**Topic 8. Transport in Plants**

**8.1 Transport in Plants**

**State the functions of xylem and phloem**

* Xylem transports water in plants and help to support them.
* Phloem transports sucrose and other substances in plants

**Identify the position of xylem and phloem as seen in sections of roots, stems and leaves, limited to non-woody dicotyledonous plants**



**T.S of a root T.S of a stem**



**T.S of a leaf**

**8.2 Water uptake**

**Identify root hair cells, as seen under the light microscope, and state their functions**



Functions:

* Increases the surface area of the root for absorption of water and mineral ions.
* Provides anchorage for the plant.

**Explain that the large surface area of root hairs increases the rate of the absorption of water by osmosis and ions by active transport**

* Each root hair is a long epidermal cell, this increases the surface area for absorption;
* Root hairs are long & thin and so can penetrate between the smallest soil particles for absorption.

**State the pathway taken by water through root, stem and leaf as root hair cell, root cortex cells, xylem and mesophyll cells**

Root hair Root cortex cells xylem of root xylem of stem xylem of leaf mesophyll cells



**Investigate, using a suitable stain, the pathway of water through the above ground parts of a plant**

*IGCSE Biology* (Jones & Jones), p. 105, activity 8.2 ‘to see which part of a stem transports water & solutes’.

**8.3 Transpiration**

**State that water is transported from the roots to leaves through the xylem vessels**

**Define transpiration -** the loss of water vapour from plant leaves by evaporation of water at the surfaces of the mesophyll cells followed by diffusion of water vapour through the stomata

**Explain how water vapour loss is related to the large surface area of cell surfaces, interconnecting air spaces and stomata**

* Transpiration is the loss of water vapour from the leaf;
* Water in the mesophyll cells form a thin layer on their surfaces;
* The water evaporates into the air spaces in the spongy mesophyll;
* This creates a high concentration of water molecules in the air spaces.
* Water vapour diffuses out of the leaf into the surrounding air, through the stomata, by diffusion.

**Explain the mechanism by which water moves upwards in the xylem in terms of a transpiration pull that draws up a column of water molecules, held together by cohesion**

* **Mechanism of water uptake**
1. Water enters root hair cells by osmosis (as the water potential in the soil surrounding the root is higher than in the cell);
2. As the water enters the cell, its water potential becomes higher than in the cell next to it, e.g. in the cortex;
3. So the water moves by osmosis, into the next cell;
4. This process is repeated until water reaches the xylem.
* **Mechanism of water movement through a plant**
1. Transpiration continuously removes water from the leaf;
2. Thus water is constantly being taken from the top of the xylem vessels, to supply the cells in the leaves;
3. This reduces the effective pressure at the top of the xylem vessels;
4. This creates a transpiration stream or ‘pull’, pulling water up;
5. Water molecules have a strong tendency to stick together. This is called cohesion;
6. When the water is ‘pulled’ up the xylem vessels, the whole column of water stays together;
7. Roots also produce a root pressure, forcing water up the xylem vessels.

**Explain how and why wilting occurs**

**Explain the effects of variation of temperature and humidity on transpiration rate**

The table below shows the factors that can result in an increase in the rate of transpiration.

(If these factors are reversed, the rate will decrease).

|  |  |
| --- | --- |
| FACTOR | EXPLANATION |
| Increase in temperature | Increases the kinetic energy of the water molecules, so they diffuse faster |
| Increase in air movement e.g. wind | Removes water molecules as they pass out of the leaf, maintaining a steep concentration gradient for diffusion |
| Decrease in humidity | Results in lower concentration of water molecules outside the leaf, making a steeper concentration gradient for diffusion |
| Increase in light intensity | Stomata open to allow gas exchange for photosynthesis , so water vapour can diffuse out of the leaf |

**Investigate and describe the effects of variation of temperature and humidity on transpiration rate**

**8.4 Translocation**

**Define translocation** – the movement of sucrose and amino acids in phloem:

 – from regions of production (source)

 – to regions of storage OR to regions where they are used in respiration or growth (sink)

**Explain that some parts of a plant may act as a source and a sink at different times during the life of a plant**