**Topic 9.1: Transport in the Xylem of Plants**

**Essential Idea: Structure and function are correlated in the xylem in plants.**

**Statements & Objectives:**

**9.1.U1 Transpiration is the inevitable consequence of gas exchange in the leaf.​**

Define transpiration.

(**Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

Outline gas exchange that occurs through leaf stomata.

(**Outline** Give a brief account or summary.)

**9.1.U2 Plants transport water from the roots to the leaves to replace losses from transpiration.**

Outline structures and mechanisms involved in the flow of water from roots to leaves.

(**Outline** Give a brief account or summary.)

**9.1.U3 The cohesive property of water and the structure of the xylem vessels allow transport under tension.**

Describe structure of xylem.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

Outline how xylem is able to maintain rigidity even under low pressure or mechanical disturbance.

(**Outline** Give a brief account or summary.)

Outline polarity of water molecule.

(**Outline** Give a brief account or summary.)

Define cohesion.​

(**Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

**9.1.U4 The adhesive property of water and evaporation generate tension forces in leaf cell walls.**

Explain the decrease in pressure and transpiration-pull that results from evaporation of water from the leaf.

(**Explain** Give a detailed account including reasons or causes.)

State the transpiration is a passive processes.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**9.1.U5 Active uptake of mineral ions in the roots causes absorption of water by osmosis.**

Explain why roots are hypertonic relative to the soil.

(**Explain** Give a detailed account including reasons or causes.)

Outline the role of active transport in maintaining root tonicity.

(**Outline** Give a brief account or summary.)

Describe how water enters roots from the soil.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

Compare the symplastic and apoplastic pathways of water transport through the root.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

**9.1.A1 Adaptations of plants in deserts and in saline soils for water conservation.**

Define xerophyte and halophytic.

(**Define** Give the precise meaning of a word, phrase, concept or physical quantity.)

Outline strategies used by xerophytes and halophytes to reduce water loss. ​

(**Outline** Give a brief account or summary.)

**9.1.A2 Models of water transport in xylem using simple apparatus including blotting or filter paper, porous pots and capillary tubing.**

Explain use of models in science.

(**Explain** Give a detailed account including reasons or causes.)

Describe simple models of water transport, inclusive of evaporation, adhesion and cohesion. ​

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**9.1.S1 Drawing the structure of primary xylem vessels in sections of stems based on microscope images.**

Draw a xylem vessel tube, labeling cellulose wall and helical lignin thickening.

(**Draw**: Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler (straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

**9.1.S2 Measurement of transpiration rates using photometers. (Practical 7)**

Describe the use of a photometer to measure transpiration rates.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**9.1.S3 Design of an experiment to test hypothesis about the effects of temperatures or humidity on transpiration rates.**

​Identify the manipulated, responding and controlled variables in an experiment to test the effect of an abiotic factor on the rate of transpiration.

(**Identify** Provide an answer from a number of possibilities. Recognize and state briefly a distinguishing factor or feature.)

**9.1.NOS Use models as representations of the real world-mechanisms**

**Involved in water transport in the xylem can be investigated using apparatus and material that show similarities in structure to plant tissues.**

State a similarity and a difference between transpiration models and transpiration in plant tissues. ​

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**Key Terms**

Transpiration

​guard cells

​lumen

​active transport

​xylem

​osmosis

apoplastic pathway

cellulose wall

vascular bundles

​stomata

​pit

​mutualistic

​tension

​hypertonic

​xerophyte

helical lignin

humidity

​epidermis cells

​abiotic

​facilitated diffusion

​polarity

hypotonic

​halophytic

​cambium

transpiration stream

​turgid

​xerophytes

​photometer

​transpiration-pull

​root tonicity

​porous pots

​pith

cohesion

​LS vessel

​halophytes

​turgor pressure

​passive transport

​symplastic pathway

 capillary tubing

cortex