12. What essential role does the root endodermis play during mineral absorption in plants?
Solution: Like all cells, the endodermal cells have many transport proteins embedded in their plasma membrane; they let some solutes cross the membrane, but not others. Transport proteins of endodermal cells are control points, where a plant adjusts the quantity and types of solutes that reach the xylem. Because of the layer of suberin, the root endodermis has the ability to actively transport ions in one direction only.

13. Explain why xylem transport is unidirectional and phloem transport bidirectional.
Solution: Transport over longer distances proceeds through the vascular system (the xylem and the phloem) and is called translocation. In rooted plants, transport in xylem (to water and minerals) is essentially unidirectional, from roots to the stems. Organic and mineral nutrients however, undergo multidirectional transport. Food, primarily sucrose, is transported by the vascular tissue, phloem, from a source to a sink. Usually the source is part of the plant which synthesises the food,
i.e., the leaf, and sink, the part that needs or stores the food. But, the source and sink may be reversed depending on the season, or the plant's needs. Since the source-sink relationship is variable, the direction of movement in the phloem can be upward or downward, i.e., bi-directional. Hence, unlike one-way flow of water in xylem, food in phloem tissues can be transported in any required direction.

14. Explain pressure flow hypothesis of translocation of sugars in plants.
Solution: The accepted mechanism used for the translocation of sugars from source to sink is called the pressure flow hypothesis. As glucose is prepared at the source i.e., in leaves, (by photosynthesis) it is converted to sucrose (a dissacharide). The sugar is then moved in the form of sucrose into adjacent companion cells and then into the living phloem i.e., in sieve tube cells by active transport. This process of loading at the source produces a hypertonic conditions in the phloem. Water in the adjacent xylem moves into the phloem by osmosis. As osmotic pressure builds up, the phloem sap will move to areas of lower pressure. At the sink, osmotic pressure must be reduced. Again active transport is necessary to move the sucrose out of the phloem sap and into the cells which will use the sugar converting it into energy, starch, or cellulose. As sugars are removed, the osmotic pressure of the phloem decreases and water moves out of the phloem.

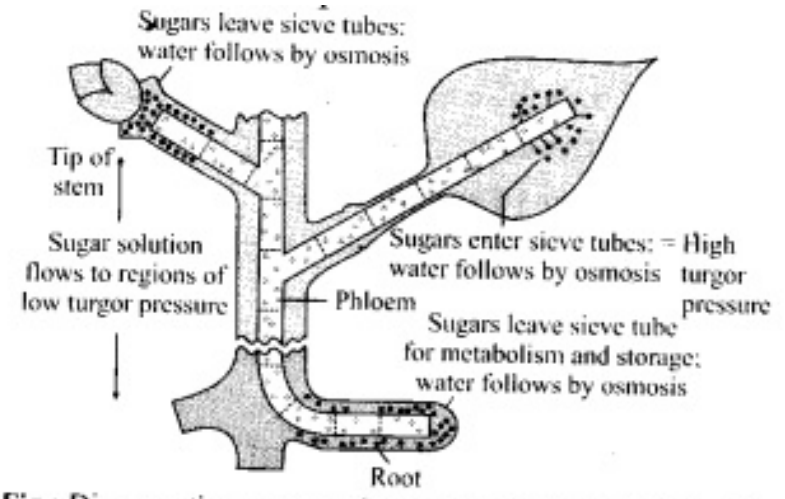

Fig.: Diagramatic representation of mechanism of translocation.

15. What causes the opening and closing of guard cells of stomata during transpiration?
Solution: Transpiration is the evaporative loss of water by plants. It occurs mainly through the stomata in the leaves. The immediate cause of the opening or closing of the stomata is change in the turgidity of the guard cells. The inner wall of each of the guard cells, towards the pore or stomatal aperture, is thick and elastic. When turgidity increases within the two guard cells flanking each stomatal aperture or pore, the thin outer walls bulge out and force the inner walls into a crescent shape and thus the stomata opens. The opening of the stoma is also aided due to the orientation of the microfibrils in the cell walls of the guard cells. Cellulose microfibrils are oriented radially rather than longitudinally making it easier for the stoma to open. When the guard cells lose turgor, due to water loss (or water stress) the elastic inner walls regain their original shape, the guard cells become flaccid and the stoma closes.

********** END **********