Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 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 Yeast cells contain an enzyme, catalase, which catalyses the release of oxygen from the substrate hydrogen peroxide.

You will investigate the effect of temperature on the activity of catalase in yeast suspension **Y**.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
Y	3.0% yeast suspension	none	100
H	3.0% hydrogen peroxide solution	irritant	20

If any of **Y** or **H** 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.

State whether the risk of using hydrogen peroxide solution, **H**, is **low**, **medium** or **high**.

Give a reason for your answer.

risk .....

reason .....

.....

[1]

(ii) You will test the activity of catalase in yeast suspension **Y** at room temperature and at other temperatures up to a maximum of 70 °C.

Use the thermometer to measure the temperature of the room.

State the room temperature and the other temperatures you will use in your investigation.

room temperature .....

other temperatures .....

[1]

Read step 1 to step 6 and **(a)(iii)**.

Carry out step 1 to step 6.

1. Stir yeast suspension **Y**.
2. Take up 4.0 cm^3 of yeast suspension **Y** into a syringe.
3. Wipe the syringe to remove any yeast suspension on the outside.
4. Take up 1.0 cm^3 of hydrogen peroxide solution **H** into the same syringe, as shown in Fig. 1.1.

   The reaction will start immediately.

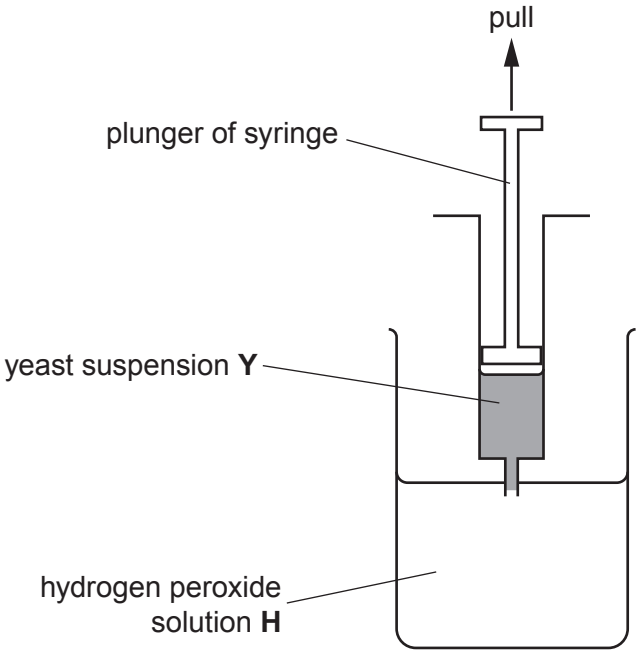

Fig. 1.1

5. Put the syringe into the test-tube, as shown in Fig. 1.2.

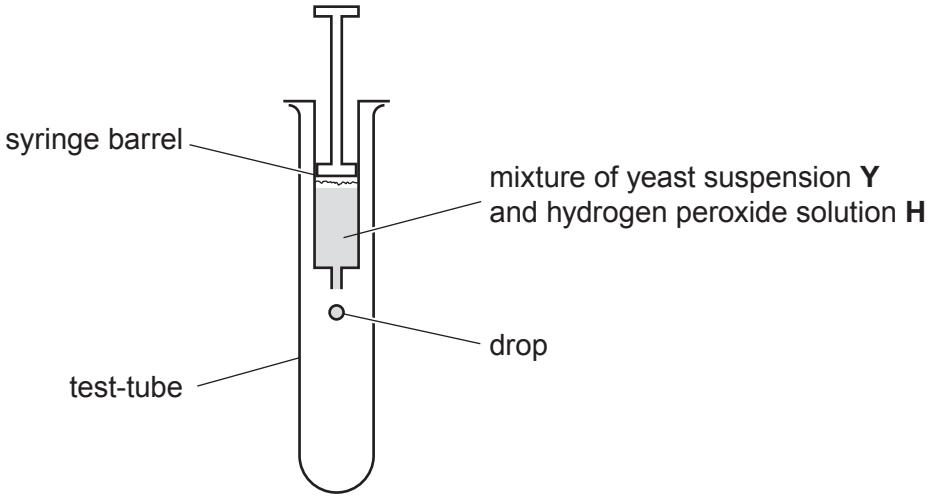

Fig. 1.2

Oxygen is released as hydrogen peroxide is broken down by catalase in the yeast suspension. This pushes some of the yeast suspension out of the nozzle of the syringe, which falls as drops into the test-tube.

6. Observe the release of drops from the syringe as the reaction continues.

(iii) Decide how you could determine the rate at which drops are released from the syringe.

The method that you decide should take no longer than two minutes.

State the **measurements** that you will need to make.

.....

.....

.....

..... [2]

You will now test the activity of catalase in yeast suspension **Y** at room temperature by finding the rate at which drops are released from the syringe.

7. Empty the syringe and test-tube into the container labelled **For waste**.

8. Wash out the syringe using the water in the container labelled **For washing**.

9. Stir yeast suspension **Y**.

10. Take up 4.0 cm^3 of yeast suspension **Y** into the syringe.

11. Wipe the syringe to remove any yeast suspension on the outside.

12. Take up 1.0 cm^3 of hydrogen peroxide solution **H** into the same syringe, as shown in Fig. 1.1.

    The reaction will start immediately.

13. Put the syringe into the test-tube, as shown in Fig. 1.2.

14. Take the measurements stated in **(a)(iii)** and record these measurements in **(a)(iv)**.

15. Repeat step 7 and step 8 to wash out the syringe.

You will now test the activity of catalase in yeast suspension **Y** at the other temperatures you decided in **(a)(ii)**. You must start with the **lowest** of these temperatures.

16. Use the Bunsen burner to heat the beaker containing yeast suspension **Y**. Stir gently while heating.

    Stop heating as soon as the temperature of the yeast suspension in **Y** reaches the required temperature stated in **(a)(ii)**.

17. Repeat step 9 to step 15.

18. Repeat step 16 and step 17 for each of the other temperatures you decided in **(a)(ii)**.

(iv) Record your results in an appropriate table.

[5]

A student investigated the effect of the concentration of hydrogen peroxide solution on the activity of catalase.

The student was provided with 5.0% hydrogen peroxide solution.

(v) State the concentrations of hydrogen peroxide solution that the student could prepare to provide a suitable range for this investigation.

Outline how these concentrations could be prepared from 5.0% hydrogen peroxide solution.

concentrations .....

.....

how prepared .....

.....

.....

.....

.....

.....

[2]

(vi) The student standardised the volume and concentration of the catalase solution.

State **one** other variable that would need to be standardised.

Describe how this variable could be standardised.

variable .....

how standardised .....

.....

[1]

(b) A scientist carried out an investigation into the effect of pH on the activity of a different enzyme.

The results are shown in Table 1.2.

Table 1.2

pH	enzyme activity / arbitrary units (au)
3.2	1.50
4.8	22.75
5.7	29.00
6.5	24.50
7.5	9.00

(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.

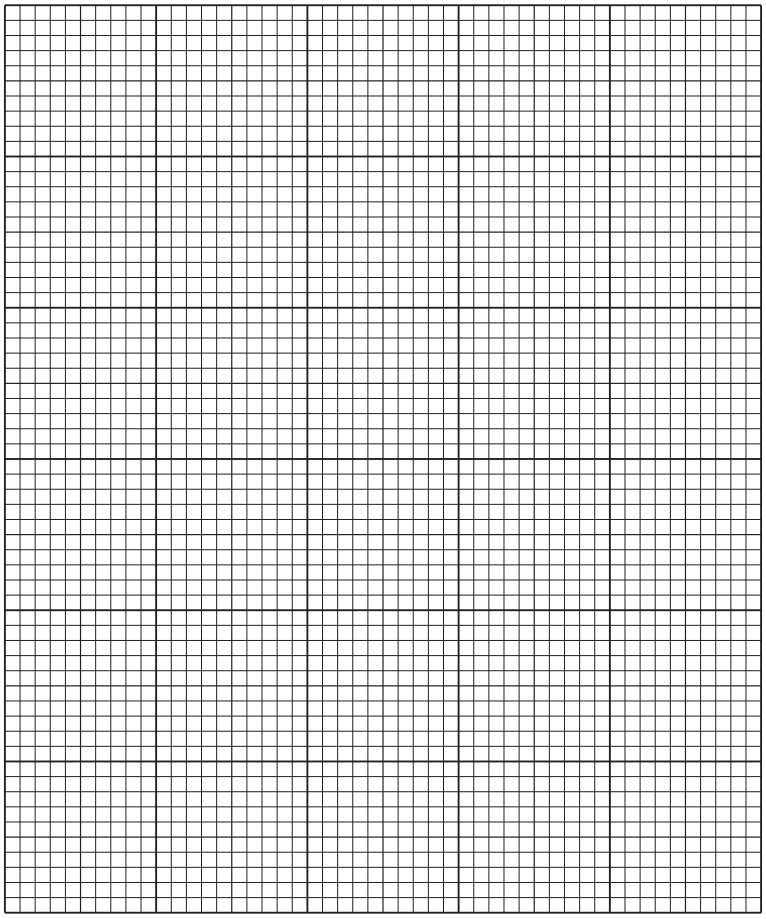

Fig. 1.3

[4]

(ii) Use your graph to estimate the enzyme activity when the pH is 4.0.

Show on your graph how you estimated this value.

enzyme activity = ... au
[2]

(iii) Describe the trend in the results shown by your graph plotted on Fig. 1.3.

.....

.....

..... [1]

(iv) Explain the effect of pH on this enzyme.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 22]

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2 Starch grains from different types of plant differ in size and shape. Some starch grains have rings on their surfaces.

You will now observe and draw starch grains from one type of plant.

1. Put one **clean** and **dry** microscope slide onto a paper towel.

2. Using a pipette, put a few drops of **S** onto the slide. **S** is a suspension of starch grains.

3. Cover the drops of **S** on the slide with a coverslip and use a paper towel to remove any excess suspension.

4. Use the microscope to find and observe the starch grains on the slide.

   You may need to reduce the amount of light entering the microscope and adjust the fine focus to observe the starch grains clearly.

5. Select, from a single field of view, **four** starch grains that show different sizes and features.

(a) (i) Make a large drawing of the **four** starch grains that you have selected.

[4]

6. Remove the slide from the microscope and place it on a paper towel.

Fig. 2.1 shows some different types of starch grains and patterns on the surface of the starch grains.

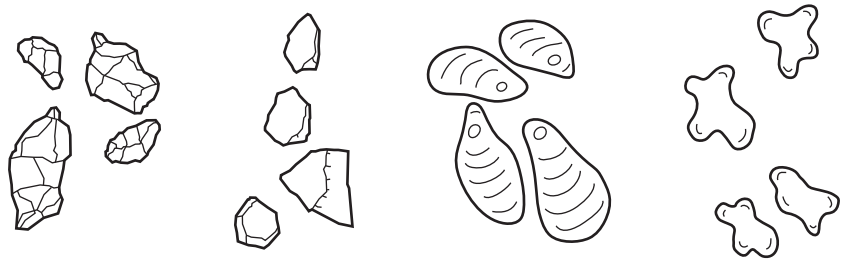

Fig. 2.1

(ii) Use the diagrams in Fig. 2.1 to identify which of the starch grains, **J**, **K**, **L** or **M**, matches most closely the starch grains drawn in **(a)(i)**.

answer ..... [1]

A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale.

The calibration was:

1 eyepiece graticule unit = 16 μm

The student used the microscope to observe and draw three starch grains to the same scale. The student drew a line across the length of each drawing of a starch grain. The student's drawings are shown in Fig. 2.2.

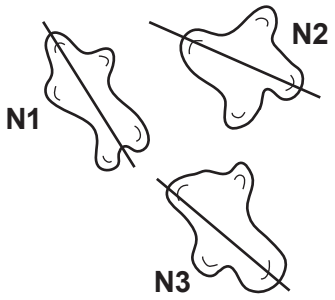

Fig. 2.2

(iii) Find the mean **image** length of the three starch grains drawn by the student, along the lines shown in Fig. 2.2.

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

mean image length = ...
[2]

(iv) When viewed using the microscope, the student found that starch grain **N1** measured 4 eyepiece graticule units along the position of the line drawn in Fig. 2.2.

Use this information and your answer to **(a)(iii)** to calculate the mean **actual** length of the three starch grains in Fig. 2.2.

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

mean actual length = ...
[2]

[Turn over

(b) Fig. 2.3 is a photomicrograph of a transverse section of a plant root containing starch grains. The section has been stained with iodine solution.

You are not expected to be familiar with this specimen.

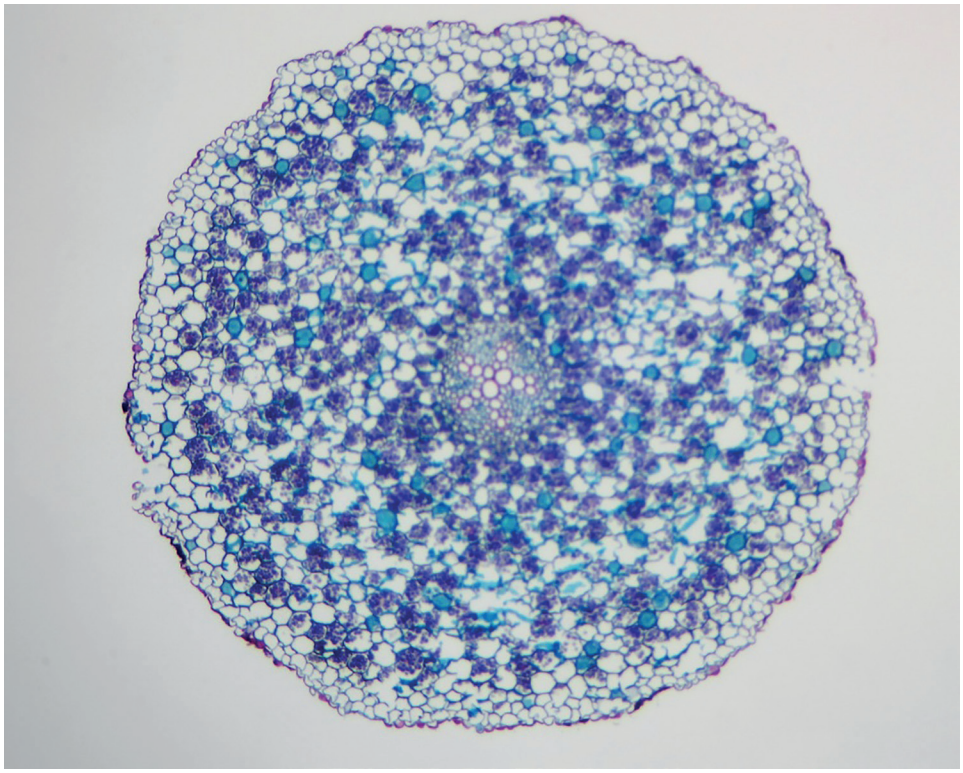

Fig. 2.3

Use a sharp pencil for drawing.

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

Draw a large plan diagram of the transverse section of the whole root shown in Fig. 2.3.

Use **one** ruled label line and label, with the letter **G**, the tissue that contains most of the starch grains.

[5]

(c) Fig. 2.4 is a photomicrograph of a stained transverse section through a root of a different type of plant.

You are not expected to be familiar with this specimen.

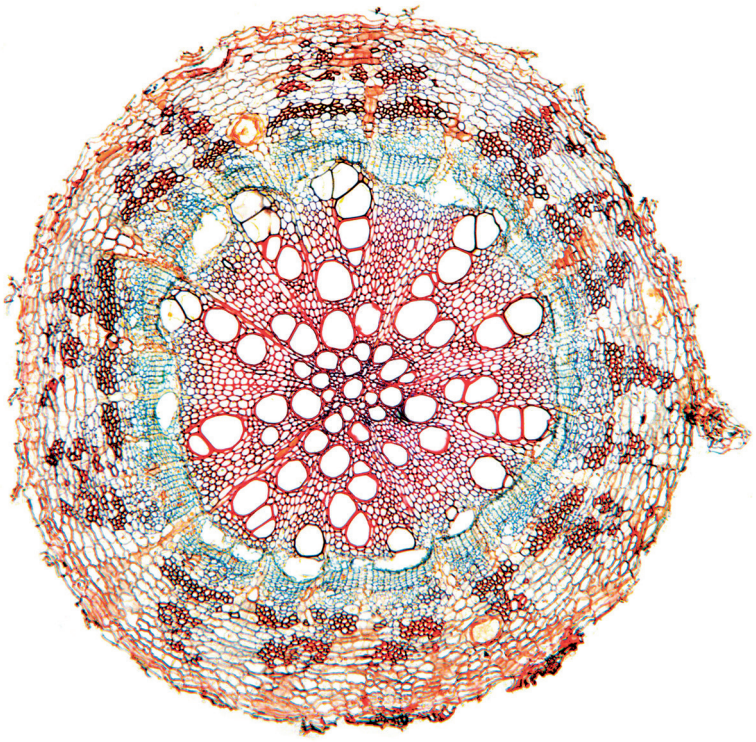

Fig. 2.4

Fig. 2.5 is a photomicrograph of the same root section that is shown in Fig. 2.3.

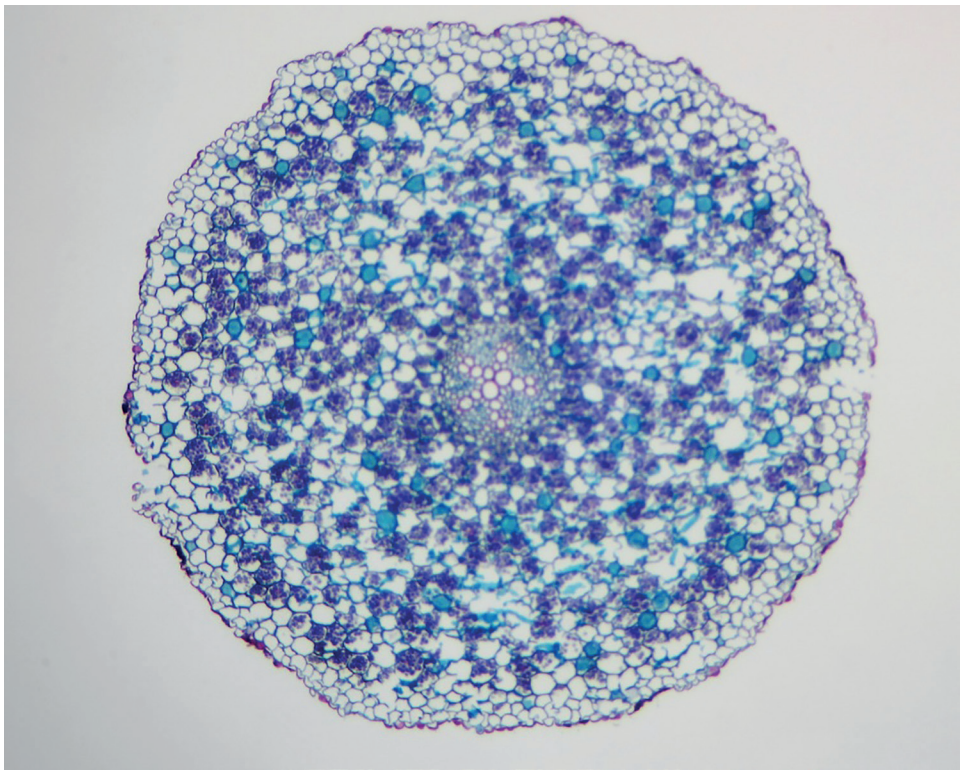

Fig. 2.5

Prepare an appropriate table so that it is suitable for you to record the observable differences between the root in Fig. 2.4 and the root in Fig. 2.5.

Record the observable differences, other than differences in colour, in your table.

[4]

[Total: 18]

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