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General Certificate of Education  
 June 2004  
 Advanced Level Examination



**BIOLOGY (SPECIFICATION B) BYB678/B**  
**Unit 6 Section B Applying Biological Principles**  
**Unit 7 Section B Applying Biological Principles**  
**Unit 8 Section B Applying Biological Principles**

Friday 25 June 2004 1.30 pm to 3.45 pm

**In addition to this paper you will require:**

- Section A;
- a ruler with millimetre measurements.

You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			

Time allowed: The total time for Section A and Section B of this paper is 2 hours 15 minutes.

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** the questions in **Section B** in the spaces provided. All working must be shown.
- **Section A** and **Section B** will be marked by different examiners. You must ensure that any supplementary sheets are fastened to the appropriate question paper answer book.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

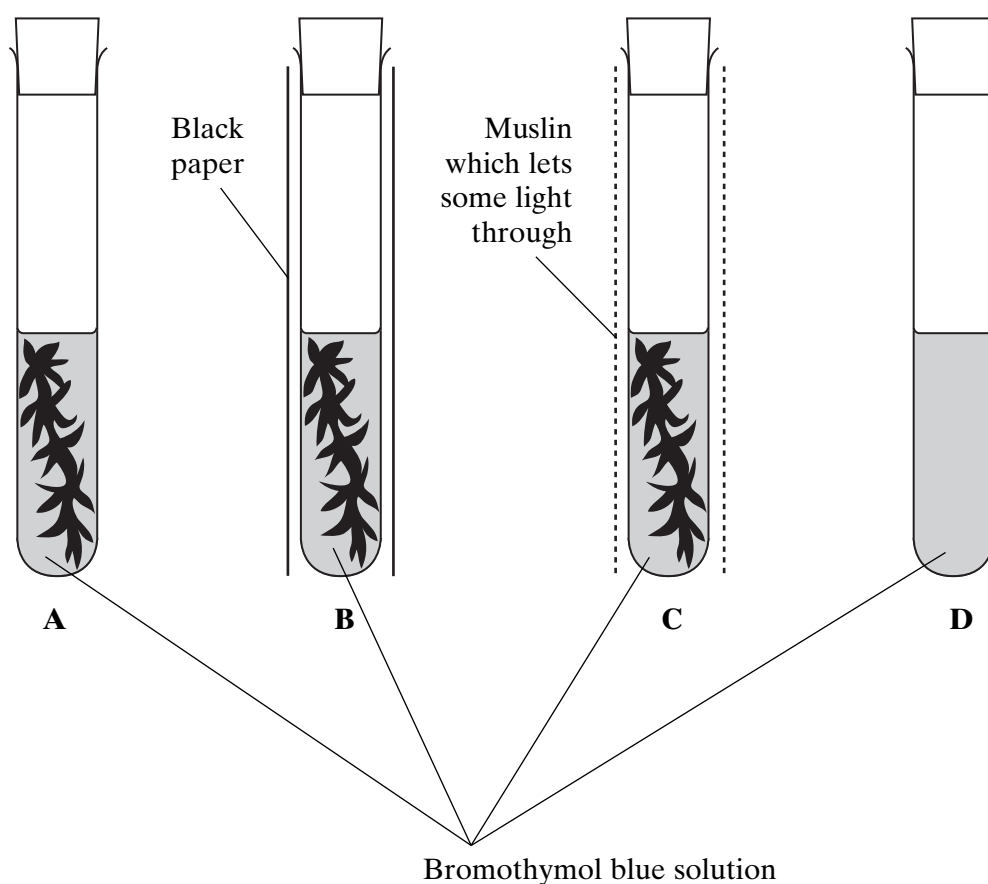
- The maximum mark for **Section B** is 50.
- Mark allocations are shown in brackets.
- You are reminded that all questions in this **Section B** are synoptic (indicated by the letter **S**). You must use your knowledge of different parts of the specification when answering this section.
- You are advised to spend 1 hour 15 minutes on **Section B**.
- You are reminded of the need for clear presentation in your answers. All answers should be in good English and should use accurate scientific terminology.

**SECTION B**

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

- S 1** Gas exchange in an aquatic plant was investigated by placing shoots in tubes containing bromothymol blue indicator solution. Bromothymol blue indicator is yellow below pH 6, green between pH 6.1 and 7.5, and blue at pH 7.6 and above. Into each of four tubes, **A**, **B**, **C** and **D**, 10 cm<sup>3</sup> of bromothymol blue solution were placed. Each tube was closed with a bung and left for 10 minutes. Similar-sized shoots of an aquatic plant were then placed into each of tubes **A**, **B** and **C**. The tubes were treated as shown in the diagram.

They were then placed at equal distances from a 60 watt lamp and left for one hour.



The table shows the initial and final colours of the indicator in the four tubes.

Tube	Treatment	Initial colour of indicator	Colour of indicator after one hour
<b>A</b>	Uncovered	Green	Blue
<b>B</b>	Covered with black paper	Green	Yellow
<b>C</b>	Covered with muslin	Green	Green
<b>D</b>	Uncovered	Green	Green

(a) Explain the results for

tube **A**;

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tube **B**;

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tube **C**.

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*(4 marks)*

(b) (i) Explain how the results from tube **D** help to confirm that the explanations for the other tubes are valid.

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*(1 mark)*

(ii) Explain why all the tubes were placed the same distance from the lamp.

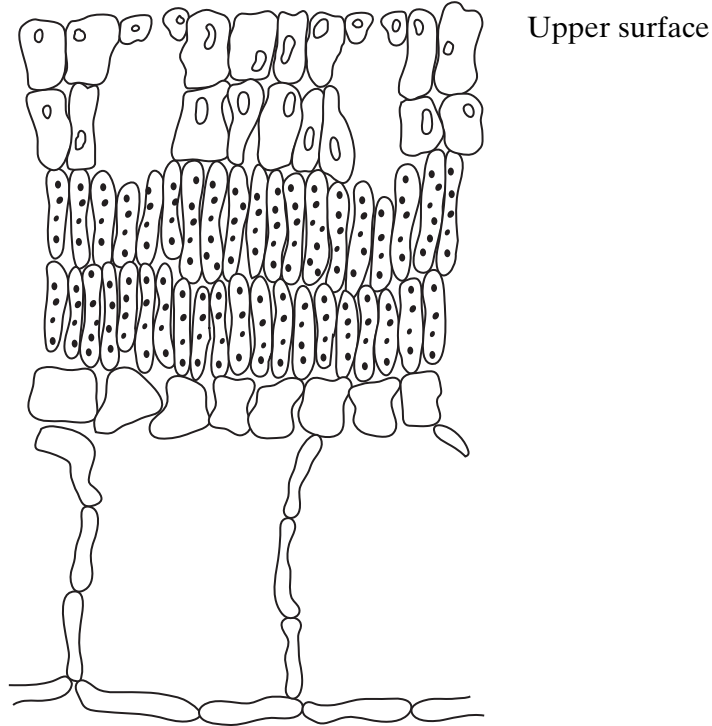
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*(1 mark)*

**QUESTION 1 CONTINUES ON THE NEXT PAGE**

**Turn over** ►

- (c) Water lily plants have leaves that float on the surface of ponds. The drawing has been made from a photomicrograph and shows the internal structure of the upper part of a water lily leaf.

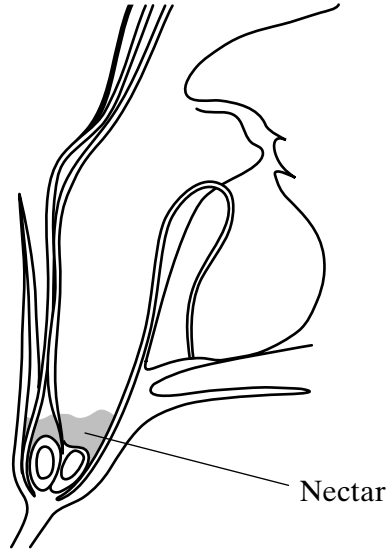


Using information from the diagram, explain **two** ways in which the leaf is adapted for living on the surface of water.

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

(2 marks)

**S 2** Penstemon plants have mechanisms that regulate the amount of nectar produced by their flowers. Nectar is a solution containing sucrose which attracts insect pollinators. The diagram shows a section through a penstemon flower.



To investigate these mechanisms the volume of nectar produced was determined. A thin strip of filter paper was dipped into the nectar until all the nectar was absorbed. The distance the nectar moved up the paper was measured. The actual volume of nectar was found by reading the value from a calibration curve on a graph. A sucrose solution similar to nectar was used to produce this calibration curve.

- (a) (i) The solution contained 22% by mass of sucrose. Describe how you would make 50 cm<sup>3</sup> of this solution.

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(1 mark)

- (ii) Describe how you would use the solution to produce the calibration curve.

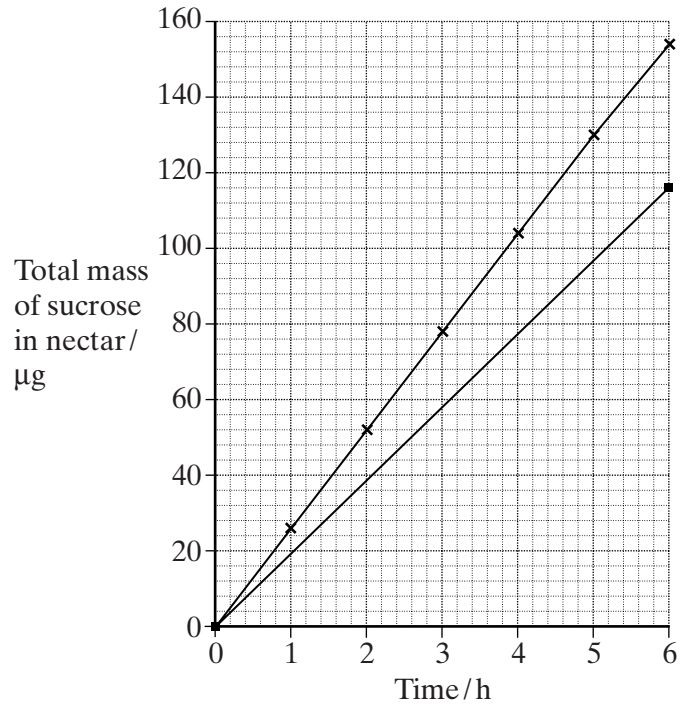
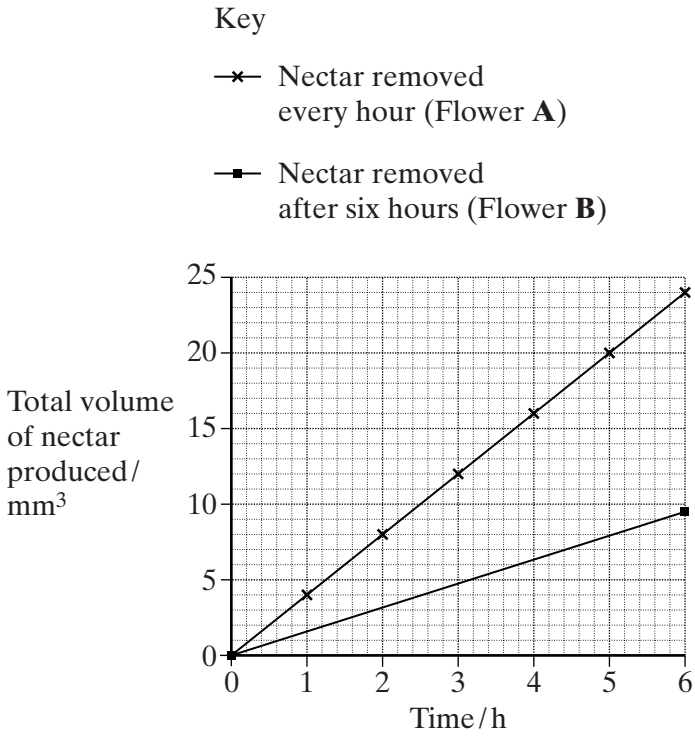
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(2 marks)

**QUESTION 2 CONTINUES ON THE NEXT PAGE**

**Turn over** ►

In one experiment the effect of removing nectar at regular intervals was investigated. First all the nectar was removed from two penstemon flowers. From one flower (**A**) all the nectar produced was removed each hour for the next six hours. In the second flower (**B**) the nectar was allowed to accumulate for six hours. Each time the nectar was removed, the sugar was extracted from the strip of filter paper and its mass was measured. The graphs show the results.



(b) (i) Describe the effects on nectar production and on sucrose secretion of removing the nectar every hour compared with removing it after 6 hours.

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(2 marks)

(ii) How would the nectar collected after 6 hours from plant **B** differ from that collected after 6 hours from plant **A**.

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(1 mark)

- (iii) Pollinating insects such as bees visit flowers and collect nectar. Suggest **one** advantage for penstemon flowers of the response to regular removal of nectar.

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(1 mark)

- (c) In a different experiment the nectar was removed from two penstemon flowers. In one flower the nectar was replaced with  $5 \text{ mm}^3$  of a solution containing a total of  $120 \mu\text{g}$  of sucrose. The second flower was left empty as a control. The two flowers were protected from insects. After three hours the nectar solutions in the flowers were removed. The table shows the results.

Time/h	Volume of solution/ $\text{mm}^3$		Mass of sucrose in solution/ $\mu\text{g}$	
	Experimental	Control	Experimental	Control
0	5.00	0.00	120	0
3	5.75	1.65	104	20

Describe the effect of the addition of sucrose solution on the volume of nectar produced and on the movement of sucrose.

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(3 marks)

- (d) Nectar is formed by specialised cells in the flower which synthesise sucrose. Describe how sucrose is moved against a concentration gradient from these cells into the nectar.

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(2 marks)

Turn over 

- S 3** A medical officer investigated the effectiveness of five different types of influenza vaccine. A total of 1350 people agreed to be vaccinated. The medical officer divided these into five groups. The number who suffered from influenza in the following year was recorded. The results are shown in the table.

Type of influenza vaccine	Number of people vaccinated			Proportion suffering from influenza
	Suffered from influenza	Did not suffer from influenza	Total	
I	43	237	280	0.15
II	52	198	250	0.21
III	25	245	270	0.09
IV			260	0.18
V	57	233	290	0.20

- (a) Complete the spaces in the table for the people vaccinated with type IV vaccine.

(1 mark)

- (b) The medical officer used a statistical test to assess the effectiveness of the five different vaccines.

- (i) What would be the null hypothesis?

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(1 mark)

- (ii) The statistical test gave a probability of less than 0.05. What conclusion can be drawn from this?

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(1 mark)

(c) It was suggested that the raw data showed that the type III vaccine was the most effective. Give **two** reasons why this conclusion may not be reliable.

1 .....

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2 .....

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(2 marks)

$\frac{\quad}{5}$

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** 



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Turn over 



Handwriting practice area consisting of 25 horizontal dotted lines.

Turn over 



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