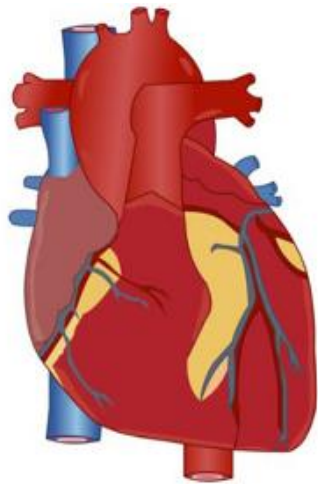


LIFE PROCESSES

Class 10 Biology

TRANSPORTATION

PART 4/4



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TRANSPORTATION IN PLANTS

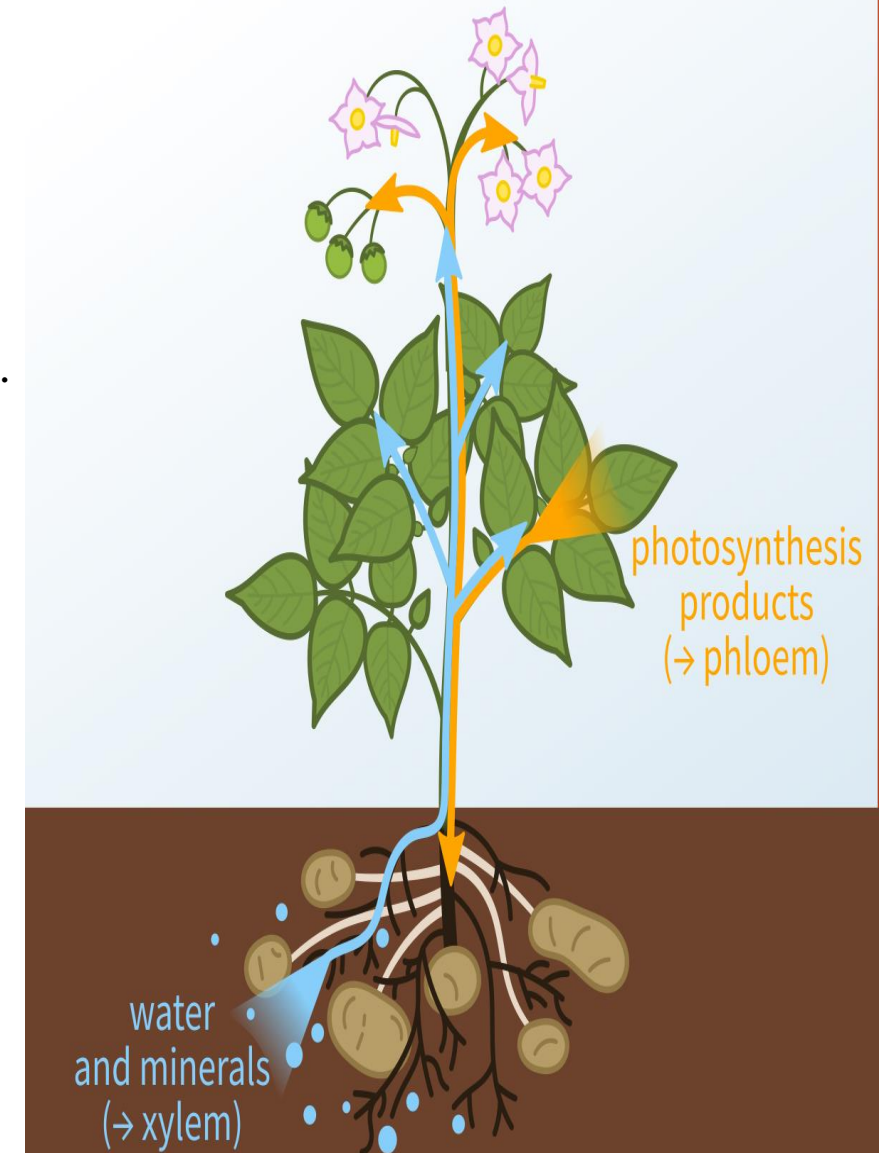
- Plants need various raw materials for photosynthesis
- They take in CO₂ through the stomata that diffuses into their cells.
- They take in nitrogen, phosphorus, other minerals through the roots.
- The distance between the soil and chlorophyll containing organs is large so, diffusion process is not sufficient to provide these raw materials to the leaves and energy to the roots. Thus a proper transportation system is needed in plants.

Energy requirements in plants is low because-

- Plants do not move.
- Plant bodies have a large proportion of dead cells in many tissues.

So, transport system in plants is a slow process, though the distances to be operated are very large.

Plant transport systems move energy stores from the leaves and raw materials from the roots.



TRANSPORT IN PLANTS

Plants have two pathways of conducting tubes-

Xylem that moves water and minerals from the roots to the leaves.

Phloem transports food/sugars/energy from the leaves to all parts of the plant body.

Similar to the circulatory system in humans, the xylem and phloem tissues extend throughout the plant body.

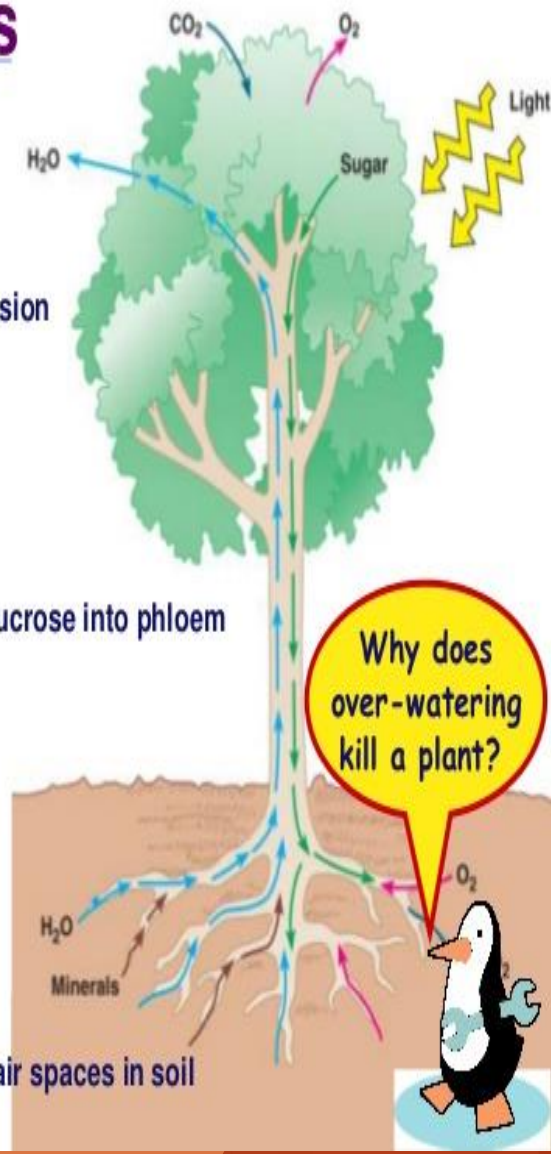
Plants have gas exchange taking place through the stomata.

Roots also exchange gases within the air spaces in the soil.

Slide 2

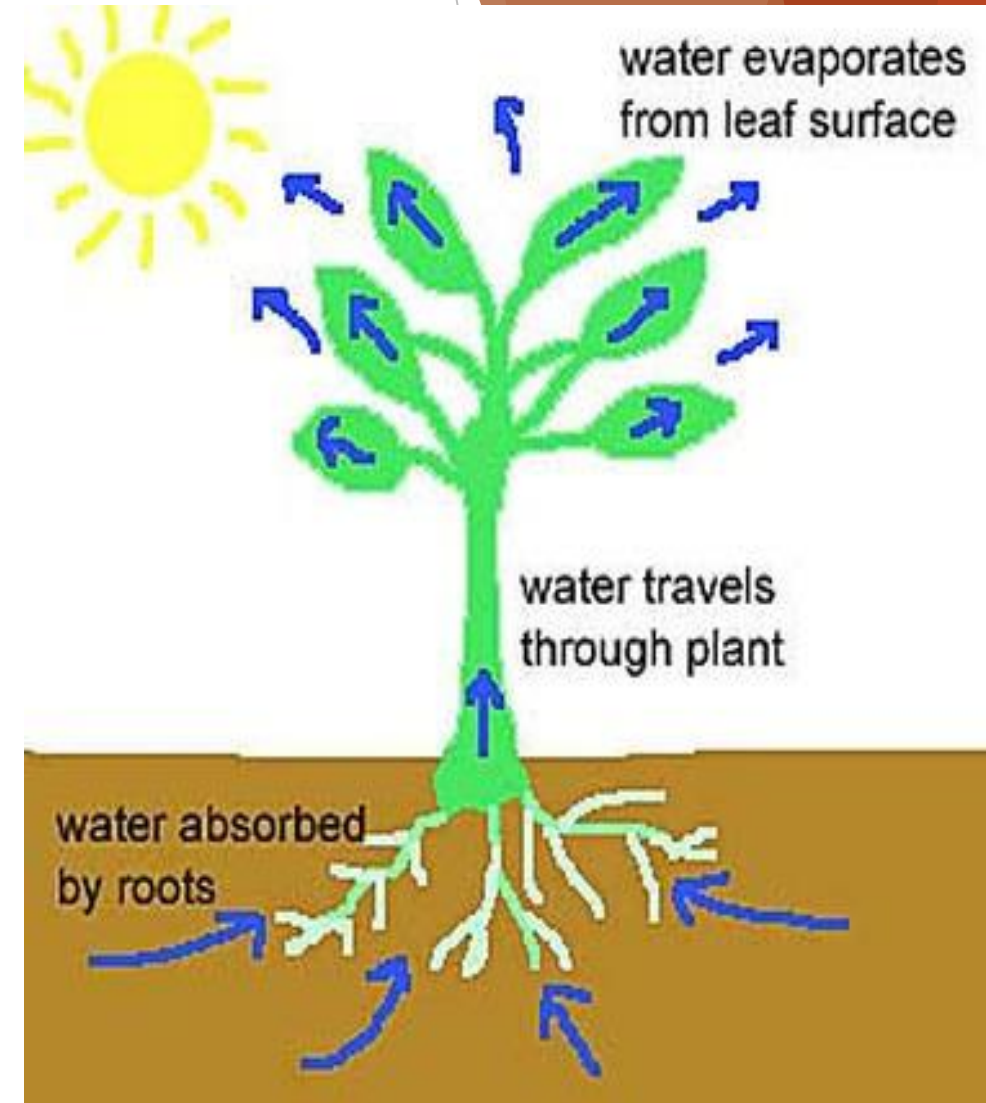
Transport in plants

- **H₂O & minerals**
 - ◆ transport in **xylem**
 - ◆ **transpiration**
 - evaporation, adhesion & cohesion
 - **negative pressure**
- **Sugars**
 - ◆ transport in **phloem**
 - ◆ **bulk flow**
 - Calvin cycle in leaves loads sucrose into phloem
 - **positive pressure**
- **Gas exchange**
 - ◆ photosynthesis
 - CO₂ in; O₂ out
 - **stomates**
 - ◆ respiration
 - O₂ in; CO₂ out
 - roots exchange gases within air spaces in soil



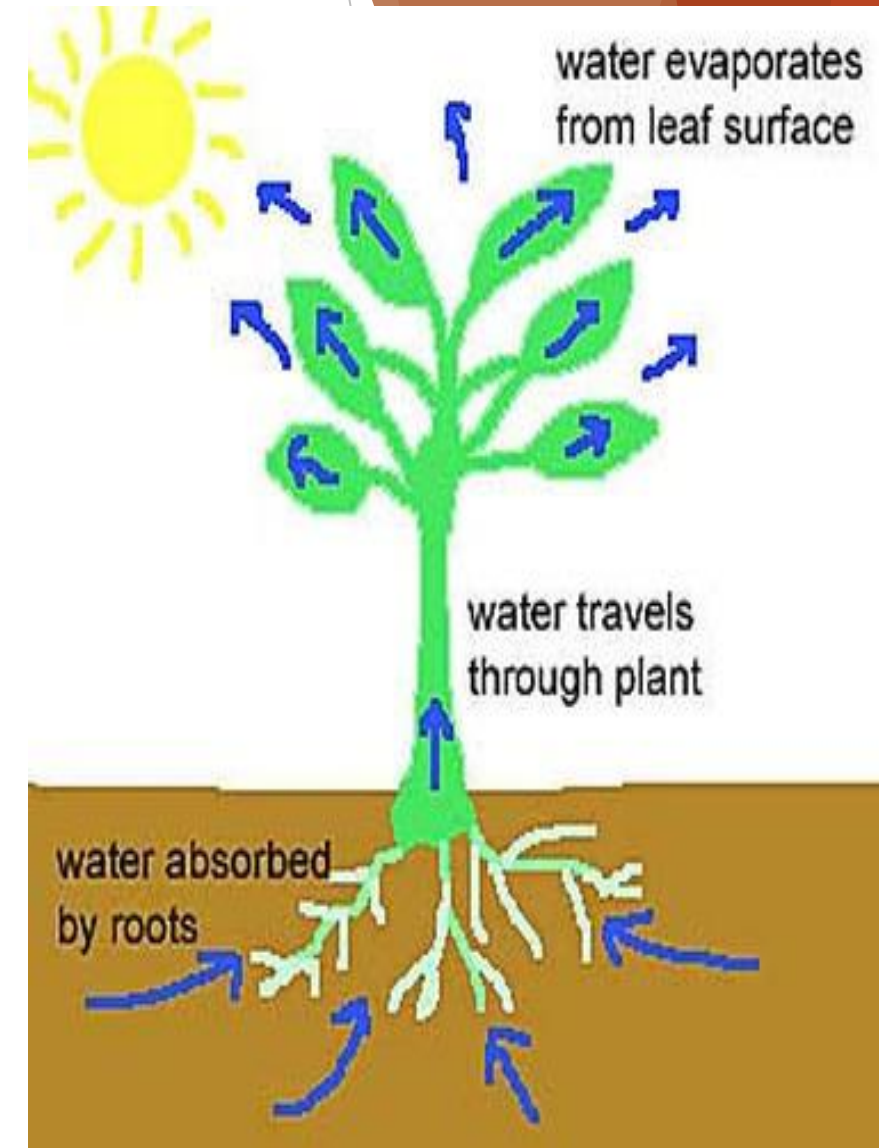
TRANSPORT OF WATER THROUGH XYLEM

- Xylem is the specialized vascular tissue in plants that transports water and nutrients from the soil to the leaves.
- **The flow of water is unidirectional and in the upward direction.**
- It is responsible for replacing water lost through transpiration and photosynthesis.
- Xylem is a complex tissue that is composed of four basic types of cells (tracheid, vessel, xylem fibre and xylem parenchyma).
- **The only living component of xylem is xylem parenchyma.**
- The water is absorbed by the root hair and undergoes cell to cell movement by osmosis until it reaches the xylem.
- The water then travels through the plant to reach the leaves.
- This is called Ascent of sap.



ASCENT OF SAP THROUGH XYLEM

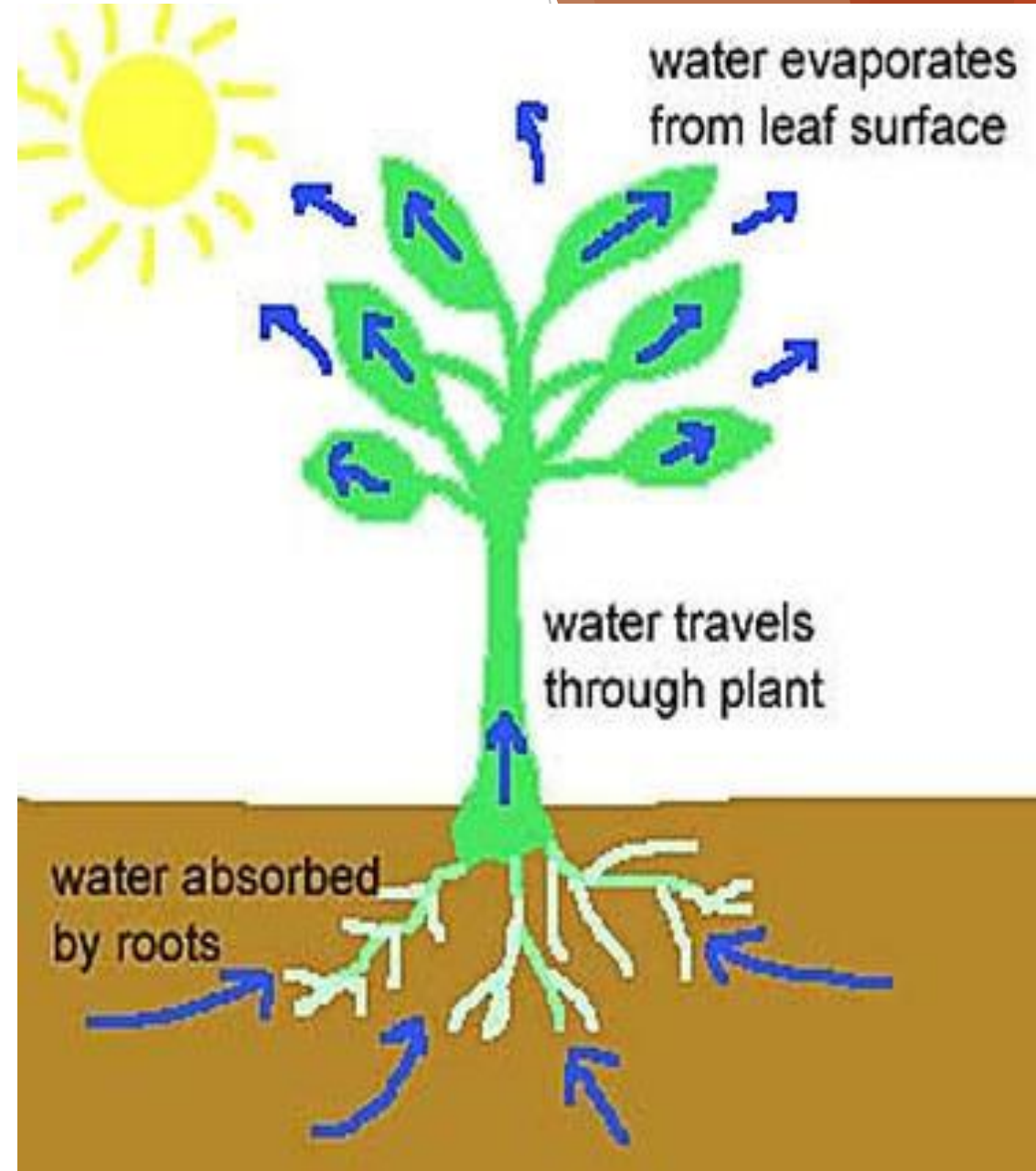
- At the root, the cells in contact with the soil actively take up ions causing a concentration difference between the roots and the soil. So water moves into the root to eliminate the difference.
- The absorbed water at the root hair undergoes cell to cell movement by osmosis until it reaches the xylem.
- This causes a continuous movement of water into the root xylem, creating a column of water that is steadily pushed upwards and is called **root pressure**.
- This alone isn't enough for the ascent of sap.
- The continuous supply of water to the xylem of the leaf ,replaces the water which is lost through the stomata.
- The evaporation of water(Transpiration) from the stomata creates a **suction effect/pull**.
- This pulls the water up from the xylem cells of the roots. Transpiration helps in absorption and upward movement of water and minerals, also called ascent of sap.
- Transpiration also helps in temperature regulation.



FACTORS AFFECTING ASCENT OF SAP

1. **Root Pressure** is the positive pressure created by the movement of water from the soil to the roots, for upward movement of water. The effect of root pressure in the transport of water is more important **at night**.

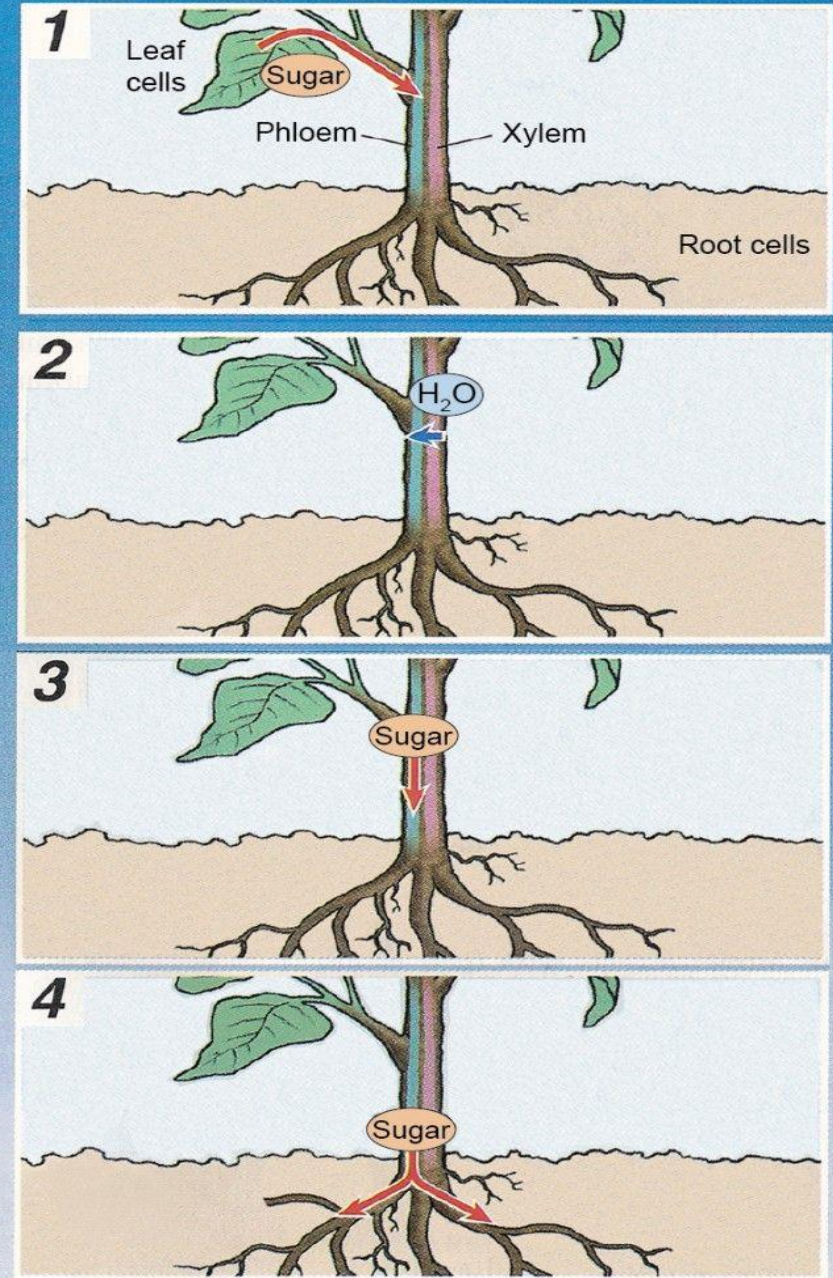
2. **Transpiration pull** is the pull of water as a result of tension created by transpiration in the aerial parts of the plant. It is the major driving force of water movement upwards in a plant during **the day**. High temperature, wind velocity and low humidity influence transpiration pull.



TRANSPORT OF FOOD/ TRANSLOCATION THROUGH PHLOEM

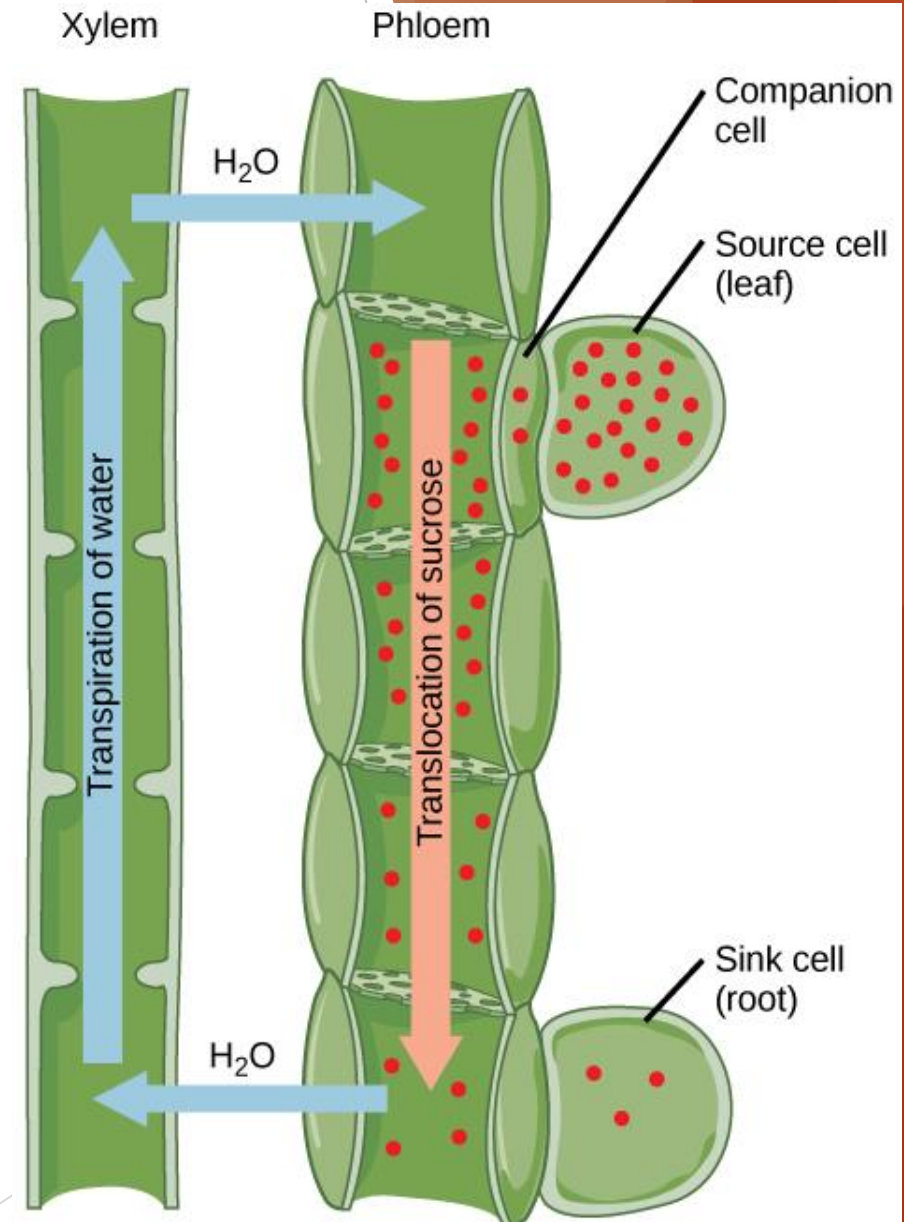
- The transport of food/glucose and also amino acids and other substances from the leaves to the different parts of the plant body is called **TRANSLOCATION**.
- Translocation takes place in the phloem delivering substance to the storage organs like roots, fruits etc and to growing organs.
- Phloem is a complex tissue that is composed of four basic types of cell (sieve tubes, companion cells, phloem fiber and phloem parenchyma). **The only dead component of phloem is phloem fibre.**
- **Translocation is bidirectional ie both in the upward and downward directions and takes place in the sieve tubes with the help of the companion cells.**
- Ascent of sap takes place by simple physical forces but translocation in phloem is achieved by utilising energy.

TRANSLOCATION

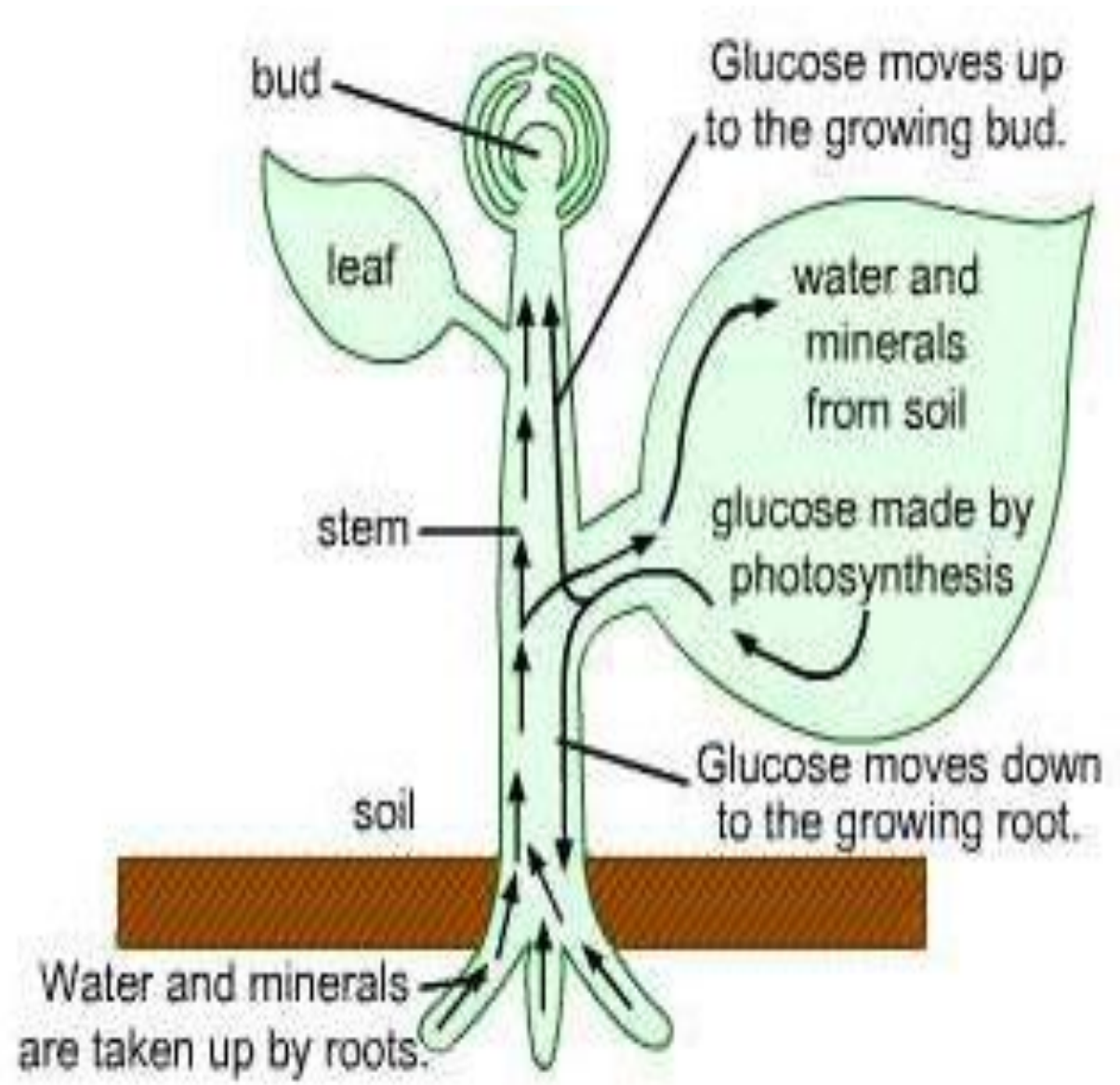


TRANSPORT OF FOOD/ TRANSLOCATION THROUGH PHLOEM

- Materials like Sucrose that is formed in the leaf is transferred into the phloem using energy from ATP.
- This increases the osmotic pressure of the tissue.
- Water from the neighbouring xylem now moves into the sieve tube via the companion cells.
- The bulk pressure increases in the sieve tubes and the material moves in the phloem to tissues which have less pressure.
- This allows the phloem to move materials according to the plants needs in both directions, upwards and downwards.
- The materials may be stored in roots, fruits , seeds etc.
- So, sugars stored in root or stem tissues may move to growing buds in spring as these growing buds need energy.



TRANSPORTATION IN PLANTS



Source:
NCERT Science text book.
GOOGLE

THANK YOU