Name _____ Class _____ Date _____

23.2 Roots

Lesson Objectives

- Describe the main tissues in a mature root.
- Describe the different functions of roots.

Lesson Summary

Root Structure and Growth The root is the first part of a plant to emerge from a seed.

- Plants have two main types of root systems:
  - Taproot systems are found mainly in dicots and consist of a large primary root that has many smaller branches.
  - Fibrous root systems are found mainly in monocots and consist of many equally sized branch roots. They help prevent topsoil from being washed away.
- Roots contain cells from the three tissue systems. A mature root has an outside layer, called the epidermis, and also contains vascular tissue and a large area of ground tissue. The root system is important to water and mineral transport.
  - The root's epidermis performs the dual functions of protection and absorption. Its surface is covered with thin cellular projections called **root hairs,** which produce a large surface area that allows water and minerals to enter.
  - Ground tissue called **cortex** stores products of photosynthesis, such as starch. Water and minerals move through the cortex. A layer called the **endodermis** encloses the vascular cylinder.
  - The xylem and phloem together make up a region called the **vascular cylinder** at the center of the root.
  - Apical meristems produce new cells near the root tip, which is covered by a tough **root cap** that protects the root tip as it grows into the soil.

Root Functions Roots support a plant, anchor it in the ground, store food, and absorb water and dissolved nutrients from the soil.

- Roots take in many essential inorganic nutrients, such as nitrogen and potassium.
- Active transport brings the mineral ions of dissolved nutrients from the soil into the plant.
- Cells of the root epidermis create conditions under which osmosis causes water to "follow" ions and flow into the root.
- The waterproof **Casparian strip** enables the endodermis to filter and control the water and nutrients that enter the vascular cylinder, as well as ensuring that nutrients do not leak out.
- Root pressure, produced within the vascular cylinder by active transport, forces water through the vascular cylinder and into the xylem.

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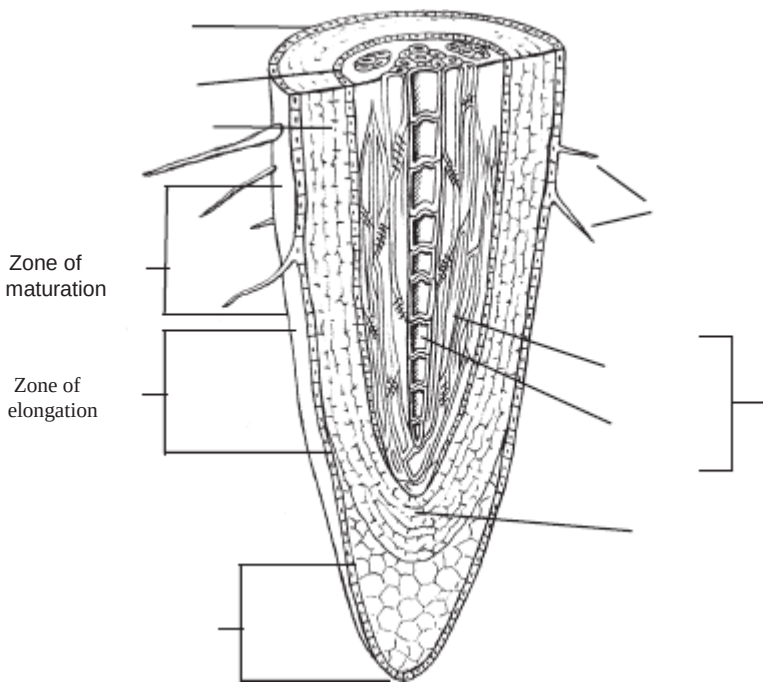
Root Structure and Growth

1. Complete the table that compares the types of root systems.

Types of Root Systems			
Type of Root	**Description**	**Mainly in Dicots or Monocots?**	**Examples**
	Long and thick primary roots that grow deep into the soil		
	Equally sized branch roots that grow separately from the base of the stem		

For Questions 2–6, complete each statement by writing the correct word or words.

2. A mature root has a large area of _____ tissue between its dermal and vascular tissues.
3. A root's surface area for absorption of water is increased by _____.
4. One function of the _____ is the storage of starch.
5. The _____ cylinder, made up of xylem and phloem, is found at the center of a root.
6. A root's apical meristem can be found just behind the _____.
7. **THINK VISUALLY** Complete the illustration of a cross section of a root by adding labels for the parts indicated.



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Root Functions

8. Name at least two functions, besides uptake of water and nutrients, of a plant's roots.

_____

_____

9. What is the role of active transport in the uptake of water by plant roots?

_____

_____

_____

_____

10. Where in roots are active transport proteins located?

_____

11. What happens to water and dissolved minerals after they move across the epidermis of a root?

_____

_____

12. Why is there a one-way passage of materials into the vascular cylinder in plant roots?

_____

_____

13. How do water and nutrients cross the endodermis that surrounds the vascular cylinder?

_____

_____

14. What is root pressure?

_____

_____

Apply the Big idea

15. People often give potted houseplants more fertilizer than they need. As a result, the plants begin to wilt and eventually die instead of getting larger and healthier. What could be the reason for this result?

_____

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