Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0698978578

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 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.

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

Plan the use of the **two hours** to make sure that you finish 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 Enzyme **E** hydrolyses (breaks down) starch to reducing sugar.

You are required to investigate the effect of temperature (independent variable) on the activity of **E** by recording the time taken for the starch to be hydrolysed (dependent variable).

(a) You will investigate the hydrolysis of starch:
- at room temperature
- at other temperatures, starting at 40 °C to a maximum of 80 °C.

(i) State the temperatures, other than room temperature, that you will investigate.

.....[2]

You are provided with:

labelled	contents	hazard	volume/cm^3
E	2.0% enzyme **E** solution	harmful	20
S	starch solution	none	50
iodine	iodine solution	none	15

You are advised to wear suitable eye protection.

Iodine solution is a stain.

If **E** or **iodine** comes into contact with your skin, wash it off immediately under cold water.

The enzyme and starch solutions are mixed together and then a sample of the mixture is removed every 15 seconds and tested for starch.

The end-point of the hydrolysis of the starch is when a sample does **not** change the colour of iodine solution, showing that all of the starch has been hydrolysed.

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Fig. 1.1 shows a spotting tile with drops of iodine solution that have been labelled with the time, in seconds, that they will be used to test a sample.

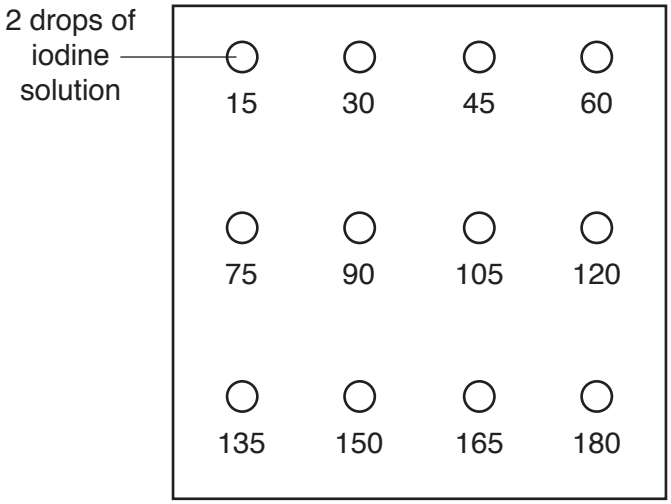


Fig. 1.1

Proceed as follows:

1. Set up a water-bath at room temperature.
2. Set up a spotting tile, as shown in Fig. 1.1.
3. Measure the temperature of the water-bath and record its temperature in Table 1.1, in **(a)(ii)**.
4. Label one test-tube **E** and label another test-tube **S**.
5. Put 1 cm^3 of **E** into the test-tube labelled **E**.
6. Put 3 cm^3 of **S** into the test-tube labelled **S**.
7. Put both of these test-tubes into the water-bath. Leave for one minute.
8. After one minute, remove both of the test-tubes and put them into a test-tube rack.
9. Heat the water-bath to 40 °C, which is the **next** temperature that you will test. Continue with step 10 while the water is heating.

Read step 10 to step 13 and **(a)(ii)** before proceeding.

Note: as soon as the starch is added to the enzyme the reaction will start.

10. Put the starch solution from test-tube **S** into the enzyme solution in test-tube **E** and mix. Start timing.
11. After 15 seconds, use the glass rod to remove a sample of the mixture and stir it into the iodine solution labelled '15' on the spotting tile, as shown in Fig. 1.1. Wipe the end of the glass rod with a paper towel.

    Continue removing and testing samples every 15 seconds until the colour of the iodine solution does **not** change, up to a maximum of 180 seconds. Each time, use the next labelled iodine solution on the spotting tile and wipe the end of the glass rod clean between tests.

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12. Record the colour of the iodine solution for **each** test in Table 1.1, in **(a)(ii)**. These are the raw results.

13. Use a paper towel to wipe the spotting tile clean.

14. Repeat step 2 to step 13 for all of the temperatures you stated in **(a)(i)**, each time heating the water-bath in step 9 to the **next** temperature that you are going to use.

(ii) Record your raw results by completing Table 1.1, using the letters stated below for the colours.

You will observe a range of colours depending on the concentration of starch in the sample.

You will see some of the following colours and should record the colours by using these letters.

BB	blue/black	**DB**	dark brown
DP	dark purple	**B**	brown
P	purple	**PB**	pale brown
PP	pale purple	**Y**	yellow/orange (colour of iodine solution at start)

Table 1.1

	colour of iodine solution											
time/s / **temperature/°C**	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**	**135**	**150**	**165**	**180**

[3]

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(iii) Prepare the space below and, using your raw results from Table 1.1 in **(a)(ii)**, record the time taken for enzyme **E** to hydrolyse all of the starch at each temperature.

Record 'more than 180' if there is still starch present at 180 seconds.

[4]

(iv) Describe **two** significant sources of error in this investigation.

.....

.....

.....

.....[2]

(v) A student using the same enzyme concluded that the source of enzyme **E** was **not** from humans.

Explain how your results support the student's conclusion.

.....

.....

.....

.....[2]

(vi) This procedure investigated the effect of temperature on the activity of enzyme **E**, using the time taken to hydrolyse starch.

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

Describe how the temperature could be standardised.

.....

.....

Think about how you could modify this procedure to investigate the effect of **enzyme concentration** (the new independent variable) on the time taken to hydrolyse the starch.

Describe the modifications needed to investigate the effect of **enzyme concentration**.

.....

.....

.....

.....

[3]

(b) A student investigated the effect of temperature on the activity of an enzyme extracted from an organism living in very low temperatures.

All the variables were standardised at each temperature.

The student's results are shown in Table 1.2.

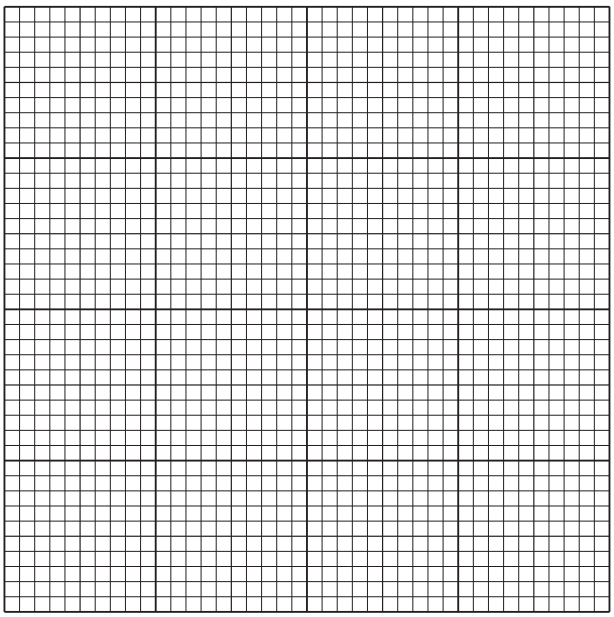
Table 1.2

temperature /°C	activity of enzyme /arbitrary units
4.0	19.00
7.0	17.50
10.5	14.75
12.0	3.25
19.5	0.75

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Use a sharp pencil for graphs.

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



[4]

(ii) Describe the effect of temperature on the activity of this enzyme.

.....

.....

.....[1]

[Total: 21]

2 **P1** is a slide of a stained transverse section through a plant root.

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 half of the root on **P1** shown by the shaded area in Fig. 2.1.

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

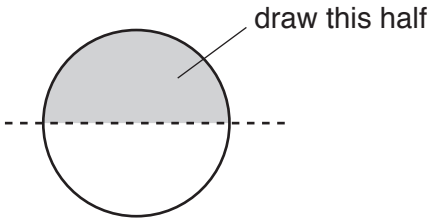


Fig. 2.1

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

[5]

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(ii) Observe the central tissue in the root on **P1**. The cells in the central tissue are not identical.

Select one group of **four** adjacent (touching) cells that show some of the differences between these cells. Each cell 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]

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

You are not expected to be familiar with this specimen.

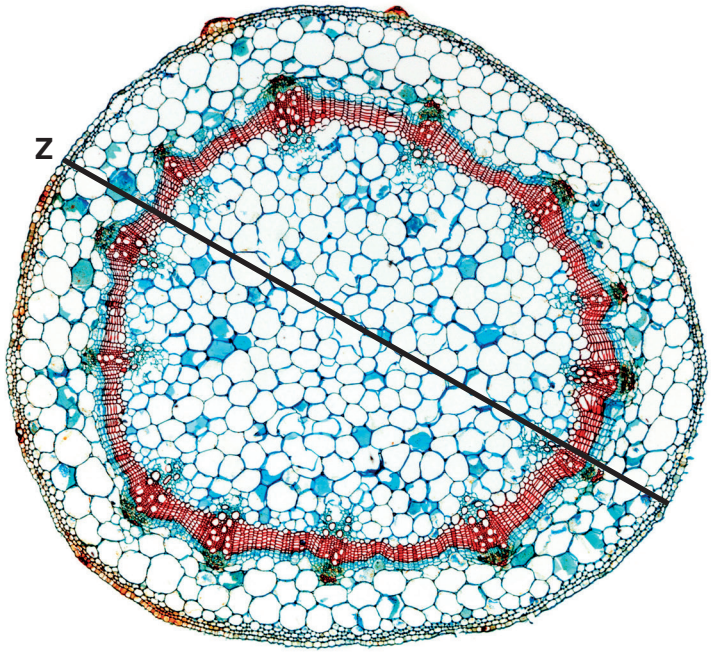


Fig. 2.2

(i) Identify the organ shown in Fig. 2.2. Describe one observable feature that supports your identification.

name of organ .....

feature .....

[1]

(ii) The actual diameter of the organ in Fig. 2.2 along line **Z** is 4500 μm.

Calculate the magnification of the organ shown in Fig. 2.2.

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

magnification × .....

[4]

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(iii) Prepare the space below so that it is suitable for you to record the observable differences between the root on **P1** and the organ in Fig. 2.2.

Record these differences in the space you have prepared.

[4]

[Total: 19]

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