

GRADE 10
LIFE SCIENCES
THE LEAF AS AN ORGAN

 1. INTRODUCTION TO ORGANS

- **Organ:** A group of different **tissues** working together to perform a specific function.
- The **leaf** is an organ composed of various tissues that function together to carry out **photosynthesis**, **gaseous exchange**, and **transpiration**

 2. TYPES OF LEAVES

 Dicotyledonous (Dorsiventral) Leaves:

- **Unequal upper and lower surfaces**
- Net-like venation (pinnate or palmate)
- Contains **petiole**

 Monocotyledonous (Isobilateral) Leaves:

- Both surfaces look similar
- **Parallel venation**
- No petiole (sessile leaves)

 3. EXTERNAL STRUCTURE OF A LEAF

Part	Description
Lamina	Leaf blade
Apex	Tip of the leaf
Petiole	Leaf stalk
Margin	Leaf edge
Midrib	Main vein
Leaflets	Parts of a compound leaf

 4. INTERNAL TISSUES OF THE LEAF

 4.1 Epidermis (Upper & Lower)

- **Transparent**, thin outer layer of cells
- Covered with a **waxy cuticle** to reduce water loss
- **Stomata** with **guard cells** regulate **gaseous exchange** and **transpiration**
- Secretes metabolic compounds

-  **4.2 Mesophyll (Photosynthetic tissue)**

- Located between the upper and lower epidermis; contains:

Layer	Structure	Function
Palisade Parenchyma	Vertically elongated cells, many chloroplasts	Main site of photosynthesis
Spongy Parenchyma	Loosely packed cells with air spaces	Gas exchange , some photosynthesis

- Contains **chlorenchyma** (parenchyma with chloroplasts)

4.3 Vascular Tissue (Veins)

Tissue	Function
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Xylem	Transports water and minerals <i>to</i> the leaf
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Phloem	Transports sucrose and organic nutrients <i>from</i> the leaf
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- Surrounded by **bundle sheath** of collenchyma/sclerenchyma for support

5. FUNCTIONS OF THE LEAF

5.1 Photosynthesis

- Carried out mainly by **palisade mesophyll**
- Requires:
 - **Chlorophyll**
 - **Light**
 - **Carbon dioxide**
 - **Water**

5.2 Gaseous Exchange

- Through **stomata**
- **CO₂ enters** for photosynthesis
- **O₂ leaves** as a by-product during day
- During **cellular respiration** at night, **O₂ enters** and **CO₂ exits**

5.3 Transpiration

- Water evaporates from **mesophyll** → **stomata** → **atmosphere**
- Maintains upward pull of water
- Cools plant

6. TRANSPORT IN THE LEAF

6.1 Movement of Gases

- **Photosynthesis (day):**
 - CO₂ in, O₂ out
- **Respiration (night):**
 - O₂ in, CO₂ out
- All via **diffusion through stomata**

6.2 Water Movement

- Drawn up via xylem by **transpirational pull**
- Enters mesophyll by osmosis down concentration gradient

6.3 Sugar Transport

- Glucose made in **palisade cells**
- Converted to **sucrose** → transported by **phloem**
- Stored as **starch**

7. OPENING AND CLOSING OF STOMAT

Condition	Stomata
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Bright light, high humidity	Open
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Darkness, dry conditions	Closed
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- Controlled by **guard cells** that respond to internal/external signals

8. TISSUES THAT FORM THE LEAF ORGAN

Tissue	Role
Epidermis	Protects leaf, controls water loss
Palisade Mesophyll	Main site of photosynthesis
Spongy Mesophyll	Gas exchange
Xylem	Brings in water/minerals
Phloem	Removes sugars
Bundle Sheath	Structural support

9. LEAF ADAPTATIONS FOR FUNCTION

For Photosynthesis:

- Large surface area
- Many chloroplasts in palisade cells
- Thin to reduce distance for diffusion

- Transparent upper epidermis

For Gaseous Exchange:

- Stomata present (mostly underside)
- Spongy layer with air spaces

For Transpiration:

- Stomata allow controlled water loss
- Waxy cuticle prevents excess loss