Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

BIOLOGY

Paper 6 Alternative to Practical

May/June 2014

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 the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of 12 printed pages.
1 A student investigated the effect of surface area on the rate of digestion of food by observing the color change in agar jelly pieces placed in dilute sulfuric acid.

The student was provided with a Petri dish of agar jelly. The agar jelly contained Universal Indicator that changed color according to the pH of its environment.

<table>
<thead>
<tr>
<th>RED pH1</th>
<th>ORANGE</th>
<th>BLUE pH10</th>
</tr>
</thead>
</table>

The student was also provided with a beaker of sulfuric acid.

When a small piece of agar jelly was put into the beaker of dilute sulfuric acid, it gradually changed color.

(a) Suggest what color the agar jelly became after it changed color in the dilute sulfuric acid.

It started orange and changed to .................................................................[1]

The student cut four identical blocks of agar jelly, each 2 cm × 1 cm × 1 cm, as shown in Fig. 1.1.

![Fig. 1.1](image)

The student labelled the agar blocks A, B, C and D.
The blocks of agar jelly were then cut up as shown in Fig 1.2.

<table>
<thead>
<tr>
<th>block</th>
<th>view of block from above showing cuts that were made</th>
<th>total number of pieces after cutting</th>
<th>total surface area of all pieces/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><img src="image" alt="Block A" /></td>
<td>1</td>
<td>........................................</td>
</tr>
<tr>
<td>B</td>
<td><img src="image" alt="Block B" /></td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>C</td>
<td><img src="image" alt="Block C" /></td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>D</td>
<td><img src="image" alt="Block D" /></td>
<td>8</td>
<td>20</td>
</tr>
</tbody>
</table>

**Fig. 1.2**

The student calculated the total surface area of all the pieces cut from each block.

(b) (i) Calculate the surface area of block A.

Show your working.

surface area of block A ........................................ cm² [2]
(ii) Calculate the volume of block A.

Show your working and include the units.

volume of block A ...........................................................[2]

The student labelled four large test-tubes, A, B, C and D.

The student put all the agar pieces that had been cut from each agar block, A, B, C and D, into the large test-tube that was labelled with the same letter as the agar block.

This is shown in Fig. 1.3.

Fig. 1.3

The student poured sulfuric acid into each large test-tube and timed how long it took for all the pieces of agar jelly in each large test-tube to change colour.

The student wrote down their results.

Block A took 12 minutes to change.
Block B took 6 minutes 25 seconds.
Block C took 2 minutes 40 seconds.
Block D took 4 minutes 10 seconds.
(c) (i) State two pieces of apparatus, not shown in Fig. 1.3, that the student needed to use for this investigation.

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

(ii) Use the space below to draw a suitable results table for this investigation.

...................................................................................................................................................

...................................................................................................................................................

...................................................................................................................................................

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...................................................................................................................................................

...................................................................................................................................................

...................................................................................................................................................

.............................................................................................................................................. [4]

(d) Describe and explain the results.

.......................................................................................................................................................... [5]
(e) Explain why it was important for blocks A, B, C and D to have the same volume at the start, before they were cut into pieces.

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

(f) Suggest two possible sources of errors in the investigation.

For each error, describe one way that you could improve the investigation.

error 1 ............................................................................................................................................
....................................................................................................................................................
improvement 1 ..........................................................................................................................
....................................................................................................................................................

error 2 ........................................................................................................................................
....................................................................................................................................................
improvement 2 ..........................................................................................................................
.................................................................................................................................................... [4]

(g) The surface area of food particles affects the rate of their break down.

A student carried out an experiment to investigate the rate of the break down of fat.

Two test-tubes were set up as shown in Table 1.1.

Each test-tube contained the same volumes and concentrations of enzyme.

<table>
<thead>
<tr>
<th>test-tube</th>
<th>contents of test-tube</th>
<th>time taken for break down of fat / min</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>fat + enzyme + water</td>
<td>8</td>
</tr>
<tr>
<td>F</td>
<td>fat + enzyme + bile</td>
<td>3</td>
</tr>
</tbody>
</table>
(i) Suggest a reason for the difference in results recorded in Table 1.1.

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
........................................................................................................................................... [2]

(ii) Another student carried out a similar experiment but also included a test-tube that contained fat and water only.

Suggest a reason for this additional test-tube.

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

[Total: 23]
2 The outline of a leaf has been drawn on the grid in Fig. 2.1.

Fig 2.1

(a) Label *two* features of the leaf shown in Fig. 2.1.  [2]
(b) (i) Use the grid to estimate the area of the surface of the leaf shown in Fig. 2.1.

Each square of the grid has an area of $1 \text{ cm}^2$.

................................................... $\text{cm}^2$ [1]

(ii) Suggest one way to improve the accuracy of this method of calculating the surface area of a leaf.

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

(c) The two leaves, G and H, shown in Fig. 2.2 are from the same plant.

![Fig. 2.2](image)

One of the leaves was from higher up the plant, in full sunlight.

The other leaf was from lower down the plant, in the shade.

Suggest and explain which leaf is from lower down the plant, in the shade.

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
........................................................................................................................................... [2]
(d) Table 2.1 shows the results of an investigation into the relationship between the total surface area of the leaves on a plant and the volume of water lost from the plant.

Table 2.1

<table>
<thead>
<tr>
<th>total surface area of leaves / m²</th>
<th>volume of water lost from plant per day / dm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>4.5</td>
</tr>
<tr>
<td>0.10</td>
<td>6.5</td>
</tr>
<tr>
<td>0.15</td>
<td>8.0</td>
</tr>
<tr>
<td>0.20</td>
<td>10.0</td>
</tr>
<tr>
<td>0.25</td>
<td>12.5</td>
</tr>
</tbody>
</table>

(i) Plot a graph of the data in Table 2.1 on the grid below. Draw a straight line of best-fit.
(ii) Describe the trend shown by the results.

...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
...........................................................................................................................................
........................................................................................................................................... [2]

(e) Fig. 2.3 shows the lower surface of a leaf as seen under a microscope.

![Fig. 2.3](image)

*Fig. 2.3*

**JK** shows the length of a stoma in Fig. 2.3.

Measure the length of **JK**.

length of **JK** ................................................ mm

Calculate the actual length of the stoma.

Show your working.

actual length of stoma ........................................ mm [3]
A student investigated how light intensity affected the rate of water loss from a leaf.

Suggest two variables that the student would control in their investigation.

1. ................................................................................................................................................
   ...................................................................................................................................................

2. ................................................................................................................................................
   ...................................................................................................................................................

[Total: 17]