Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 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	

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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 Invertase is an enzyme found in honey.

Invertase breaks down sucrose into reducing sugars, as shown in Fig. 1.1.

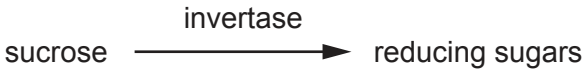

Fig. 1.1

You will carry out an investigation to determine the concentration of invertase in a sample of honey.

The presence of the reducing sugars can be detected by using Benedict's solution. The time taken for the Benedict's solution to first show a colour change can be used to estimate the concentration of invertase in the honey extract, **H**.

You will need to prepare a serial dilution of 1.0% invertase solution, **E**.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
H	honey extract	none	10
E	1.0% invertase solution	harmful irritant	10
B	Benedict's solution	harmful irritant	30
S	5% sucrose solution	none	25
W	distilled water	none	150

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 invertase solution, **E**, as shown in Table 1.1.

State whether the risk of using the invertase solution, **E**, is **low**, **medium** or **high**. Give a reason for your answer.

risk .....

reason .....

.....

[1]

You need to carry out a **serial** dilution of the invertase solution, **E**, to reduce the concentration of invertase by a factor of 10 between each successive dilution.

Fig. 1.2 shows how to prepare the 1.0% and 0.1% concentrations of invertase solution.

(ii) Complete Fig. 1.2 by drawing as many extra beakers as you need for your serial dilution of invertase solution.

For each beaker:

- state, under the beaker, the volume and concentration of invertase solution available for use in the investigation
- use one arrow with a label, above the beaker, to show the volume and concentration of invertase 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.

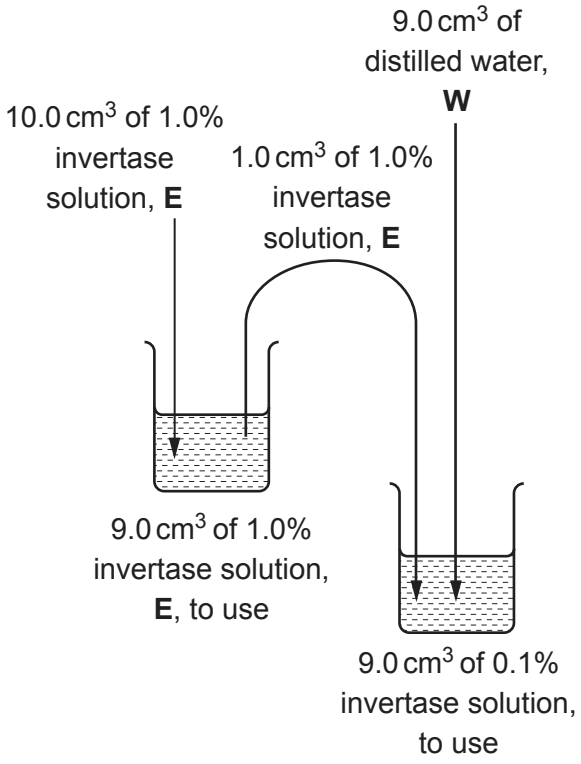

Fig. 1.2

[3]

Carry out step 1 to step 14 to determine the concentration of invertase in the honey extract, **H**.

1. Prepare the concentrations of invertase solution as you decided in **(a)(ii)** and shown in Fig. 1.2. Use a glass rod to mix the invertase solutions and water.

2. Set up a water-bath and heat the water to approximately 30 °C.

3. Label test-tubes with the concentrations of invertase solution prepared in step 1.

4. Put 2 cm^3 of each concentration of invertase solution into an appropriately labelled test-tube.

5. Label another test-tube **H**.

6. Put 2 cm^3 of honey extract, **H**, into the test-tube labelled **H**.

7. Put 2 cm^3 of **S** into each labelled test-tube, including the test-tube labelled **H**.

8. Put all of the test-tubes into the water-bath at approximately 30 °C. Leave the test-tubes in the water-bath for 10 minutes. You do **not** need to keep the water-bath at 30 °C.

   While you are waiting, use your time to continue with question 1.

9. After the 10 minutes remove the test-tubes from the water-bath and put them in a test-tube rack.

10. Put 4 cm^3 of Benedict's solution, **B**, into each of the test-tubes.

11. Heat the water-bath to boiling and then stop heating.

12. Put the test-tube labelled **H** into the water-bath. Start timing.

13. Measure the time taken to the first colour change. Record the result in **(a)(iii)**.
    If there is no colour change after 180 seconds, record as 'more than 180'.

14. Repeat step 12 and step 13 using each of the concentrations of invertase solution you prepared in step 1, instead of **H**. Record your results in **(a)(iv)**.

(iii) State the result for **H**.

..... seconds [1]

(iv) Record your results in an appropriate table for the concentrations of invertase solution you prepared in step 1.

[5]

(v) Use your results from **(a)(iii)** and **(a)(iv)** to estimate the concentration of invertase in **H**.

concentration of invertase in **H** = ... % [1]

(vi) Suggest how you would make improvements to this investigation in order to obtain a more accurate estimate of the invertase concentration in **H**.

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.....

.....

..... [3]

(b) Honey contains a mixture of sugars. The percentage concentration of these sugars changes over time.

The percentage concentration of sucrose in honey was measured for a period of 25 weeks. The results are shown in Table 1.2.

Table 1.2

storage time /weeks	percentage concentration of sucrose
0	2.3
3	1.8
6	1.3
12	0.9
25	0.5

(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.

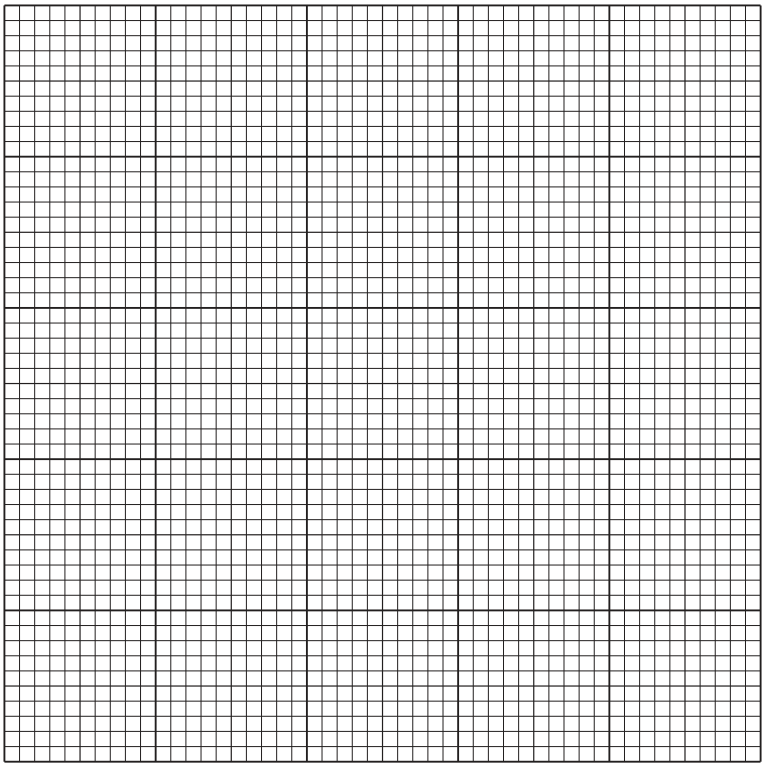

Fig. 1.3

[4]

(ii) Describe the change in percentage concentration of sucrose shown by your graph in Fig. 1.3.

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.....

.....

..... [2]

(iii) State which sugars, other than sucrose, will be present in the honey after 25 weeks. Explain your answer.

sugars present .....

explanation .....

.....

.....

.....

.....

[2]

[Total: 22]

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

You are not expected to be familiar with this specimen.

(a) Select a field of view so that you can observe the different tissues in the sector shown by the shaded area in Fig. 2.1.

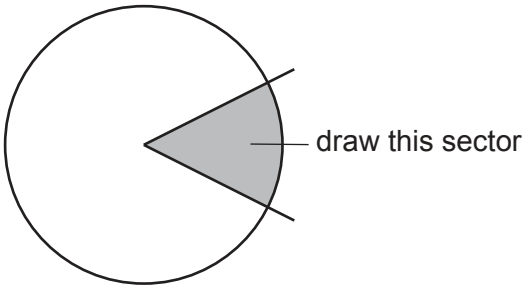


Fig. 2.1

Use a sharp pencil for drawing.

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

(i) Draw a large plan diagram of the sector of the stem on **J1** shown by the shaded area in Fig. 2.1.

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

[5]

(ii) Observe one vascular bundle in the stem on **J1**.

The xylem within the vascular bundle is made up of rows of xylem vessel elements.

Select a row of at least three adjacent, touching, xylem vessel elements.

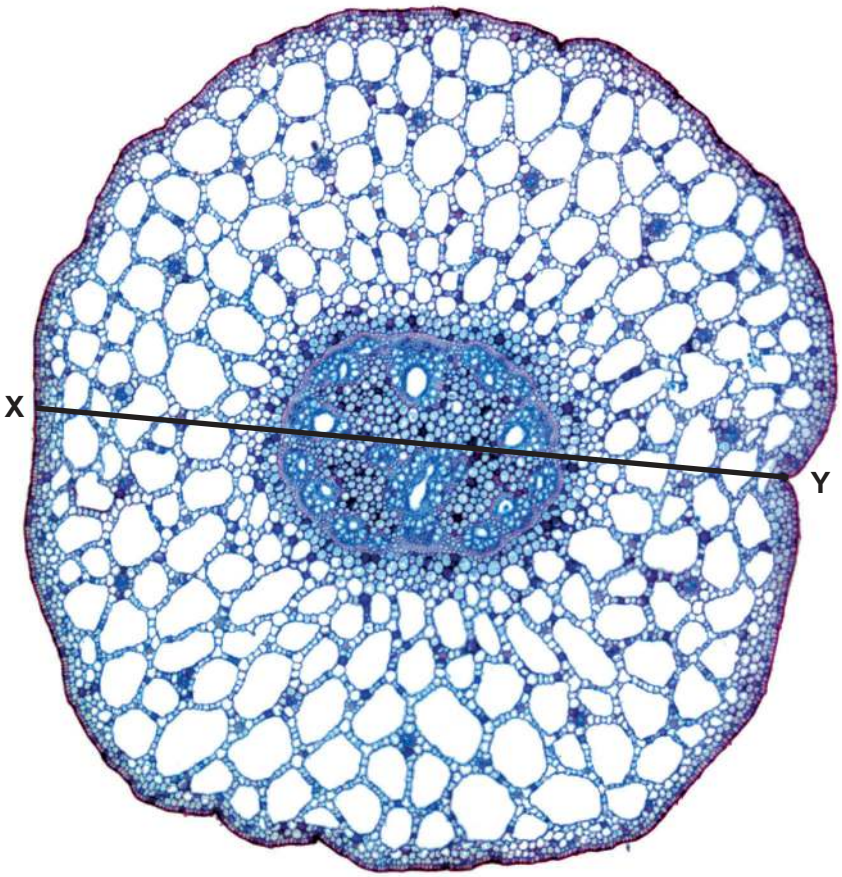
Make a large drawing of **three** adjacent, touching xylem vessel elements in this line.

On your drawing use a ruled label line and label to identify **one** lumen.

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a stem of a different type of plant that grows in water.

You are not expected to be familiar with this specimen.



scale bar

1.5 mm

Fig. 2.2

(i) Use the scale bar on Fig. 2.2 to calculate the actual diameter of the stem indicated by line **X**–**Y**.

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

actual diameter = ... [4]

(ii) Identify **three** observable differences between the stem on **J1** and the stem shown in Fig. 2.2.

1 .....

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2 .....

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3 .....

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[3]

(iii) Suggest **one** observable feature shown by the stem in Fig. 2.2 that allows the plant to live in water. Give a reason for your answer.

feature .....

reason .....

.....

[1]

[Total: 18]

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