Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7723508459

BIOLOGY **9700/31**

Advanced Practical Skills 1 **May/June 2014**

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.
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.

For Examiner's Use	
1	
2	
Total	

This document consists of **15** printed pages and **1** blank page.

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Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

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

1 The Benedict's test can be used to detect the presence of reducing sugars such as glucose. A solution to be tested is mixed with Benedict's solution, heated and the time taken to the first appearance of a colour change recorded.

A student suggested the hypothesis:

> "the time taken for the Benedict's solution to show the first appearance of a colour change will decrease as the temperature increases."

You are required to investigate the effect of different temperatures (the independent variable) when carrying out the Benedict's test.

You are provided with:

labelled	**contents**	**hazard**	**volume / cm^3**
G	4% glucose solution	none	60
Benedict's solution	Benedict's solution	harmful irritant	80

You must now read up to the end of step 4 before proceeding.

You will need to standardise the Benedict's test to compare the time taken to the first appearance of a colour change at four different temperatures, 70 °C, 80 °C, 90 °C and 100 °C.

Use 4 cm^3 of **G** for each temperature tested.

(a) (i) Decide the volume of Benedict's solution you will use for each test.

Complete the table to show the volume of Benedict's solution you will use.

solution	**volume / cm^3**
Benedict's	
G	4

[1]

Proceed as follows;

1. Set up a water-bath and maintain it at the first temperature of 70 °C.

2. Test 4 cm^3 of **G** with Benedict's solution using the volume you decided in **(a)(i)**.
   Start timing when the test-tube is placed into the water-bath and record the time taken for the first appearance of a colour change at the **top** of the mixture in the test-tube.
   If no colour change occurs after 4 minutes, stop the experiment and record 'more than 240'.

3. Immediately pour the contents of the test-tube into the container labelled 'for waste'. Fill the test-tube with water from the container labelled 'for washing'. Empty the contents of the test-tube into the container labelled 'for waste'.

4. Repeat steps 1 to 3 with the other temperatures of the water-bath, 80 °C, 90 °C and 100 °C.

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

[2]

The student's hypothesis was:

"the time taken for the Benedict's solution to show the first appearance of a colour change will decrease as the temperature increases."

(iii) State whether your results support this hypothesis.

.....

Use your results to explain your answer.

.....

.....

.....

.....

[2]

You are required to:

- select **one** temperature from 70 °C, 80 °C, 90 °C or 100 °C to carry out the Benedict's test
- make different concentrations of glucose from the solution **G**
- estimate the glucose concentrations of solutions **S1** and **S2** at the selected temperature.

You are provided with:

labelled	contents	hazard	percentage concentration	volume / cm^3
S1	glucose solution	none	unknown	15
S2	glucose solution	none	unknown	15
W	distilled water	none	–	100

To compare the concentrations of glucose you will need to standardise the temperature using your results from **(a)(ii)**.

(iv) State the temperature you will use.
State a reason for the temperature you have chosen.

temperature .....

reason .....

.....
[1]

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

You will need 15 cm^3 of each glucose concentration.

Fig. 1.1 shows how to make the first concentration of 2% glucose solution.

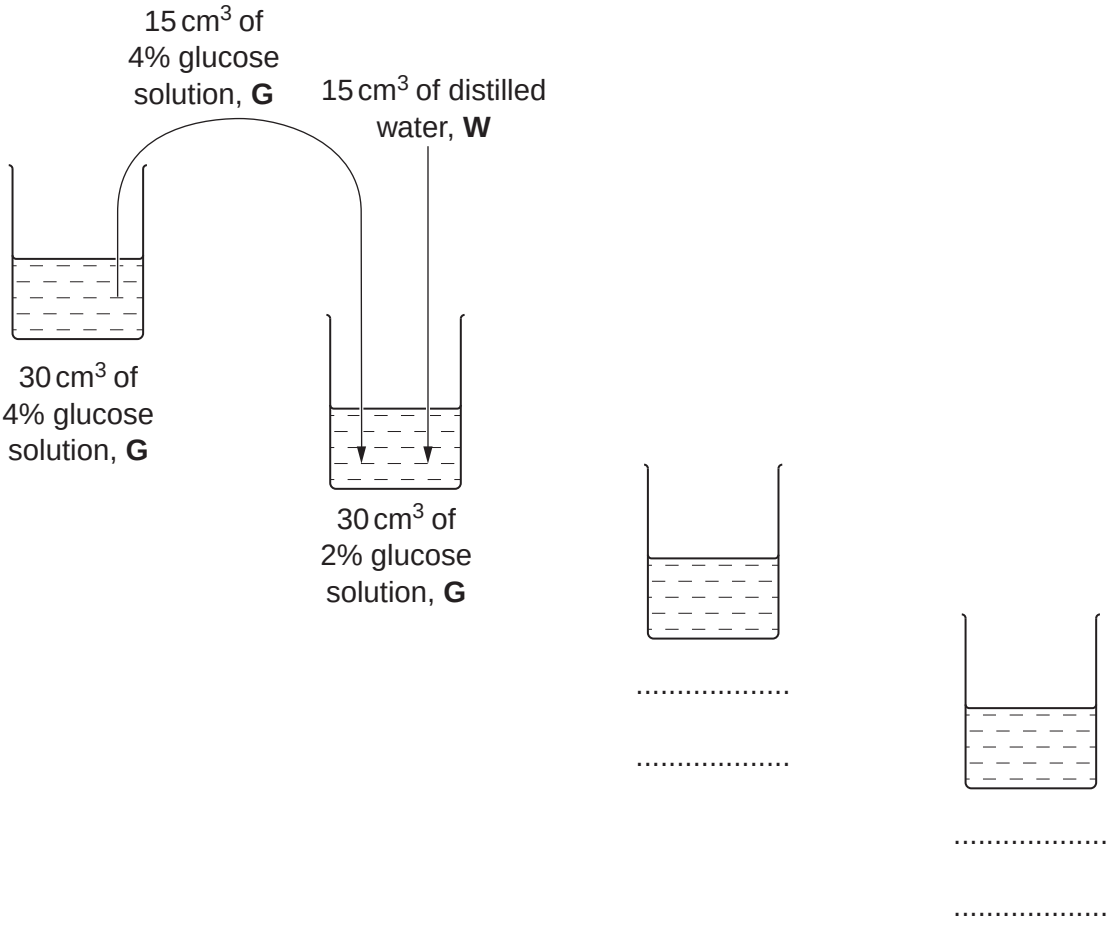


Fig. 1.1

(v) Complete Fig. 1.1 to show how you will make **two** further concentrations of **G**. [2]

You will need to test the different concentrations of glucose, as well as **S1** and **S2**, with Benedict's solution.

(vi) Decide the volumes of solutions you will use in your investigation.

Complete the table.

solution	volume / cm^3
Benedict's	
glucose solutions	
S1	
S2	

[1]

Proceed as follows:

5. Prepare all the concentrations of glucose solution as shown in Fig. 1.1 in the containers provided.

6. Set up a water-bath and maintain it at the temperature you decided in **(a)(iv)**.

7. Test the four concentrations of glucose solution and **S1** and **S2** to compare the concentration of glucose.

8. Record your results in **(vii)** on page 7.

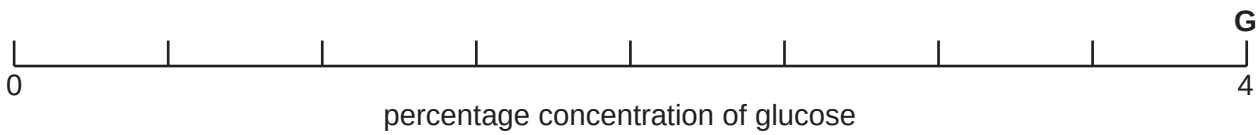
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(vii) Prepare the space below and record your results.

[3]

(viii) Complete Fig. 1.2 below to show:

- each percentage concentration of glucose solution (the concentration of **G** is shown)
- where the samples **S1** and **S2** fit in the series of concentrations.



[2]

Fig. 1.2

(ix) Describe **three** modifications to this investigation which would improve the confidence in your results.

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

(x) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

[Total: 18]

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Question 2 starts on page 10

2 **(a)** The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissues or cells, if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportions of tissues or cells, as in **(a)(i)** and **(a)(ii)**, it is **not** necessary to calibrate the eyepiece graticule scale.

J1 is a stained transverse section through a plant leaf.

This plant species grows in sub-tropical and temperate regions.
You are not expected to have studied this leaf.

(i) Draw a large plan diagram of the mid-rib of the leaf on **J1**. The mid-rib is shown by the shaded area in Fig. 2.1.

On your diagram, use a ruled label line and label to show the xylem.

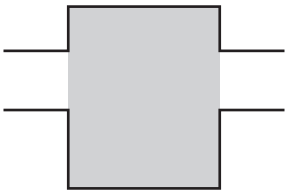


Fig. 2.1

[4]

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(ii) Within the vascular bundles the xylem is made up of chains of vessel elements (arranged in lines).

Select **two** different chains of xylem vessel elements.

Make a large drawing of **three** complete adjacent (touching) xylem vessel elements from **each** of these two selected chains.

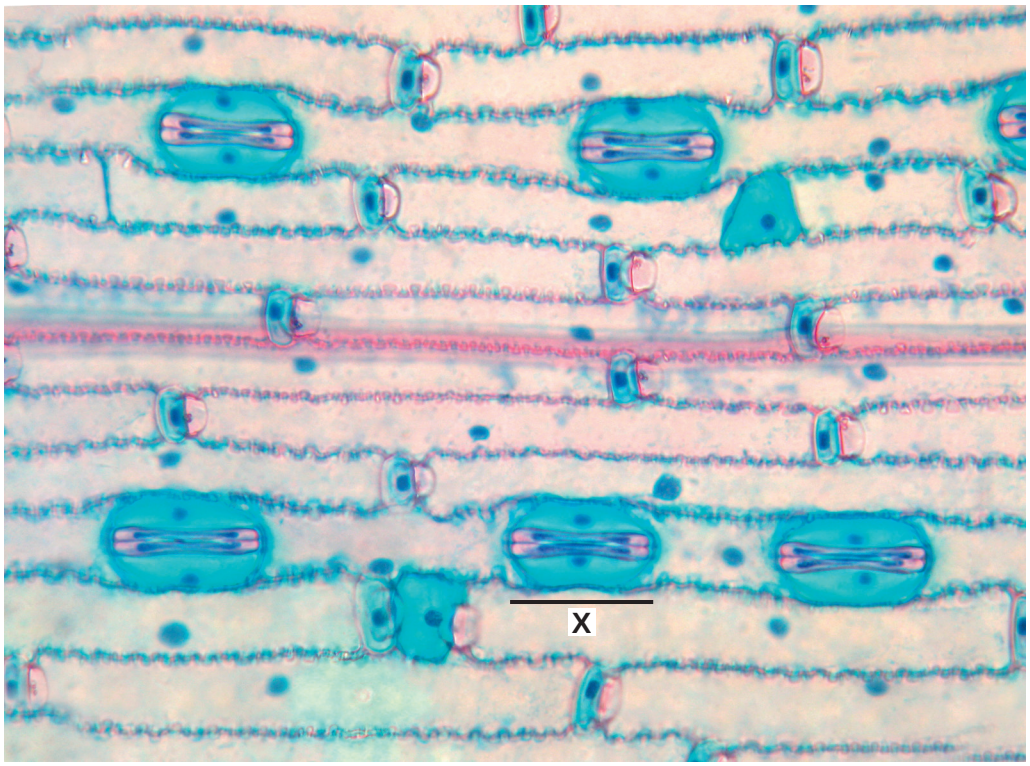
On your drawing use a ruled label line and label to **one** lumen.

first chain

second chain

[5]

(b) Fig. 2.2 is a photomicrograph of the surface of a plant leaf showing stomata. This plant species grows throughout the world's temperate regions.



magnification ×230

Fig. 2.2

(i) Use the magnification on Fig. 2.2 to calculate the actual length, in μm, of line **X**.

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

..... μm [4]

(ii) State **one** observable feature of the leaf surface, shown in Fig. 2.2, that supports the conclusion that water loss was being reduced in this leaf.

Explain how this feature reduces water loss.

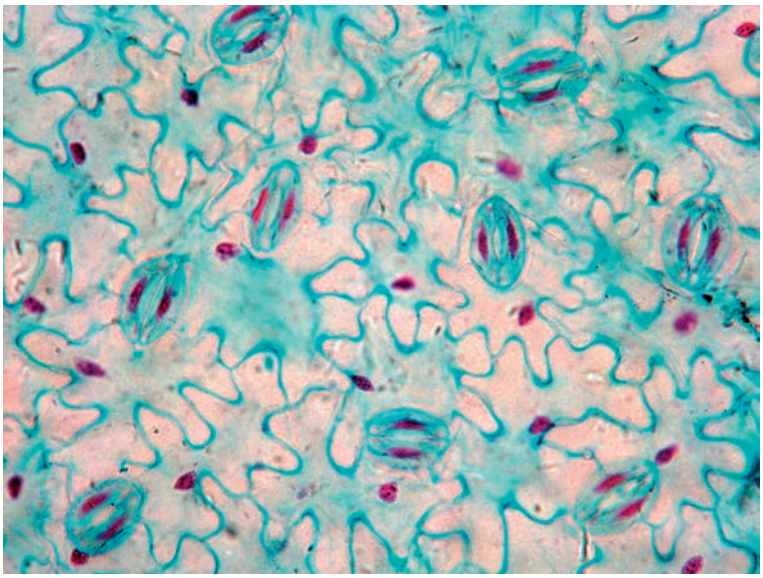
feature .....

explanation .....

[1]

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Fig. 2.3 is a photomicrograph of a stained surface of another leaf showing stomata. This plant species is native to North Africa and South-west Asia.



magnification × 230

Fig. 2.3

(c) Prepare the space below so that it is suitable for you to record the observable differences between the specimens shown in Fig. 2.2 and in Fig. 2.3. Record your observations in the space you have prepared.

[4]

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[Turn over

Rising concentrations of carbon dioxide in the atmosphere have been recorded by scientists for over one hundred years and can be used to predict future increases.

Scientists have studied the effect of carbon dioxide on the number of stomata per mm^2 on the upper and lower epidermis of leaves of one species of plant.

A large sample of plants was grown in air containing one of each of the following concentrations of carbon dioxide:

- $380\,\mu mol\,mol^{-1}$ (the concentration measured in the atmosphere now)
- $560\,\mu mol\,mol^{-1}$ (the predicted concentration in the atmosphere 50 years in the future)
- $800\,\mu mol\,mol^{-1}$ (the predicted concentration in the atmosphere 100 years in the future).

All other variables were standardised.

After a set time the number of stomata per mm^2 on the upper and lower epidermis of the leaves was found and the mean number of stomata per mm^2 was calculated.

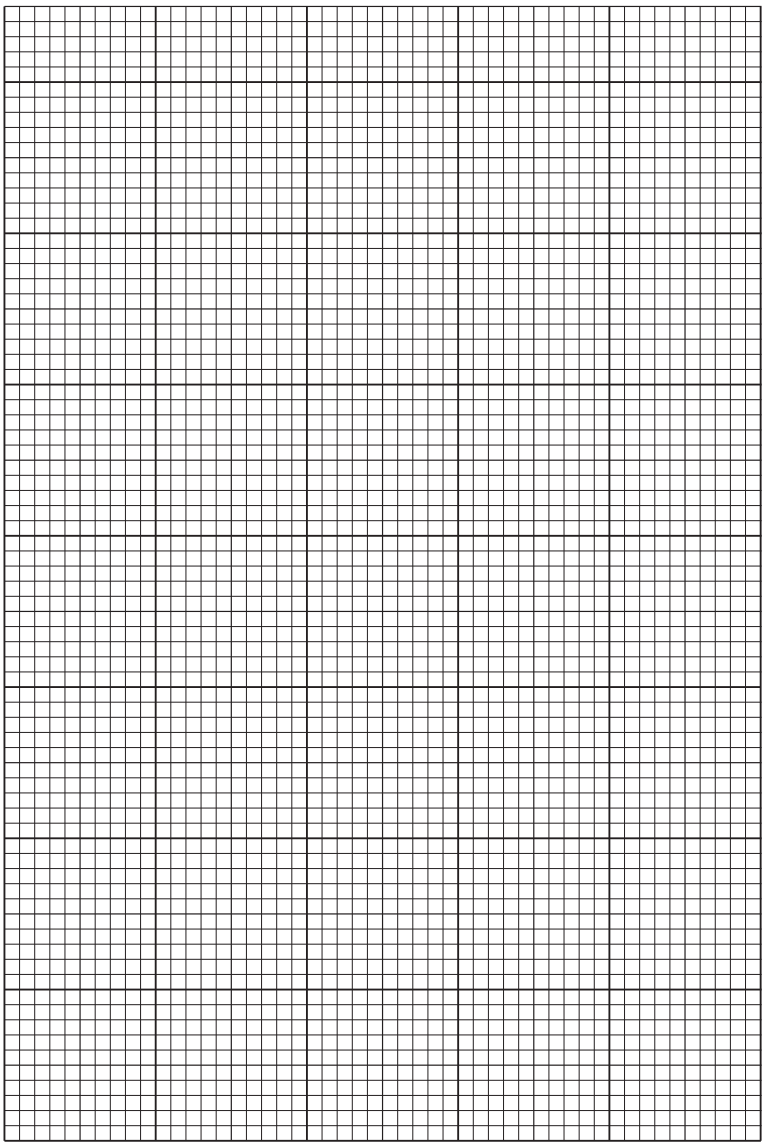
The results are shown in Table 2.1.

Table 2.1

concentration of CO_2 / $\mu mol\,mol^{-1}$	**mean number of stomata / mm^2**	
	upper epidermis (U)	**lower epidermis (L)**
380	2	104
560	3	121
800	8	142

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(d) Plot a **chart** of the data shown in Table 2.1.



[4]

[Total: 22]

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Fig. 2.3 © GARRY DELONG/SCIENCE PHOTO LIBRARY.

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