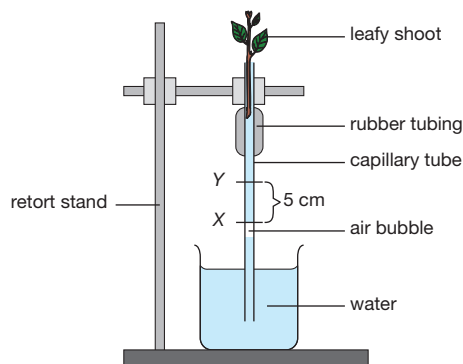


## EXPERIMENT 2.1

### Effects of light intensity, temperature, air movement and relative air humidity on the rate of transpiration



- 1 A potometer is prepared as shown in the diagram. The distance between X and Y is 5 cm. The time taken for the movement of air bubble from X to Y is recorded.
- 2 Tables A to D show the results of the experiment on the effects of light intensity, temperature, air movement and relative air humidity on the rate of transpiration. Based on the results, analyse and discuss the effects of light intensity, temperature, air movement and relative air humidity on the rate of transpiration.

#### A Effects of temperature

Environmental condition	Time taken for the movement of the air bubble from X to Y (s)				Transpiration rate ( $\text{mm s}^{-1}$ )
	1	2	3	Average	
In the laboratory ( $30^\circ\text{C}$ )	685	710	720	705	0.07
Outside the laboratory ( $33^\circ\text{C}$ )	474	480	450	468	0.11

#### B Effects of light intensity

Environmental condition	Time taken for the movement of the air bubble from X to Y (s)				Transpiration rate ( $\text{mm s}^{-1}$ )
	1	2	3	Average	
Plant is covered with a black plastic bag (low light intensity)	346	390	374	370	0.14
Plant is covered with a transparent plastic bag (high light intensity)	148	157	160	155	0.32

#### C Effects of air movement

Environmental condition	Time taken for the movement of the air bubble from X to Y (s)				Transpiration rate ( $\text{mm s}^{-1}$ )
	1	2	3	Average	
Windy	163	158	165	162	0.31
Still air	370	380	381	377	0.13

#### D Effects of relative air humidity

Environmental condition	Time taken for the movement of the air bubble from X to Y (s)				Transpiration rate ( $\text{mm s}^{-1}$ )
	1	2	3	Average	
Low humidity (the presence of anhydrous calcium chloride)	480	459	465	468	0.11
High humidity (presence of water)	693	704	718	705	0.07

- (a) **Light intensity**
- An **increase in light intensity** increases the rate of transpiration.
  - Light stimulates the opening of the **stomata**.
  - As a result, the stomata open wider. Hence, more water vapour evaporates through the stomata.
- (b) **Temperature**
- An **increase in temperature** increases the rate of transpiration.
  - An increase in temperature increases the **rate of evaporation of water** from the surfaces of the mesophyll cells. The rate of diffusion of water through the stomata also increases.
- (c) **Humidity**
- High humidity surrounding the leaves reduces the evaporation of water from the stomata.
  - This causes transpiration to slow down.
  - Conversely, a rise in temperature lowers the relative humidity of the surrounding air, and this increases the rate of transpiration.
- (d) **Air movement**
- The faster the air movement, the faster the rate of transpiration.
  - As the water vapour that diffuses through the stomata accumulates near the leaf surface, a **faster air movement** helps to remove the water vapour.
  - Air movement increases the concentration gradient between the water vapour in the leaf and that outside the leaf. This increases the transpiration rate.
  - When the air is still, the transpiration rate decreases or stops altogether.
- Conclusion**
- The higher the light intensity, temperature and air movement, the higher the rate of transpiration. The lower the air humidity, the higher the rate of transpiration.