

WJEC England Biology A Level

SP C3 02a: Investigation into
transpiration using a simple potometer
Practical notes



Introduction

Transpiration is **water loss** from the **aerial** parts of a plant, that is the leaves, due to **diffusion** and **evaporation**.

The **rate of water uptake** from a shoot is measured using a **potometer**. Although a small amount of water is used in processes such as **photosynthesis** or to maintain **turgidity**, it is assumed that the rate of water uptake is **equal** to the rate of transpiration.

Equipment

- Cut shoot
- Potometer
- Scissors
- Beaker of water
- Vaseline
- Clamp stand
- Stopwatch

Risk assessment

Hazard	Risk	Precaution	Emergency
Broken glass	Cuts	Keep glassware away from the edge of the desk	Dispose of broken glassware carefully; elevate cuts and apply pressure; do not remove glass from cuts; seek medical assistance
Scissors	Cuts	Handle scissors with care; keep scissors away from the edge of the desk	Elevate cuts and apply pressure; wash minor cuts in cold water; seek medical assistance

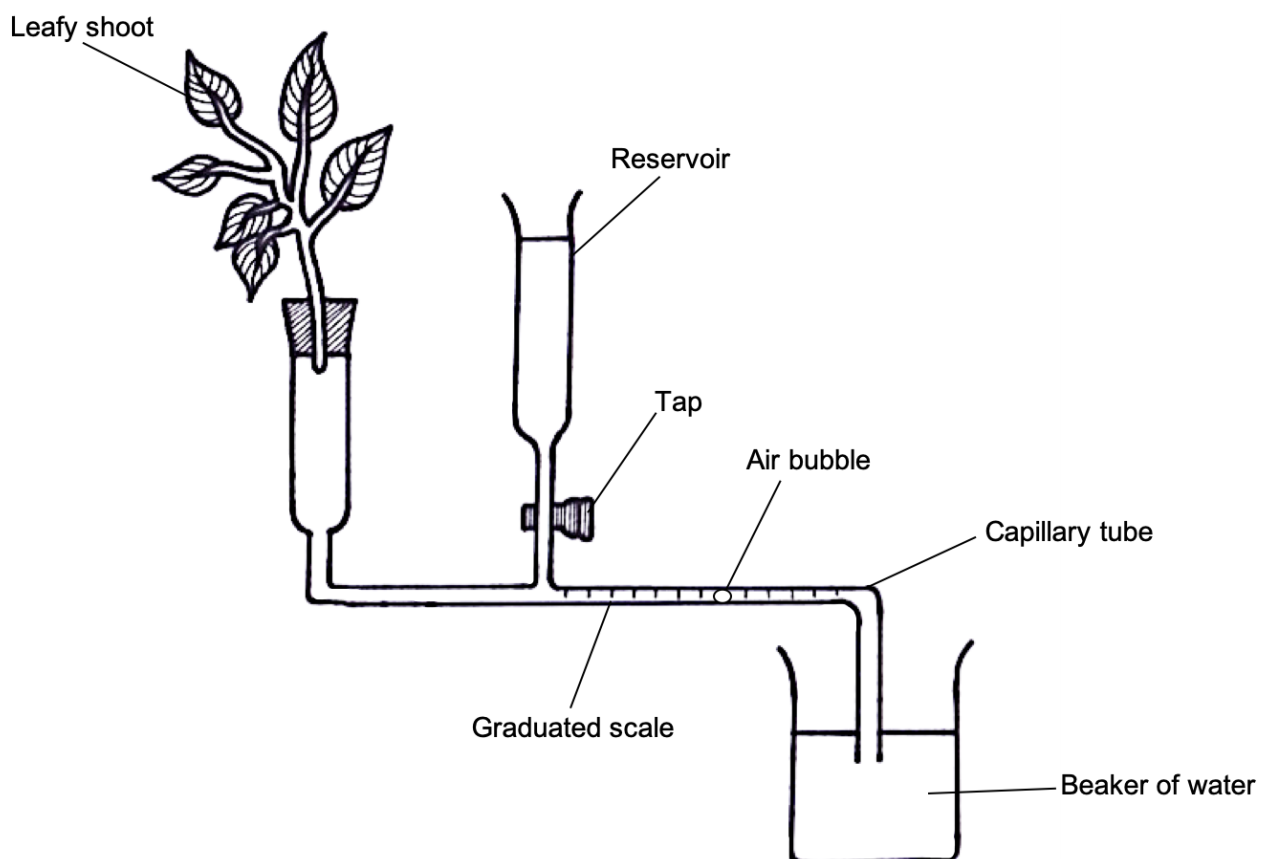
Method

1. Construct the potometer **underwater**. *This stops the entry of air bubbles.*
2. Immerse the end of the cut shoot underwater and using a pair of scissors, cut the last centimeter off at an **oblique** angle. *Cut underwater to prevent the entry of air bubbles into*



the xylem. Cut at an oblique angle to increase the surface area for water absorption. Ensure that the leaves of the shoot remain dry to prevent the obstruction of stomata by water droplets.

3. Whilst still underwater, insert the shoot tip into the rubber tubing of the potometer. *The shoot tip must perfectly fit the rubber tubing to prevent the entry of air and formation of air bubbles.*
4. Remove the apparatus from the water and grease **all joints** with **Vaseline** to give a tight seal. *This prevents air entering.*
5. Leave the cut shoot in the potometer for 10 minutes to allow it to **equilibrate**.
6. Clamp the potometer so that the end of the capillary tube is immersed under water. Remove the end from the water to allow an air bubble to form. Reimmerse and seal the capillary tube.
7. Note the **starting position** of the bubble on the volume scale. Start the stopwatch and record the distance travelled by the bubble in a **set period of time** (e.g. 10 minutes).
8. Repeat steps 6 to 7 a further two times to obtain three repeats



Results

Calculate the **mean** distance travelled from the three repeats.

The readings taken are expressed as a distance travelled by the air bubble in a certain period of time e.g. 10 mm in 10 minutes. The **volume** of water taken up in a **set period of time** (i.e. transpiration rate) can be calculated if the **radius** of the capillary tube is known.

If the radius of the capillary tube is 2 mm:

$$\begin{aligned}\text{Volume} &= \pi r^2 h \\ &= 3.14 \times 2^2 \times 10 \\ &= 125.7 \text{ mm}^3\end{aligned}$$

$$\text{Rate of water uptake} = 125.7 \div 10 = \mathbf{12.6 \text{ mm}^3 \text{ min}^{-1}}$$

