

Essential elements

Definition *Elements necessary for healthy plant growth.* Total = 16 essential elements
Macronutrients *Needed in large amounts.*
Carbon (C) *Hydrogen (H)* Oxygen (O)
Nitrogen (N) Phosphorus (P) *Potassium (K)*
Sulphur (S) *Calcium (Ca)* Magnesium (Mg)
Micronutrients (Trace Elements) *Needed in small amounts.* Chlorine (Cl) *Iron (Fe)*
Copper (Cu) *Boron (B)* Molybdenum (Mo)
Zinc (Zn) Manganese (Mn)

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xylem (occurrence and functions))

xylem and phloem usually **occur together :** in the **roots, stems and leaves** and they both form **vascular bundles.**

Functions- Transport water & minerals (roots → plant). *Support: Tracheids + xylem fibres.* Storage: Xylem parenchyma.

Phloem

Complex tissue → Parenchymatous + sclerenchymatous cells. *Contains living & non-living cells.* 4 elements: Sieve tubes, Companion cells, Phloem parenchyma, Phloem fibres.

sieve tubes- Main conducting elements. *Elongated, cylindrical, thin-walled cells.* Arranged in vertical rows. *End walls perforated → Sieve plates.* Pores = Sieve areas. *Food passes through sieve areas.* At maturity → No nucleus. * Remain living due to companion cells.

Phloem (cont)

companion cells- Associated with sieve tubes. *Smaller cells.* Dense cytoplasm. *Prominent nucleus.* Help in food conduction.

Phloem Parenchyma *Thin-walled, living cells.* Stores food. Phloem Fibres *Sclerenchymatous, elongated.* Dead, lignified. *Provide mechanical support.* *Occurrence* Present in all parts of the plant. Functions *Conducts food from leaves → other plant parts & storage organs.* Stores organic matter (Phloem parenchyma). * Mechanical support (Phloem fibres).

To show transport of food

Aim *Show transport of food in plants.*
Girdling Removal of phloem (bark) from the wood. Procedure 1. Select a small tree. 2. Remove 1 cm ring of bark using a razor blade. 3. Leave for 1 week. Observation *Above girdled area → Swells.* Below girdled area → No swelling. Reason *Phloem removed → Food transport blocked.* Food accumulates above the cut. Conclusion *Phloem transports food.* Xylem remains intact → Water transport continues.

Root pressure

Definition *Pressure causing water to move from living root cells into xylem.* Cause Accumulation of absorbed water in roots. Function * Helps transport water stem → leaves.

Partially permeable membrane

Definition *Membrane that allows certain substances to pass but blocks others.* Thin membrane with small pores. Allows *Solvent (water) molecules.* Does NOT Allow Solute molecules. Examples *Plasma membrane Egg membrane Cellophane paper SCIS-BITS* Cell wall is freely permeable → allows almost all substances to pass.

What is diffusion?

Diffusion is the **method of transport** of materials in **single celled and simple multicellular**** plants

Diffusion is the **net movement of molecules** from the **region of higher concentration** to the region of **lower concentration** until they are **spread out evenly**

Transpiration

Definition *Loss of water as water vapour from leaves to the atmosphere.* Occurs through stomata by diffusion. Why does it occur? *Plants absorb more water than required.* Excess water is lost by transpiration. *Some water is used for: Photosynthesis Keeping plant erect Preventing wilting* Transpiration Pull *Evaporation of water from leaves creates suction pull.* Pulls water roots → stem → branches → leaves. *Water moves through xylem.* Importance Transports water & minerals to leaves. *Supplies water for photosynthesis.* Produces cooling effect. *Prevents damage due to strong sunlight.* Cools surroundings.

Ascent of Sap

Ascent of Sap Definition * Upward movement of water through xylem due to transpiration. Process 1. Cell membrane = Partially permeable. 2. Cell sap in vacuole has high solute concentration. 3. Soil has higher water concentration than root hairs. 4. Water enters root hair by osmosis. 5. Cell sap becomes diluted. 6. Water moves cell → cell by osmosis. 7. Water reaches xylem. 8. Xylem carries water upwards against gravity due to transpiration.

Minerals in plants

Sources *Atmosphere Water Soil* Minerals return to soil by death & decay of plants and animals.



Factors affecting transpiration

1. Intensity of Light *Day: Stomata open* → More transpiration *Night: Stomata close* → Less transpiration
2. Temperature *Higher temperature* → Higher transpiration
3. Wind Higher wind speed → Higher transpiration
4. Humidity *Higher humidity* → Lower transpiration
5. Soil Water Dry soil → Less available water → Lower transpiration □
SCI-BITS *Root Pressure Theory proposed in the early 18th century. Cannot alone explain water rise in tall trees.*

Osmosis

Definition *Movement of water molecules through a partially permeable (semipermeable) membrane. Water moves from higher water concentration → lower water concentration. A special type of diffusion involving water only. Requirements Two solutions. * Partially permeable membrane.*

Upward movement of water in plant shoot

Aim *Show upward movement of water in a plant shoot. Procedure 1. Take a balsam shoot. 2. Place in dilute red dye (eosin/saffranin). 3. Leave for some time. 4. Cut stem sections. 5. Observe under low-power microscope. Observation Only certain parts become red. Stained region = Xylem. Conclusion Xylem transports water upward through the plant.*

What are conducting tissues?

In **tall plants** diffusion **occurs slowly**, it cannot move materials enough in **sufficient quantities**.

So **conducting tissues** in plants have developed.

movement of water and minerals takes place from the **roots to other plant parts**, through **stem**. The **upward movement** of water and minerals occurs through **channels** called **xylem elements**.

these xylems element channels r present in **roots, stem and leaves of plants**.

What are conducting tissues? (cont)

movement of food materials in the leaves transport through another channel called **phloem**. It transports the food from **leaves to all other parts of the plant body**

Demonstration of Osmosis

Aim *Demonstrate osmosis. Procedure 1. Take 2 bowls. 2. Bowl A: Put raisins in water. 3. Bowl B: Put grapes in sugar solution. 4. Leave for a few hours. Observation Bowl A: Raisins swell. Bowl B: Grapes in sugar solution do not swell (may shrink if observed longer). Conclusion Water enters raisins by osmosis, causing them to swell.*

Demonstration of transpiration

Aim *Demonstrate transpiration. Materials 2 flasks Water Plant twig Oil Cotton plug Procedure 1. Fill flasks half with water. 2. Mark water level. 3. Add oil layer (prevents evaporation). 4. Place plant twig in Flask A. 5. Close both flasks with cotton plugs. 6. Leave for 24 hours. Observation Flask A: Water level decreases. Flask B: Water level unchanged. Conclusion * Water lost through transpiration from leaves.*

Absorption of water by roots

Functions of Roots *Anchor (fix) plant to soil. Absorb water & mineral salts.*

Structure of Roots *Root Cylindrical, non-green, underground part. Near root tip → Root hairs present. Root Hairs Unicellular, microscopic. Absorb water & mineral salts from soil. Water enters by osmosis. □ Key Ideas Plants have no heart or blood. Circulation occurs through sap. Sap moves via xylem & phloem.*

Active transport

Definition *Movement of molecules against concentration gradient. Requires energy. Occurs across a semipermeable membrane. In Plants Root hairs absorb minerals by active transport. Root hair cells have higher mineral concentration than soil. Passive Absorption Water absorbed by transpiration pull. * No energy required.*

Xylem (parts and structure)

Xylem is a **complex tissue** as it consists of both **parenchymatous** (living thin wall cells) and **sclerenchymatous** (dead thick walled cells)

xylems is composed of **four elements ;0**

1. **Tracheid**- It is a **non-living, elongated** cell with **tapering ends**. The wall is highly **thickened** with **lignin** except at certain circular spots called **pits**.

2. **Vessel**- It is a **cylindrical tube-like** structure which is **placed one above the other, end to end**. The **end walls** of the vessels **dissolve** partially or completely to form a **continous channel**

Tracheids and vessels are **main conducting elements** in the xylem. they also provide **mechanical support** tho...

3. **Xylem parenchyma**- it consists of **thick walled..living cells** it performs the **function of storage**.

4. **xylem fibers**- They are **non living and thick walled cells** which provide **mechanical support**.



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