Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5459814647

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 2015**

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 (NH/SW) 88803/3
© UCLES 2015

CAMBRIDGE International Examinations

PAPA CAMBRIDGE

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, consider 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 When plant tissue is soaked in methylene blue solution, the stain enters the tissue and colours it blue. This stained tissue can be used to investigate the effect of different solutions on the cells.

You are required to investigate the effect of different concentrations of sodium chloride solution (independent variable) on pieces of plant tissue which have been soaked in methylene blue solution.

You are provided with:

labelled	contents	hazard	volume /cm^3
S	10% sodium chloride solution	none	50
W	distilled water	none	200

labelled	contents	hazard	details	quantity
P	plant tissue stained with methylene blue	methylene blue will stain your skin	each piece has same cross-sectional area and is stained with methylene blue, then washed	5 pieces

If any methylene blue comes into contact with your skin wash it off immediately with water.

It is recommended that you wear safety goggles/glasses.

(a) You are required to make a serial dilution of the 10% sodium chloride solution, **S**, which reduces the concentration of the sodium chloride solution **by a factor of ten** between each successive dilution.

You will need to prepare 20 cm^3 of each concentration.

© UCLES 2015

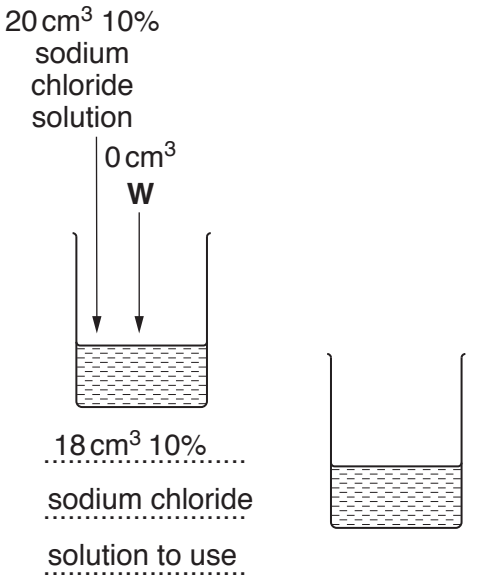
PAPA CAMBRIDGE

(i) Complete Fig. 1.1 to show how you will dilute the solution.

You should use the two beakers shown in Fig. 1.1 and draw as many extra beakers as you need to prepare sufficient concentrations for the investigation.

For each beaker:

- state, under the beaker, the **volume** and **concentration** of the sodium chloride solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **volume** and **concentration** of sodium chloride 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.



[4]

Fig. 1.1

PAPA CAMBRIDGE

Proceed as follows:

Always use blunt forceps when handling the plant tissue to avoid contact with the methylene blue solution.

1. Prepare the concentrations of sodium chloride solution as stated in **(a)(i)** in the containers provided.

2. Remove the pieces of plant tissue from the container, labelled **P**, and place them onto a white tile.

3. Cut the ends off each piece of plant tissue.

4. Cut the plant tissue into **equal** lengths. These should be between 0.75 cm and 1 cm in length.

5. Any pieces of plant tissue which you do not need should be put into the beaker labelled '**For waste**'.

6. Empty the coloured water from the container labelled **P**.

7. Put all the pieces of plant tissue into the empty container labelled **P** and cover with tap water.

8. Change the tap water 5 times, either using a syringe or by pouring off the water. Do not touch the plant tissue.

9. Label test-tubes with the concentrations of sodium chloride solution you prepared in step 1.

10. Label a test-tube **W**.

(ii) The volume of solution surrounding the plant tissue in the test-tube is a variable that must be standardised.

One piece of plant tissue will be put into each test-tube with sodium chloride solution.

State the volume of solution that you will use in each test-tube. Explain why you have selected this volume.

volume .....

reason for selecting this volume .....

.....[1]

11. Put the volume of **W** stated in **(a)(ii)** into the test-tube labelled **W**.

12. For each of the concentrations of sodium chloride solution you prepared in step 1, put the volume stated in **(a)(ii)** into the test-tubes labelled in step 9.

13. Put one piece of plant tissue into each test-tube and leave for 10 minutes.

While you are waiting continue with Question 1.

© UCLES 2015

PAPA CAMBRIDGE

After 10 minutes you will need to remove the plant tissue from each test-tube so that the colour of each solution can be recorded.

14. After 10 minutes, pour the solution **and** the piece of plant tissue from **one** of the test-tubes into the beaker labelled **R**.

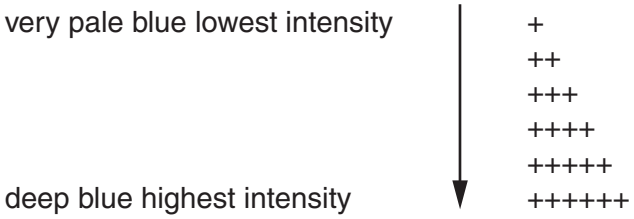
15. Put the piece of plant tissue into the container labelled **'For waste'**. Put the solution back into the test-tube.

16. Rinse beaker **R** with tap water.

17. Repeat step 14 to step 16 with each of the remaining test-tubes.

18. Put the test-tubes into the test-tube rack in the order of the intensity (quantity) of blue colour.

19. Observe the colour in the test-tubes and use the scale below to match each test-tube to an intensity of colour.



20. Record your observations in **(a)(iii)**.

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

[4]

PAPA CAMBRIDGE

When carrying out a practical procedure, the hazards of the use of all the apparatus and solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

(iv) State the hazard with the greatest level of risk when carrying out steps 2 to 8 on page 4. State the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....[1]

(v) The test-tube containing water and stained potato is a control experiment for this investigation.

Explain why it is necessary to collect this result.

.....

.....[1]

(vi) With reference to the experiment you have just carried out, explain why the use of a 1 cm^3 syringe that can measure to an accuracy of 0.01 cm^3 would **not** increase the accuracy of your results.

.....

.....[1]

(b) A scientist investigated the effect of concentration of sodium chloride solution on the increase in length of the roots of a fruit tree.

Nutrient solutions were prepared containing two different concentrations of sodium chloride solution, 1 mM and 25 mM.

10 young fruit trees were placed so that their roots were in 1 mM sodium chloride solution and another 10 young fruit trees were placed so that their roots were in 25 mM sodium chloride solution.

The root length of each of the trees was measured and the mean length of roots recorded at intervals over a period of 10 days.

The results are shown in Table 1.1.

Table 1.1

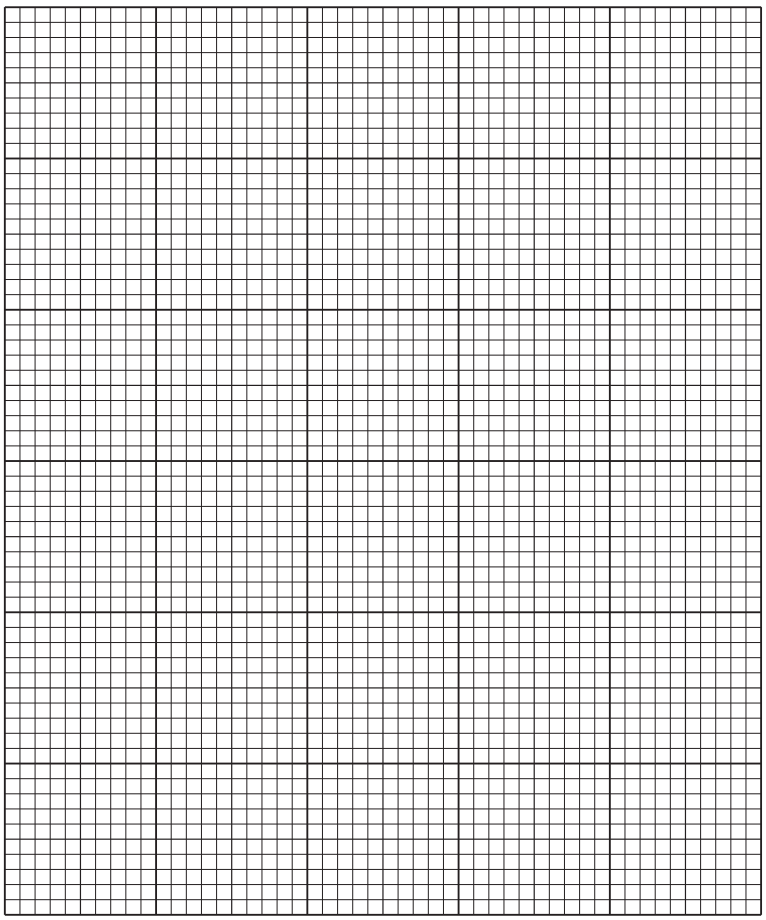
time in sodium chloride solution/days	mean length of roots/mm	
	1 mM sodium chloride solution	25 mM sodium chloride solution
1	37.25	37.00
3	41.25	38.00
5	45.25	39.50
8	52.00	40.00
10	55.00	40.25

© UCLES 2015

PAPA CAMBRIDGE

You are required to use a sharp pencil for graphs.

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



[4]

(ii) Using the data in Table 1.1, the rate at which root length increased between day 3 and day 5 for trees in 1 mM is calculated as 2.00 mm day^{-1}.

Use the data in Table 1.1 to calculate the rate at which root length increased between day 3 and day 5 for plants in 25 mM sodium chloride solution.

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

answer ..... mm day^{-1} [2]

PAPA CAMBRIDGE

(iii) The increase in length of the roots occurs due to an increase in cell numbers following mitosis. These cells then become longer as they take up water by osmosis.

Explain the difference in the rates between day 3 and day 5 for the two concentrations of sodium chloride solution.

.....

.....

.....

.....

.....[2]

(iv) This scientist investigated the effect of concentration of sodium chloride solution on the increase in length of the roots of a fruit tree.

Consider how you would modify this investigation to find the effect of **temperature** on the increase in length of the roots of a fruit tree in 1 mM sodium chloride solution.

Describe how the independent variable (temperature) will be investigated.

.....

.....

.....

.....

Describe how one other variable will be standardised.

.....

.....

.....[3]

[Total: 23]

Check that you have finished the whole of Question 1.

© UCLES 2015

PAPA CAMBRIDGE

Question 2 starts on page 10

PAPA CAMBRIDGE

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

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of the part of the leaf indicated by the shaded area in Fig. 2.1.



Fig. 2.1

On your diagram use **one** ruled label line and label to identify **one** feature that adapts the plant to living in a dry habitat.

Annotate this label to explain **how** the feature you have identified adapts this plant to living in a dry habitat.

[5]

© UCLES 2015

PAPA CAMBRIDGE

(ii) Select one group of **four** cells from the tissue below the vascular bundle found in the centre of the leaf. Each cell in the group should touch two of the other cells.

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

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

[5]

PAPA CAMBRIDGE

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a leaf of a different xerophytic plant species.

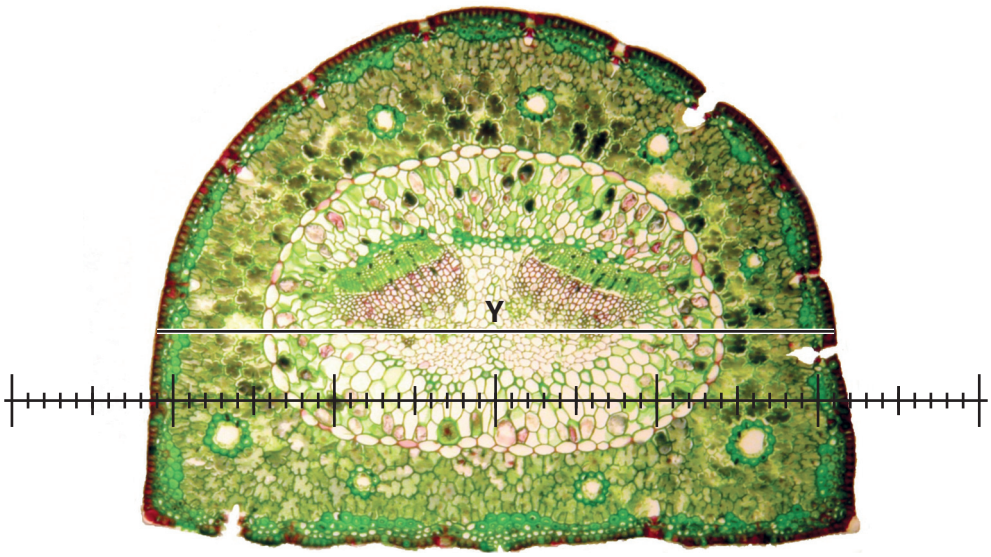


Fig. 2.2

(i) On Fig. 2.2, use a label line and the label '**X**' to suggest the position of the xylem tissue in the leaf. [1]

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

The calibration was: one eyepiece graticule division equal to 0.012 mm.
This is converted to one eyepiece graticule division equal to 12 μm, which is the most appropriate units for use with the light microscope.

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

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

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

..... μm [3]

© UCLES 2015

PAPA CAMBRIDGE

(c) The leaf on slide **J1** and the leaf in Fig. 2.2 are adapted to living in dry conditions.

Prepare the space below so that it is suitable for you to record observable differences in xerophytic adaptations between these two specimens.

Record your observations in the space you have prepared.

[3]

[Total: 17]

© UCLES 2015

PAPA CAMBRIDGE

BLANK PAGE

© UCLES 2015

PAPA CAMBRIDGE

BLANK PAGE

© UCLES 2015

PAPA CAMBRIDGE

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.

PAPA CAMBRIDGE

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5438794417

BIOLOGY **9700/33**

Advanced Practical Skills 1 **October/November 2015**

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.

DC (NH/SW) 88805/3
© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

PAPA CAMBRIDGE

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, consider 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 Yeast cells contain an enzyme, catalase, which catalyses the hydrolysis (breakdown) of hydrogen peroxide into oxygen and water with the transfer of heat to the surroundings. Sodium chloride solution can affect this reaction in yeast cells.

The effect of sodium chloride solutions on yeast cells can be measured by the increase in temperature.

You are required to:

- prepare different concentrations of the sodium chloride solution, **S**
- investigate the effect of different concentrations of sodium chloride solution (independent variable) on the yeast cells by finding the highest increase in temperature.

You are provided with:

labelled	**contents**	**hazard**	**volume /cm^3**
S	10% sodium chloride solution	none	60
W	distilled water	none	60
Y	yeast cell suspension	none	60
H	hydrogen peroxide solution	harmful irritant	60

It is recommended that you wear safety glasses/goggles.

When carrying out a practical procedure, the hazards of the use of all the apparatus and the solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

(a) State the hazard with the greatest level of risk when using the apparatus and solutions and state the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....[1]

© UCLES 2015

PAPA CAMBRIDGE

You are required to change the concentration of the sodium chloride solution.

Table 1.1 shows how to make up two of the sodium chloride concentrations you will use.

Table 1.1

volume of 10% sodium chloride solution **S** / cm^3	volume of distilled water **W** / cm^3	percentage concentration of sodium chloride solution **S**
0	10	0
10	0	10

During the investigation you will mix 10 cm^3 of each concentration of sodium chloride solution with 10 cm^3 of yeast cell suspension to make a mixture, **SY**.

This will result in the concentration of the sodium chloride solution in **SY** being halved as shown in Table 1.2.

Table 1.2

volume of 10% sodium chloride solution **S** / cm^3	volume of distilled water **W** / cm^3	percentage concentration of sodium chloride solution **S**	percentage concentration of sodium chloride solution in **SY**
0	10	0	0
10	0	10	5

(b) (i) Decide which concentrations of sodium chloride solution to prepare:

- using simple dilution
- using 10% sodium chloride solution, **S**.

Complete the table to show how you will prepare these concentrations.

volume of 10% sodium chloride solution **S** / cm^3	volume of distilled water **W** / cm^3	percentage concentration of sodium chloride solution **S**	percentage concentration of sodium chloride solution in **SY**
0	10	0	0
10	0	10	5

[3]

PAPA CAMBRIDGE

Read step 1 to step 13 before proceeding.

To help you answer **(b)(ii)***, you should consider how to record the temperatures (raw results) and then process your raw results to find the temperature rise.*

Proceed as follows:

1. Prepare the concentrations of **S** as stated in **(b)(i)** in the beakers provided.

2. Stir the yeast cell suspension, **Y**.

3. Use a clean syringe to collect 10 cm^3 of **Y** from below the froth.

4. Put 10 cm^3 of **Y** into each of the beakers used in step 1 to make a mixture, **SY** in each beaker.

5. Stir well.

6. Leave for at least 5 minutes.

While you are waiting continue with Question 1.

7. Label test-tubes with the concentration of sodium chloride solution in the mixture **SY** you prepared in step 4.

8. Put 5 cm^3 of **H** into each of these test-tubes.

9. Record the temperature of **H** in each test-tube.

10. After leaving **SY** for at least 5 minutes (step 6), put 1 cm^3 of the mixture **SY** with 0% sodium chloride solution into the appropriate test-tube. Stir well.

11. Time for 2 minutes and record the **highest** temperature of the contents of the test-tube during the 2 minutes.

12. Repeat step 10 and step 11 using the mixture of **SY** with the next lowest concentration of sodium chloride solution.

13. Repeat step 12 with the remaining concentrations.

© UCLES 2015

PAPA CAMBRIDGE

(ii) Prepare the space below to record your raw results and your processed results.

[6]

(iii) Explain why it is necessary to collect a result for the 0% sodium chloride solution and yeast mixture, **SY**.

.....

.....[1]

(iv) State the value of the smallest division on the scale of your thermometer.

smallest division ..... °C

State the actual error in measuring an **increase in temperature** of 6 °C using this thermometer.

actual error 6 °C ± ..... [1]

PAPA CAMBRIDGE

(v) The actual error of using the thermometer is the same for each measurement. The trend in the results is not affected and it is not a **significant** source of error.

Due to the procedure, the highest temperature recorded may be inaccurate (not close to the true temperature).

Suggest how step 9 and step 11 (on page 4) introduced an error which caused the highest temperature recorded to be inaccurate.

.....

.....[1]

(vi) This procedure investigated the effect of the concentration of sodium chloride solution on the activity of catalase in yeast cells.

To modify this procedure for investigating another variable, the independent variable (concentration of sodium chloride) would need to be standardised.

Describe how the independent variable (concentration of **sodium chloride solution**) will be standardised.

.....

.....

Consider how you would modify this procedure to investigate the effect of the concentration of **hydrogen peroxide** on the activity of the catalase in yeast cells.

Describe how the independent variable (concentration of **hydrogen peroxide**) will be investigated.

.....

.....

.....

.....

.....[3]

© UCLES 2015

PAPA CAMBRIDGE

(c) In a similar investigation, a student investigated how changing the concentration of copper sulfate solution (independent variable) affected the hydrolysis of hydrogen peroxide.

The release of oxygen was measured by counting the bubbles when the oxygen was released through a delivery tube into a test-tube of water.

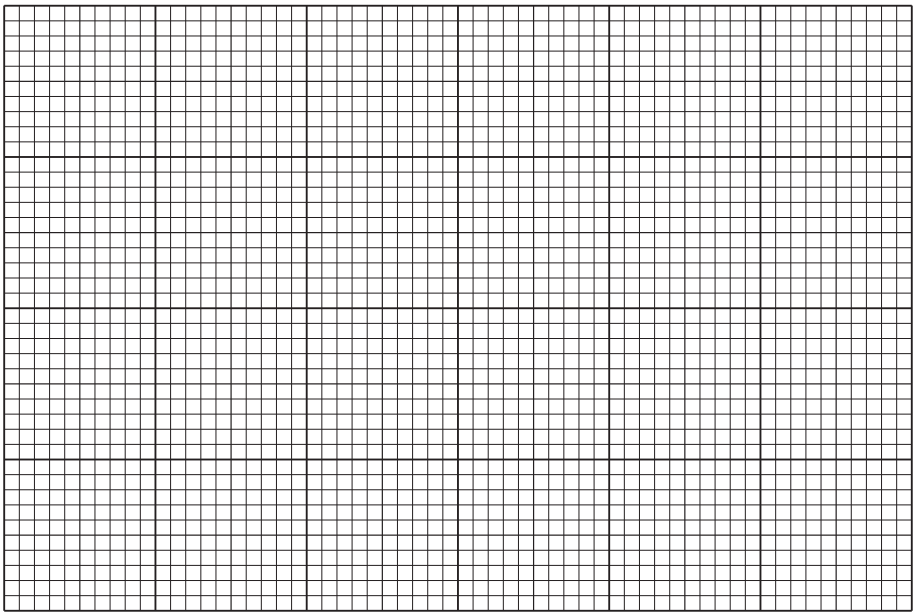
The results are shown in Table 1.3.

Table 1.3

percentage concentration of copper sulfate solution	**rate of catalase activity / number of bubbles released min^{-1}**
0.3000	0
0.1500	1
0.0750	2
0.0375	37
0.0000	39

You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 1.3.



[4]

PAPA CAMBRIDGE

(ii) Explain the relationship between the concentration of copper sulfate solution and the activity of the catalase.

.....

.....[2]

[Total: 22]

Check that you have finished the whole of Question 1.

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

You are not expected to be familiar with this specimen.

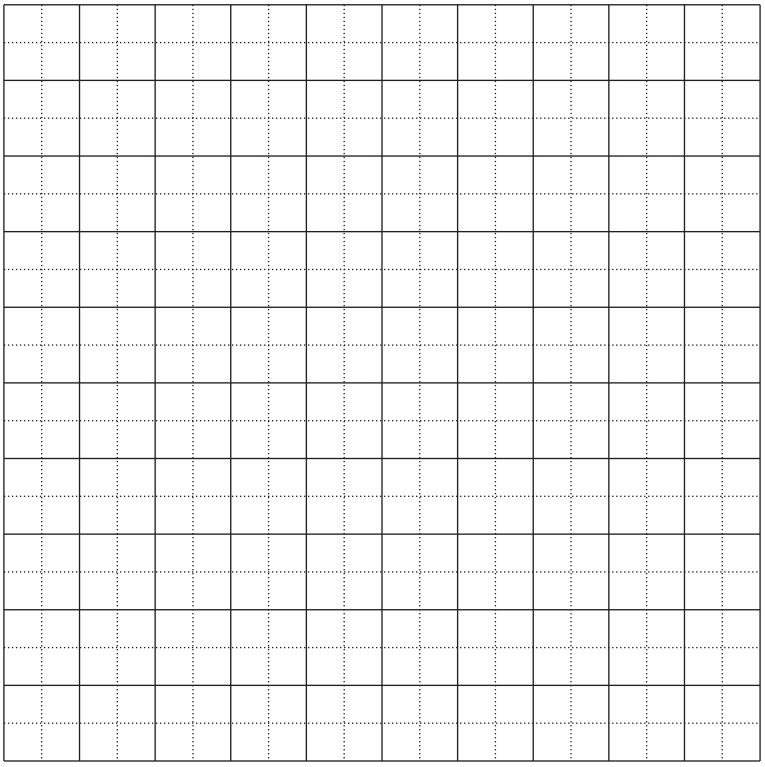
An eyepiece graticule scale can be used to measure the layers of tissues and to help draw a plan diagram with the correct shape and proportions of the tissues, without needing to calibrate the eyepiece graticule scale.

You are required to use a sharp pencil for drawings.

(i) Select one vascular bundle from one of the **corners** of the specimen on **K1**.

The grid and your eyepiece graticule should help you draw the vascular bundle with the correct shape and proportions of the tissues.

Draw on the grid below a large plan diagram of the vascular bundle you have selected.



Use **one** ruled label line and label to identify the xylem. [5]

© UCLES 2015

PAPA CAMBRIDGE

(ii) Observe the tissue (cortex) between the epidermis and the vascular bundle.

Select one group of four cells made up of:

- two cells from the epidermis
- two cortex cells which touch each other and at least one of the epidermis cells.

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

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

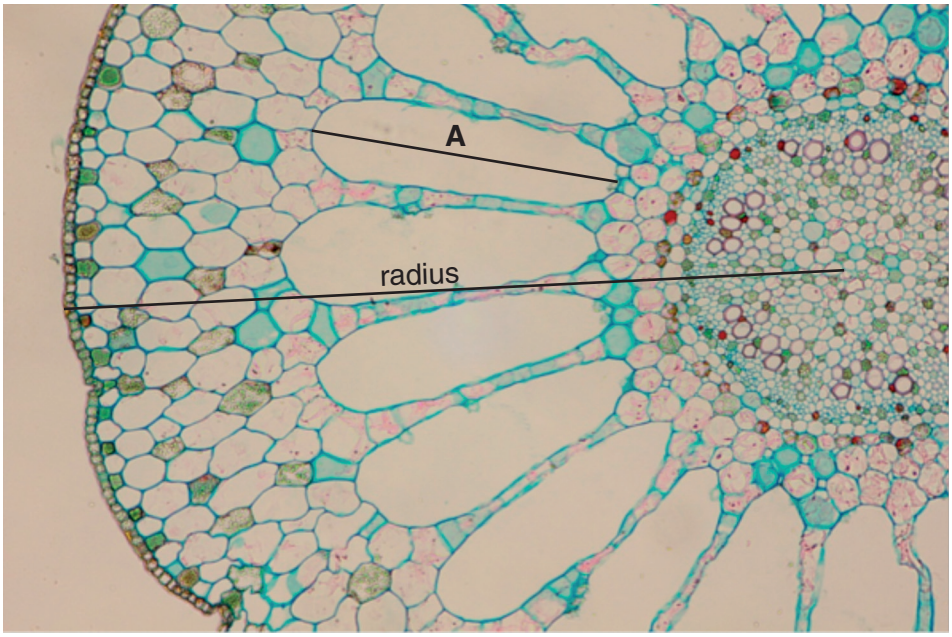
[5]

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

(b) Fig. 2.1 is a photomicrograph of a stained transverse section of a stem of a different plant species.



magnification ×125

Fig. 2.1

(i) Calculate the **actual** length of the line **A** shown on Fig. 2.1.

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

actual length ..... μm [2]

© UCLES 2015

PAPA CAMBRIDGE

(ii) A student observed a different plant of the same species shown in Fig. 2.1. The student determined the ratio of the radius of the stem to the length of one air space as 266:82.

However, a ratio may be simplified to the smallest possible whole number on each side.

In this example, both sides of the ratio 266:82 are divisible by 2, so the simplest ratio for the measurements taken by the student is 133:41.

The actual radius of the stem in Fig. 2.1 is 825 μm.
Determine the simplest ratio of the radius of the stem in Fig. 2.1 to the length of an air space (line **A**).

ratio .....[1]

(iii) Suggest a habitat where this plant might grow and one observable feature shown in Fig. 2.1, which enables it to live in this habitat.

habitat .....

feature .....[1]

(c) Prepare the space below so that it is suitable for you to record observable differences between the specimen on **K1** and Fig. 2.1.

Record your observations in the space you have prepared.

[4]

[Total: 18]

© UCLES 2015

PAPA CAMBRIDGE

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.

PAPA CAMBRIDGE

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

3655420055

BIOLOGY **9700/34**

Advanced Practical Skills 2 **October/November 2015**

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.

© UCLES 2015

CAMBRIDGE International Examinations

PAPA CAMBRIDGE

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, consider 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 When plant tissue is soaked in methylene blue solution, the stain enters the tissue and colours it blue. When the stained plant tissue is placed into a salt solution, methylene blue is released.

You are required to investigate the effect of different surface areas (independent variable) on the release of methylene blue from pieces of stained plant tissue.

You are provided with:

labelled	contents	hazard	volume /cm^3
S	salt solution *(sodium chloride)*	none	250

labelled	contents	hazard	details	quantity
P	plant tissue stained with methylene blue	methylene blue will stain your skin	same cross-sectional area, stained with methylene blue and washed	4 pieces

If any methylene blue comes into contact with your skin wash off immediately with water.

It is recommended that you wear safety glasses/goggles.

When carrying out a practical procedure, the hazards of the use of all the apparatus and solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

(a) State the hazard with the greatest level of risk when carrying out step 1 on page 4.
State the **level** of risk of the procedure: low or medium or high.

hazard .....

.....

level of risk .....

[1]

© UCLES 2015

PAPA CAMBRIDGE

You are required to prepare pieces of plant tissue with different surface areas.

(b) Each piece of plant tissue has the same cross-sectional area. The largest piece needs to be cut to a length of **4 cm** by removing **each end**.

(i) Complete Fig. 1.1 to show how you will cut further pieces which reduce the length by half between each piece of plant tissue. *Fig. 1.1 is not drawn to scale*.

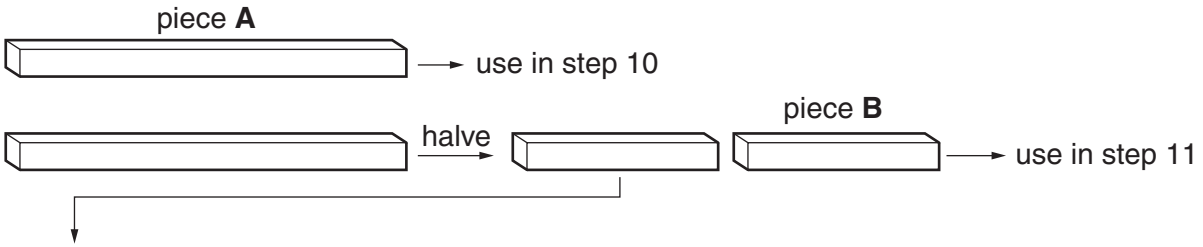


Fig. 1.1

[1]

(ii) Complete the table to show for each piece in **(b)(i)**:
- the dimensions of the piece of plant tissue
- the surface area of each piece.

piece	dimensions / mm	surface area / mm^2
A	*5 × 5 × 40*	850

[2]

PAPA CAMBRIDGE

Proceed as follows:

Always use blunt forceps when handling the plant tissue to avoid contact with the methylene blue solution.

1. Remove the pieces of plant tissue from the container, labelled **P**, and place them onto a white tile.

2. Prepare the pieces of plant tissue as stated in **(b)(ii)**.

3. Any pieces of plant tissue which you do not need should be put into the beaker labelled '**For waste**'.

You will need to prepare a number of pieces of plant tissue to enable you to have confidence in your results.

4. Empty the coloured water from the container labelled **P**.

5. Put the pieces of plant tissue into the empty container labelled **P** and cover with water from the beaker labelled '**Tap Water**'.

6. Change the tap water five times, either using a syringe or by pouring off the water.

Fig. 1.2 shows how you will set up the apparatus for each piece of plant tissue.

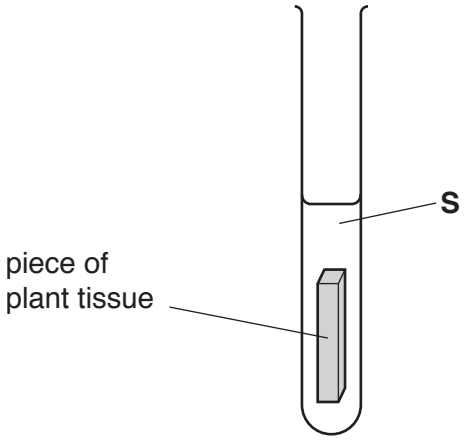


Fig. 1.2

(iii) Describe how you will standardise the volume of **S** for each piece of plant tissue.

.....

.....

.....[1]

© UCLES 2015

PAPA CAMBRIDGE

7. Label one test-tube as 850 (surface area in mm^2 of piece **A**).

8. Repeat step 7 for each of the other surface areas as in **(b)(ii)**.

9. Put the volume of **S** into **each** of the test-tubes as described in **(b)(iii)**.

10. Put piece **A** into the test-tube labelled 850.

11. Repeat for the other pieces of plant tissue, matching the surface area to the label on the test-tube.

12. Leave for 5 minutes.

While you are waiting continue with Question 1.
After 5 minutes you will need to remove the plant tissue from each test-tube so that the colour of each solution can be recorded.

13. After 5 minutes, pour the solution **and** the piece of plant tissue from **one** of the test-tubes into the beaker labelled **R**.

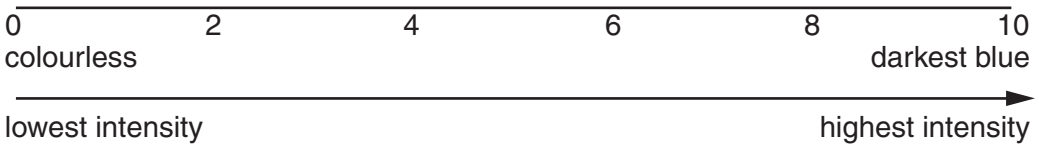
14. Put the piece of plant tissue into the container labelled '**For waste**'. Put the solution back into the test-tube.

15. Rinse beaker **R** with tap water.

16. Repeat step 13 to step 15 with each of the remaining test-tubes.

17. Put the test-tubes into the test-tube rack in the order of the intensity (quantity) of blue colour from lowest intensity to highest intensity.

18. Observe the colour in the test-tubes and use the number scale below to match each test-tube to an intensity of colour.



19. Record the results in **(b)(iv)** on page 6.

PAPA CAMBRIDGE

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

[6]

(v) *A student suggested:*

'The ruler used to measure the pieces of plant tissue resulted in both systematic error and random error.'

State which type of error, systematic or random, could affect the trend in the results. Give a reason for your answer.

type of error .....

reason .....[2]

(vi) Explain how the methylene blue solution was released from the stained plant tissue.

.....

.....

.....[1]

© UCLES 2015

PAPA CAMBRIDGE

(vii) This procedure investigated the effect of different surface areas of stained plant tissue when placed into a salt solution.

To modify this procedure for investigating another variable, the independent variable (surface area) would need to be standardised.

Describe how the independent variable (surface area) would be standardised.

.....

.....

Consider how you would modify this procedure to investigate the effect of **temperature** on the stained plant tissue.

Describe how the independent variable, **temperature**, will be investigated.

.....

.....

.....

.....[3]

[Total: 17]

Check that you have finished the whole of Question 1.

PAPA CAMBRIDGE

2 Some plant cells, for example in roots, store starch as grains.

Fig. 2.1 shows some different shapes of starch grains and patterns in the surface of the starch grains.

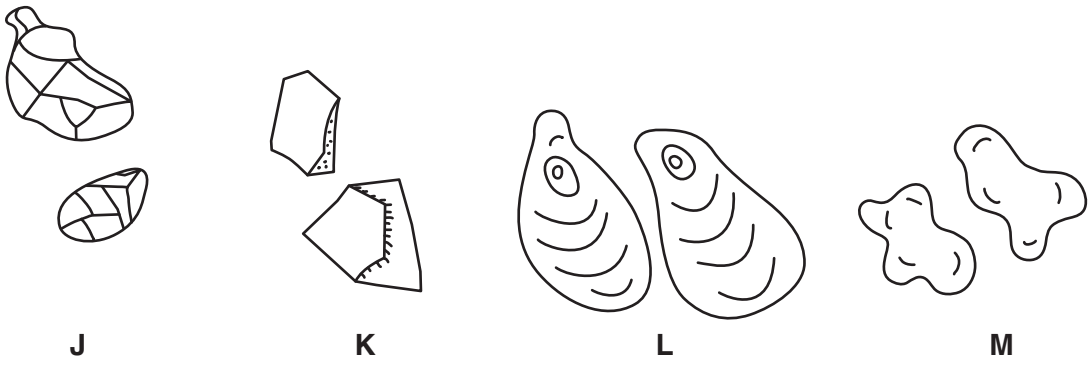


Fig. 2.1

You are required to:
- observe and draw the starch grains from potato cells
- observe the effect of iodine stain on starch grains.

You are provided with a piece of peeled potato tuber in a dish, labelled **T**, water in a container, labelled **W**, and iodine solution in a container labelled **I**.

1. Put one **clean and dry** microscope slide on a piece of black card with a paper towel underneath as shown in Fig. 2.2.

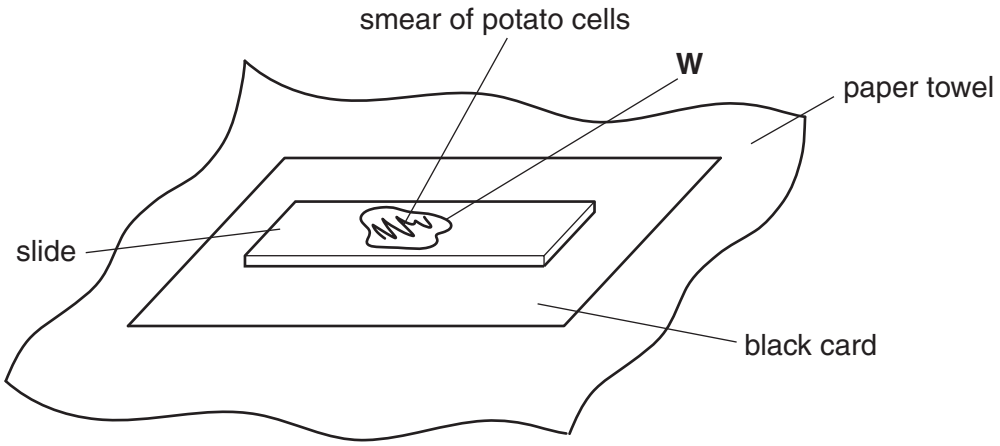


Fig. 2.2

2. Using a sharp blade or scalpel, cut the piece of potato to show a fresh surface.

3. Scrape the fresh surface of the piece of potato to remove a small quantity of tissue.

4. Put this tissue onto the slide and use the flat surface of the blade to squash this tissue.

5. Use forceps to remove any larger bits of tissue so that a smear of cells can be seen on the slide.

6. Put a few drops of **W** onto the smear of cells.

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

© UCLES 2015

PAPA CAMBRIDGE

8. View the slide to observe the starch grains using the microscope. Select an area of starch grains on the slide.

You may need to reduce the amount of light entering the microscope to observe cells clearly.

You must adjust the fine focus to observe the patterns in the starch grains.

You are required to use a sharp pencil for drawings.

(a) Select **6** starch grains which show the different sizes and features of the grains.

(i) Make a large drawing of these 6 starch grains.

[5]

(ii) Use Fig. 2.1 to suggest which of the starch grains, **J**, **K**, **L** or **M** matches some of the grains observed on the slide.

answer .....[1]

9. Remove the slide from the microscope and place it on a paper towel.

You will now add solution **I** to the water on the slide without removing the coverslip.

10. Put a drop of solution **I** onto the slide so that the drop touches the **edge** of the coverslip. Wait a few seconds while the solution **I** moves under the coverslip. Use the paper towel to remove any excess liquid from the top of the coverslip.

11. Immediately use the microscope to observe the starch grains where there is solution **I** on the slide.

(iii) Suggest why using solution **I** as a stain may lead to inaccurate recording of the features of starch grains.

.....

.....[1]

PAPA CAMBRIDGE

(b) Scientists investigated the mean size of starch grains in cells from five different types of maize **D**, **E**, **F**, **G** and **H**.

The results are shown in Table 2.1.

Table 2.1

type of maize	size of starch grain / μm					mean size of starch grains / μm
	1	2	3	4	5	
D	16.240	16.255	16.525	16.260	16.245	
E	16.725	16.730	16.715	16.730	16.725	16.725
F	17.195	17.205	17.200	17.198	17.202	17.200
G	16.975	16.980	16.970	16.976	16.974	16.975
H	17.945	17.950	17.955	17.940	17.960	17.950

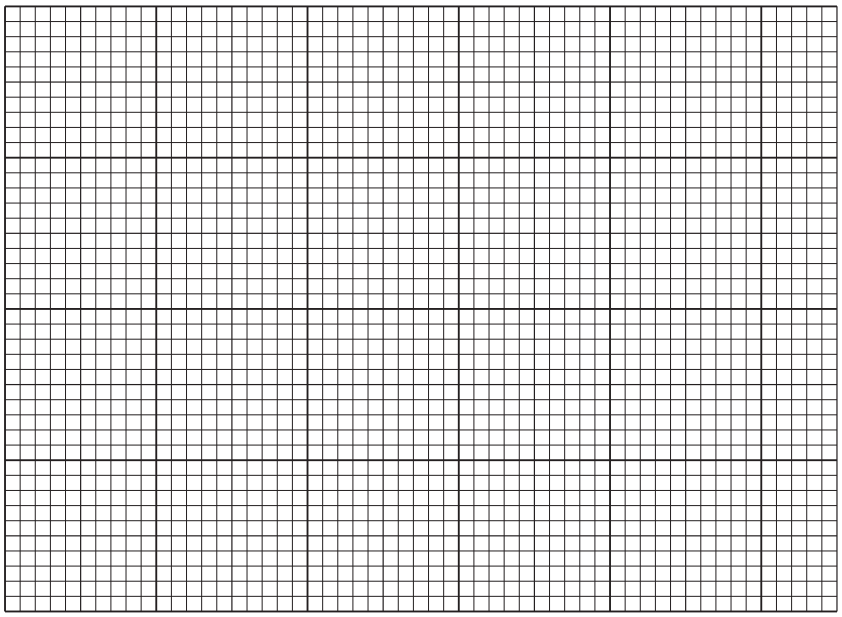
(i) Circle the anomalous result in Table 2.1. [1]

(ii) Complete the table by calculating the missing mean value. [1]

You are required to use a sharp pencil for charts.

(iii) Plot a chart of the data in Table 2.1.

*Note: To plot the data clearly, the scale should **not** have 0 at the origin.*



[4]

© UCLES 2015

PAPA CAMBRIDGE

(iv) Suggest **one** reason which might explain the differences in the mean size of starch grains between different types of maize.

.....

.....

.....[1]

(c) A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that they could find the actual length of specimens observed using a light microscope.

The calibration was: one eyepiece graticule division equal to 0.023 mm.

The use of this unit (mm) is **not** the most appropriate unit for use with a light microscope.

(i) State which unit is the most appropriate for use with a light microscope **and** show how the value 0.023 mm is converted to this unit.

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

[2]

PAPA CAMBRIDGE

(ii) Fig. 2.3 is a photomicrograph showing a stained transverse section through a root with a root nodule.

draw this sector in **(d)**

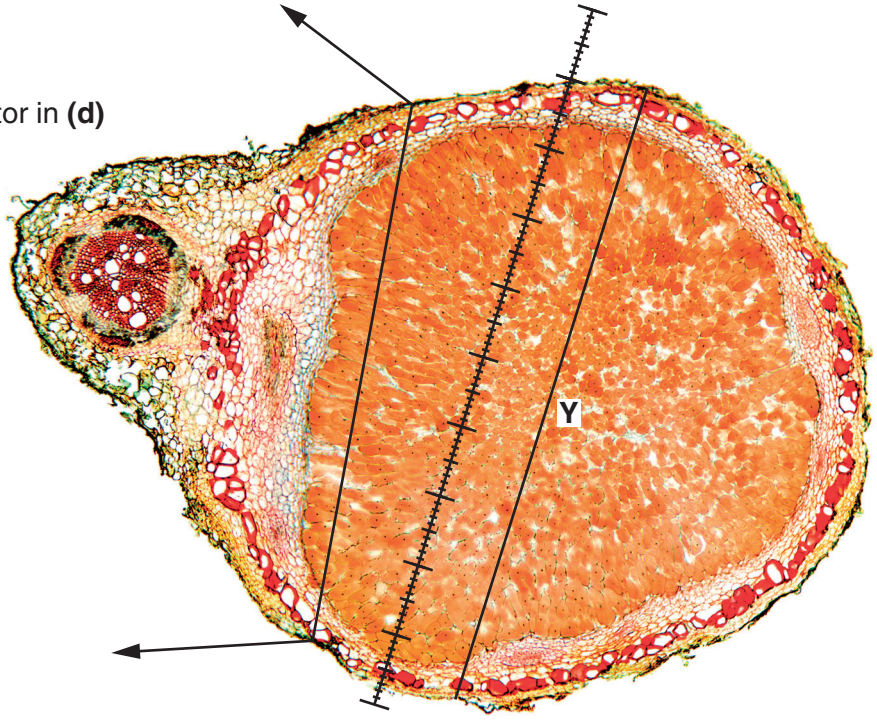


Fig. 2.3

Fig. 2.3 was produced using the same microscope with the same lenses as the student.

Use the calibration of the eyepiece graticule division from **(c)(i)** and line **Y** shown on Fig. 2.3 to calculate the actual total width as shown by line **Y**.

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

actual total width .....[2]

© UCLES 2015

PAPA CAMBRIDGE

You are required to use a sharp pencil for drawings.

(d) Draw a large plan diagram of the sector as shown on Fig. 2.3.

You are not expected to be familiar with this specimen.

Use **one** ruled label line and label to identify the vascular bundle.

[5]

[Total: 23]

© UCLES 2015

PAPA CAMBRIDGE

BLANK PAGE

© UCLES 2015

PAPA CAMBRIDGE

BLANK PAGE

© UCLES 2015

PAPA CAMBRIDGE

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.

PAPA CAMBRIDGE

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

5123914689

BIOLOGY **9700/35**

Advanced Practical Skills 1 **October/November 2015**

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.

© UCLES 2015

CAMBRIDGE International Examinations

PAPA CAMBRIDGE

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, consider 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 A number of plant tissues are coloured because the cells contain chemicals called anthocyanins. These anthocyanins change colour according to the pH and the colour changes are reversible.

You are provided with red cabbage which contains anthocyanins and can be used to make a pH indicator solution.

You are required to:

- prepare a pH indicator solution from red cabbage
- investigate the effect of pH (the independent variable) on the colour of the indicator solution
- identify the pH of the solutions, **S1** and **S2**.

You are provided with:

Table 1.1

labelled	contents	hazard	volume / cm^3
pH 3	solution of pH 3	irritant	30
pH 4	solution of pH 4	irritant	30
pH 6	solution of pH 6	irritant	30
S1	solution of unknown pH	irritant	30
S2	solution of unknown pH	irritant	30
W	distilled water	none	30

labelled	contents	hazard	quantity
P	red cabbage	–	pieces of leaves

It is recommended that you wear safety glasses/goggles.

© UCLES 2015

PAPA CAMBRIDGE

When carrying out a practical procedure, the hazards of the use of all the apparatus and solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

(a) State the hazard with the greatest level of risk when using the solutions in Table 1.1.
State the **level** of risk of using the solutions: low or medium or high.

hazard .....

level of risk .....
[1]

Proceed as follows:

1. Cut the red cabbage leaves into small pieces and place into the water in beaker **A**.

2. Heat the water in beaker **A** and boil for 5 minutes.

3. Turn off the Bunsen burner and leave the water in beaker **A** to cool for 5 minutes to produce a coloured liquid.
This is your pH indicator solution.

While you are waiting continue with Question 1.

4. After 5 minutes, pour approximately 100 cm^3 of this pH indicator solution into a container. Most of the cabbage leaves should remain in beaker **A**.

You are now going to investigate the effect of pH on the colour of the pH indicator solution.

You will need to decide how to standardise the volume of pH indicator solution required to observe the colour change.

So that you can observe the colour change clearly, you need to decide the volume of pH indicator solution to add.

5. Put 4 cm^3 of the **pH 6** solution into a test-tube.

6. Put 1 cm^3 of pH indicator solution into the same test-tube and mix the contents.

7. Add further 1 cm^3 volumes, up to 5 cm^3, in order to decide which volume to use to observe the colour change clearly.

8. Record in **(b)(ii)** the final colour of the pH indicator solution at **pH 6**.

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

(b) (i) State the **volume** of pH indicator solution you will use to observe the colour change clearly and describe how you will standardise the volume of the pH indicator solutions to carry out step 9.

volume ..... cm^3

description .....

.....[1]

9. Using the information in step 5 and **(b)(i)**, find the colour of the pH indicator solution with **pH 3**, **pH 4**, **W, S1** and **S2**. Record all your observations in **(b)(ii).**

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

[5]

PAPA CAMBRIDGE

(iii) Fig. 1.1 shows the position of pH 7 on a scale.
Using your results in **(b)(ii)** complete Fig. 1.1 to show:

- the positions of pH 3, pH 4 and pH 6 on the scale
- the positions of **W**, **S1** and **S2** on the scale.

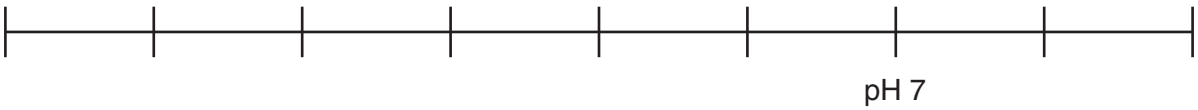


Fig. 1.1

[2]

(c) Like red cabbage, beetroot cells also contain anthocyanins.

A student investigated the effect of temperature on the cell surface membranes of beetroot.

- Beetroot was cut into 1 cm^3 cubes.
- One cube of beetroot was put into each of five test-tubes containing water which had been heated to 25°C or 30°C or 35°C or 45°C or 50°C.
- All other variables were standardised.
- The cubes were removed after 15 minutes.
- The absorbance of light by the coloured liquid left in the test-tubes was measured using a colorimeter.

The absorbance of light by pure water is 0.000 arbitrary units.

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

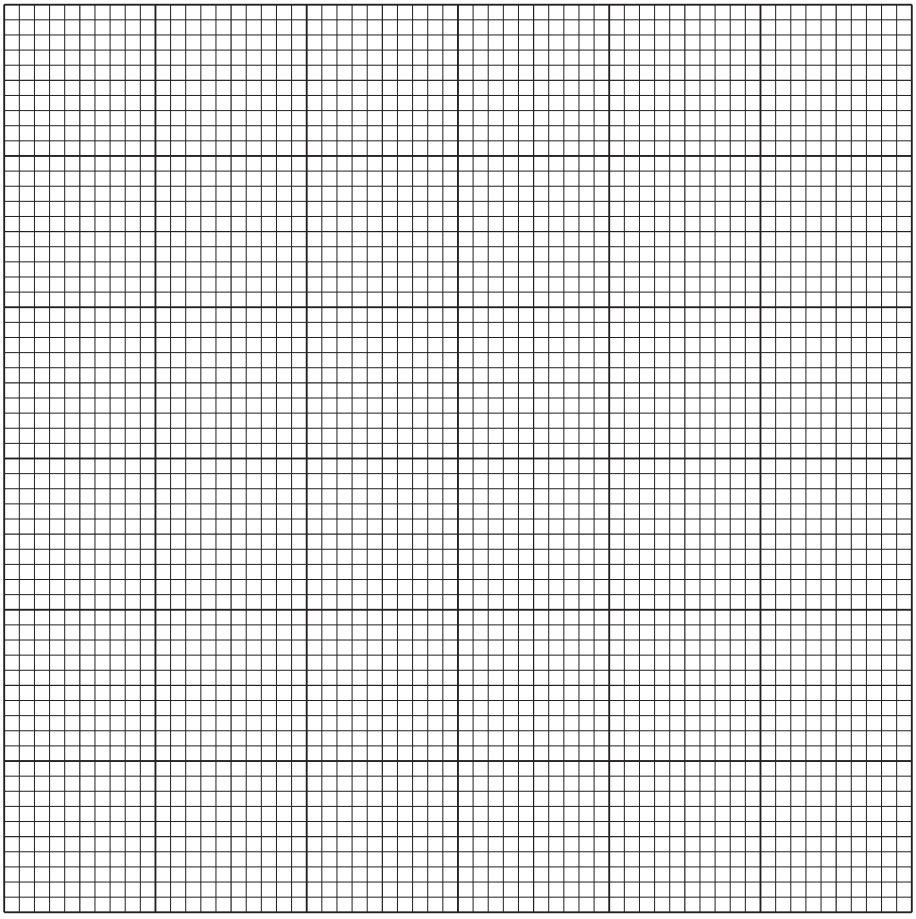
The results of the student's investigation are shown in Table 1.2.

Table 1.2

temperature / °C	absorbance of light by the coloured liquid / arbitrary units
25	0.080
30	0.155
35	0.225
45	0.395
50	0.580

You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 1.2.



[4]

© UCLES 2015

PAPA CAMBRIDGE

(ii) Use your graph to estimate the absorbance of light at 40°C.
Show on your graph how you estimated the absorbance of light.

absorbance .....[2]

(iii) Explain the effect of temperature on the permeability of cell surface membranes in beetroot.

.....

.....

.....

.....

.....[3]

The student decided to investigate the effect of alcohol on the cell surface membranes of beetroot cubes at 20°C.

(iv) Describe how the temperature will be standardised in this investigation.

.....

.....[1]

(v) Describe how the independent variable will be investigated.

.....

.....

.....[2]

[Total: 21]

Check that you have finished the whole of Question 1.

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

2 **L1** is a slide of a stained transverse section through a plant stem.

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of half of the stem to show the observable features.

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

[5]

(ii) Annotate your diagram to describe one difference between the cells in the centre (pith) and the cells in the outer layer (epidermis). [1]

© UCLES 2015

PAPA CAMBRIDGE

(iii) Select one group of four cells from the pith. Each cell of the group must touch two of the other cells.

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

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

[5]

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

(b) Fig. 2.1 and Fig. 2.2 are photomicrographs of transverse sections (TS) of leaves from the same plant.

TS of leaf grown in sunlight

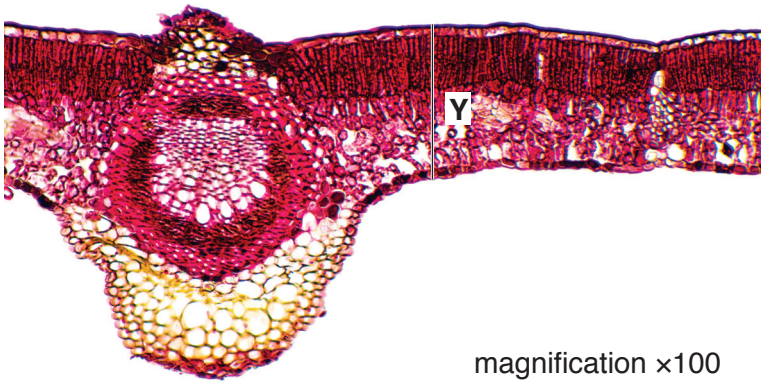


Fig. 2.1

TS of leaf grown in shade



Fig. 2.2

(i) Calculate the **actual** thickness of the leaf grown in sunlight as shown by line **Y** on Fig. 2.1.

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

actual length .....μm
[3]

© UCLES 2015

PAPA CAMBRIDGE

(ii) Prepare the space below so that it is suitable for you to record observable differences between Fig. 2.1 and Fig. 2.2.
Do **not** include difference in thickness of the leaves.

Record your observations in the space you have prepared.

[4]

(iii) A student observed a different plant of the same species shown in Fig. 2.1. The student determined the ratio of the thickness of a leaf grown in sunlight to the thickness of a leaf grown in shade as 120:60.

However, a ratio may be simplified to the smallest possible whole number on each side.

In this example, both sides of the ratio 120:60 are divisible by 60, so the simplest ratio for the thickness of leaves measured by the student is 2:1.

The actual thickness of the leaf grown in shade in Fig. 2.2 is 70 μm.

Determine the simplest ratio of the thickness of the leaf grown in sunlight in Fig. 2.1 compared to the thickness of the leaf grown in shade in Fig. 2.2.

ratio .....
[1]

[Total: 19]

© UCLES 2015

PAPA CAMBRIDGE

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.

PAPA CAMBRIDGE

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6673773990

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 2015**

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 **14** printed pages and **2** blank pages.

DC (ST/SW) 89024/4
© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

PAPA CAMBRIDGE

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, consider 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 When onion cells are placed into a solution, water will move depending on the water potential inside the cells and the water potential of the surrounding solution.

You are required to:

- investigate the effect of sodium chloride solution on onion epidermis cells
- observe the effect of adding iodine solution to the onion epidermis cells
- observe the effect on the onion epidermis cells of replacing the sodium chloride solution with water
- calculate the percentage plasmolysis of the cells in the onion epidermis.

You are provided with:

labelled	contents	hazard	volume/cm^3
W	distilled water	none	50
I	iodine solution	irritant	10

You are also provided with:

- onion tissue in sodium chloride solution, in a container labelled **S1**.

You are required to observe and draw cells from:

- onion tissue from **S1**
- onion tissue from **S1** after staining with solution **I**.

Proceed as follows:

1. Label one **clean and dry** microscope slide as **S1** and put the slide on a paper towel.
2. Put a few drops of sodium chloride solution from **S1** onto the slide.

© UCLES 2015

PAPA CAMBRIDGE

3. Remove a piece of the onion tissue from **S1** and, using forceps or fingers, peel off the inner epidermis as shown in Fig. 1.1.

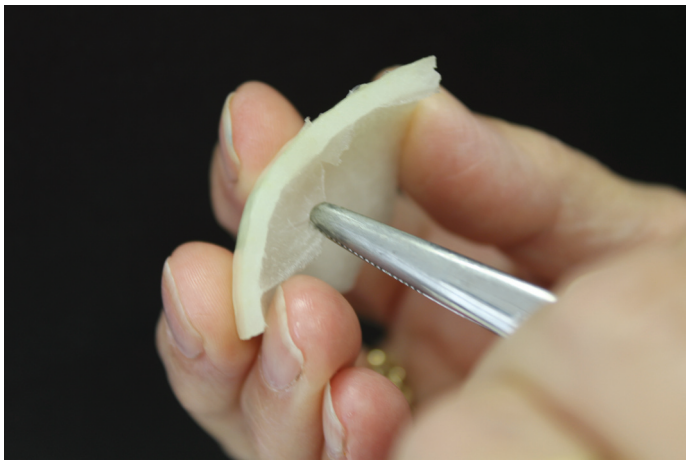


Fig. 1.1

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

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 from **S1** so that it floats and uncurls.

6. To prevent the epidermis from drying out add more drops from **S1** if needed.

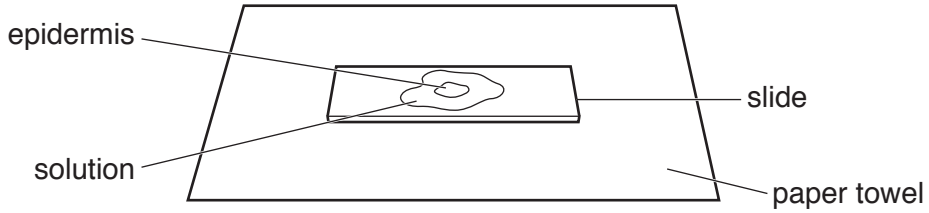


Fig. 1.2

7. Cover the epidermis with a coverslip so that one edge of the epidermis is close to the edge of the coverslip. Use a paper towel to remove any excess liquid that is outside the coverslip.

8. View the slide using the microscope.

   You may need to reduce the amount of light entering the microscope to observe the cells clearly.

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

You are required to use a sharp pencil for drawings.

(a) (i) Select **two** cells from the epidermis which show the effect of sodium chloride solution from **S1**.

Make a large drawing of these two cells.

On your drawing use a ruled label line and label to identify the cell wall of one cell.

[3]

You will now add solution **I** to the solution from **S1** without removing the coverslip.

9. Remove the slide from the microscope and place on a paper towel.

10. Put a few drops of solution **I** onto the slide in contact with one **edge** of the coverslip nearest to the edge of the epidermis as shown in Fig. 1.3.

Wait a few seconds while solution **I** moves under the coverslip.

Use a paper towel to remove any excess liquid from the top of the coverslip.

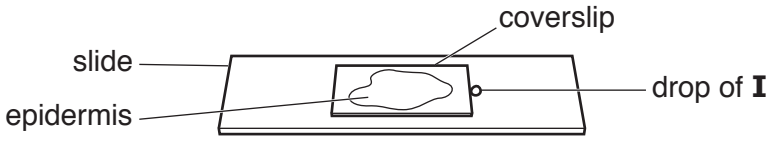


Fig. 1.3

11. View the slide using the microscope.

Select one cell which has been affected by solution **I**.

© UCLES 2015

PAPA CAMBRIDGE

(ii) Make a large drawing of the cell that you have selected.

Annotate your drawing to describe **one** feature that is different between this cell and the cells drawn in **(a)(i)**.

[3]

You are now required to:

- investigate the effect of replacing the solution from **S1** with water
- calculate the percentage of the cells that are plasmolysed in the onion tissue.

12. Label one **clean and dry** microscope slide as **W** and put the slide on a paper towel.

13. Repeat steps 3 and 4 (page 3).

14. Put the piece of the cut epidermis into the container labelled **W** (which contains distilled water) and leave for two minutes.

15. After two minutes, put a few drops of distilled water from **W** onto slide **W** and then put the epidermis on the slide as shown in Fig. 1.2 on page 3.

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

17. View the slide using the microscope.

(b) Look at an area of cells using the ×10 and ×40 objective lenses.

Select the objective lens which allows you to count a suitable number of cells in a field of view so that you can calculate the percentage of cells showing plasmolysis.

(i) State the magnification of the objective lens you will use.

magnification × .....

[1]

You will need to decide the total number of cells to count as your sample.

(ii) State the total number of cells you decided to count.

total number of cells .....

[1]

PAPA CAMBRIDGE

The onion cells may show degrees of plasmolysis, from no plasmolysis to complete plasmolysis as shown in Fig. 1.4.

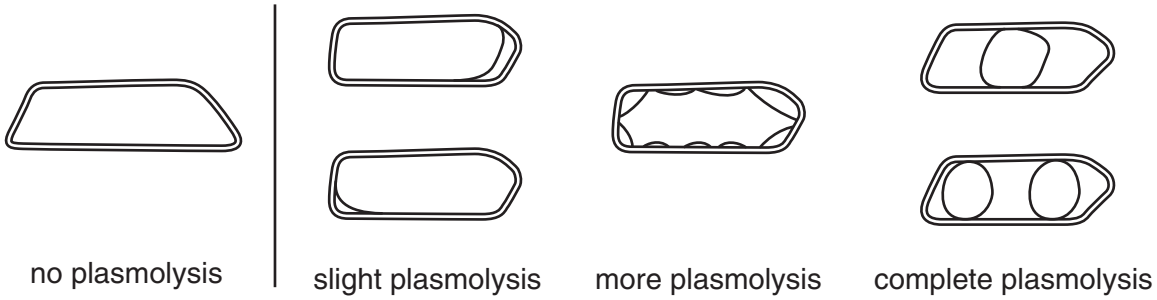


Fig. 1.4

18. Select one field of view which includes cells showing **any** degree of plasmolysis and cells showing no plasmolysis.

19. Observe and record on page 7 each of the cells in your sample, recording:

    - '✓' for each cell that shows any degree of plasmolysis (see Fig. 1.4)
    - '✗' for each cell that shows no plasmolysis.

Consider how you will obtain results which are as accurate as possible.

(iii) Using your results calculate the percentage of cells that are plasmolysed.

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

[1]

© UCLES 2015

PAPA CAMBRIDGE

(iv) Prepare the space below and record the number of cells showing any degree of plasmolysis and the number of cells showing no plasmolysis (raw results) **and** record processed results for the percentage of cells that are plasmolysed in the onion tissue.

[5]

(v) Identify **one** significant source of error in measuring the dependent variable.

.....

..... [1]

(vi) Explain, in terms of the movement of water and water potential, the effect of water replacing the sodium chloride solution on the cells of the epidermis.

.....

.....

.....

.....

.....

.....

..... [3]

(vii) Suggest how you would modify this investigation to find the sodium chloride concentration of an unknown solution.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 21]

PAPA CAMBRIDGE

2 Plants lose water through a process called transpiration. This involves the flow of water from the roots to the leaves, where water evaporates from the surfaces of the cells in the leaf.

Some plants have features to reduce water loss. For example their leaves may be rolled or their stomata are located mainly on the underside of their leaves.

These features reduce transpiration and such plants are called xerophytes.

Fig. 2.1 shows diagrams of a transverse section and surface view of the same leaf in humid conditions and in dry conditions.

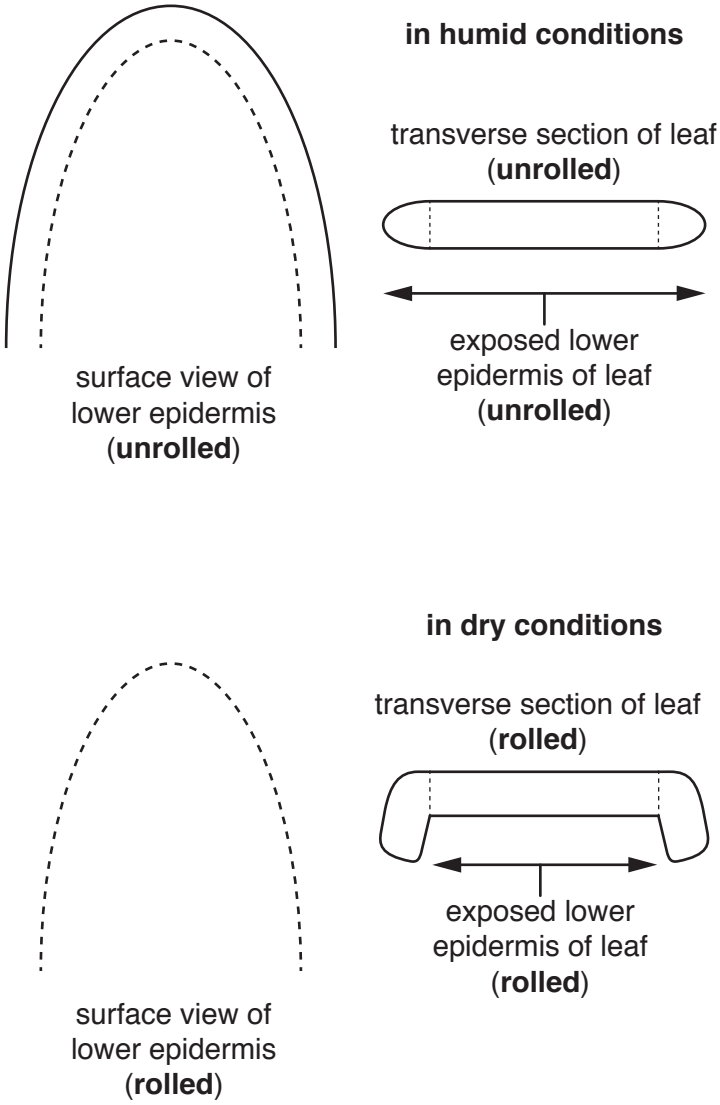


Fig. 2.1

PAPA CAMBRIDGE

You are required to investigate the effect of rolled leaves in a plant by calculating the surface area of the exposed lower epidermis in the **rolled** leaf.

You are provided with the diagram of the exposed lower epidermis of the **rolled** leaf on **page 15**.

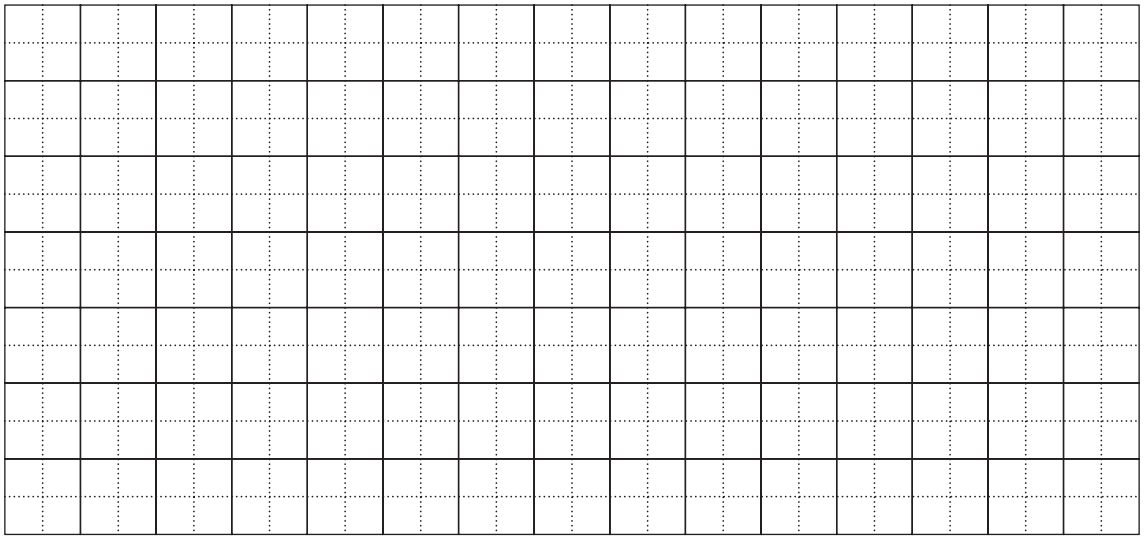
Proceed as follows:

1. Cut round the diagram of the outline of the exposed lower epidermis of the **rolled** leaf on **page 15**.

2. Put this on Grid 2.1 on page 9 and, use a sharp pencil to trace around the shape.

(a) (i) Calculate the total surface area of the exposed lower epidermis in the rolled leaf using the shape you have cut out:

- Count the number of 1 cm × 1 cm squares within the outline.
- Count any 'half square' or 'more than half square' as **one square**.
- Do **not** count any square that is less than half a square.
- Indicate **on your grid** all of the 1 cm × 1 cm squares that you have included in your surface area.



Grid 2.1

total surface area of the exposed lower epidermis in the rolled leaf .....[4]

PAPA CAMBRIDGE

(ii) A student determined the ratio of the length of the unrolled leaf compared to the width of the unrolled leaf as shown below.

> length of the unrolled leaf = 15 cm
>
> width of the unrolled leaf = 6 cm
>
> Ratio is the length of the unrolled leaf compared to the width of the unrolled leaf.
>
> Ratio is 15:6

However, a ratio may be simplified to the smallest possible whole number on each side.

In this example, both sides of the ratio 15:6 are divisible by 3, so the simplest ratio is 5:2.

The surface area of the exposed lower epidermis of the **unrolled** leaf was found to be 60 cm^2.

Determine the simplest ratio of the surface area of the **unrolled** leaf to the surface area of the **rolled** leaf (from page 15) using your answer from **(a)(i)**.

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

ratio .....

[1]

(b) A scientist investigated the effect of the number of leaves on a tomato plant on the rate of transpiration.

A tomato plant had 14 leaves at the start of the investigation. The transpiration rate of this tomato plant was recorded.
At regular intervals leaves were removed and the transpiration rate recorded.
All other variables were standardised.

© UCLES 2015

PAPA CAMBRIDGE

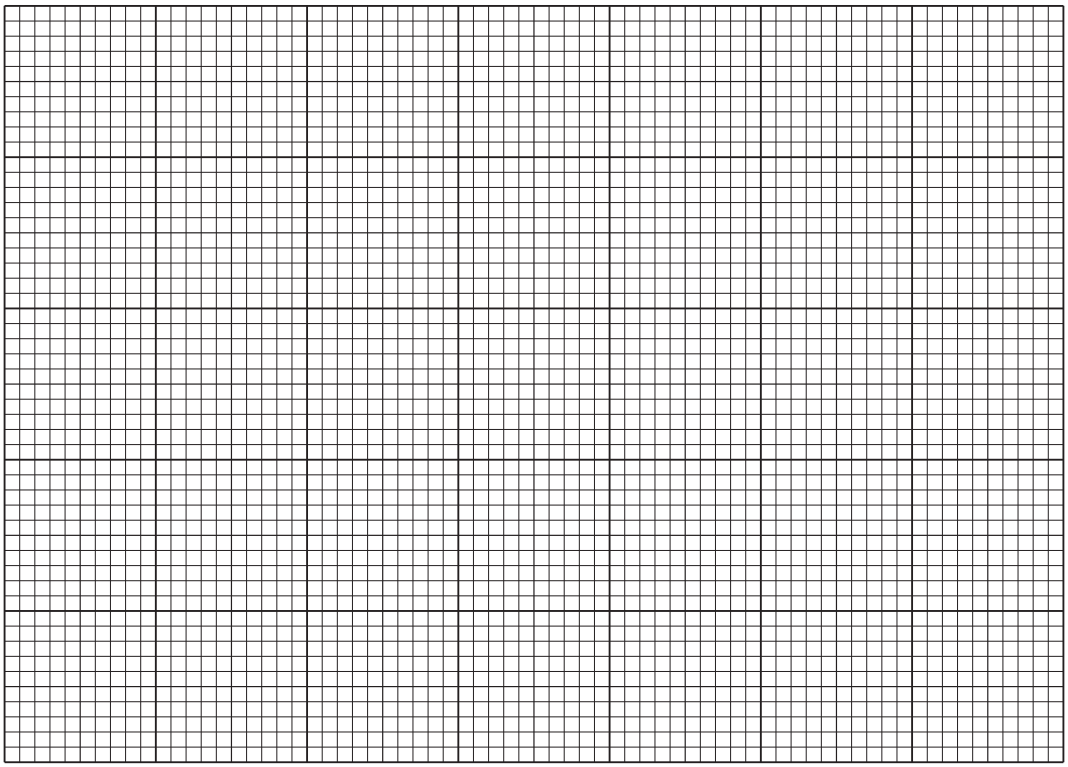
The results of the investigation are shown in Table 2.1.

Table 2.1

number of leaves	transpiration rate / $\mu l\,min^{-1}$
14	9.5
10	4.3
8	3.9
5	3.5
2	1.8

You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 2.1.



[4]

(ii) Estimate the transpiration rate of the plant with 12 leaves.

Show on the graph how you estimated the transpiration rate.

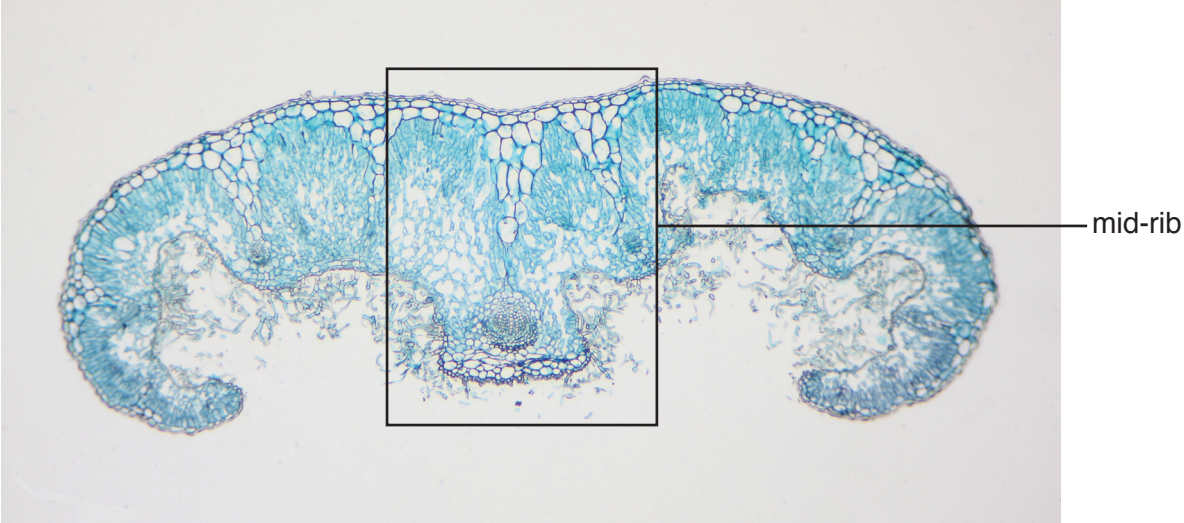
transpiration rate ..... [2]

PAPA CAMBRIDGE

You are required to use a sharp pencil for drawing.

(c) Fig. 2.2 is a photomicrograph showing a stained transverse section through a leaf.

You are not expected to be familiar with this specimen.



magnification ×200

Fig. 2.2

Draw a large plan diagram of the mid-rib as shown in Fig. 2.2.

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

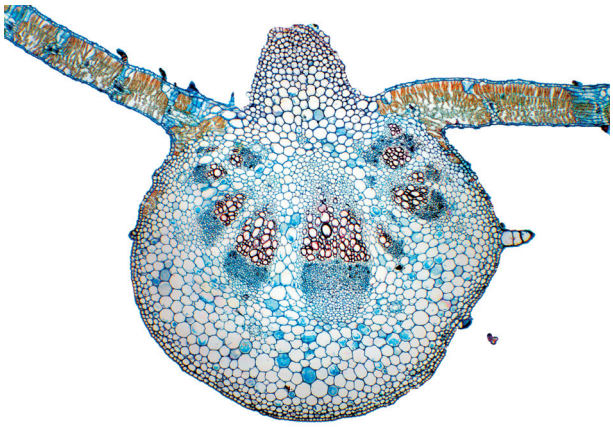
[5]

© UCLES 2015

PAPA CAMBRIDGE

(d) Fig. 2.3 is a photomicrograph showing a stained transverse section of a mid-rib of a different plant species.

You are not expected to be familiar with this specimen.



magnification ×100

Fig. 2.3

Prepare the space below so that it is suitable for you to record observable differences between the mid-rib of Fig. 2.2 and the mid-rib of Fig. 2.3.

Record your observations in the space you have prepared.

[3]

[Total: 19]

© UCLES 2015

[Turn over

PAPA CAMBRIDGE

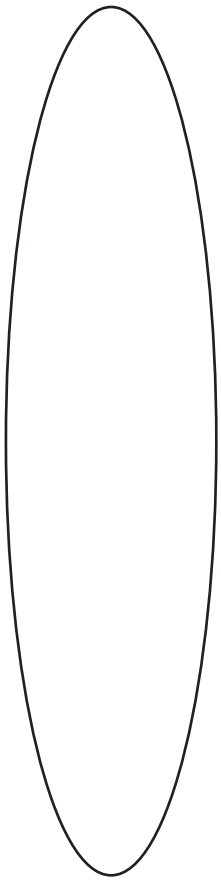
BLANK PAGE

© UCLES 2015

PAPA CAMBRIDGE

Diagram for Question 2 (a)(i)

Outline of exposed lower epidermis of the **rolled** leaf



© UCLES 2015

PAPA CAMBRIDGE

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.

PAPA CAMBRIDGE