Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

2361525521

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **October/November 2017**

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.

CAMBRIDGE International Examinations

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

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

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

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

1 Plant cells contain enzymes that catalyse metabolic reactions. Some of these enzymes catalyse the release of oxygen from hydrogen peroxide.

A plant extract solution can be produced which will contain these enzymes.

When hydrogen peroxide and a plant extract solution are mixed oxygen is released. The oxygen forms bubbles that make a foam on the surface.

You are required to investigate the effect of pH on the progress of the enzyme-catalysed reactions by:

- changing the pH (independent variable) using buffers
- measuring the height of the foam (dependent variable) produced by the release of oxygen.

To follow the progress of this reaction you will need to measure the height of foam at different times for a total of 3 minutes.

(a) (i) Decide how often you will take these measurements including the final height of foam at 3 minutes.

State the times when you will measure the height of foam.

.....[1]

(ii) Fig. 1.1**A** shows how a test-tube will be set up at the start (0 minutes).

Fig. 1.1**B** shows the test-tube after 3 minutes.

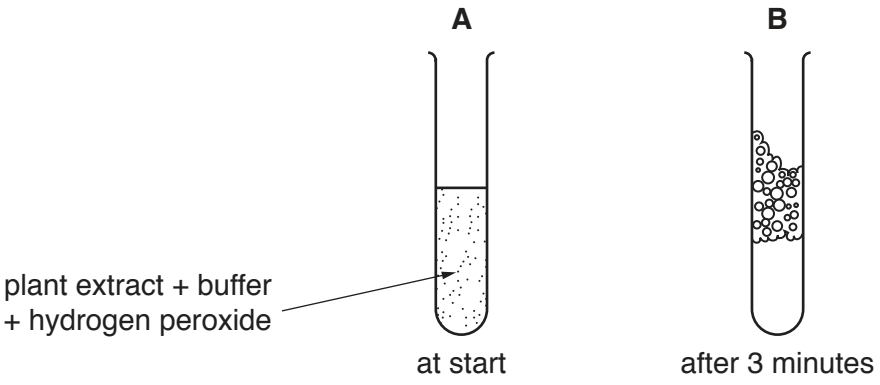


Fig. 1.1

The top of the foam may not form an even layer, so you will need to decide where to measure the layer of the foam.

Draw a double-headed arrow ↕ on Fig. 1.1**B** to show where you will measure this layer of foam. [2]

You are provided with:

labelled	contents	hazard	volume / cm^3
E	plant extract solution	harmful irritant	40
H	hydrogen peroxide solution	harmful irritant	70
B4	buffer pH4	none	10
B5	buffer pH5	none	10
B7	buffer pH7	none	10
B9	buffer pH9	none	10
B10	buffer pH10	none	10
U	unknown buffer	none	10
D	liquid detergent	none	10

If any of these liquids come into contact with your skin, wash off immediately under cold water. It is recommended that you wear suitable eye protection.

Temperature affects the rate of an enzyme-catalysed reaction and may be a significant source of error.
You are required to measure the temperature of the room before the start of the investigation **and** when all the measurements have been recorded.

Proceed as follows:

Read step 1 to step 9.

1. Measure the temperature of the room and record this measurement in **(b)(iii)** on page 5.

2. Put 1 cm^3 of each buffer into separate test-tubes.

3. Put 2 cm^3 of **E** into each test-tube. Gently shake to mix well.

4. Put 1 drop of **D** into each test-tube. Do **not** mix.

*The reaction will start as soon as **H** is added to the mixture of **E** and buffer.*

5. Put 5 cm^3 of **H** into **one** of the test-tubes.

6. Immediately start timing.

7. Using the strip of graph paper provided, measure the height of the foam as decided in **(a)(ii)**, at each of your sampling times as stated in **(a)(i)**, until you have recorded the final measurement at 3 minutes. Record your measurements in **(b)(i)**.

If the foam flows over the top of the test-tube, **stop timing**. Record the measurement of the height of the foam to the top of the test-tube **and** add an asterisk (*) to show that the foam has flowed over.

8. Repeat step 5 to step 7 with each of the other buffer solutions.

9. Measure the temperature of the room now that all the measurements have been recorded. Record the temperature in **(b)(iii)**.

(b) (i) Record your results for the height of foam (**raw** results) in an appropriate table.

[4]

(ii) Using your raw results for **pH 5**:

- State the highest height of foam ..... mm.
- State the first time when this height was reached ..... seconds.

Using these measurements, calculate the rate of production of oxygen, as millimetres per second ($mm\,s^{-1}$).

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

rate of oxygen production = ... $mm\,s^{-1}$ [2]

(iii) State the temperature of the room before the start of the investigation.

..... °C

State the temperature of the room after all the measurements have been recorded.

..... °C

State the difference between this temperature and the temperature of the room at the start of the investigation.

difference = ... °C

Explain whether temperature is a significant source of error in this investigation.

.....

..... [1]

You are provided with a sample **U** which contains a buffer.

You are now required to estimate the pH of the buffer in **U** using the same procedure.

10. Repeat step 2 to step 7 using **U** and record your results in **(b)(iv)**.

(iv) Record the maximum height of foam using **U**. ..... mm [1]

(v) Using the result in **(b)(iv)** and the results in **(b)(i)** estimate the pH of **U**.

pH ..... [1]

(vi) This procedure investigated the effect of pH on the activity of the enzymes in a plant extract solution.

To modify this procedure for investigating a different variable, the pH should be kept the same.

Think about how you could modify this procedure to investigate the effect of **substrate concentration**, using 6% hydrogen peroxide solution, on the activity of enzymes in the plant extract solution.

Describe how the independent variable, **substrate concentration**, would be changed in an investigation.

.....

.....

.....

.....

Describe how the dependent variable could be measured more accurately than measuring the height of foam. You may use a labelled diagram in the space provided.

.....

.....

.....

space for diagram

[3]

(c) A student investigated the effect of temperature on the rate of enzyme activity in a plant extract solution. All the other variables were standardised.

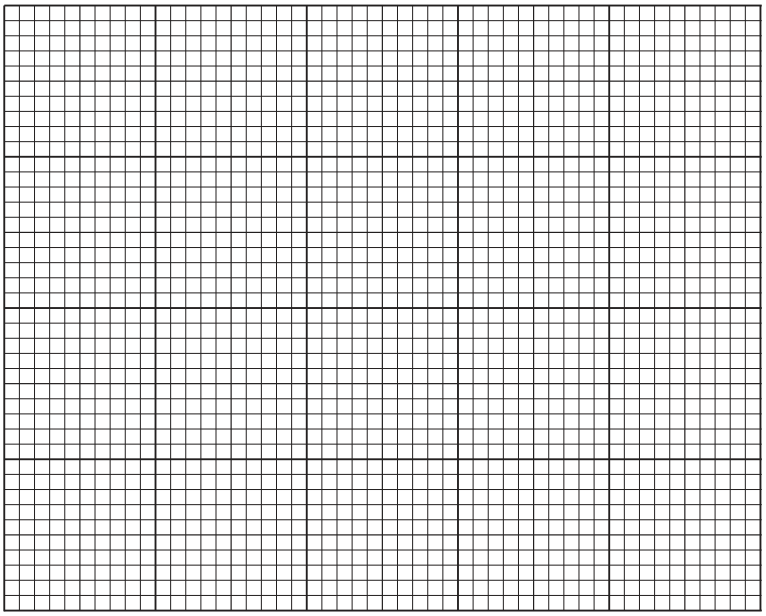
The results are shown in Table 1.1.

Table 1.1

temperature /°C	rate of enzyme activity /arbitrary units (au)
5	6.5
16	39.0
27	31.0
38	9.5
49	1.0

Use a sharp pencil for drawing graphs.

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



[4]

(ii) Use your knowledge of enzymes and the data to explain the effect of temperature on the enzyme activity in the plant extract solution.

.....

.....

.....

.....

.....

.....[3]

[Total: 22]

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

You are not expected to be familiar with this specimen.

Use a sharp pencil for drawing.

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

Select a field of view so that you can observe a sector that includes:

- a structure as shown by the shaded area and labelled **R** in Fig. 2.1
- part of the ring of vascular tissue.

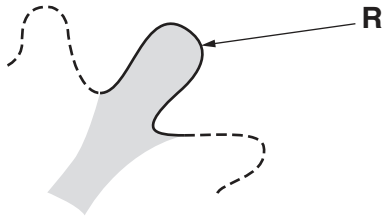


Fig. 2.1

Draw **one** large plan diagram of the different tissues shown in the field of view to show:

- the tissues making up **R**
- the tissues in the part of the vascular ring below **R**
- any other observable tissues.

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

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

[6]

(ii) Observe the cells in the centre of the stem (pith) in the specimen on **J1**.
These cells are not identical.

Select **one** group of **four** adjacent (touching) cells which show some of the differences between these cells.
Each cell of the group must touch at least two of the other cells.

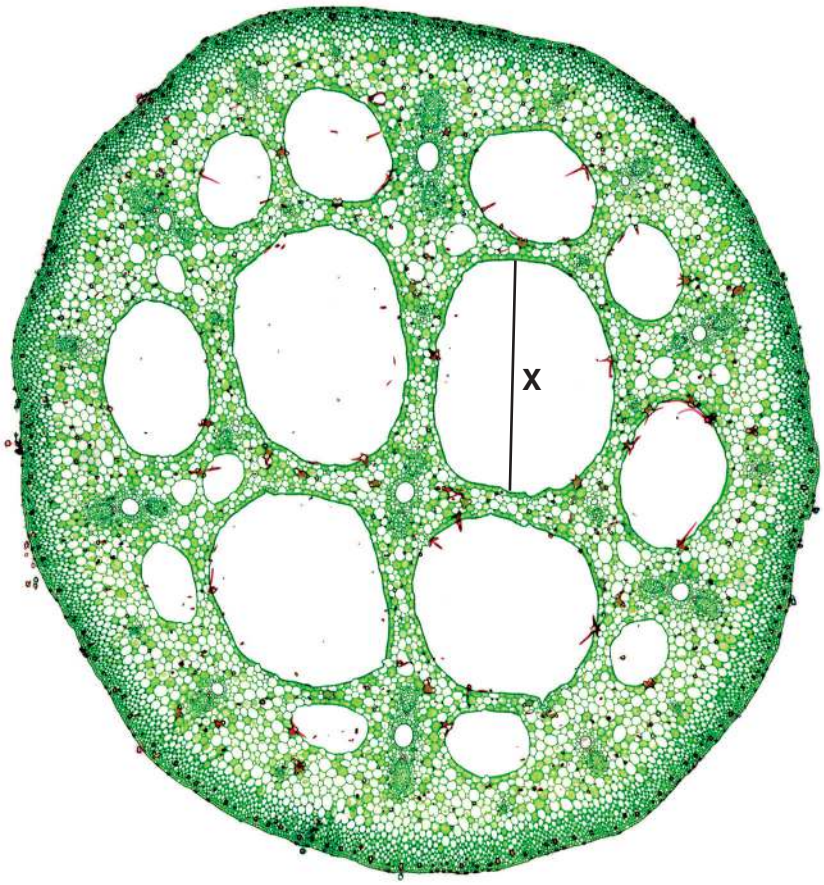
Make a large drawing of this group of **four** cells.

Use **one** ruled label line and the label **C** to identify a structure made of cellulose.

[5]

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

You are not expected to be familiar with this specimen.



magnification ×16

Fig. 2.2

(i) In Fig. 2.2 the line **X** is drawn across the length of an air space.

Use the line **X** and the magnification to calculate the actual length of the air space, in μm.

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

actual length = ... μm [3]

(ii) Observe the stem on **J1** and the stem in Fig. 2.2 and identify the differences between them.

Record the observable differences in Table 2.1.

Table 2.1

feature	J1	Fig. 2.2

[4]

[Total: 18]

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