Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 2017**

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, paperclips, 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 **13** printed pages and **3** blank pages.

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 accuracy of 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 Some plants contain types of molecules which can be useful, for example in an industrial process.

To find the best source of one of these molecules may require estimating the concentration of a useful molecule in plant extracts.

You are required to estimate the concentration of molecule **M** in a sample of plant extract, **U**.

Molecule **M** changes the colour of potassium manganate(VII) solution, **K**, from pink to colourless.

The rate of the colour change depends on the concentration of molecule **M** in the sample. The greater the concentration of molecule **M**, the faster the end-point is reached.

You are required to:

- prepare a simple dilution of a 10% solution of molecule **M**, labelled **10M**
- record the time taken for the pink colour of **K** to change to the end-point for each of the concentrations of molecule **M**.

You are provided with:

labelled	contents	hazard	volume/cm^3
10M	10% solution of molecule **M**	none	100
W	distilled water	none	100
U	unknown concentration of molecule **M** in a plant extract	none	40
A	sulfuric acid	harmful irritant	20
K	potassium manganate(VII) solution	none	20

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

(a) You are required to make simple dilutions of the **10M** solution which reduce the concentration between each successive dilution.

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

(i) Table 1.1 shows how to make up one of the concentrations of molecule **M** you will use.

Decide which concentrations of molecule **M** to prepare using simple dilutions of the **10M** solution.

Complete Table 1.1 to show how you will prepare the other concentrations.

Table 1.1

volume of **10M** / cm^3	volume of distilled water, **W** / cm^3	percentage concentration of molecule **M**
10	0	10

[3]

Proceed as follows:

1. Prepare the concentrations of molecule **M** as shown in Table 1.1.
2. Put 1 cm^3 of **A** into a test-tube.
3. Put 1 cm^3 of **K** into the same test-tube and mix well.
4. Put 1 cm^3 of **10M** into the same test-tube and mix well. Start timing.
5. Record the time taken to reach the end-point in **(a)(ii)**.

   If the end-point is not reached in 4 minutes (240 seconds) record 'more than 240' **and** record the colour of the solution.
6. Repeat step 2 to step 5 for each of the concentrations of molecule **M** prepared in step 1.

(ii) Prepare the space below and record your results for the **known** concentrations of molecule **M**.

[5]

You are now required to estimate the concentration of molecule **M** in a sample of plant extract, **U**.

7. Repeat step 2 to step 4 with **U**. Record the time taken to reach the end-point in **(a)(iii)**.

(iii) State the time taken to reach the end-point for sample **U**. ..... [1]

(iv) Use your results in **(a)(ii)** and **(a)(iii)** to estimate the concentration of molecule **M** in sample **U**.

concentration = ... [1]

(v) Describe how you could use this procedure to produce a more accurate estimate of the concentration of molecule **M** in the sample of plant extract **U** than the one given in **(a)(iv)**.

.....

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.....

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.....

.....

..... [3]

(b) A student suggested that molecule **M** might act as an antibiotic.

In order to test this suggestion the student carried out the following investigation:

- bacteria were spread over the surface of a strip of agar gel containing nutrients
- bacteria were allowed to grow, shown by the shaded area in Fig. 1.1
- small drops ($2\,\mu m^3$) of different concentrations of molecule **M** were put onto the surface of the agar gel strip
- after 24 hours, the inhibition area (where the bacteria were no longer observed) was measured for each concentration of molecule **M**.

Fig. 1.1 shows a diagram of the strip of agar gel after 24 hours. This is not to scale.

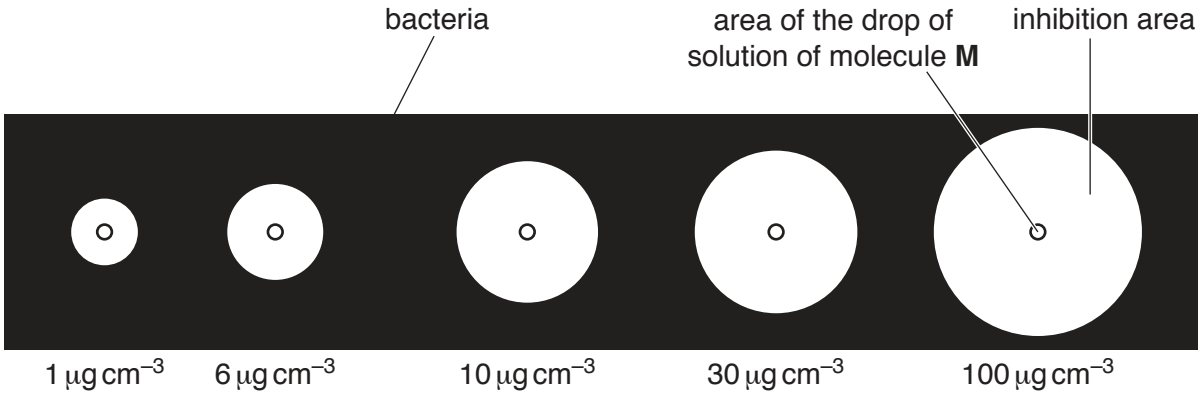


Fig. 1.1

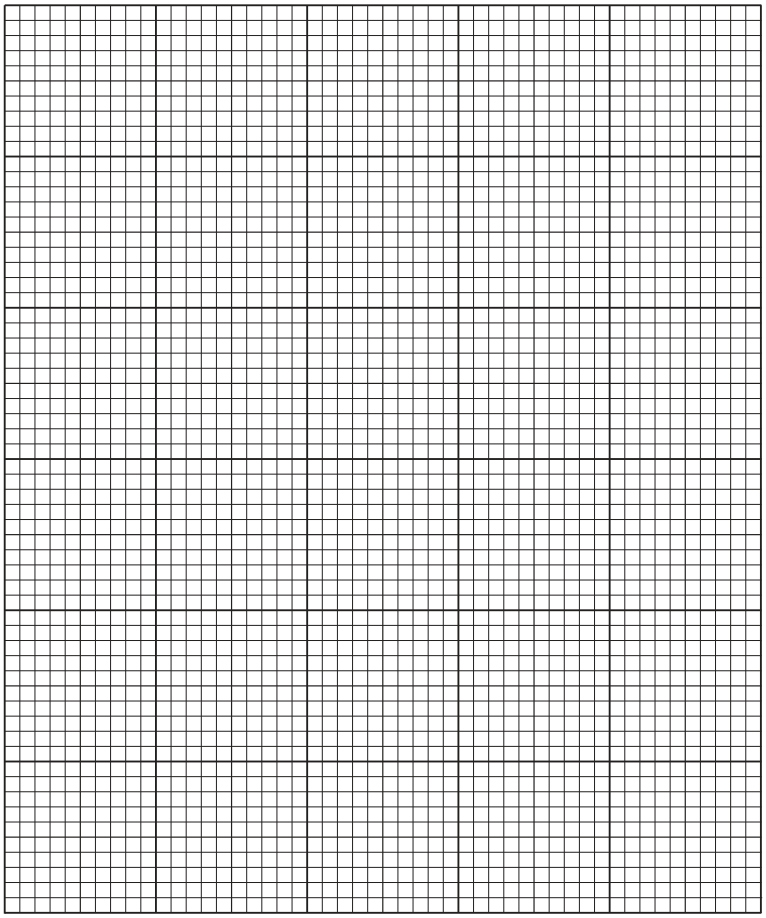
The results are shown in Table 1.2.

Table 1.2

concentration of solution of molecule M / $\mu g\,cm^{-3}$	inhibition area / mm^2
0	0
1	30
6	50
10	70
30	106
100	120

Use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 1.2.



[4]

(ii) Use your graph to estimate the inhibition area for a concentration of molecule **M** of $46\,\mu g\,cm^{-3}$.

inhibition area = ... [1]

(iii) Explain how the data support the statement that molecule **M** might act as an antibiotic.

.....

.....

..... [1]

(iv) Suggest how molecule **M** may act as an antibiotic.

.....

.....

.....

.....

..... [2]

[Total: 21]

Question 2 starts on page 10

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

You are not expected to be familiar with this specimen.

You are required to:

- use the eyepiece graticule to measure depths of different tissues across the leaf
- use these measurements to find the simplest ratio of the depth of the leaf to the depth of the palisade layer
- draw a plan diagram of part of the leaf.

(a) Select a part of the leaf on **N1** which shows the four tissue layers **L** (**L1** and **L2**), **P** and **Q**.

Do **not** include a vascular bundle.

(i) Use the eyepiece graticule in the microscope to measure:
- the depth of the whole leaf, **T**
- the depth of each of the tissues, **L** (**L1** and **L2**), **P** and **Q**, as shown in Fig. 2.1.

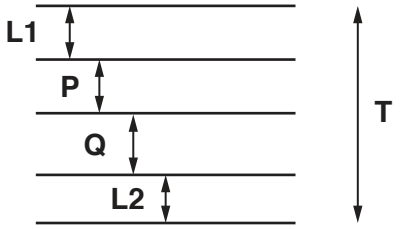


Fig. 2.1 (not drawn to scale)

T = ……. eyepiece graticule units

L1 = ……. eyepiece graticule units

P = ……. eyepiece graticule units

Q = ……. eyepiece graticule units

L2 = ……. eyepiece graticule units

[3]

(ii) Use the measurements from **(a)(i)** to determine the simplest ratio of the depth of the leaf (**T**) to the depth of the palisade layer.

You may lose marks if you do not show your working.

simplest ratio ..... [3]

Use a sharp pencil for drawing.

(iii) Use the measurements from **(a)(i)** to help you draw a large plan diagram of the part of the leaf on **N1**, as shown by the shaded area in Fig. 2.2.

This must include at least **one** vascular bundle.

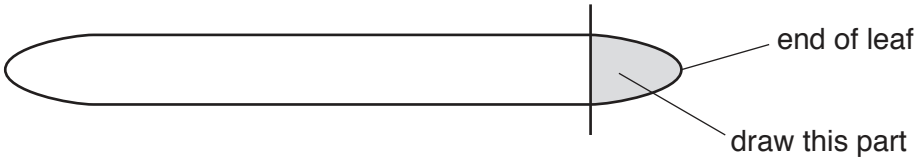


Fig. 2.2

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

Use **one** ruled label line and label to identify the palisade layer.

[5]

(iv) Observe the cells of the epidermis at the end of the leaf on **N1** as shown in Fig. 2.2. These cells are not identical.

Select one group of **four** adjacent (touching) cells which show some of the differences between these cells. Each cell must touch at least one 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.

[5]

(b) Fig. 2.3 is a photomicrograph of a stained transverse section through a different type of leaf.

You are not expected to be familiar with this specimen.

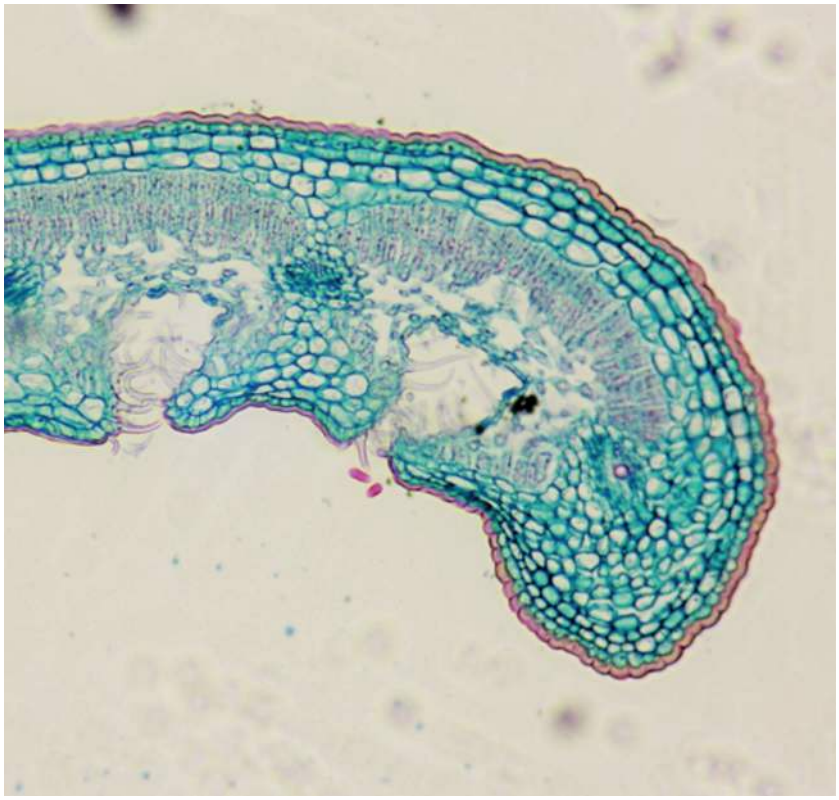


Fig. 2.3

Annotate Fig. 2.3 to describe **three** observable differences between the leaf sections in Fig. 2.3 and on **N1** by:

- drawing label lines to **three** features in Fig. 2.3 that show these differences
- describing next to each line how each feature is different from the specimen **N1**. [3]

[Total: 19]

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