Cambridge International AS & A Level

**Cambridge Assessment International Education**
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*4416760290*

**BIOLOGY** **9700/33**

Paper 3 Advanced Practical Skills 1 **October/November 2019**

**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 **14** printed pages and **2** blank pages.


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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** Enzyme **E** catalyses the hydrolysis of starch to maltose.

The progress of this enzyme-catalysed reaction can be followed by measuring the time taken for the substrate, starch, to disappear.

You will investigate the effect of an inhibitor, **C**, on the hydrolysis of starch.

You are provided with the materials shown in Table 1.1.

**Table 1.1**

| labelled | contents | hazard | volume / $cm^3$ | risk |
|---|---|---|---|---|
| **E** | 1% amylase solution | irritant | 10 | |
| **S** | 1% starch solution | none | 50 | |
| **C** | 2% copper sulfate solution | harmful irritant | 20 | |
| **W** | distilled water | none | 100 | |
| **iodine** | iodine solution | irritant | 25 | |
| **U** | unknown concentration of copper sulfate solution | harmful irritant | 10 | |

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) (i)** Think about the hazards of using the materials in Table 1.1.

Decide whether the risk of using **E**, **S** and **C** is **low**, **medium** or **high**.

Complete Table 1.1, using the words **low**, **medium** or **high**, to state the risk of using **E**, **S** and **C**. You may use each word once, more than once or not at all. [1]

You will need to make a **serial** dilution of 2.0% copper sulfate solution, **C**, which reduces the concentration by a **factor of ten** between each successive dilution.

Fig. 1.1 shows you the first two beakers you will use to make your serial dilution.

Decide which other concentrations of copper sulfate solution you will use to make your serial dilution.

**(ii)** Complete Fig. 1.1 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 copper sulfate solution available for use in the investigation
- use one arrow with a label, above the beaker, to show the volume and concentration of copper sulfate 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.

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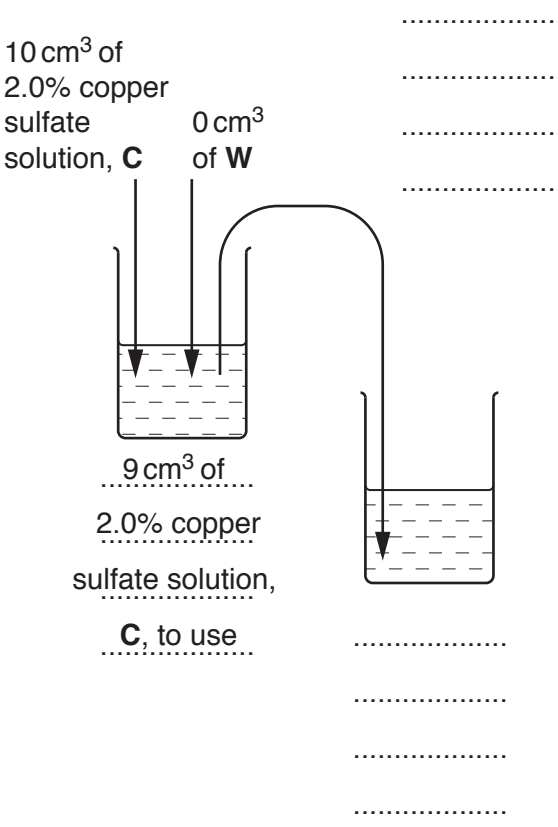

10 cm3 of 2.0% copper sulfate solution, C
0 cm3 of W
9 cm3 of 2.0% copper sulfate solution, C, to use
.....
.....
.....
.....
.....
.....
.....
.....

**Fig. 1.1** [3]

Carry out step 1 to step 19.

1. Prepare the concentrations of copper sulfate solution as decided in **(a)(ii)** and shown in Fig. 1.1.

*Use a glass rod to mix the copper sulfate solutions and water.*

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

3. Label another test-tube **W**.

4. Wipe the white tile clean with a damp paper towel and then dry the white tile.

5. Label the white tile, as shown in Fig. 1.2.
The numbers indicate the sampling times in seconds.

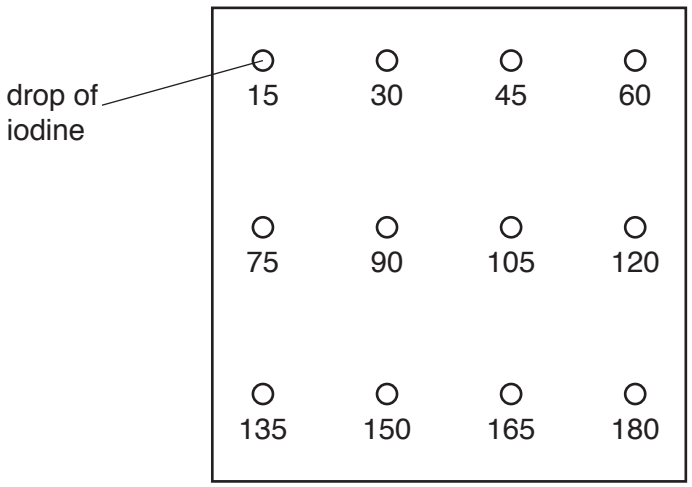



**Fig. 1.2**

6. Put one drop of iodine on the white tile at each sampling time, as shown in Fig. 1.2.

7. Put 1 $cm^3$ of **W** into the test-tube labelled **W**.

8. Put 3 $cm^3$ of **S** into the same test-tube. Mix well.

9. Put 0.5 $cm^3$ of **E** into the same test-tube. Use a glass rod to mix.

10. Start timing.

11. After 15 seconds, use the glass rod to transfer a drop of the mixture from the test-tube onto the **iodine** that is labelled **15**, on the white tile.

12. Clean the glass rod with a paper towel.

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13. Repeat step 11 to step 12 at intervals of 15 seconds until the **iodine** does not change colour.

14. Record the time taken for the starch to disappear in an appropriate table in **(a)(iii)**.
If the starch has not disappeared at 180 seconds, record 'more than 180'.

15. Repeat step 4 to step 14 replacing the 1 $cm^3$ of **W** with 1 $cm^3$ of the **lowest** concentration of copper sulfate solution.

16. Repeat step 15 with the other concentrations of copper sulfate solution.

**(iii)** Record your results in an appropriate table.

[5]

17. Label a test-tube with the letter **U**.

18. Repeat step 4 to step 13 with **U** instead of **W**.

19. Record in **(a)(iv)** your result for **U**.

**(iv)** State the result for **U**.

result for **U** ..... [1]

**(v)** Using your results in **(a)(iii)** and **(a)(iv)**, estimate the concentration of copper sulfate in **U**.

..... [1]

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**[Turn over**

**(vi)** State **one** significant source of error in this investigation.

Explain why this is a source of error.

*source of error* .....

*explanation* .....

.....

[1]

**(vii)** Suggest how you could make **one** improvement to the **independent** variable so that a more accurate estimate of the concentration of copper sulfate in **U** can be obtained.

.....

.....

.....

..... [1]

**(viii)** Suggest how you could make **two** improvements to the measuring of the **dependent** variable so that a more accurate estimate of the concentration of copper sulfate in **U** can be obtained.

.....

.....

.....

.....

.....

.....

..... [2]

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**Question 1 continues on page 10**

**(b)** A student carried out an investigation into the effect of temperature on the activity of enzyme **E**.

The results are shown in Table 1.2.

**Table 1.2**

| temperature / °C | rate of reaction / arbitrary units |
|---|---|
| 5.5 | 57.5 |
| 15.0 | 120.0 |
| 29.5 | 215.0 |
| 36.0 | 245.0 |
| 49.5 | 102.5 |

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

*Use a sharp pencil for drawing graphs.*

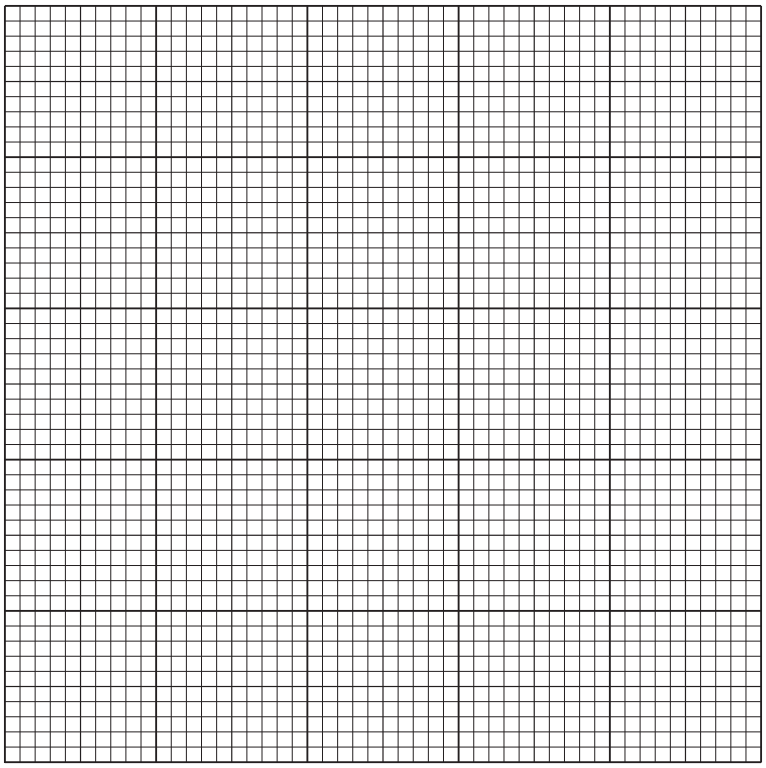


**Fig. 1.3** [4]

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**(ii)** Use your graph in Fig. 1.3 to determine the rate of reaction when the temperature is 37.5 °C.

rate of reaction = ..... arbitrary units [1]

**(iii)** Explain the shape of the graph:

between 5.5 °C and 36.0 °C

.....

.....

.....

.....

between 36.0 °C and 49.5 °C.

.....

.....

.....

.....

[3]

[Total: 23]

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

You are not expected to be familiar with this specimen.

*Use a sharp pencil for drawing.*

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

**(a) (i)** Draw a large plan diagram of the whole leaf.

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

[5]

**(ii)** Observe the epidermis of the leaf on **K1**.

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

Make a large drawing of this line of **four** cells.

Use **one** ruled label line and label to identify the cell wall of **one** cell.

[4]

**(b)** Fig. 2.1 is a photomicrograph of a stained transverse section through a leaf of a different type of plant.

You are not expected to be familiar with this specimen.

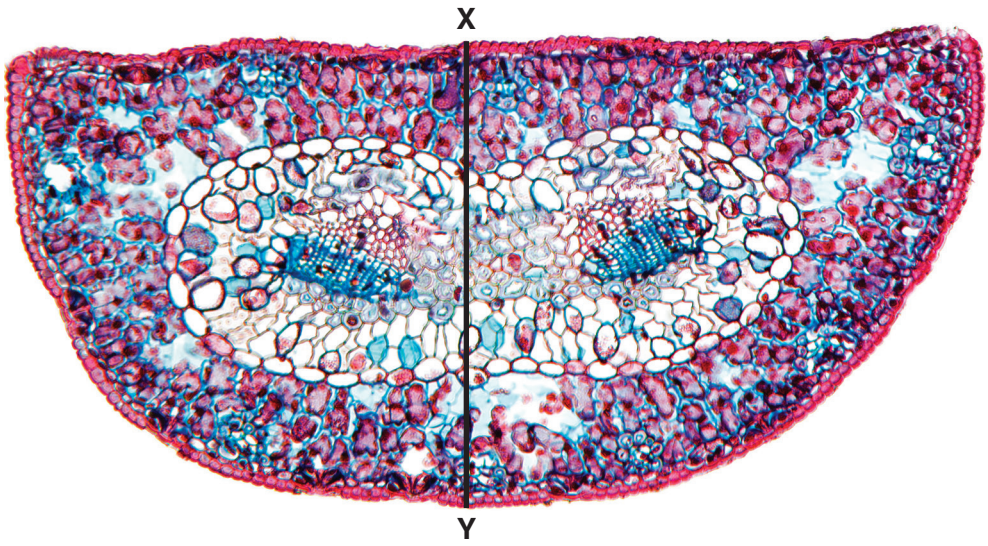



**Fig. 2.1** magnification ×74

**(i)** Calculate the actual thickness of the leaf, shown by line **X**–**Y**.

Show all the steps in your working and use appropriate units.

actual thickness of the leaf = ..... [3]

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A student calculated the actual length of five cells from the epidermis of this leaf.

The results are shown in Table 2.1.

**Table 2.1**

| **cell** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **length of cell / μm** | 28.0 | 26.0 | 27.5 | 26.5 | 27.0 |

**(ii)** Use the information in Table 2.1 to calculate the mean length of these cells.

Show all the steps in your working.

mean length = ..... μm [1]

**(iii)** Prepare an appropriate table so that it is suitable for you to record the observable differences between the leaf on **K1** and the leaf in Fig. 2.1.

Record the observable differences in your table.

[4]

[Total: 17]

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