Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **May/June 2018**

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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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 confidence in 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 Fruit growers need to know the concentration of sugars, such as sucrose, in the fruit so that it can be picked at the best time.
As the fruit matures the concentration of sucrose increases.

The concentration of sucrose can be estimated in a fruit extract by carrying out the non-reducing sugar test. Known concentrations of sucrose are tested and the result for the unknown concentration of sucrose in the fruit extract is compared to them.

You will need to:

- prepare known concentrations of sucrose solution using simple (proportional) dilution
- carry out the non-reducing sugar test on these concentrations
- carry out the non-reducing sugar test on the unknown concentration of sucrose solution in fruit extract, **U**
- estimate the concentration of sucrose in fruit extract, **U**.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
S5	5.0% sucrose solution	none	60
W	distilled water	none	100
U	unknown concentration of sucrose solution	none	20
H	dilute hydrochloric acid	irritant	50
A	10 g sodium hydrogencarbonate powder	none	–
Benedict's	Benedict's solution	harmful	20

It is recommended that you wear suitable eye protection.
If **H**, **A** or **Benedict's** come into contact with your skin, wash off immediately under cold water.

Read step 1 to step 19 before proceeding.

1. Set up a water-bath and heat to boiling ready for step 7 and step 13.

   You will need to make simple (proportional) dilutions of the sucrose solution **S5** and prepare the concentrations of sucrose solution:

   - 4.0% sucrose concentration, to be labelled **S4**
   - 3.0% sucrose concentration, to be labelled **S3**
   - 2.0% sucrose concentration, to be labelled **S2**.

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

(a) (i) Complete Table 1.2 to show how you will prepare these concentrations.

Table 1.2

label	volume of **S5** / cm^3	volume of distilled water, **W** / cm^3	final percentage concentration of sucrose solution
S5	10.0	0	5.0
S4			4.0
S3			3.0
S2			2.0

[2]

2. Prepare the concentrations of sucrose as stated in Table 1.2 in the beakers provided.

The sucrose concentration can be estimated by using the non-reducing sugar test.

To test for the presence of a non-reducing sugar, any non-reducing sugars must be hydrolysed (broken down) into the reducing sugars.

For example, boiling sucrose with dilute hydrochloric acid hydrolyses sucrose into glucose and fructose, which are both reducing sugars.

The Benedict's test can then be used to show the presence of these reducing sugars.

3. Put 2 cm^3 of **S5** into a labelled test-tube.

4. Put 2 cm^3 of **H** into the same test-tube.

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

6. Repeat step 3 to step 5 for **S4**, **S3**, **S2** and **U**.

7. Put all the test-tubes into the boiling water-bath (set up in step 1). Leave them for 2 minutes.

8. After 2 minutes, remove the test-tubes from the water-bath and put them in the test-tube rack.

[Turn over

9. Leave the test-tubes to cool for a further 3 minutes.

   You will need the boiling water-bath for step 13.

10. After 3 minutes put a small amount of **A** into each test-tube. The mixture will fizz and rise up the test-tube. Repeat until there is no more fizzing. This neutralises the acid so that the Benedict's solution can work.

*Note: there may be some of **A** left in the bottom of some of the test-tubes. This will not affect the results.*

11. Put 3 cm^3 of Benedict's solution into the test-tube containing **S5**.

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

13. Put this test-tube in the boiling water-bath. Start timing.

14. Measure the time taken to the first appearance of a colour change in the test-tube.
    If there is no colour change after 120 seconds, stop timing and record as 'more than 120'.

15. Record the result in **(a)(ii)**.

16. Remove the test-tube from the water-bath and put it in the test-tube rack.

17. Repeat step 11 to step 16 with each of the other concentrations of sucrose solution.

18. Repeat step 11 to step 14 with the sample from **U**.

19. Record the result for **U** in **(a)(iii)**.

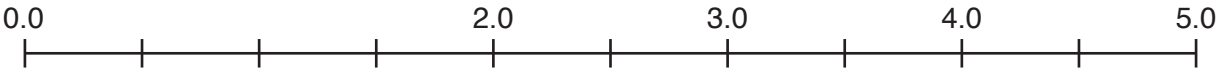
(ii) Record your results for the known concentrations of sucrose solution in an appropriate table.

[5]

(iii) State the time taken for the appearance of the first colour change for **U**.

.....

Complete Fig. 1.1 to show an estimate of the percentage concentration of sucrose solution in the sample **U**, using the letter **U**.



percentage concentration of sucrose solution

Fig. 1.1

[1]

(iv) The concentration of sucrose in **U** can also be estimated from a graph of your results.

Draw a graph using the results you recorded in **(a)(ii)** on the grid in Fig. 1.2.
The axes have been labelled for you.

Use a sharp pencil for drawing graphs.

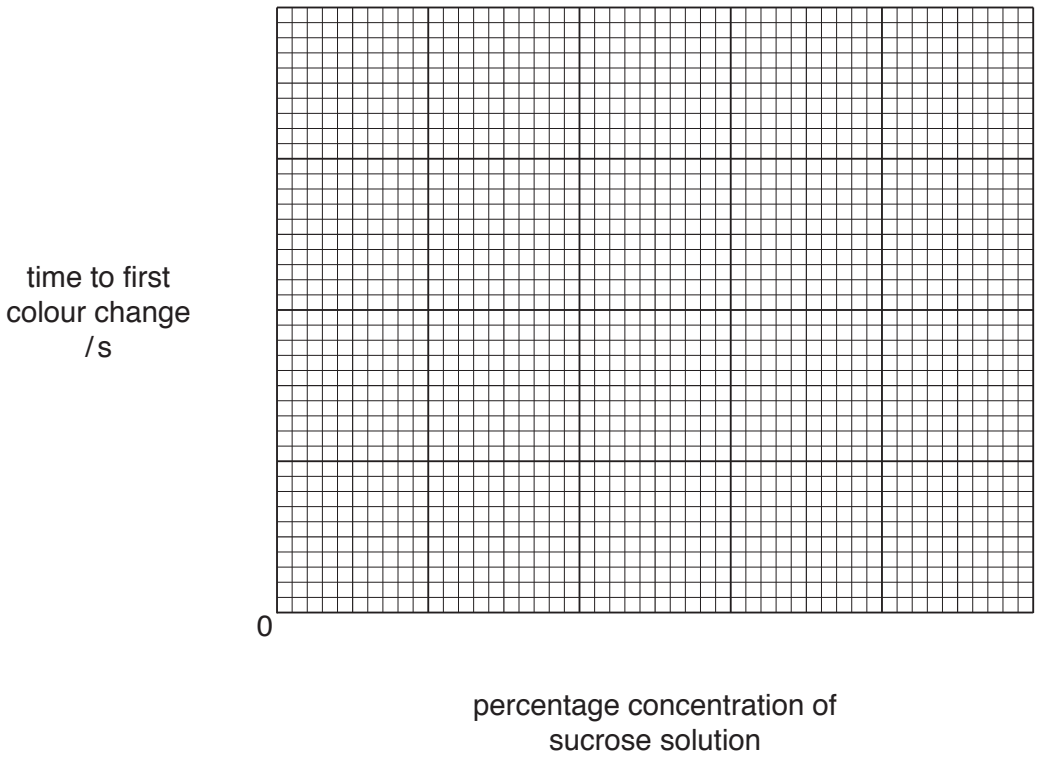


Fig. 1.2

[2]

(v) Use your graph **and** the time stated in **(a)(iii)** to estimate the percentage concentration of sucrose in **U**.
Show on the graph how you determined your answer.

percentage concentration of sucrose solution in **U** ..... [1]

(vi) Identify **one** significant source of error in this investigation.

.....

.....[1]

(vii) A student carried out the same procedure to estimate the percentage concentration of sucrose solution in a different fruit extract. The estimate for the percentage concentration of sucrose solution was found to be below 2.0%.

Apart from drawing a graph, suggest how the student could improve this procedure to obtain a more accurate estimate of the percentage concentration of sucrose solution in this fruit extract.

.....

.....

.....

.....[3]

(b) Maturing fruits contain many types of sugar. The proportions of these different sugars vary according to the type of fruit.

A scientist carried out some tests to determine the mass of each type of sugar found in one type of fruit. The total mass of the fruit was 55 g.

The results are shown in Table 1.3.

Table 1.3

type of sugar in the fruit	mass of sugar in 55 g fruit / g
P	13.6
Q	12.2
R	3.4
S	2.0
T	0.4

(i) Calculate the percentage of the fruit that is made up of sugars.

Show all the steps in your working.

percentage = ... [3]

(ii) Draw a bar chart of the data shown in Table 1.3 on the grid in Fig. 1.3.
Each bar should be separated for each type of sugar.

Use a sharp pencil for drawing bar charts.

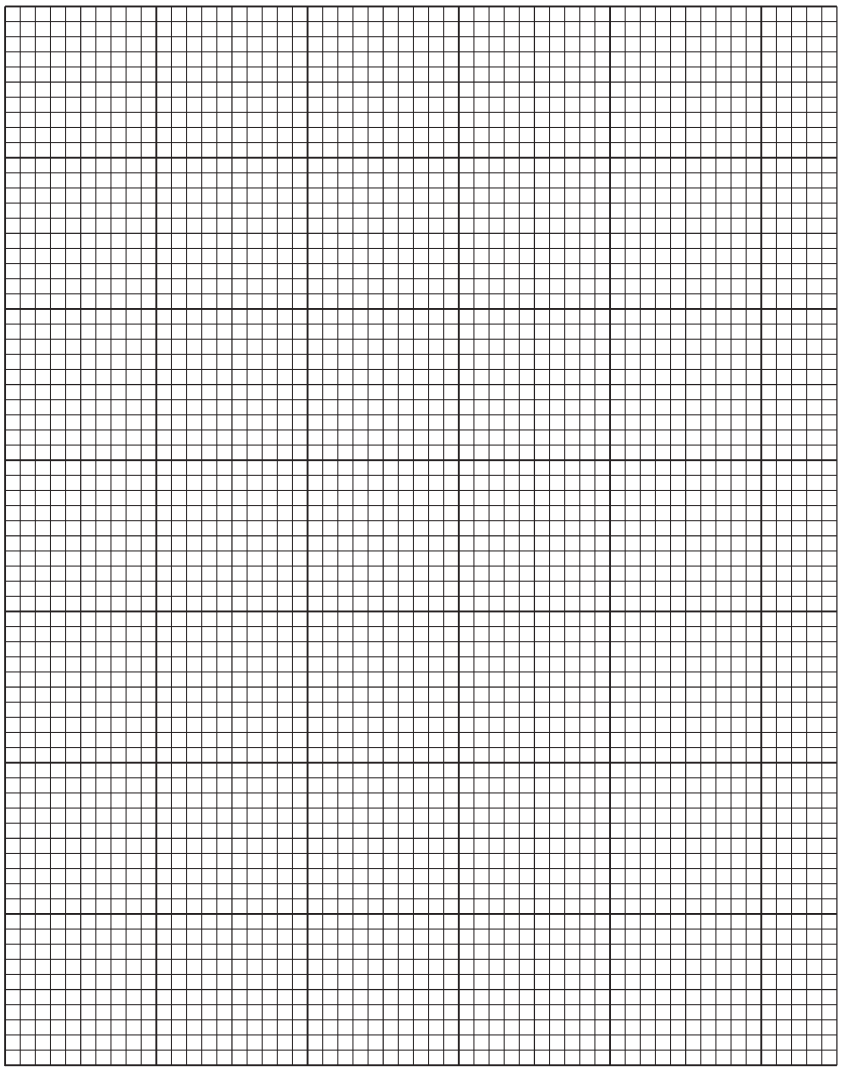


Fig. 1.3

[2]

(iii) Name **one** source of the sucrose in the plant **and** the process used for loading the sucrose into the phloem tissue.

source .....

process .....
[2]

[Total: 22]

[Turn over

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

You are not expected to be familiar with this specimen.

(a) Observe all the different tissues in the stem on **K1** and select an area (sector) that shows the epidermis and vascular bundles.

Use a sharp pencil for drawings.

(i) Draw a large plan diagram of the sector you have selected on **K1** to include:

- the epidermis
- **one** outer vascular bundle
- **three** inner vascular bundles (touching each other)
- any other observable tissues.

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

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

[5]

(ii) Observe the cells around the air spaces on **K1**.
Select one group of **four** adjacent, touching cells along the side of an air space.
Each cell must touch at least one of the other cells.

Use the eyepiece graticule in the microscope to measure, as shown in Fig. 2.1:

- the total length of the four cells, **L**
- the depth of one of the cells, **D**.

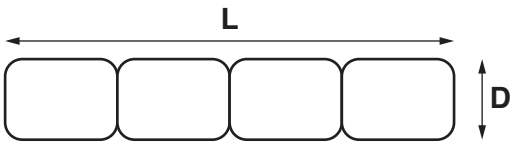


Fig. 2.1 (not drawn to scale)

L ..... eyepiece graticule units

D ..... eyepiece graticule units
[1]

(iii) Use the measurements from **(a)(ii)** to help you make a large drawing of this group of **four** cells on **K1**.

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

[5]

(iv) The tissues on **K1** include air spaces. Suggest a habitat where **K1** might grow.

.....[1]

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

You are not expected to be familiar with this specimen.

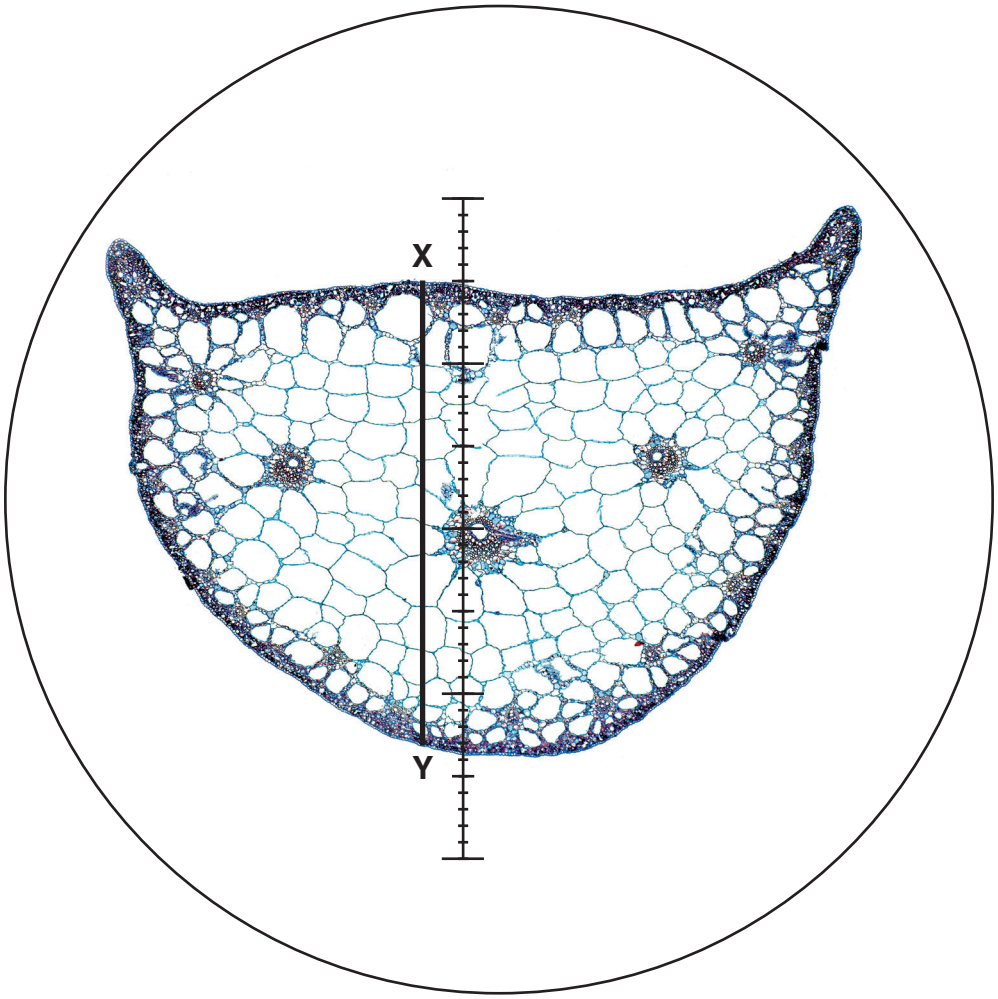


Fig. 2.2

A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual width of the stem could be found.

The calibration was one eyepiece graticule division equal to 29.5 μm.

Fig. 2.2 shows a photomicrograph taken using the same microscope with the same lenses as the student.

Use the calibration of the eyepiece graticule division and Fig. 2.2 to calculate the actual width of the stem, shown by line **X**–**Y**.

Show all the steps in your working and use appropriate units.

actual width of the stem = ... [3]

Fig. 2.3 is the same photomicrograph without the eyepiece graticule scale and without the line **X**–**Y**.

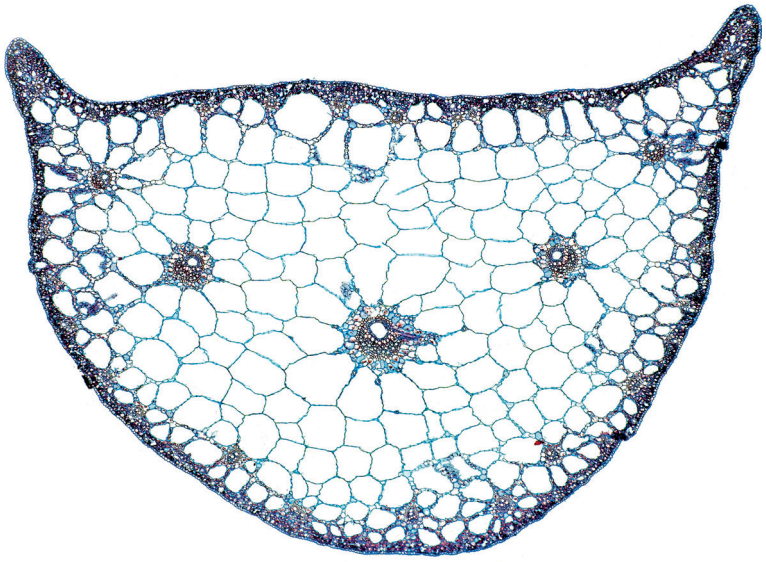


Fig. 2.3

(c) Annotate Fig. 2.3 to describe **three** observable differences between the stem sections in Fig. 2.3 and on **K1** by:

- drawing label lines to **three** features in Fig. 2.3 that show these differences
- describing next to each line how each feature is different from the specimen on **K1**.

[3]

[Total: 18]

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