

**AS Level Biology A**  
**H020/01 Breadth in Biology**

**Question Set 19**

1. Plants need water to survive.

(a) Water enters plants through the roots. Most roots are covered in root hairs.

The number of root hairs per  $\text{mm}^2$  of root surface is described as the density of root hairs. The density of root hairs can vary between and within species.

A scientist examined a plant root. The plant root had a diameter of 2 mm. In 1 mm of root **length** the scientist counted 440 root hairs.

Calculate the density of root hairs on the root the scientist examined. Use the formula:

$$\text{Surface area of cylinder} = 2\pi r(r+l)$$

Give your answer to 2 significant figures.

$$\text{Surface area of plant root} = 2\pi(1)(1+1) = 4\pi \text{ mm}^2 \quad \text{density} = \dots \mathbf{35 \text{ hairs/mm}^2} \dots \quad [3]$$

440 root hairs in  $4\pi \text{ mm}^2$

$$\frac{440}{4\pi} = \underline{\underline{35 \text{ hairs/mm}^2}}$$

(b) A scientist investigated the effect of different mineral solutions on root hair density on cress plants.

Cress plants were grown for seven days in two different mineral solutions, **A** and **B**.

The results are shown in the table below.

Cress plant	Root hair density (hairs $\text{mm}^{-2}$ )	
	Mineral solution A	Mineral solution B
1	42	25
2	53	41
3	60	32
4	52	34
5	38	58
6	48	27
Mean	48.8	<b>36.2</b>
Standard deviation	8.0	<b>12.1</b>

- (i) Calculate the standard deviation of root hair density for cress grown in mineral solution **B**.

Use the formula:  $s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$

[Write your answer in the table]

[3]

$$\bar{x} = \frac{217}{6} = 36.1\dot{6} = 36.2$$

$$s = \sqrt{\frac{(25 - 36.1\dot{6})^2 + (41 - 36.1\dot{6})^2 + (32 - 36.1\dot{6})^2 + (34 - 36.1\dot{6})^2 + (58 - 36.1\dot{6})^2 + (27 - 36.1\dot{6})^2}{5}}$$

$$= \sqrt{\frac{730.8\dot{3}}{5}} = \underline{\underline{12.1}}$$

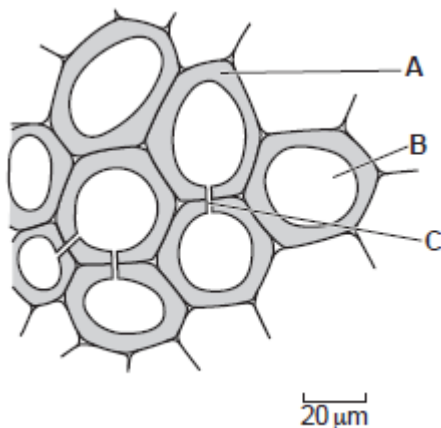
- (ii) The scientist thought that mineral solution **B** might cause a reduction in root hair density.

Suggest an appropriate statistical test that the scientist could carry out in order to confirm their hypothesis.

**Unpaired student's t-Test**

[1]

- (c) Fig. 24 is a section through xylem tissue from a **stem** of a dicotyledonous plant.



**Fig. 24**

- (i) Identify **A**, **B** and **C** on Fig. 24.

**A** Lignified cell wall.....

**B** Lumen.....

**C** Bordered pit.....

[3]

- (ii) Some plants, such as mosses, do not have xylem. Mosses are small plants that rarely grow more than a few cm in height.

Suggest why mosses do not need structures such as roots or xylem to survive.

[1]

**They are small so have a large surface area to volume ratio. They can therefore mainly rely on diffusion for the transport of water and nutrients. Being small also means a short diffusion distance for water and minerals.**

**Total Marks for Question Set 19: 11**

---

# OCR

Oxford Cambridge and RSA

## **Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge