

Stomata Sleuths

Teacher's Guide

Subject: Integrated Science (Life; Physical)

Topic: Leaf Structure; Photosynthesis; Gas Exchange

Summary: Students will collect leaves from selected plants, examine them under the microscope and count and compare the number of stomata on the top and bottom of the leaf. Students will discuss the reasons for the location of the stomata on the leaves.

After completing the field lab, students will be able to:

Objective(s):

1. Prepare slides
2. Identify stoma
3. Explain reasons for the location of stomata on a leaf

Ecosystem(s): Pinelands; Freshwater Wetlands

Equipment:

- | | | |
|----------------------|-------------|---------------------|
| • Microscopes | • Tweezers | • Calculator |
| • Clear Packing Tape | • Scissors | • Clear nail polish |
| • Slides | • Pupil Cam | • Laptop computer |

Background:

- Vocabulary: stomata, carbon dioxide, cuticle, transpiration, epidermis
- Reference Material: Massengale's biology place: http://sps.k12.ar.us/massengale/leaf_stomata_lab.htm
- Teaching Issues and Experiments in Ecology: <http://tiee.ecoed.net/vol/v1/experiments/stomata/pdf/stomata.pdf>
- Equipment Training: Compound microscope; Pupil Cam

Procedure (Engage; Explore; Explain) Procedure adapted from TIEE

1. Have the students plug their nose and hold their breath. After a while ask them how long they could survive without breathing. Use an analogy to compare our nostrils and mouth to cells on plant leaves that allow gas exchange. Discuss what students already know about how they use CO₂ and O₂.
2. Ask the students which part of the leaf (top or bottom) they think more of the CO₂ and O₂ are exchanged? Have them complete a hypothesis on their data sheet.
3. Obtain three leaves from different types of plants. Demonstrate the following procedures for one leaf, then allow the student thick patch (at least one square cm) of clear nail polish on the underside of the leaf surface being studied and allow it to dry completely. Tape a piece of clear cellophane tape to the dried nail polish patch.
4. Gently peel the nail polish patch from the leaf by pulling on a corner of the tape and "peeling" it off the leaf.
5. Tape your peeled impression to a microscope slide. Trim away any excess. Label the slide with the plant name and side of the leaf the cells were taken (top/bottom).
6. Examine the leaf impression under a light microscope at 400X (be sure you use this power and not a lower power).
7. Search for areas where there are numerous stomata, no dirt, thumb prints, air bubbles, damaged areas, or large leaf veins. Count all the stomata in one microscopic field. Record the number on your data table.
8. Repeat the count at two other distinct microscopic fields so that you will have three counts per side of each leaf. Record all the counts and calculate the average number of stomata per microscopic field.
9. From the average number/400X microscopic field, calculate the stomata per mm² by multiplying by 8.
10. Follow procedures 2 - 11 with the other leaves.
11. After completing the lab, allow the students to answer the discussion questions as a group and explain their answers relating them to the concepts, processes and skills associated with the activity. Students should record their answers individually. At this time, facilitators can introduce/explain the specific concepts and explanations in a formal manner.

Sunshine State Standards:

Science: SC.F.1.3.1,4,5,7; SC.G.1.3.4,5; SC.G.1.3.4 **Language Arts:** LA.C.1.3.1,4

Mathematics: MA.A.1.3.1; MA.B.2.3.1; MA.B.3.3.1 **Social Studies:** SS.A.6.3.2

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Student Data Sheet

General Information

Full Name:		Date:	
School (teacher):		Time:	
Latitude:		Longitude:	

Student Hypothesis and Rationale

If the upper surface of leaves in sunny warm climates is covered with a waxy cuticle to help minimize water loss then we will find a _____ number of stomata on the upper surface of leaves than the lower surface of the leaves because _____

Field Observations/Measurements/Data

	Leaf #1:	Leaf #2:	Leaf #3:
Orientation of Leaf (horizontal; upright; on water)			
Top of Leaf			
Number of stomata in field of view #1			
Number of stomata in field of view #2			
Number of stomata in field of view #3			
Average number of stomata for top			
Bottom of Leaf			
Number of stomata in field of view #1			
Number of stomata in field of view #2			
Number of stomata in field of view #3			
Average number of stomata for bottom			
Total average for top and bottom of leaf			

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Assessment

1. What was the average number of stomata/mm² on the bottom side of Leaf #1?

2. How many more stomata/mm² did the leaf with the highest concentration of stomata have compared to the leaf with the fewest stomata?

3. Do your data support your hypothesis? Whether your hypothesis is supported or not, what can you infer or conclude from your observations, measurements, and results?

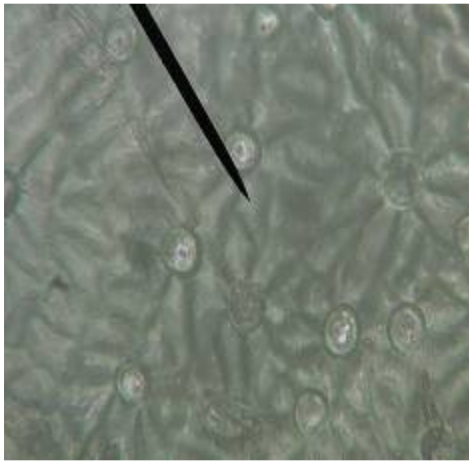
4. How might the number of stomata on a leaf of a desert plant differ from plants in Florida wetlands and why?

5. What actions can farmers take to increase the amount of time stomata are open to allow gas exchange?

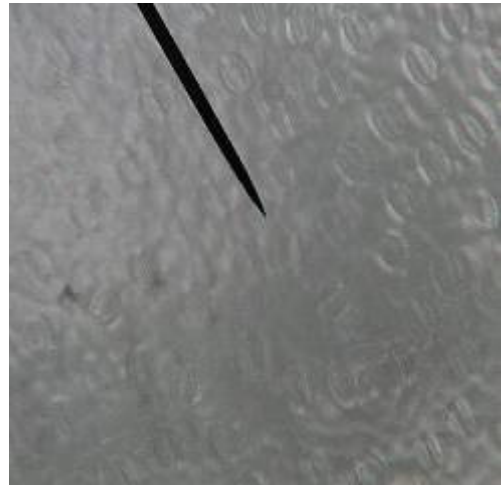
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All magnification at 400x

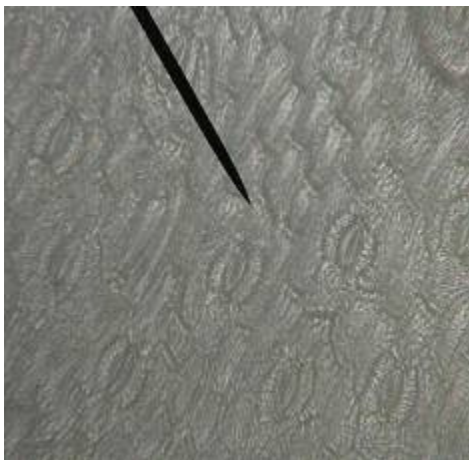
Stomata Reference Chart



Lilly Pad (lower)



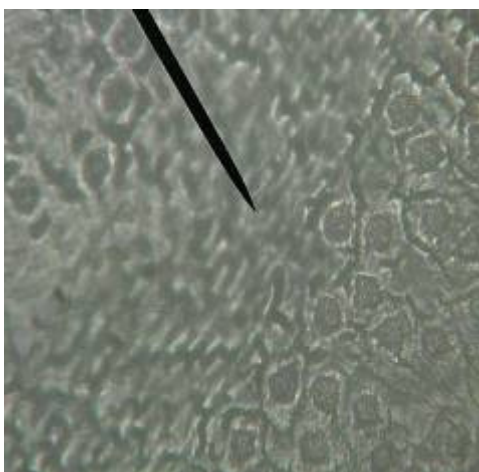
Lilly pad (upper)



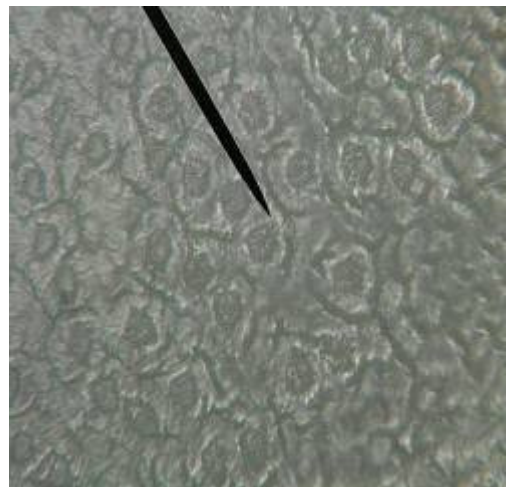
Pickeral Weed (upper)



Pickeral Weed (lower)



Saw Palmetto (upper)



Saw Palmetto (lower)