Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7608871349

BIOLOGY **9700/34**

Advanced Practical Skills 2 **May/June 2014**

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 ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, 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 **14** printed pages and **2** 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, consider how you can improve the accuracy of your results, for example by obtaining one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Many plant cells contain a water soluble molecule called ascorbic acid, which has many functions to help the plant survive.

You are provided with an extract from plant cells, **P**, which contains ascorbic acid.

Visking tubing, **V**, is selectively permeable, similar to a cell surface membrane, so that some biological molecules will diffuse through the wall of the tubing.

You are required to investigate the diffusion of ascorbic acid from **P** into the water surrounding the Visking tubing over a period of 15 minutes.

Fig. 1.1 shows the apparatus before the water was added.

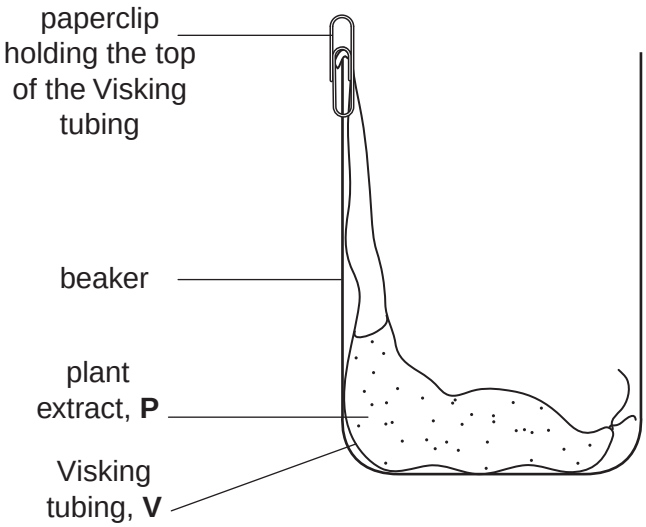


Fig. 1.1

(a) (i) Water is added to the beaker in Fig. 1.1.
Describe the expected trend in the concentration of ascorbic acid in the water over a period of 15 minutes.

..... [1]

You are provided with:

labelled	contents	hazard	volume / cm^3
A	sample of water removed after 15 minutes	irritant	15
P	plant extract containing ascorbic acid	irritant	15
W	distilled water	none	100
I	iodine in potassium iodide solution	irritant	20
S	starch	none	20

labelled	details
V	15 cm length of Visking tubing in a beaker containing water

You must now read up to the end of step 23 before proceeding.

To compare the concentration of ascorbic acid in the samples you are required to find the **volume** of iodine solution, **I**, added to each sample until the end-point is reached.

The drops of **I** will be added one at a time using a small syringe.

To practise releasing drops from a small syringe:

1. Fill the syringe with 2 cm^3 of **I**.

2. Hold the syringe over an **empty** test-tube and push the plunger **gently** to release one drop at a time, as shown in Fig. 1.2.

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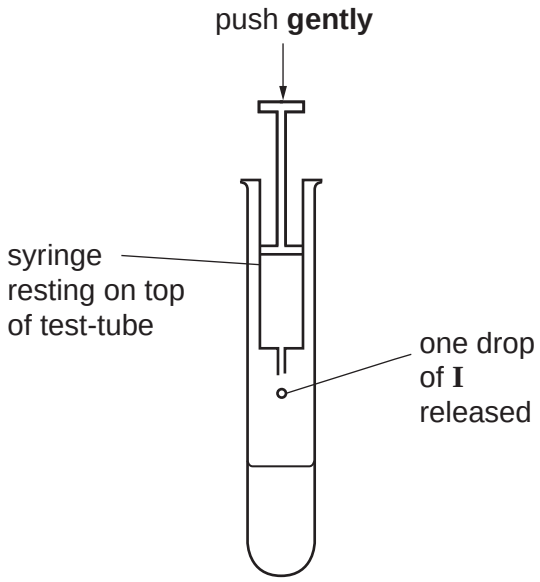


Fig. 1.2

To compare the concentration of ascorbic acid in the samples you will need to add drops of **I** until a blue colour appears. When this blue colour lasts for more than 10 seconds, this is the end-point and the **volume of I** that has been added should be recorded.

The apparatus in Fig. 1.1 was set-up and water was added and left for 15 minutes.
Sample **A** was removed from the water in the beaker.

You are required to find the volume of **I** needed to reach the end-point for sample **A**.

Proceed as follows:

3. Put 1 cm^3 of **S** into a test-tube.

4. Put 3 cm^3 of the sample (e.g. **A**) into the same test-tube.

5. Shake the test-tube gently to mix the contents.

6. Fill the syringe, labelled **I**, with 2 cm^3 of **I**.

7. Wipe off any drops of **I** from the outside of the syringe with a paper towel.

8. Add **one** drop of **I** to the mixture in the test-tube as shown in Fig. 1.2.

9. Mix gently and if there is no colour change add another drop.

10. Continue adding drops, one at a time, until the blue colour appears.
    Wait 10 seconds to see if the end-point has been reached. If the blue colour disappears then add another drop.

11. Repeat step 10 until the mixture stays blue for at least 10 seconds.

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(ii) Record the **volume of I** needed to reach the end-point.

volume ..... [1]

You are required to:

- set up Visking tubing containing **P** as in Fig. 1.3
- decide the level of water to put into the beaker
- remove samples of the water surrounding the Visking tubing at **5 minute intervals** for 15 minutes
- compare the ascorbic acid concentrations in the samples.

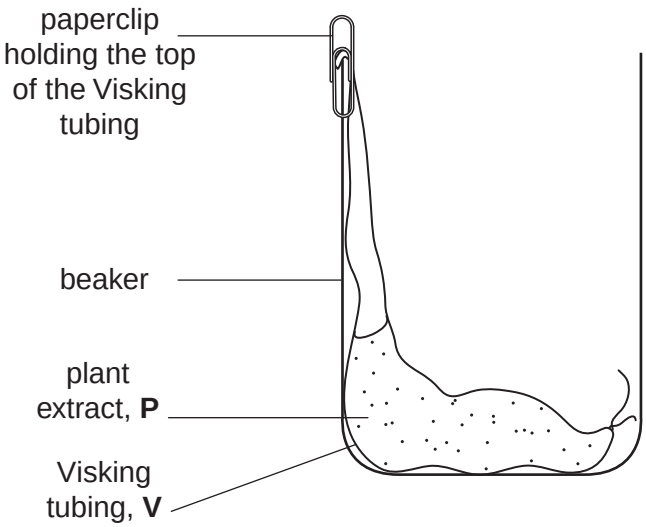


Fig. 1.3

Samples of water surrounding the Visking tubing will be removed for testing, so you need to take this into account when you decide the level of water to put into the beaker.

(iii) Draw **on Fig. 1.3** the level of the water

- before you remove any samples (label 'before'),
- after the total volume of water needed for all the tests has been removed (label 'after').

[2]

(iv) In order to compare the ascorbic acid concentrations, state **one** variable which you will need to standardise when finding the volume of **I** added to each sample.

Describe how you will standardise this variable.

variable .....

description .....

.....

[1]

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Proceed as follows:

12. Put **S**, as in step 3, into the four test-tubes you will require in order to test the samples of water.

13. Tie a knot in the Visking tubing as close as possible to one end so that it seals the end.

14. To open the other end, wet the Visking tubing and rub the tubing gently between your fingers.

15. Put 6 cm^3 of **P** into the open end of the Visking tubing.

16. Rinse the outside of the Visking tubing by dipping it into the water in the container labelled **V**.

17. Put the Visking tubing into an empty beaker as shown in Fig. 1.3.

18. Make sure the open end of the Visking tubing is held in place by a paperclip.

You will start timing as soon as you add **W** (**steps 19 and 20**).

You should read steps 19 to 23 before proceeding.

19. Put **W** into the beaker to the level you decided in **(iii)**.

20. Immediately start timing and remove the first sample of water (as in **step 4**) and put into a prepared test-tube (as in **step 12**).

21. Test the sample as in **steps 5 to 11**.

22. After 5 minutes, gently mix the water surrounding the Visking tubing and then remove the next sample, put it into a different (prepared) test-tube and repeat **steps 5 to 11**.

23. Repeat **step 22** for two more samples.

Record your results in **(a)(v)** on page 8.

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[Turn over

(v) Prepare the space below and record your results.

[5]

(vi) Describe how the results support your expected trend as stated in **(a)(i)**.

.....

.....

..... [1]

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This investigation provides results to compare the concentration of ascorbic acid in the samples.

(vii) If you had been provided with 1.0% ascorbic acid solution, suggest how you would modify this investigation to find the **percentage concentration** of ascorbic acid in the water after 15 minutes.

.....

.....

.....

.....

.....

.....

..... [2]

(viii) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

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[Turn over

(b) Iodine solution (iodine in potassium iodide solution) turns blue-black when starch is present in plant tissues.

However, as ascorbic acid is also found in plant tissues, some scientists investigated the effect of testing for starch with iodine solution when there was ascorbic acid present.

The concentration of ascorbic acid was $0.0001\,\text{mol}\,\text{dm}^{-3}$ and the concentration of starch solution was standardised.

The percentage of starch which reacted with the iodine solution was measured.

The results are shown in Table 1.1.

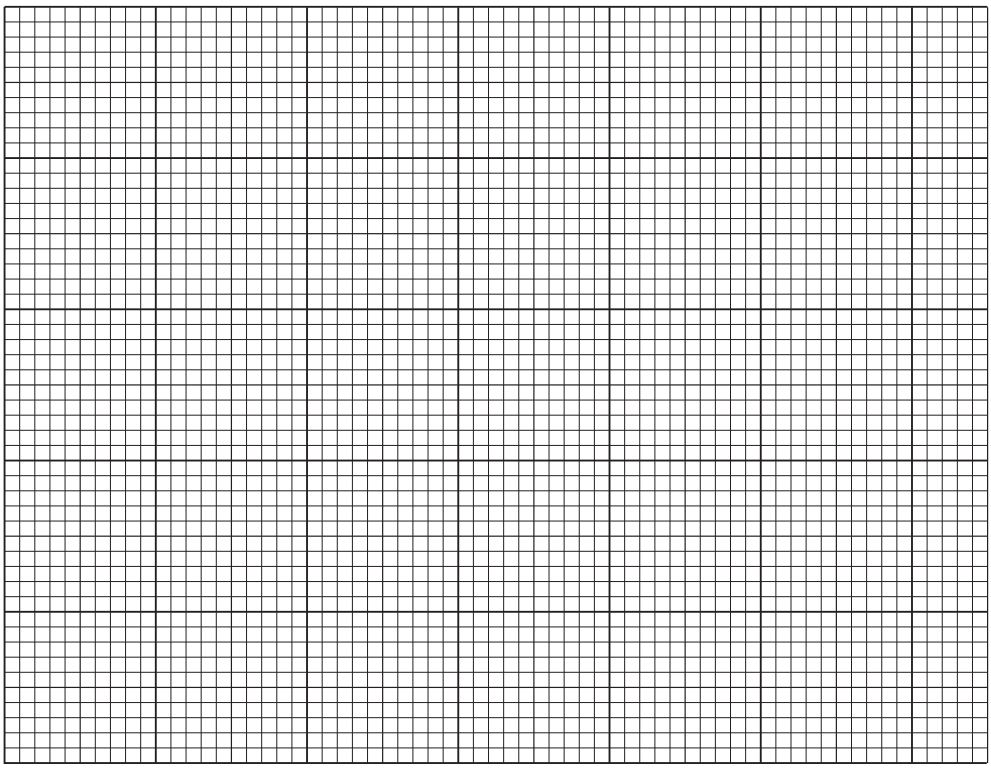
Table 1.1

volume of iodine solution / cm^3	percentage of starch which reacted with iodine solution
0.0	0.0
0.5	2.0
1.5	5.0
2.0	36.0
2.5	68.0

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

*You will need to consider the answer to **(b)(ii)** before you plot your graph.*



[4]

(ii) Estimate the volume of iodine solution needed for 100% of the starch to be reacted. Show on your graph how you obtained the volume of iodine solution.

volume of iodine solution ..... cm^3 [1]

(iii) Explain how the presence of ascorbic acid may affect the use of iodine solution as a test for the presence of starch in different plant tissues.

.....

.....

.....

.....

..... [2]

(iv) A plant tissue contains 0.0001 mol dm^{-3} ascorbic acid and starch.
Suggest how you would make sure that the iodine test showed the presence of all the starch (100%).

.....

.....

..... [1]

[Total: 22]

2 The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissues or cells, if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportions of tissues or cells, as in **(a)(i)**, it is **not** necessary to calibrate the eyepiece graticule scale.

(a) **M1** is a stained transverse section showing the tissues where there is gas exchange in a mammal.

(i) Make a large drawing to show the details of **three** whole structures which are specialised for gas exchange (alveoli). The walls of one alveolus must be touching the walls of the other two alveoli.

On your drawing, use a ruled label line and label to show **one** nucleus.

[4]

(ii) On your drawing, use a ruled label line and label to show where gas exchange takes place. [1]

(iii) State **one observable** feature, shown in your drawing, that supports the conclusion that gas exchange is a function of this tissue.

Explain how this feature enables gas exchange to take place.

feature .....

explanation .....

.....

[2]

(b) Fig. 2.1 is a photomicrograph of a stained transverse section through the tissues in a leaf where gas exchange takes place. This plant species is native to South America.

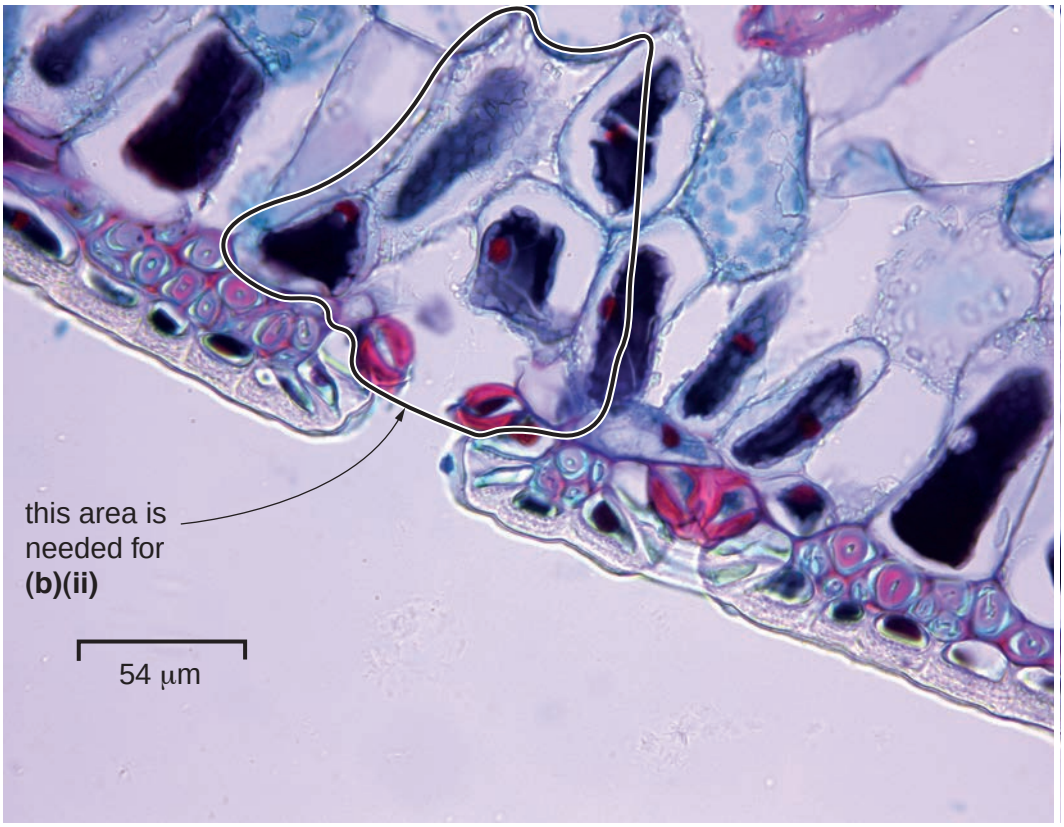


Fig. 2.1

(i) Use a ruled label line and the label **Z on Fig. 2.1** to show **one** observable feature which has reduced transpiration.
Explain how this feature has decreased the rate of transpiration.

.....

..... [2]

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(ii) Make a large drawing of the whole cells shown **inside** the area shown by the line on Fig. 2.1.

On your drawing, use a ruled label line and label to **one** guard cell.

[5]

(iii) Calculate the magnification of Fig. 2.1 using the scale bar.

You may lose marks if you do not show your working or if you do not use appropriate units.

magnification × ..... [4]

[Total: 18]

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