

Name _____

Period _____

Regents Biology

Date _____

LAB ____ . LEAF STRUCTURE

Plants are incredible organisms! They can make all their own food from the simple inputs of:

- sunlight
- air (carbon dioxide)
- water
- minerals

This biological wizardry is accomplished through the magic of photosynthesis. This process can be summarized by the equations below.



or the process can be written as:



This means that plants are able to harness the energy of the sun to turn CO₂ from the air into the carbon-based molecules of life — carbohydrates, proteins, lipids, and nucleic acids.

Plants capture the sun's light within their green leaves. Inside a leaf's cells are green organelles — chloroplasts — which do all this hard work of producing the food that feeds the plant... and, in fact, the whole rest of the world, too!

To do this job best, leaves have evolved a specific structure — 3 types of tissue arranged in layers:

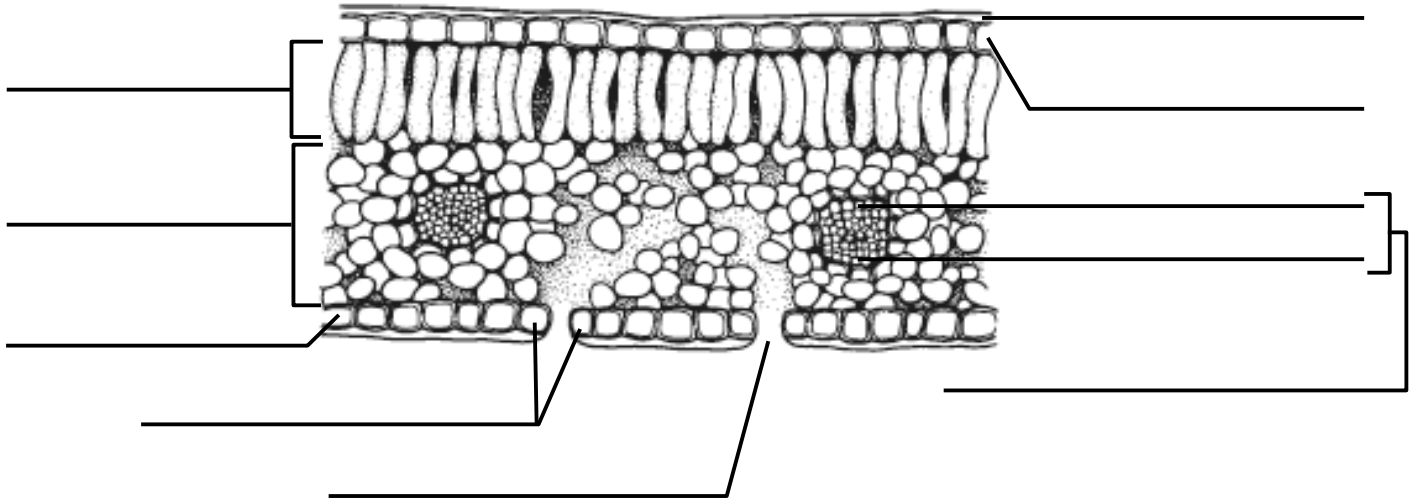
- epidermis
- mesophyll
- vascular tissue

The **epidermis** is the outer layer of cells that acts like a protective “skin” for the leaf. Covering the epidermis is a waxy coating, called the **cuticle**, which stops evaporation of water from the leaves thereby helping plants conserve water. In the lower epidermis are openings called **stomates** surrounded by two cells called **guard cells**. The stomates act like the lungs of the plant in that they allow gas exchange — letting CO₂ into the inner plant tissues for photosynthesis and then allowing O₂ out as a waste product of photosynthesis.

The mesophyll is the main inner leaf tissue making up the blade of the leaf. Most of the photosynthesis of the plant takes place in the mesophyll. The mesophyll in the upper part of the leaf is made up of tightly packed cells, full of chloroplasts, and is called the **palisades layer**. The mesophyll in the lower part of the leaves is made up of loosely packed cells and is called the **spongy layer**.

The **vascular tissue** functions like the circulatory system of the plant. The **xylem** carries water from the roots to the leaves and to the other upper parts of the plant. The **phloem** carries the sugars produced during photosynthesis in the chloroplasts of the leaves to any place else in the plant that needs the food. Xylem and phloem are found in vascular bundles in the veins of the leaf.

1. Below is a diagram of a cross section through a leaf. **Label** the structures discussed above.



2. Examine the prepared slide of a cross section through a leaf under the compound microscope. Draw a neat, clear diagram of your specimen in the space below. Find all of the structures illustrated above and **label** them.

3. Obtain a specimen of a *Tradescantia* leaf from your teacher. Place a flat section of the leaf **bottom-side up** on a slide as a **dry mount**. View with the compound microscope. Locate the **stomates** on the underside of the leaf — they will be dots of bright green in the purple field of the leaf. Locate the **guard cells** — two bright green bean-shaped cells on either side of the stomate. Draw a neat, clear diagram of a single stomate with its guard cells on the purple leaf in the space below.

4. Construct a model of the cross section of a leaf using the model parts provided. Color each leaf structure or tissue a different color using the color key below.

COLOR KEY	
LEAF STRUCTURE	COLOR CODE
Cuticle	yellow
Lower epidermis	orange
Palisades layer	green
Phloem	brown
Upper epidermis	orange
Spongy layer	purple
Xylem	blue
Guard cells	red

5. Cut out each of the colored cell layers. Be sure to cut along the outer edge of each group or along the dotted line. Do not cut out the inside spaces of each layer.
6. On a separate sheet of paper, correctly place each of the cell layers together by laying one on top of each other. You may consult your textbook to make sure you get all the structures in their correct places. Review with your teacher before you glue them. Once you receive approval then glue them together and **label** each structure or cell layer.
- cuticle
 - upper epidermis
 - lower epidermis
 - palisades layer
 - spongy layer
 - stomate
 - guard cells
 - xylem
 - phloem
 - vascular bundle
7. Now **add the sun** to your diagram to show which side of the leaf collects the energy from the sun.
8. **Place the symbols** for CO₂, O₂ and H₂O on your model and **draw arrows** to show the movement of these gases in and out of the leaf through the stomates. Show the completed diagram to your teacher.
9. Answer the Summary Questions.

SUMMARY QUESTIONS

1. What are the 3 functions of stomates.

a. _____

b. _____

c. _____

2. Why are most of the stomates on the bottom of the leaf?

3. Why are the epidermis layers of the leaf coated in a waxy cuticle?

4. Why are the cells of the palisades layer packed so tightly together?

5. Why are the cells of the spongy layer packed so loosely together?

6. What is the function of the xylem?

7. What is the function of the phloem?

8. Describe how the functions of the xylem and phloem specifically relate to photosynthesis.

a. xylem _____

b. phloem _____

9. Why would the cells of the palisades layer have more chloroplasts in them?

10. What is the function of guard cells?

11. Why do stomates need to be open?

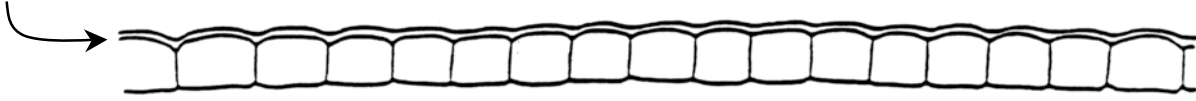
12. Under what conditions would guard cells close the stomates?

13. Why do plants need to take in CO₂?

14. Write out the equation for photosynthesis.

Tissue Layers of a Leaf

cut along here

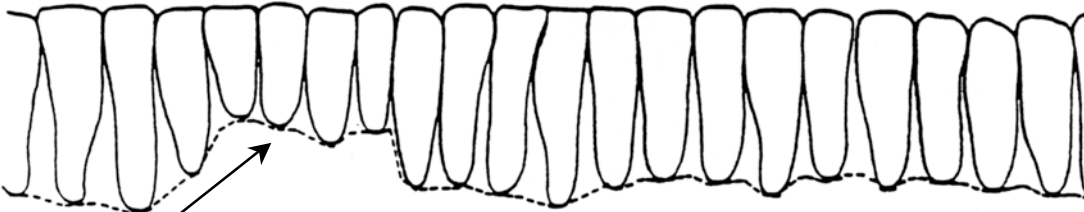


- epidermis layers –
- cut on the **OUTSIDE** of these epidermis layers
 - do **NOT** cut these epidermis layers apart
 - all other pieces will be glued into here

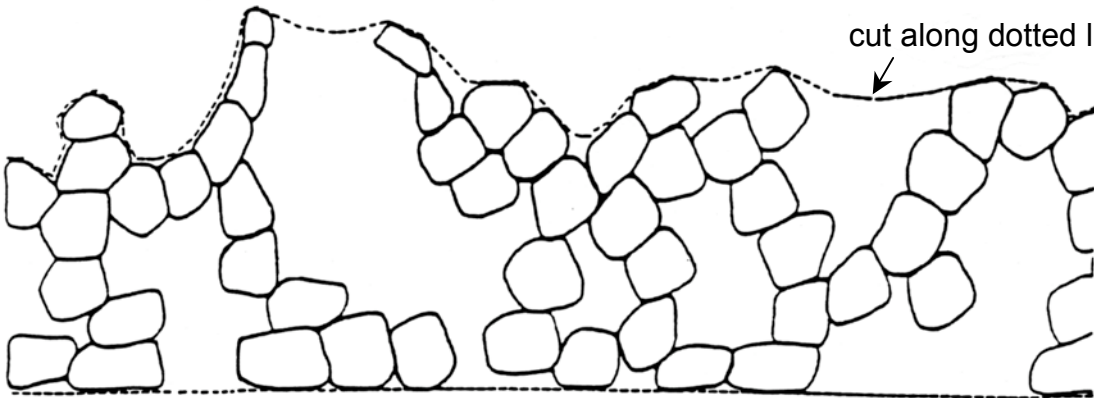
cut along here



cut along dotted line



cut along dotted line



phloem



xylem

