STOMATA PRE- LAB

Background Information:

Leaf stomata are the principal means of gas exchange in vascular plants. ***Stomata*** are small pores on leaves that are opened or closed under the control of a pair of banana-shaped cells called ***guard cells***. When open, stomata allow CO_2 to enter the leaf, and allow for water and oxygen to escape. In addition to opening and closing the stomata, plants may exert control over their gas exchange rates by varying stomata density in new leaves when they are produced (such as in the spring or summer). The more stomata per unit area is the ***stomata density***.

Why might it be adaptive for a plant to control its rates of water loss and CO_2 uptake? One answer can be found in the sun. Increases in heat could denature proteins of membranes of chloroplasts. When overheated, plants may open the stomata to evaporate water to lower the temperature. Based on this, you could hypothesize that leaves in the sun would have a higher stomata density than leaves in the shade.

On the other hand, if water is not available, such as under drought conditions, excessive evaporation might lead to desiccation (drying out.) Plants in hot areas may benefit from fewer stomata so that they can conserve water.

The discussion illustrates an important concept in experimental biology, that there are often alternative hypotheses to explain variation in nature. In this case, the stomata density may increase or decrease in response to environmental variation in sunlight and water availability.

Phenomenon: View the video and brainstorm observations as well as questions.

Observations	Questions

Use the background information to answer the following questions.

1. Which gases enter the stomata and which exit?

2. Two hypothesis for stomata density are described in the background information. What are they?

3. Plant species might have variation in the number of stomata present on their leaves. Why?

4. Plants move water from the roots of the plant to the leaves through transpiration. As water evaporates from the leaf, water is pulled up from the roots. How is stomata density related to the rate of transpiration? transpiration and stomata reading.

Laboratory Instructions and Information:

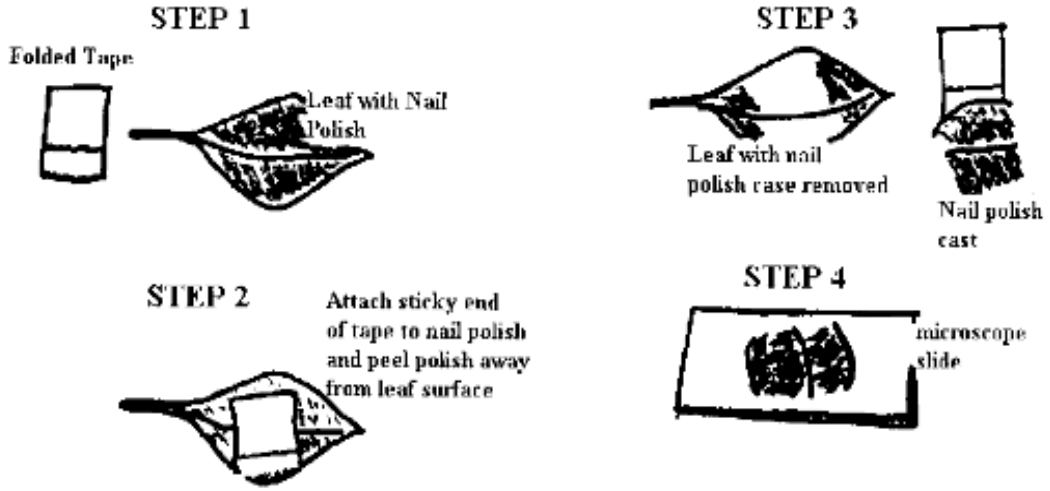
Materials:
Glass slides, collected leaves, clear nail polish, clear tape, microscopes.

Plant Species

Succulent Plant Species	**Non-succulent Plant Species**
• **Purple heart** (*Tradescantia pallidia*) • **Florist kalanchoe, aka widow's thrill and Flaming Katy** (*Kalanchoe blossfeldiana*) • **Goldfish Plant** *Columnea gloriosa*	• **Brazilian Jasmine, aka Mexican love vine** (*Mandevilla sanderi)* • **Golden pothos, aka Devil's ivy, Taro vine, and Hunter's robe** (*Epipremnum aureum*)
***Unknown plant species** (leaves have red borders)	

Procedure for Counting Stomata Tutorial Guide

1. Obtain a leaf. Be sure it is dry and free from dirt.
2. Paint a thin strip of clear fingernail polish a section of the leaf (paint between parallel veins). Allow the fingernail polish to completely dry.
3. Place a piece of clear tape over the dried nail polish. Gently but firmly press the tape onto the leaf.
4. Peel the tape from the leaf and place the tape sticky side down onto a microscope slide. Examine the tape, which now contains an impression of the leaf cells. Try to use both scanning and low power.
5. Count the number of **stomata** in the field of view. Move the slide so you can see other areas. It may be best to take an average of several areas on the leaf.



Name:_____ Per:_____ Date:_____

Stomata Lab Student Responses **/45**

After researching the different plant species, write a hypothesis to compare succulent vs. non-succulent leaves and number of stomata. 6 pts

If_____
(IV: this is done)

then_____
(DV: this will happen)

because_____
(research how stomata # may differ in succulent vs. non-succulent plant types)

A. **Sketch** (choose power with a reasonable number of stomata to count) 8 points If absent view photos linked below:

Upper surface

Lower surface

Label:
Plant leaf cell
Stomata
Guard Cell

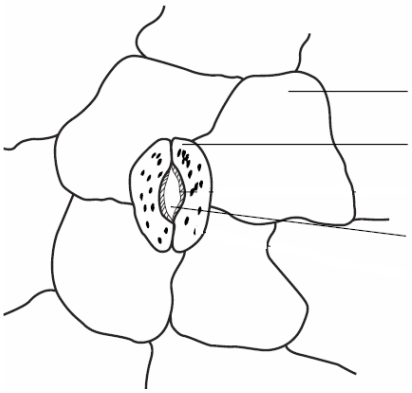
B. Number of Stomata in Fields of View on each surface of Leaf Samples. 8 pts

Surface of Leaf Sample #1 (Succulent)	View 1	View 2	**Average Number of Stomata**	**Stomatal Density Average # of Stomata/area** Low power area=3.14mm^2 High power area= 0.13mm^2
Top Surface				
Bottom Surface				

Surface of Leaf Sample #2 (Non-Succulent)	View 1	View 2	**Average Number of Stomata**	**Stomatal Density Average # of Stomata/area** Low power area=3.14mm^2 High power area= 0.13mm^2
Top Surface				
Bottom Surface				

<u>Calculation Space</u>

C. <u>Label</u> <u>Diagram using word bank (3 points)</u>



Wordbank:

Guard Cell
Stoma (opening)
Plant leaf cell

D. <u>Discussion</u> <u>Questions</u> (20 pts)**:**

1. Which plant sample (succulent vs. non-succulent) has more stomata? Use data. [conclusion] (3 pts)

2. Which surface (top or bottom) has a greater stomatal density? Use data [conclusion]. (3 pts)

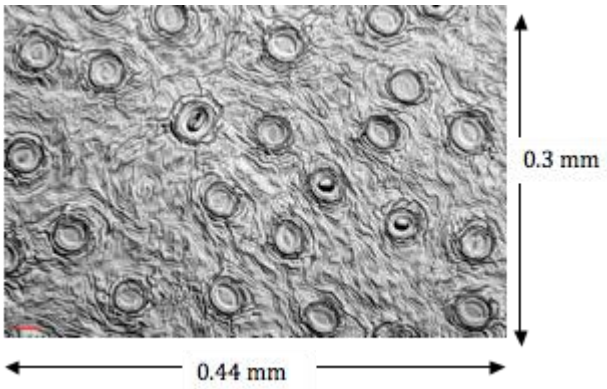
3. What was an advantage and a disadvantage to using the nail polish casting method? [validity](3 pts)

4. What would likely happen to the stomata in the following situations: [predictions](3 pts)

High wind	open	closed (choose one)
Daylight	open	closed (choose one)
Night	open	closed (choose one)

5. Different species of plants often have different amount of stomata. Why might this be the case? What abiotic factors may be involved? [predictions](3 pts)

6. Reflection: The following image was taken from a Venus Fly Trap lower leaf surface. How does the stomatal density compare to student collected leaf data? What does this infer (mean) about the Venus Fly Trap? [application] SHOW WORK(5 pts)



Extension: Classify the unknown plant as a succulent or non-succulent using both qualitative and quantitative observations. Infer the type of climate most suitable for this unknown species.