Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2019**

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.

Cambridge Assessment International Education

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 the whole of Question 1 and Question 2.

1 Beetroot is a root vegetable that contains a red pigment in its cells. When beetroot is put in ethanol, the red pigment is released from the beetroot tissue and the ethanol changes to a red colour.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	quantity
B	beetroot cylinders in distilled water	none	2
A	100% ethanol	flammable	100 cm^3
W	distilled water	none	300 cm^3

If any solution comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

Beetroot tissue can stain clothing.

You will investigate the effect of different concentrations of ethanol on the release of red pigment from beetroot tissue.

You will need to:

- prepare different concentrations of ethanol, **A**
- put beetroot tissue into the different concentrations of ethanol
- record the intensity of colour for each concentration of ethanol.

You will make different concentrations of ethanol using proportional dilution of the 100% ethanol, **A**.

Table 1.2 shows how to make up two of the concentrations of ethanol you will use.

(a) (i) Complete Table 1.2 for the other concentrations you will use.

Table 1.2

percentage concentration of ethanol	volume of **A** / cm^3	volume of **W** / cm^3
100	20.0	0.0
0	0.0	20.0

[2]

Carry out step 1 to step 14.

1. Prepare the concentrations of ethanol as shown in Table 1.2 in the beakers provided.
2. Label large test-tubes with the concentrations of ethanol stated in Table 1.2.
3. Put 10 cm^3 of each concentration of ethanol into the appropriately labelled large test-tube.
4. Cut the beetroot cylinders into 2 mm thick discs using a single-edged blade.
   You will need 5 discs for each concentration of ethanol.
5. Put the discs into a small beaker and cover with **W**.
6. Stir with a glass rod.
7. Pour the liquid into the beaker labelled **For waste**.
8. Put the discs on a paper towel and blot them to remove excess **W**.
9. Put 5 discs into each of the large test-tubes. Leave for 5 minutes.

While you are waiting use your time to continue with Question 1.

10. Label **small** test-tubes with the ethanol concentrations stated in Table 1.2.
11. After 5 minutes stir the contents of each large test-tube.
12. Pour the liquid from each large test-tube into the appropriately labelled small test-tube.
    Make sure that the discs remain in the large test-tubes.

Fig. 1.1 shows the key you need to use to record your results.

Key

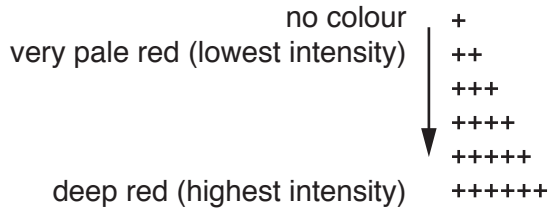

Fig. 1.1

13. Observe the colour of the liquid in each small test-tube.

It may help to observe the liquid with a piece of white card behind the test-tube.

You may observe the same intensity in more than one test-tube.

14. Record your observations in **(a)(ii)** using the symbols shown in the key in Fig. 1.1.

(ii) Prepare a table in the space below to record your observations.

[5]

(iii) State the independent variable in this investigation.

..... [1]

(iv) Use your results from **(a)(ii)** to explain the effect of different ethanol concentrations on the beetroot tissue.

.....

.....

.....

.....

.....

..... [3]

(v) Identify **two** significant sources of error in your investigation.

For each source of error, suggest an improvement.

source of error 1 .....

.....

improvement 1 .....

.....

.....

source of error 2 .....

.....

improvement 2 .....

.....

.....

[4]

(b) Scientists investigated the effect of water potential on the properties of potato tissue.
This was done by placing potato cylinders in solutions with different water potentials for 20 hours. All other variables were kept constant.

The tissue was then compressed. The scientists measured the sound that the potato tissue made as it was compressed using an acoustic emission meter.

The measurement of acoustic emission from compressed potato tissue can be used to judge the quality of the potato.

The results are shown in Table 1.3.

Table 1.3

water potential / MPa	acoustic emission / arbitrary units
–0.3	95
–0.5	76
–0.6	68
–0.9	50
–1.2	43
–1.5	24

(i) Plot a graph of the data in Table 1.3 on the grid in Fig. 1.2.

The position of zero on the *x*-axis is shown.

Use a sharp pencil for drawing graphs.

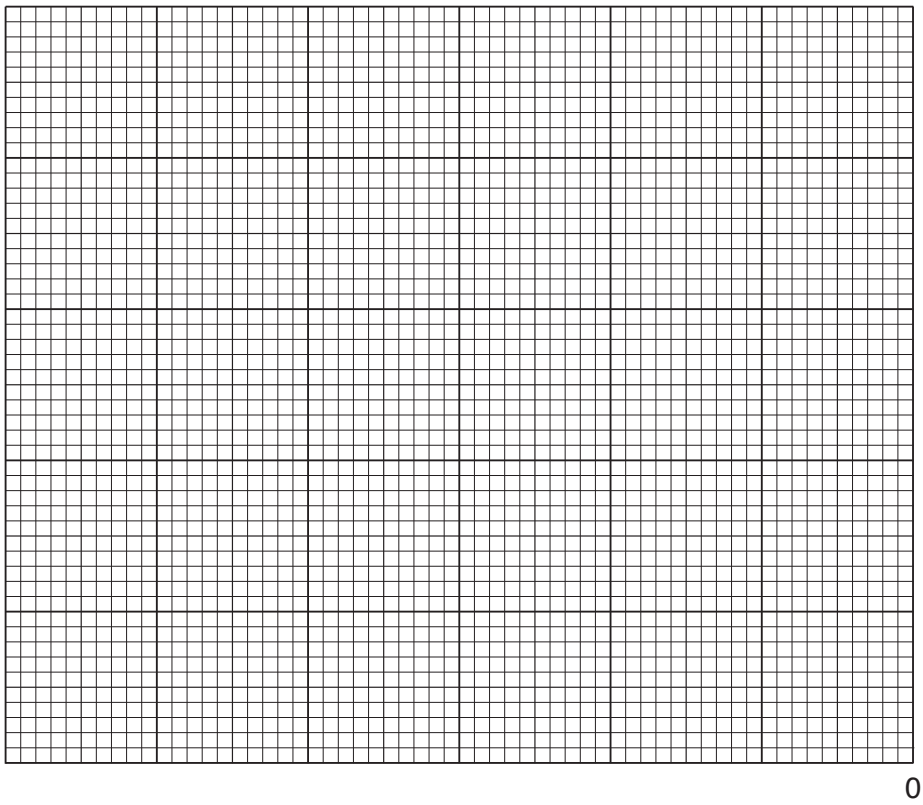

Fig. 1.2 [4]

(ii) Use your graph in **(b)(i)** to estimate the water potential of the potato tissue at an acoustic emission value of 80 arbitrary units.

water potential = ... [1]

(iii) Suggest how the scientists could make **one** improvement to the independent variable so that a more accurate estimate of the water potential at 80 arbitrary units can be obtained.

.....

.....

..... [1]

[Total: 21]

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

You are not expected to be familiar with this specimen.

Use a sharp pencil for drawing.

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

(a) (i) Draw a large plan diagram of the sector shown in Fig. 2.1.

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

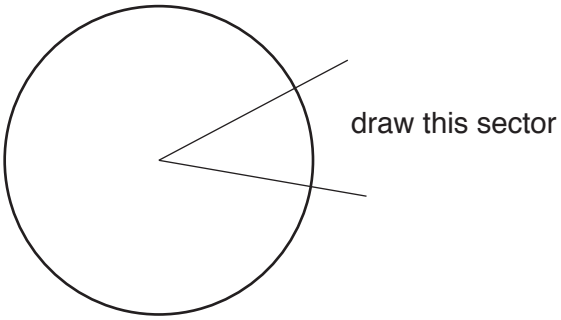

Fig. 2.1

[5]

(ii) Observe the cells from the central region (the pith) of the stem of **J1**.

Select **four** adjacent, touching cells.

Each cell must touch at least two of the other cells.

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

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

[5]

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

You are not expected to be familiar with this specimen.

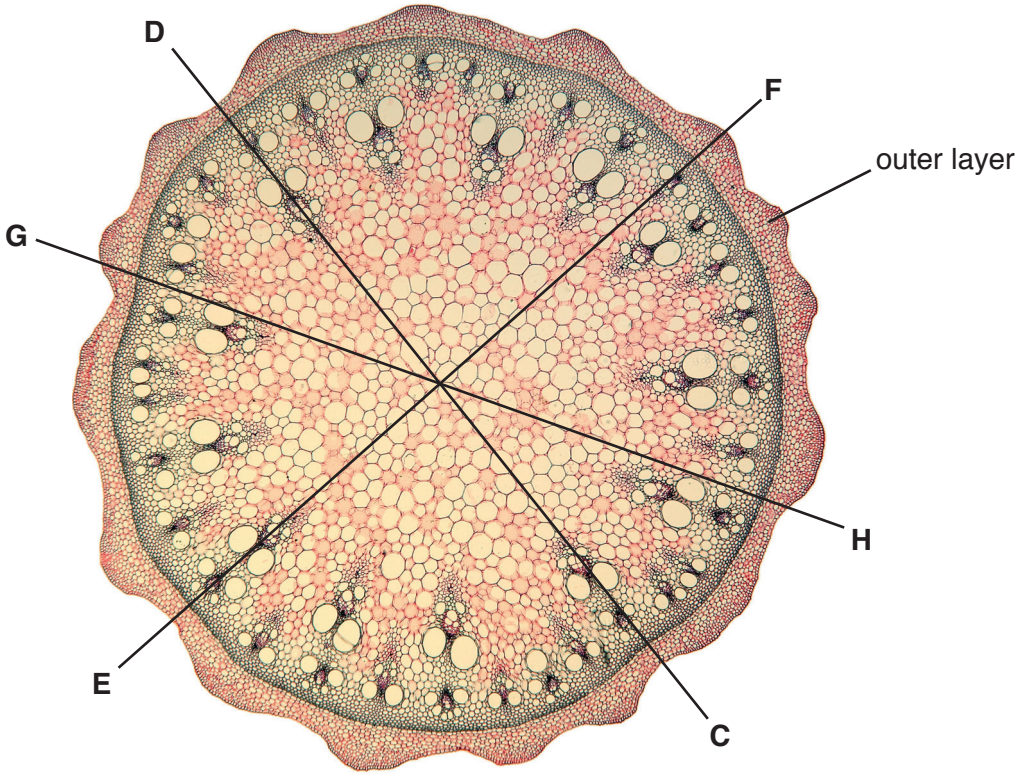

Fig. 2.2

(i) Use the lines **C**–**D**, **E**–**F** and **G**–**H** to determine:

- the mean diameter of the whole stem, as seen in the photomicrograph in Fig. 2.2.
- the mean depth of the outer layer, as seen in the photomicrograph in Fig. 2.2.

Show all the steps in your working.

mean diameter of whole stem .....mm

mean depth of outer layer .....mm

[4]

(ii) Use your answers to **(b)(i)** to determine the simplest whole number ratio of the mean diameter of the whole stem to the mean depth of the outer layer.

simplest whole number ratio = ... [1]

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

Record the observable differences in your table.

[4]

[Total: 19]

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