Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2225442478

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 2016**

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 **12** printed pages and **4** blank pages.

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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 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 Antibiotics are tested by observing how effective the antibiotics are at killing bacteria or preventing their growth.
Agar blocks can be used to set up a model for antibiotic testing.
In this model an acid represents the antibiotic solution and the blue stain in the agar block represents the bacteria.

You will investigate the effect of the antibiotic solution (independent variable) on 'killing the bacteria', shown by the blue colour changing to yellow as the end-point.

You are required to:
- prepare different concentrations of the antibiotic solution, **A**, using serial dilution
- record the time taken to reach the end-point (yellow) for each of the concentrations of **A**
- record the time taken to reach the end-point for an unknown concentration of antibiotic solution, **U**
- use the results to estimate the concentration of antibiotic in **U**.

You are provided with:

labelled	contents	hazard	volume / cm^3
A	1% acid (antibiotic solution)	irritant	50
W	distilled water	none	100
U	unknown concentration of acid (antibiotic solution)	irritant	30
B	agar block containing a blue stain	none	–

You are advised to wear suitable eye protection, especially when using the antibiotic solution, **A**.
If **A** comes into contact with your skin, wash off with cold water.

(a) When carrying out a practical procedure the hazards of using the solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

State the hazard with the greatest level of risk when using the solutions then state the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....[1]

(b) You are required to make a **serial** dilution of the 1% antibiotic solution, **A**, which reduces the concentration **by half** between each successive dilution.

You will need to **prepare** 20 cm^3 of each concentration.

Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

(i) Complete Fig. 1.1 by drawing as many extra beakers as you need for your serial dilution.

For each beaker:

- state, under the beaker, the **volume** and **concentration** of the antibiotic solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **volume** and **concentration** of antibiotic solution added to prepare the concentration
- use another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

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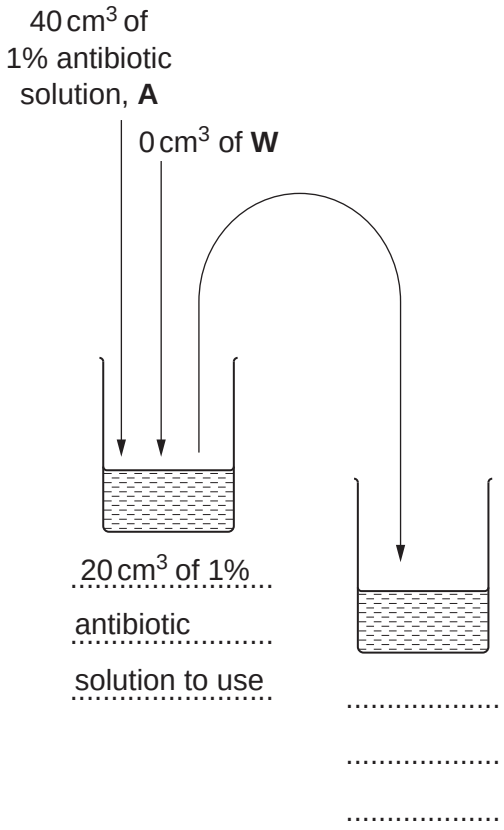

40 cm3 of
1% antibiotic
solution, A
0 cm3 of W
20 cm3 of 1%
antibiotic
solution to use

Fig. 1.1

[3]

Proceed as follows:

1. Prepare the concentrations of antibiotic solution as decided in **(b)(i)** and as shown in Fig. 1.1.

2. Adjust the volumes so that there is 20 cm^3 of antibiotic solution in each beaker.

3. Label a beaker as **U** and put 20 cm^3 of **U** into this beaker.

You will need to cut the agar block, **B**, into smaller pieces as shown in Fig. 1.2.

To avoid staining your skin, try not to touch the agar. You may use the blunt forceps and paper towels to handle the agar.

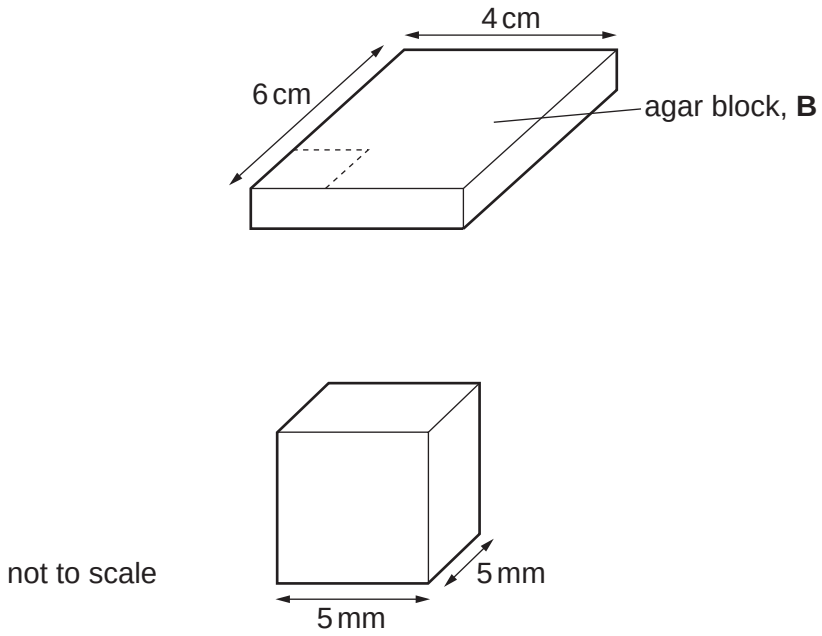


Fig. 1.2

4. Place the agar block, **B**, onto a white tile and cut into identical pieces, each 5 mm × 5 mm as shown in Fig. 1.2. You do not need to adjust the depth.

5. Put one piece of agar into each beaker containing the concentrations prepared in step 1 and start timing.

6. Gently stir the contents of each beaker at intervals.

7. Record in **(b)(ii)** the time taken for the pieces of agar to reach the end-point.

   Note that the colour of the agar may change from blue to green and then to yellow.

   If any piece of agar has not changed to yellow after 240 s, **stop timing** and record as 'more than 240'.

   Note that the same concentrations of antibiotic solution can be used again.

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

[5]

8. Put one piece of agar into the beaker labelled **U** and start timing.

(iii) Record the time taken for the piece of agar in **U** to change to reach the end-point.

time taken ..... [1]

(iv) Use your results in **(b)(ii)** and **(b)(iii)** to estimate the concentration of antibiotic solution in **U**.

.....[1]

(v) Identify **one** significant source of error in this investigation.

.....

.....[1]

(vi) This procedure investigated the effect of the concentration of the antibiotic solution (the independent variable) on its diffusion into stained agar blocks.

To modify this procedure for investigating the effect of another independent variable, the concentration of antibiotic solution would need to be standardised.

Describe how the concentration of antibiotic solution could be standardised.

.....

.....

Describe how you would modify this procedure to investigate the effect of the independent variable, **temperature**, on diffusion into stained agar blocks.

.....

.....

.....

.....

.....[3]

(c) In your investigation the antibiotic solution entered the agar blocks by diffusion.

In animals, some substances cross cell surface membranes either by simple diffusion or by facilitated diffusion.

A student investigated the rate of glucose uptake into animal cells.

These animal cells were placed into different concentrations of glucose and the rate of glucose uptake into the cells was measured.

All the other variables were standardised.

The results are shown in Table 1.1.

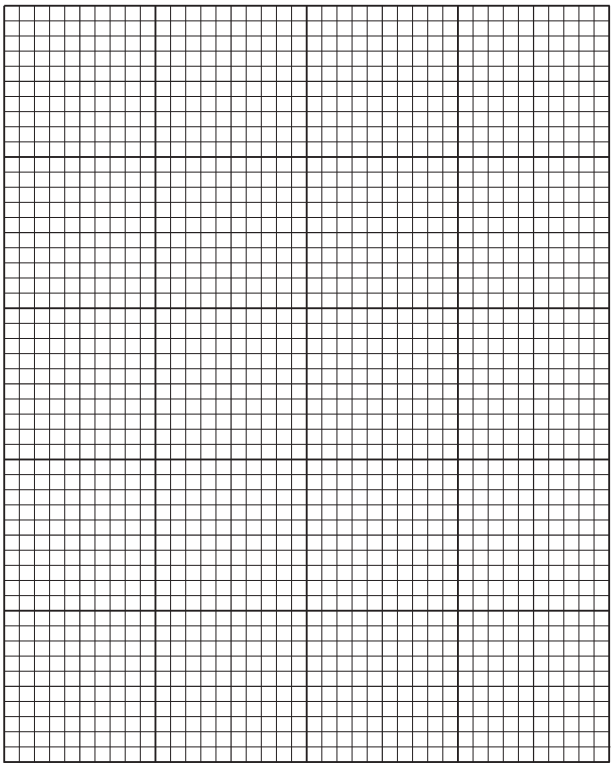
Table 1.1

external concentration of glucose / mmol dm^{-3}	rate of glucose uptake by cells / mmol cm^{-3} h^{-1}
0	0
1	205
3	320
5	395
10	450
20	455

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You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 1.1.



[4]

(ii) Use your graph to estimate the rate of glucose uptake by cells for an external concentration of glucose of 7 mmol dm^{-3}.

Show on your graph how you estimated the rate of glucose uptake.

rate of glucose uptake ..... mmol cm^{-3} h^{-1} [1]

(iii) Using the graph, explain how the results of the investigation support the idea that glucose enters cells by facilitated diffusion.

.....

.....

.....

.....

.....[2]

[Total: 22]

2 **M1** is a slide of a stained transverse section through a plant leaf.

You are not expected to be familiar with this specimen.

This leaf has several vascular bundles along its length.

(a) Select the central vascular bundle which is larger than the others.

You are required to use a sharp pencil for drawings.

(i) Draw a large plan diagram of the quarter of the **midrib** shown by the shaded area in Fig. 2.1.

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

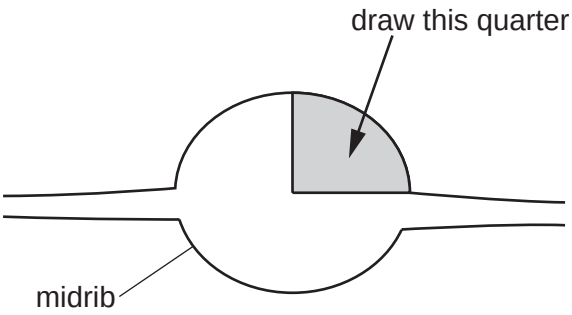


Fig. 2.1

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

[4]

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(ii) Observe the xylem tissue in the vascular bundle of the midrib on **M1**.

Select one group of **four** adjacent (touching) cells in a chain.

Each cell of the chain 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. 2.2 is a photomicrograph of a stained transverse section through a different type of leaf, including the midrib.

You are not expected to be familiar with this specimen.

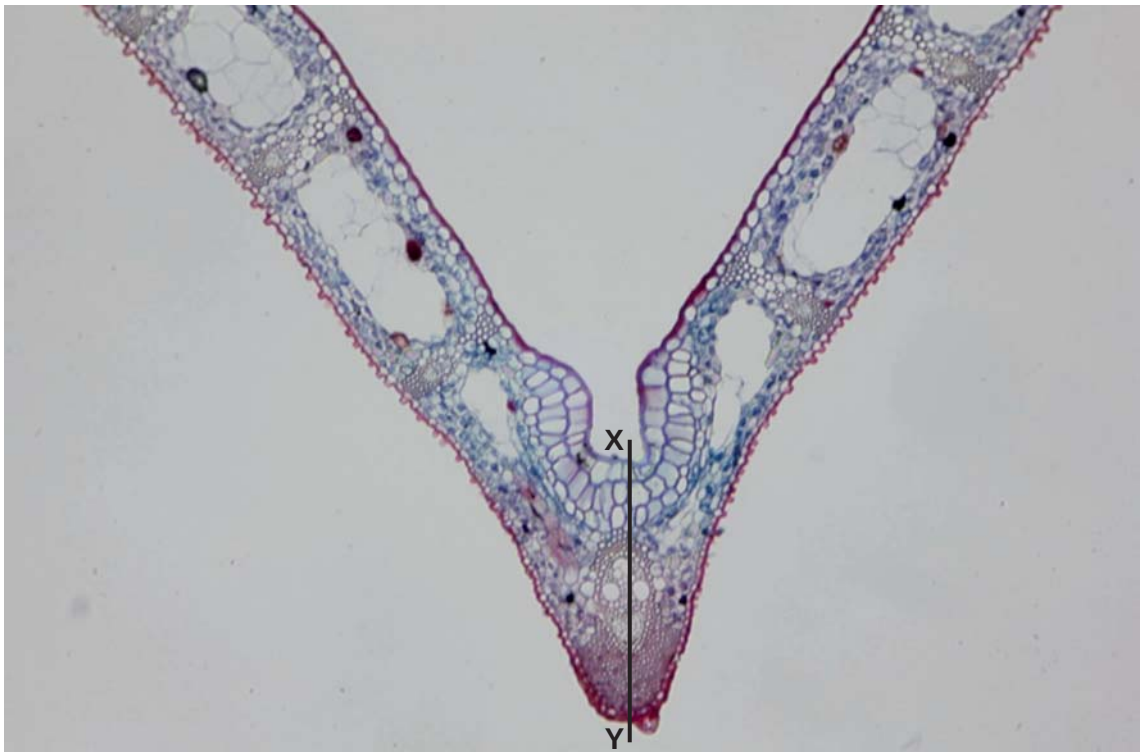


Fig. 2.2

(i) Use the line **X–Y** to determine the simplest ratio of the depth of the midrib to the length of the vascular bundle.

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

simplest ratio ..... [4]

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(ii) Suggest **one** observable feature, shown in Fig. 2.2, which supports the conclusion that this plant may grow in an aquatic habitat.

.....

.....[1]

(c) Prepare the space below so that it is suitable for you to record observable differences between the leaf midrib on **M1** and the leaf midrib in Fig. 2.2.

Record your observations in the space you have prepared.

[4]

[Total: 18]

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