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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

4591537489

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 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.

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1	
2	
Total	

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

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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 Question 1 and Question 2.
- 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 Substrate **S** reacts with water as shown in the following equation:

substrate **S** + water $\longrightarrow$ product

Enzyme **E** catalyses this reaction.

You are provided with:

labelled	contents	hazard	percentage concentration	volume / cm^3
E	enzyme	irritant	–	20
S	substrate	irritant	0.1	20
P	phenolphthalein solution	irritant	–	20
W	distilled water	none	–	100

The product forms an alkaline solution which causes phenolphthalein to turn pink.
The first appearance of the pink colour will be used to indicate the end-point of the reaction.

You are required to investigate the independent variable, concentration of substrate solution, **S**.

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

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Fig. 1.1 shows how to make the first concentration of 0.05% substrate solution.

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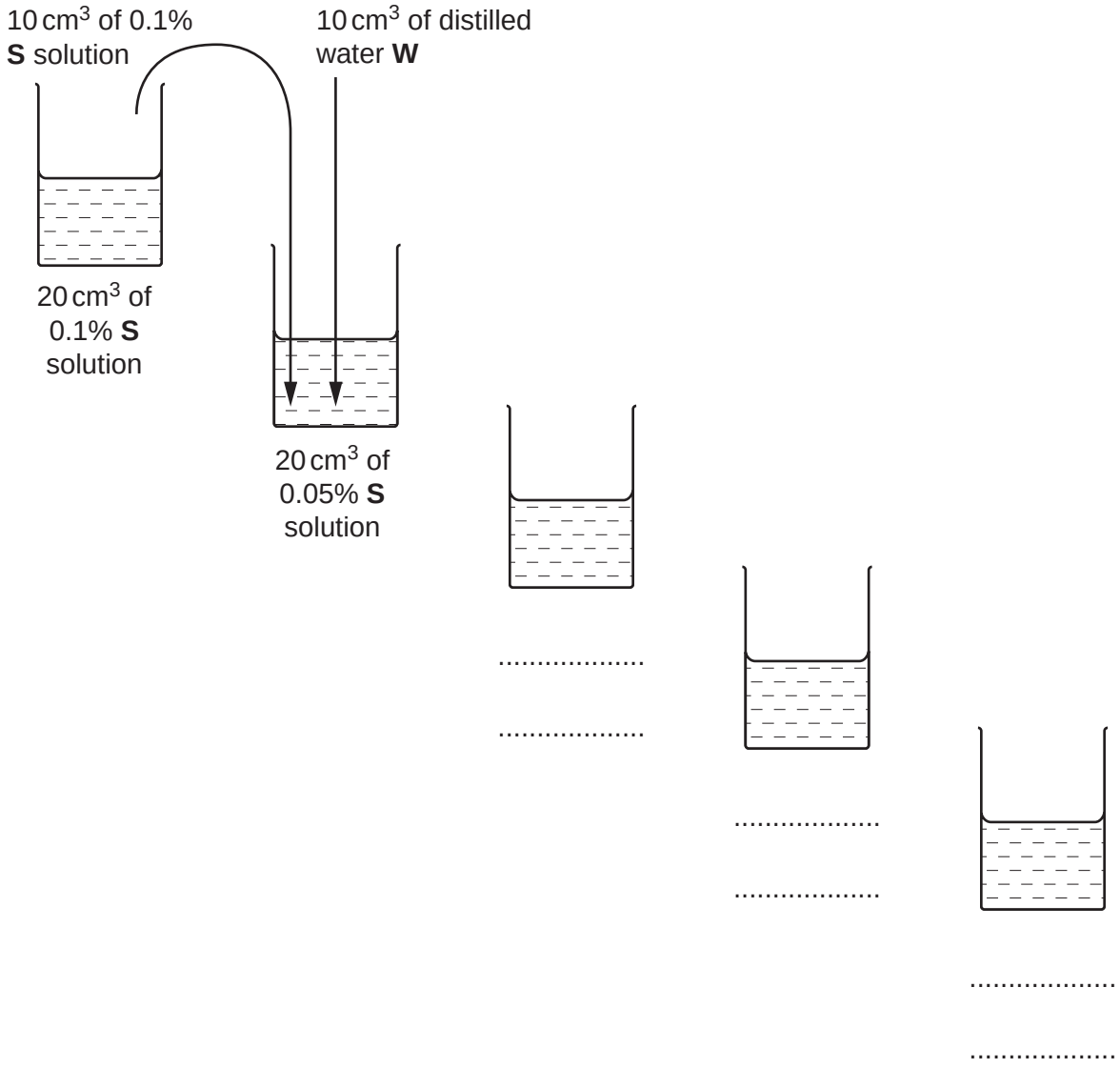


Fig. 1.1

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

Proceed as follows:

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1. Prepare the concentrations of substrate solution as shown in Fig. 1.1, in the containers provided.

2. Put 2 cm^3 of 0.1% substrate solution, **S** into a labelled test-tube.

3. Put 0.5 cm^3 of phenolphthalein solution into the same test-tube.

4. Put 1 cm^3 of enzyme **E** into the same test-tube. Mix and start timing.

5. Record the time taken to reach the end-point of the reaction.

If the end-point is not reached at ten minutes, record 'more than 600' for that concentration.

6. Repeat steps 2 to 5 with each of the concentrations of substrate solution.

(ii) Prepare the space below and record your observations.

[5]

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(iii) State **one** variable which should have been controlled and how you could modify this procedure so that this variable would be controlled.

.....

.....

..... [1]

(iv) Describe **two** ways in which the accuracy of the results could be improved.

.....

.....

.....

.....

..... [2]

A student investigated the effect of an inhibitor on an enzyme.
A strip of agar gel containing **the enzyme and its substrate** was produced. The enzyme breaks down (hydrolyses) the substrate to release a product which stains black when a dye is added.

Small drops (2μl) of different concentrations of the inhibitor were put onto the surface of the agar gel strip. After 10 minutes the agar gel strip was treated with the dye.

Fig. 1.2 shows a diagram of the strip of agar gel after adding the dye. This is not to scale.

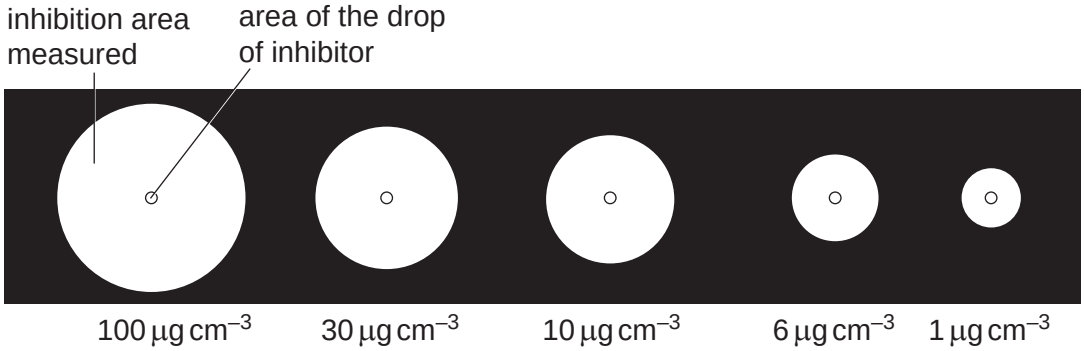


Fig. 1.2

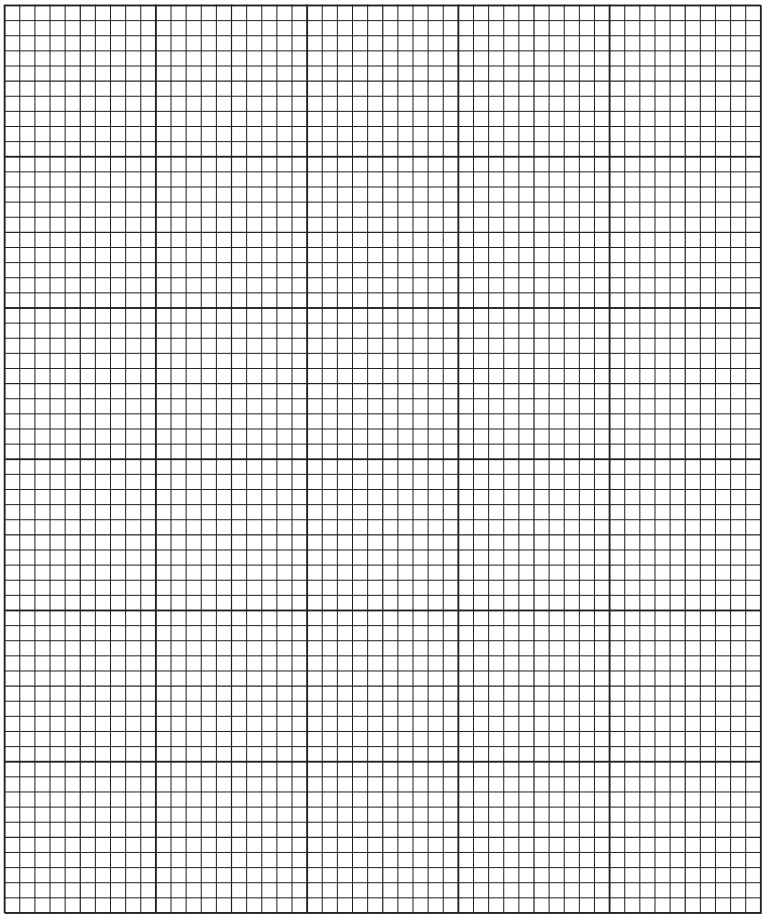
The student's results are shown in Table 1.1.

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Table 1.1

concentration of inhibitor / $\mu g\,cm^{-3}$	inhibition area / mm^2
1	30
6	50
10	70
30	106
100	120

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



[4]

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(ii) Estimate the concentration of inhibitor which would produce an inhibition area of 100 mm^2. Show on your graph where you obtained the estimate.

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concentration ..... $\mu g\,cm^{-3}$ [1]

(iii) Describe the trend shown in your graph.

.....

.....

.....

.....

.....[2]

(iv) Explain the effect of changing the concentration of the inhibitor.

.....

.....

.....

.....

.....[2]

[Total: 20]

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

The genus of this plant is found in Europe, Asia, Africa and Australia.

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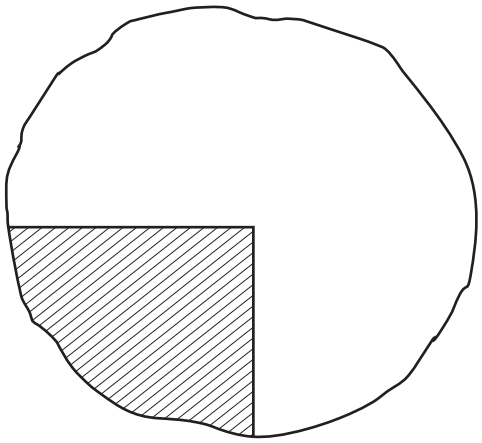


Fig. 2.1

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

Label the epidermis.

[5]

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In this stem, crossing the air space, are chains of cells which are attached to the tissue surrounding the vascular bundle.

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Select a chain of cells which is attached by only **one** cell to the tissues surrounding the vascular bundle. The cells should have distinct cell walls and cell contents.

(ii) Make a large drawing of

- two adjacent (touching) chain cells and
- one cell that attaches these two cells to the tissue surrounding the vascular bundle.

There should be only one group of **three** cells in your drawing.
Label a cell wall.

[5]

(iii) Suggest **one** observable feature of **J1** which supports the conclusion that this is a stem from a plant living in water.

Suggest how this feature may help the plant to live in water.

.....

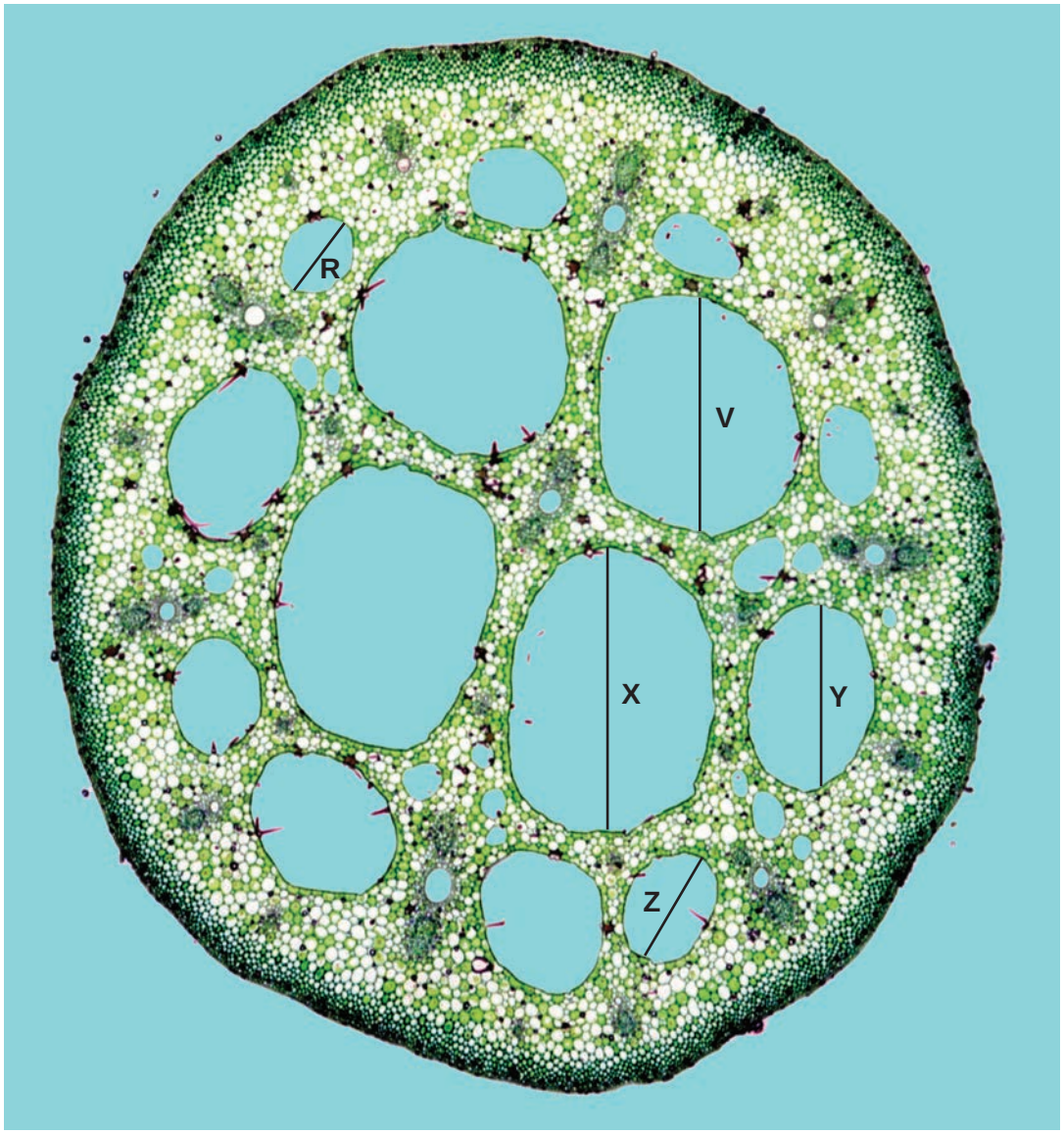
.....[1]

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Fig. 2.2 is a photomicrograph of a transverse section of a stem from a different plant species. The genus of this plant is found in Europe, North Africa and the Middle East.

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To find the mean length of an air space, a student measured five air spaces, as shown in Fig. 2.2.



magnification x 30

Fig. 2.2

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(b) (i) Use the magnification to calculate the mean actual length, in μm, of an air space using **R**, **V**, **X**, **Y** and **Z**.

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..... μm [4]

(ii) Prepare the space below so that it is suitable for you to record **one** observable similarity and **two** observable differences between the specimen on **J1** and in Fig. 2.2.

Record your observations in the space you have prepared.

[5]

[Total: 20]

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Copyright Acknowledgements:

Question 2, Fig. 2.2 DR. KEITH WHEELER/SCIENCE PHOTO LIBRARY

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