

Centre Number						Candidate Number					
Surname						Other Names					
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Candidate Signature						Date					

For Teacher's Use	
Section	Mark
PSA	
Stage 1 Skills	
Stage 2 Skills	
Section A	
Section B	
<b>TOTAL</b> (max 50)	



General Certificate of Education  
Advanced Subsidiary Examination  
June 2013

# Biology

# BIO3T/Q13/test

## Unit 3T AS Investigative Skills Assignment

### Written Test

For submission by 15 May 2013

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>the task sheet, your results and your graph</li> <li>a ruler with millimetre measurements</li> <li>a calculator.</li> </ul>	<p><b>Time allowed</b></p> <ul style="list-style-type: none"> <li>1 hour 15 minutes</li> </ul>
<p><b>Instructions</b></p> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul>	<p><b>Information</b></p> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>You are expected to use a calculator where appropriate.</li> <li>The maximum mark for this paper is 34.</li> <li>You will be marked on your ability to: <ul style="list-style-type: none"> <li>use good English</li> <li>organise information clearly</li> <li>use scientific terminology accurately.</li> </ul> </li> </ul>

**Details of additional assistance (if any).** Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes  No

**Teacher Declaration:**

I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

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**Section A**

These questions relate to your investigation into the density of stomata in the lower epidermis of leaves.

Use your Task Sheet, your results and your graph to answer the questions.

Answer **all** the questions in the spaces provided.

**1** You were given three leaves from the same plant. Suggest **one** reason why the leaves should be from the same plant.

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(1 mark)

**2** You were told to decide for yourself how many fields of view to use to count the number of stomata.

Explain how you decided how many fields of view to use.

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(1 mark)

**3** You were told to count the number of stomata in a field of view using the highest power magnification of your microscope (step 6).

The magnification depends on the eyepiece lens and the objective lens.

Describe how you would find the magnification you used.

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(1 mark)

**4** Give **one** precaution you took when counting the number of stomata in a field of view to make sure the count was accurate.

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(1 mark)

**5** You were told to count the number of stomata in different fields of view of the same leaf (step 7). Explain why this was important.

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(1 mark)

**6** Using the data you obtained in your investigation, what can you conclude about the number of stomata per field of view in different leaves of the same plant?

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(2 marks)

**7** A student carried out an investigation similar to yours. In her investigation, she found the area of the field of view and then estimated the number of stomata in the lower epidermis of one leaf.

**7 (a)** Describe a method she could have used to find the area of the field of view.

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(2 marks)

**7 (b)** Describe how she could have used her calculation of the area of the field of view when estimating how many stomata were in the lower epidermis of one leaf.

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(4 marks)

(Extra space) .....

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**8** In her investigation, the student compared leaves from a xerophytic plant with a plant similar to the one you used. She found that the leaves of the xerophytic plant had a lower number of stomata per mm<sup>2</sup>.

Explain why having fewer stomata would be of benefit to the xerophytic plant.

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(2 marks)

15
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**Turn over for the next question**

## Resource Sheet

### Introduction

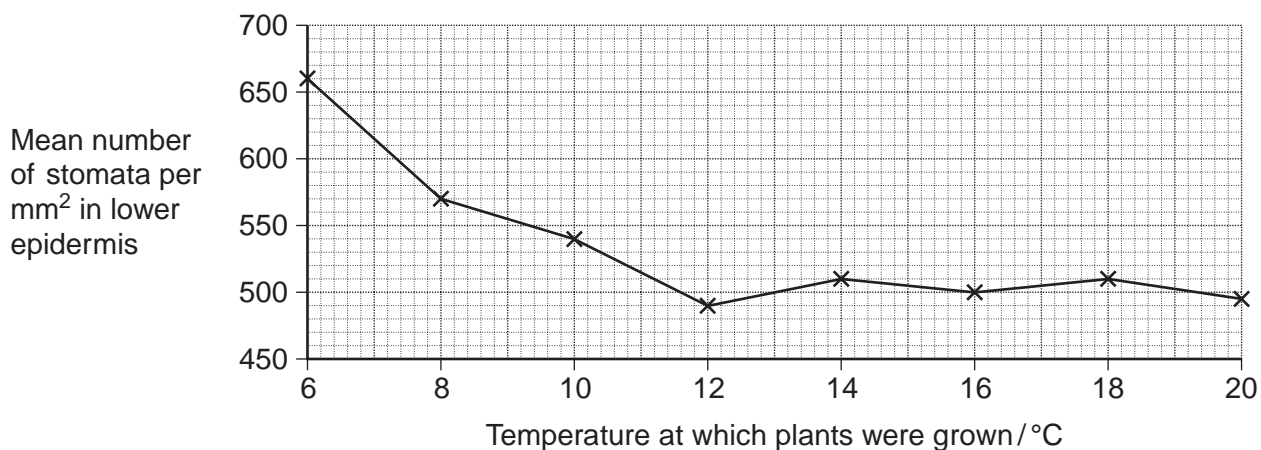
Environmental factors can affect the density of stomata in the lower epidermis of leaves of plants of the same species.

### Resource A

Scientists investigated how growing plants at different temperatures affected the density of stomata in the lower epidermis of leaves. They grew plants of the same species from seeds. Their method is outlined below.

- They took 8 trays containing soil and planted 50 seeds in each tray.
- They put each tray in a controlled environment at a different temperature.
- When the plants had grown from the seeds, they selected 20 fully grown leaves from the plants in each tray.
- They determined the mean number of stomata per  $\text{mm}^2$  in the lower epidermis for each group of leaves.

Their results are shown in the graph.



## Resource B

Scientists used fossil leaves from one species of pine tree to investigate whether changes in the concentration of carbon dioxide in the air over long periods of time had led to changes in the number of stomata in the leaves.

Their method is outlined below.

- They selected sites of different ages.
- They collected between 11 and 24 fossil leaves from each site.
- They found the mean number of stomata per mm<sup>2</sup> on the leaves from each site.
- They estimated the age of each sample by dating organic remains around the leaves at each site.

They compared results from the fossil leaves with leaves from the same species of pine tree growing today.

They knew the concentration of carbon dioxide in the air at different times in the past.

Their results are shown in the table.

Age of sample / years	Concentration of carbon dioxide in the air / %	Mean number of stomata per mm <sup>2</sup> ( $\pm$ standard deviation)
present day	0.0350	92 ( $\pm$ 2)
5000	0.0270	87 ( $\pm$ 4)
10 000	0.0250	95 ( $\pm$ 2)
15 000	0.0205	108 ( $\pm$ 6)
20 000	0.0195	115 ( $\pm$ 4)
25 000	0.0188	118 ( $\pm$ 6)
30 000	0.0190	130 ( $\pm$ 6)

Turn over ►

**Section B**

Use the information in the **Resource Sheet** to answer the questions.

Answer **all** the questions in the spaces provided.

Use **Resource A** to answer **Questions 9 to 12**.

**9** Give **three** environmental variables, other than temperature, that the scientists would have controlled when growing the plants.

- 1 .....
- 2 .....
- 3 .....

*(3 marks)*

**10** The scientists used a range of temperatures from 6 to 20 °C. Using their data, explain why they did **not** use temperatures above 20 °C.

- .....
- .....
- .....

*(1 mark)*

**11** The scientists only selected fully grown leaves from the plants. Suggest why.

- .....
- .....
- .....

*(1 mark)*



**12** The plants grown at higher temperatures had a lower number of stomata per mm<sup>2</sup>. This would be an advantage to the plant because the transpiration rate increases as the temperature increases.

Explain why the transpiration rate increases when the temperature increases.

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(2 marks)

Use **Resource B** to answer **Questions 13 to 18**.

**13** The concentration of carbon dioxide in the air has changed with time. Use the data to describe how.

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(2 marks)

**14** The scientists calculated the mean number of stomata per mm<sup>2</sup> and the standard deviation.

What does the standard deviation show?

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.....

(2 marks)

Turn over ►

**15** The scientists found the age of the fossil leaves by dating the organic remains around them.  
Would this have affected the accuracy of their data? Explain your answer.

.....  
.....  
.....

(1 mark)

**16** 30 000 years ago the mean number of stomata per mm<sup>2</sup> on the lower epidermis of pine tree leaves was much higher than it is today. This would have enabled the plant to grow faster when the carbon dioxide concentration of the air was low.

Explain why.

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.....  
.....

(1 mark)

**17** A student who saw these results concluded that as the carbon dioxide concentration of the air had increased the number of stomata per mm<sup>2</sup> in leaves had decreased.  
Do the results support this conclusion?

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(3 marks)

(Extra space) .....

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18

The leaves of plants that grow in dry areas usually have a low number of stomata per mm<sup>2</sup>. Use your knowledge of leaf structure to suggest **three** other adaptations that the leaves might have that enable the plants to grow well in dry conditions.

1 .....

2 .....

3 .....

(3 marks)

19

**END OF QUESTIONS**