Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **October/November 2022**

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	

This document has **16** pages. Any blank pages are indicated.

[Turn over

1 You are provided with a solution labelled **E** containing an enzyme which coagulates (clots) milk.

Enzyme **E** hydrolyses (breaks) peptide bonds between certain amino acids in a protein found in milk and this results in the coagulation of the milk.
Calcium ions are needed for this coagulation.

When a mixture of milk, calcium chloride solution and **E** is gently turned in a test-tube, the milk will coagulate, producing lumps of a white solid in a liquid.

The end-point of the enzyme-catalysed coagulation is when all the milk coagulates, as shown in Fig. 1.1.

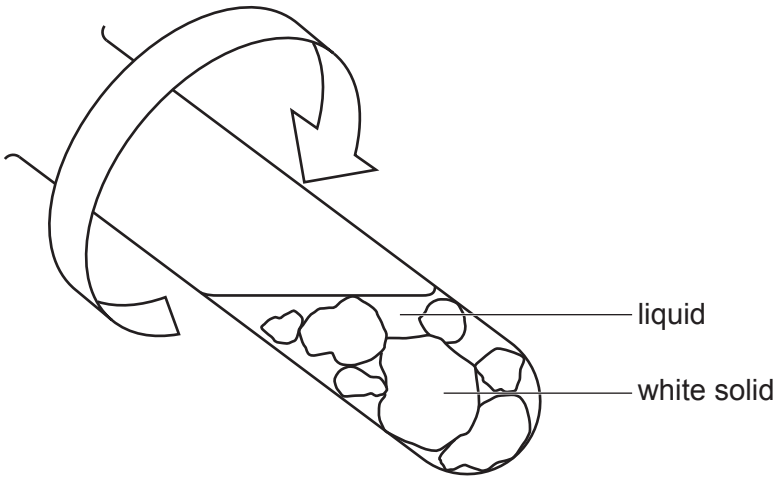

Fig. 1.1

You will investigate the effect of temperature on the time taken to reach the end-point.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
M	100% milk	none	150
E	enzyme solution	harmful irritant	20
C	calcium chloride solution	harmful irritant	20

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

It is recommended that you wear suitable eye protection.

You will test the activity of enzyme **E** at 30 °C and other temperatures up to a maximum of 50 °C.

(a) (i) Complete Table 1.2 to show three other temperatures that you will use to show the effect of temperature on the activity of enzyme **E**.

Table 1.2

temperature / °C				
30	.....	.....	.....	50

[1]

Carry out step 1 to step 14.

step 1 Set up a water-bath ready for step 6. The starting temperature of the water-bath should be 30 °C, as shown in Table 1.2.

step 2 Put 10 cm^3 of **M** into a test-tube.

step 3 Repeat step 2 so that you have **two** test-tubes containing **M**.

step 4 Put 1 cm^3 of **C** into each test-tube.

step 5 Gently shake the test-tubes to mix **M** and **C**.

step 6 Put the test-tubes into the water-bath and leave for 3 minutes.

(ii) Explain why the test-tubes are left in the water-bath for 3 minutes in step 6.

.....

..... [1]

step 7 Remove **one** of the test-tubes from the water-bath.

[Turn over

The process of coagulation will start when **E** is added to the test-tube.

step 8 Put 1 cm^3 of **E** into the test-tube, so that it runs down the side of the test-tube and forms a layer on the surface of the mixture, as shown in Fig. 1.2.

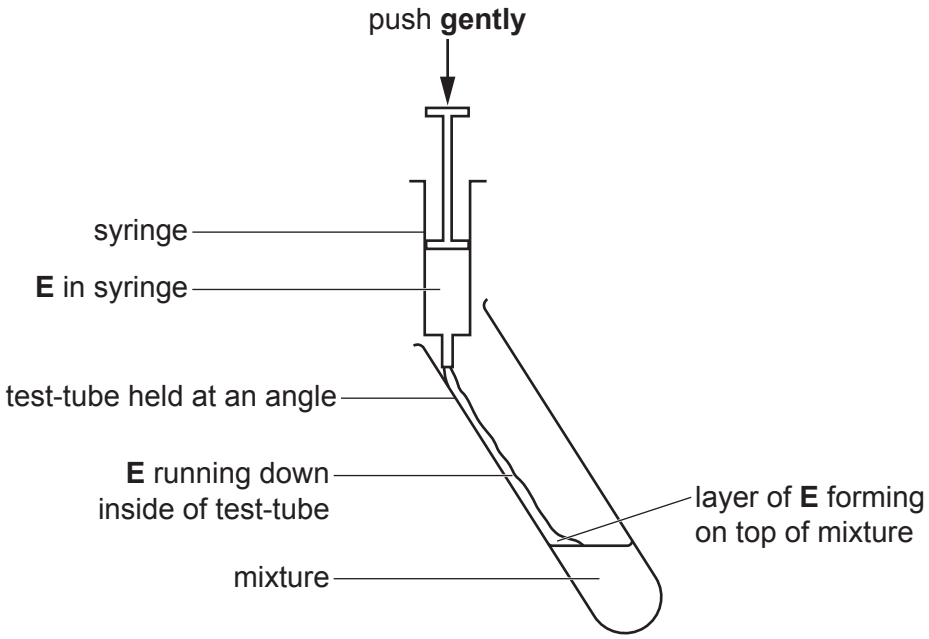

Fig. 1.2

step 9 Gently shake the test-tube to mix the solutions and start timing.

step 10 Rotate the test-tube and continue to rotate it while observing the mixture until the end-point is reached. Stop timing when the end-point is reached.

If the end-point has not been reached by 180 seconds, stop timing and record this as 'more than 180'.

step 11 Record in **(a)(iii)** the time to reach the end-point.

step 12 Repeat step 7 to step 11 with the other test-tube in the water-bath.

step 13 Set up the water-bath at the next temperature after 30 °C stated in Table 1.2.

step 14 Repeat step 2 to step 13 for each temperature stated in Table 1.2.

(iii) Record your results in an appropriate table.

[5]

(iv) State the independent variable in this experiment.

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..... [1]

(v) Suggest a suitable control for this investigation to show that it is the enzyme **E** that coagulates the milk.

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.....

..... [1]

(vi) The procedure described by step 1 to step 14 investigated the effect of temperature on the activity of enzyme **E**, using the time taken to reach the end-point.

Describe how you would modify the procedure to investigate the effect of changing the concentration of milk on the time taken to reach the end-point.

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..... [3]

(b) A scientist carried out an investigation into the effect of enzyme concentration on the coagulation of milk. The scientist calculated the activity of the enzyme for each concentration of enzyme.

The results are shown in Table 1.3.

Table 1.3

% enzyme concentration	activity of enzyme / arbitrary units (au)
0.05	19
0.10	34
0.15	50
0.20	65
0.30	96

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

Use a sharp pencil.

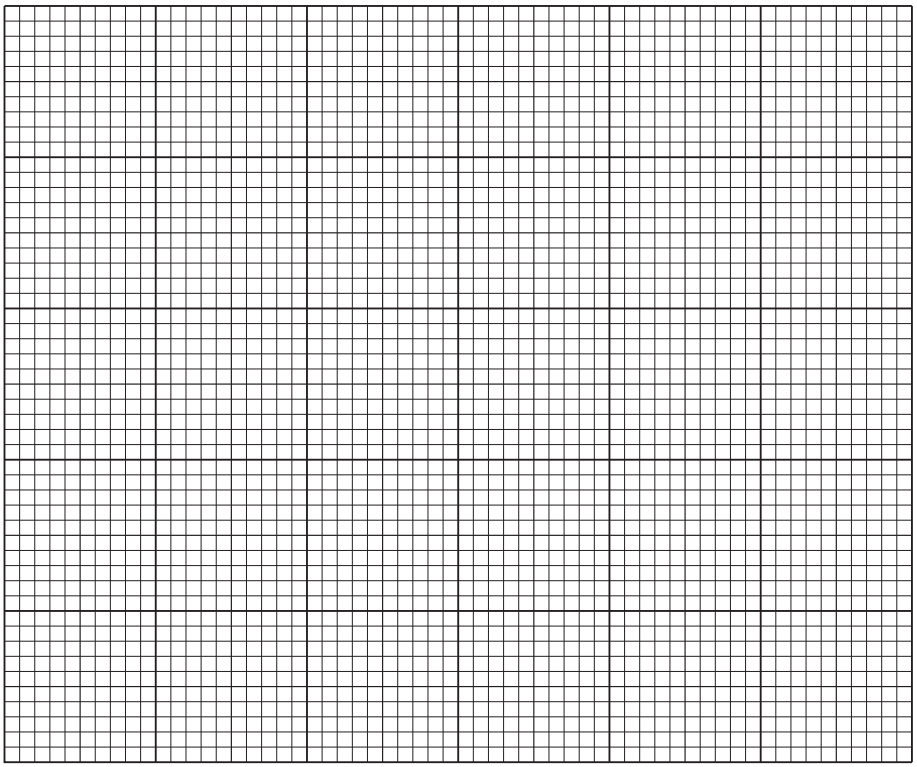

Fig. 1.3

[4]

(ii) Use your graph to determine the activity of the enzyme when the enzyme concentration is 0.25%.

Show on your graph how you determined this value.

activity of the enzyme = ... au

[2]

(iii) Describe the trend in the results shown by your graph.

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..... [1]

(iv) Suggest an explanation for the trend you described in **(b)(iii)**.

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..... [2]

[Total: 21]

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

(a) **(i)** Draw a large plan diagram of the region of the stem on **K1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

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

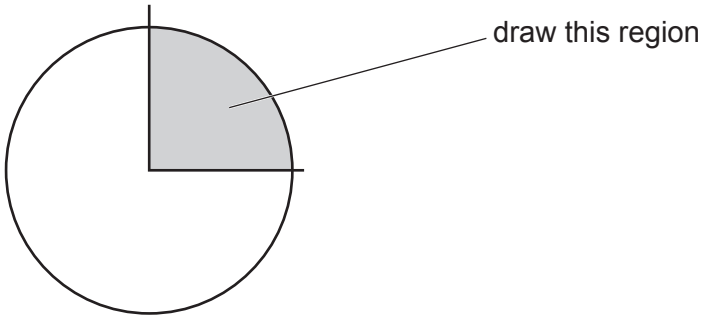

Fig. 2.1

[5]

(ii) Observe the epidermis of the stem on **K1** and the layer of cells beneath.

Select a group of four adjacent cells. This group must include **two** cells from the epidermis and **two** cells from below the epidermis.

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]

Fig. 2.2 is a photomicrograph of a stained transverse section of a stem from a different type of plant.

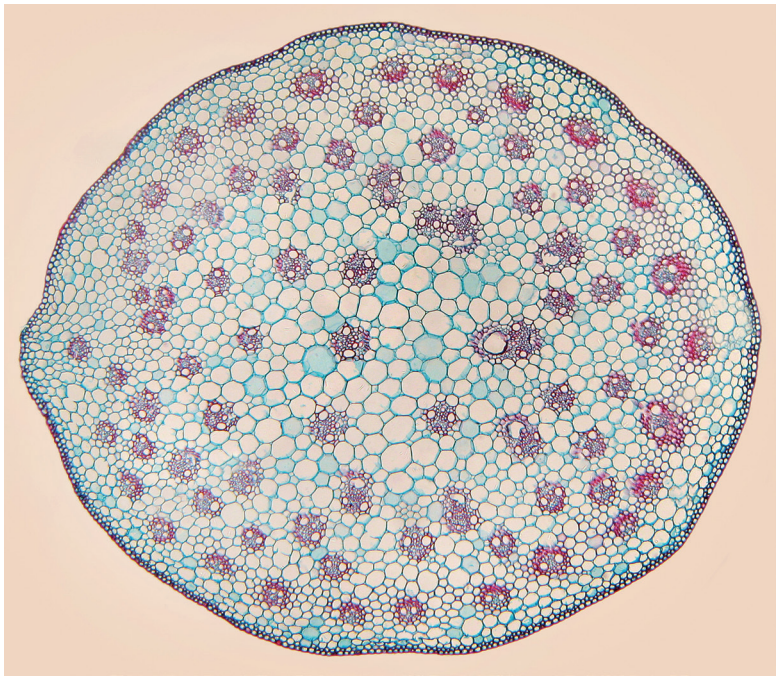

Fig. 2.2

(b) Identify **three** observable differences, other than size and colour, between the stem in Fig. 2.2 and the stem on **K1**.

Record these **three** observable differences in an appropriate table.

[4]

(c) Fig. 2.3 is the same photomicrograph as that in Fig. 2.2.

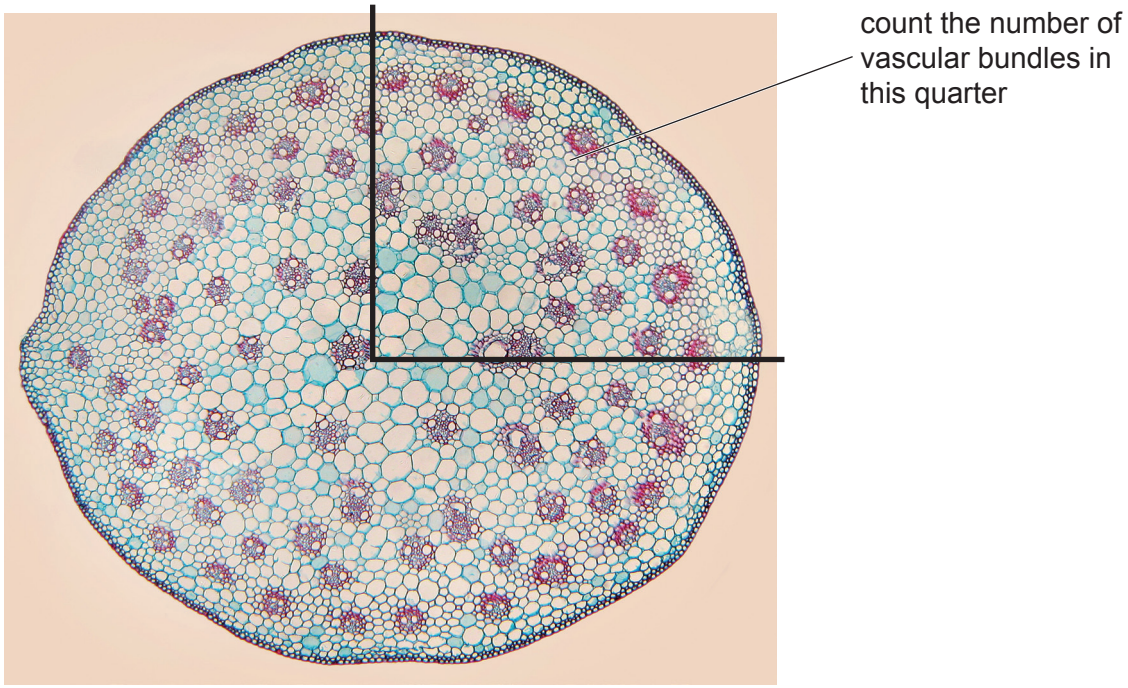

Fig. 2.3

Fig. 2.3 shows many vascular bundles within the photomicrograph. A sampling technique may be used to estimate the number of vascular bundles present in the whole photomicrograph.

(i) The region shown in Fig. 2.3 is one quarter of the stem section.

Count and record the number of vascular bundles in the region shown in Fig. 2.3.

If half or more of a vascular bundle is within the region, count it as a whole vascular bundle.
Do not count any vascular bundle if less than half of the vascular bundle is within the region.

Mark clearly, using a pen (not a pencil), on Fig. 2.3 each of the vascular bundles you have counted.

Estimate the total number of vascular bundles in the whole photomicrograph.

Show your working.

estimated number of vascular bundles in the whole photomicrograph .....
[4]

(ii) The plant shown in Fig. 2.3 has many vascular bundles.

Suggest why it is an advantage to the plant to have many vascular bundles in its stem.

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..... [1]

[Total: 19]

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