

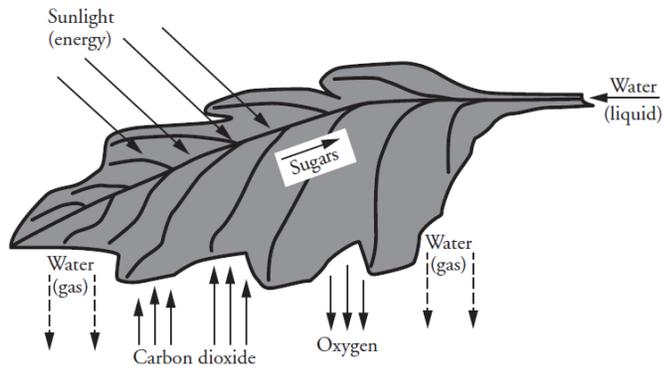
# Photosynthesis: What's in a Leaf?

What is the relationship between structure and function in a leaf?

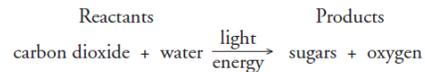
## Why?

What would the world be like without leaves—no grass for ball fields, no beautiful landscaping? It would also mean no oxygen for animals and no food for heterotrophs. Leaves are like living machines that recycle the carbon and oxygen in our environment. This process, driven by the sun's energy, allows for a constant supply of oxygen and food for the inhabitants of Earth.

### Model 1 – Leaf Sun-Catcher



#### General Equation for Photosynthesis



1. List three things entering the leaf in Model 1.

2. List three substances leaving the leaf.

3. Which substance is both entering and leaving?

4. How is the substance you identified in Question 3 changed between its entry and its exit?

5. Use the general equation for photosynthesis and Model 1 to answer the following questions.

a. What are the reactants for photosynthesis?

b. Where do these reactants enter the leaf?

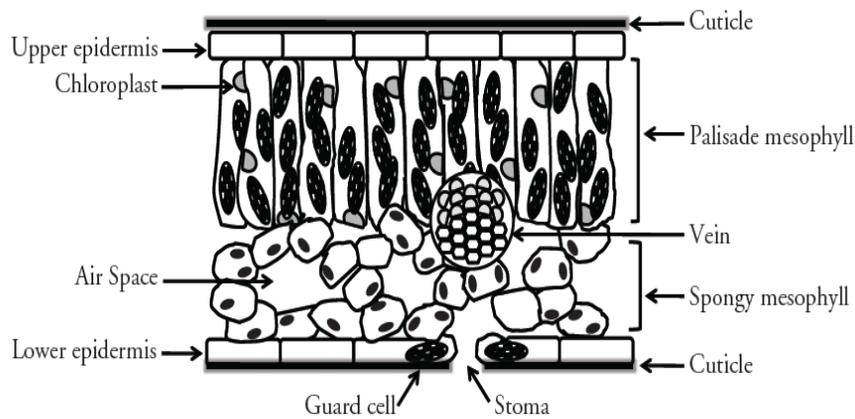
c. What are the products of photosynthesis?

d. From where do the products leave the leaf?

7. Categorize all the components involved in photosynthesis as either matter or energy.

8. List the layers of the leaf starting at the upper cuticle all the way to the lower cuticle.

## Model 2 – Cross Section of the Internal Structure of a Leaf



### Read This!

Inside plant veins are two different types of tissues. **Xylem** carries water and minerals up from the roots of the plant and **phloem** carries the sugars (nutrients) away from the leaf to areas where the plant is growing or to storage areas in the plant.

9. Look back at your answers to Questions 1–3 and the photosynthesis equation. In the appropriate locations on Model 2, mark with **labels** and arrows what is **entering** the leaf and what is **exiting** the leaf.

10. Which kind(s) of cells have chloroplasts in them?

11. Remembering the function of chloroplasts, in which part(s) of the leaf is photosynthesis taking place?

12. The **green color** of chloroplasts is due to a pigment in them called **chlorophyll**, which absorbs light energy of all colors but **reflects** the light energy of the green wavelength. Knowing this, infer which layer inside a leaf gives the whole leaf its green color. Write one complete sentence to express your reasoning.

13. List at least three differences between the cells of the palisade mesophyll and the cells that make up the other areas within the leaf.

### Read This!

The cuticle covering the upper and lower epidermis of land plants is made of a waxy substance that repels water in much the same way as wax on a paper cup.

14. What is the purpose of having a water-tight covering?

15. What is the relationship between the stoma and an air space?

16. Looking back at Model 1, what gases might you find inside the air spaces?

17. During the time that stomata (the plural of stoma) are closed, gases cannot enter or leave. Explain how this would affect the plant's ability to do photosynthesis.

### Extension Question:

18. Plants that live on the floor of forests tend to have much larger leaves than plants that live in hot, sunny conditions. Offer an explanation for this in which you refer to specific parts of the internal structure of a leaf.