the age of a tree.

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## 67. Competency-Based Question

A student accidentally touches a hot object and immediately pulls her hand away.

**Which tissue coordinates this response?**

👉 Nervous tissue

**Which specialised cells are involved?**

👉 Neurons

**What happens?**

**Stimulus → Nervous system → Muscle response → Hand moves away**

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## 68. Competency-Based Question

A person bends the elbow while lifting a book.

**Which joint is involved?**

👉 Hinge joint

**Which muscle type is mainly responsible for voluntary movement?**

👉 Skeletal muscle

**What connects muscle to bone?**

👉 Tendon

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## 69. Super Quick Revision

- ★ Tissue = Group of cells performing a specific function.
- ★ Meristematic tissue = Actively dividing tissue.
- ★ Apical meristem = Increase in length.
- ★ Lateral meristem = Increase in girth.
- ★ Intercalary meristem = Regrowth after cutting.
- ★ Differentiation = Specialisation of cells.
- ★ Permanent tissues = Specialised tissues that generally lose the ability to divide.
- ★ Parenchyma = Storage/photosynthesis.
- ★ Collenchyma = Flexible support.
- ★ Sclerenchyma = Hard strength/support.
- ★ Epidermis = Protection.
- ★ Stomata = Gas exchange + transpiration.

- ★ Xylem = Water + minerals.
  - ★ Phloem = Food.
  - ★ Epithelial tissue = Covering/lining.
  - ★ Connective tissue = Support and connection.
  - ★ Skeletal muscle = Voluntary movement.
  - ★ Smooth muscle = Involuntary movement.
  - ★ Cardiac muscle = Heart.
  - ★ Nervous tissue = Control and coordination.
  - ★ Tendon = Muscle to bone.
  - ★ Ligament = Bone to bone.
  - ★ Ball-and-socket = Many directions.
  - ★ Hinge = One main direction.
  - ★ Pivot = Rotation.
  - ★ Fixed joint = No movement.
  - ★ Totipotency = Ability of certain plant cells to regenerate a complete plant.
- 

## 70. Memory Tricks

### Meristems

**A-L-I**

**A = Apical → Adds length**

**L = Lateral → Larger girth**

**I = Intercalary → In grasses, regrowth**

## Simple Permanent Tissues

**P-C-S**

**P → Parenchyma → Packing/storage**

**C → Collenchyma → Curving/flexibility**

**S → Sclerenchyma → Strength**

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## Conducting Tissues

**X = Xylem → Water**

**P = Phloem → Food**

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## Connective Tissues

**Tendon → Muscle → Bone**

**Ligament → Bone → Bone**

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## Muscles

**Skeletal → Skeleton → Voluntary**

**Smooth → Stomach → Involuntary**

**Cardiac → Cardio → Heart**

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# FINAL CHAPTER TAKEAWAY

A multicellular organism works because its cells do not work independently.

## Cells specialise



 **Tissues form**



 **Organs develop**



 **Organ systems coordinate**



 **A complete organism functions**

In plants, specialised tissues provide **growth, protection, support and transport**.

In animals, specialised tissues provide **protection, connection, movement and coordination**.

That division of labour is what allows a complex organism to function efficiently.