1.i) Cellular level transport

A key component of cellular-level transport is the movement of solutes and ions across the plasma membrane.

Survival of the plant depends on balancing water uptake and water loss.

The combination of solute concentration differences and physical pressure are incorporated into water potential.

ii)Absorption of water and mineral nutrients

As the xylem vessels of root are in contact with the soil, it actively absorbs the water ions.

When the roots are in contact with the soil, the soil has more concentration of water and roots have less concentration; obviously a difference in concentration of ions is present in between the roots and the soil.

To balance the difference in water ions between root and soil, water moves into the roots which means a steady or continuous movement of water into the xylem of roots which creates a column of water steadily pushing upwards.

In xylem, the flow of water is bulk flow, and negative pressure facilitates movement of water and minerals into roots.

iii)The uptake and release of water and solutes by individual cells

The nutritional requirements are obtained from minerals and water for hydrogen from the soil.

All minerals cannot be passively absorbed by the roots. Most minerals must enter the root by active absorption in the cytoplasm of epidermal cells.

The active uptake of ions is partly responsible for water potential gradient in roots and therefore, for the uptake of water by osmosis. Some ions also move into the epidermal cells passively. Ions are absorbed from the soils by both passive and active transport; specific proteins in the membrane of root hair cells actively pump ions from the soil into the cytoplasm of the epidermal cells.

The endodermal cells may have transport proteins embedded in their plasma membranes.

After the ions have reached the xylem through active or passive uptake, both, their further transport up to the stem to all parts of the plant through the transpiration stream.

The chief sinks for mineral elements are growing regions of the plant- apical and lateral meristems, young leaves, developing flowers, fruits, seeds and the storage organs.

Unloading of the mineral ions takes place at the fine vein endings through diffusion and active uptake by these cells.

2. Xylem

Consists of xylem vessels and tracheids. They develop from cylindrical cells, arranged end to end, in which the cytoplasm die and cross walls disappear leaving a dead empty tube. Through this, water mineral salts, move from roots, stems up to leaves.

Xylem vessels are strengthened by lining in their walls. This strength gives support to the soft tissue of roots, stems and leaves. It also prevents collapse of the vessels under tension as sap pressure changes.

Phloem

Consists of sieve tubes and companion cells. The sieve tubes are formed from cylindrical cells arranged end to end. Unlike the xylem vessels, the cross walls do not disappear but develop perforations of enlarged pits forming sieve plates. The protoplasm of the sieve tube element remains living although its nucleus disintegrates. Each sieve tube is closely associated with companion cells which are complete cells. The companion cells regulate metabolic activities of the sieve tubes.