IGCSE Coordinated Science: Transport in Plants

Transport in Plants

1. State the functions of xylem and phloem.

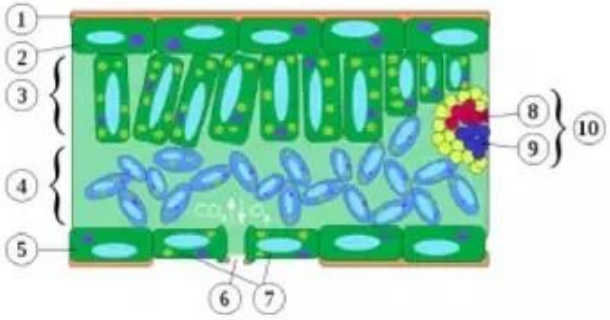
Xylem vessels transport water and dissolved minerals from the root up to all the other parts of the plant

Phloem Vessels: The function of Phloem Vessels is to transport food nutrients such as glucose from the leave to other parts of the plant.

2. Identify the positions of xylem and phloem tissues as seen in transverse sections of unthickened, herbaceous, dicotyledonous roots, stems and leaves.

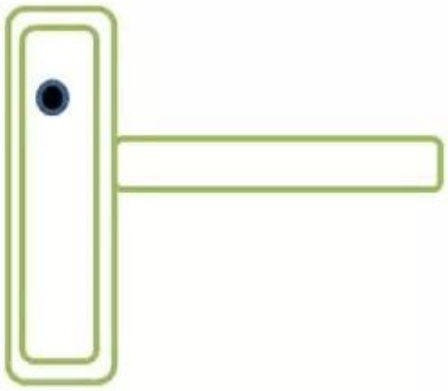
Xylem Tissue and Phloem Tissue

In the diagram directly below, Xylem is shown as 8 (red circles), whilst Phloem is shown as 9 (blue circles)



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

The root hair cell basically helps absorb water and inorganic ions from the soil via osmosis, which we touched upon in Unit 2, Movement in and out of cells.



4. Relate the structure and functions of root hairs to their surface area and to water and ion uptake.

Refer to the diagram above.

The elongated section of the root hair, which you can clearly see on the diagram (the extended bit which looks like something…yes, you know what i'm talking about now), basically provides **a large surface area** for the absorption of water and inorganic ions.

Additionally, the membrane of the root hair cell is **semi-permeable.** What that means is basically only minerals and water can go through the membrane, but no necessarily go back out.

5. State the pathway taken by water through root, stem and leaf (root hair, root cortex cells, xylem, mesophyll cells).

The process of water traveling from the soil to leaves is rather simple, so you'll just have to memorize this.

1) There is a high water potential in the soil and not-so-high water potential in the root hair cell, as the root hair cell has a very concentrated cell-sap. Because of this, **osmosis** occurs and water and inorganic ions move from the soil to the root hair cells, down a concentration gradient.
2) The inorganic ions and water travel to the **xylem tube, which is responsible for traveling the products up to the leaves.**
3) The xylem vessel transports the water and inorganic ions (minerals) up the xylem tube from the root to stem through a process called **Capillary Action** , against gravity.
4) The water and inorganic ions leave the xylem and is absorbed by the cells in the leaves.

7. Define transpiration

Transpiration is the evaporation of water at the surfaces of the mesophyll cells followed by loss of water vapour from plant leaves, through the stomata.

8. Describe the effects of variation of temperature, humidity and light intensity on transpiration rate.

Humidity: Humidity is basically a measure of the amount of water vapour in the air. Remember, unit 2, when we talked about difference in concentration and diffusion?

Yes, of course you remember.

If the air outside is very humid, then that means that there is a high concentration of water vapour in the surroundings, which will create a concentration gradient between the inside of the plant and the surroundings. The surroundings has loads of water vapour, so there would be less concentration gradient for the water to transpire to, so the rate of transpiration will decrease in humid environments. All in all, **increased humidity decreases rate of transpiration.**

Temperature: When the temperature is high, molecules have more kinetic energy and move faster, hence allowing evaporation to occur faster. This increases the rate of transpiration.

Light Intensity: When there is high light intensity, the stomata will open up to allow carbon dioxide in for photosynthesis, so there will be more

chance for water molecules to escape the stomata into the surroundings via transpiration. In the dark, where little photosynthesis occurs, the stomata's are closed, hence little transpiration occurs in the dark.

9. Explain the mechanism of water uptake and movement in terms of transpiration producing a tension from above, creating a water potential gradient in the xylem, drawing cohesive water molecules up the plant.

Water transport up the plant requires something that will allow it to work against gravity. Visualize the xylem tube. The water is flowing upwards right, from the soil to the xylem tube. In order to work against gravity, water travels via this process called **Capillary Action,** which allows liquids to flow liquids to flow through narrow spaces such as the xylem tube without the assistance of gravity. According to wikipedia, Capillary Action works "because of inter-molecular attractive forces between the liquid and solid surrounding surfaces; If the diameter of the tube is sufficiently small, then the combination of surface tension (which is caused by cohesion within the liquid) and adhesive forces between the liquid and container act to lift the liquid"

10. Define translocation in terms of the movement of sucrose and amino acids in phloem; from regions of production to regions of storage OR to regions of utilisation in respiration or growth.

- This is the movement of sucrose and amino acids in the phloem tubes of the plant.
- Glucose is very important as it makes many other important nutrients.
- For Example, **Glucose is used to make sucrose.**
- Sucrose then enters the phloem
- The phloem then transports the sucrose all across the leaf where it can be made used of.