TRANSPORT IN TRACHEOPHYTE PLANTS

WHERE TRANSPORT OCCURS	SUBSTANCES TRANS-PORTED	METHOD OF TRANS-PORTATION	DIRECTION OF MOVEMENT	REASON FOR MOVEMENT
Soil to root hair	Water and soluble nutrients	Osmosis and active transport	Into plant	To provide water required for photo-synthesis, to provide turgidity necessary to open stomata for gas exchange and transpiration
Root hair to root cortex	As above	Osmosis through cell cytoplasm and vacuoles	Into plant	As above
Root cortex to xylem	As above	Diffusion through cell wall pores and inter-cellular air spaces	Into vascular bundle (Xylem)	As above
VASCULAR BUNDLES (a) xylem to leaf cells containing chlorophyll	As above	Osmosis, diffusion, transpiration pull, root pressure	Upwards to leaves	To provide water to cells in leaf (Mesophyll) that contain chlorophyll for photosynthesis
(b) phloem to cells containing mitochondria	Soluble inorganic ions, organic material (sucrose and amino acids)	Active transport	Up and down	To provide nutrients to cells for respiration
Cells to stomata	Water and carbon dioxide	Diffusion	Out of plant	Reduces carbon dioxide concentration in plant and remove water (by-product of respiration)

THE ROOT

4 Root Regions are:

1. **Root Cap** – a toughened thimble-shaped covering of cells on the _____ ___ of the root
2. **Meristem** – the region of greatest cell _____ (mitosis) from which all root cells are produced
3. **Zone of Elongation** – the region where cells elongate to _____ the root
4. **Zone of Maturation** – the region containing fine root _____ to increase the surface area for absorption of _____ and mineral ions from the soil, and to differentiate into other cells

Cross-Section of the Zone of Maturation

- **Epidermis** – outer layer that produces root hairs and _____ underlying cells
- **Cortex** – layer beneath _____; contains the vascular bundles with **xylem** (carrying water and _____ ions), **phloem** (carrying nutrient-rich _____) and **cambium** between them (grows to make new xylem and phloem cells)

Movement of Water and Mineral Ions into the Root

- Water **diffuses** from _____ into root through root hairs.
- Ions enter by **active transport**.
- The entry of water into the _____ vessels of the root builds up **root pressure** that aids in _____ movement of water.

THE STEM

Cell Wall and Cytoplasmic Pathways

After water and mineral ions have been taken into the root, they travel through the plant either between the _____ _____ of plant cells (**Cell wall pathway**) or from cell to cell through the _____ (**Cytoplasmic pathway**).

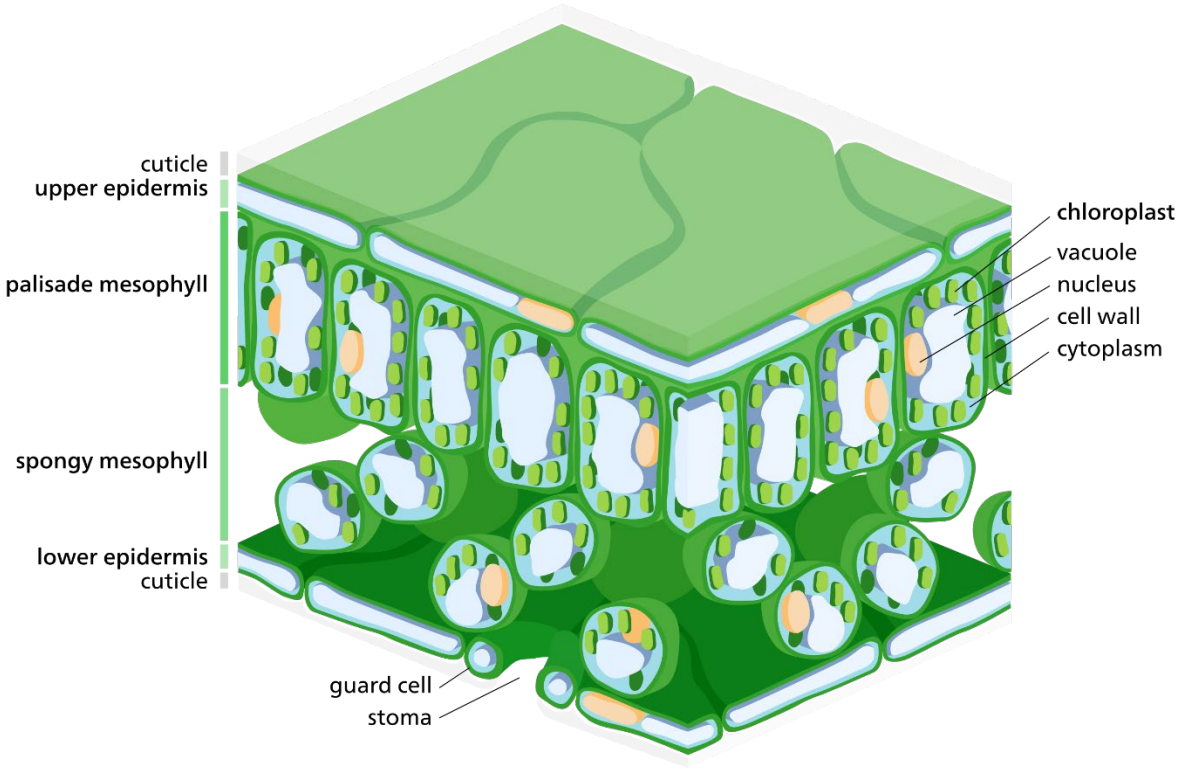
Stem Structure

- **Epidermis** – outer layer of the stem; may be covered by a layer called the **cuticle** for _____; replaced by _____ in a woody plant
- **Cortex** – layer beneath the epidermis
- **Vascular Bundles** – These are groups of outer _____ (carrying sugar-rich sap), inner _____ (carrying water and mineral ions), and cambium in between (gives rise to both phloem and xylem vessels).
  Xylem is composed of long _____ water-filled xylem vessels whose cell walls are strengthened by lignin and whose ends have holes for water flow, tracheids, supporting fibres and parenchyma cells.
  Phloem is composed of _____ sieve tubes, parenchyma cells (especially a special kind called companion cells) and supportive fibres.
- **Pith** - the inner area composed of large parenchyma cells which serve as storage places

Transport of Water, Mineral Ions and Nutrients in the Stem

- **Diffusion** allows water and minerals to travel up the _____ from root to leaf. Also **root pressure** and **capillary action** aid in this.
- **Diffusion** also allows the two-way movement of nutrients such as sugar through the _____.
- **Turgor Pressure** is the pressure within plant cells due to amount of water. A plant wilts when there is a lack of _____ and reduction in turgidity.

THE LEAF



Leaf Cross-Section

- **Upper and Lower Epidermis** – protective layers on the upper and lower sides of the leaf
- **Cuticle** – waxy layer on the _____ epidermis to reduce water loss
- **Palisade Cell Layer** – layer without chloroplasts beneath the upper epidermis
- **Spongy Mesophyll Layer** – layer beneath _____ layer containing **chloroplasts**; also contains **veins** carrying xylem and phloem, and many **air spaces** for exchange of carbon dioxide and _____
- **Stoma (Plural: Stomata)** – pores in the lower epidermis that are surrounded by bean-shaped **guard cells** that contain _____

Action of Stomata

- In general, stomata open in the presence of light and close in the _____.
- The bean-shaped guard cells have thicker _____ on the side toward the stoma than on the other sides.

- As glucose is produced and builds up in the guard cells during photosynthesis, water is drawn into the cells by _____. This increase the turgor pressure and the guard cells change shape, _____ the stoma.

Transport of Water, Mineral Ions and Nutrients in the Leaf

- **Transpiration** is the water _____ that occurs through the open stomata. This loss helps to draw water up through the xylem from the _____.
- Factors that affect transpiration are temperature, _____ intensity and duration, wind speed and humidity.
- **Diffusion, osmosis and capillary action** also play a role in transport through the phloem and xylem of veins. Much of the glucose produced in the leaf in the day is converted to starch in the leaf. It is then converted back into glucose for transport in _____. If stored in root or stem, it is changed back into starch in most plants. The movement of glucose is called **translocation**.