



23.5 Transport in Plants

Lesson Objectives

-  Explain the process of water movement in a plant.
-  Describe how the products of photosynthesis are transported throughout a plant.

Lesson Summary

Water Transport The pressure created by water entering the tissues of a root push water upward in a plant stem, but this pressure is not enough. Other forces are much more important.

- ▶ The major force is provided by the evaporation of water from leaves during transpiration. Its pull extends into vascular tissue so that water is pulled up through xylem.
- ▶ Both the force of attraction between water molecules, cohesion, and the attraction of water molecules to other substances, **adhesion**, help with water transport. The effects of cohesion and adhesion of water molecules are seen in **capillary action**, which is the tendency of water to rise in a thin tube. Capillary action is important because xylem tissue is composed of tracheids and vessel elements that form hollow, connected tubes.

Nutrient Transport The leading explanation of phloem transport is known as the **pressure-flow hypothesis**.

- ▶ Active transport moves sugars into the sieve tube from surrounding tissues.
- ▶ Water then follows by osmosis, creating pressure in the tube at the source of the sugars.
- ▶ If another region of the plant needs sugars, they are actively pumped out of the tube and into the surrounding tissues. Pressure differences move the sugars to tissues where they are needed.
- ▶ Changes in nutrient concentration drive the movement of fluid through phloem tissue in directions that meet the nutritional needs of the plant.

Water Transport

For Questions 1–2, refer to the Visual Analogy of clowns being pulled up a ladder compared to water being pulled up a tree.

1. **VISUAL ANALOGY** In the visual analogy of the climbing circus clowns, what makes it possible for the falling clowns to pull others up the ladder?



2. How are water molecules similar to the clowns?

3. Complete the table about the types of attraction between molecules.

Attraction Between Molecules	
Type of Attraction	Definition
Cohesion	
Adhesion	

For Questions 4–8, complete each statement by writing the correct word or words.

4. Water cohesion is especially strong because water molecules tend to form _____ bonds with each other.
5. The tendency of water to rise in a thin tube is called _____.
6. The height to which water can rise in a tube is determined by its _____.
7. _____ in xylem form many hollow, connected tubes through which water moves.
8. The pull of transpiration extends from the leaves to the _____ of a plant.

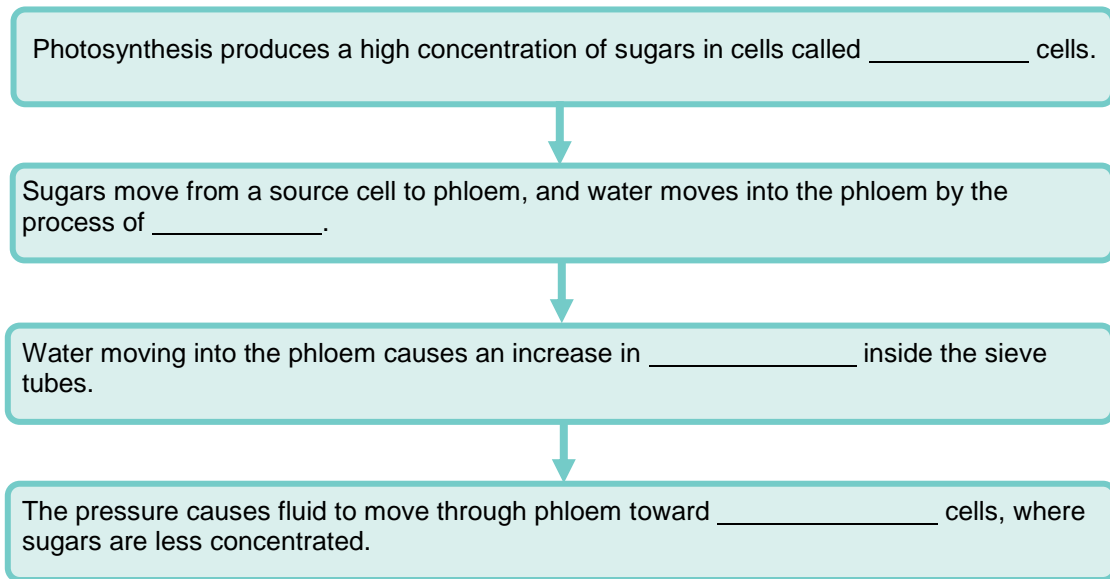
Nutrient Transport

9. According to the pressure-flow hypothesis, why must sieve-tube elements in phloem be living cells?

10. Where sugar concentration is high, what is the source of water taken in by phloem?

11. How does the structure of the vascular bundles in stems and roots and of the veins in leaves make the process of pressure-flow possible?

12. Complete the flowchart that summarizes the movement of sugars in plants.



13. What is one importance of the cell walls of xylem to the capillary action that occurs during transpiration?

14. According to the pressure-flow hypothesis, what process prompts rapid spring growth in a plant?

Apply the Big idea

15. Leaves range in size from very large to very tiny. In what type of environment would you expect to find the most plants with very large leaves? Very small leaves? Explain.
