Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5008781059

BIOLOGY **9700/31**

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

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **14** printed pages and **2** blank pages.

DC (ST/SW) 137882/3
© UCLES 2018

CAMBRIDGE International Examinations

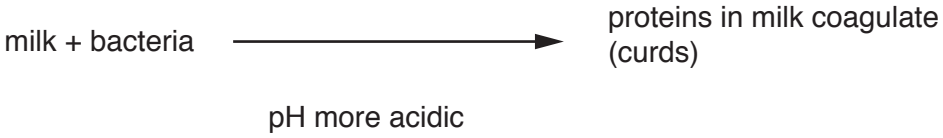
Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

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 confidence in your results, for example by obtaining and recording one or more additional measurements.

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

1 Milk contains proteins which are used to make cheese.
During cheese making, bacteria are added to the milk. The bacteria change the pH of the milk to acidic, causing the proteins to coagulate (clot) forming curds. The curds are then used to make the cheese.



Estimating the protein concentration in milk is important when making cheese.

You will need to:
- make simple (proportional) dilutions of the proteins in the milk, **M**
- carry out the biuret test on each concentration, to provide a measure of the concentration of proteins present in the milk
- carry out the biuret test on milk with an unknown concentration of protein, **U**
- estimate the concentration of milk protein in **U**.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
M	1.0% milk	none	40
U	milk with an unknown concentration of protein	none	20
K	5% potassium hydroxide solution	harmful irritant	20
C	0.15% copper sulfate solution	none	20
W	distilled water	none	100

It is recommended that you wear suitable eye protection.
If **K** comes into contact with your skin, wash it off immediately under cold water.

© UCLES 2018

(a) You are required to make simple (proportional) dilutions of the proteins in the milk, **M** (1.0%). Reduce the concentration by **0.2%** between each successive dilution.
You will also make a 0.1% concentration.

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

(i) Table 1.2 shows how to make up two of the concentrations you will use, 1.0% and 0.1%.

Decide which other concentrations of milk to prepare using simple (proportional) dilutions of **M**.

Complete Table 1.2 to show how you will prepare the other concentrations.

Table 1.2

volume of **M** /cm^3	volume of distilled water, **W** /cm^3	percentage concentration of milk
10.0	0.0	1.0
1.0	9.0	0.1

[2]

Read step 1 to step 9 before proceeding.

1. Prepare all the concentrations of milk as shown in Table 1.2 in the test-tubes provided.

2. Put the bung into one of the test-tubes and invert it to mix well. Repeat with each of the test-tubes.

3. Label the spotting tile with the concentrations of milk prepared in step 1.

4. Use a pipette to put 2 drops of 1.0% milk into the labelled cavity on the tile.

   Any milk remaining in the pipette should be put back into the test-tube so that as little of the milk as possible is removed from the test-tube. You will need this milk for step 13.

5. Repeat step 4 with each of the concentrations of milk.

6. Put 1 or 2 drops of **K** into each of the concentrations of milk on the tile and mix.

7. Put 0.5 cm^3 of **C** into each mixture on the tile, using the syringe labelled **C**.

8. Leave for 2 minutes for the colour to change.

© UCLES 2018

[Turn over

9. Compare the colour with the standard colours in Fig. 1.1. Record the colour of the mixture in **(a)(ii)**.

violet 	pale violet 	blue 

Fig. 1.1

(ii) Record your results in an appropriate table for the known concentrations of milk, using **only** the standard colours shown in Fig. 1.1.

[3]

You are now required to estimate the concentration of milk in sample **U**. This provides a measure of the proteins in the milk.

10. Put 2 drops of **U** onto the spotting tile.

11. Repeat step 6 to step 9 with **U**. Record the colour in **(a)(iii)**.

(iii) State the colour for sample **U**.

.....[1]

© UCLES 2018

Fig. 1.1 has only three colours. In **(a)(ii)** more than one of the known concentrations may match **U**. This means that an estimate of the concentration of milk protein in **U** may not be accurate.

(iv) Using the result in **(a)(iii)**, state the known concentrations of milk protein where the colour result for **U** is the same.

.....[1]

(v) A significant source of error in this procedure is the difficulty of matching the colour to Fig. 1.1.

Complete Table 1.3 to suggest:
- an improvement to this procedure of matching the colour (dependent variable)
- **one** other significant source of error in this procedure
- an improvement to reduce this error.

Table 1.3

significant source of error	improvement
matching the colour may be inconsistent	
another significant source of error	

[3]

(b) A student suggested that another procedure to estimate the concentration of protein in milk could be to compare how much coagulation was produced in acidic conditions.

The student added acid to known concentrations of milk protein and observed a range of coagulation. The concentration of milk protein in an unknown sample could then be estimated more accurately.

You are provided with 1.0 mol dm^{-3} hydrochloric acid, labelled **A**.

It is recommended that you wear suitable eye protection.
If **A** comes into contact with your skin, wash it off immediately under cold water.

Read step 12 to step 16 before proceeding.

12. Put 10 cm^3 of **U** into a test-tube.

    *In step 13, you will be adding **A** to the milk in the test-tubes, do **not** stir or mix **A** with the milk.*

13. Put 2 cm^3 of **A** into each of the test-tubes containing the known concentrations of milk protein (from step 4) and **U**.

14. Observe the changes in the milk in all of the test-tubes for up to 1 minute.

15. If coagulation is not visible after 1 minute, you may need to carefully tilt each test-tube to move the milk and then observe the coagulation.

16. Using the observations from step 14 and step 15 and the key in Fig. 1.2, record the results in **(b)(i)**.

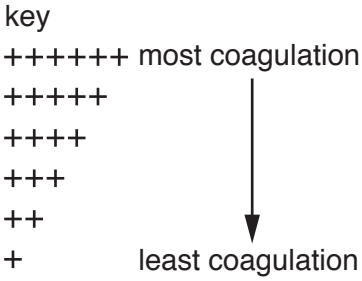


Fig. 1.2

(i) Prepare the space below and record the results for the known concentrations of milk protein using Fig. 1.2.

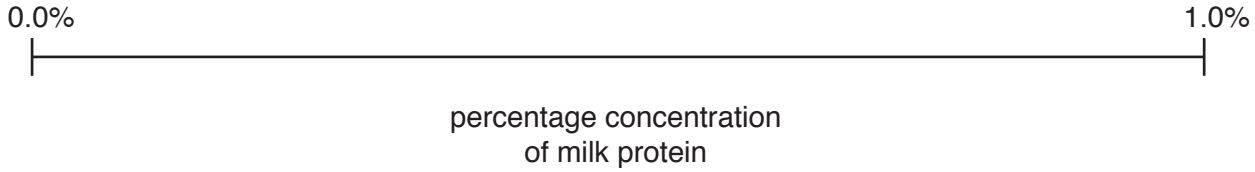
[2]

(ii) Using the key in Fig. 1.2, record the result for **U**.

.....[1]

(iii) Complete Fig. 1.3 to show the position on the line of each of the percentage concentrations of milk decided in Table 1.2.

Put the label **U** on Fig. 1.3 to show an estimate of the concentration of milk which provides a measure of the proteins in **U**, using the result in **(b)(ii)**.



[2]

Fig. 1.3

(c) Milk proteins can also be coagulated using the enzyme rennet.

A student investigated the effect of temperature on the activity of rennet, shown by the percentage coagulation of the milk.

The results are shown in Table 1.4.

Table 1.4

temperature /°C	percentage coagulation of the milk
8.5	7
28.0	63
35.5	84
41.0	92
50.0	39

(i) Plot a graph of the data in Table 1.4 on the grid in Fig. 1.4.

Use a sharp pencil for drawing graphs.

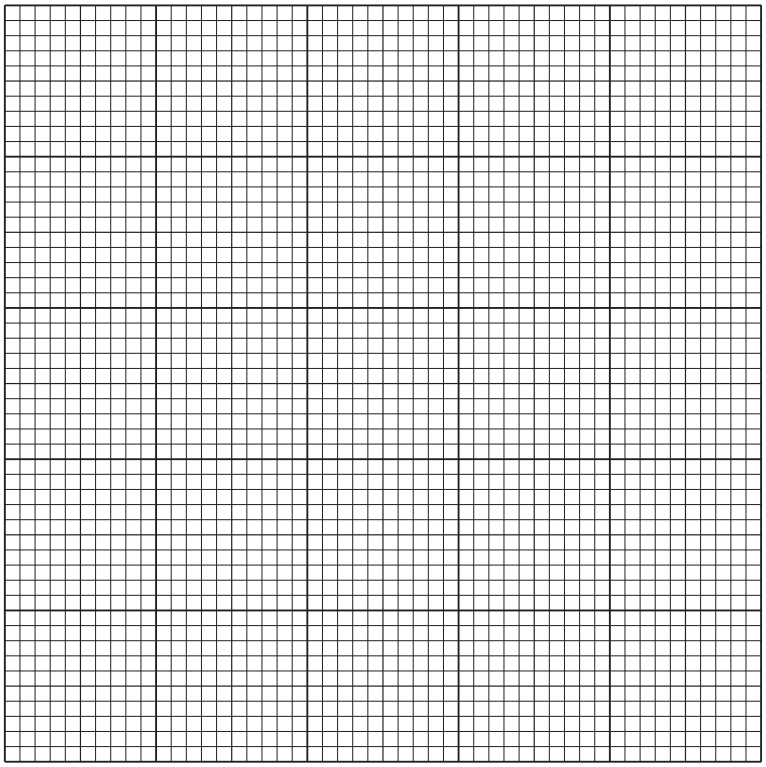


Fig. 1.4

[4]

© UCLES 2018

(ii) Suggest explanations for the results between 35 °C and 45 °C.

.....

.....

.....

.....

.....[2]

(iii) If a student wanted to investigate the independent variable, pH, a number of experiments would need to be set up.

State the pH values you would select **and** describe how you would change the pH.

pH values .....

description .....

.....

[1]

[Total: 22]

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

You are not expected to be familiar with this specimen.

(a) The specimen on **J1** has an irregular shape.

Use a sharp pencil for drawings.

(i) Draw a large plan diagram of the section of the leaf shown by the shaded area in Fig. 2.1.

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

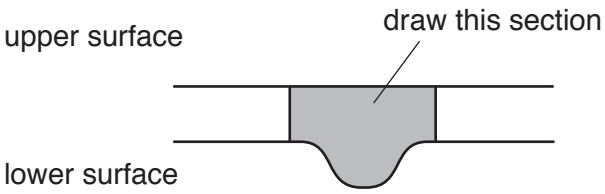


Fig. 2.1

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

[5]

(ii) Observe the upper epidermis and palisade layer in the leaf (see Fig. 2.1).

Select **one** group of two adjacent, touching cells from the upper epidermis and one adjacent, touching cell from the palisade tissue below.
Each cell must touch at least one of the other cells.

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

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

[4]

(iii) Observe the leaf on **J1**.
Suggest **one** observable feature of **J1** which supports the conclusion that this plant grows in a dry environment.

Explain how this feature would prevent water loss.

feature .....

explanation .....

.....

[2]

(b) Fig. 2.2 shows a diagram of a stage micrometer scale that is being used to calibrate an eyepiece graticule.

One division, on either the stage micrometer scale or the eyepiece graticule, is the distance between two adjacent lines.

The length of one division on this stage micrometer is **0.1 mm**.

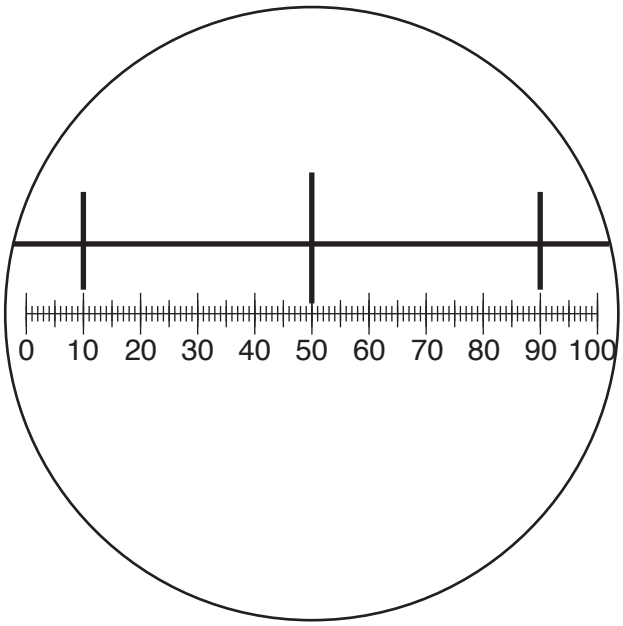


Fig. 2.2

(i) Complete Fig. 2.3, by using Fig. 2.2 to calculate the actual length of one eyepiece graticule unit.

Step 1

1 eyepiece graticule unit = [ ] divided by [ ] = ……..…… mm

Step 2

Convert the answer to a measurement with the unit most suitable for use in light microscopy.

[ ] multiplied by [ ] = ……..……

Fig. 2.3

[3]

© UCLES 2018

Fig. 2.4 shows a photomicrograph of a transverse section through a leaf, taken using the same microscope with the same lenses as Fig. 2.2.

You are not expected to be familiar with this specimen.

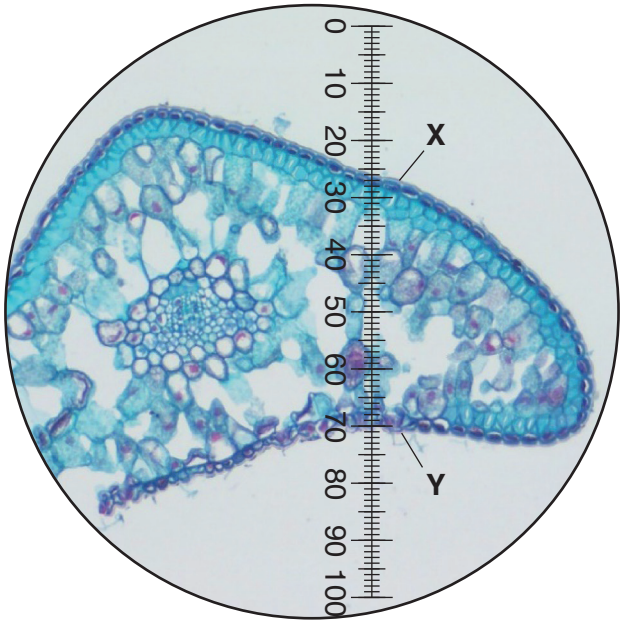


Fig. 2.4

(ii) Use the calibration of the eyepiece graticule unit from **(b)(i)** and Fig. 2.4 to calculate the actual length of the plant leaf from **X** to **Y**.

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

.....[2]

© UCLES 2018

[Turn over

(iii) Fig. 2.5 is a photomicrograph of a transverse section of the same leaf as in Fig. 2.4.

Annotate Fig. 2.5 to describe **two** observable differences between the leaf in Fig. 2.5 and the leaf on **J1**:

- Draw label lines to **two** different features and use only the labels **P** and **Q**.
- Next to each letter, describe how each feature on the leaf in Fig. 2.5 differs from the leaf on **J1**.

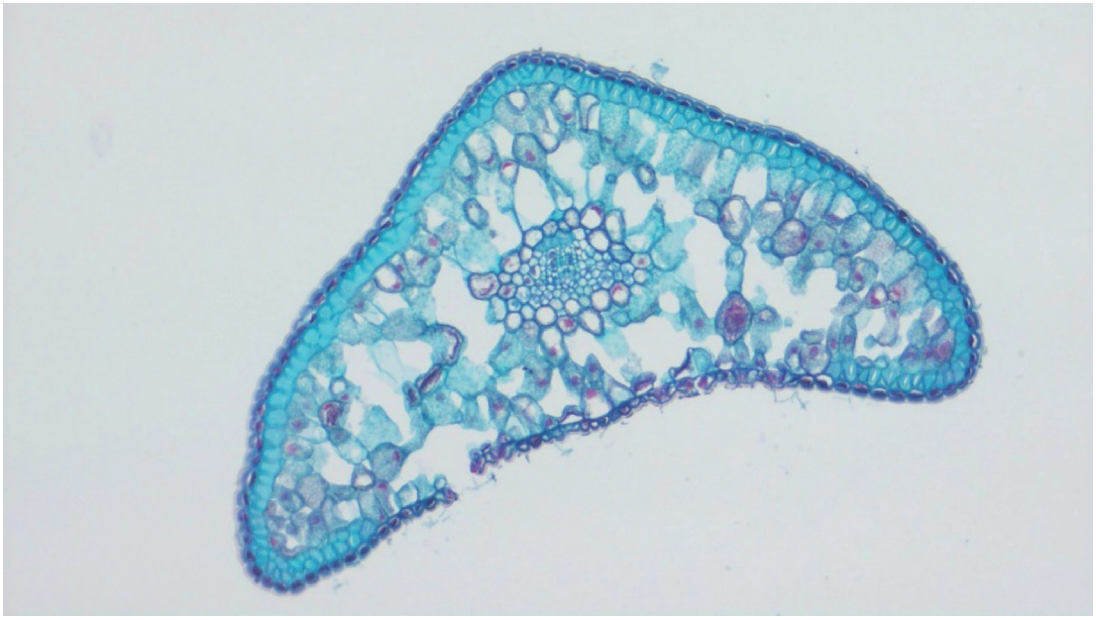


Fig. 2.5

[2]

[Total: 18]

© UCLES 2018

BLANK PAGE

© UCLES 2018

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.

© UCLES 2018

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2064326800

BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **13** printed pages and **3** blank pages.

DC (ST/SW) 137873/4
© UCLES 2018

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 confidence in your results, for example by obtaining and recording one or more additional measurements.

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

1 You are required to investigate the effect of concentration of hydrochloric acid (independent variable) on the rate of diffusion.

The investigation involves placing agar cubes containing an indicator into dilute hydrochloric acid. As the acid diffuses into the agar cubes the indicator changes colour.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
H	1.0 mol dm^{-3} hydrochloric acid	irritant	100
A	agar	none	–
W	distilled water	none	60

It is recommended that you wear suitable eye protection.
If **H** comes into contact with your skin, wash it off immediately under cold water.

You must not touch the agar with your hands. Use the blunt forceps and paper towel to handle the agar.

You will need to carry out a trial test (step 1 to step 4) before you start your investigation.

© UCLES 2018

Read step 1 to step 4 before proceeding.

1. Cut 3 cubes from the agar, **A**, as shown in Fig. 1.1. Each cube should be approximately 5 mm × 5 mm x 5 mm but they must all have the same dimensions. Cut the cubes from **A** on the white tile provided.

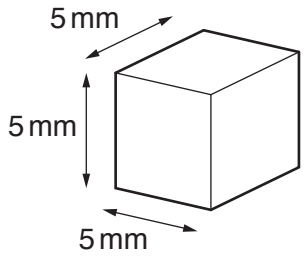


Fig. 1.1

2. Put 10 cm^3 of 1.0 mol dm^{-3} hydrochloric acid, **H**, into a beaker.

3. Put the 3 cubes you cut in step 1 into the beaker containing **H**, using blunt forceps. Start timing.

As the acid diffuses into the agar cubes they change colour. The end-point is reached when the blue-green colour disappears and the **whole cube** has changed colour from blue-green to pink.

Putting the beaker on the white card provided may help you to see the colour changes more clearly.

4. Measure the time taken for each cube to reach the end-point and record the times in **(a)(i)**. If any cube remains blue-green after 3 minutes record as 'more than 180'.

(a) (i) Record your results in an appropriate table.

[2]

(ii) Calculate the mean time taken for the cubes to reach the end-point.

mean time = ...[1]

(iii) A student carried out this trial experiment and recorded three results which were not consistent.
Identify **one** error in this trial procedure that could have caused repeated results to be inconsistent.

.....

.....[1]

The student investigated the effect of concentration of hydrochloric acid on the rate of diffusion and suggested the hypothesis:

Lowering the concentration of hydrochloric acid below 1.0 mol dm^{-3} will have no effect on the rate of diffusion of acid into the agar cubes.

You will need to investigate this hypothesis by:

- diluting **H** to provide four further concentrations of hydrochloric acid
- putting agar cubes into each of these concentrations of hydrochloric acid
- measuring the rate at which the hydrochloric acid diffuses into the agar cubes.

(iv) State two variables that you will need to standardise during your investigation.

1 .....

2 .....
[2]

You will need to use simple (proportional) dilution of the 1.0 mol dm^{-3} hydrochloric acid, **H**, to prepare four further concentrations of hydrochloric acid.

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

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

Table 1.2

volume of 1.0 mol dm^{-3} hydrochloric acid / cm^3	volume of distilled water, **W** / cm^3	final concentration of hydrochloric acid / mol dm^{-3}
10	0	1.0
		0.8
		0.6
		0.4
		0.2

[2]

© UCLES 2018

Read step 5 to step 10 before proceeding.

5. Prepare the concentrations of hydrochloric acid, as shown in Table 1.2, in the beakers provided.

6. Cut three cubes, each approximately 5 mm × 5 mm × 5 mm, from **A**. Cut the cubes on the white tile provided.

7. Put the 3 cubes into the beaker containing 1.0 mol dm^{-3} hydrochloric acid, **H**, and immediately start timing. Do **not** stir.

8. Measure the time taken for each cube to reach the end-point and record the times in **(a)(vi)**. If any cube remains blue-green after 3 minutes record as 'more than 180'.

9. Repeat step 6 to step 8 for each of the other concentrations of hydrochloric acid you have prepared.

10. Calculate the mean time taken for each concentration and record the mean times in **(a)(vi)**.

(vi) Record your results and mean times in an appropriate table.

[3]

(vii) Using your mean times, calculate the rate of diffusion when the concentration of hydrochloric acid is 1.0 mol dm^{-3} **and** in the lowest concentration of hydrochloric acid you have investigated.

rate in 1.0 mol dm^{-3} hydrochloric acid ..... s^{-1}

rate in the lowest concentration ..... s^{-1}

[1]

The student's hypothesis stated that:

Lowering the concentration of hydrochloric acid below 1.0 mol dm^{-3} will have no effect on the rate of diffusion of acid into the agar cubes.

(viii) State whether you **support** or **reject** this hypothesis.
Explain how your results provide evidence for this decision.

support or reject .....

explanation .....

.....

.....

.....[2]

(ix) This procedure investigated the effect of the concentration of hydrochloric acid on the rate of diffusion.

To modify this procedure for investigating a different variable, the concentration of hydrochloric acid would need to be standardised.

Suggest the concentration of hydrochloric acid that should be used. Give a reason for your answer.

concentration .....

reason .....
[1]

(x) Think about how you could modify this procedure to investigate the effect of surface area to volume ratio on the rate of diffusion.

Describe the modifications needed to investigate the effect of surface area to volume ratio.

.....

.....

.....

.....[2]

© UCLES 2018

Question 1 continues on page 8

(b) A scientist carried out an experiment to investigate whether a chemical, **C**, extracted from the flowers of a plant, was able to inhibit the reproduction of pathogenic bacteria.

The scientist prepared 5 Petri dishes containing agar (agar plates) which had each been inoculated with a different type of pathogenic bacterium.

A filter paper disc, soaked in chemical **C**, was put onto each agar plate. Chemical **C** diffused from the filter paper disc into the agar. The agar plates were incubated at 25 °C to allow the bacteria in the agar to reproduce.

A clear zone, called a zone of inhibition, is observed around the filter paper disc if the chemical is effective at preventing bacteria from reproducing, as shown in Fig. 1.2.

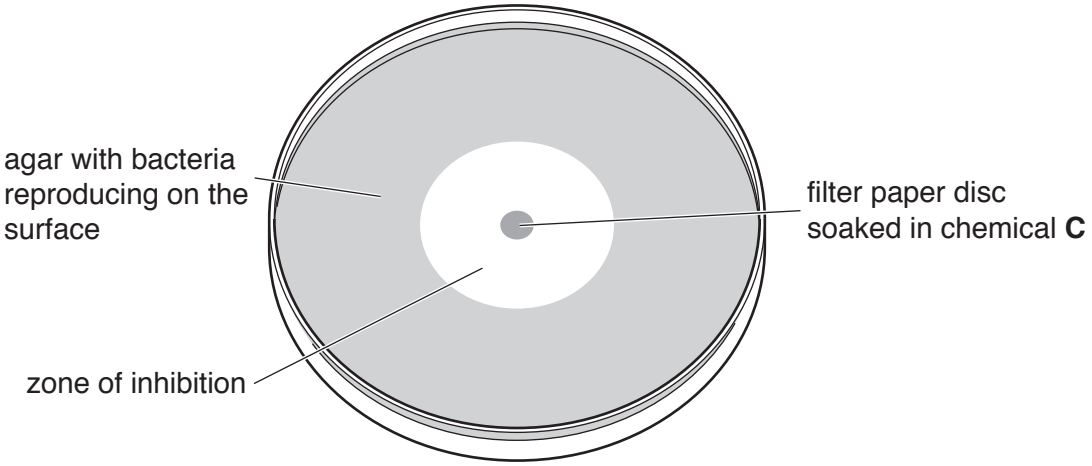


Fig. 1.2

The scientist measured the diameter of the zone of inhibition produced in the agar for each of the 5 different types of pathogenic bacterium.

The results are shown in Table 1.3.

Table 1.3

type of pathogenic bacterium	diameter of zone of inhibition /mm
P	7.0
Q	24.0
R	18.0
S	15.5
T	19.0

© UCLES 2018

(i) Draw a bar chart of the data in Table 1.3 on the grid in Fig. 1.3.
Each bar should be separated for each type of pathogenic bacterium.

Use a sharp pencil for drawing bar charts.

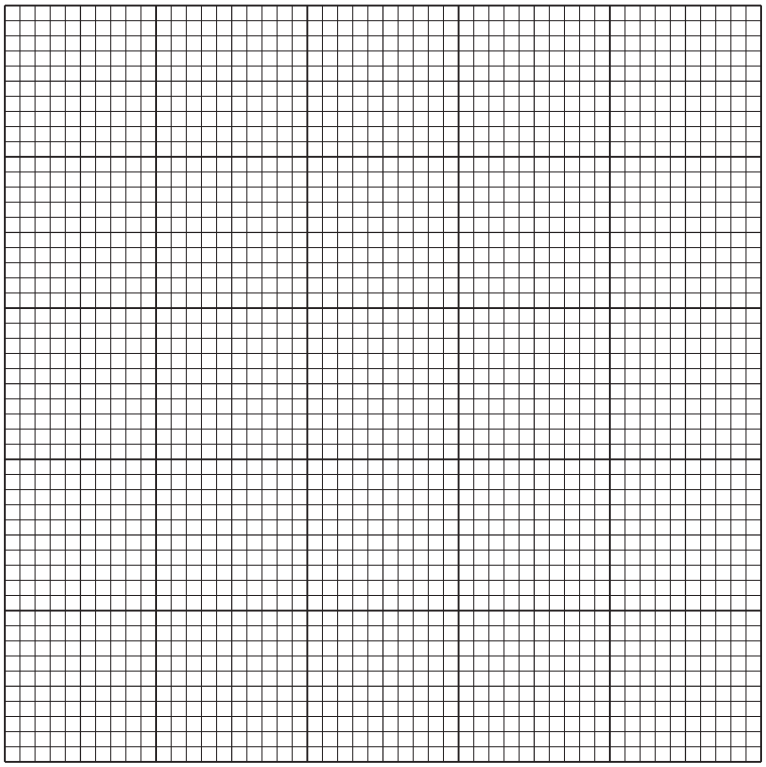


Fig. 1.3

[4]

(ii) A scientist studied the results in Table 1.3 and noticed that one type was most affected by chemical **C**.
The scientist decided to carry out further experiments to learn more about the effects of chemical **C** on this type of bacterium.

State which type of bacterium in Table 1.3 the scientist should use for further experiments.
Give a reason for your answer.

type of bacterium .....

reason .....

.....

[1]

[Total: 22]

© UCLES 2018

[Turn over

2 **M1** is a slide of a stained transverse section through a plant leaf.

You are not expected to be familiar with this specimen.

Use a sharp pencil for drawing.

(a) **(i)** Draw a large plan diagram of the section of the leaf (midrib) shown by the shaded area in Fig. 2.1.

Use **one** ruled label line and the label **X** to identify a region containing xylem tissue.



Fig. 2.1

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

[5]

© UCLES 2018

(ii) Observe the upper epidermis of the leaf on **M1**. The upper epidermis has no guard cells.

Select **one** group of two adjacent, touching cells from the upper epidermis and one adjacent, touching cell from the palisade tissue below.

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

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

Use **one** ruled label line and the label **P** to identify a structure that produces ATP.

[4]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section of part of a leaf from a different species. A grid has been placed over the photomicrograph to help you answer the question. Each square is 1 cm^2.

You are not expected to be familiar with this specimen.

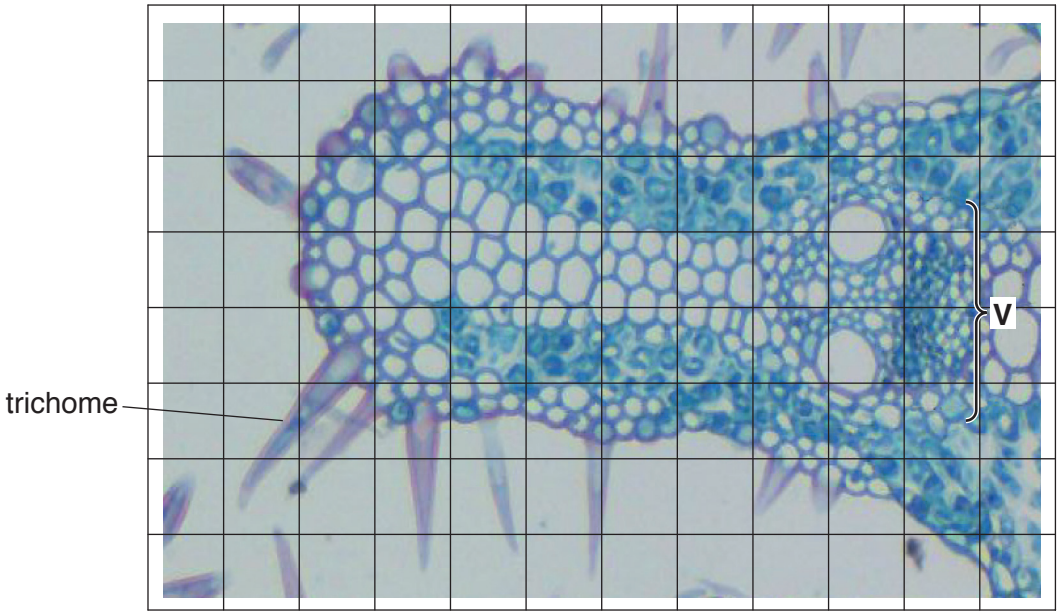


Fig. 2.2

(i) Describe how you will use the grid to find the total area of the part of the leaf shown in Fig. 2.2. You do **not** need to include the trichomes.

.....

.....

.....[1]

(ii) Use the procedure you have described in **(b)(i)** to find:

the total area of the part of the leaf shown in Fig. 2.2 ..... cm^2

the area of the leaf section occupied by the vascular bundle, labelled **V**. ..... cm^2 [2]

© UCLES 2018

(iii) Calculate the percentage of the part of the leaf shown in Fig. 2.2 that is occupied by the vascular bundle, labelled **V**.

Show all the steps of your working.

..... % [2]

(iv) Suggest how you could modify the procedure you have used in **(b)(ii)** to give a more accurate estimate of the area of the leaf.

.....

.....[1]

(c) Observe the leaf on **M1** and the part of the leaf shown in Fig. 2.2 and identify the differences between them.

Record the observable differences in Table 2.1.

Table 2.1

feature	**M1**	Fig. 2.2

[3]

[Total: 18]

© UCLES 2018

BLANK PAGE

© UCLES 2018

BLANK PAGE

© UCLES 2018

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.

© UCLES 2018

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9951626639

BIOLOGY **9700/33**

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

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

DC (ST/SG) 137920/3
© UCLES 2018

CAMBRIDGE International Examinations

[Turn over

Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish all the work that you would like to do.

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

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

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

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

You will need to:

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

You are provided with the materials shown in Table 1.1.

Table 1.1

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

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

© UCLES 2018

Read step 1 to step 19 before proceeding.

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

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

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

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

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

Table 1.2

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

[2]

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

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

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

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

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

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

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

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

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

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

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

© UCLES 2018

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

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

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

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

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

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

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

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

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

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

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

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

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

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

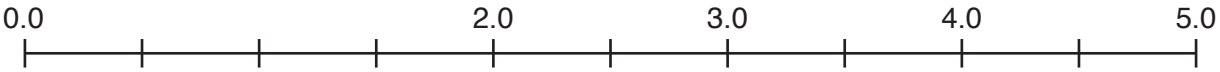
[5]

© UCLES 2018

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

.....

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



percentage concentration of sucrose solution

Fig. 1.1

[1]

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

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

Use a sharp pencil for drawing graphs.

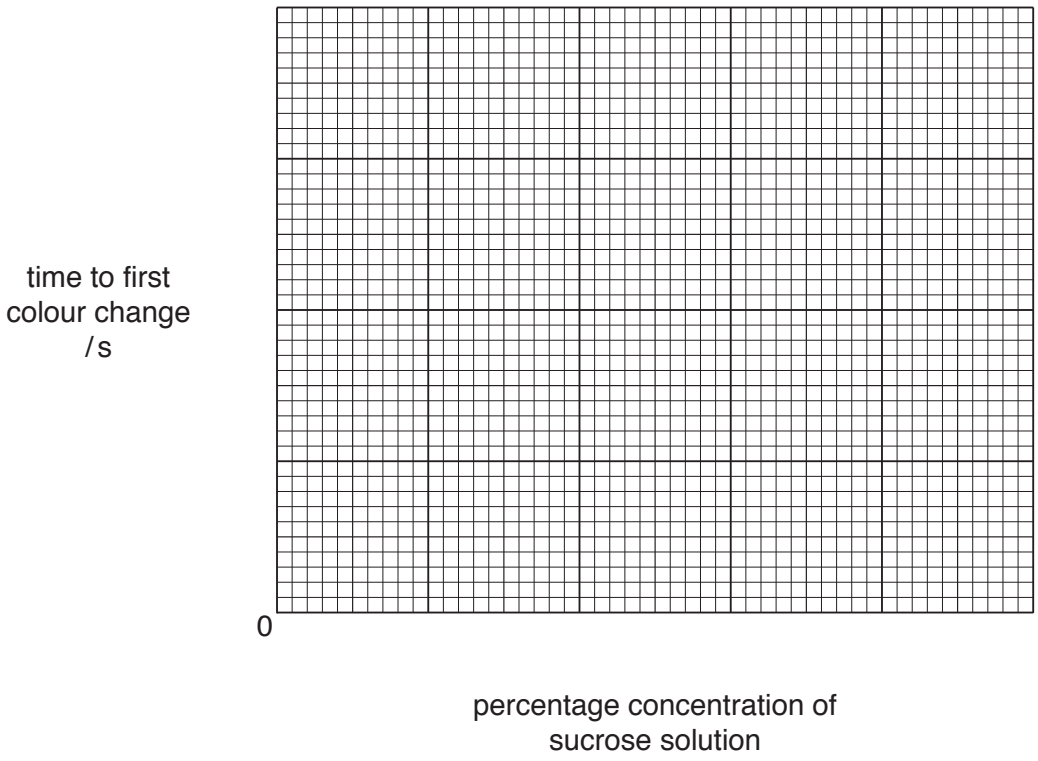


Fig. 1.2

[2]

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

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

© UCLES 2018

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

.....

.....[1]

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

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

.....

.....

.....

.....[3]

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

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

The results are shown in Table 1.3.

Table 1.3

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

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

Show all the steps in your working.

percentage = ... [3]

© UCLES 2018

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

Use a sharp pencil for drawing bar charts.

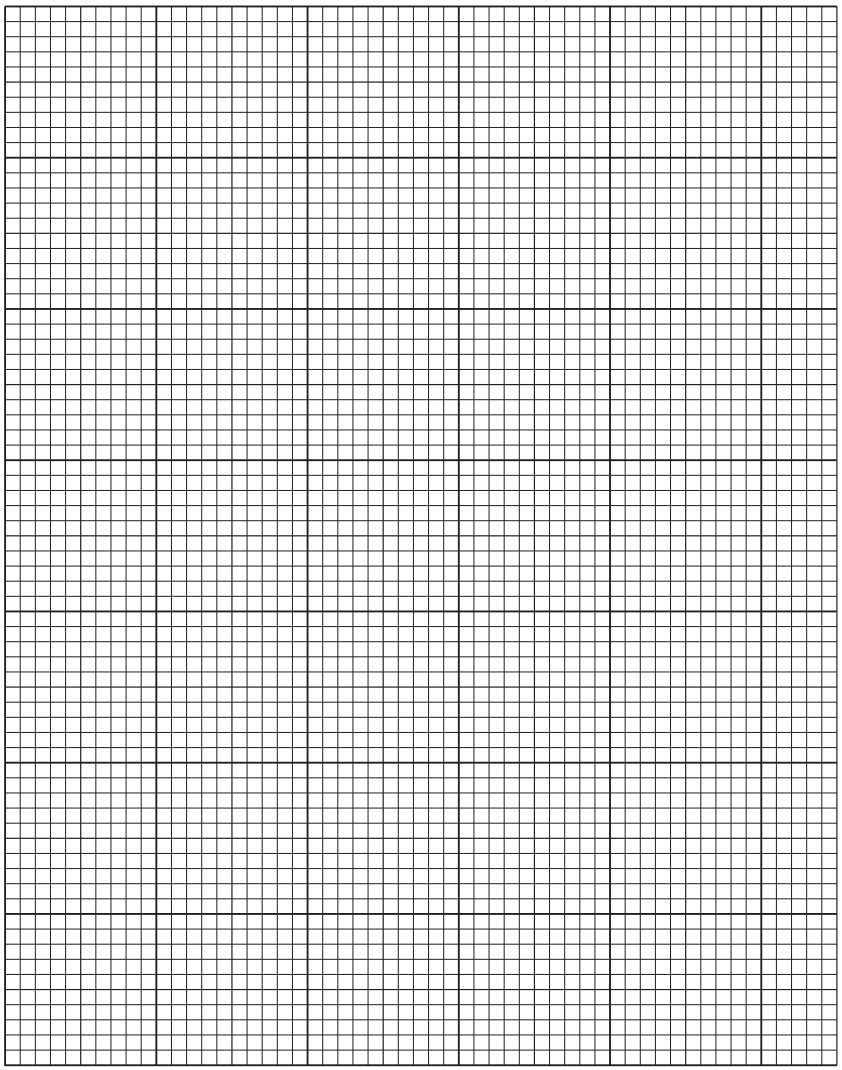


Fig. 1.3

[2]

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

source .....

process .....
[2]

[Total: 22]

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

You are not expected to be familiar with this specimen.

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

Use a sharp pencil for drawings.

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

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

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

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

[5]

© UCLES 2018

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

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

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

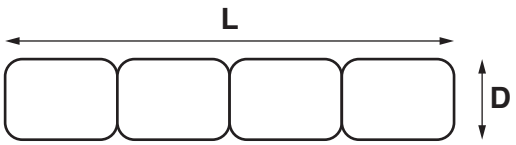


Fig. 2.1 (not drawn to scale)

L ..... eyepiece graticule units

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

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

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

[5]

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

.....[1]

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

You are not expected to be familiar with this specimen.

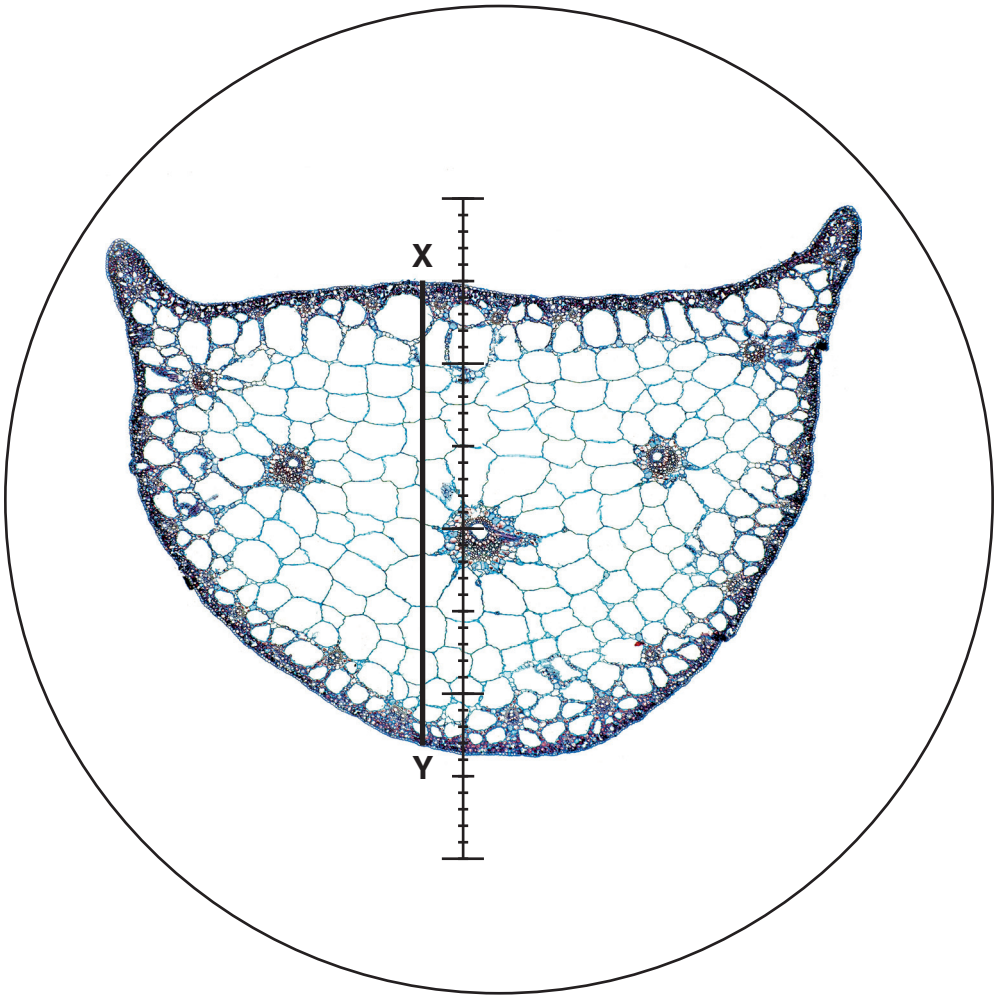


Fig. 2.2

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

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

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

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

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

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

© UCLES 2018

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

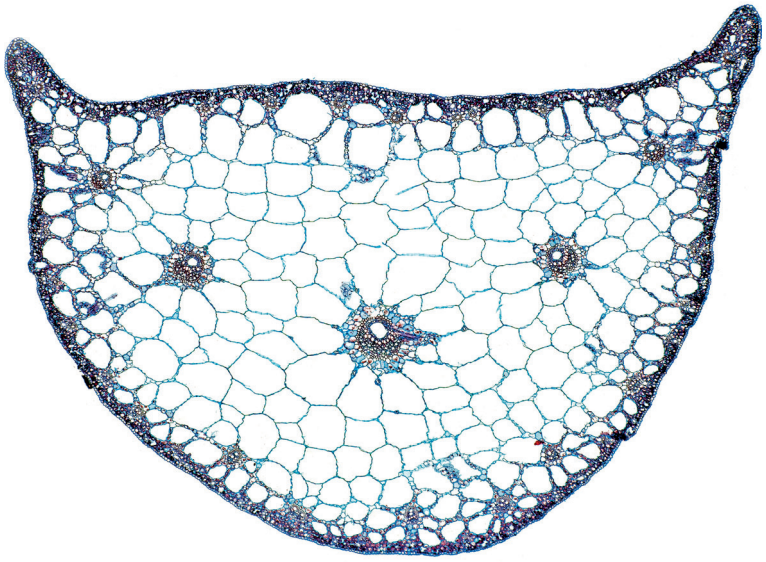


Fig. 2.3

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

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

[3]

[Total: 18]

© UCLES 2018

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.

© UCLES 2018

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0028233108

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, 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.

DC (ST/SG) 137915/3
© UCLES 2018

CAMBRIDGE International Examinations

BLANK PAGE

© UCLES 2018

Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish all the work that you would like to do.

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

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

1 Yeast cells contain enzymes which catalyse the breakdown of glucose to produce ethanol and carbon dioxide. When dissolved, the carbon dioxide forms a weak acid.
The activity of the yeast cells is determined by measuring the change in pH using Universal Indicator paper.

As the yeast continues to break down the glucose, the concentration of ethanol becomes toxic and the yeast cells are killed.

You will need to investigate the effect of different concentrations of ethanol on the activity of yeast cells.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
E	15% ethanol	flammable harmful	50
W	distilled water	none	100
U	unknown concentration of ethanol	flammable harmful	20
Y	beaker and 6 test-tubes, with 1 g of dried yeast in each tube	none	–
G	glucose solution	none	100
P	Universal Indicator paper with pH colour chart	none	3 lengths

It is recommended that you wear suitable eye protection.

Ethanol is harmful and highly flammable. If any comes into contact with your skin, wash off immediately under cold water.
Keep the ethanol covered when you are not using it.

© UCLES 2018

[Turn over

A student found that, at concentrations of ethanol greater than 15%, there was no activity of the yeast cells.

The student suggested the hypothesis:

Concentrations of ethanol below 15% will continue to cause the death of yeast cells.

You will need to investigate this hypothesis by measuring the activity of the yeast cells using different concentrations of ethanol.

(a) You will need to make a serial dilution of 15% ethanol, **E**, which reduces the concentration by half between each successive dilution.

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

Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

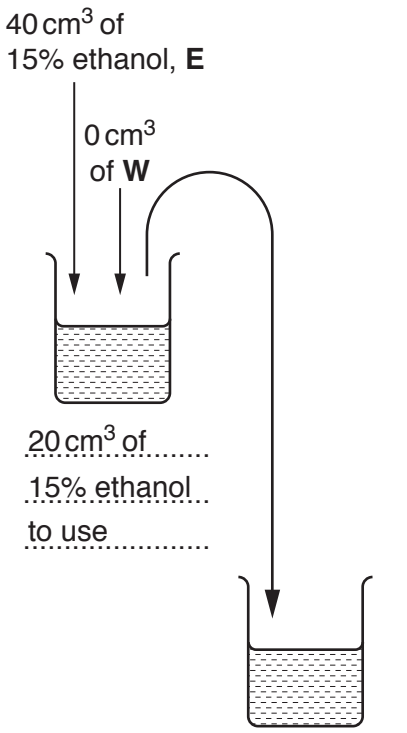
(i) Complete Fig. 1.1 by drawing as many extra beakers as you need for your serial dilution.

For each beaker:

- state, under the beaker, the volume and concentration of ethanol available for use in the investigation
- use one arrow, with a label above the beaker, to show the volume and concentration of ethanol added to prepare the concentration of ethanol in the beaker
- use another arrow, with a label above the beaker, to show the volume of **W** added to prepare the concentration of ethanol in the beaker.

The first beaker in Fig. 1.1 has been labelled for you.

© UCLES 2018



.....

.....

.....

[3]

Fig. 1.1

Read step 1 to step 16 before proceeding.

1. Prepare the concentrations of ethanol as shown in Fig. 1.1.

   Use a glass rod to mix the ethanol and water.

2. Label the test-tubes from beaker **Y** with the concentrations of ethanol prepared in step 1 **and** label one test-tube as **U**.

3. Using the beakers labelled **hot water** and **cold water** set up a water-bath with water between 45 °C and 50 °C.

4. Put 10 cm^3 of **G** into each of the labelled test-tubes, including **U**.

5. Use a glass rod to mix the contents.

6. Put the test-tubes into the water-bath (set up in step 3) for 5 minutes.

7. Cut the Universal Indicator paper, **P**, into approximately 0.5 cm lengths. You will need 2 pieces for **each** of the ethanol concentrations prepared in step 1 **and** 2 pieces for **U**.

8. After 5 minutes (step 6) put 10 cm^3 of 15% ethanol into the test-tube labelled 15%. Shake gently to mix then return it to the water-bath.

9. Repeat step 8 with the other concentrations of ethanol made in step 1 **and** with **U**.

10. Start timing.

11. Put pieces of **P** onto the white tile.

You will need to sample the mixtures in each of the test-tubes at 3 minutes and at 9 minutes.

12. At 3 minutes, use the glass rod to remove a drop from the test-tube containing 15% ethanol and touch one piece of **P** with the end of the glass rod.

13. Observe the colour of **P** and record the colour in **(a)(ii)**.

14. Compare the colour with the pH colour chart and record the pH in **(a)(ii)**.

    Note: if there are several colours on the paper (e.g. dark green and light green) record the pH as a range (e.g. pH 8–pH 7).

15. Wipe the end of the glass rod with a paper towel to clean it and repeat step 12 to step 15 with the other mixtures, including **U**.

16. Repeat step 12 to step 15 at 9 minutes.

© UCLES 2018

(ii) Record your results in an appropriate table, including:
- colour
- pH.

[5]

(iii) State the colour and pH for **U** at 9 minutes.

colour .....

pH .....

Complete Fig. 1.2 to show:
- the percentage concentrations of ethanol prepared in step 1
- the estimated percentage concentration of ethanol in **U**, using the letter **U**.



percentage concentration of ethanol

Fig. 1.2

[1]

(iv) The student's hypothesis stated that:

Concentrations of ethanol below 15% will continue to cause the death of yeast cells.

State whether you **support** or you **reject** this hypothesis.
Explain how your results provide evidence for this decision.

support or reject .....

explanation .....

.....

.....

.....[2]

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

.....

.....

.....[1]

(b) A student investigated the activity of a yeast cell suspension and glucose by measuring the release of carbon dioxide given off over a period of 11 minutes.
The carbon dioxide was measured by recording the volume of gas collected in a graduated test-tube.
The temperature was kept constant at 25 °C. All other variables were standardised.

The results are shown in Table 1.2.

Table 1.2

time / minutes	volume of CO_2 / arbitrary units (au)
0	0.18
3	0.23
6	0.38
8	0.55
11	0.84

© UCLES 2018

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

Use a sharp pencil for drawing graphs.

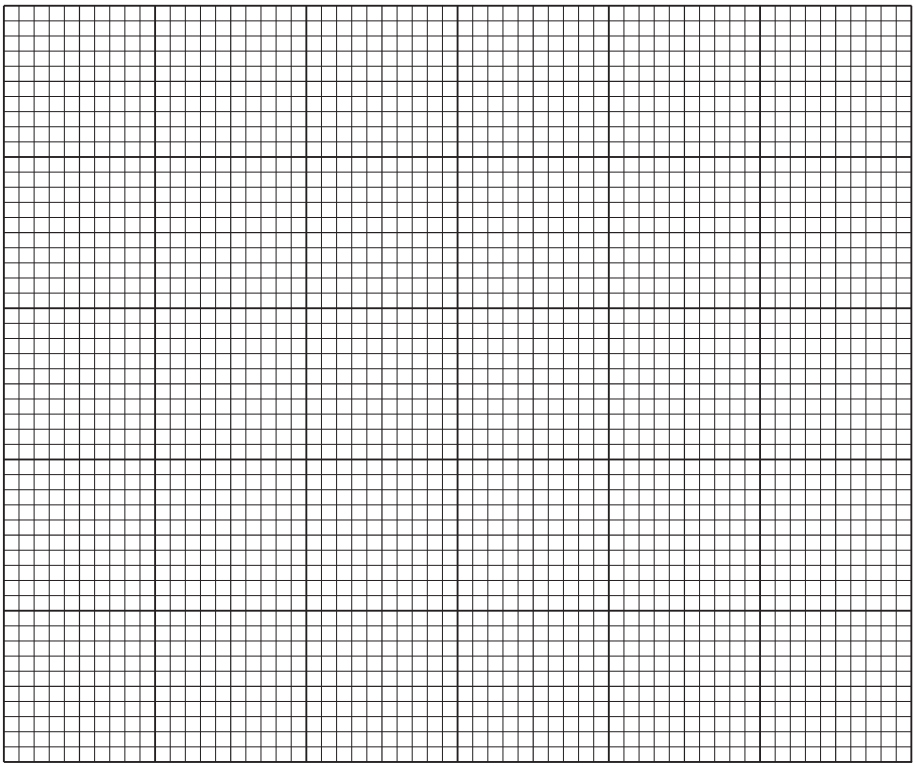


Fig. 1.3

[4]

(ii) Use your graph to calculate the rate of carbon dioxide given off between 7 minutes and 10 minutes.

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

rate = ... au min^{-1} [2]

(iii) The student investigated the release of carbon dioxide from a yeast cell suspension using the apparatus shown in Fig. 1.4.

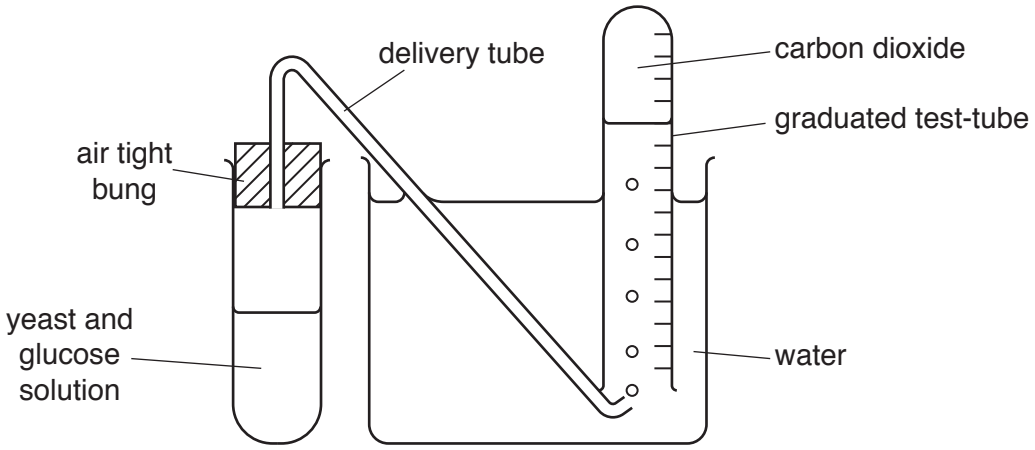


Fig 1.4

Describe how you would modify this investigation to determine the effect of **temperature** on the release of carbon dioxide from a yeast cell suspension.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 21]

© UCLES 2018

2 In order to observe yeast cells using a light microscope, they are often stained.
You will need to observe the effects of two stains, methylene blue solution and iodine solution.

You are provided with the material shown in Table 2.1.

Table 2.1

labelled	contents	hazard	volume/cm^3
Y	suspension of yeast cells	none	20
M	methylene blue solution	none	10
I	iodine solution	none	10

It is recommended that you wear suitable eye protection.
If **M** or **I** come into contact with your skin, wash off immediately under cold water.

You will need to use the microscope to observe the colour of the yeast cells both before and after adding the stains, **M** and **I**. You will record your observations using annotated drawings.

Read step 1 to step 12 before proceeding.

1. Label 3 clean, dry microscope slides with the letters **Y**, **M** and **I**.

2. Put the slide labelled **Y** on a paper towel.

3. Put a few drops of yeast cell suspension **Y** onto the slide.

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

5. Use the microscope to view the yeast cells on the slide.

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

(a) (i) Select 3 whole yeast cells from slide **Y**.
Make a large drawing of these yeast cells in **box Y** in Fig. 2.1.

Use a sharp pencil for drawings.

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

7. Put the slide labelled **M** on a paper towel.

8. Put a few drops of yeast cell suspension **Y** onto the slide.

9. Put a drop of **M** onto the slide in order to stain the yeast cells.

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

11. Use the microscope to view the yeast cells on the slide.

© UCLES 2018

[Turn over

(ii) Select 3 whole yeast cells from slide **M**.
Make a large drawing of these yeast cells in **box M** in Fig. 2.1.

12. Repeat step 6 to step 11 using **I** instead of **M**.

(iii) Select 3 whole yeast cells from slide **I**.
Make a large drawing of these yeast cells in **box I** in Fig. 2.1.

box Y

box M

box I

Fig. 2.1

[3]

(iv) Annotate your drawings in Fig. 2.1 to describe:

- **one** observable difference between the yeast cells on slide **Y** compared to yeast cells stained with **M**
  and
- **one** observable difference between the yeast cells on slide **Y** compared to yeast cells stained with **I**.

[2]

© UCLES 2018

(b) Fig. 2.2 is a photomicrograph of yeast cells.

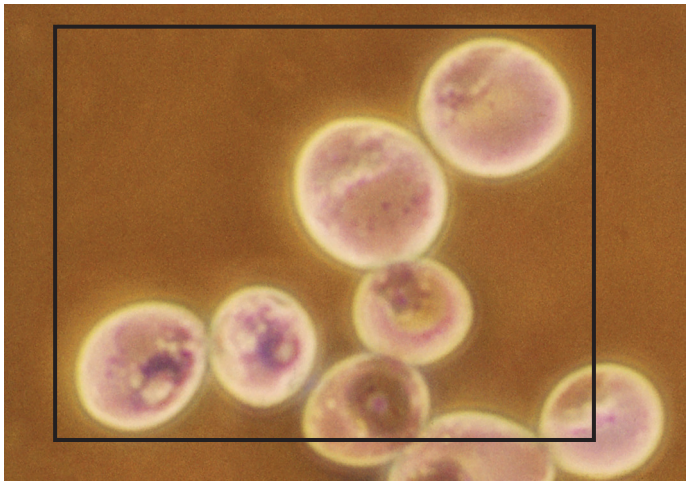


Fig. 2.2

Use a sharp pencil for drawings.

Make a large drawing of the 5 whole cells shown in the area on Fig. 2.2.

[4]

(c) Fig. 2.3 is a photomicrograph of a stained transverse section through two blood vessels, **B1** and **B2**.

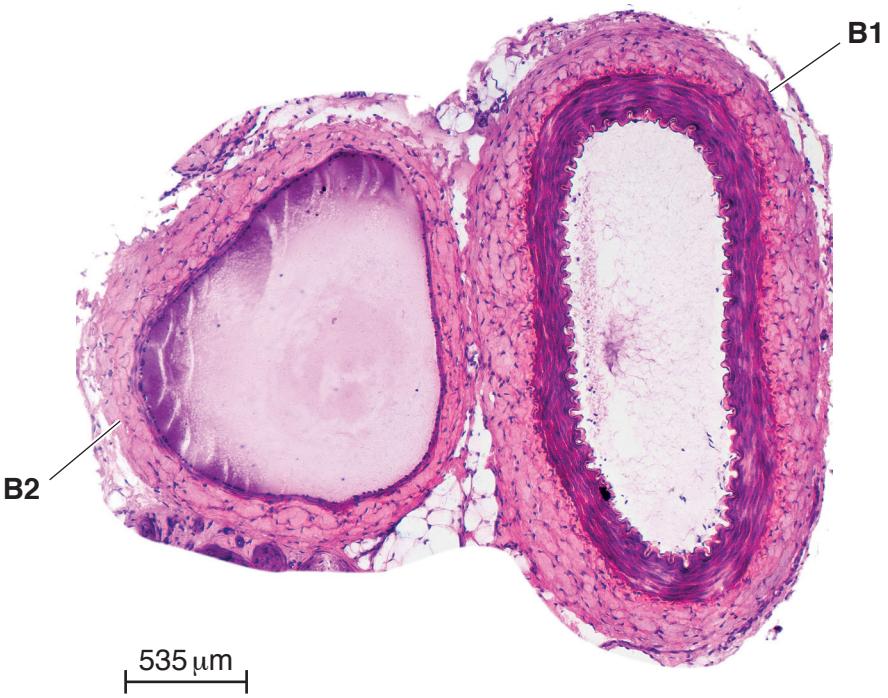


Fig. 2.3

(i) Draw large plan diagrams of the two blood vessels, **B1** and **B2**, shown in Fig. 2.3.

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

[4]

© UCLES 2018

(ii) Annotate your drawings in **(c)(i)** to describe **three** observable differences between **B1** and **B2** by:

- drawing label lines to **B1** and to **B2** that show these differences
- describing next to each line how each feature is different. [3]

(iii) State which blood vessel, **B1** or **B2**, carries blood under high pressure.
Give **one** reason for your choice.

blood vessel .....

reason .....
[1]

(iv) Use the scale bar in Fig. 2.3 to calculate the magnification of Fig. 2.3.

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

magnification × .....[2]

[Total: 19]

© UCLES 2018

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.

© UCLES 2018

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

5362227812

BIOLOGY **9700/35**

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

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **13** printed pages and **3** blank pages.

© UCLES 2018

CAMBRIDGE International Examinations

BLANK PAGE

© UCLES 2018

Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish all the work that you would like to do.

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

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

1 The enzyme **E** catalyses the hydrolysis (breakdown) of sucrose to fructose and glucose.

You are required to investigate the effect of substrate concentration on this enzyme-catalysed reaction.

The products of the hydrolysis of sucrose will change the colour of potassium manganate(VII) solution, **P**, from purple to colourless.

You have been provided with test-tube **Z** which shows the colourless end-point.

You will need to:

- prepare a serial dilution of sucrose solution
- investigate the action of **E** on the different concentrations of sucrose solution
- record the time taken to reach the end-point for each concentration of sucrose solution.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
S	10% sucrose solution	none	20
W	distilled water	none	50
A	1 mol dm^{-3} sulfuric acid	irritant	20
E	1% enzyme solution	irritant	20
P	0.01% potassium manganate(VII) solution	low risk irritant	20

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

© UCLES 2018

[Turn over

(a) You will need to make a serial dilution of the 10% sucrose solution, **S**, which reduces the concentration **by half** between each successive dilution.

You will need to prepare 5 cm^3 of each concentration of sucrose solution.

Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

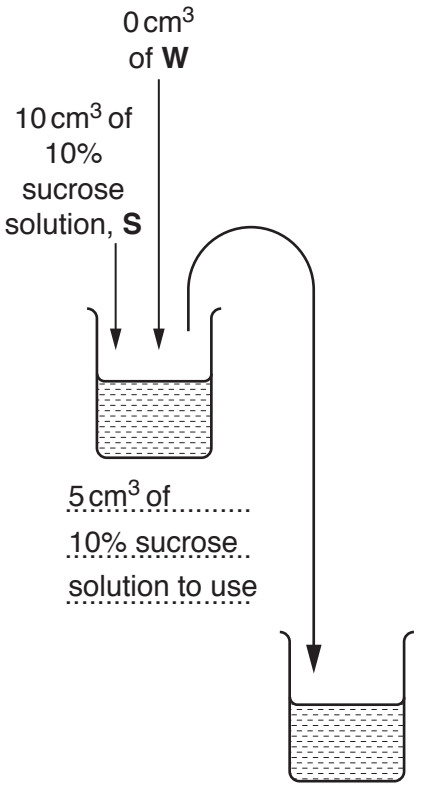
(i) Complete Fig. 1.1 by drawing as many extra beakers as you need for your serial dilution.

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 the sucrose solution added to prepare the concentration of sucrose solution in the beaker
- use another arrow, with a label above the beaker, to show the volume of **W** added to prepare the concentration of sucrose solution in the beaker.

The first beaker in Fig. 1.1 has been labelled for you.

© UCLES 2018


0 cm3 of W
10 cm3 of 10% sucrose solution, S
5 cm3 of 10% sucrose solution to use

.....

.....

.....

[3]

Fig. 1.1

Read step 1 to step 12 before proceeding.

1. Prepare the concentrations of sucrose solution, as shown in Fig. 1.1.

2. Label as many test-tubes as you require for all the sucrose solutions prepared in step 1.

3. Put 1 cm^3 of 10% sucrose solution into the labelled test-tube.

4. Repeat step 3 with each of the other concentrations.

5. Using the beakers labelled **hot water** and **cold water**, set up a water-bath with water between 35 °C and 40 °C.

You will **not** need to maintain this temperature during steps 8 to 10.

*The reaction will start when **E** is added in step 6.*

6. Put 1 cm^3 of **E** into each test-tube, using the syringe labelled **E**. Shake gently to mix.

7. Put all of the test-tubes into the water-bath and start timing.

8. Leave the test-tubes in the water-bath for **8 minutes**.

During the 8 minutes continue with Question 1.

9. At 8 minutes remove the test-tubes from the water-bath and **immediately** put 1 cm^3 of **A** into each of the test-tubes. Shake gently to mix.

10. Put 1 cm^3 of **P** into each of the test-tubes and start timing. Shake gently to mix.

11. Record in **(a)(ii)** the time in minutes and seconds (raw results) for each test-tube to reach the end-point, as shown by the contents of test-tube **Z**. Do **not** stop the timer.

    If the end-point has not been reached after 10 minutes, **stop timing** and record as 'more than 10'.

12. When all the times have been recorded, record the time taken to reach the end-point in seconds (processed results) in **(a)(ii)**.

© UCLES 2018

(ii) Record your results in an appropriate table, including:
- raw results
- processed results.

[5]

(iii) Using your results in **(a)(ii)**, calculate the **rate** of enzyme activity in 10% sucrose solution.

State your answer in **standard form**.

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

rate of enzyme activity = ... s^{-1} [2]

(iv) This procedure investigated the effect of substrate concentration on the activity of an enzyme. To modify this procedure to investigate a different variable, the substrate concentration should be kept the same.

Describe how you would standardise the substrate concentration.

.....

.....

Think about how you could modify this procedure to investigate the effect of pH on the rate of enzyme activity.

State the pH values you would select **and** describe how you would change the pH.

pH values .....

description .....

.....

.....

.....

.....[3]

(b) A scientist carried out a similar experiment to investigate the effect of substrate concentration on the activity of an enzyme in the presence of an inhibitor.

The concentration of the enzyme and the concentration of the inhibitor were standardised. The rate of enzyme activity was calculated at different concentrations of substrate. All other variables were kept constant.

The results are shown in Table 1.2.

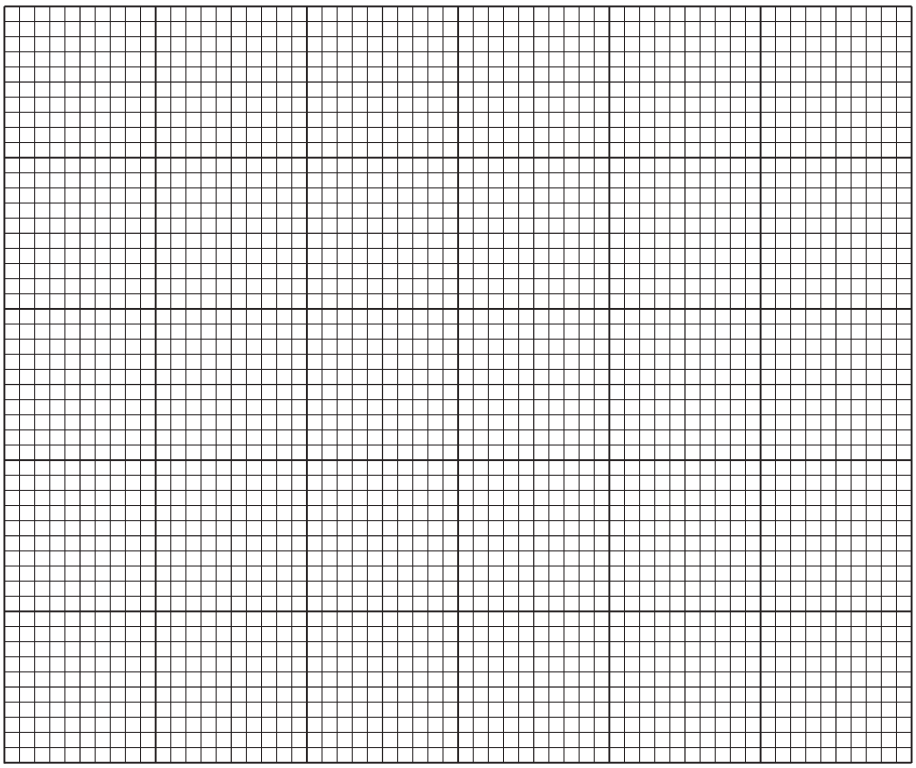
Table 1.2

percentage substrate concentration	rate of enzyme activity / arbitrary units (au)
0.0	0.0
2.0	1.9
6.0	5.6
9.0	8.5
11.0	9.4
12.0	9.4

© UCLES 2018

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

Use a sharp pencil for drawing graphs.



[4]

Fig. 1.2

(ii) Explain the effect that increasing the substrate concentration from 2.0% to 6.0% has on the rate of enzyme activity.

.....

.....

.....

.....

.....

.....

.....[3]

(iii) The scientist repeated the experiment but **without** an inhibitor.
V_{max} was reached at 4.5% substrate concentration and V_{max} was the same in both experiments.

State the type of inhibitor present.

.....[1]

[Total: 21]

Check that you have completed Question 1 from step 9 on page 6.

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

You are not expected to be familiar with this specimen.

(a) **(i)** Observe all the different tissues in the stem on **L1** and select an area that shows the epidermis and vascular bundles.

Use a sharp pencil for drawing.

Draw a large plan diagram of the area you have selected on **L1** to include:

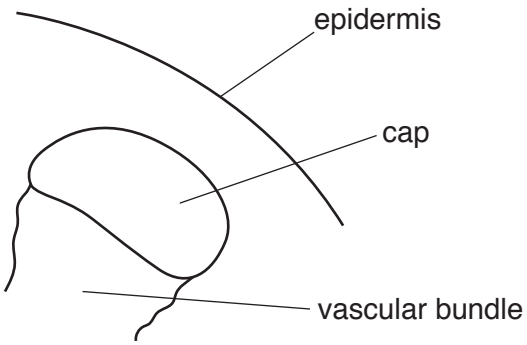
- the epidermis
- only **three** vascular bundles
- any other observable tissues.

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

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

[6]

(ii) Observe the cells in the cap of the vascular bundle on slide **L1** as shown in Fig. 2.1. These cells are not identical.



not to scale

Fig. 2.1

Select **one** group of **four** cells in the cap. Each cell of the group must touch at least 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 cell wall of **one** cell.

[5]

© UCLES 2018

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

You are not expected to be familiar with this specimen.

Observe the stem on **L1** and the stem in Fig. 2.2.

Annotate Fig. 2.2 to describe **three** observable differences between the stem in Fig. 2.2 and the stem on **L1**:

- Draw label lines to three different features and use only the labels **P**, **Q** and **R**.
- Next to each letter, describe how each feature on the stem in Fig. 2.2 differs from the stem on **L1**.

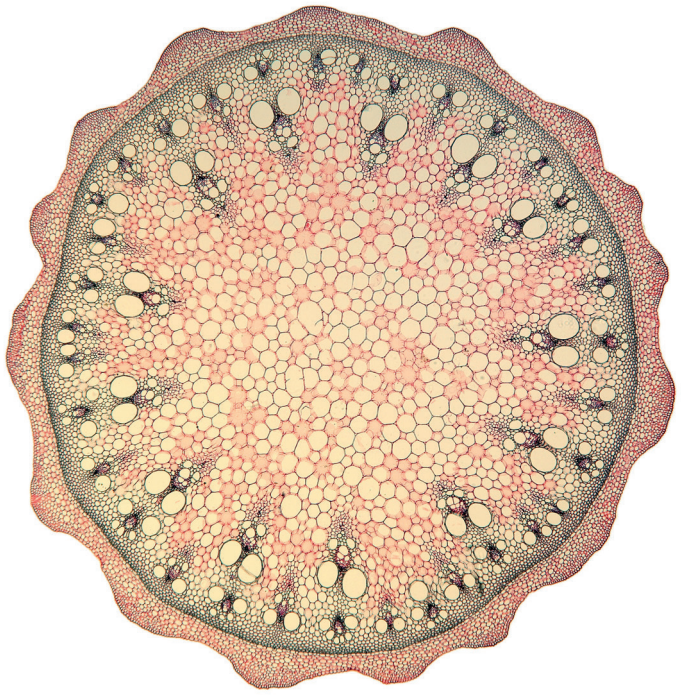


Fig. 2.2

[4]

© UCLES 2018

[Turn over

(c) Fig. 2.3 shows a photomicrograph of a transverse section through a different stem taken using a light microscope fitted with an eyepiece graticule.

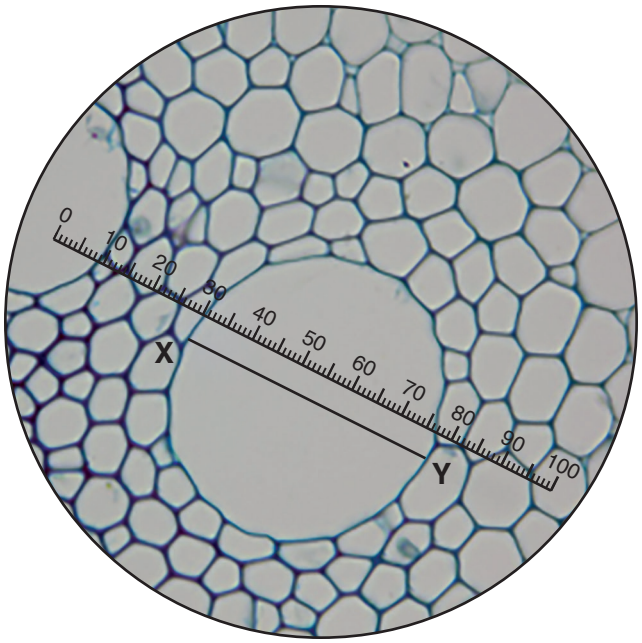


Fig. 2.3

A student calibrated the eyepiece graticule using a stage micrometer scale so that the actual length of the tissues could be determined.
The calibration was one eyepiece graticule division equal to 0.01 mm.

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

State which unit is most appropriate for use with the light microscope **and** show how 0.01 mm is converted to this unit.

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

.....[2]

(ii) Use the calibration of the eyepiece graticule division and Fig. 2.3 to calculate the actual length of the line **X**–**Y**.

actual length = ...[2]

[Total: 19]

© UCLES 2018

BLANK PAGE

© UCLES 2018

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.

© UCLES 2018