



23.4 Leaves

Lesson Objectives

-  Describe how the structure of a leaf enables it to carry out photosynthesis.
-  Explain how gas exchange in leaves relates to homeostasis.

Lesson Summary

Leaf Structure and Function The structure of a leaf is optimized to absorb light and carry out photosynthesis.

- ▶ Most leaves have a thin, flattened part called a **blade**, which is attached to the stem by a thin stalk called a **petiole**. Leaves are made up of the three tissue systems.
 - Leaves are covered on their top and bottom surfaces by epidermis. The epidermis of nearly all leaves is covered by a waxy cuticle, which protects tissues and limits water loss.
 - The vascular tissues of leaves are connected directly to the vascular tissues of stems. Xylem and phloem tissues are gathered together into bundles called leaf veins that run from the stem throughout the leaf.
 - The area between leaf veins is filled with a specialized ground tissue known as **mesophyll**, where photosynthesis occurs.
- ▶ Photosynthesis happens in the mesophyll, which has two specialized layers:
 - The **palisade mesophyll** is beneath the upper epidermis. The cells are closely packed and absorb light.
 - Beneath this layer is a loose tissue called the **spongy mesophyll**, which has many air spaces between its cells. These air spaces connect with the exterior through small openings called **stomata**. Stomata allow carbon dioxide, water, and oxygen to diffuse in and out of the leaf.
- ▶ The mesophyll cells lose water by evaporation. This loss of water through leaves is called **transpiration**. Transpiration helps to cool the leaves, but also threatens their survival during droughts.

Gas Exchange and Homeostasis A plant's control of gas exchange is one of the most important elements of homeostasis.

- ▶ Plant leaves allow gas exchange between air spaces in the spongy mesophyll and the exterior by opening their stomata.
- ▶ Plants maintain homeostasis by keeping their stomata open just enough to allow photosynthesis to take place but not so much that they lose an excessive amount of water.
- ▶ **Guard cells** are highly specialized cells that surround the stomata and control their opening and closing depending on environmental conditions.
- ▶ Wilting results from the loss of water and pressure in a plant's cells. The loss of pressure causes a plant's cell walls to bend inward. When a plant wilts, its stomata close so the plant can conserve water.

Leaf Structure and Function

For Questions 1-4, complete each statement by writing the correct word or words.

1. The structure of a leaf is optimized for the purposes of absorbing _____ and carrying out _____.
2. The _____ of nearly all leaves is covered by a waxy _____.
3. The vascular tissues of leaves are connected directly to the vascular tissues of _____.
4. The area between leaf veins is filled with a specialized ground tissue known as _____.

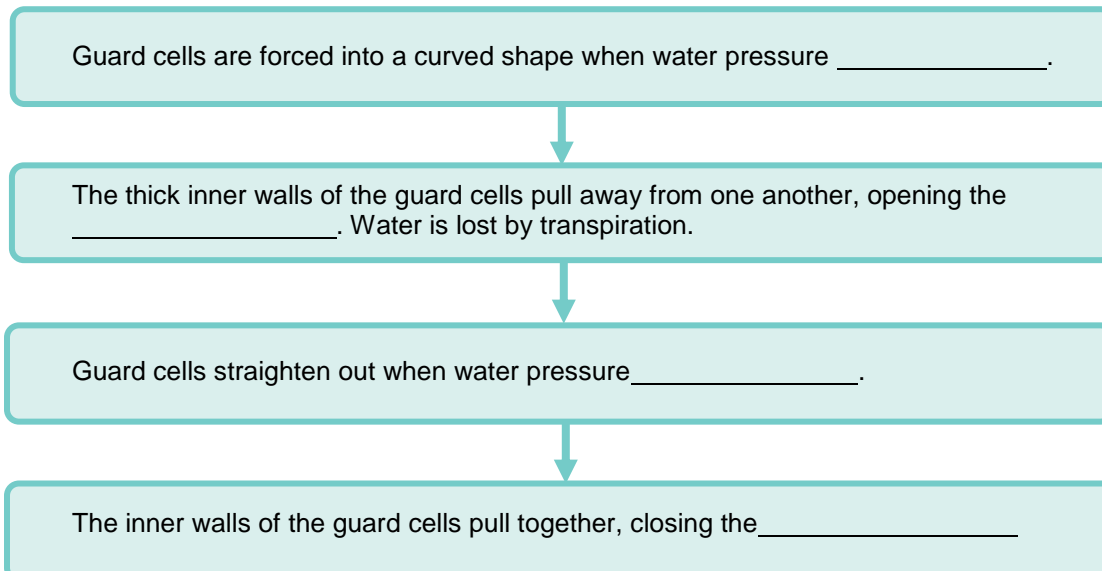
For Questions 5-10, match the description with the leaf structure.

Description	Structure
_____ 5. A layer of mesophyll cells that absorb light that enters the leaf	A. leaf vein
_____ 6. Small openings in the epidermis	B. blade
_____ 7. The thin, flattened part of a leaf	C. petiole
_____ 8. A bundle of xylem and phloem tissues in a leaf	D. stomata
_____ 9. A stalk that attaches a leaf to a stem	E. spongy mesophyll
_____ 10. A loose tissue with many air spaces between its cells	F. palisade mesophyll

Gas Exchange and Homeostasis

11. Why can't stomata be kept open all the time?

12. Complete the flowchart that summarizes how guard cells help maintain homeostasis.



For Questions 13-17, write the letter of the correct answer on the line at the left.

- _____ 13. Which is likely to happen to a plant if it starts losing more water than it can take in?
- A. It will reproduce.
 - B. It will flower.
 - C. It will grow.
 - D. It will wilt.
- _____ 14. Which is a plant that has narrow leaves with a waxy epidermis?
- A. cactus
 - B. spruce
 - C. rock plant
 - D. rose bush
- _____ 15. A pitcher plant's leaves are adapted for
- A. conducting photosynthesis.
 - B. limiting transpiration.
 - C. catching and digesting insects.
 - D. pollination and fertilization.
- _____ 16. A rock plant adapts to hot, dry conditions by having very few
- A. thorns.
 - B. leaves.
 - C. stomata.
 - D. nutrients.
- _____ 17. A cactus's thorns are actually its
- A. leaves.
 - B. stems.
 - C. roots.
 - D. bark.

Apply the Big idea

18. The inside of the glass or plastic walls of a greenhouse full of plants is very wet on cool days. Where does this water come from?
