Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 2020**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

For Examiner's Use	
1	
2	
Total	

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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 the whole of Question 1 and Question 2.

1 Amylase is an enzyme which hydrolyses starch into reducing sugars, as shown in Fig. 1.1.

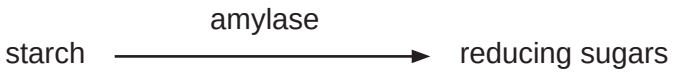

Fig. 1.1

The progress of this reaction can be followed by measuring the concentration of starch remaining using iodine solution.

You will need to:

- prepare a serial dilution of a 1.0% starch solution, **S**
- estimate the concentration of starch remaining after hydrolysis with amylase at two different pH values.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	**contents**	**hazard**	**volume / cm^3**
S	1.0% starch solution	none	50
iodine	0.01 mol dm^{-3} iodine solution	none	20
W	distilled water	none	150
X	a sample of 1.0% starch solution which has been incubated with amylase and pH2 buffer	harmful irritant	20
Y	a sample of 1.0% starch solution which has been incubated with amylase and pH7 buffer	harmful irritant	20

If any solution comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

(a) You need to carry out a **serial** dilution of the 1.0% starch solution, **S**, which reduces the concentration of the starch solution by a factor of 10 between each successive dilution.

Fig. 1.2 shows you the first two beakers you will use to make your serial dilution.

(i) Complete Fig. 1.2 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 starch solution available for use in the investigation
- use one arrow with a label, above the beaker, to show the volume and concentration of starch solution added to prepare the concentration
- use another arrow with a label, above the beaker, to show the volume of **W** added to prepare the concentration.

5

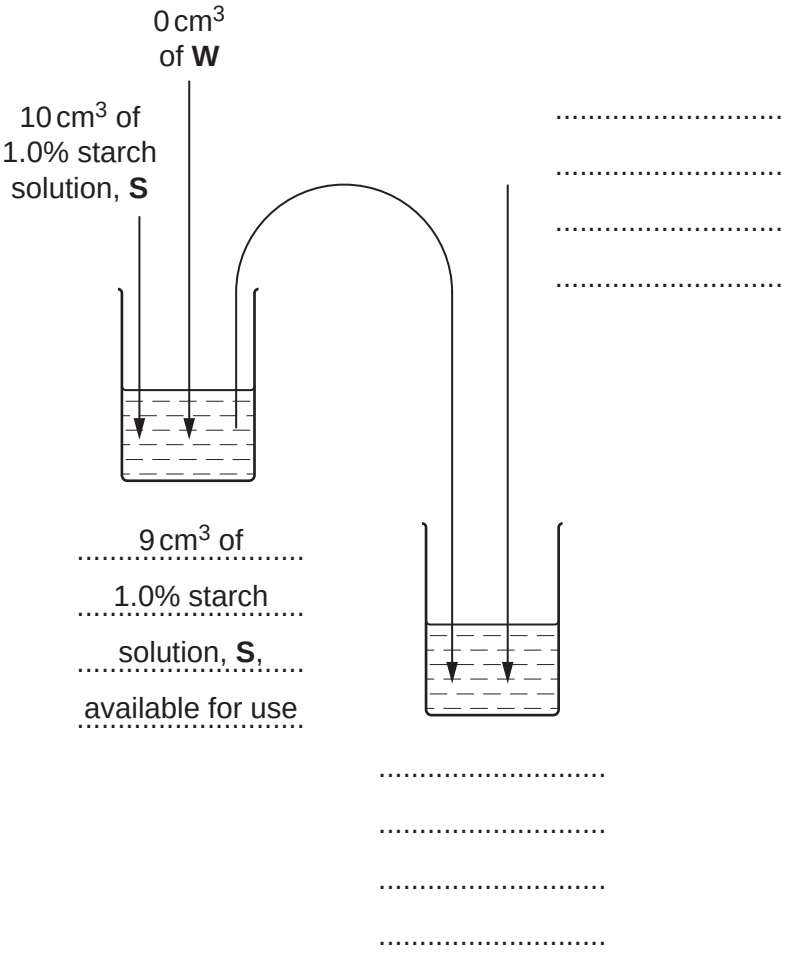
0 cm3 of W
10 cm3 of 1.0% starch solution, S
.....
.....
.....
.....
9 cm3 of
1.0% starch
solution, S,
available for use
.....
.....
.....
.....

Fig. 1.2

[3]

Carry out step 1 to step 6.

1. Prepare the concentrations of starch solution as decided in **(a)(i)** and shown in Fig. 1.2.

   Use a glass rod to mix the starch solutions and water.

2. Label test-tubes with the concentrations of starch solution prepared in step 1.

3. Put 5 cm^3 of each concentration of starch solution into an appropriately labelled test-tube.

4. Put 3 drops of **iodine** into each of the test-tubes. Shake gently to mix.

5. After step 4, observe the colour of the liquid in each test-tube. You may see the same colour in more than one test-tube.

It may help to hold a piece of white card behind the test-tube to see the colour more clearly.

Fig. 1.3 shows the key you need to use to record your results.

Key

colour	**symbol**
blue/black or purple	+++++
blue	++++
dark brown	+++
brown	++
yellow/orange	+

Fig. 1.3

6. Record your results in **(a)(ii)** using the symbols shown in the key in Fig. 1.3.

(ii) Record your results in an appropriate table.

[5]

Carry out step 7 to step 10.

7. Label a test-tube **X**.

8. Put 5 cm^3 of **X** into this test-tube.

9. Put 3 drops of **iodine** into this test-tube. Shake gently to mix.

10. Observe the colour of the liquid and record the result in **(a)(iii)** using the symbols shown in Fig. 1.3.

11. Repeat step 7 to step 10, using **Y** instead of **X**.

(iii) Record your result for **X** and **Y** using the symbols shown in the key in Fig. 1.3.

result for **X** .....

result for **Y** .....

[1]

(iv) Using your results in **(a)(ii)** and **(a)(iii)**, estimate the concentration of starch in **X** and **Y**.

X = ...

Y = ...

[1]

(v) A student investigated the hydrolysis of starch by amylase.

The student decided to use a semi-quantitative method to measure the products.

These products are reducing sugars.

Suggest how the student would use a semi-quantitative method to measure the concentration of reducing sugars produced.

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.....

.....

..... [3]

(b) One of the reducing sugars produced by the hydrolysis of starch is maltose.

Maltose is a disaccharide that can be hydrolysed to glucose by the enzyme maltase.

A student investigated the effect of maltose concentration on the initial rate of reaction of maltase.

The results are shown in Table 1.2.

Table 1.2

concentration of maltose / mol dm^{-3}	initial rate of reaction of maltase / arbitrary units
0.00	0
0.60	90
1.30	175
1.85	225
2.45	255
3.55	260
3.95	260

(i) Plot a graph of the data in Table 1.2 on the grid in Fig. 1.4.

Use a sharp pencil for drawing graphs.

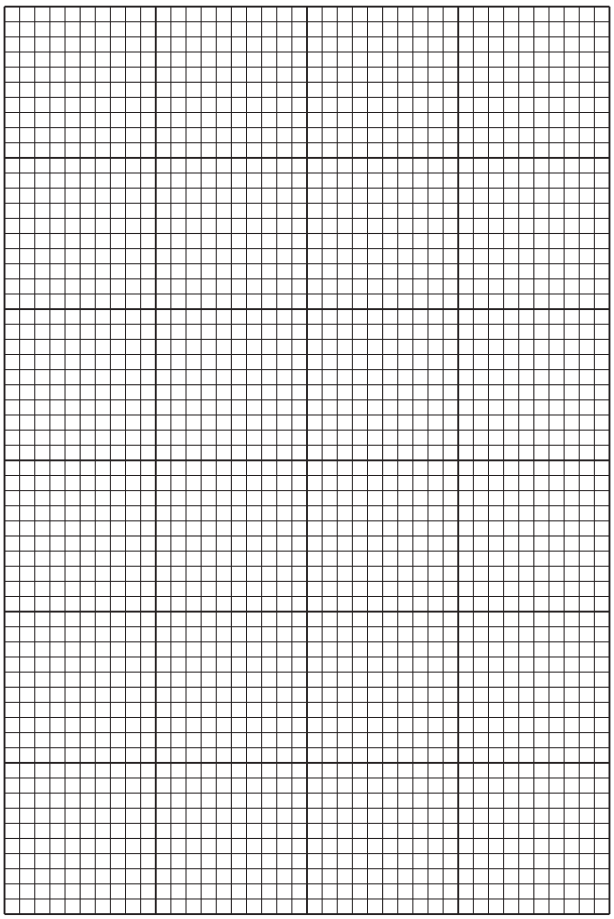

Fig. 1.4

[4]

(ii) Use the graph in Fig. 1.4 to estimate the Michaelis–Menten constant, K_m.

Show your working on the graph and in the space below.

K_m = ... mol dm^{-3} [2]

(iii) A student investigated a different enzyme, **Z**, and found the K_m value to be 0.50 mol dm^{-3}.

State which enzyme, **Z** or maltase, has a **lower affinity** for its substrate. Give a reason for your answer.

enzyme .....

reason .....

.....

[1]

(iv) Using the graph in Fig. 1.4, explain the change in the rate of reaction between 0.00 mol dm^{-3} of maltose and 3.95 mol dm^{-3} of maltose.

.....

.....

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.....

.....

..... [2]

[Total: 22]

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) Select a field of view so that you can observe the different tissues as shown by the shaded area in Fig. 2.1.

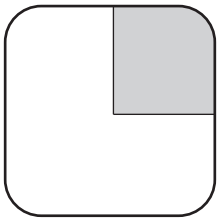

Fig. 2.1

Use a sharp pencil for drawing.

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

(i) Draw a large plan diagram of the region of the stem on **L1** shown by the shaded area in Fig. 2.1.

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

[5]

(ii) Observe the cells in the central tissue (pith) of the stem section on **L1**.

Select **four** adjacent, touching cells which show observable features of the central tissue.

Each cell must touch at least two other cells.

- Make a large drawing of this group of **four** touching 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 a stem of a different type of plant.

You are not expected to be familiar with this specimen.

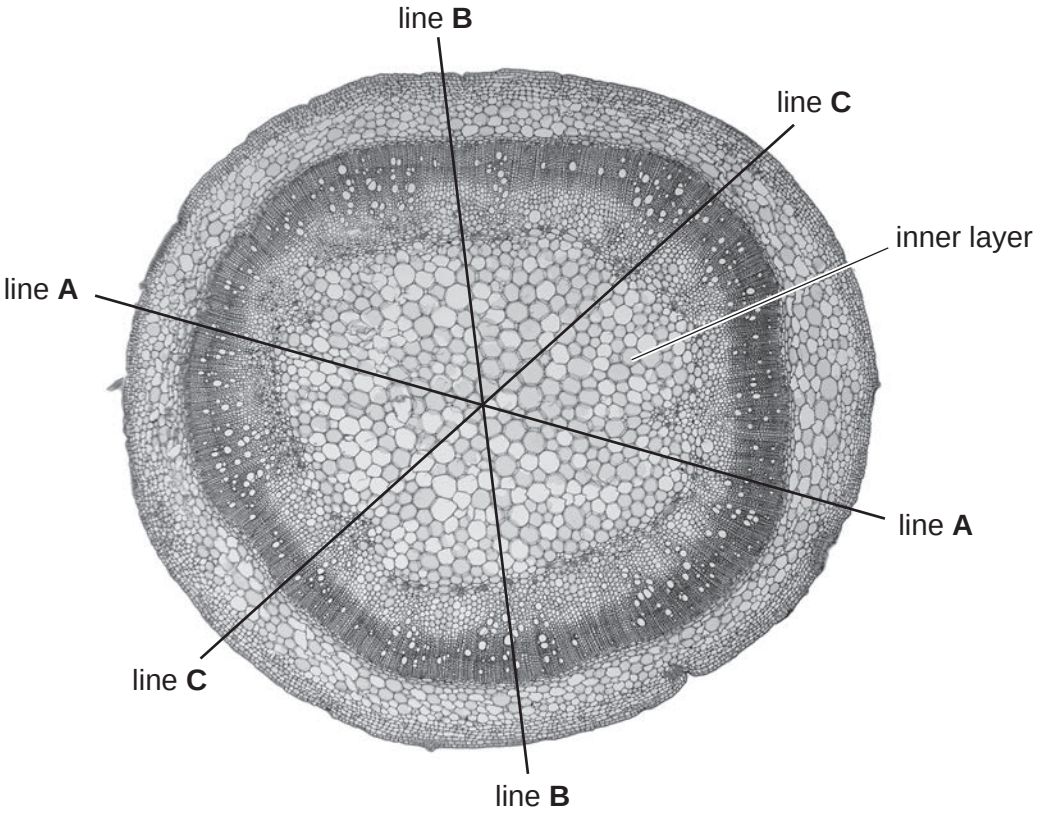

Fig. 2.2

(i) The magnification of the stem section in Fig. 2.2 is ×32.
Use line **A**, line **B** and line **C** to determine:

- the mean actual diameter of the whole stem section
- the mean actual diameter of the inner layer.

Show all the steps in your working.

mean actual diameter of whole stem section .....

mean actual diameter of inner layer .....

[4]

(ii) Use your answers to **(b)(i)** to determine the simplest whole number ratio of the mean actual diameter of the whole stem section to the mean actual diameter of the inner layer.

simplest whole number ratio = ... [1]

(c) Fig. 2.3 is a photomicrograph of the same stem section that is in Fig. 2.2.

Fig. 2.3

Identify the observable differences between the stem section in Fig. 2.3 and the stem section on **L1**.

Record the observable differences in Table 2.1.

Table 2.1

feature	Fig. 2.3	L1

[3]

[Total: 18]

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