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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4565210539

BIOLOGY **9700/31**

Paper 31 Advanced Practical Skills **October/November 2007**

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 in the spaces provided on the Question Paper.
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 **both** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
You are advised to spend an hour on each question.
At the end of the examination, fasten all your work securely together.

For Examiner's Use	
1	
2	
Total	

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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 of the work that you would like to do.

1 The enzyme catalase is found in a wide range of living organisms. It catalyses the breakdown of hydrogen peroxide which is a highly reactive by-product of respiration.

$$2H_2O_2 \xrightarrow{\text{catalase}} 2H_2O + O_2$$

The rate of this reaction can be monitored by measuring the rate of bubble production of oxygen gas.

You are required to investigate the effect of potato tissue extract on hydrogen peroxide.

Take care. Hydrogen peroxide is corrosive when in contact with skin or eyes. Wear safety glasses while performing this experiment.

You are provided with 40 cm^3 of water, labelled **beaker 1**.
You are provided with 20 cm^3 of 20 vol H_2O_2, labelled **beaker 2**.
You are also provided with 10 cm^3 of potato tissue extract containing catalase, labelled **C**.

You are going to make a serial dilution of the 20 vol H_2O_2.

- Label two small beakers **3** and **4**.
- Into beaker **3** place 10 cm^3 of 20 vol H_2O_2 from **beaker 2**.
- Add an equal volume of water from **beaker 1** to produce 10 vol H_2O_2.

- Into beaker 4 place 10 cm^3 of 10 vol H_2O_2 from **beaker 3**.
- Add an equal volume of water from **beaker 1** to produce 5 vol H_2O_2.

You are provided with the apparatus as shown in Fig. 1.1.

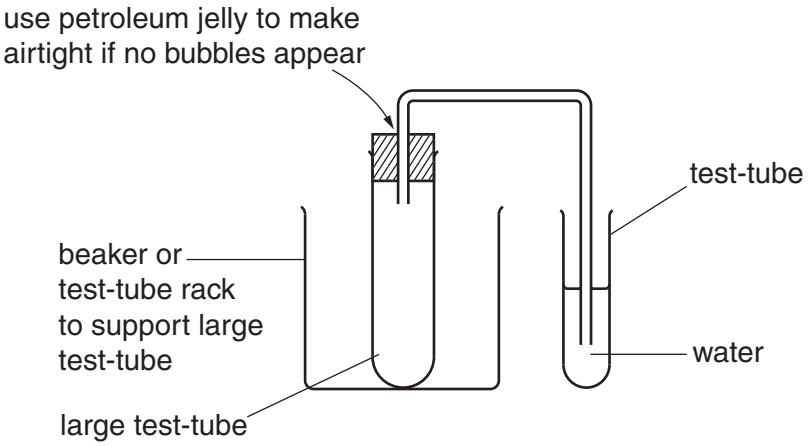

Fig. 1.1

- Place 4 cm^3 of 20 vol H_2O_2 from **beaker 2** into the large test-tube. Add 1 cm^3 of potato extract solution **C**. **Immediately** place the bung of the delivery tube firmly into the large test-tube. Bubbles of gas should come from the end of the delivery tube.
- If no bubbles appear then use petroleum jelly to make the delivery tube airtight.

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(a) Determine the number of bubbles produced in an appropriate length of time.

Repeat the process with solutions from beakers **1**, **3** and **4**.

(i) Record your results in the space below.

[2]

(ii) Identify the most significant source of error in the collection of your data.

.....

.....[1]

(iii) Describe how you could modify your experiment to make the results more reliable.

.....

.....

.....

.....[3]

(b) A student carried out a similar experiment. The student used a constant concentration of hydrogen peroxide but used **pieces** of potato tissue of varying surface area.

(i) Describe how you would prepare the potato pieces.

.....

.....

.....

.....[3]

Table 1.1 shows the data the student recorded.

Table 1.1

volume of potato tissue / cm^3	surface area of potato tissue / cm^2	time taken to produce 40 cm^3 of gas / secs
1	1	180
1	2	110
1	4	62
1	8	27

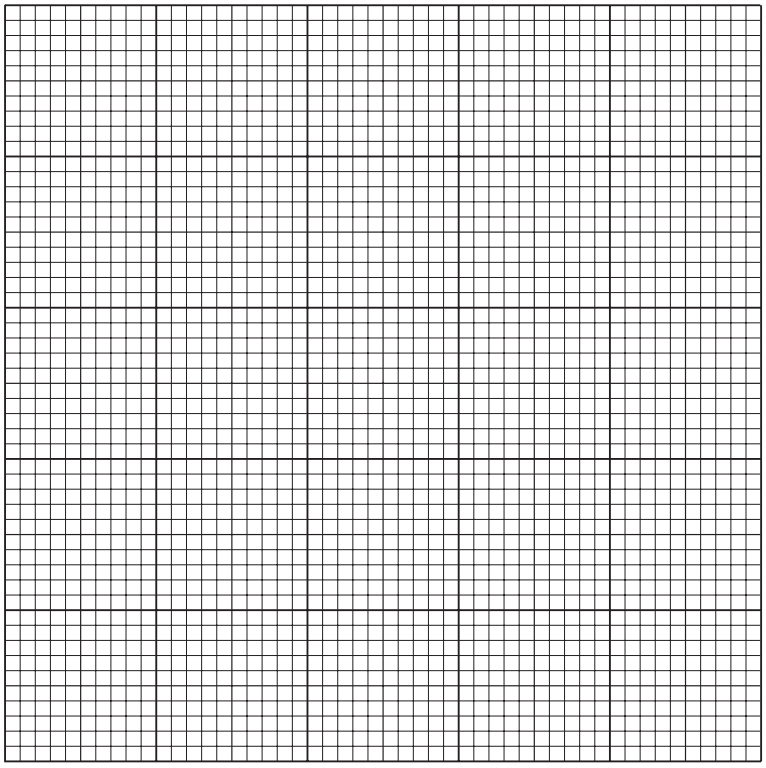
(ii) Suggest a control for this experiment.
Give a reason for this control.

.....

.....

.....[2]

(iii) Plot a graph of the student's data on the grid below to show the effect of surface area on gas production.



[4]

(iv) Describe the pattern shown by the results.

.....

.....[1]

(v) Using your knowledge of enzymes and the information provided, explain the pattern shown by the results.

.....

.....

.....[2]

(vi) Use your graph to determine the time taken for a piece of potato of 5.5 cm^2 to evolve 40 cm^3 of gas.

.....[2]

(vii) Calculate the rate of reaction in cm^3 of gas per second for a piece of potato of 5.5 cm^2.

.....[1]

(c) Describe how you would set up and perform a similar experiment to determine the effect of temperature on the rate of the reaction.

.....

.....

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.....

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.....

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.....

.....

.....[4]

[Total: 25]

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2 **(a)** You are provided with a stage micrometer scale on a microscope slide.
The 1 cm stage scale is divided into 100 divisions.
The length of each division is 0.1 mm.

Calculate the length of each division **in micrometres**.
Show your working.

.....μm [1]

(b) **(i)** Your microscope has been fitted with an eyepiece graticule. **J1** is a transverse section of a stem. Carefully examine the section under the high-power of your microscope. Put a ring around the number written on the objective lens.

×40 4 mm $\frac{1}{6}''$ other .....

Identify a large, empty xylem vessel and adjust the slide so that the xylem vessel is in the centre of your field of vision.

Count the number of divisions of the eyepiece graticule across the diameter of the xylem vessel.

number of divisions .....

(ii) Remove the slide and replace it with the stage micrometer scale.
Using the same magnification, adjust the focus until you can see the eyepiece graticule on top of the stage scale.

Explain why the stage scale appears larger than the eyepiece graticule.

.....

.....

.....[1]

(iii) Count the number of eyepiece graticule divisions that fit into one stage scale division.

number of eyepiece graticule divisions .....

Use this information to calculate the actual width between each division on the eyepiece graticule.
Show your working.

.....[2]

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(iv) Calculate the actual diameter of the xylem vessel.

.....[2]

(c) Make a large, low-power, labelled plan diagram of **one quarter** the section, **J1**.

[5]

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(d) Make a large, high-power, labelled drawing to show the cells present in a vascular bundle including a phloem sieve tube and the cells immediately next to it. No more than eight cells should be drawn.

[4]

[Total: 15]

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