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Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6121770184

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 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, paperclips, 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 **14** printed pages and **2** blank pages.

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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** the whole of Question 1 and Question 2.

If you have enough time, think about how you can improve the confidence in your results, for example by recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Onion cells in sodium chloride solutions may show plasmolysis, where the cell surface membrane pulls away from the cell wall.

Fig. 1.1 shows onion cells in different states of plasmolysis.

- Cell **A** is showing no plasmolysis.
- Cells **B**, **C** and **D** are all showing plasmolysis.

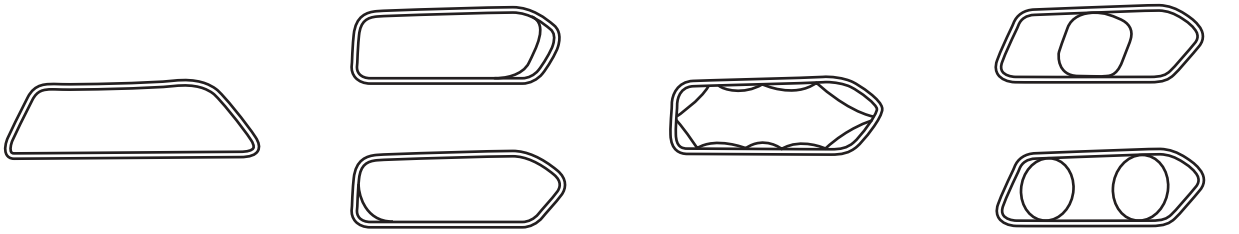


Fig. 1.1

Different concentrations of sodium chloride solutions have different water potentials.

When onion cells are put into a sodium chloride solution with a lower water potential than the cells, water leaves the vacuoles and the cells show plasmolysis.

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You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume /cm^3
S1	0.50 $mol\,dm^{-3}$ sodium chloride solution + onion tissue	none	50
S2	sodium chloride solution + onion tissue	none	50
S3	sodium chloride solution + onion tissue	none	50
S4	sodium chloride solution + onion tissue	none	50

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

It is recommended that you wear suitable eye protection.

S1 is 0.50 $mol\,dm^{-3}$ sodium chloride solution.

S2, **S3** and **S4** are 1.00 $mol\,dm^{-3}$, 0.25 $mol\,dm^{-3}$ and 0.00 $mol\,dm^{-3}$, but **not** necessarily in that order.

You will need to:

- observe a sample of onion cells from **S1**, **S2**, **S3** and **S4**
- decide how many cells you will observe to record the states of plasmolysis
- record the number of cells that show the different states of plasmolysis, **A**, **B**, **C** and **D**, as shown in Fig. 1.1
- use your results to identify the concentration of the sodium chloride solutions, **S2**, **S3** and **S4**.

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Carry out step 1 to step 7 to prepare a slide of onion tissue.

1. Label one dry and clean microscope slide, **S1**. Put the slide on a paper towel.

2. Put a few drops of sodium chloride solution, **S1**, onto the microscope slide.

3. Remove a piece of the onion tissue from **S1**. Peel off the inner epidermis as shown in Fig. 1.2. *The inner epidermis may start to separate or have become separated from the rest of the onion tissue, so the epidermis may be floating in the sodium chloride solution.*

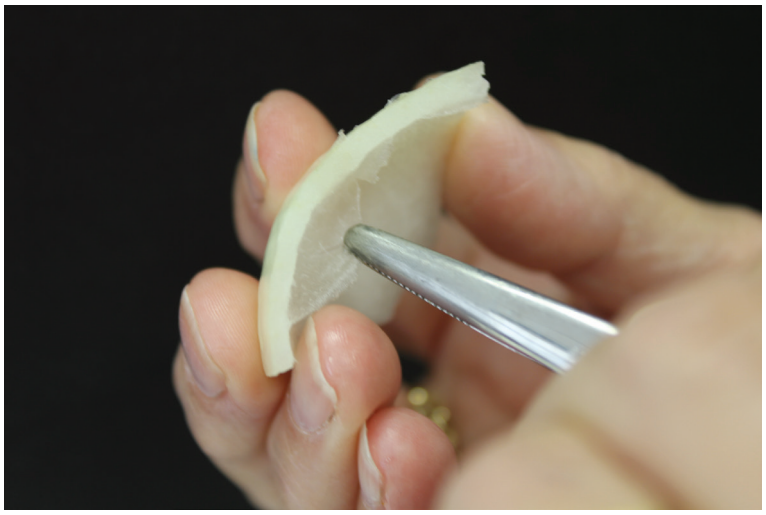


Fig. 1.2

4. Cut one piece of the epidermis so that it will fit under a coverslip. Put the remaining epidermis into **S1**.

5. Put the piece of epidermis on the labelled microscope slide as shown in Fig. 1.3. If the piece of epidermis is folded, you may need to add more drops of **S1** so that it floats and can be unfolded.

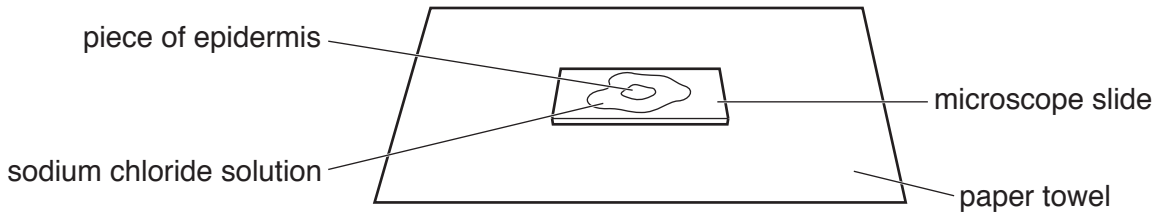


Fig. 1.3

6. Put a coverslip over the piece of epidermis on the microscope slide. Use a paper towel to remove any excess solution that is outside the coverslip.

7. Observe the cells of the epidermis using the microscope. You may need to reduce the amount of light entering the microscope to observe the cells clearly.

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(a) You need to decide which objective lens you will use **and** decide the number of cells you will need to observe to give you confidence in your results.

(i) State the objective lens you will use and the number of cells you will observe. Explain how this will give you confidence in your results.

objective lens .....

number of cells .....

explanation .....

.....

.....

[2]

8. Using the objective lens and the number of cells you decided in **(a)(i)**, count the number of cells for **S1** that are in **each** state of plasmolysis, **A**, **B**, **C** and **D** (as shown in Fig. 1.1). Record your results in **(a)(ii)**.

9. Repeat step 1 to step 8 for each of **S2**, **S3** and **S4**. Record your results in **(a)(ii)**.

(ii) Record your results in an appropriate table.

[5]

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(iii) Solution **S1** is 0.50 mol dm^{-3}.
S2, **S3** and **S4** are 1.00 mol dm^{-3}, 0.25 mol dm^{-3} and 0.00 mol dm^{-3}, but **not** necessarily in that order.

Using your results in **(a)(ii)**, identify the concentration of sodium chloride solution in **S2**, **S3** and **S4**.

S2 .....

S3 .....

S4 .....

[1]

Use a sharp pencil for drawings.

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

(b) Observe the onion cells on the microscope slide you labelled **S4**.

Select **four** adjacent, touching cells, with at least two cells showing plasmolysis.

Make a large drawing of these **four** cells.

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

[4]

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(c) A student investigated the effect of different concentrations of sucrose solutions on pieces of potato tissue.

- Each piece of potato tissue was cut to exactly 50 mm in length and had a cross-sectional area of exactly 10 mm × 10 mm.
- Each piece of potato tissue was put into a different concentration of sucrose solution.
- After 1 hour the length of each piece of potato was measured.

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

Table 1.2

sucrose concentration / mol dm^{-3}	change in length / mm
0.0	+2.5
0.2	+1.5
0.4	0.0
0.6	–0.5
1.0	–1.5

(i) Describe the pattern of water movement shown in Table 1.2.

.....

.....

.....

.....

..... [2]

(ii) Using your knowledge of water potential, explain the result at 0.2 mol dm^{-3}.

.....

.....

..... [2]

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(iii) The student decided to compare the effect of different concentrations of sucrose solution using a different type of potato.

Complete Table 1.3 to suggest how **three** variables would need to be standardised.

Table 1.3

variable	how variable may be standardised

[3]

[Total: 19]

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2 **(a)** A student investigated the effect of different factors on transpiration.
In the investigation, three identical plants were put in flasks containing 70 cm^3 of water as shown in Fig. 2.1.

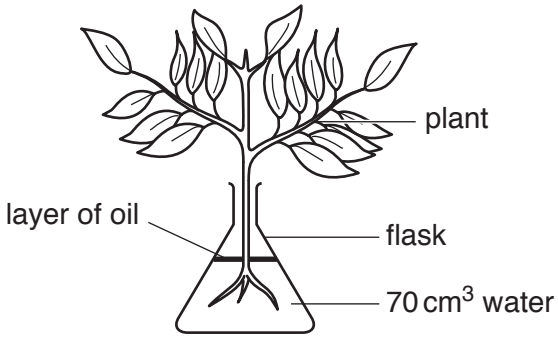


Fig. 2.1

The plants were each kept in different conditions:
- 20 °C + still air + high humidity
- 20 °C + windy + low humidity
- 30 °C + still air + low humidity.

All other variables were kept constant.

After 4 hours the water remaining in each flask was put into beakers labelled **P1**, **P2** and **P3**.

(i) Suggest a suitable control for this investigation.

.....

.....

..... [1]

(ii) Describe how the student could have decreased the humidity.

.....

.....

..... [1]

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You have been given the beakers, labelled **P1**, **P2** and **P3**, containing the water that was collected from each flask after the 4 hours.

You will need to determine the volume of water **lost** by transpiration from each plant.

(iii) Using the apparatus provided, measure the volume of water in **P1**, **P2** and **P3**.

Calculate the volume of water lost through transpiration by **each** plant.

Record your results in an appropriate table.

[2]

(iv) State which plant was grown in high humidity.
Give a reason for your answer.

plant .....

reason .....

.....

.....

[1]

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(b) Plants lose water through stomata by transpiration.

A scientist investigated the effect of carbon dioxide concentration in the air on the number of stomata present per mm^2 of leaf area, in five plants. The carbon dioxide concentration was measured in parts per million (ppm).

Table 2.1

carbon dioxide concentration /ppm	number of stomata/mm^2					
	plant 1	plant 2	plant 3	plant 4	plant 5	mean
288	294	307	286	301	292	296
306	271	285	266	278	270	274
328	254	241	265	263	242	253
357	242	237	297	235	246	
383	234	227	231	234	219	229

(i) Complete Table 2.1 by calculating the mean number of stomata/mm^2 at a carbon dioxide concentration of 357 ppm.

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

[2]

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(ii) Plot a graph of the mean results shown in Table 2.1 on the grid in Fig. 2.2.
The first values for the *x*-axis and the *y*-axis are shown on the grid in Fig. 2.2.

Use a sharp pencil for drawing graphs.

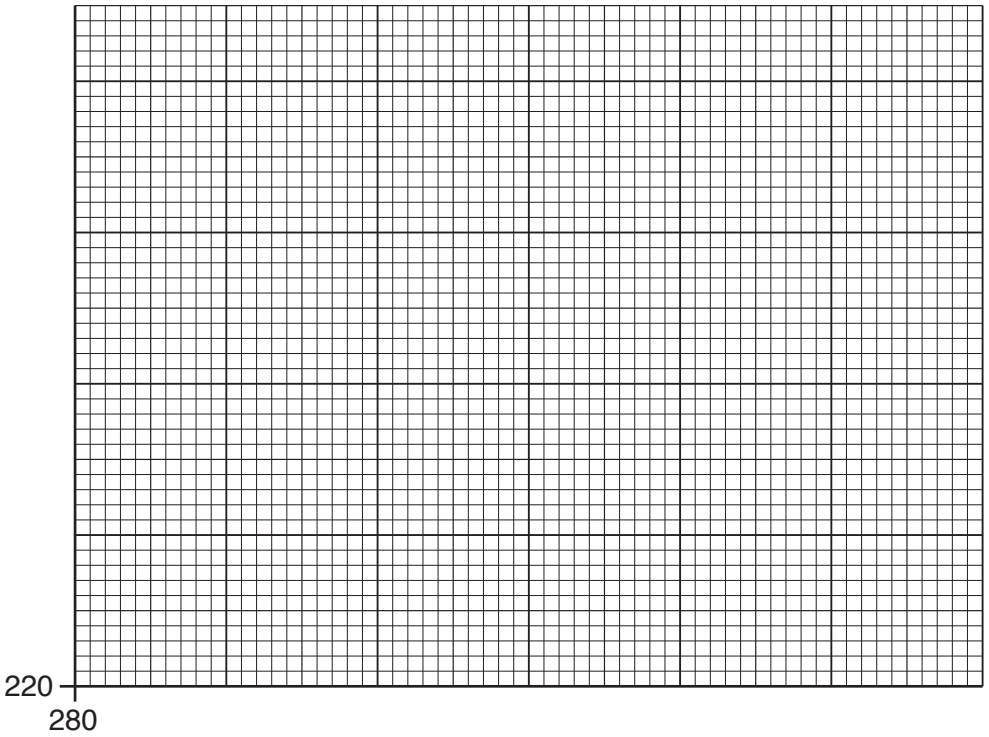


Fig. 2.2

[4]

(iii) Describe the trend shown by your graph in Fig. 2.2.

.....

.....

..... [1]

(iv) A plant has 302 stomata / mm^2.
Use your graph in Fig. 2.2 to determine the carbon dioxide concentration in the air where this plant is growing.

carbon dioxide concentration = ... ppm
[1]

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(c) Fig. 2.3 is a photomicrograph of a stained transverse section through a leaf.

You are not expected to be familiar with this specimen.

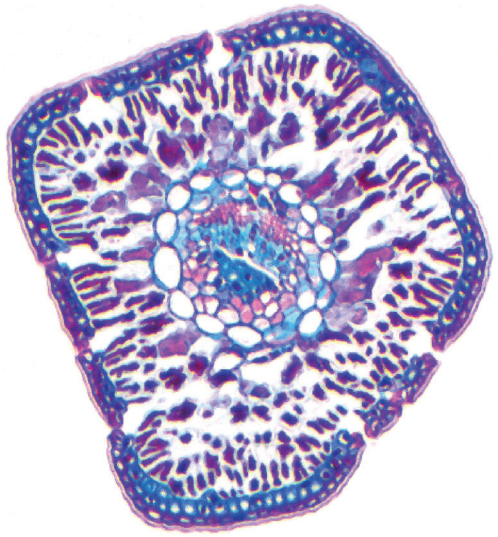


Fig. 2.3

Use a sharp pencil for drawings.
You are expected to draw the correct shape and proportions of the different tissues.

Draw a large plan diagram of the **whole** leaf shown in Fig. 2.3.

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

[5]

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(d) Fig. 2.4 shows the same photomicrograph as in Fig. 2.3, with an eyepiece graticule scale added.

The calibration of the eyepiece graticule scale is:

1 eyepiece graticule division = 39.7 μm.

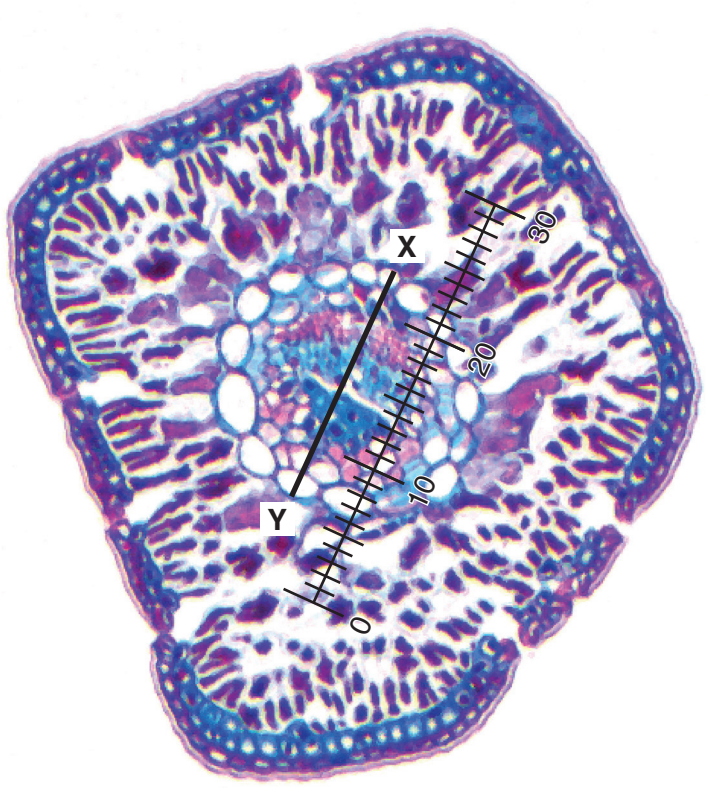


Fig. 2.4

Use the calibration of the eyepiece graticule scale and Fig. 2.4 to calculate the actual width of the vascular bundle, shown by line **X** - **Y**.

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

actual width of the vascular bundle = ... [3]

[Total: 21]

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