Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4343786601

BIOLOGY **9700/36**

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	

This document has **12** pages. Blank pages are indicated.

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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 Urease is an enzyme that catalyses the breakdown of urea as shown in Fig. 1.1.

$$\text{urea + water} \xrightarrow{\text{urease}} \text{ammonium carbonate + carbon dioxide}$$

Fig. 1.1

The ammonium carbonate forms an alkaline solution that causes red litmus paper to change to blue.

The change in colour of the litmus paper can be used to determine the rate of reaction.

Urease can be extracted from germinating beans.

- You will investigate the effect of different concentrations of urease on the breakdown of urea.
- You will use your results to estimate the concentration of urease in a bean extract.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	**contents**	**hazard**	**volume / cm^3**
E	10% urease solution	harmful irritant	10
U	5% urea solution	none	10
W	distilled water	none	100
B	bean extract	harmful irritant	10
–	red litmus paper	none	–

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

It is recommended that you wear suitable eye protection.

[Turn over

(a) You will need to carry out a serial dilution of the 10% urease solution, **E**, to reduce the concentration by **half** between each successive dilution.

Fig. 1.2 shows 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 urease solution available for use in the investigation
- use one arrow with a label, above the beaker, to show the volume and concentration of urease 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.

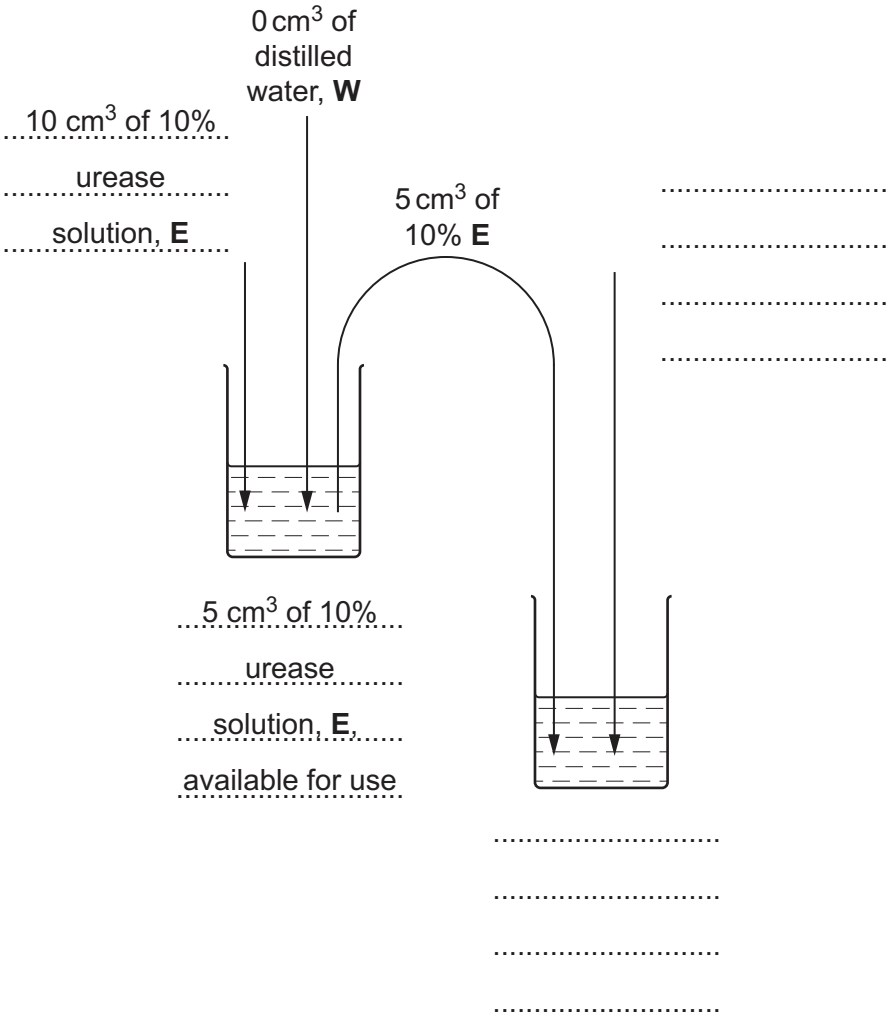

Fig. 1.2

[3]

Carry out step 1 to step 10.

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

2. Prepare a clean, dry spotting tile by labelling the wells with the concentrations of urease solution, as decided in **(a)(i)**. Label one well **W**, for water.

3. Put 5 drops of urea solution, **U**, into each labelled well.

4. Put 3 drops of 10% urease solution into the appropriately labelled well. Mix gently.

5. Repeat step 4 with the other concentrations of urease solution you prepared in step 1.

6. Put 3 drops of water, **W**, into the appropriately labelled well. Mix gently.

7. Cut the red litmus paper into lengths of approximately 0.5 cm. Put one piece of litmus paper into each labelled solution on the spotting tile.

8. Start timing and leave for 2 minutes.

9. After 2 minutes, observe the colour of the litmus paper in each well.
You may see the same colour in more than one well.

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

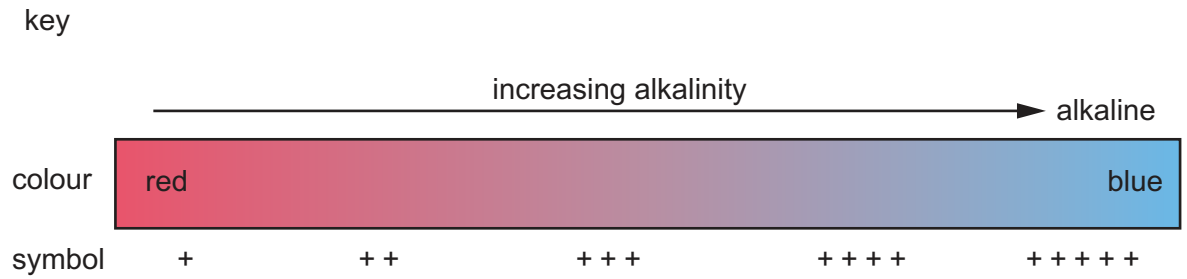

Fig. 1.3

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

(ii) Record your results in an appropriate table.

[4]

(iii) Describe the trend in your results.

.....

..... [1]

11. Choose a clean, dry well on the spotting tile, and label it **B**.

12. Put 5 drops of **U** into this well.

13. Put 3 drops of **B** into the same well. Mix gently.

14. Put one 0.5 cm length of litmus paper into the well.

15. Start timing and leave for 2 minutes.

16. After 2 minutes, observe the colour of the litmus paper in the well.

(iv) Record your result for **B** using the symbols shown in the key in Fig. 1.3.

result for **B** ..... [1]

(v) Use your results in **(a)(ii)** and **(a)(iv)** to estimate the concentration of urease in bean extract, **B**.

concentration = ... %
[1]

(vi) Describe how you could modify this procedure to produce a more accurate estimate of the concentration of urease in bean extract, **B**.

.....

.....

..... [1]

(vii) Identify **two** sources of error in step 3 to step 8. For each error suggest an improvement to the method that will reduce the effect of the error.

error 1 .....

improvement .....

.....

error 2 .....

improvement .....

.....
[2]

(b) The enzyme urease is also produced by soil bacteria.

The effect of soil temperature on urease activity was investigated. The results are shown in Table 1.2.

Table 1.2

soil temperature / °C	urease activity / arbitrary units
5	2.5
15	5.0
25	7.5
35	15.0
45	32.5
55	31.0

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

Use a sharp pencil for drawing graphs.

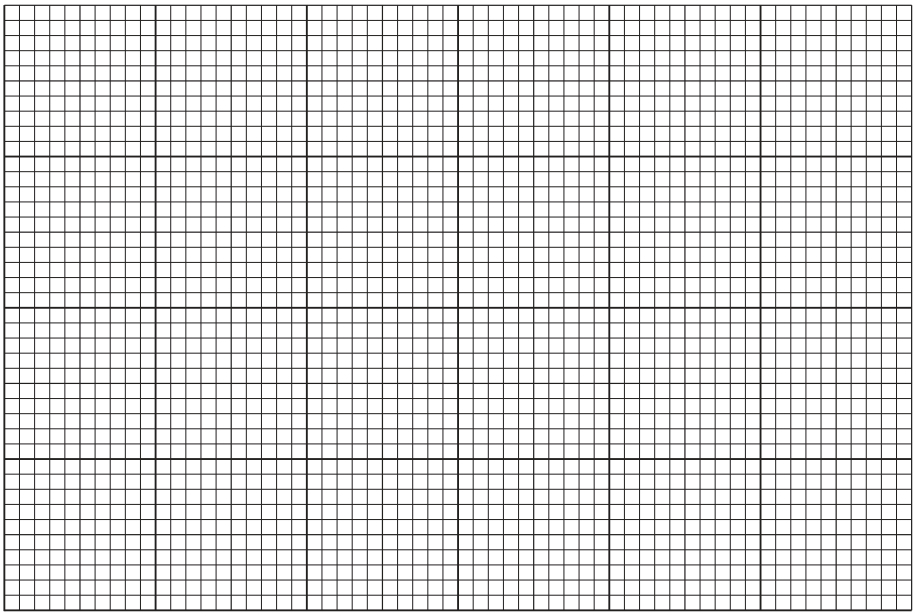

Fig. 1.4

[4]

(ii) The average soil temperature recorded in a woodland was 21°C.

Use your graph in **(b)(i)** to estimate the urease activity in the soil at 21°C.

Show on your graph how you obtained your answer.

urease activity at 21°C = ... [2]

(iii) Explain the effect of soil temperature on urease activity as shown in your graph in **(b)(i)**.

.....

.....

.....

.....

.....

.....

.....

..... [3]

[Total 22]

2 **N1** 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 section of the leaf on **N1**.

Use **one** ruled label line and label to identify the palisade mesophyll.

[5]

(ii) Observe the epidermis of the leaf section on **N1**.

Select a **line** of **four** adjacent cells that make up the epidermis. Each cell must touch at least one other cell.

- 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.

[5]

(iii) Prepare the space below so that it is suitable for you to record observable differences between the upper epidermis and the lower epidermis of the leaf section on **N1**.

Record your observations in the space you have prepared.

[3]

(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.

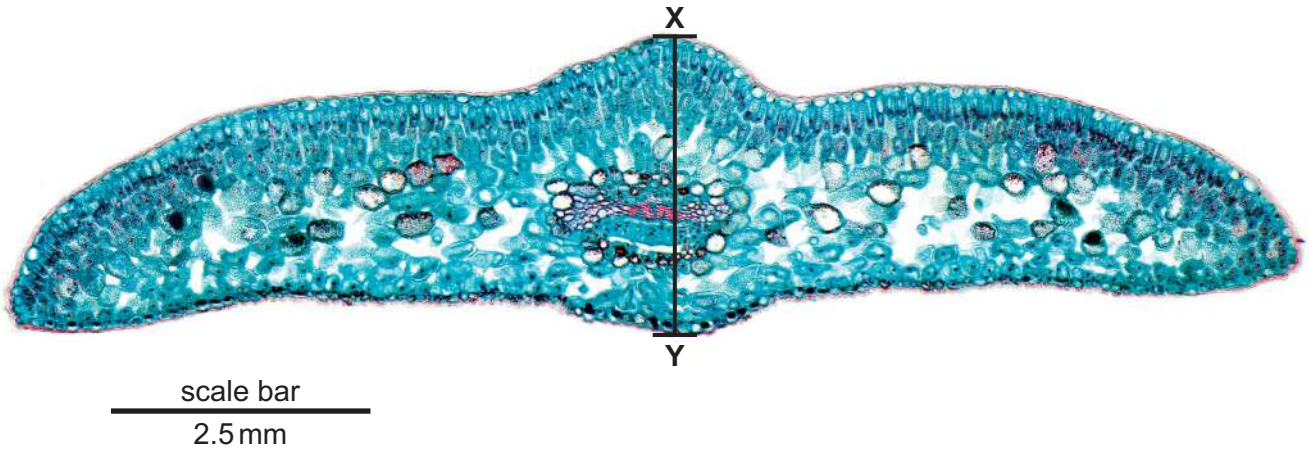

Fig. 2.1

Use the scale bar on Fig. 2.1 to calculate the actual depth of the leaf section indicated by line **X**–**Y**.

Show your working and use appropriate units.

actual depth = ... [5]

[Total 18]