Cambridge International AS & A Level

**Cambridge Assessment International Education**
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*5583857315*

**BIOLOGY** **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 2019**

**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 Assessment International Education

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** Catalase is an enzyme that catalyses the break down of hydrogen peroxide, as shown in Fig. 1.1.

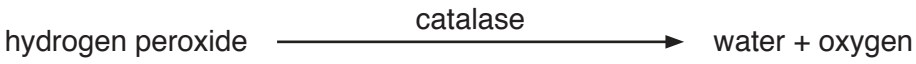


**Fig. 1.1**

You will investigate the progress of this reaction by measuring the production of oxygen at different concentrations of catalase. Catalase can be found in plant extract.

You will need to prepare different concentrations of plant extract, **P**, using proportional dilution.

You are provided with the materials shown in Table 1.1.

**Table 1.1**

| labelled | contents | hazard | volume /cm$^3$ | risk |
|---|---|---|---|---|
| **H** | hydrogen peroxide solution | harmful irritant | 60 | |
| **W** | distilled water | none | 80 | |
| **P** | 100% plant extract solution | harmful irritant | 50 | |

If **H** or **P** 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.

Decide whether the risk of using **H**, **W** and **P** is **low**, **medium** or **high**.

Complete Table 1.1, using the words **low**, **medium** or **high**, to state the risk of using **H**, **W** and **P**. You may use each word once, more than once or not at all. [1]

You will need to prepare different concentrations of plant extract, **P**, using proportional dilution.

You will need to prepare 10 $cm^3$ of each concentration.

Table 1.2 shows how to make up two of the concentrations of **P** you will use.

Decide which other concentrations of **P** you will use.

**(ii)** Complete Table 1.2 to show how you will prepare the concentrations of **P** you will use.

**Table 1.2**

| percentage concentration of **P** | volume of **P** / $cm^3$ | volume of **W** / $cm^3$ |
|---|---|---|
| 100 | 10.0 | 0.0 |
| 0 | 0.0 | 10.0 |

[2]

When discs of filter paper that have been soaked in **P** are put into hydrogen peroxide solution, the discs rise to the surface as oxygen bubbles are produced. The higher the rate of oxygen production the faster the discs will rise to the surface.

Carry out step 1 to step 8.

1. Prepare the concentrations of **P** as stated in Table 1.2.

2. Pick up one disc of filter paper using forceps.

3. Continue to hold the disc in the forceps **and**:

    - dip the disc in 100% **P**
    - remove excess **P** by briefly blotting the disc on a paper towel
    - put the disc at the bottom of the liquid in the beaker labelled **H**.

4. Immediately release the disc from the forceps and start timing.

5. Record in **(a)(iii)** the time taken for the disc to reach the surface of **H** and then remove the disc using the forceps. If the time taken for the disc to rise back to the surface is longer than 180 seconds then record 'more than 180'.

6. Dip the forceps in the water in the beaker labelled **For washing**. Dry the forceps with a paper towel.

7. Repeat step 2 to step 6 **two more** times, using 100% **P**.

8. Repeat step 2 to step 7 using the other concentrations of **P** as stated in Table 1.2.

**(iii)** Record your results in an appropriate table.

[5]

**(iv)** State the independent variable in this investigation.

..... [1]

**(v)** Identify **three** sources of error in this investigation. Suggest an improvement to the procedure for each source of error that would improve the confidence in your results.

1. *source of error* .....

   *improvement* .....

   .....

2. *source of error* .....

   *improvement* .....

   .....

3. *source of error* .....

   *improvement* .....

   .....

[3]

**(b)** Another way of measuring the activity of catalase from plant tissue would be to measure the volume of oxygen produced when it reacts with hydrogen peroxide.

A student decided to investigate the effect of changing the concentration of hydrogen peroxide on the volume of oxygen produced in 30 seconds.

Table 1.3 shows the results of the student's investigation.

**Table 1.3**

| percentage concentration of hydrogen peroxide | volume of oxygen produced in 30 seconds/$cm^3$ | | | | | |
|---|---|---|---|---|---|---|
| | test 1 | test 2 | test 3 | test 4 | test 5 | mean |
| 0.5 | 4.0 | 4.4 | 5.2 | 3.9 | 3.7 | 4.0 |
| 1.0 | 6.4 | 6.6 | 6.0 | 6.2 | 6.8 | 6.4 |
| 1.5 | 7.5 | 7.8 | 8.2 | 8.0 | 7.5 | 7.8 |
| 2.0 | 8.7 | 10.5 | 8.5 | 8.3 | 8.8 | |
| 2.5 | 9.2 | 9.5 | 9.6 | 9.9 | 8.8 | 9.4 |
| 3.0 | 9.6 | 9.5 | 9.2 | 9.9 | 10.3 | 9.7 |

**(i)** Complete Table 1.3 by calculating the mean value at 2.0% hydrogen peroxide.

*Space for working.*

[2]

**(ii)** Plot a graph of the mean values shown in Table 1.3 on the grid in Fig. 1.2.

*Use a sharp pencil for drawing graphs.*

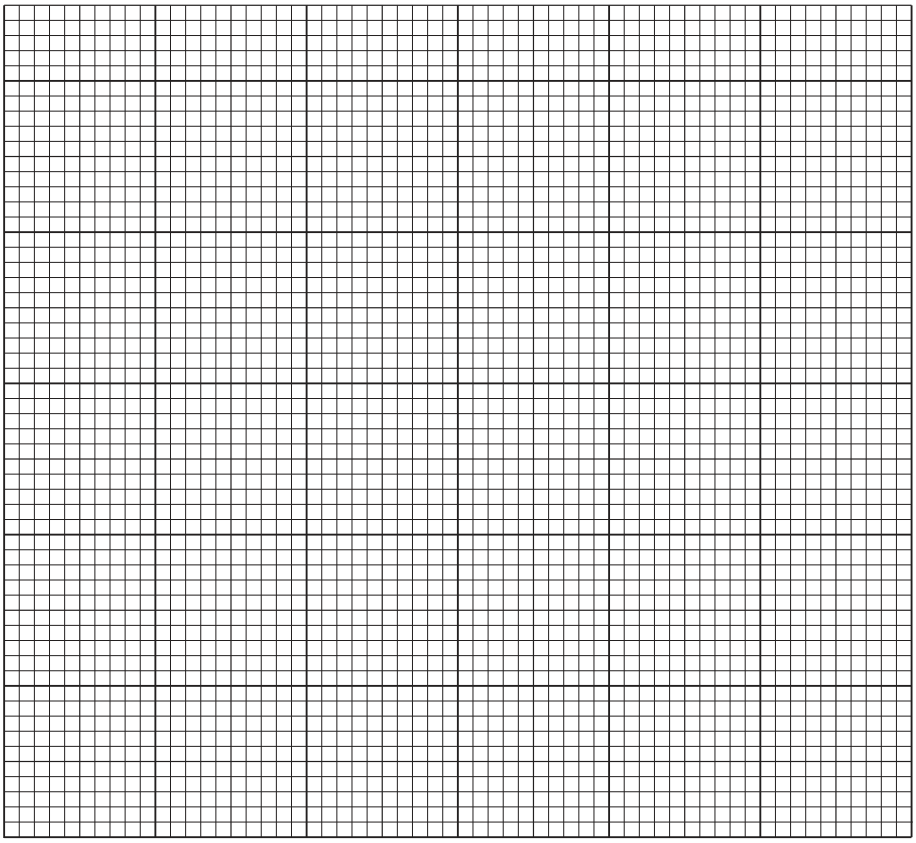

**Fig. 1.2** [4]

**(iii)** Use your graph in Fig. 1.2 to determine the percentage concentration of hydrogen peroxide that produces 7.0 $cm^3$ of oxygen in 30 seconds.

percentage concentration = .....% [1]

**(iv)** Explain why the volume of oxygen production increases as the concentration of hydrogen peroxide increases.

.....

.....

.....

.....

.....

..... [3]

[Total: 22]

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

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 sector of the stem on **N1**, shown by the shaded area in Fig. 2.1.

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

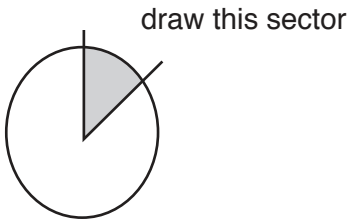


**Fig. 2.1**

[5]

**(ii)** Select **four** adjacent, touching xylem vessels.

Each vessel must touch at least **two** other cells.

Make a large drawing of this group of **four** touching xylem vessels.

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

[5]

**(b)** Fig. 2.2 is a photomicrograph of a stained transverse section through the root of a different type of plant.

You are not expected to be familiar with this specimen.

An eyepiece graticule scale is shown on Fig. 2.2.

The calibration of the eyepiece graticule scale is:

1 eyepiece graticule division = 24.6 μm

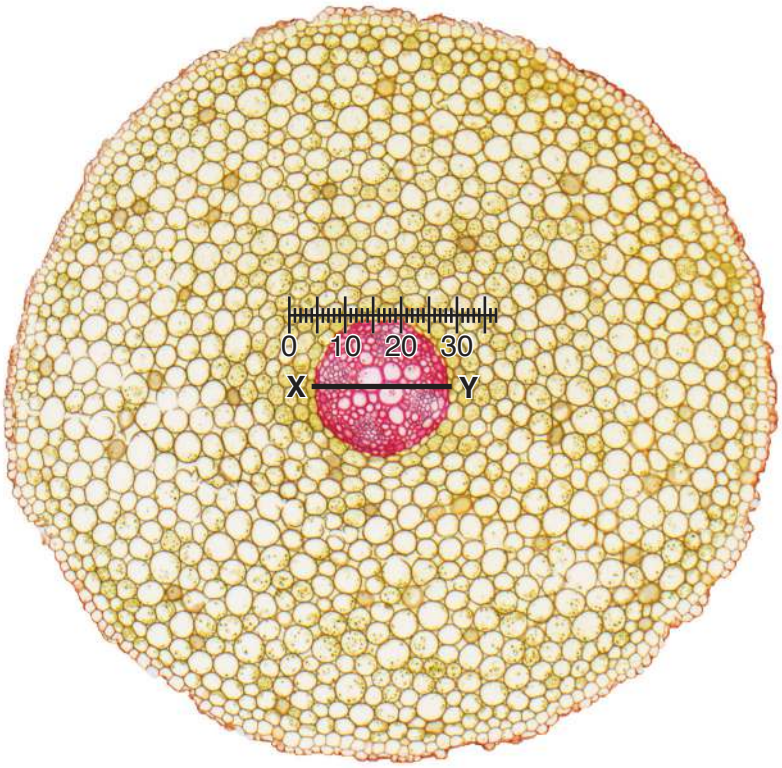


**Fig. 2.2**

**(i)** Use the calibration of the eyepiece graticule on Fig. 2.2 to calculate the actual width of the vascular tissue, shown by line **X**–**Y**.

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

actual width of vascular tissue = ..... [4]

**(ii)** Prepare an appropriate table so that it is suitable for you to record the observable differences between the stem on **N1** and the root in Fig. 2.2.

Record the observable differences in your table.

[4]

[Total: 18]

**BLANK PAGE**