UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/31**

Paper 31 Advanced Practical Skills **May/June 2009**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

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.
You are advised to spend one hour on each question.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

You are reminded that you have only one hour for each question in the practical examination. You should read carefully through the whole of each question and then plan your use of the time to make sure that you finish all the work that you would like to do.

For Examiner's Use

You must record all your results and will not be penalised if these results are not as expected.

1 Yeast cells contain enzymes, which catalyse the breakdown of glucose to produce ethanol and carbon dioxide.
These products change the environment of the yeast cells and can affect their activity and survival.
The carbon dioxide when dissolved forms a weak acid so the more carbon dioxide that is released the more acid will be formed.

You are required to investigate the effect of different concentrations of ethanol on the activity of yeast cells by measuring the change in pH, using Universal Indicator paper.

You are provided with:

- five labelled tubes each containing 0.7 g of dried yeast
- at least 50 cm^3 ethanol, labelled **E**
- at least 100 cm^3 20% glucose solution, labelled **G**
- at least 100 cm^3 distilled water, labelled **W**

Ethanol is harmful and highly flammable. If any comes into contact with your skin, wash immediately under cold water.
It is recommended that you should wear eye protection.
Keep the ethanol covered when you are not using it.

It is important to find the pH of the glucose solution and the ethanol before starting the investigation.

Place a small piece of the Universal Indicator paper on a white tile.
Using a clean pipette, place a drop of glucose solution onto the paper.
Use the colour chart to identify the pH.
Repeat, after cleaning the pipette, to find the pH of ethanol.

(a) (i) Record the colour of the Universal Indicator paper and the pH for the glucose solution and the ethanol below.

[2]

Clean and dry the tile.

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You are going to change the independent variable, the concentration of ethanol.

Table 1.1 shows how to make up two of the concentrations you should use.

Table 1.1

volume of distilled water / cm^3	volume of ethanol / cm^3	percentage concentration of ethanol
10	0	0
6	4	40

(ii) Using the information in Table 1.1, decide which other concentrations to make and complete Table 1.2 including the concentrations from Table 1.1.

Table 1.2

tube number	volume of distilled water / cm^3	volume of ethanol / cm^3	percentage concentration of ethanol

[3]

Tubes **1** to **5** each contain the same mass (0.7 g) of dried yeast.

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1. **Adding the water before the ethanol,** use the syringes provided to make up the ethanol concentrations in the correct tubes.

2. Use the beaker, or other container provided, to make a water bath with warm water between 45 °C and 50 °C.

3. Shake the tubes carefully to thoroughly mix the ethanol and water.

4. Place the tubes into the warm water and leave them for **at least** 5 minutes.

5. Use the marker pen provided to label the white tile as shown in Fig. 1.1.

6. Arrange two rows of small pieces of Universal Indicator paper on the white tile as shown in Fig. 1.2.

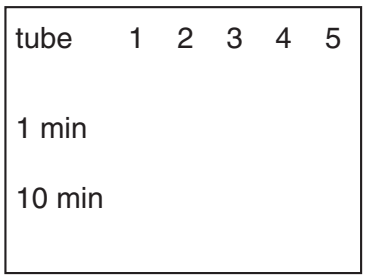

Fig. 1.1

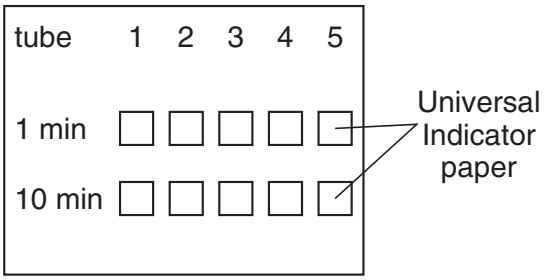

Fig. 1.2

7. After the tubes have been in the water bath for **at least five minutes** start a stopwatch or stop clock or note the time on a clock.

8. Use a clean 10 cm^3 syringe to put 10 cm^3 of the glucose solution into each tube starting with tube 1.

   Each time shake the tube well and return it to the warm water bath.

9. When the clock shows one minute, use the glass rod to remove a drop from the contents of tube 1 and place the drop onto the correct piece of Universal Indicator paper.

10. Clean the glass rod and use it to remove a drop as described in step 9 from the other four tubes.

11. When the clock shows 10 minutes, use the glass rod to take further drops as described in step 9.

(iii) Prepare the space below, to record both the colour of each piece of Universal Indicator paper and the pH.

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[4]

(b) (i) Identify a significant source of error in this investigation.

.....

..... [1]

(ii) You used syringes to measure the volumes of ethanol and water.

State the volume of the smallest division on the syringe ……

State the degree of uncertainty …… [1]

A student decided to investigate the effect of temperature on the activity of enzymes in yeast. The student measured the activity of the enzymes by counting the number of bubbles of carbon dioxide, which were released in three minutes.

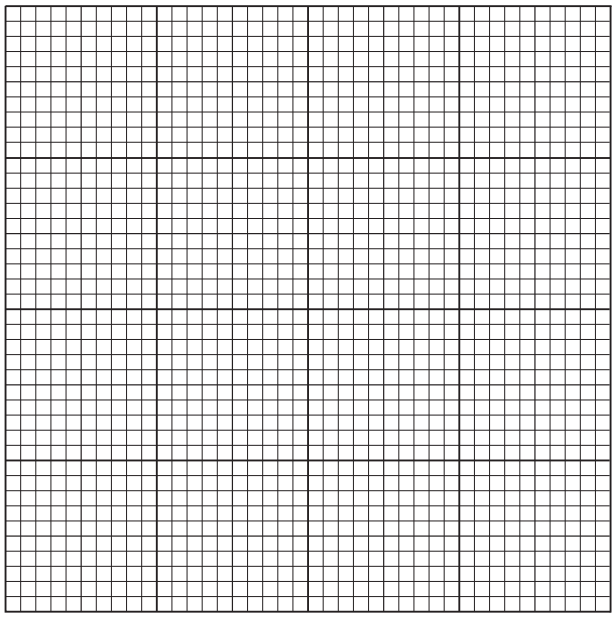
For Examiner's Use

The results of the student's investigation are shown in Table 1.3.

Table 1.3

temperature / °C	enzyme activity / mean number of carbon dioxide bubbles released per minute
15	5
20	7
30	11
35	15
40	18

(c) (i) Plot a graph of the data shown in Table 1.3.



[4]

(ii) From the graph, estimate the enzyme activity at 25 °C.

..... [1]

(iii) Suggest how the student should make sure that the results of this investigation are as accurate as possible,

.....

.....

.....

.....

as reliable as possible.

.....

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.....

..... [3]

In carrying out this investigation the student made the hypothesis that:

The activity of the enzymes in yeast increases as temperature increases.

(d) State whether you think that this hypothesis is supported by the student's results.

Explain your answer.

.....

.....

.....

..... [2]

[Total: 21]

2 **J1** is a slide of a stained transverse section of a plant organ.

For Examiner's Use

(a) Draw a large, low power, plan diagram of a quarter of the specimen as shown in Fig. 2.1.

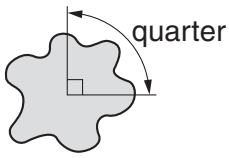

Fig. 2.1

Label the phloem and xylem in a vascular bundle.

[5]

(b) Fig. 2.2 is a photomicrograph showing some cells from a transverse section of a root viewed under high-power.

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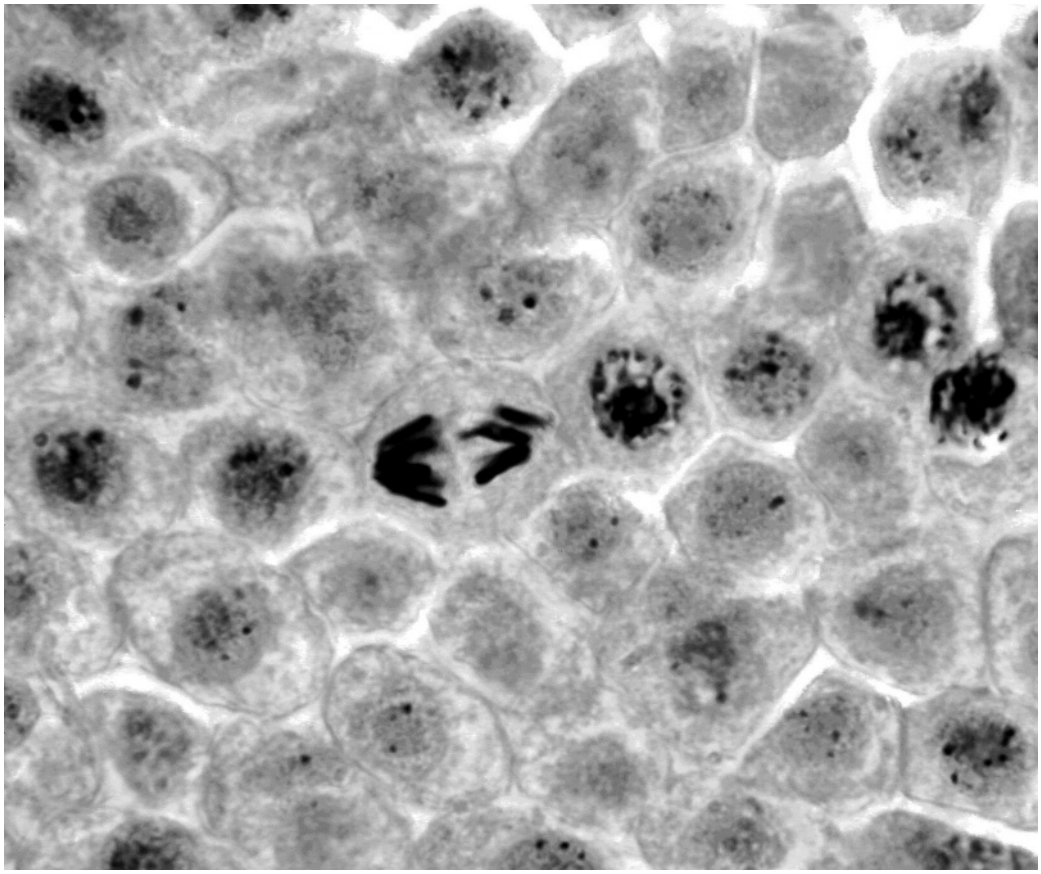

magnification ×400

Fig. 2.2

(i) Calculate the mean width of the cells shown in Fig. 2.2 in micrometres (μm).

Mark clearly on Fig. 2.2 the cells which you used in your calculation.

Show your working.

..... μm [4]

(ii) Fig. 2.3 is an outline of a longitudinal section of a root.

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Label with a label line and the letter **X**, the area on Fig. 2.3 from which the section shown in Fig. 2.2 may have been cut.

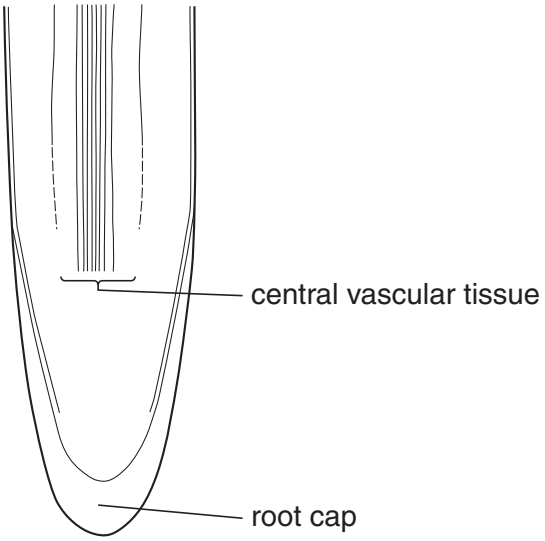
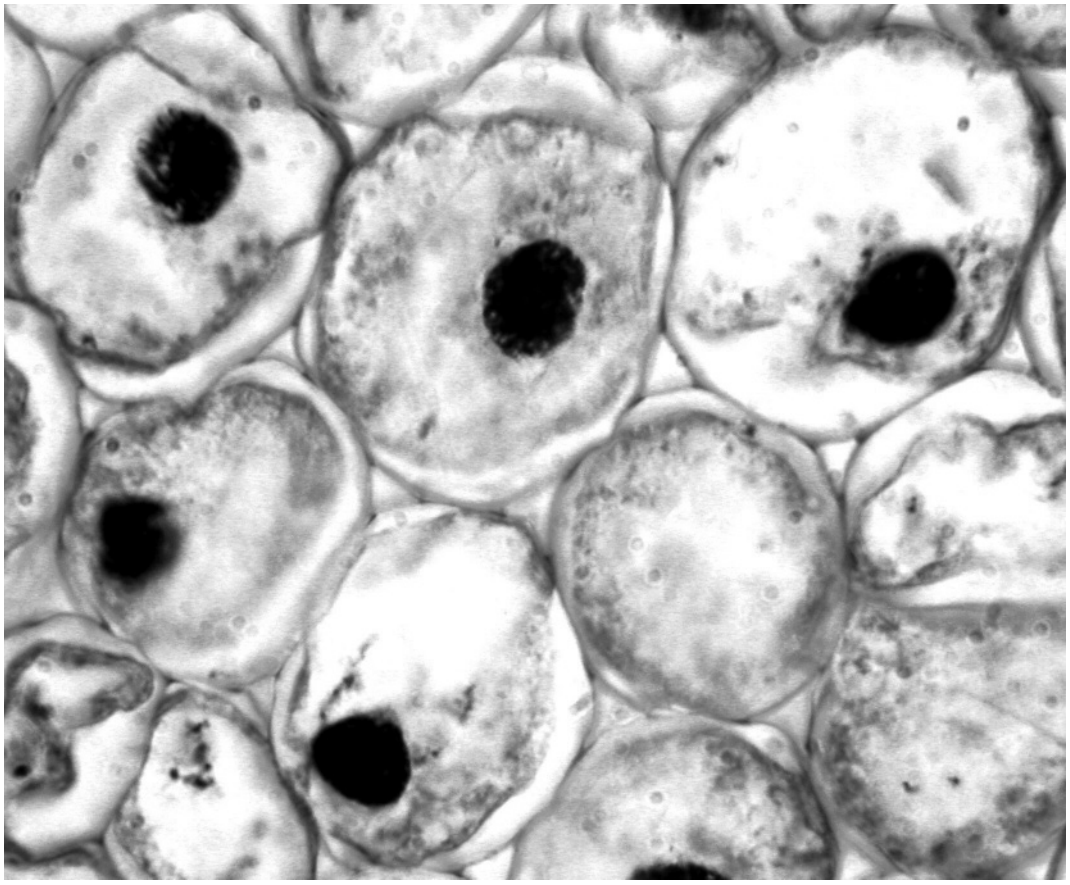


Fig. 2.3 [1]

Fig. 2.4 is a photomicrograph showing some cells from a transverse section from another part of the same root taken under high-power.



magnification ×400

Fig. 2.4

(c) From Fig. 2.4 make a large, labelled drawing of three complete cells which are touching and include at least one cell with a nucleus.

For Examiner's Use

Show clearly on Fig. 2.4 the three cells, which you have drawn.

[5]

(d) Prepare the space below so that it is suitable for you to show the differences between the cells shown in Fig. 2.2 and Fig. 2.4.

Record your observations in the space which you have prepared.

[4]

[Total: 19]

[Paper total: 40]

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