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.

DC (NH/SG) 137945/4
© 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.

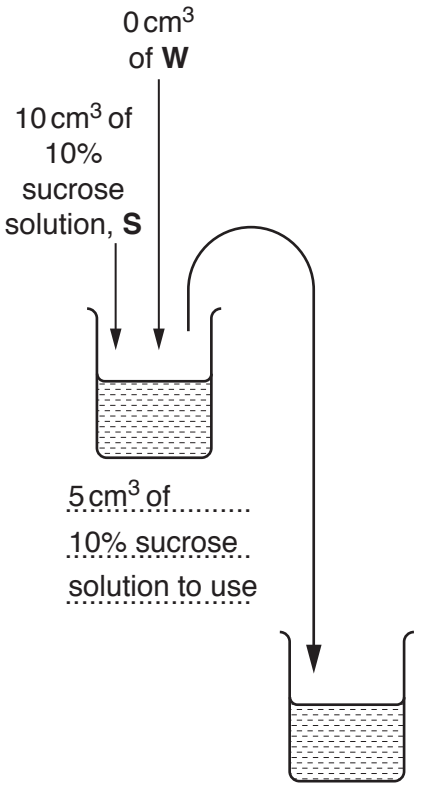
(i) Complete Fig. 1.1 by drawing as many extra beakers as you need for your serial dilution.

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.

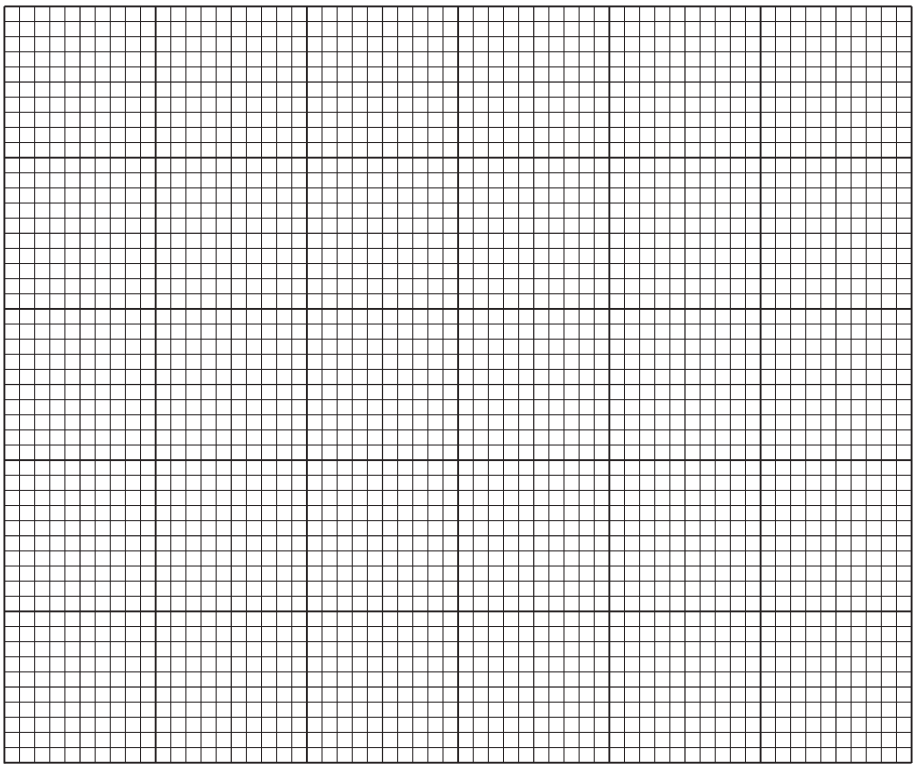
Table 1.2

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:

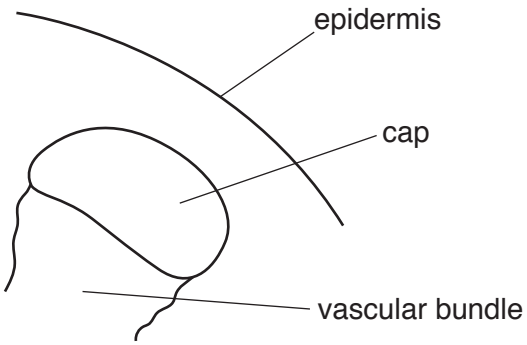
- the epidermis
- only **three** vascular bundles
- any other observable tissues.

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**.

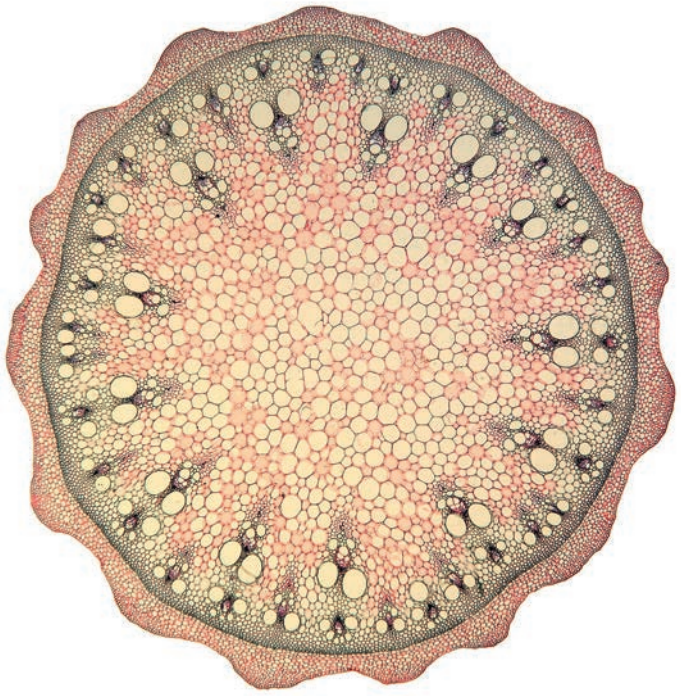


Fig. 2.2

[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.

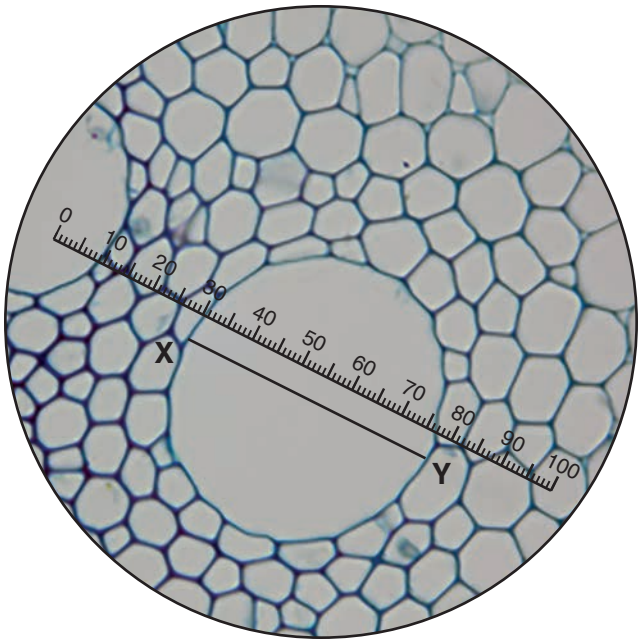


Fig. 2.3

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