Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2018**

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 **11** printed pages and **1** blank page.

CAMBRIDGE International Examinations

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 all the work that you would like to do.

If you have enough time, think about how you can improve the confidence in your results, for example by obtaining and recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Yeast cells contain enzymes which catalyse the breakdown of glucose to produce ethanol and carbon dioxide. This process is used to make beer. After the beer has been made, the yeast is no longer needed and is removed.

The yeast cells are removed by allowing the cells to sink slowly to the bottom of the container, forming a sediment. This process is called sedimentation.

You will need to follow the progress of sedimentation of yeast cells in a test-tube. You will need to measure the height of the sediment at different times, for a total of 10 minutes.

You will use a graph paper scale to measure the sediment.

(a) Test-tube **A** in Fig. 1.1 shows how the test-tube will be set up at the start (0 minutes).

(i) Decide what you would expect the contents of the test-tube to look like after 10 minutes of sedimentation.

Draw on test-tube **B** in Fig. 1.1:

- the layers that you expect to see after 10 minutes of sedimentation
- label lines and labels for the layers.

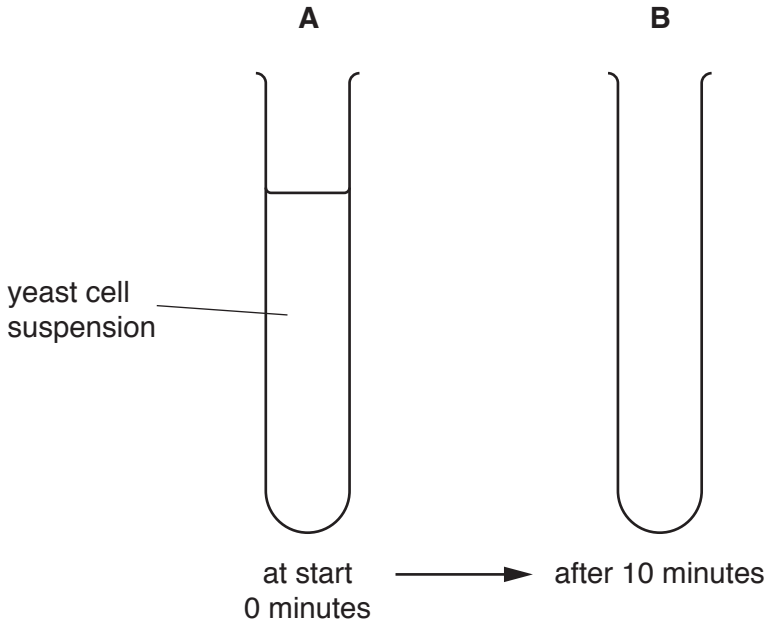


Fig. 1.1

[2]

(ii) Describe how you will use the graph paper scale to measure the sediment.
You may draw on test-tube **B** to help you with your answer.

.....

.....

..... [1]

(iii) Decide how often you will take these measurements, including measuring the sediment at 10 minutes.

State the times you will use for measuring the sediment.

..... [1]

There are molecules on the surface of yeast cells which cause the yeast cells to stick together.

The more cells that stick together, the faster the rate of sedimentation. This process may be affected by the pH of the yeast cell suspension.

You will need to:

- investigate the effect of the independent variable, pH, on the sedimentation of a yeast cell suspension
- use the results to estimate the pH of buffer **BU**.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
Y	yeast cell suspension	none	50
B3	buffer pH3	none	25
B4	buffer pH4	none	25
B5	buffer pH5	none	25
B6	buffer pH6	none	25
BU	buffer (pH unknown)	none	25
C	calcium chloride solution	irritant	25

If any of **C** comes into contact with your skin, wash off immediately under cold water.
It is recommended that you wear suitable eye protection.

[Turn over

Read step 1 to step 9 before proceeding.

1. Put 7 cm^3 of **B3** into a test-tube.
2. Put 1 cm^3 of **C** into the same test-tube.
3. Stir **Y** in the beaker, then put 7 cm^3 of **Y** into the same test-tube.
4. Repeat step 1 to step 3 for **B4**, **B5**, **B6** and **BU**.
5. Put a bung into one of the test-tubes and invert the test-tube three times to mix the contents.
6. Repeat step 5 for all the other test-tubes.
7. Immediately start timing.
8. At your selected times, as stated in **(a)(iii)**, measure the sediment in each test-tube, as you described in **(a)(ii)**. Do not disturb the contents of the test-tubes.
9. Record your results for **B3**, **B4**, **B5** and **B6** in **(a)(iv)** and record the results for **BU** in **(a)(v)**.

(iv) Record your results for **B3**, **B4**, **B5** and **B6** in an appropriate table.

[5]

(v) Complete Table 1.2 by recording your results for **BU**.

Table 1.2

time / minutes		10
height of sediment / mm		

Use your results in **(a)(iv)** and **(a)(v)** at 10 minutes to estimate the pH for **BU**.

estimated pH of **BU** = ... [2]

(vi) Suggest how to modify this procedure to obtain a more accurate estimate of the pH for **BU**.

.....

.....

.....

..... [2]

(vii) Suggest an explanation for the effect of pH on the sedimentation of yeast cells.

.....

.....

..... [1]

(viii) Identify **one** significant source of error in this investigation.
Explain why this is a source of error.

source of error .....

explanation .....

.....
[1]

[Turn over

(b) At the end of beer making, the yeast is no longer needed and is separated from the beer by sedimentation.
The progress of sedimentation can be monitored by removing samples of beer at intervals over a period of 30 hours and counting the number of yeast cells remaining in the beer, as shown in Table 1.3.

Table 1.3

time / hours	number of yeast cells / arbitrary units cm^{-3}
0	1180
10	720
20	250
25	190
30	180

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

Use a sharp pencil for drawing graphs.

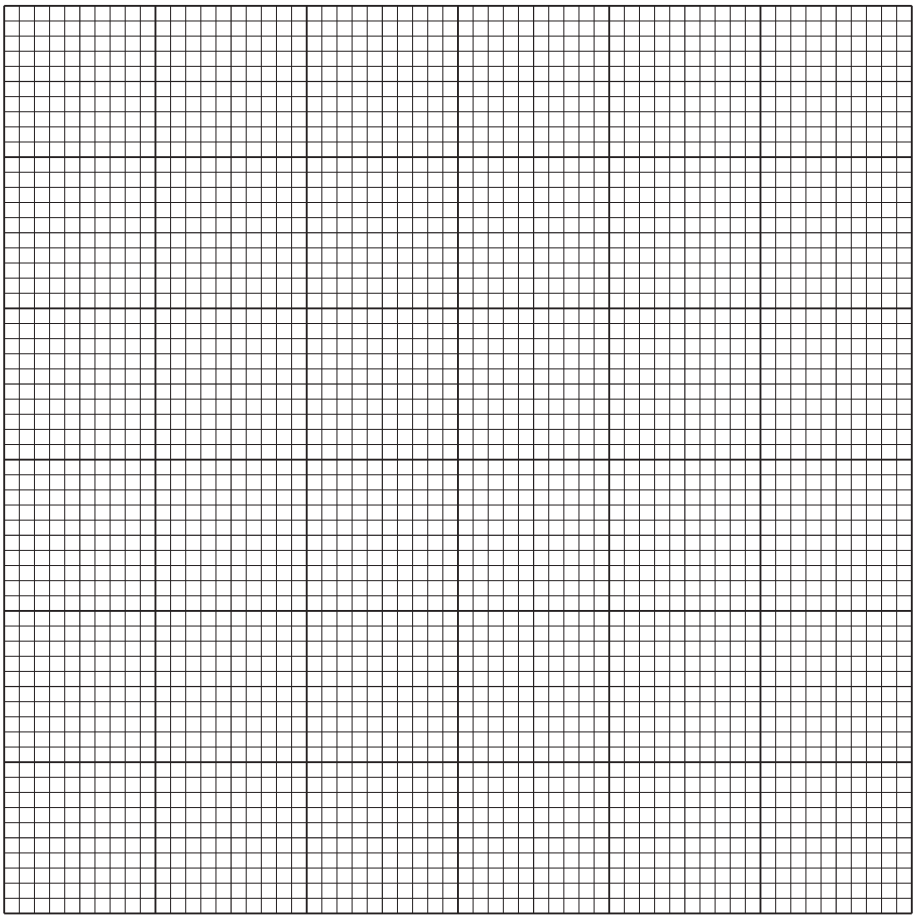


Fig. 1.2

[4]

(ii) Use your graph to find the number of yeast cells at 18 hours.

Show **on the graph** how you determined your answer.

number of yeast cells ..... arbitrary units cm^{-3} [2]

[Total: 21]

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) Observe all the different tissues in the stem on **J1**.

(i) Draw a large plan diagram of a quarter of the stem on **J1**, shown by the shaded area in Fig. 2.1.
Use **one** ruled label line and label to identify the xylem.

Use a sharp pencil for drawing.

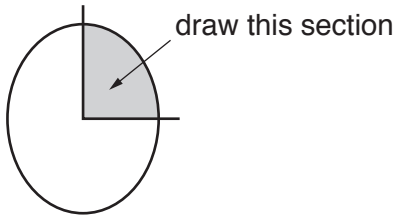


Fig. 2.1

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

[5]

(ii) Observe the tissues close to the epidermis of the stem on **J1**.
Near to the epidermis there are cells which are larger than any other cells in the stem.

Select **one** group of **four** adjacent, touching 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.

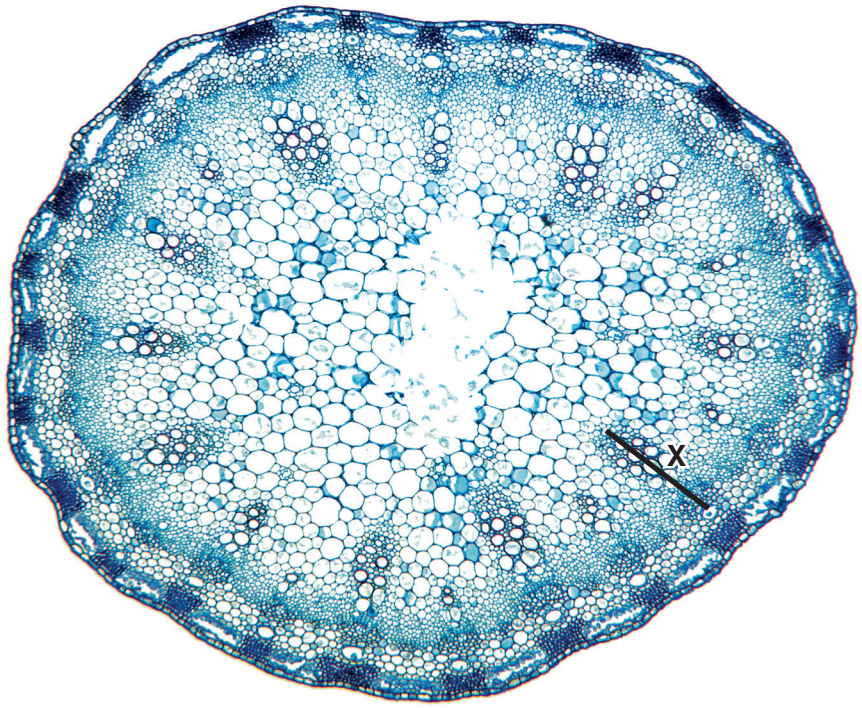
Use **one** ruled label line and label to identify the cell wall of **one** cell.

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

[5]

Fig. 2.2 is a photomicrograph of a stained transverse section through the stem of a different type of plant.

You are not expected to be familiar with this specimen.



magnification ×13

Fig. 2.2

(b) (i) Use the magnification on Fig. 2.2 to calculate the actual length, in μm, of line **X** (length of a vascular bundle).

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

actual length of **X** = ... μm [4]

(ii) A student used a light microscope to observe a slide of the section shown in Fig. 2.2.

State how the student would use an eyepiece graticule scale to measure the actual length of a vascular bundle.

.....

.....

..... [1]

(c) Prepare the space below so that it is suitable for you to record the observable differences between the stem on **J1** and the stem in Fig. 2.2.

Record your observations in the space you have prepared.

[4]

[Total: 19]

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