



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Advanced Level

CANDIDATE  
NAME

CENTRE  
NUMBER

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**BIOLOGY**

**9700/52**

Paper 5 Planning, Analysis and Evaluation

**October/November 2009**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
<b>Total</b>	

This document consists of **7** printed pages and **1** blank page.



## 2

- 1 A definition of probiotics is: *'Live microorganisms which when administered in adequate amounts confer a health benefit to a person'*.

Lactic acid bacteria (LAB), which can be found in yoghurt, are commonly used as probiotics. The longer these bacteria survive in gastric juice (in the stomach) and intestinal juice (in the small intestine) the greater the benefit to the person.

The effect of immobilisation and continuous culture on the probiotic characteristics of the LAB bacterium *Bifidobacterium longum* was studied.

Two continuous culture systems were used:

**C1:** a control culture containing free bacteria,

**C2:** a test culture containing bacteria immobilised in beads.

The temperature of the fermenters was varied during the culture period.

Day 1–6	37°C
Day 7–13	35°C
Day 14 onwards	32°C

Samples were collected from each culture system at different times. These cells were tested for their tolerance to a variety of environmental stresses.

- (a) Suggest two variables in the fermenter that should be controlled. For each variable, suggest a method by which it might be controlled.

1. variable .....

method of control .....

.....

2. variable .....

method of control .....

.....[4]

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.....  
 .....  
 ..... [8]

- (b)** In a further investigation, the student collected pollen between 06.00h and 12.00h on a dry, hot day and estimated the number of pollen grains in  $1 \text{ m}^3$  of air.

The mean number of pollen grains visible in the field of view = 6

The area of the field of view =  $0.25 \text{ mm}^2$

The number of pollen grains in  $1 \text{ m}^3$  of air = 2800

Use the data collected by the student and the information in Fig. 2.1 to show how the student obtained this number. Show all the steps in your calculation.

[3]

- (c)** The student then collected pollen for the same time period on a wet, hot day.

The mean number of pollen grains visible in the field of view = 2

The chi-squared test at 1 degree of freedom showed that the results were significant at 0.05 probability.

- (i)** State a null hypothesis for the chi-squared test.

.....  
 ..... [1]

- (ii)** Explain why the student chose the chi-squared test.

.....  
 ..... [1]

- (iii)** Explain why the student used 1 degree of freedom.

..... [1]

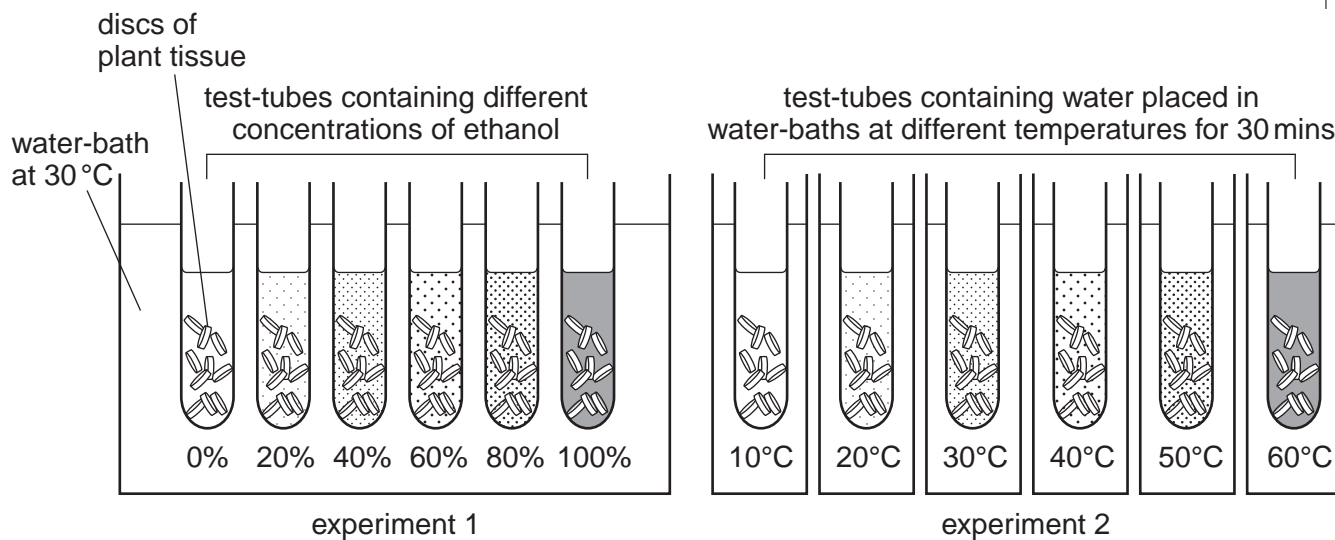
[Total: 14]

- 3 Discs of a plant tissue with cells containing a red pigment were cut and washed in running water for 24 hours. These discs were used by a group of students in an investigation to test the hypothesis:

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**Ethanol increases membrane permeability more than an increase in temperature.**

Fig. 3.1 shows the experimental set up used.



**Fig. 3.1**

After 30 minutes the liquid around the discs of plant tissue was poured into a colorimeter tube. A colorimeter with a blue filter was used to measure the absorbance of light. Water was used to standardise the absorbance of the colorimeter to 0.

The more red pigment in the liquid the higher the absorbance of light.

- (a) (i) Identify the two independent variables in the investigation.

1. ....

2. .... [2]

- (ii) Identify the dependent variable.

..... [1]

Table 3.1 shows the results of experiment 1.

**Table 3.1**

	absorbance at each ethanol concentration					
	0%	20%	40%	60%	80%	100%
student 1	0.00	0.12	0.21	0.35	0.65	0.70
student 2	0.10	0.10	0.22	0.32	0.60	0.75
student 3	0.00	0.18	0.20	0.38	0.59	0.72
student 4	0.00	0.18	0.35	0.35	0.65	0.76
student 5	0.15	0.10	0.18	0.34	0.62	0.75

Table 3.2 shows the results of experiment 2.

**Table 3.2**

	absorbance at each temperature					
	10 °C	20 °C	30 °C	40 °C	50 °C	60 °C
student 1	0.00	0.00	0.00	0.09	0.65	0.79
student 2	0.15	0.20	0.05	0.15	0.70	0.85
student 3	0.10	0.05	0.00	0.18	0.62	0.81
student 4	0.00	0.00	0.04	0.30	0.75	0.88
student 5	0.10	0.00	0.02	0.25	0.60	0.85

(b) (i) On Table 3.1, indicate by placing a circle around the value, **two** results that may be anomalous. [2]

(ii) Suggest why the design of this investigation does not provide reliable results to allow a conclusion to be made about the hypothesis.

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..... [2]

[Total: 7]

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