

Whole Plant Transpiration, Teacher Guide

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 (impatiens, tomato seedling, Mexican heather, etc.) 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



Set-up:

- Water the plants well (saturate) the night before beginning the lab
- Wrap the root ball of plant in a plastic bag
- Tie bag around the base of the plant with string so that only the leaves are exposed
- Remove flowers and buds from the plant before massing so flowers and petals won't drop off plant during the lab

Conducting the lab:

- Write the mass of the plant and bag on the plastic bag each day so data will not get "lost" during the week. It is best to begin the lab on Monday and mass the plants each day of the week. For alternating block schedule, M, W, F will work, but an extra data point may be required
- Calculate amount of surface area for each plant by calculating it for one leaf and extrapolating to the entire plant by counting the number of leaves.
- When the lab is over, remove the plants from the bags, water them, and let the students take them home and plant them.

Measure using the following treatments:

- Control - normal light conditions in your room.
- Fan - place plants about 1-2 meters away from a fan on low. Leaves should not be rustling as this can cause some plants to close their stomata.
- Light - under a light bank on 24 hrs a day
- Moist - mist the inside of a 10-gallon aquarium and invert it over the plants
- Dark - Inside a cabinet

Transpiration Lab (#9A, College Board lab Manual)

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?

FROM: Texas Association of Biology Teachers

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