Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1747536269

BIOLOGY **9700/33**

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.

DC (LEG/CGW) 116082/3
© UCLES 2016

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 You are provided with one sample of onion epidermis which has been kept in a sucrose solution, **U**.

You are required to:

- make a slide of the epidermis that has been kept in **U**
- observe and draw a cell from the epidermis.

Proceed as follows:

1. Put one **dry and clean** microscope slide on a paper towel.

2. Put a few drops of **U** onto the slide.

3. Remove a piece of the onion epidermis from **U** and, using forceps or fingers, peel off the inner epidermis, as shown in Fig. 1.1.

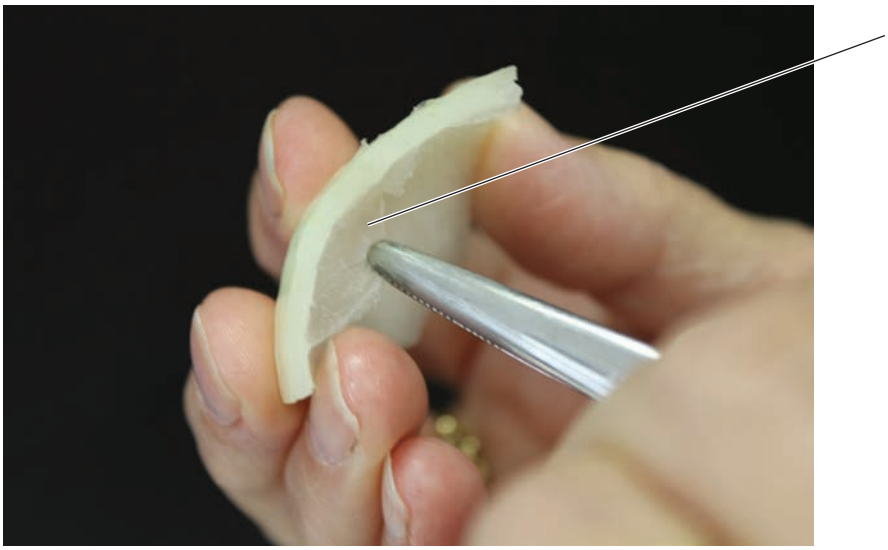


Fig. 1.1

4. Cut one piece of the epidermis that will fit under a coverslip. Put the remaining epidermis back into **U**.

5. Place the epidermis on the slide as shown in Fig. 1.2. If the epidermis is folded, you may need to add more drops of **U** so that it floats and uncurls.

   *Note: it is important to prevent the epidermis from drying out so add more drops of **U** if needed.*

© UCLES 2016

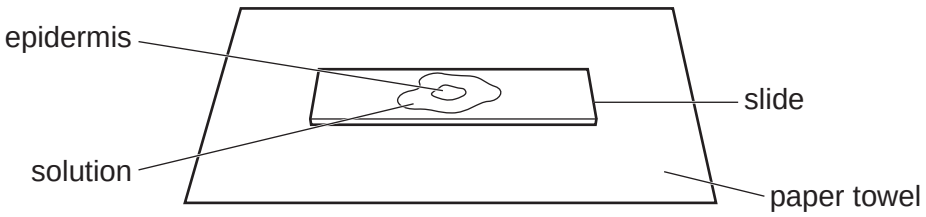


Fig. 1.2

6. Cover the epidermis with a coverslip and use a paper towel to remove any excess liquid that is outside the coverslip.

(a) Use the microscope to select an area of cells on the slide which shows the effect of keeping the epidermis in **U**. Adjust the amount of light entering the microscope to observe cells clearly.

You are required to use a sharp pencil for drawings.

Draw **one** cell from the slide which shows the effect of the sucrose solution **U**.

Use **one** ruled label line and label to identify the cell surface membrane in the cell.

[4]

Your answer to **(a)** shows the effects of the water potential of this concentration of sucrose solution on the onion cells.
To estimate the water potential of the sucrose solution in **U**, the concentration of sucrose in **U** needs to be estimated.

You are required to:

- prepare different concentrations of sucrose solution, **S**, using serial dilution
- carry out the non-reducing sugar test on these concentrations
- carry out the non-reducing sugar test on the solution in **U**
- use the results to estimate the concentration of sucrose solution in **U**.

You are provided with:

labelled	contents	hazard	volume / cm^3
S	1.0 mol dm^{-3} sucrose solution	none	50
W	distilled water	none	100
U	unknown concentration of sucrose solution containing onion epidermis	none	100
H	dilute hydrochloric acid	none	50
A	sodium hydrogencarbonate powder	none	–
Benedict's	Benedict's solution	none	25

7. Set up a water-bath and heat to boiling ready for step 12 and step 16.

(b) You are required to make a **serial** dilution of the 1.0 mol dm^{-3} sucrose solution, **S**, 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.

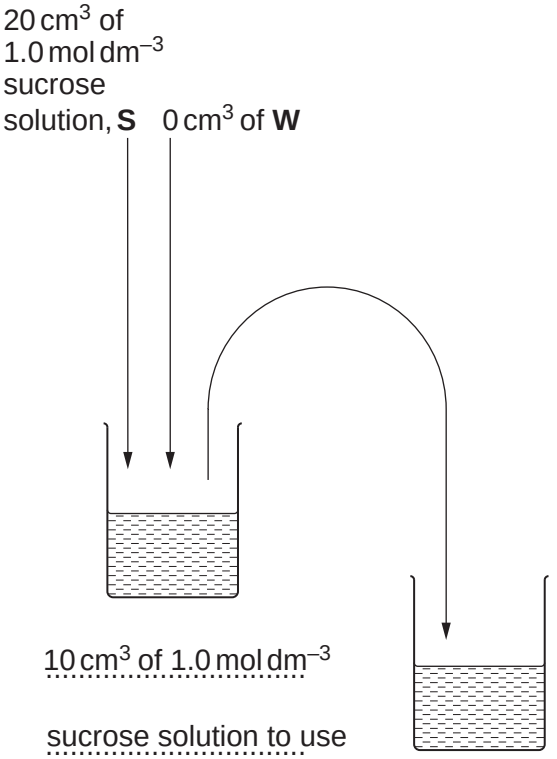
Fig. 1.3 shows the first two beakers you will use to make your serial dilution.

(i) Complete Fig. 1.3 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 sucrose solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **volume** and **concentration** of sucrose 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.

© UCLES 2016


20 cm3 of
1.0 mol dm–3
sucrose
solution, S
0 cm3 of W
10 cm3 of 1.0 mol dm–3
sucrose solution to use

....

.....

.....

Fig. 1.3

[3]

8. Prepare the concentrations of sucrose solution as decided in **(b)(i)** and in Fig. 1.3.

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.

S and **U** contain only non-reducing sugars so a reducing sugar test would give a blue colour after boiling. You are required to carry out **only** the non-reducing sugar test **not** the reducing sugar test.

9. Put 2 cm^3 of **S** (1.0 mol dm^{-3} sucrose solution) into a labelled test-tube.

10. Repeat step 9 with each of the other concentrations prepared in step 8 and with a sample from **U**.

11. Put 2 cm^3 of **H** into each of the test-tubes.

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

13. After 2 minutes, remove the test-tubes and put them into the beaker labelled **C** and leave for a further 2 minutes to cool. *You will need the boiling water-bath for step 16.*

14. After 2 minutes, put a small amount of **A** into each test-tube and repeat until there is no more fizzing. This neutralises the acid so that the Benedict's solution can work.

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

15. Put 3 cm^3 of Benedict's solution into the test-tube containing 1.0 mol dm^{-3} sucrose solution (**S**).

16. Put this test-tube into the boiling water-bath. Start timing.

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

18. Record the result in **(b)(ii)**.

19. Repeat step 15 to step 18 with each of the other concentrations of sucrose solution.

20. Repeat step 15 to step 17 with the sample from **U**. Record the result for **U** in **(b)(iii)**.

© UCLES 2016

(ii) Prepare the space below and record your results for the known concentrations of sucrose solution.

[5]

(iii) State the time taken for the appearance of the first colour change for **U** .....[1]

(iv) Use your results in **(b)(ii)** and **(b)(iii)** to estimate the concentration of sucrose in **U**.

*estimated concentration in **U***.....[1]

(v) Suggest how you would improve this procedure to obtain a more accurate estimate of the concentration of sucrose in **U**.

.....

.....

.....

.....

.....

.....[3]

(c) Using a more accurate procedure a student estimated the concentration of sucrose in a solution which had contained onion epidermis. The student's estimate was 0.66 mol dm^{-3}.

To find the water potential for this concentration of sucrose solution a graph needs to be plotted for known water potentials of different concentrations of sucrose solution as shown in Table 1.1.

Table 1.1

concentration of sucrose solution / mol dm^{-3}	water potential / kPa
1.0	–3.25
0.8	–2.60
0.6	–1.95
0.4	–1.30
0.2	–0.65

© UCLES 2016

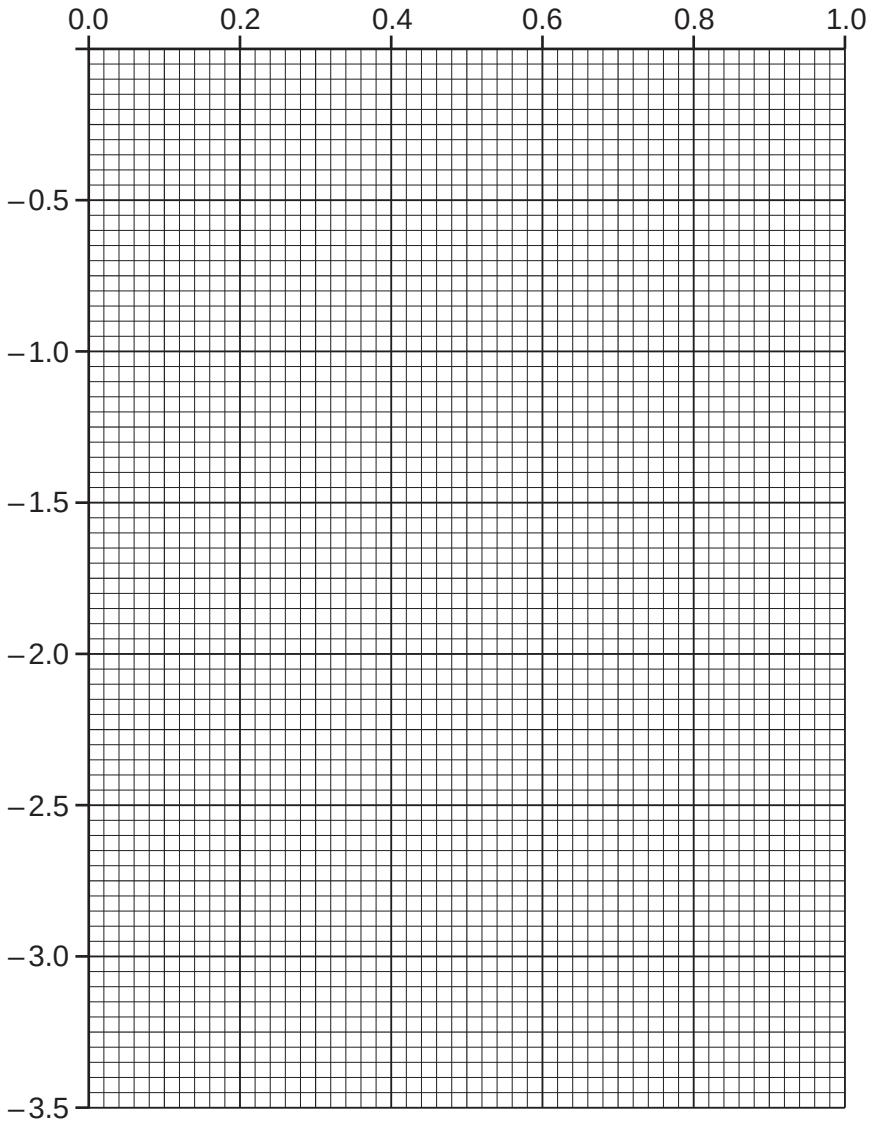
You are required to use a sharp pencil for graphs.

(i) Complete the graph, including axes labels, using the scale provided and using the data in Table 1.1.

.....

.....

.....



[3]

(ii) Use your graph to estimate the water potential of the concentration of sucrose solution recorded by the student (0.66 mol dm^{-3}).

Show on your graph how you estimated the water potential.

water potential .....kPa [1]

(iii) Assuming the water potential in **(c)(ii)** produced the observations of the onion cells in your drawing in **(a)**, explain the effect of the sucrose solution on the onion cells.

.....

.....

.....

.....

.....[2]

[Total: 23]

2 **(a)** Some plants store starch in cells in the roots. As a plant grows more sucrose may be transported to the roots to be stored as starch.

You are provided with three samples which represent cell extracts from roots of different ages, **P1**, **P2** and **P3**.

You are required to test each sample for starch.

(i) Describe how you will test the samples so that you can compare the quantity of starch in each sample.

.....

.....

.....

.....

.....[2]

1. Test each of the samples, **P1**, **P2** and **P3** for starch using the method described in **(a)(i)**.
2. Record your observations in **(a)(ii)**.

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

[3]

(iii) Use your observations recorded in **(a)(ii)** to state which of the samples **P1**, **P2** or **P3** may represent the oldest root.

.....[1]

(b) Fig. 2.1 is a photomicrograph of a stained longitudinal section of part of a root.

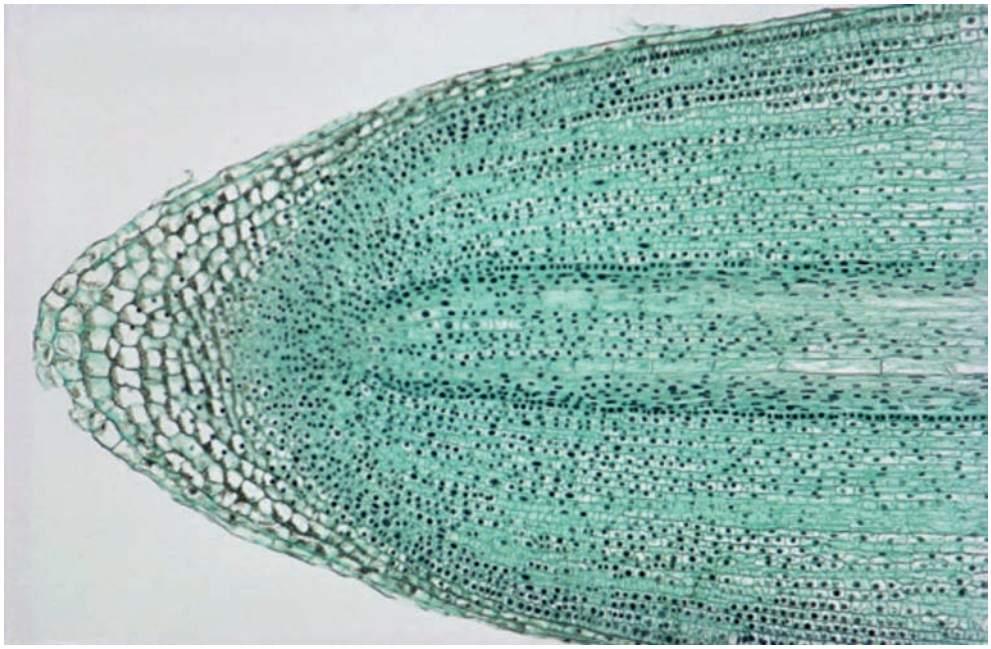


Fig. 2.1

You are required to use a sharp pencil for drawings.

Draw a large plan diagram of the part of the root shown in Fig. 2.1.

Use **one** ruled label line and the letter **T** to identify a tissue containing cells which may store starch in the root.

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

[5]

© UCLES 2016

(c) Fig. 2.2 is a photomicrograph of starch grains inside plant root cells.

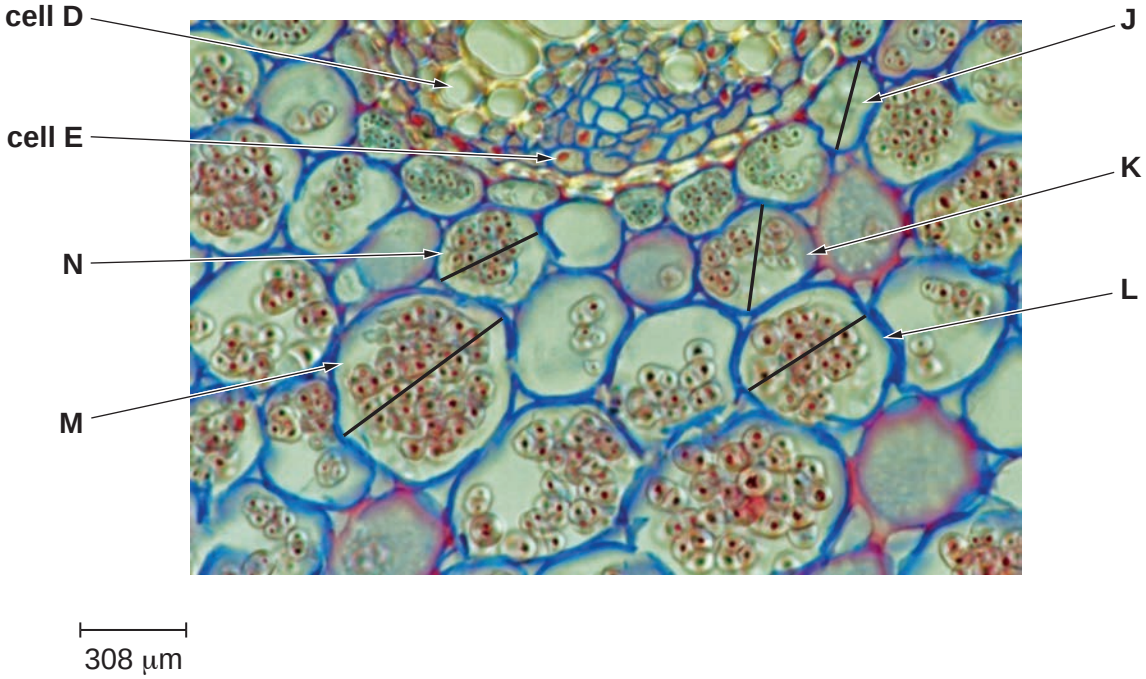


Fig. 2.2

(i) Use the scale bar and the lines in Fig. 2.2 to find the actual width, in μm, of the cells labelled **J**, **K**, **L**, **M** and **N**.

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

J..... μm, **K**..... μm, **L**..... μm, **M**..... μm, **N**..... μm [3]

(ii) Using the actual widths calculated in **(c)(i)**, calculate the **mean** actual width of a cell.

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

mean actual width .....[2]

(iii) State **one** observable difference between the two cells labelled **D** and **E** on Fig. 2.2.

.....

.....[1]

[Total: 17]

© UCLES 2016

BLANK PAGE

© UCLES 2016

BLANK PAGE

© UCLES 2016

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.