UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **5090/06**

Paper 6 Alternative to Practical **May/June 2008**

1 hour

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 work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE ON ANY BARCODES.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
You may use a pencil for any diagrams, graphs or rough working.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
Total	

This document consists of **10** printed pages and **2** blank pages.

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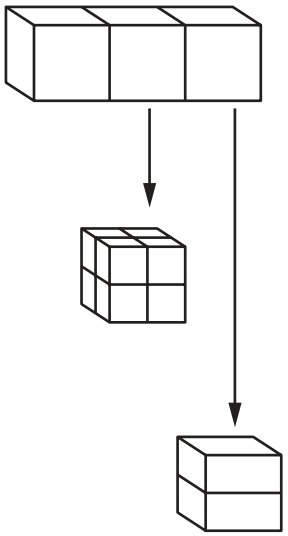
1 The maximum size of most living cells is determined by the ratio of their surface area to their volume. As cells increase in size, their volume increases proportionally more than their surface area, thus limiting the ability of the surface area to supply the cell with all the nutrients the cell needs.

A student investigated the relationship between the volume and surface area in model cells made of red-coloured agar jelly and the absorption of a liquid by those model cells using the method outlined below.

The student was provided with a piece of red-coloured agar, labelled **A1** and a solution, labelled **A2**.

These are the instructions that the student used.

- Using a sharp knife or scalpel, cut the agar block into three cubes, each approximately 1 cm × 1 cm × 1 cm.
- Place one of these cubes into a large test-tube.



- Cut one of the remaining cubes into 8 blocks so that each block is approximately 0.5 cm × 0.5 cm × 0.5 cm.
- Put all 8 blocks into another large test-tube.

- Cut the remaining cube into two equal pieces.
- Put these two equal pieces into a third large test-tube.

The agar blocks in the test-tubes are the model cells.

The student added solution **A2** to each test-tube knowing that, as this solution diffused into the agar, the agar would change colour from red to pale orange.
The student measured the time taken for each of the model cells in each of the test-tubes to change colour completely after **A2** was added.

This is what the student recorded.

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> The largest block took 8 and $\frac{1}{2}$ minutes to completely change colour.
> The eight smallest blocks changed colour the quickest and took 45 seconds.
> The two equal sized slices took 3 minutes and 45 seconds.

(a) Prepare a table in the space below in which to record

- the **total** surface area of the blocks in each test-tube,
- the time taken for the colour change.

Transfer the information the student recorded into your table.
Carry out any calculations needed and complete the table.

[5]

(b) The student carried out a similar experiment and went on to compare the surface area to volume ratio with the time taken for the blocks to lose their red colour.

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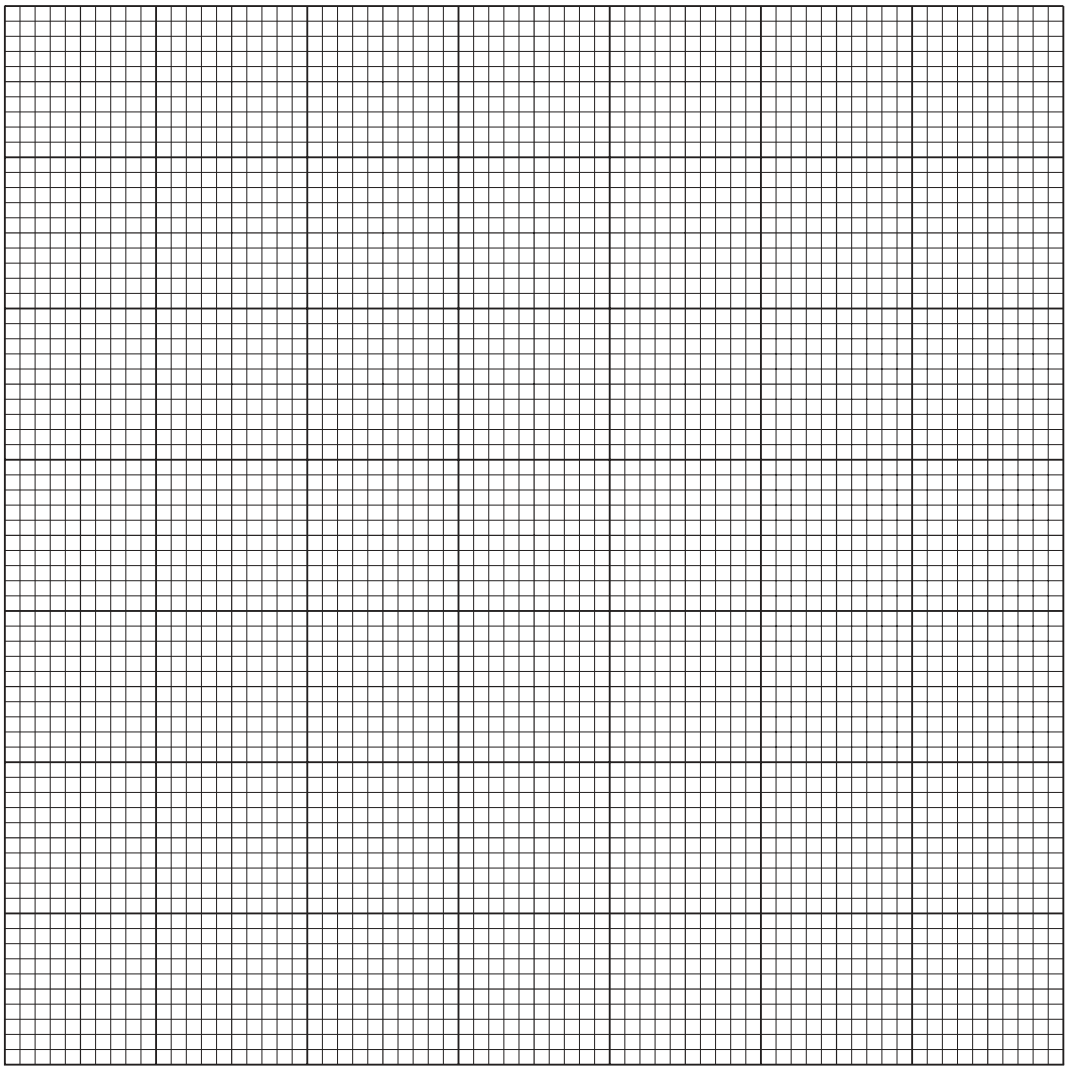
The results are shown in Table 1.1.

Table 1.1

$\frac{\text{surface area}}{\text{volume}}$	time / secs
1.5	120
2	105
3	84
4	60
6	30

(i) Construct a graph of these results on the grid below.



[5]

(ii) State the relationship between the surface area to volume ratio of the blocks and the time taken for substances to diffuse into them that is shown by the graph you have drawn.

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..... [1]

(c) Suggest **two** possible sources of experimental error, other than variations in temperature, which may have affected the results of the investigation.

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..... [2]

(d) Describe how the structure and function of a living animal cell differs from the model cells in the movement of substances into the cell.

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..... [2]

[Turn over

(e) Design an experiment to investigate the effect of temperature on the time taken for a block of agar to change colour when placed in **A2**.
Include full practical details.

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You may use the space below to draw a diagram if you wish.

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.....[6]

[Total : 21]

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2 A student was provided with two leaves, **L1** and **L2**, as shown in Fig. 2.1 and Fig. 2.2 from the same plant. Both had been kept under the same conditions.

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L1

Fig. 2.1

After it had been picked, leaf **L1** has received no treatment.

(a) (i) Make a large, labelled drawing of leaf **L1**, in Fig. 2.1.

[4]

(ii) Measure and record the width of **L1** in Fig. 2.1 at its widest point.

width of **L1** .....

Draw a straight line across the widest point of **L1** on your **drawing**.

Measure and record the length of your line.

length of line .....[2]

(iii) Calculate the magnification of your drawing.
Show your working.

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magnification .....[2]

L2

Fig. 2.2

After it had been picked, Leaf **L2** was tested for starch by being

- dipped in boiling water,
- heated in alcohol,
- placed in iodine solution.

(b) Suggest why each of the following processes was performed on **L2**.

(i) Dipped in boiling water .....

.....[1]

(ii) Heated in alcohol .....

.....[1]

(iii) Placed in iodine solution .....

.....[1]

(c) **L1** was a leaf at the beginning of an experiment and **L2** was a leaf at the end of that experiment. Give a full explanation for any conclusions than can be made from this experiment.

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.....[3]

(d) Fig. 2.3 is a photomicrograph of a section through another dicotyledonous leaf.

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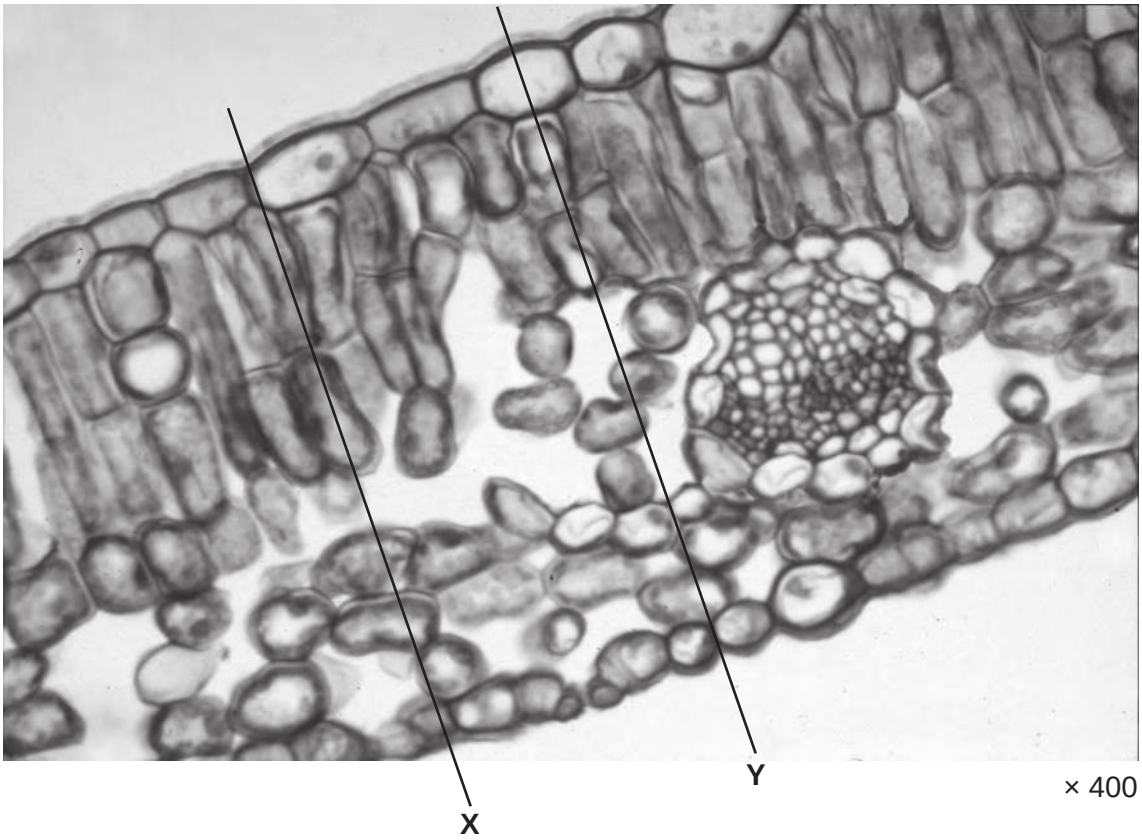

Fig. 2.3

Make a large, labelled drawing of the cells between lines labelled **X** and **Y**.

[5]

[Total : 19]

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