Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

BIOLOGY **0610/61**

Paper 6 Alternative to Practical **May/June 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **12** printed pages and **4** blank pages.

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1 A student measured the distance moved by different concentrations of citric acid solution through agar jelly.

The agar contained Universal Indicator which changed colour in the presence of acid. The agar mixed with Universal Indicator was green at the beginning of the investigation.

Step 1 Three test-tubes were labelled **A**, **B** and **C**. Three different concentrations of citric acid solution were made.

Table 1.1 shows the volumes of 5% citric acid solution and distilled water that were used to make each solution.

Table 1.1

	solution		
	A	**B**	**C**
volume of 5% citric acid solution / cm^3	1.0	2.0	10.0
volume of distilled water / cm^3	9.0	8.0	0.0
percentage concentration of citric acid solution	0.5	1.0	5.0

Step 2 The base of a Petri dish containing agar and Universal Indicator was labelled **A**, **B** and **C**.

Three holes were cut into the agar. This is shown in Fig. 1.1.

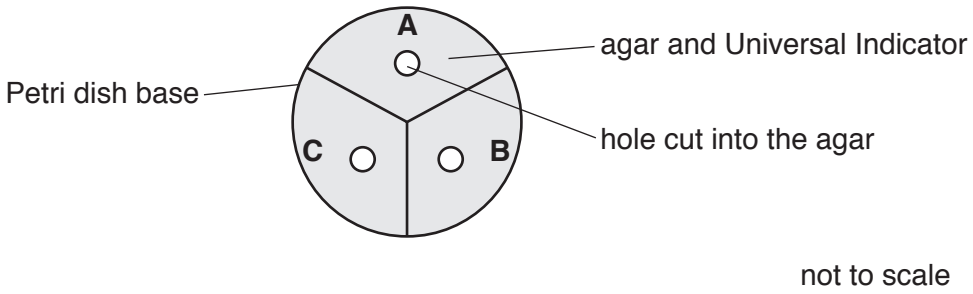

Fig. 1.1

Step 3 The student was provided with one dropping pipette. Three drops of solution **A** were placed into the hole in section **A** of the Petri dish.

Step 4 Three drops of solution **B** were placed into the hole in section **B** of the Petri dish.

Step 5 Three drops of solution **C** were placed into the hole in section **C** of the Petri dish.

Step 6 A stop-clock was started.

Step 7 After 30 minutes the student observed the colour change in the agar around the hole in each section of the Petri dish. The colour change was caused by the diffusion of the citric acid solution through the agar.

Step 8 A ruler was used to measure the distance travelled by each concentration of citric acid solution through the agar.

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Fig. 1.2 shows the appearance of the Petri dish after 30 minutes.

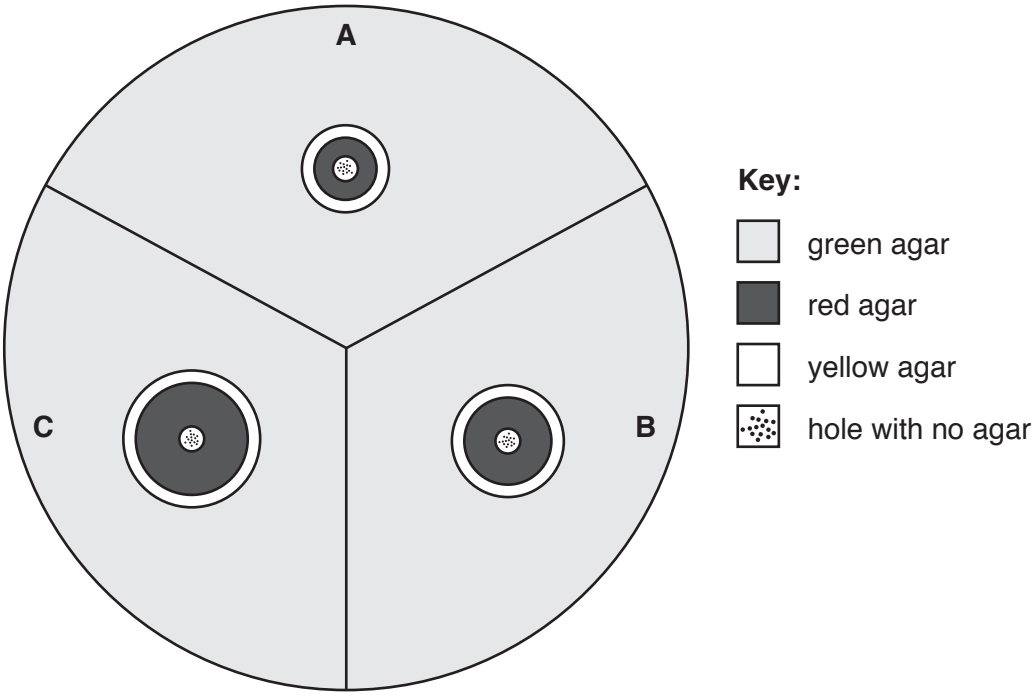

Fig. 1.2

(a) Use a ruler to measure the distance travelled by each concentration of citric acid solution after 30 minutes in Fig. 1.2.

Record these results in your table in **1(a)(i)**.

View solution

(i) Prepare a table to record the results.

You should include:
- the concentration of the citric acid solutions
- the distance travelled by the citric acid solutions.

[3]

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(ii) Describe how you decided where to measure the distance travelled by the citric acid solutions.

.....

.....

..... [1]

(iii) State a conclusion for these results.

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.....

..... [1]

(iv) The citric acid moves through the agar by diffusion. The diffusion coefficient is used to show the effect of concentration on diffusion.

The formula to calculate the diffusion coefficient is:

$$\text{diffusion coefficient} = \frac{(\text{distance travelled})^2}{\text{time}}$$

Calculate the diffusion coefficient for a 10% solution of citric acid that travelled 14 mm in 30 minutes.

Give your answer to two significant figures.

Space for working.

..... mm^2 per minute
[2]

(v) Universal Indicator is used to estimate the pH value of substances.

Estimate the pH value for the green agar and the red agar.

green agar pH .....

red agar pH .....
[2]

(b) (i) State **two** variables that have been kept constant in this investigation.

1 .....

2 .....
[2]

(ii) Identify **one** potential source of error in this investigation and suggest how the error could affect the results.

error .....

.....

effect on results .....

.....

.....
[2]

View solution

(c) Describe how you could adapt this method to find the effect of temperature on the rate of diffusion. Agar melts at 70 °C.

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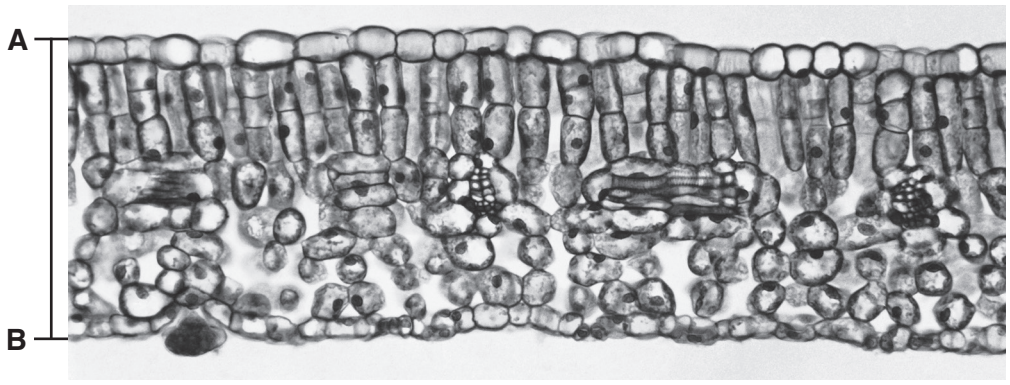
..... [6]

[Total: 19]

View solution

2 **(a)** Fig. 2.1 is a photomicrograph of a cross-section of part of a leaf.

View solution



magnification ×100

Fig. 2.1

(i) Draw a large diagram to show the layers present in the leaf section shown in Fig. 2.1.

Do not draw any cells.

[3]

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(ii) Measure the thickness of the leaf along the line **AB** on Fig. 2.1.

View solution

length of line **AB** .....

Calculate the actual thickness of the leaf using your measurement and the formula.

Include the units.

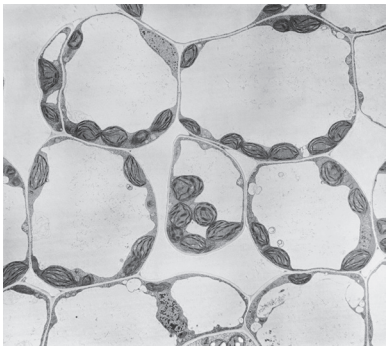
$$\text{magnification} = \frac{\text{length of line } \mathbf{AB} \text{ on Fig. 2.1}}{\text{actual thickness of leaf}}$$

.....

[3]

(iii) Fig. 2.2 shows a photomicrograph of cells from one type of tissue found in leaves.

View solution



magnification ×300

Fig. 2.2

Label the layer on your drawing, with the letter **X**, to show where this type of tissue is found. [1]

(b) Scientists carried out an investigation into the effect of light on the growth of leaves.

View solution

Plants of the same species (**A**) were grown in three different light intensities.

The plants were grown in the same soil and kept in glasshouses with automatic watering.

A sample of 100 leaves was selected at random and collected from plants in each of the three different light intensities. A total of 300 leaves were collected.

The scientists studied the variations in the size and structure of the leaves in each sample.

(i) Suggest why the scientists used large samples of leaves.

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..... [1]

(ii) Suggest why the leaves in each light intensity were selected at random.

View solution

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..... [1]

(iii) A grid, divided into millimetre squares, was used to measure the surface area of the leaves.

Outline how the grid could have been used.

View solution

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..... [2]

(iv) State the variable that was changed (independent variable) in this investigation.

..... [1]

View solution

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(c) The scientists collected data from one other plant species (**B**).

View solution

Table 2.1 shows the results.

Table 2.1

light intensity / arbitrary units	average leaf area / mm^2	
	species **A**	species **B**
100	3600	2800
50	3900	3400
10	6500	2900

(i) Calculate the percentage difference in the average leaf area for species **A** from a light intensity of 50 arbitrary units to 10 arbitrary units.

Show your working and give your answer to the nearest whole number.

.....%
[2]

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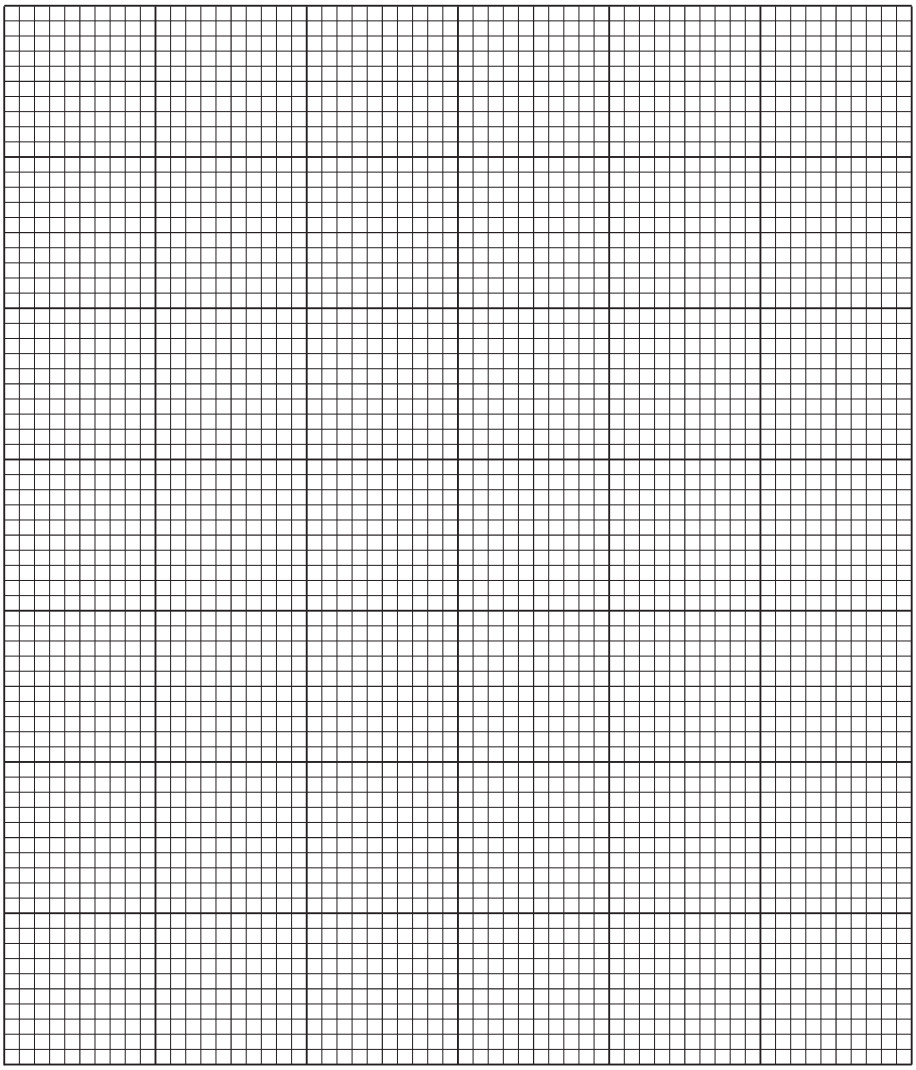
(ii) Plot a bar chart on the grid to show the average leaf area for species **A** and **B**, at each light intensity.

View solution



[4]

(iii) Describe the trends shown in your graph for species **A** and species **B**.

View solution

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..... [2]

(iv) The scientists want to determine more precisely the light intensity that results in the largest leaf area for species **B**.

Suggest how the method used in the investigation could be modified to achieve this.

View solution

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..... [1]

[Total: 21]

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