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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **9700/33**

Advanced Practical Skills 1 **May/June 2011**

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 ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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.

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.

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You should:

- Read carefully through **the whole** of each question.
- Plan your use of **the time** to make sure that you finish all the work that you would like to do.

You will **gain marks** for recording your results according to the instructions.

1 Urea reacts with water to form ammonium carbonate.

$$\text{urea} + \text{water} \longrightarrow \text{ammonium carbonate}$$

Enzyme **E** catalyses this reaction.

Aqueous ammonium carbonate produces ammonium ions. This forms an alkaline solution which causes red litmus paper to turn blue. This will be used to indicate the end-point of the reaction.

Animals release urea into the soil in urine and ammonium carbonate is produced as part of the nitrogen cycle.

You are provided with:

labelled	contents	hazard	concentration / %	volume / cm^3
E	urease solution	irritant	10	25
W	distilled water	none	–	100
U	urea solution	none	–	25

labelled	contents	hazard	details	quantity
red litmus paper	–	–	total length of about 5 cm	1 strip

You are required to investigate the independent variable, enzyme **E** concentration on the formation of ammonium carbonate.

You are required to carry out a serial dilution of enzyme **E**, to reduce the concentration of the enzyme solution by half between each successive dilution.

Fig. 1.1 shows how to make the first concentration of 5% enzyme **E** solution.

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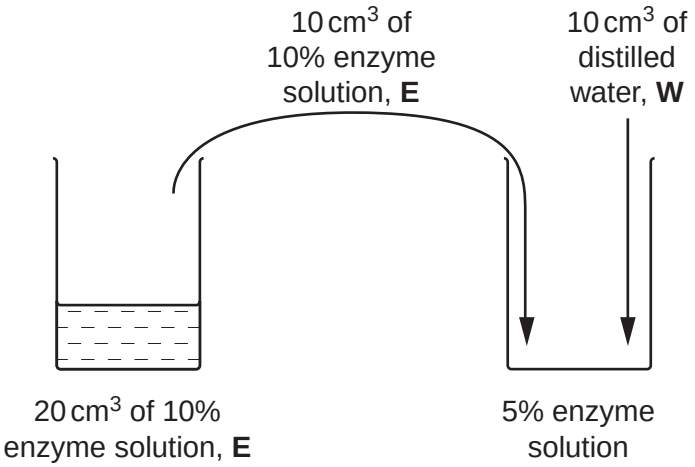

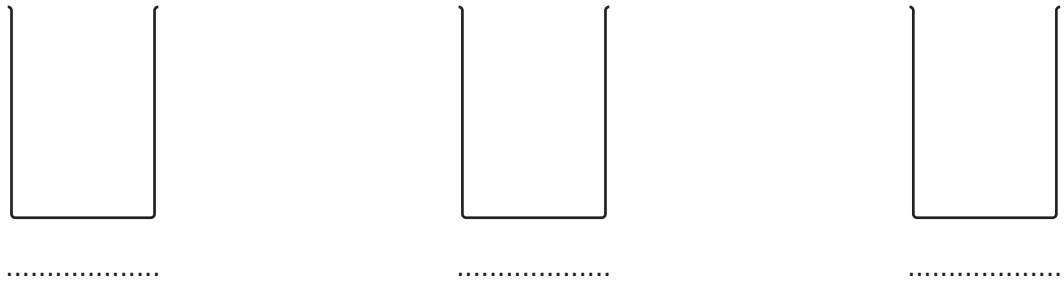

Fig. 1.1

(a) (i) Complete Fig. 1.1 to show how you will make **three** further concentrations of enzyme **E** solution. [3]

As part of this investigation you are required to set up a suitable control.

(ii) Describe how you will set up this control using the apparatus provided.

.....

..... [1]

Proceed as follows:

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1. Prepare the concentrations of **E** as shown in Fig. 1.1 in the containers provided.

2. Label test-tubes with the concentrations of **E** and the **control**.

3. Cut the red litmus paper into lengths of 0.5 cm. Add one piece of litmus paper to each test-tube.

4. Put 2 cm^3 of **U** into each test-tube.

5. Put 2 cm^3 of the **lowest** concentration of **E** into the labelled test-tube and mix well.

6. Repeat step 5 with each of the other concentrations of **E** and the control. Immediately start timing.

7. Record the time taken for the first appearance of blue colour in each piece of litmus paper. This is the end-point of the reaction.
   If a piece of litmus paper does not reach the end-point in ten minutes, record 'more than 600' for that dilution as your result.

(iii) Prepare the space below and record your results.

[5]

(iv) Calculate the rate of reaction for the 10% **E** concentration.

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rate of reaction .....[1]

(v) Identify **one** significant error in your investigation.

.....

.....[1]

(vi) Suggest how you would make **two** improvements to this investigation.

.....

.....

.....

.....

.....[2]

An investigation on global nitrogen fixation, from 1990 to 2000, studied the quantities of nitrogen fixed by different methods.

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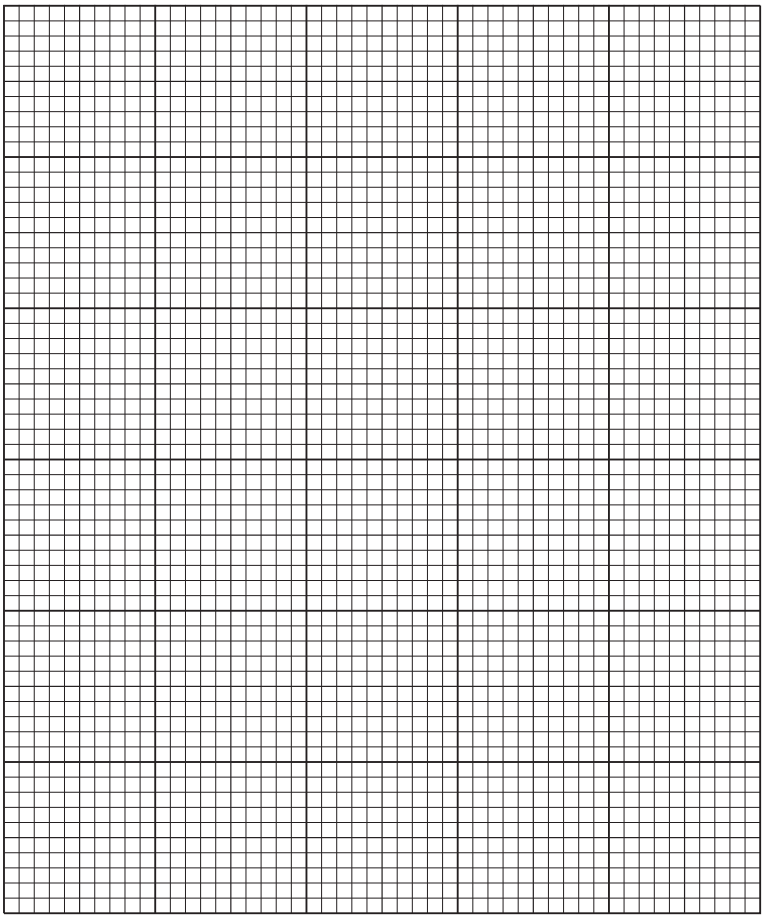
The results are shown in Table 1.1.

Table 1.1

method of fixation	example of method	nitrogen fixed / millions tonnes of nitrogen per year
industrial (I)	formation of nitrogen dioxide e.g. car engines	23
agricultural (A)	fixation by leguminous plants e.g. peas and beans	39
depositional (D)	fixation by lightning	54
natural (N)	fixation in any uncultivated areas e.g. lakes, woodlands, seas	108
fertiliser production (F)	production of inorganic fertilisers e.g. ammonium nitrate	77

(b) (i) Plot a chart of the data shown in Table 1.1.



[4]

Natural fixation in the years 1840–1850 was 123 million tonnes per year.
Natural fixation in the years 1990–2000 was 108 million tonnes per year.

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(ii) Calculate the percentage decrease from 1840–1850 to 1990–2000.

You may lose marks if you do not show your working.

.....% [2]

(iii) Suggest **one** reason for the difference in the natural fixation between 1840–1850 and 1990–2000.

.....

.....

.....[1]

[Total: 20]

2 **K1** is a slide of a stained transverse section through a leaf.

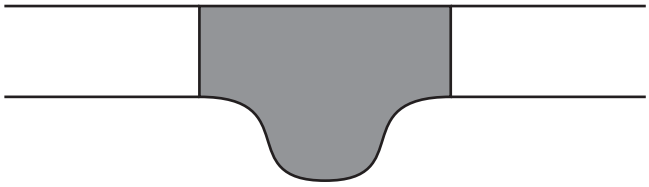

Fig. 2.1

(a) **(i)** Draw a large plan diagram of the part of the leaf indicated by the shaded area in Fig. 2.1.

Label the vascular bundle and the palisade layer.

[5]

(ii) From **K1**, make a large drawing of one epidermal cell with one attached, whole trichome (hair).

Label the trichome (hair) and the epidermal cell.

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[5]

(iii) State **two** observable features of **K1** which support the conclusion that this is a leaf from a plant growing in a dry habitat.
Explain how these features reduce water loss.

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.....

.....

.....[2]

Fig. 2.2 is a photomicrograph of a transverse section of a leaf from a different plant species.

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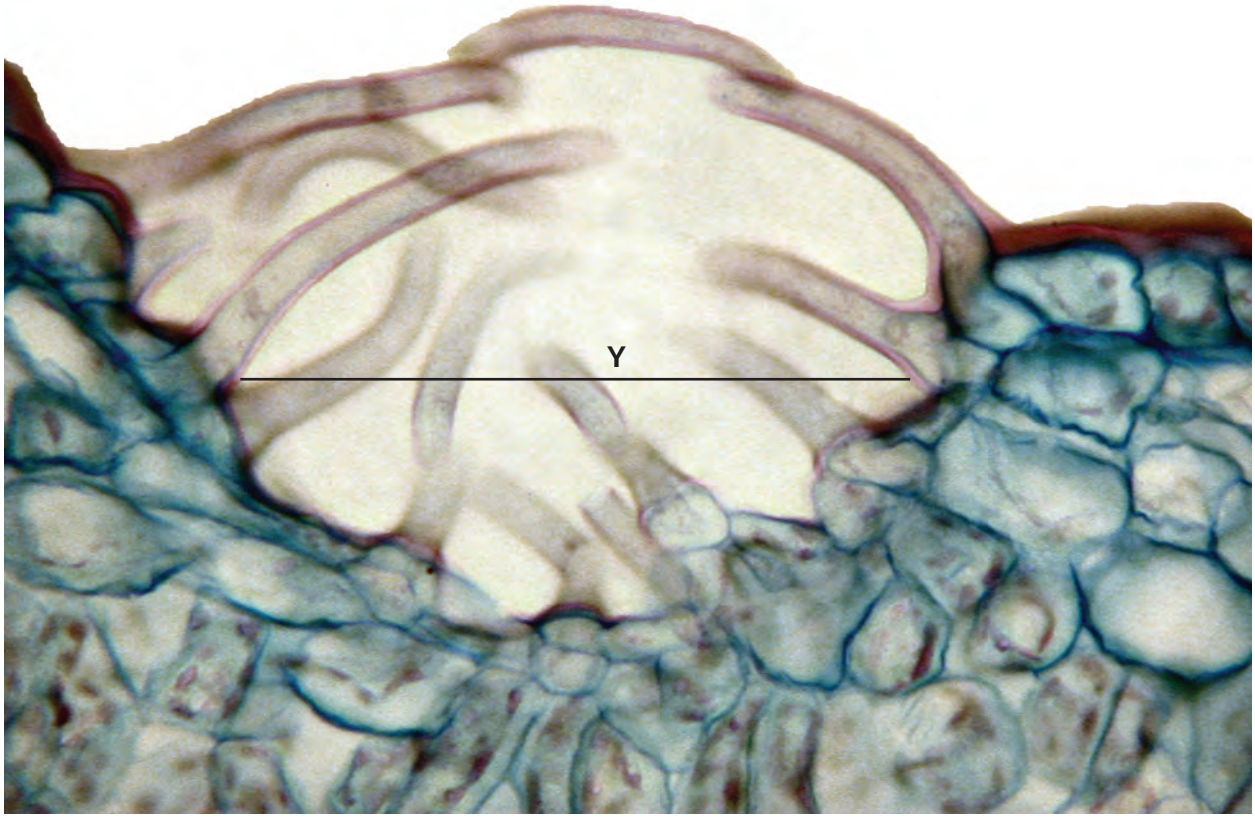

magnification × 350

Fig. 2.2

(b) (i) Use the magnification to calculate the **actual length** of line **Y** in μm.

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

.....μm [3]

(ii) Prepare the space below so that it is suitable for you to record the observable similarities and differences between the specimens on **K1** and in Fig. 2.2.

Record your observations in the space you have prepared.

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[5]

[Total: 20]

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