Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5406497834

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 2016**

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 **11** printed pages and **1** blank page.

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[Turn over

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 Visking tubing, **V**, is selectively permeable, so that some biological molecules will diffuse through the wall of the tubing.

You are required to investigate the diffusion of reducing sugars into the water surrounding the Visking tubing.

Fig. 1.1 shows the apparatus you will set up for this investigation before the water has been added.

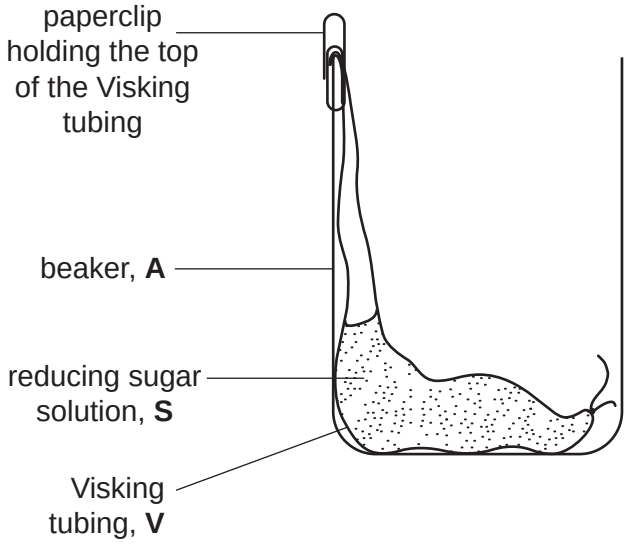


Fig. 1.1

(a) One sample of water surrounding the Visking tubing will be removed and tested using Benedict's solution, so you need to take this into account when you decide the volume of water to put into the beaker.

(i) Draw on Fig. 1.1 the level of water:

- before you remove the sample and label this level '**before**'
- after the volume of water needed for the test has been removed and label this level '**after**'. [2]

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You are provided with:

labelled	contents	hazard	volume / cm^3
S	20% reducing sugar solution	none	25

labelled	details
V	15 cm length of Visking tubing in a beaker containing distilled water

You are required to set up the apparatus as in Fig. 1.1, add the water and then remove a sample of this water (**U**) after 15 minutes.

Proceed as follows:

1. Set up a water-bath and heat to boiling ready for step 13.

2. Tie a knot in the Visking tubing as close as possible to one end so that it seals the end.

3. To open the other end, wet the Visking tubing and rub the tubing gently between your fingers.

4. Put 8 cm^3 of **S** into the open end of the Visking tubing.

5. Rinse the outside of the Visking tubing by dipping it into the water in the container labelled '**For washing**'.

6. Put the Visking tubing into the empty beaker, labelled **A**, as shown in Fig. 1.1.

7. Make sure the open end of the Visking tubing is held in place by a paperclip.

8. Put water from the container labelled **V** into **A** to the level you decided in **(a)(i)** and start timing. Leave for 15 minutes.

While you are waiting continue with Question 1.

9. After 15 minutes, gently mix the water surrounding the Visking tubing.
   Remove 2 cm^3 of the water and put this sample into a test-tube and label this **U**.
   Stop timing.

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[Turn over

You are required to:

- prepare different concentrations of reducing sugar solution
- find, for each reducing sugar solution, the time taken for the **first** appearance of a colour change when heated with Benedict's solution
- estimate the concentration of the reducing sugar solution, **U**.

You are provided with:

labelled	**contents**	**hazard**	**volume / cm^3**
G	0.5% reducing sugar solution	none	60
W	distilled water	none	250
Benedict's	Benedict's solution	none	50

You are required to prepare different concentrations of reducing sugar solution using **G**.
You will need to **prepare** 10 cm^3 of each concentration.

(ii) Table 1.1 shows how to make up one of the concentrations of reducing sugar solution you will use.
Decide which concentrations of reducing sugar solution to prepare:
- using **simple** dilution
- using 0.5% reducing sugar solution, **G**.

Complete Table 1.1 to show how you will prepare the other concentrations.

Table 1.1

volume of 0.5% reducing sugar solution, **G** / cm^3	volume of distilled water, **W** / cm^3	final percentage concentration of reducing sugar solutions
10.0	0.0	0.5

[2]

10. Prepare the concentrations of reducing sugar solutions as shown in Table 1.1, in the beakers provided.

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11. Put 2 cm^3 of the **highest** percentage concentration of reducing sugar solution into a test-tube.

12. Put 3 cm^3 of Benedict's solution into the same test-tube.

13. Put this test-tube into the water-bath (prepared in step 1) and record the time taken for the first appearance of a colour change in **(a)(iii)**.
    If there is no colour change after 120 seconds, stop timing and record the time as 'more than 120'.

14. Repeat step 11 to step 13 for each of the other concentrations you prepared in step 10.

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

[4]

You are required to use the same procedure to estimate the concentration of reducing sugar in the sample **U** (from step 9).

(iv) State which variable you will need to standardise when testing **U**.

.....[1]

15. Carry out the standardised test for the sample, **U**.

(v) Record the time taken for the first appearance of a colour change for **U**.

U ..... [1]

(vi) Use your results in **(a)(iii)** to estimate the percentage concentration of reducing sugar in **U**.

.....[1]

(b) Reducing sugars are produced when an enzyme, **E**, hydrolyses sucrose. The reducing sugars change the colour of pink potassium manganate(VII) solution to a colourless end-point.

The rate of colour change depends on the concentration of the reducing sugar solution. The greater the reducing sugar concentration the faster the end-point is reached.

A student investigated the effect of the concentration of sucrose solution on the activity of enzyme, **E** by recording the time taken to decolourise potassium manganate(VII) solution.

All other variables were standardised.

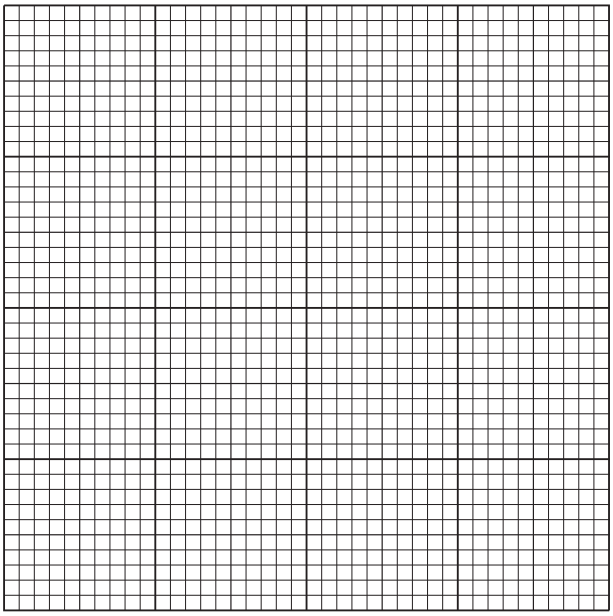
The results of the student's investigation are shown in Table 1.2.

Table 1.2

percentage concentration of sucrose solution	**time to decolourise potassium manganate(VII) solution / s**
0.5	158.0
1.0	84.0
1.5	74.0
2.0	32.0
2.5	22.0

You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 1.2.



[4]

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(ii) Estimate the time to decolourise potassium manganate(VII) solution at 1.75% sucrose concentration.
Show on your graph how you obtained the time to decolourise potassium manganate(VII) solution.

time ..... [2]

(iii) Using the data in Table 1.2 and your graph, explain the relationship between the concentration of sucrose solution and the enzyme activity.

.....

.....

.....

.....

.....[2]

(iv) This student's procedure investigated the effect of sucrose concentration on the rate of enzyme activity.

To modify this procedure for investigating another variable, the independent variable (sucrose concentration) would need to be standardised.

Describe how sucrose concentration could be standardised.

.....

.....

Now consider how you could modify the student's procedure to investigate the effect of **pH** on the hydrolysis of sucrose.

Describe how this independent variable, **pH**, could be investigated.

.....

.....

.....

.....

.....[3]

[Total: 22]

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

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of half of the root as shown by the shaded area in Fig. 2.1.

Use **one** ruled label line and label to identify the xylem.

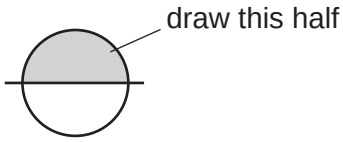


Fig. 2.1

You are expected to draw the correct shape and proportions of the different tissues.

[4]

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(ii) Observe the vascular tissue in the centre of the root on **J1**.
The vascular tissue is surrounded by a ring of cells.

Select **one** group of **four** adjacent (touching) cells from this ring of cells.
Each cell of the group must touch at least one of the other cells.

Make a large drawing of this group of **four** cells.

Use **one** ruled label line and label to identify the cell wall of **one** cell.

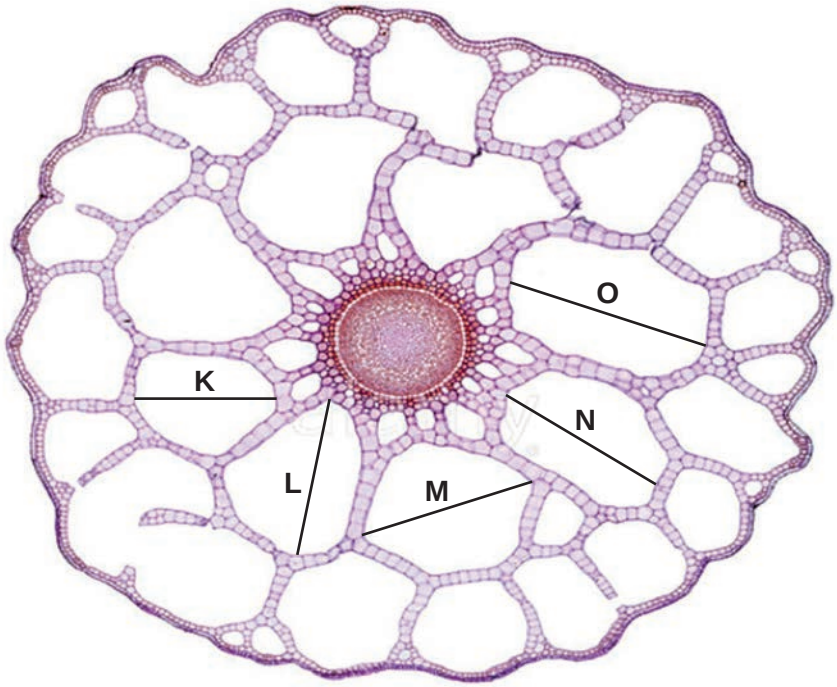
[5]

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(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a plant stem of a different type of plant.

You are not expected to be familiar with this specimen.



magnification ×25

Fig. 2.2

(i) Use the magnification and the lines in Fig. 2.2 to find the actual diameter, in μm, of the air spaces labelled **K**, **L**, **M**, **N** and **O**.

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

K ..... μm, **L**..... μm, **M**..... μm, **N**..... μm, **O**..... μm [2]

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(ii) Using the actual diameters calculated in **(b)(i)**, calculate the **mean** actual diameter of an air space.

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

mean actual diameter ..... [2]

(iii) A feature of the plant in Fig. 2.2 is the presence of air spaces in the plant stem.

Suggest a habitat where this plant might grow .....

Suggest how the air spaces adapt the plant to this habitat.

.....

.....[1]

(c) Prepare the space below so that it is suitable for you to record the observable differences between the root on **J1** and the stem in Fig. 2.2.

Record your observations in the space you have prepared.

[4]

[Total: 18]

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