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.

carbon dioxide	+	water	+	light energy	→	glucose	+	oxygen

or the process can be written as:

$6\ CO_2$	+	$6\ H_2O$	+	light energy	→	$C_6H_{12}O_6$	+	$6\ O_2$

This means that plants are able to harness the energy of the sun to turn CO_2 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:

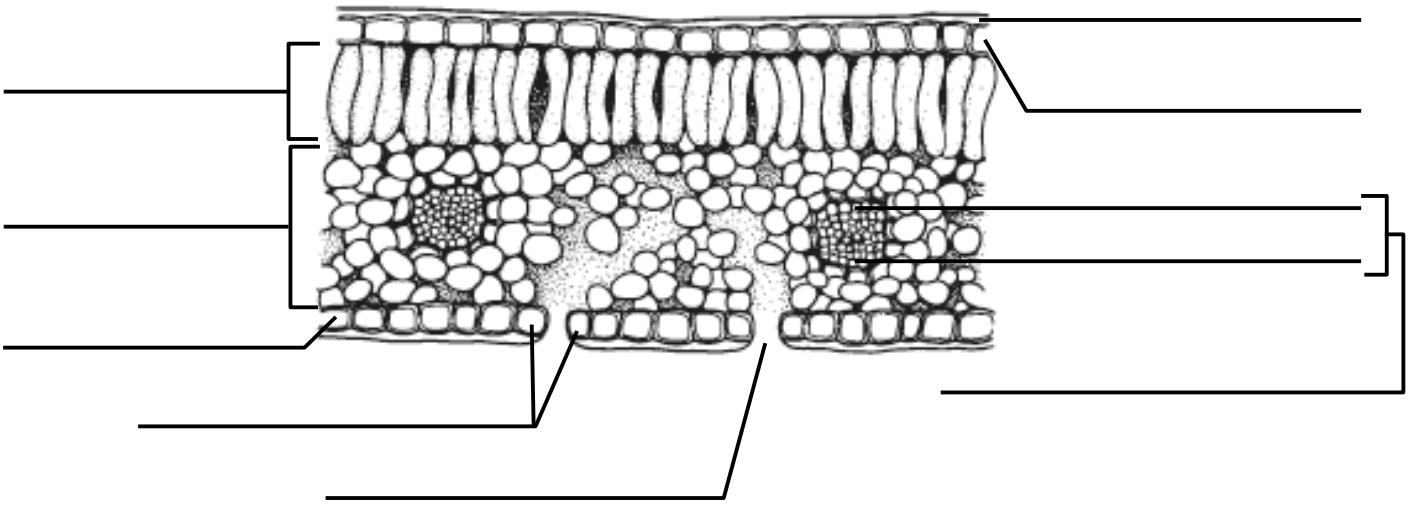
- epidermis
- mesophyll
- vascular tissue

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 CO_2 into the inner plant tissues for photosynthesis and then allowing O_2 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 CO_2, O_2 and H_2O 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 CO_2?

    _____

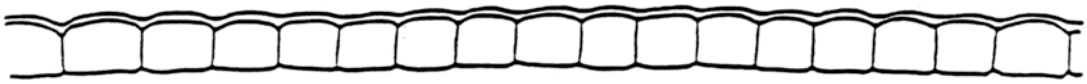
    _____

14. Write out the equation for photosynthesis.

    _____

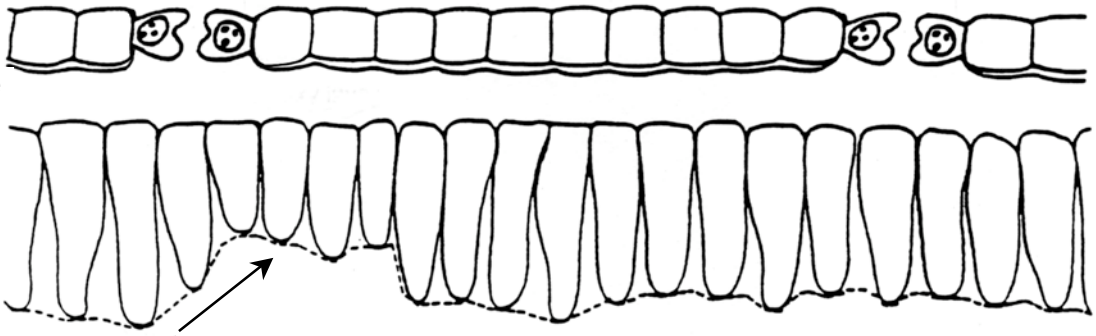
Tissue Layers of a Leaf

cut along here



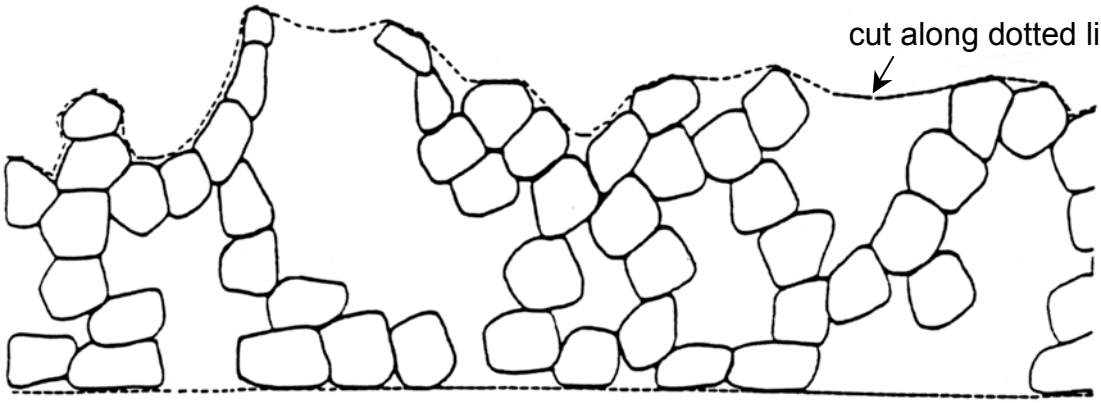
epidermis layers –
- cut on the **OUTSIDE** of these epidermis layers
- do **NOT** cut these epidermis layers apart
- all other pieces will be glued into here

cut along here

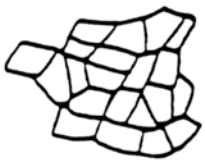


cut along dotted line

cut along dotted line



phloem



xylem