Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9045134674

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 2022**

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 Yeast cells contain enzymes that catalyse metabolic reactions. Some of these reactions release carbon dioxide.

You will investigate the release of carbon dioxide from a mixture of yeast and carbohydrate. The mixture is put into dialysis (Visking) tubing.

The dialysis tubing acts as a partially permeable membrane, allowing the carbon dioxide to diffuse out of the dialysis tubing.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
Y	1g dried yeast	none	-
G	10.0% warm glucose solution	none	20
W	distilled water	none	50
B	bromothymol blue indicator solution	harmful	10
D	20 cm length of dialysis tubing in a beaker of distilled water	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.

To test for the release of carbon dioxide, a sample of the water surrounding the dialysis tubing is added to drops of an indicator, **B**.

Fig. 1.1 shows the effect of increasing concentration of carbon dioxide on the colour of **B**. Yellow is the end-point.



Fig. 1.1

Carry out step 1 to step 21.

step 1 Using the beakers labelled **hot water** and **cold water**, adjust the water in the beaker labelled **water-bath** to 45 °C. You will **not** need to maintain this temperature.

step 2 Put 15 cm^3 of **G** into the test-tube labelled **Y**. Mix well.

Between step 3 and step 4, you will be leaving the apparatus for 15 minutes. Use this time to continue with other parts of Question 1.

step 3 Put test-tube **Y** into the water-bath for 15 minutes.

step 4 After 15 minutes, remove test-tube **Y** from the water-bath.

step 5 Stir the mixture in test-tube **Y** and pour it into a beaker.

step 6 Label the spotting tile (dimple tile) with the sample times in minutes, as shown in Fig. 1.2.

step 7 Put 3 drops of **B** onto the spotting tile at each sample time, as shown in Fig. 1.2.

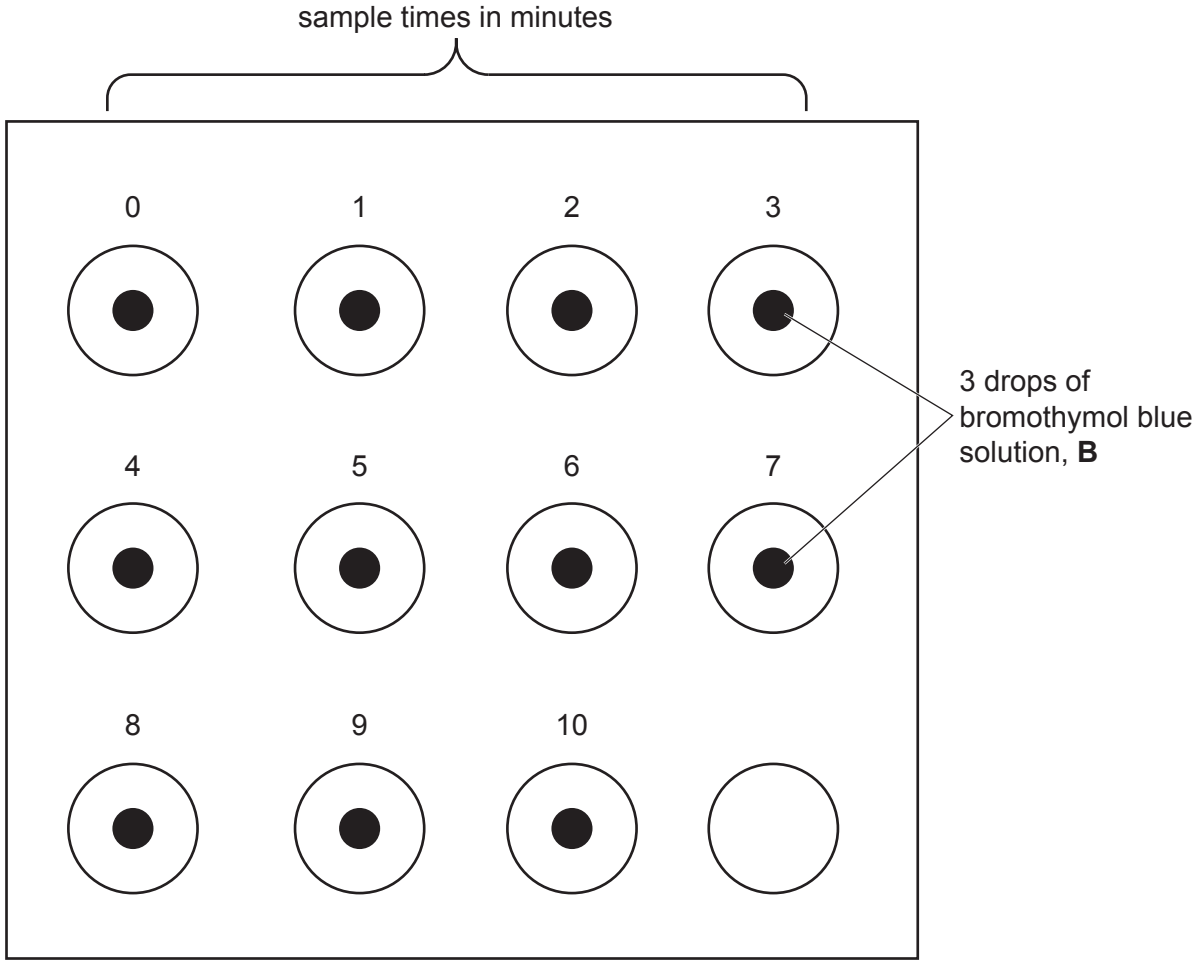


Fig. 1.2

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Fig. 1.3 shows the apparatus you will set up for this investigation.

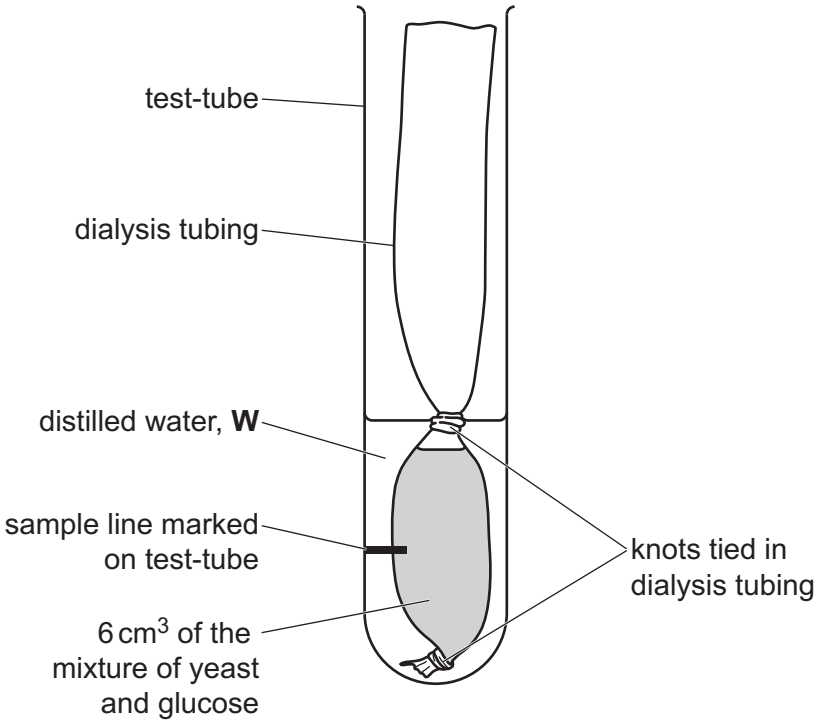


Fig. 1.3

step 8 Tie a knot in the dialysis tubing as close as possible to one end, so that the end is sealed.

step 9 To open the other end, rub the tubing gently between your fingers and thumb.

step 10 Stir the mixture in the beaker from step 5 and put 6.0 cm^3 of this mixture into a syringe.

step 11 Wipe the outside of the syringe and put the mixture from the syringe into the dialysis tubing.

step 12 Rinse the outside of the dialysis tubing by dipping it into the water in the container labelled **D**.

Look carefully at Fig. 1.3 to help you with step 13 to step 15.

step 13 Tie a knot just above the level of the mixture in the dialysis tubing, as shown in Fig. 1.3.

step 14 Put the dialysis tubing into a clean test-tube so that it is resting on the bottom of the test-tube, as shown in Fig. 1.3.

step 15 Draw a line on the test-tube so that it is half-way between the two knots, as shown in Fig. 1.3. This is where you will take your samples from.

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step 16 In this step, you will use a syringe to measure the volume of distilled water, **W**, needed to cover the section of dialysis tubing containing the mixture.

Use a syringe to put **W** into the test-tube to cover the section of dialysis tubing containing the mixture.

(a) (i) State the volume of **W** that you added to the test-tube in step 16.

volume of **W** = ... cm^3 [1]

step 17 Take a sample of **W** from the test-tube at the point you marked in step 15, using a pipette.

step 18 Put 3 drops of **W** onto **B** at time 0 on the white tile. Put the remaining **W** in the pipette back into the test-tube.

step 19 Start timing and put the test-tube containing the dialysis tubing into the beaker labelled **water-bath**.

step 20 Mix the sample of **W** and **B** on the white tile and immediately record the colour in **(a)(ii)**, using the colours stated in Fig. 1.1.

step 21 Repeat step 17, step 18 and step 20 for each of the sampling times until the end-point (yellow) is reached for **two** consecutive samples. If the end-point is not reached at 10 minutes, stop timing.

(ii) Record your results in an appropriate table.

[4]

(iii) This investigation used colour to indicate the concentration of carbon dioxide in the sample.

Suggest **three** improvements to this investigation that would increase the accuracy of the results.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(iv) A student repeated the investigation using the same procedure but with starch as the substrate instead of glucose.

Suggest why it took much longer to reach the end-point when starch was used as the substrate.

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.....

.....

..... [3]

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[Turn over

(b) A student measured the rate of carbon dioxide production when yeast was incubated with a substrate at different temperatures.

(i) State the independent variable in this investigation.

..... [1]

The results from the investigation at **35 °C** are shown in Table 1.2.

The rate of carbon dioxide production is shown in arbitrary units (au).

Table 1.2

time / min	rate of carbon dioxide production / au
0	0.00
14	0.15
22	0.30
27	0.60
53	2.75
66	3.05

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

Use a sharp pencil.

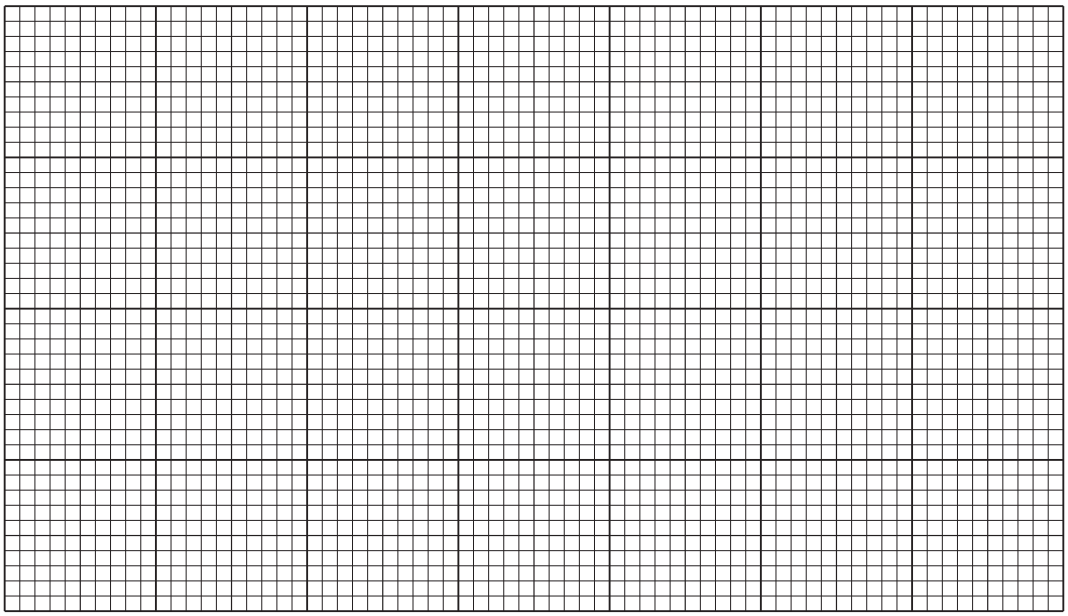


Fig. 1.4

[4]

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(iii) Describe the trend shown by the graph in Fig. 1.4.

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.....

..... [3]

(iv) Use the graph in Fig. 1.4 to find the time required for the rate of carbon dioxide production to be 1.75 au when the yeast was incubated at 35 °C.

..... [1]

[Total: 20]

2 **N1** is a slide of a stained transverse section through a plant root.

(a) **(i)** Draw a large plan diagram of the whole section of the root on **N1**.
Use a sharp pencil.

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

[5]

(ii) Observe the cells in the cortex of the root 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 an air space.

[5]

(b) Fig. 2.1 is a photomicrograph of a stained transverse section through a different root.

Observe the photomicrograph in Fig. 2.1 and the section on **N1** to identify differences between them.

Fig. 2.1 has been annotated to describe **one** of these differences. A label line has been used to indicate the feature that is different.

Complete Fig. 2.1 by:

- identifying **and** annotating **three** more differences between the photomicrograph in Fig. 2.1 and the section on **N1**
- using a label line to identify the feature that is different.

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Fig. 2.1 .....

.....

N1 .....

.....

Fig. 2.1 has flattened cells
N1 has rounded cells

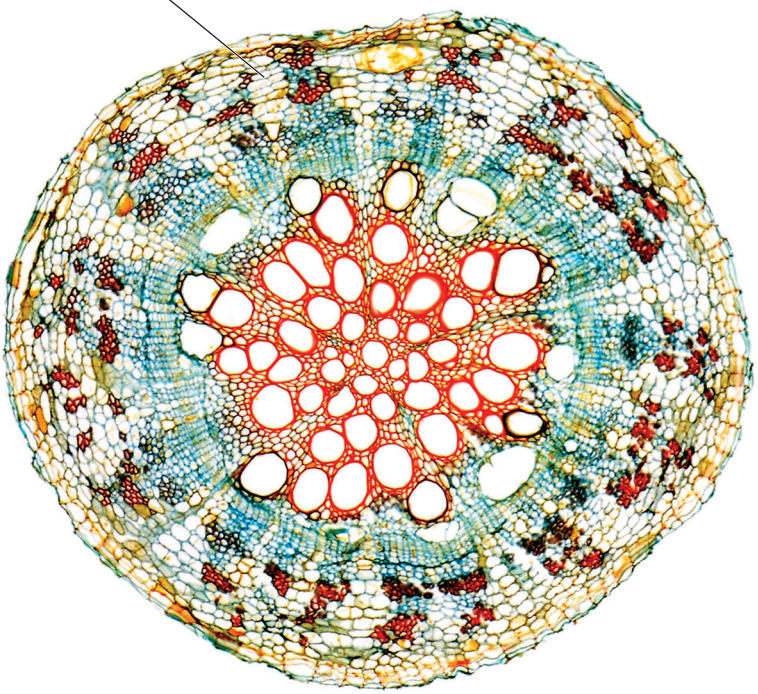


Fig. 2.1 .....

.....

N1 .....

.....

Fig. 2.1 .....

.....

N1 .....

.....

Fig. 2.1

[4]

(c) Fig 2.2 is the same photomicrograph as that shown in Fig. 2.1.

A black dot has been placed at the centre of the section.

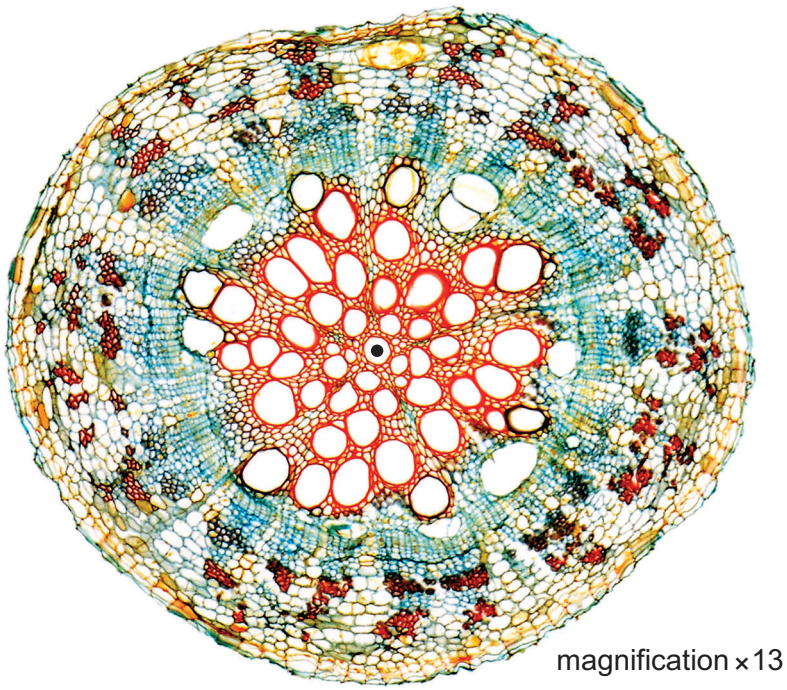


Fig. 2.2

(i) Determine the mean actual diameter of the section in Fig. 2.2.

- draw lines across the diameter of Fig. 2.2
- use your lines to measure the diameter of the section
- calculate the mean actual diameter of the section.

mean actual diameter = ... mm
[3]

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(ii) Calculate the actual area of the section using your answer in **(c)(i)** and the formula: actual area = πr^2, where $\pi = 3.14$.

State your answer to the nearest whole number and use appropriate units.

actual area of the section = ...
[3]

[Total: 20]

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