Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0822589752

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 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 **13** printed pages and **3** blank pages.

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CAMBRIDGE International Examinations

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, think about 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 Some people feel unwell after drinking animal milk. This is because they are unable to digest the reducing sugar lactose found in this milk. Other sources of milk, such as milk made from plant material, do not contain this reducing sugar and can be included in the diet instead.

You are required to:
- prepare different concentrations of reducing sugar solution, **R**, using serial dilution
- determine the concentration of reducing sugar in two samples of milk
- identify which milk would be the most suitable for a person who is unable to digest lactose.

You are provided with:

labelled	contents	hazard	volume / cm^3
R	1% reducing sugar solution	none	50
W	distilled water	none	50
Benedict's	Benedict's solution	none	50
M1	milk	none	40
M2	milk	none	40

(a) You are required to make a serial dilution of the 1% reducing sugar solution, **R**, which reduces the concentration **by half** between each successive dilution.

Decide how many different concentrations you will prepare for your serial dilution.

You will need to **prepare** 10 cm^3 of each concentration.

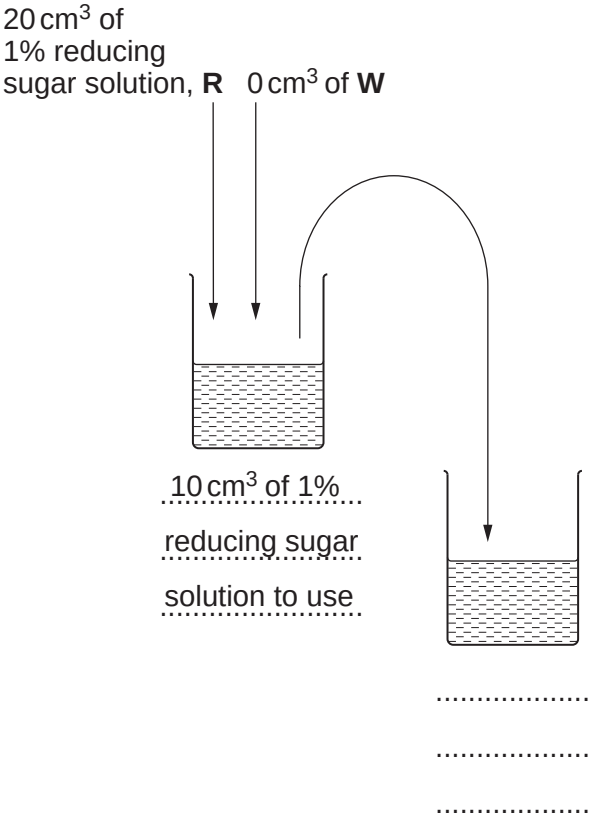
Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

(i) Complete Fig. 1.1 by drawing as many extra beakers as you need for your serial dilution.

For each beaker:

- state, under the beaker, the **volume** and **concentration** of the reducing sugar solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **volume** and **concentration** of reducing sugar solution added to prepare the concentration
- use another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

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20 cm3 of
1% reducing
sugar solution, R
0 cm3 of W
10 cm3 of 1%
reducing sugar
solution to use
.....
.....
.....

[3]

Fig. 1.1

Proceed as follows:

1. Set up a water-bath and heat to boiling ready for step 6.

2. Prepare the concentrations of reducing sugar solution as decided in **(a)(i)** and in Fig. 1.1.

(ii) You will be required to carry out the Benedict's test on each of the reducing sugar solutions you have prepared. You will use 2 cm^3 of reducing sugar solution for each test.

State the volume of Benedict's solution you will use for each reducing sugar test.
Explain why you have selected this volume.

volume of Benedict's solution ..... cm^3

explanation .....

.....

[1]

3. Put 2 cm^3 of 1% reducing sugar solution into a test-tube.

4. Put the volume of Benedict's solution you stated in **(a)(ii)** into the same test-tube.

5. Shake the test-tube gently to mix the contents.

6. Put this test-tube into the boiling water-bath (prepared in step 1) and record in **(a)(iii)** the time taken for the first appearance of a colour change.

   If there is no colour change after 90 s, **stop timing** and record as 'more than 90'.

7. Repeat step 3 to step 6 for each of the other concentrations of reducing sugar that you prepared in step 2.

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

[3]

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(iv) A student carried out step 1 to step 7 and recorded the result for one of the concentrations as 42 s.
Calculate the rate of this reaction.

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

..... s^{-1} [2]

You are required to find the concentration of reducing sugar in two samples of milk, **M1** and **M2**, using Benedict's solution.

(v) State the variables that you will need to standardise so that you can compare the results of the Benedict's test on **M1** and **M2** with those recorded in **(a)(iii)**.

.....

.....

.....

.....[2]

8. Repeat step 3 to step 6 for each of **M1** and **M2** and record your results in **(a)(vi)**.

(vi) Record your results for **M1** and **M2**.

M1 .....

M2 ..... [1]

(vii) Use your results in **(a)(iii)** to estimate the percentage concentration of reducing sugar in each of **M1** and **M2**.

M1 .....

M2 .....[2]

(viii) State which sample, **M1** or **M2**, would be most suitable for a person who is unable to digest lactose. Give a reason for your answer.

sample.....

reason .....[1]

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(b) In most people the reducing sugar lactose is hydrolysed by an enzyme during digestion to produce monosaccharides which are absorbed into the blood.

Some people do not produce this enzyme. When they drink animal milk, the lactose is undigested.

Certain bacteria use the undigested lactose for respiration and produce hydrogen gas. This enters the bloodstream, and is transported to the lungs where it is breathed out (exhaled).

Scientists can measure the concentration of hydrogen in exhaled air.

A scientist gave a person who does not produce this enzyme a drink of animal milk. The effect of drinking milk containing lactose was investigated by measuring the concentration of hydrogen in exhaled air every 20 minutes for 80 minutes.

The results are shown in Table 1.1.

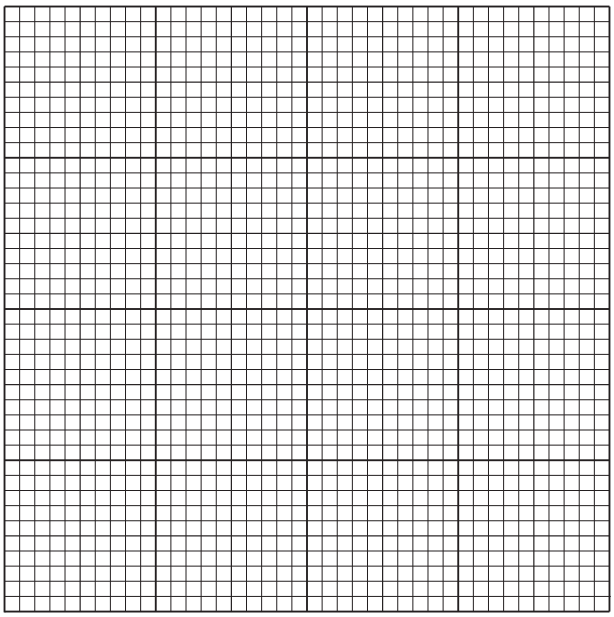
Table 1.1

time after drinking milk containing lactose / minutes	concentration of hydrogen in exhaled air / ppm
0	15
20	17
40	24
60	52
80	80

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You are required to use a sharp pencil for graphs.

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



[4]

Fig. 1.2 is a photomicrograph of a stained transverse section through an animal organ. The bacteria that use lactose may be found in the lumen of this organ.

You are not expected to be familiar with this specimen.

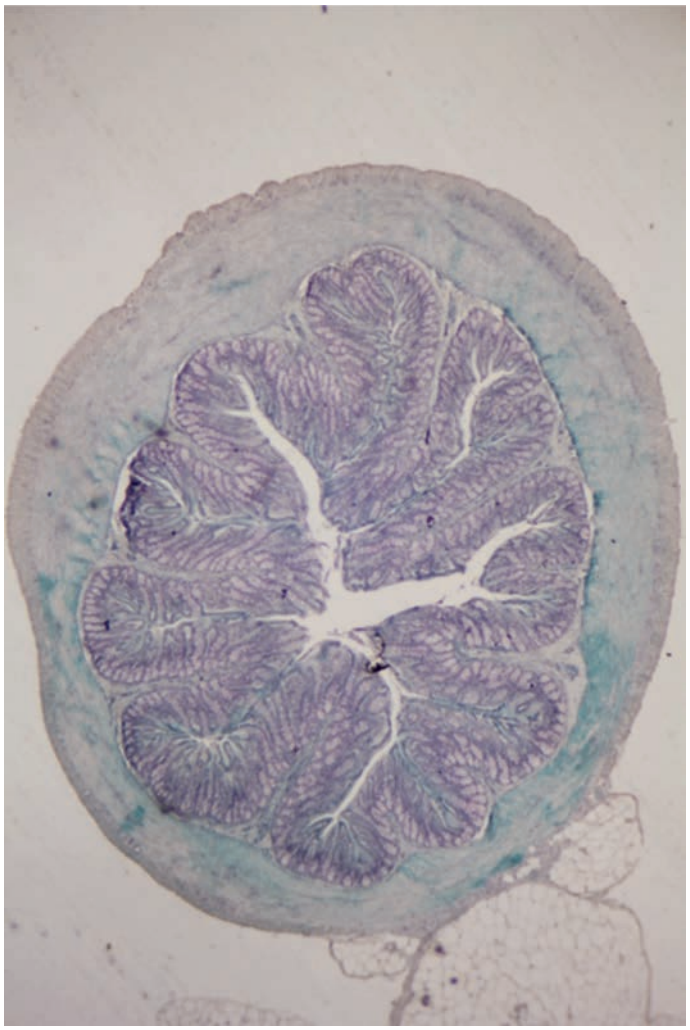


Fig. 1.2

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You are required to use a sharp pencil for drawings.

(ii) Draw a large plan diagram of the half of the organ shown by the shaded area in Fig 1.3 .

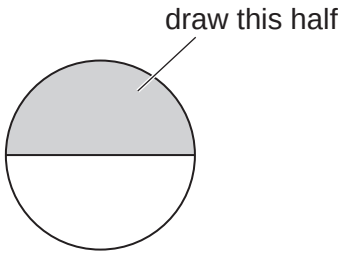


Fig. 1.3

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

[4]

[Total: 23]

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

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Observe the upper epidermis at the top of the leaf on **J1**.
Select one group of **three** cells with:

- two cells from the upper epidermis
- one adjacent (touching) cell from the tissue below.

Each cell of the group must touch at least one of the other cells.

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

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

[4]

(ii) State the function of the cell you have drawn from the tissue below the epidermis.
Identify **one** observable feature of this cell that supports your answer.

function of cell .....

observable feature .....[2]

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Fig 2.1 is a photomicrograph of a stained transverse section through part of a leaf from a different type of plant.

You are not expected to be familiar with this specimen.

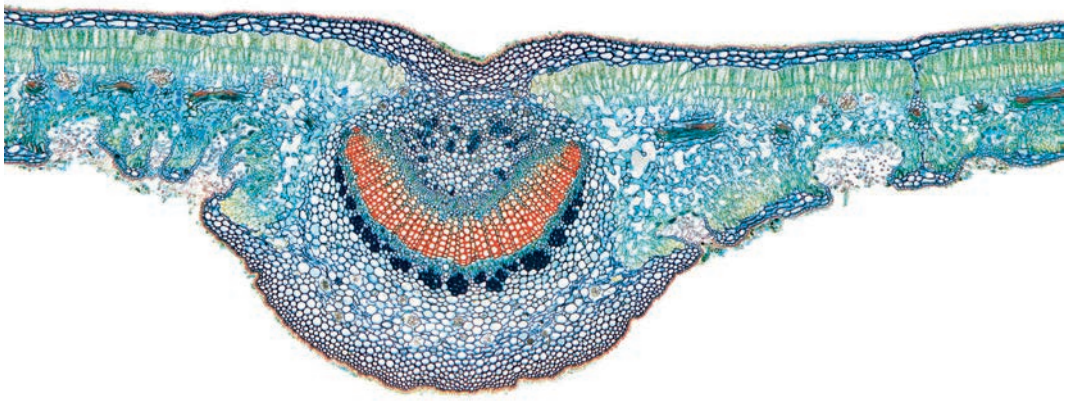


Fig. 2.1

(b) Prepare the space below so that it is suitable for you to record observable differences between the leaf on **J1** and the leaf in Fig. 2.1.

Record your observations in the space you have prepared.

[4]

(c) You are required to measure the diameter of the field of view using the clear plastic ruler.

Proceed as follows:

1. Put the clear plastic ruler on the stage of the microscope and view the scale lines using low power (×100).
2. Measure the diameter of the field of view and record this in **(c)(i)**.

(i) Diameter of the field of view ..... mm [1]

Fig. 2.2 is the same photomicrograph as in Fig. 2.1 showing the field of view at the same magnification as the field of view you have just measured.

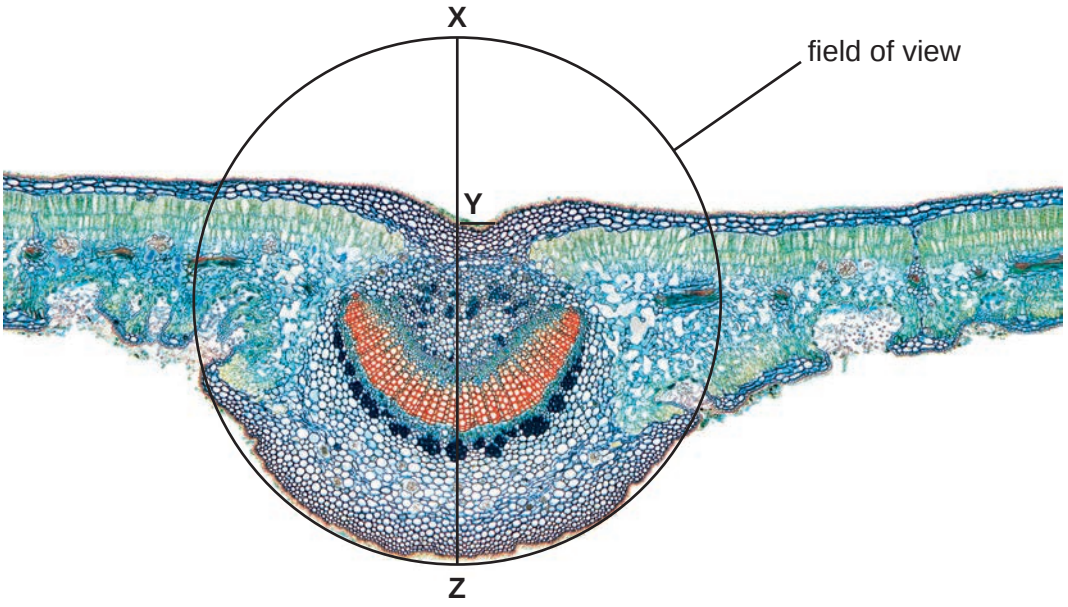


Fig. 2.2

(ii) Using appropriate measurements, calculate the fraction of the diameter of the field of view occupied by the leaf in Fig. 2.2 along the line **X–Z**.

fraction of diameter of field of view .....[1]

(iii) Using your answers to **(c)(i)** and **(c)(ii)** calculate the depth of the midrib, as shown by line **Y–Z**. Give your answer to the nearest μm.
You may lose marks if you do not show your working.

.....μm [2]

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(iv) A student used a clear plastic ruler to measure the field of view of a microscope. The student replaced the ruler with a slide of a leaf and estimated the diameter of the midrib. Using these results the student calculated the actual diameter of the midrib.

State how this student could have modified their method to obtain a more accurate result. State the apparatus the student would use and describe the method.

apparatus .....

.....

method .....

.....

.....

.....

.....[3]

[Total: 17]

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