

57 Investigating Plant Transpiration

Key Idea: The relationship between the rate of transpiration and the environment can be investigated using a potometer. This activity describes a typical experiment to investigate the

effect of different environmental conditions on transpiration rate using a potometer. You will present and analyse the results provided.

The potometer

A potometer is a simple instrument for investigating transpiration rate (water loss per unit time). The equipment is simple to use and easy to obtain. A basic potometer, such as the one shown right, can easily be moved around so that transpiration rate can be measured under different environmental conditions.

Some physical conditions investigated are:

- Humidity or vapour pressure (high or low)
- Temperature (high or low)
- Air movement (still or windy)
- Light level (high or low)
- Water supply

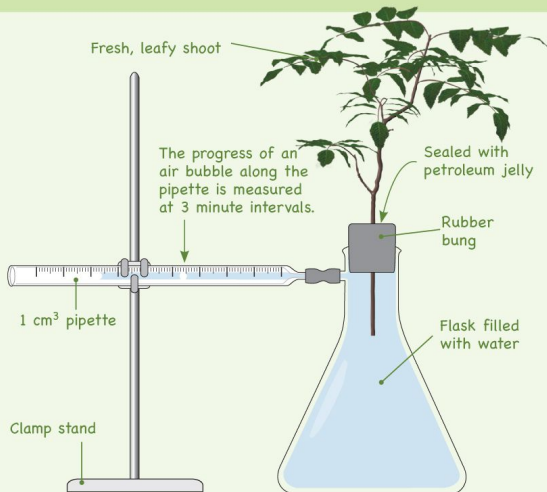
It is also possible to compare the transpiration rates of plants with different adaptations e.g. comparing transpiration rates in plants with rolled leaves vs rates in plants with broad leaves. If possible, experiments like these should be conducted simultaneously using replicate equipment. If conducted sequentially, care should be taken to keep the environmental conditions the same for all plants used.



Investigation 4.1 Investigating plant transpiration

See appendix for equipment list.

1. Four different conditions that influence transpiration will be tested: room conditions (ambient), wind, bright light, and high humidity.
2. Before starting, your teacher will decide if your group is to test one of these conditions (and which one) and pool class data for all four.
3. Set up the potometer and plant as in the diagram. It is best if the plant leaves used are large and few (4–6 leaves) rather than small and many. Alternatively the plant can be placed in a 250 mL conical flask with 200 mL of water and a thin layer of cooking oil floated on top. This is weighed before the experiment and then every 3 minutes (or as the experiment requires). The difference in mass in grams is equal to the volume of water transpired in mL.



4. After setting up the potometer, let the apparatus equilibrate for 10 minutes, and then record the position of the air bubble in the pipette (or the mass of the equipment for the alternative method). This is time 0 and position 0.
5. The plant can now be exposed to one of the four conditions. Record results in Table 1.
6. For the ambient environment the equipment can be placed on the bench away from bright light or wind. Record the net movement of the bubble every 3 minutes for 30 minutes.
7. For the high wind environment the equipment can be placed on the bench in front of a fan set on a moderate speed (away from bright light). Record the net movement of the bubble every 3 minutes for 30 minutes.

8. For the bright light environment, the equipment can be placed on the bench in front of a bright light (about 40 cm away). Record the net movement of the bubble every 3 minutes for 30 minutes.
9. For the high humidity environment the equipment can be placed on a bench away from bright light, in a sealed plastic bag with 2–3 sprays of water from a spray bottle. Record the net movement of the bubble every 3 minutes for 30 minutes.
10. It is important that for fair comparison of transpiration the area of leaf used in each environment (or by different groups) should be calculated and the volume of water lost per square centimetre compared (mL/cm²).
11. Leaf area can be measured by tracing the leaves onto graph paper and counting the squares, or by tracing or photocopying the leaves onto a paper of a known mass per area, then cutting out the shapes and weighing them. For both methods, multiply by 2 for both leaf surfaces.
12. Once the area of the leaf is calculated the transpiration (water lost) in mL/cm² can be calculate for each time recording and record in Table 2.

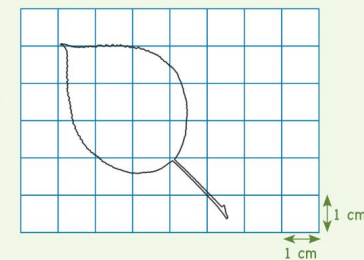


Table 1. Potometer readings (in mL water loss)

Time (min) \ Treatment	0	3	6	9	12	15	18	21	24	27	30
Ambient											
Wind											
High humidity											
Bright light											

Table 2. Potometer readings in mL per cm²

Time (min) \ Treatment	0	3	6	9	12	15	18	21	24	27	30
Ambient											
Wind											
High humidity											
Bright light											

1. Measure the area of the leaves you used: _____
2. Why is comparing the transpiration per square over time more important than just comparing the water lost over time?

