Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8835247660

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2024**

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 **12** pages.

[Turn over

1 Milk is sometimes contaminated with substances such as starch.

You will determine the concentration of starch in a sample of contaminated milk, using a range of starch standards.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
M	milk	none	50
SM	1.0% starch solution in milk (starch-milk)	none	20
CM	contaminated milk	none	20
iodine	iodine solution	irritant	20

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

It is recommended that you wear suitable eye protection.

You will need to carry out a **serial** dilution of the 1.0% starch-milk solution, **SM**, to reduce the concentration by **one fifth** between each successive dilution.

You will need to prepare **four** concentrations of starch-milk solution in addition to the 1.0% starch-milk solution, **SM**.

You must use the milk, **M**, to dilute the starch-milk solution. Do **not** use water for the dilution.

After the serial dilution is completed, you will need to have 8 cm^3 of each concentration available to use.

(a) (i) Complete Fig. 1.1 to show how you will prepare your serial dilution.

Each beaker should have:

- a labelled arrow to show the volume of starch-milk, **SM**, solution transferred
- a labelled arrow to show the volume of milk, **M**, added
- a label under the beaker to show the concentration of the starch-milk solution.

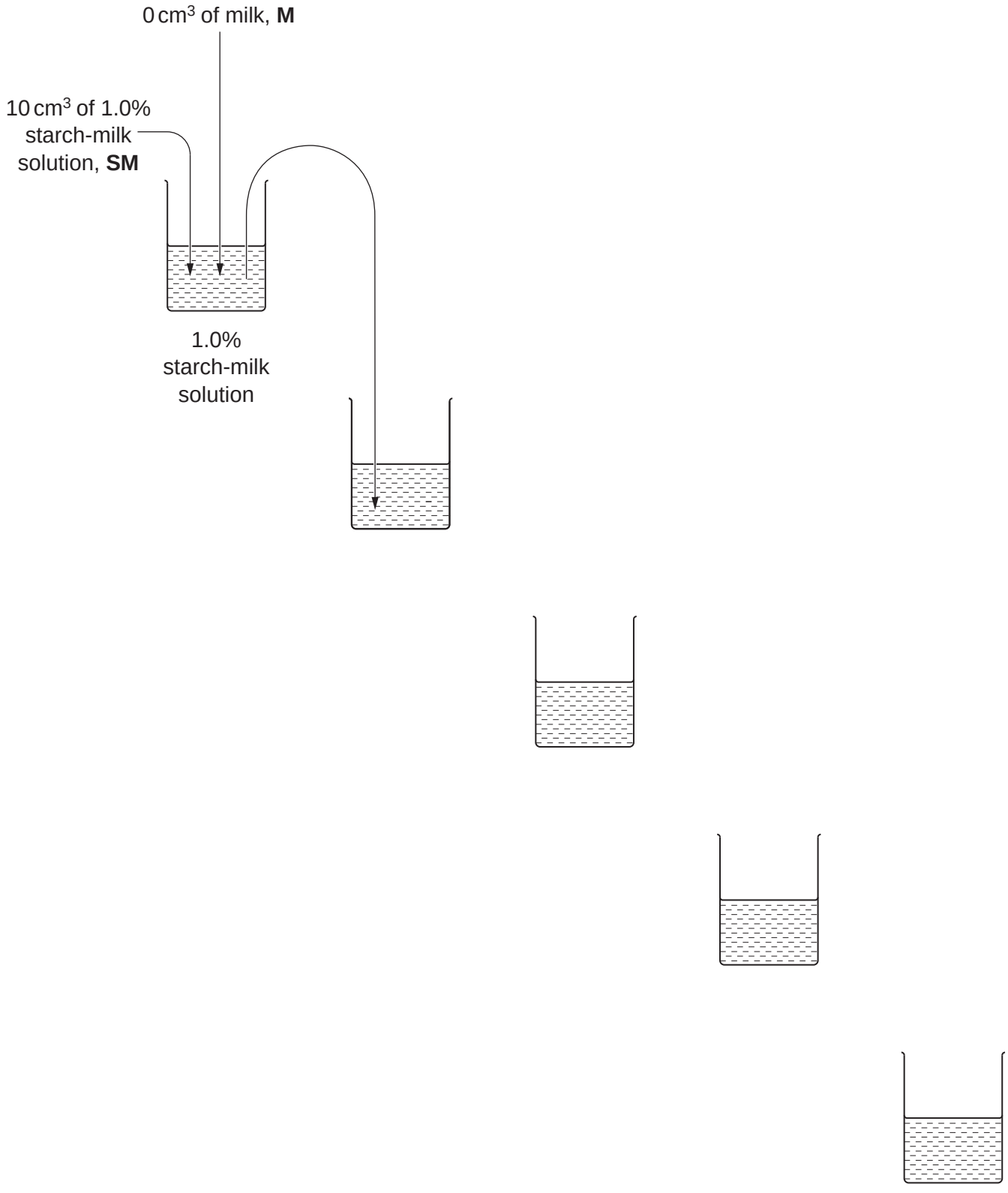
0 cm3 of milk, M
10 cm3 of 1.0% starch-milk solution, SM
1.0% starch-milk solution

Fig. 1.1

[3]

Carry out step 1 to step 11.

step 1 Prepare the concentrations of starch-milk solution as shown in Fig. 1.1.

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

step 3 Put 1 cm^3 of the 1.0% starch-milk solution into the appropriately labelled test-tube.

step 4 Repeat step 3 with the remaining concentrations of starch-milk solution.

step 5 Add 1 cm^3 of iodine solution to each test-tube. Shake gently to mix.

step 6 Observe the colour in each test-tube and use the key in Fig. 1.2 to determine the colour score.

step 7 Record in **(a)(ii)** the colour score for each concentration of starch-milk solution.

colour of solution						
colour score	5	4	3	2	1	0

Fig. 1.2

(ii) Record your results in an appropriate table.

[5]

(iii) To determine the concentration of starch in the contaminated milk, **CM**, you will need to test a sample of **CM**.

State the volume of **CM** that you will use.

volume = ... [1]

step 8 Label a test-tube **CM**.

step 9 Transfer the volume of **CM** that you stated in **(a)(iii)** into test-tube **CM**.

step 10 Put 1 cm^3 of iodine solution into the test-tube. Shake gently to mix.

step 11 Observe the colour in the test-tube, and use the key in Fig. 1.2 to determine the colour score.

(iv) Record the colour score for test-tube **CM**.

colour score for **CM** ..... [1]

(v) Use your results in **(a)(ii)** and **(a)(iv)** to determine the concentration of starch in the contaminated milk, **CM**.

concentration of starch in **CM** ..... [1]

(vi) Identify **one** source of error in step 6.

.....

.....

..... [1]

(vii) Suggest why milk is used to dilute the starch-milk solution rather than water.

.....

.....

..... [1]

(viii) Milk is sometimes contaminated with glucose.

Suggest how you would modify this investigation to determine the concentration of glucose in a sample of contaminated milk.

.....

.....

.....

..... [2]

(b) Some people are intolerant to lactose in milk. The enzyme β-galactosidase is used to break down the lactose in milk.

In an investigation, equal quantities of β-galactosidase were added to different concentrations of lactose in milk. The rate of lactose breakdown was measured and recorded.

The results are shown in Table 1.2.

Table 1.2

concentration of lactose / mmol dm^{-3}	rate of reaction / arbitrary units
12	0.30
42	0.65
70	0.80
110	1.15
164	1.25
210	1.25

(i) Plot a graph of the data in Table 1.2 on the grid in Fig. 1.3.

Use a sharp pencil.

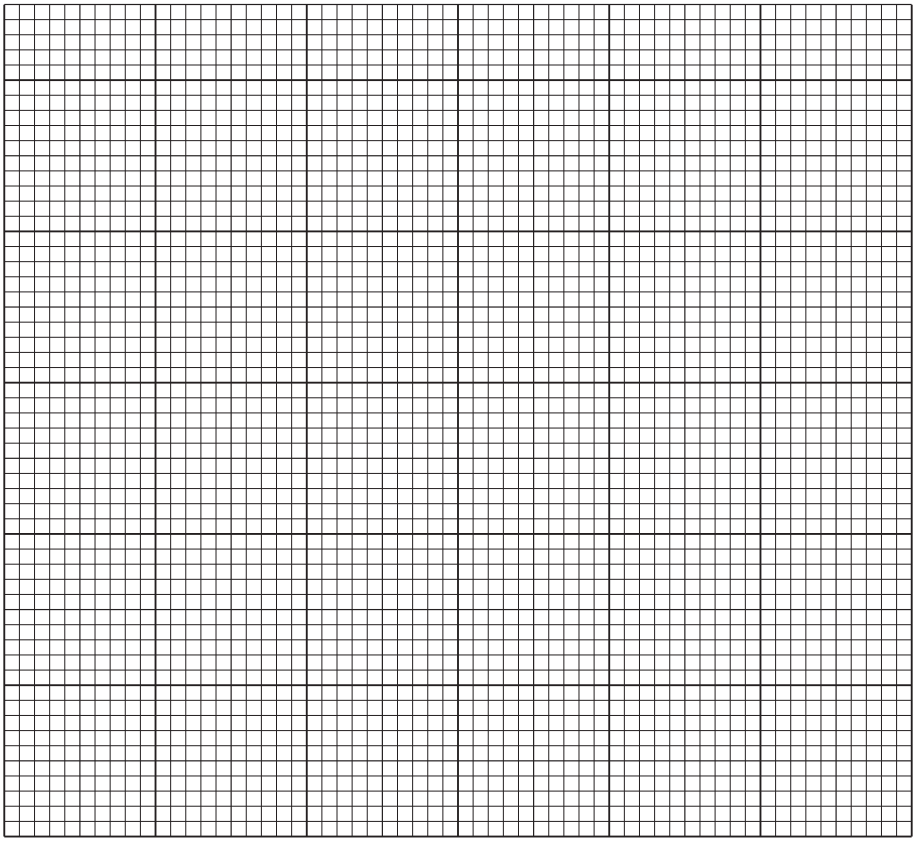

Fig. 1.3

[4]

(ii) Describe **and** explain the shape of the graph in Fig. 1.3.

description .....

.....

.....

explanation .....

.....

.....

.....

.....

.....

[3]

[Total: 22]

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

(a) **(i)** Draw a large plan diagram of the region of the leaf on **J1** indicated by the shaded area in Fig. 2.1.

Use a sharp pencil.

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

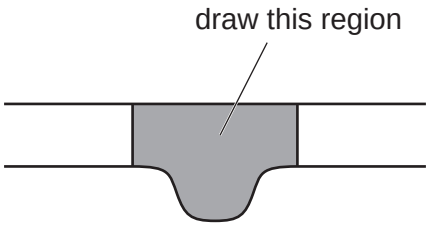

Fig. 2.1

[5]

(ii) Observe the xylem vessel elements in the leaf on **J1**.

Select a line of **four** adjacent xylem vessel elements.

Each xylem vessel element must touch at least **one** other xylem vessel element.

- Make a large drawing of this line of **four** xylem vessel elements.
- Use **one** ruled label line and label to identify the wall of **one** xylem vessel element.

[5]

(b) Fig. 2.2 is a photomicrograph of a transverse section through a different leaf from **J1**.

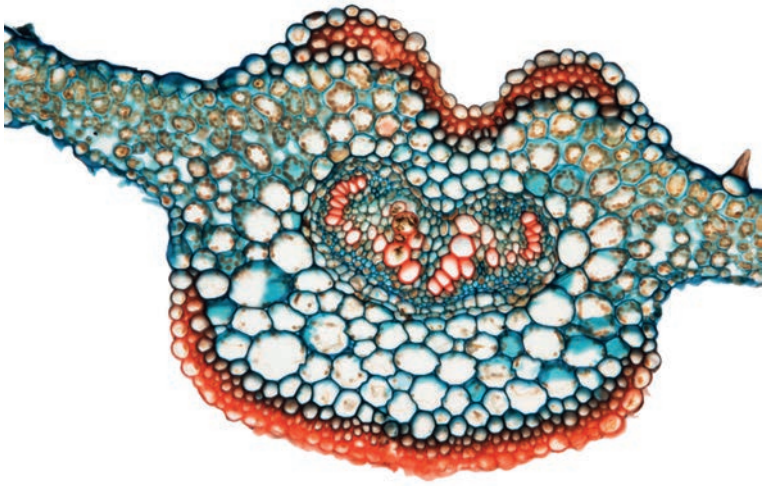

Fig. 2.2

(i) Identify **three** observable differences, other than colour, between the section on **J1** and the section in Fig. 2.2.

Record these **three** observable differences in Table 2.1.

Table 2.1

feature	J1	Fig. 2.2

[3]

(ii) Fig. 2.3 shows a diagram of a stage micrometer scale that is being used to calibrate an eyepiece graticule.

The length of one division on this stage micrometer is 0.2 mm.

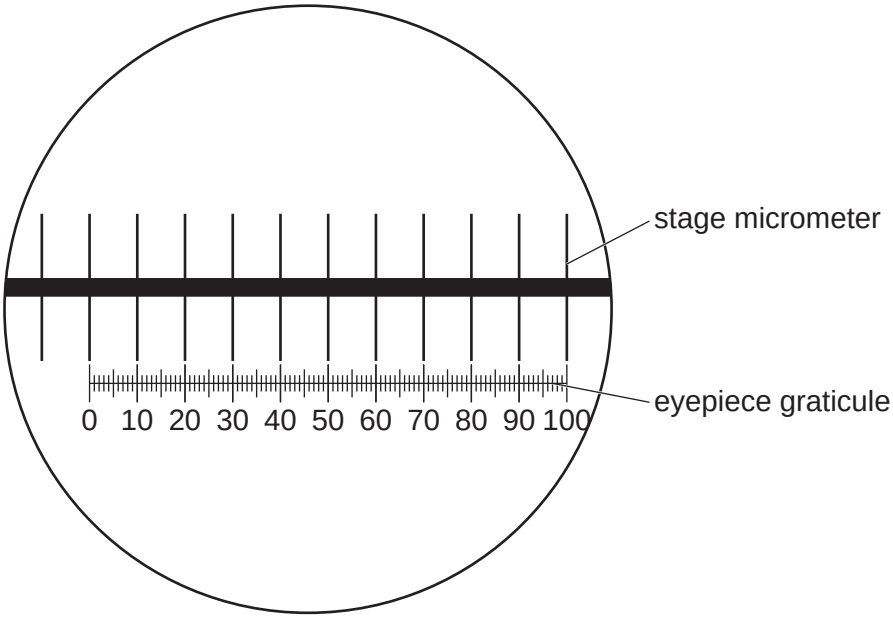

Fig. 2.3

Use Fig. 2.3 to calculate the length of **one** eyepiece graticule unit.

Show your working.

Include the unit in your answer.

length of one eyepiece graticule unit = ... [3]

(iii) Fig. 2.4 shows the same eyepiece graticule and same lenses being used to measure the width of the section shown in Fig. 2.2.

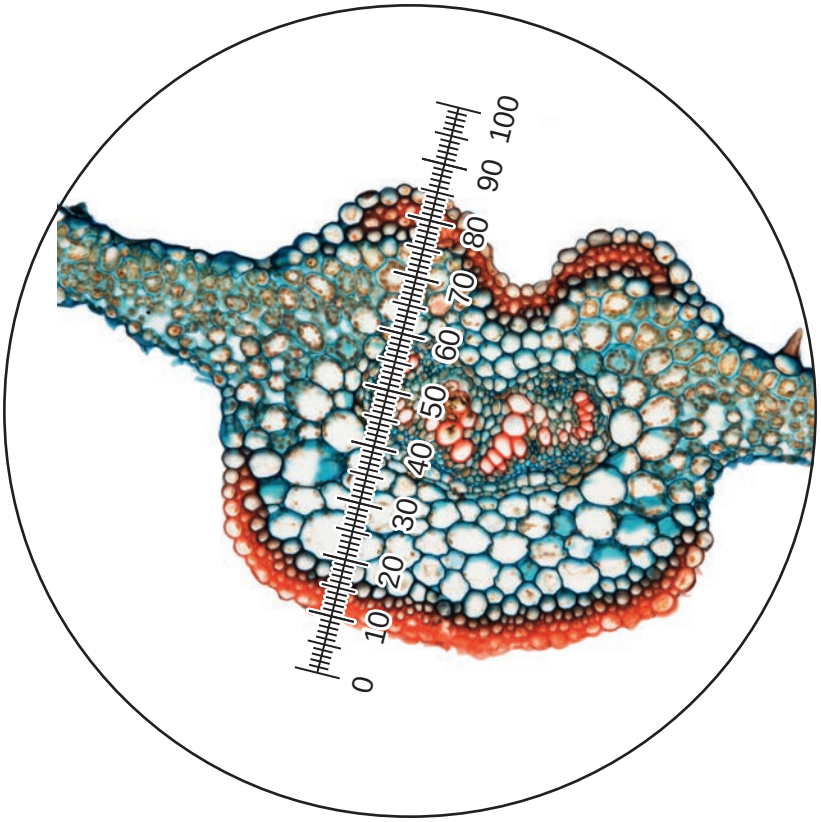

Fig. 2.4

Use your answer in **(b)(ii)** to calculate the actual width of the section shown in Fig. 2.4.

Show your working.

actual width of the section ..... [2]

[Total: 18]