Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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7432199526

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 2023**

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.

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1 Milk is a source of protein and reducing sugars. Different types of milk contain different concentrations of protein. The concentration of protein in milk can be measured using potassium hydroxide solution and copper sulfate solution.

You will investigate the protein content of milk.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
M	milk containing a 5.0% concentration of protein	none	50
W	distilled water	none	100
K	potassium hydroxide solution	harmful irritant	20
C	copper sulfate solution	none	20
U	milk containing an unknown concentration of protein	none	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.

You will prepare a range of known concentrations of protein, using the milk containing a 5.0% concentration of protein, **M**.

You will need to carry out a serial dilution of the milk containing 5% protein, **M**, to reduce the concentration of protein by **half** between each successive dilution.

You will need to prepare **four** concentrations of protein in addition to 5.0% protein, **M**.

After the serial dilution is completed, you will need to have 10 cm^3 of each concentration available to use.

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

Fig. 1.1 shows the beakers you will use.

For each beaker, add labelled arrows to show:

- the volume of protein solution transferred
- the volume of distilled water, **W**, added.

Under each beaker, state the concentration of protein solution.

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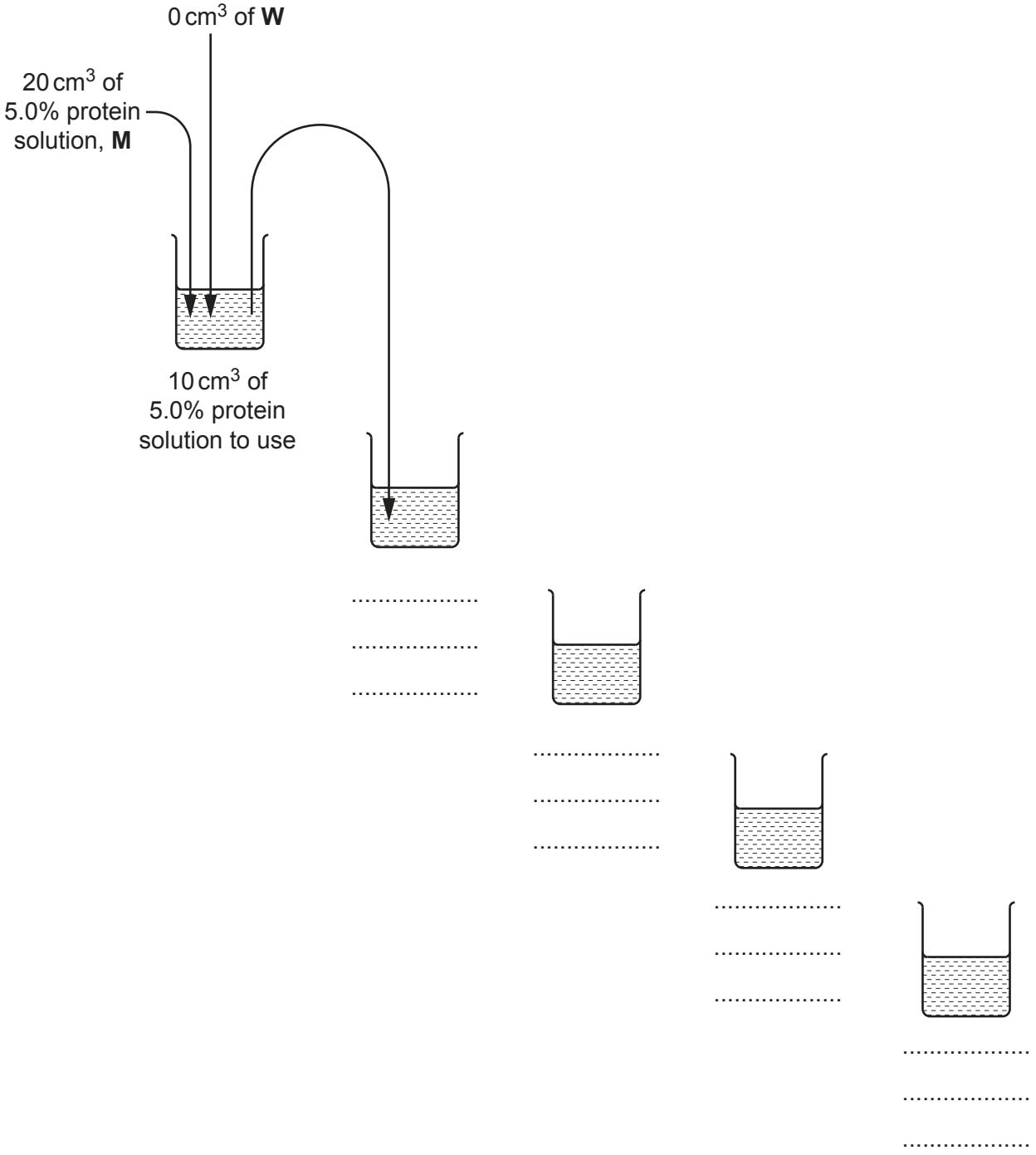

0 cm3 of W
20 cm3 of 5.0% protein solution, M
10 cm3 of 5.0% protein solution to use
.....
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Fig. 1.1

[3]

Carry out step 1 to step 7.

step 1 Prepare the concentrations of protein, as shown in Fig. 1.1, in the beakers provided. Mix well.

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

step 3 Put 2 cm^3 of each concentration of protein solution into the appropriately labelled test-tube.

step 4 Put 2 cm^3 of **K** into each of the labelled test-tubes. Shake gently to mix.

step 5 Put 2 cm^3 of **C** into each of the labelled test-tubes. Shake gently to mix.

step 6 Leave for 2 minutes for the colour to change.

step 7 Observe the colour in each test-tube and compare with the colours in Fig. 1.2.
You will see the same colour in more than one test-tube. Record your observations in **(a)(ii)** using **only** the colours shown in Fig. 1.2.

dark purple	purple	light purple	blue

Fig. 1.2

(ii) Record your observations in an appropriate table.

You may record the same colour for more than one test-tube.

[3]

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Carry out step 8 to step 9.

step 8 Stir **U** and put 2 cm^3 of **U** into a test-tube.

step 9 Repeat step 4 to step 7 with **U**. Record the colour in **(a)(iii)**.

(iii) State the colour for sample **U** ..... [1]

(iv) Use your results in **(a)(ii)** and **(a)(iii)** to estimate the protein concentration in **U**.

..... [1]

(v) Describe **one** significant source of error when carrying out step 7 **and** suggest an improvement to reduce this error.

source of error .....

.....

improvement .....

.....

[2]

(vi) Suggest how you would modify the experiment to determine the concentration of reducing sugars in a sample of milk.

.....

.....

.....

.....

.....

.....

..... [3]

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(b) Milk can be made from plant sources.

A scientist compared the protein content in milk from cows with milk produced from different plants.

The results are shown in Table 1.2.

Table 1.2

type of milk	protein content / g per 100 cm^3
cow (C)	3.400
almond (A)	0.575
cashew (H)	2.250
oat (O)	0.400
soya (S)	3.325

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Plot a bar chart of the data shown in Table 1.2 on the grid in Fig. 1.3.

Use a sharp pencil.

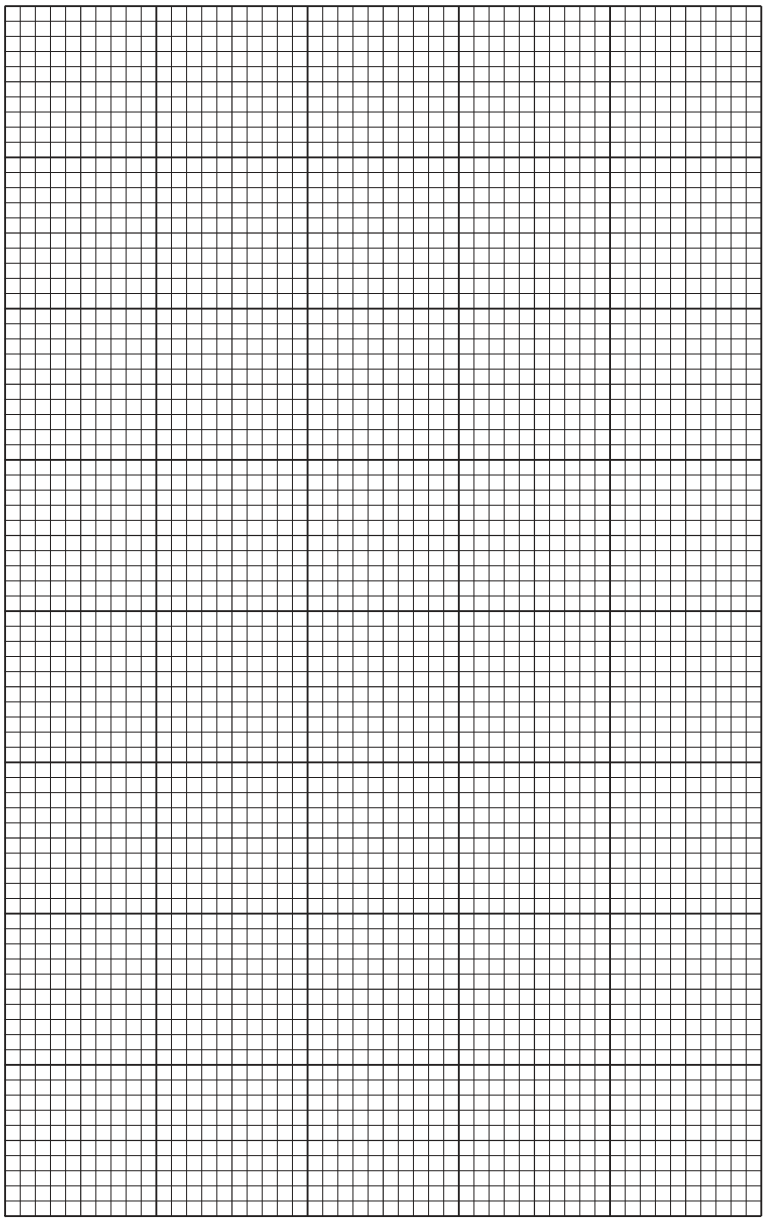


Fig. 1.3

[4]

(c) One of the reducing sugars found in cow's milk is lactose. Some people are intolerant to lactose and cannot digest it. A method of producing lactose-free milk is to treat cow's milk with the enzyme lactase.

Lactase hydrolyses lactose to produce glucose and galactose.

A scientist investigated the effect of different lactase concentrations on the mass of lactose converted to glucose and galactose in 10 minutes.

The scientist plotted a graph of the results, shown in Fig. 1.4.

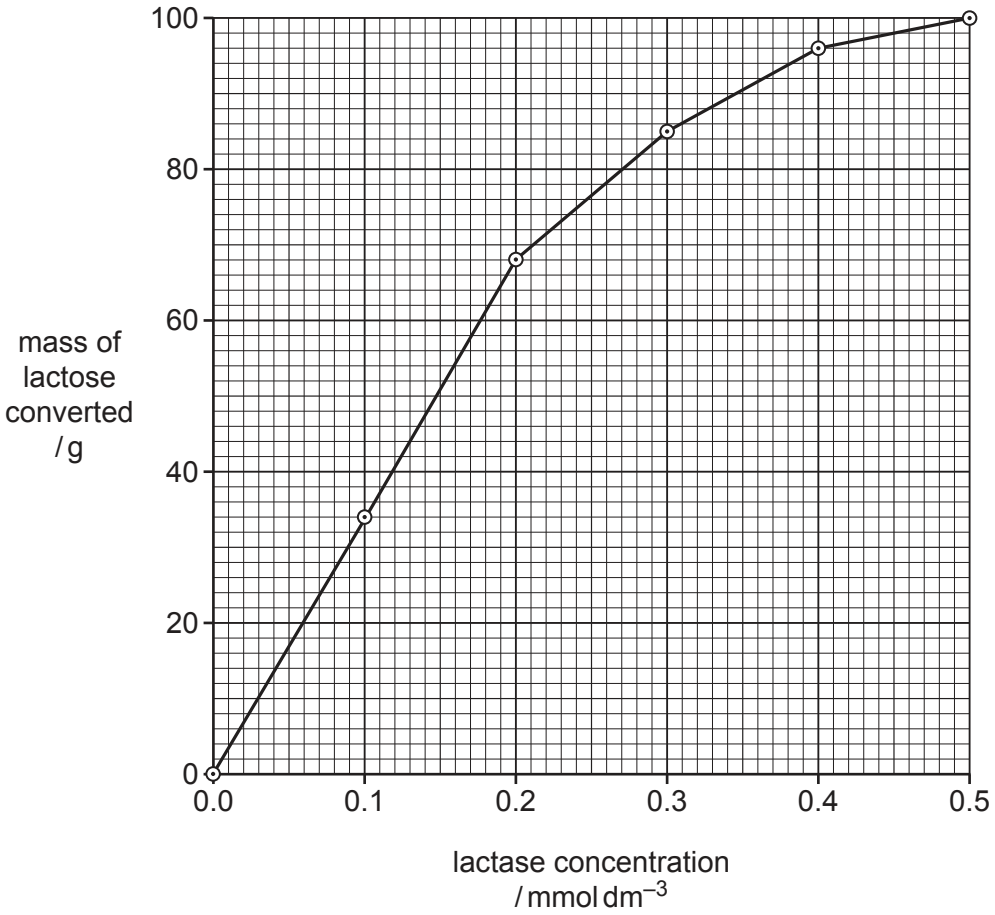


Fig. 1.4

(i) Use the graph in Fig. 1.4 to determine the mass of lactose converted when 0.16 mmol dm^{-3} of lactase is used.

Show your working on the graph.

mass of lactose = ... g [1]

(ii) Calculate the **rate** of lactose conversion when 0.16 mmol dm^{-3} of lactase is used.

..... g min^{-1} [1]

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(iii) Explain the shape of the graph between 0.1 mmol dm^{-3} and 0.2 mmol dm^{-3} of lactase.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 22]

2 **N1** 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 **N1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

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

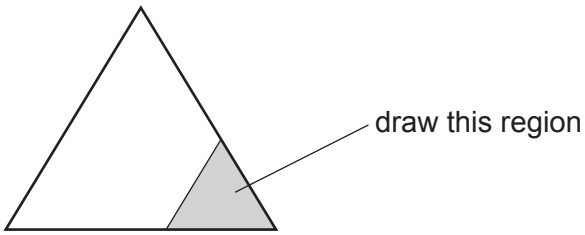


Fig. 2.1

[5]

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(ii) Observe the cells in the central tissue of the stem on **N1**.

Select a group of **four** adjacent cells that make up this tissue.

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 of a stem from a different plant species to the stem on **N1**.

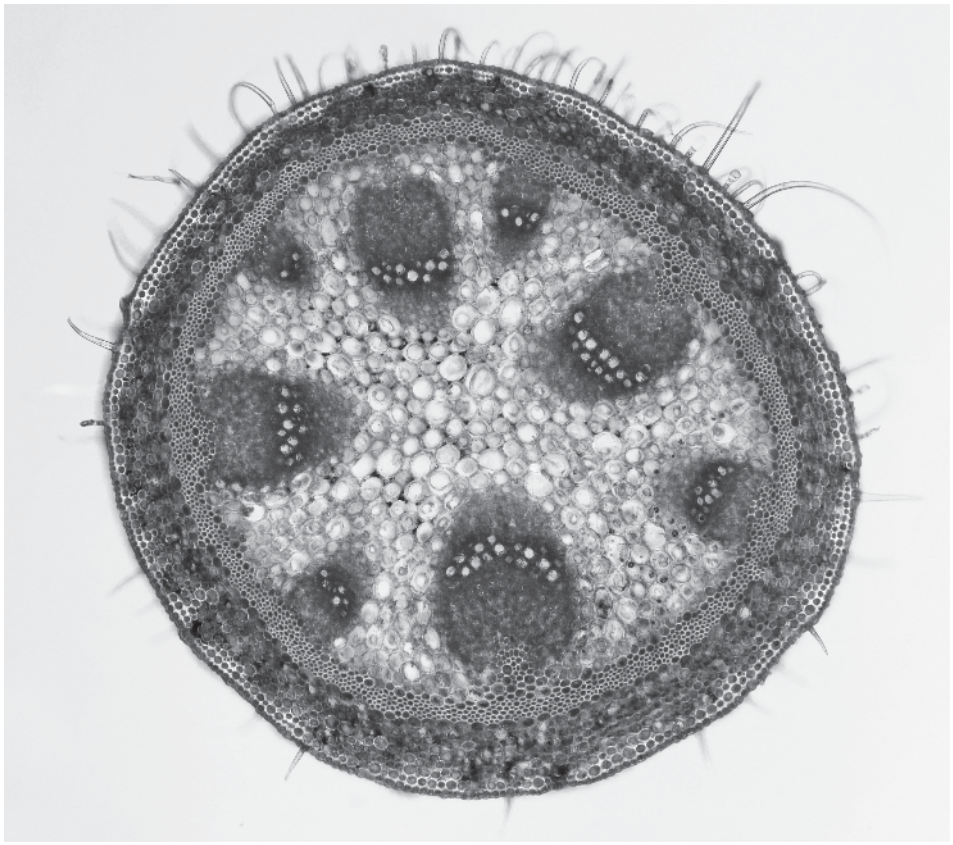


Fig. 2.2

Identify **three** observable **differences**, other than colour, between the stem in **N1** and the stem in Fig. 2.2.

Record these three observable differences in Table 2.1.

Table 2.1

feature	N1	Fig. 2.2

[4]

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

One division, on either the stage micrometer scale or the eyepiece graticule, is the distance between two adjacent lines.

The length of one division on the stage micrometer in Fig. 2.3 is 0.50 mm.

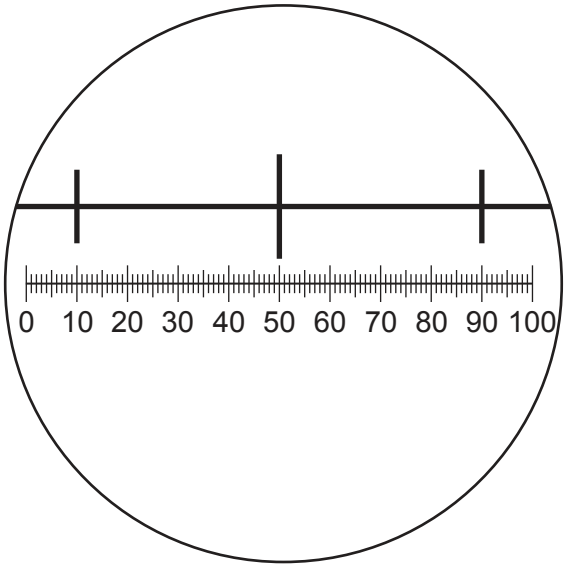


Fig. 2.3

(i) Calculate the actual length of one eyepiece graticule unit shown in Fig. 2.3.

Give your answer in micrometres (μm).

Show your working.

actual length = ... μm [2]

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Fig. 2.4 shows a magnified section of the stem shown in Fig. 2.2. This was taken with the same microscope and the same lenses used to take the photomicrograph in Fig. 2.3.

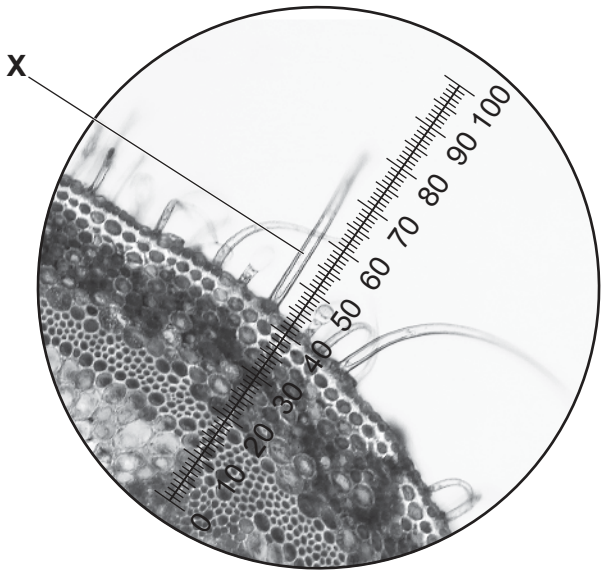


Fig. 2.4

(ii) Use the calibration of the eyepiece graticule unit from **(c)(i)** to calculate the actual length of the trichome labelled **X** in Fig. 2.4.

Show your working.

actual length = ... [2]

[Total : 18]

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