

## Investigation into factors affecting transpiration

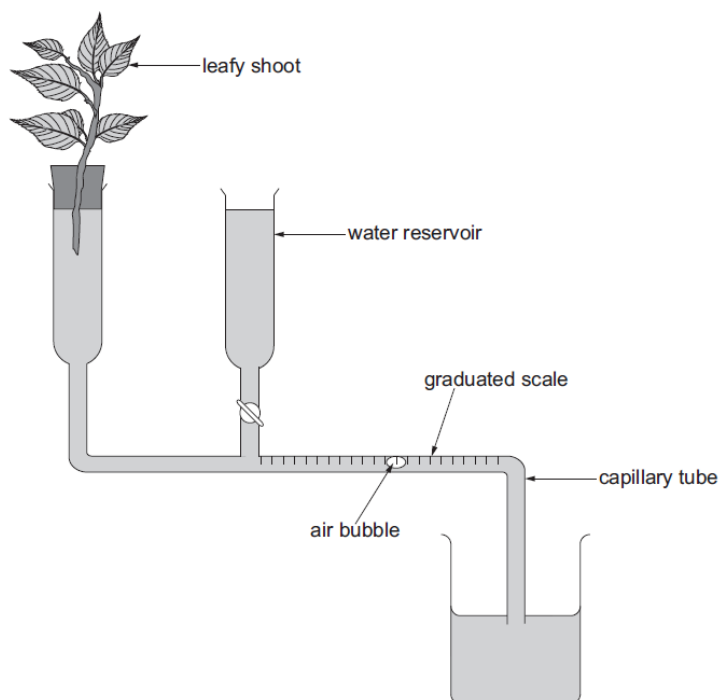
### Introduction

Transpiration is the evaporation of water from the leaves of a plant, which causes the uptake of water from the roots. It is assumed that the volume of water taken up at the roots is equal to evaporation from the leaves. In this investigation a freshly cut plant stem will carry out transpiration. The rate of transpiration can be measured by the distance travelled by an air bubble along a capillary tube in a particular time.

### Apparatus

potometer  
 100 cm<sup>3</sup> beaker of water  
 leafy shoot cut under water  
 clamp stand, clamp and boss  
 scissors  
 stopwatch  
 Vaseline  
 paper towel  
 bowl of water

### Diagram of Apparatus



## Method

1. Immerse the potometer in the bowl of water and make sure the apparatus is full of water with no air bubbles.
2. Put the cut end of the leafy shoot in the water, taking care to keep the leaves above the surface.
3. Diagonally cut the last centimetre from the stem underwater.
4. With the potometer and stem still underwater, gently push the stem into the bung as shown in the diagram. Make sure it is a tight fit.
5. Remove the assembled apparatus from the water and apply Vaseline to all the joints to avoid air entering the apparatus.
6. Gently dab the leaves with the paper towel to remove excess water.
7. Clamp the potometer in an upright position with the capillary tube in the beaker of water.
8. Remove the capillary tube from the beaker to allow an air bubble to form and then return it to the beaker.
9. When the air bubble reaches the start of the scale begin timing.
10. After a set amount of time record how far the air bubble has travelled along the scale.
11. Repeat steps 8-10 twice more.

## Analysis

1. Calculate the mean water loss per minute.

## Risk Assessment

Hazard	Risk	Control measure
Scissors is sharp	Cutting hand when cutting stem	Cut away from hand
Some plants exude sap which irritates	Allergic reaction to sap	Wear gloves
Delicate capillary tubing easily breaks	Cutting hand on smashed tubing due to pressure of inserting bung/stem.	Use minimal pressure to push stem into bung and bung into tubing.

## Teacher/Technician notes

The setting up of potometers should be carried out as a demonstration or in advance by technicians due to the delicate nature of the capillary tubing and the fact the apparatus needs to be assembled under water. However, if students are to carry out the procedure note the risk assessments.

**Use the given method to introduce how to investigate transpiration. Students could then be asked to plan an investigation into the effects of the following factors on the rate of transpiration.**

- Light intensity (Lamp)
- Temperature (Incubator)
- Wind speed (Fan)
- Surface area of leaves (Remove leaves one by one and repeat experiment)
- Humidity (Clear bags over leaves)

Different groups of students could be asked to plan investigations into each of the factors above. They could be asked to identify independent and dependent variables and then identify and describe how to control the other variables in the experiment and explain why it is necessary to control them.

If home-made potometers are to be used the web link below leads to an excellent set of teacher/ technician guidance notes on how to make them.

<http://www.saps.org.uk/secondary/teaching-resources/1341-a-level-set-practicals-using-a-potometer>

The experiment could also be demonstrated or students could use the virtual experiment below to test their predictions.

<http://www.reading.ac.uk/virtualexperiments/ves/preloader-transpiration.html>

## Working scientifically skills covered

### 2. Experimental skills and strategies

Plan experiments or devise procedures to make observations, produce or characterise a substance test hypotheses, check data or explore phenomena.

Apply knowledge of a range of techniques, instruments, apparatus and materials to select those appropriate to this experiment.

Carry out experiments appropriately having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.

Make and record observations and measurements using a range of apparatus and methods.

Evaluate methods and suggest possible improvements and further investigations.