NAME _____

Whole Plant Transpiration

This lab is an alternate to the AP Biology Transpiration lab (#9A) in the College Board lab manual. It is easier to set-up, run, and is less time consuming to conduct. Additionally, the data is easy to generate and of high quality.

Materials:

- Small potted plant with lots of green leaves, few flowers
- Plastic container (may be the one it comes in)
- gallon size "food storage" bag (***not*** zipper-style)
- String

Objectives:

- To understand how water moves from roots to leaves in terms of the physical and chemical properties of water and the forces provided by differences in water potential.
- To understand the role of transpiration in the transport of water within a plant.
- To understand the structures used by plants to transport water and regulate water movement.
- To test the effects of environmental variables on rates of transpiration using a controlled experiment.

Introduction:

See College Board Lab Manual

Procedure:

1. Wrap the entire root ball in a plastic bag, snug it up to the stem with string, mark with your group name, and weigh on Monday. Weigh each successive day for the entire week.
2. All groups put their **controls** in one place, those in front of the **fan** together, those in **bright light** together, and the last are **misted** and covered with a 10-gallon aquarium. **Dark** are placed in a drawer or cabinet at the back of the room.
3. If your plant blooms, be sure any leaves or blooms that fall off are put back in the center of the plant to be weighed each day so as not to represent water loss.
4. Write a hypothesis about what you think what will happen based on your knowledge of transpiration and plants.

Results:

Determine the % change in mass over the week and graph. Be sure your graph has all of the appropriate titles and units.

Analysis: (From the College Board Lab Manual)

1. For this experiment, what were the independent variable and the dependent variable? What were the constants?
2. Calculate the average rate of water loss per day for each of the treatments. (Humidity, Light, Fan, Dark, Room or control).
3. Explain why each of the conditions causes an increase or decrease in transpiration compared with the control.
4. How did each condition affect the gradient of water potential from the stem to leaf in the experimental plant?
5. What is the advantage to a plant of closed stomata when water is in short supply? What are the disadvantages?
6. Describe several adaptations that enable plants to reduce water loss from their leaves. Include both structural and physiological adaptations.
7. Why did you need to calculate the % water loss each day instead of graphing the total amount of water lost each day?

WHOLE PLANT TRANSPIRATION LAB

Enter the mass of each plant in grams daily. Subtract each day from original mass. Calculate % change in mass by dividing change in mass each day by the original mass.

TREATMENT	AT START		After 24 hrs		After 48 hrs		After 72 hrs		After 96 hrs	
Light										
	0	0%								
Dark										
	0	0%								
Fan										
	0	0%								
Humidity										
	0	0%								
Countertop										
	0	0%								

TREATMENT	Mass of plant (g)	
	Mass at start minus today's mass	Change $\frac{\text{in mass}}{\text{original mass}}$ X 100

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http://www.texarkanacollege.edu/~mstorey/TABT/nucleus/Spring2007.pdf

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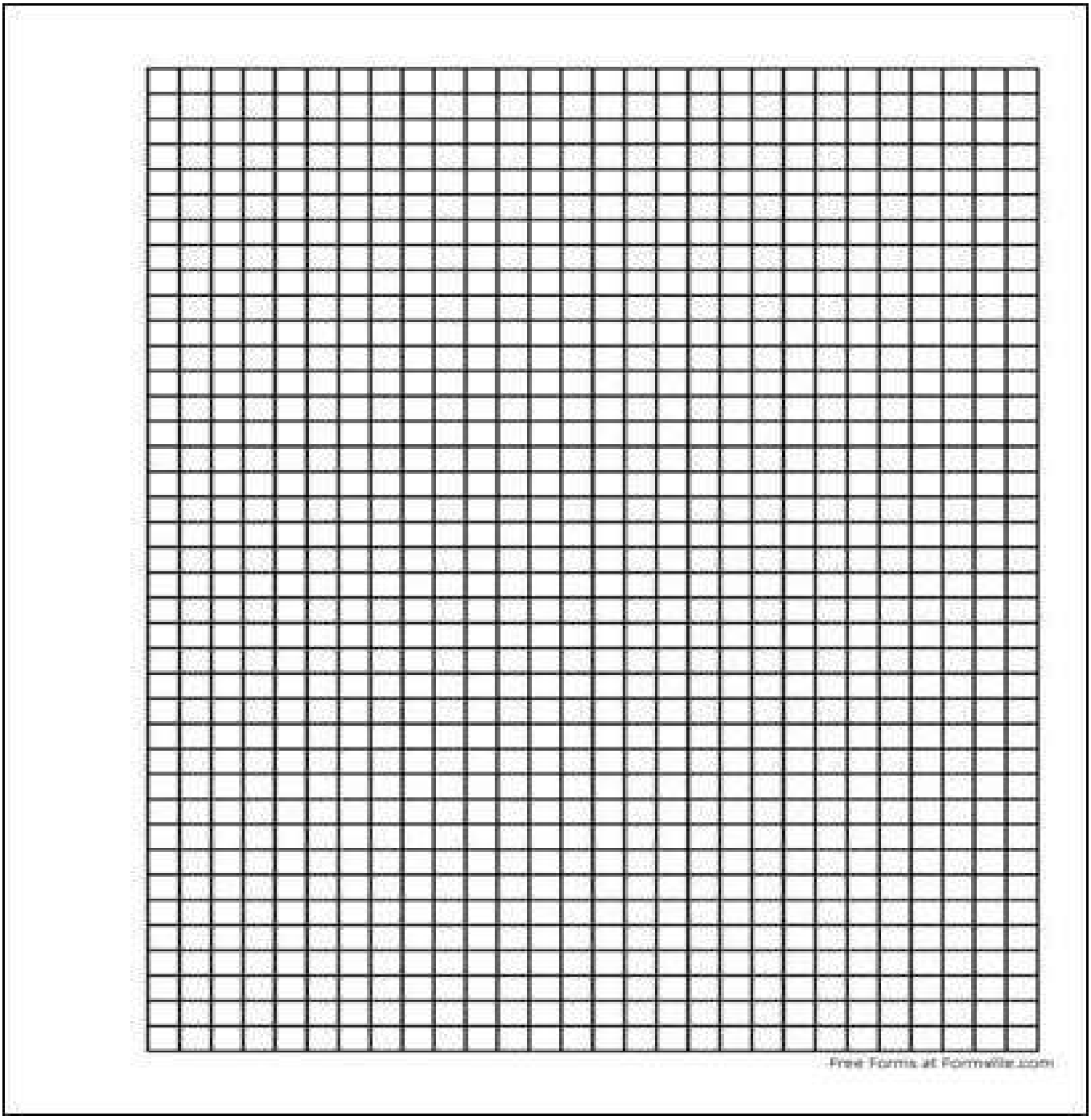
GRAPH THE CLASS DATA:



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ANALYSIS/DISCUSSION QUESTIONS

Analysis: (From the College Board Lab Manual)

1. For this experiment, what were the independent variable and the dependent variable?

_____

_____

2. What were the control variables?

_____

_____

3. Is there a control group in this experiment? EXPLAIN

_____

_____

CLASS DATA:

4. Calculate the average rate of water loss per day for each of the environmental conditions.

   Humidity

   Light

   Fan

   Dark

   Humid

   Countertop

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5. Why did you calculate the % change in mass instead of graphing the total amount of water lost each day?

_____

_____

_____

6. Explain why each of the conditions caused an increase or decrease in transpiration compared with the control.

LIGHT vs COUNTERTOP _____

_____

_____

_____

DARK vs COUNTERTOP_____

_____

_____

_____

HUMID VS COUNTERTOP _____

_____

_____

_____

WIND VS COUNTERTOP_____

_____

_____

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7. REFRESH YOUR BIO BRAIN AND MAKE CONNECTIONS TO CONCEPTS YOU LEARNED ABOUT EARLIER BY WATCHING THIS VIDEO
https://www.youtube.com/watch?v=mc9gUm1mMzc

8. EXPLAIN how transpiration works to move water from roots to leaves in a plant.

9. What roles do COHESION and ADHESION play in transpiration?

8. What is the advantage to a plant of closed stomata when water is in short supply on hot dry days?

9. What are the disadvantages?

10. EXPLAIN the role of WATER POTENTIAL in the movement of water from soil through the plant and into the atmosphere during TRANSPIRATION. Compare the water potential in different locations as water moves up the plant from roots to leaves. (Include: the atmosphere, soil, leaf spaces, root cells, and xylem)

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