UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0790342953

BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **May/June 2010**

1 hour 15 minutes

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.

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	

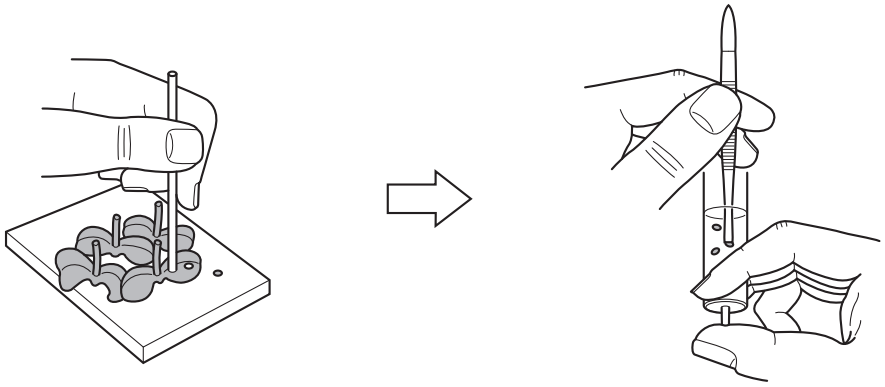
This document consists of **10** printed pages and **2** blank pages.

DC (SHW) 00479 5/09 16009/5
© UCLES 2010

For Examiner's Use

1 Many plants produce two types of leaves. One type is produced where the leaves develop in full sunlight and are called 'sun leaves'. The other type is produced where the leaves develop in the shade and are called 'shade leaves'.

A student investigated photosynthesis in both types of leaves using leaf discs. Fig. 1.1 shows the method used by the student to obtain the leaf discs.



1. leaf discs cut using a plastic straw

2. forceps used to place six leaf discs into 0.2 mol dm^{-3} sodium hydrogen carbonate solution in a syringe barrel

Fig. 1.1

The student then carried out the following actions:

3. replaced the plunger into the syringe, turned the syringe upside down and pushed in the plunger to force out all the air
4. placed a finger over the open end of the syringe and pulled down the plunger to create a vacuum
5. tapped the side of the syringe to remove air bubbles
6. repeated actions 3–5 until the leaf discs sank to the bottom of the syringe.

© UCLES 2010

The student measured the rate of photosynthesis of discs from both types of leaves to test the hypothesis

For Examiner's Use

Leaf discs from shade leaves will photosynthesise at a higher rate in low light intensity than leaf discs from sun leaves.

Fig. 1.2 shows the appearance of the leaf discs in the syringe as they photosynthesise.

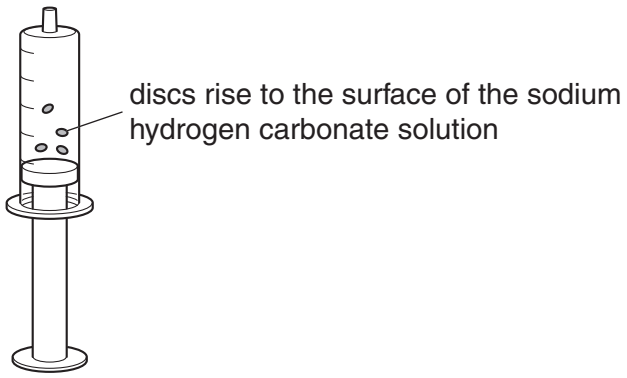


Fig. 1.2

(a) (i) Explain why the leaf discs rise to the surface in the light.

.....

..... [1]

(ii) Using this method, outline how the student could test the hypothesis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

For Examiner's Use

.....

.....

.....

Fig. 1.3 shows the results that the student plotted from the investigation.

For Examiner's Use

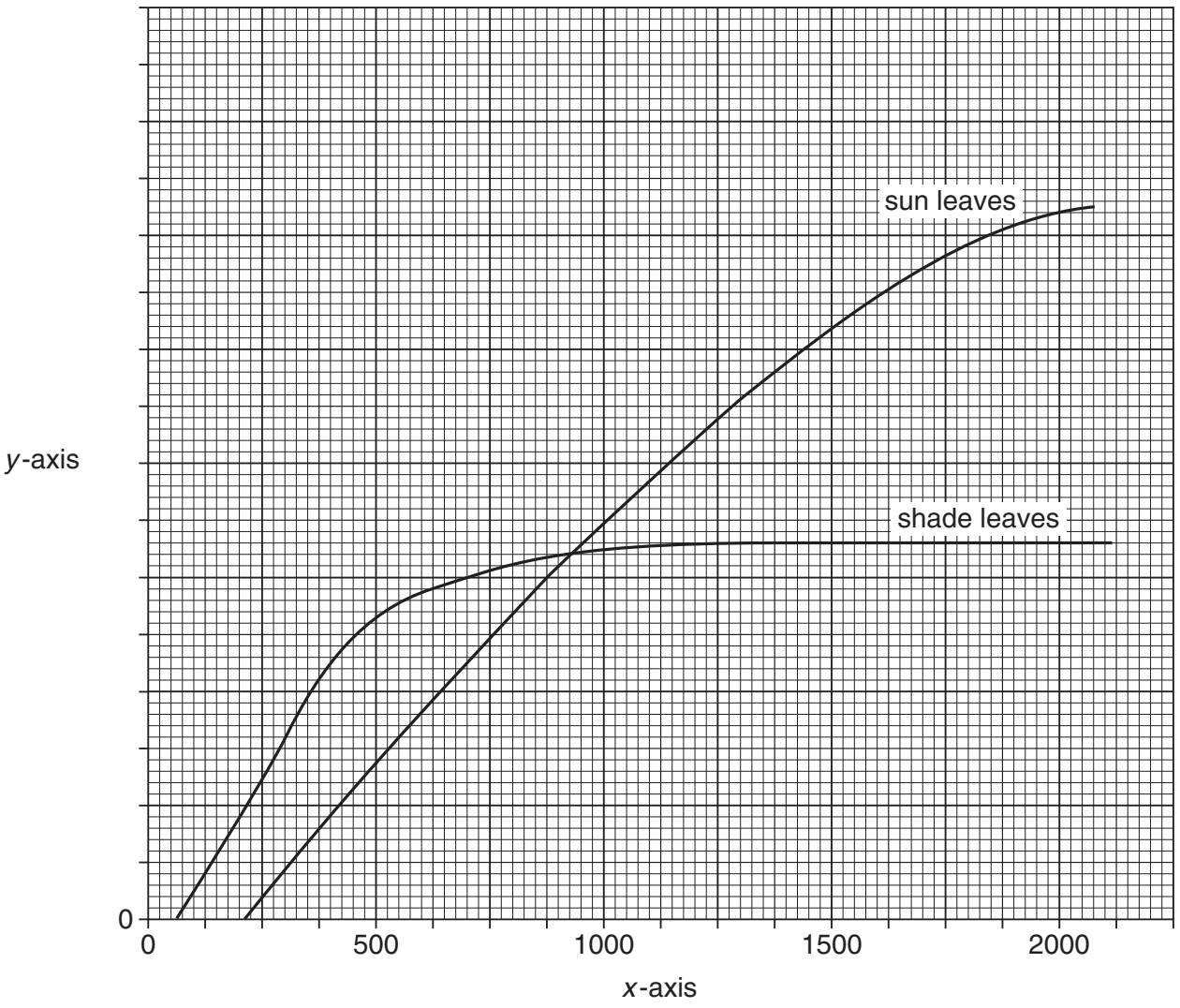


Fig. 1.3

(b) (i) Suggest labels for the axes of this graph.

x-axis .....

.....

y-axis .....

..... [2]

(ii) State two ways in which the student's data support the hypothesis.

1. .....

.....

2. .....

..... [2]

In a further investigation using these two types of leaves, the student estimated the number of stomata per unit area. Epidermal strips from the lower surface of the leaf were mounted in water and observed under a microscope.

For Examiner's Use

The diameter of the field of view was measured using an eyepiece graticule. The actual field of view was calculated using a calibration value from a slide micrometer scale.

Diameter of field of view at ×100 magnification = 0.5 mm

(c) (i) Calculate the area of the field of view. Use the formula $\pi \mathbf{r}^2$. ($\pi = \frac{22}{7}$ or $\pi = 3.14$)

Give your answer to one significant figure.

..... [1]

(ii) Table 1.1 shows the results of the stomatal count investigation.

Table 1.1

	number of stomata visible at ×100 magnification										mean number of stomata	number of stomata per mm^2
sun leaves	21	24	36	24	15	18	27	33	18	24	24±6	120
shade leaves	36	39	35	42	28	36	34	40	48	32	37±6	

Calculate the mean number of stomata per mm^2 for the shade leaves.
Show your working below and write your answer in Table 1.1.

[2]

© UCLES 2010

For Examiner's Use

(iii) State the null hypothesis for a statistical test to find out whether the difference in the number of stomata is significant.

.....

..... [1]

(iv) Name a statistical test that could be used and give the reason for your answer.

.....

..... [2]

(d) The results of the statistical test showed that the difference was significant.

Suggest **one** reason why there is a difference in the number of stomata of shade leaves and sun leaves.

.....

..... [1]

[Total: 19]

2 One technique used for studying antigen-antibody reactions is immunodiffusion.

For Examiner's Use

Wells are cut into an agar support medium to contain antigens and antibodies. Antibodies and antigens diffuse out of the wells into the agar. If an antigen meets a complementary antibody a reaction occurs causing a band of precipitate to appear.

Fig. 2.1 shows the results of an immunodiffusion test with known antigens **P** and **Q** and the antibodies to these antigens.

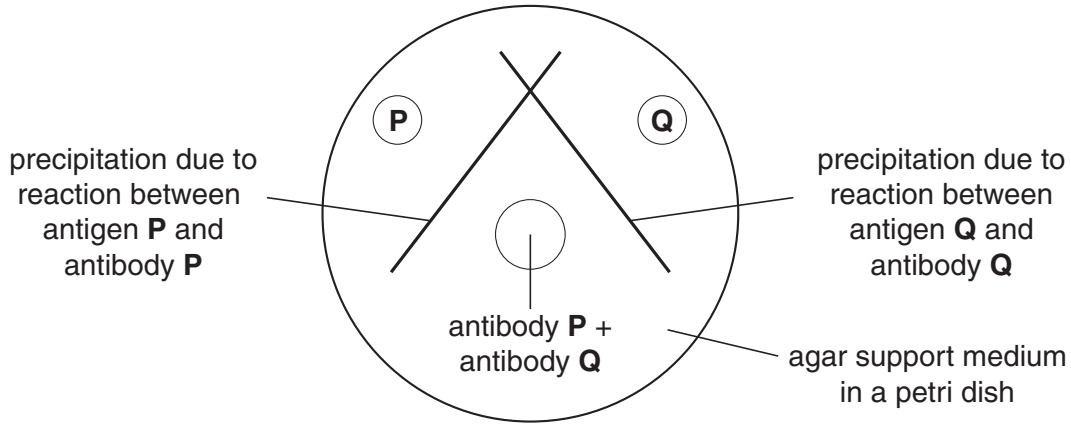


Fig. 2.1

In an investigation, the serum from two test organisms was tested for the presence of antibodies to specific antigens. Both organisms had been previously exposed to both antigens. The serum was placed in wells at the edge of the petri dish and the antigens in a central well.

Fig. 2.2 shows the test set-up.

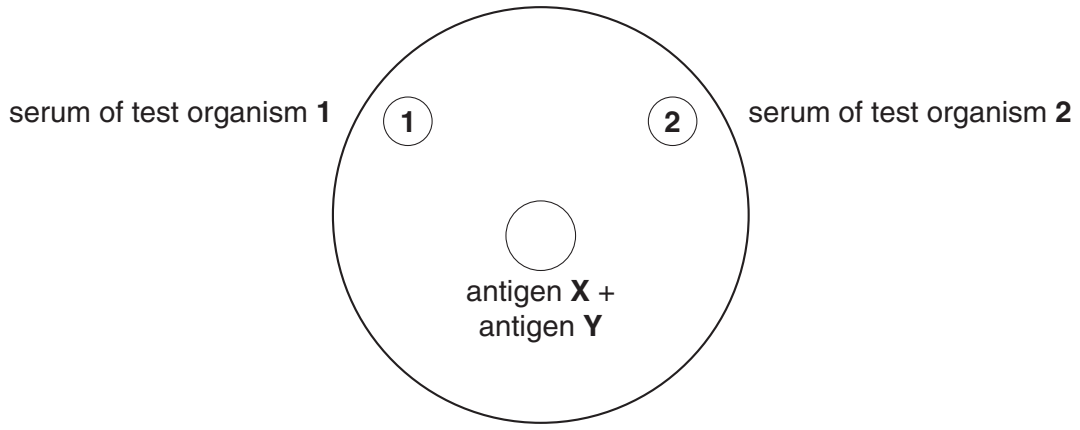


Fig. 2.2

© UCLES 2010

For Examiner's Use

(a) (i) Suggest **one** variable that must be controlled in this procedure.

..... [1]

(ii) State the independent variable in this investigation.

..... [1]

(iii) Both test organisms had antibodies against antigen **X**, but only organism **2** had antibodies against antigen **Y**.

On Fig. 2.2 draw lines to represent where precipitation might have occurred for both organisms. [2]

(b) Suggest two disadvantages of immunodiffusion for detecting antigens.

1. .....

.....

2. .....

..... [2]

For Examiner's Use

(c) A naturally occurring mutant of *Plasmodium* sp. has been tested for use as a 'whole organism' vaccination against malaria. The mutant organism develops normally in mosquito vectors and infects the salivary glands in the same way as non-mutant wild type *Plasmodium* sp. In mice, the mutant infects liver cells but does not multiply and cannot enter red blood cells.

Trials using mice were carried out and the effectiveness of the mutant organism as a vaccine tested by injecting non-mutant wild type *Plasmodium* sp. into vaccinated and non-vaccinated mice.

Table 2.1 shows the results of investigations in mice using the mutant *Plasmodium* sp.

Table 2.1

	number of mutant *Plasmodium* cells given to the mice			percentage of mice not infected by wild type *Plasmodium* sp.
test group	first inoculation	first booster inoculation	second booster inoculation	
1	0	0	0	0
2	50 000	25 000	25 000	100
3	10 000	10 000	10 000	100
4	10 000	10 000	0	70

(i) Suggest the purpose of including each of the following test groups.

group 1 .....

.....

groups 2 and 3 .....

.....

group 4 .....

..... [3]

(ii) Using the information in the question, outline a procedure that might be used to obtain mutant *Plasmodium* sp. to use in the vaccination trials.

.....

.....

.....

..... [2]

[Total: 11]

© UCLES 2010

BLANK PAGE

© UCLES 2010

BLANK PAGE

Copyright Acknowledgements:

Figure 1.2 © Appearance of leaf discs in a syringe; http://www-saps.plantsci.cam.ac.uk/worksheets/scotland/sunshade.htm
Figure 2.1 © W R Clark; *The Experimental Foundations of Modern Immunology*; 4th Ed; Wiley & Sons Inc; 1991.

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2010

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

* 3 7 1 3 7 5 3 5 2 3 *

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2010**

1 hour 15 minutes

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.

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 **7** printed pages and **1** blank page.

© UCLES 2010

1 Fig. 1.1 shows one type of potometer used by a student to investigate transpiration.

For Examiner's Use

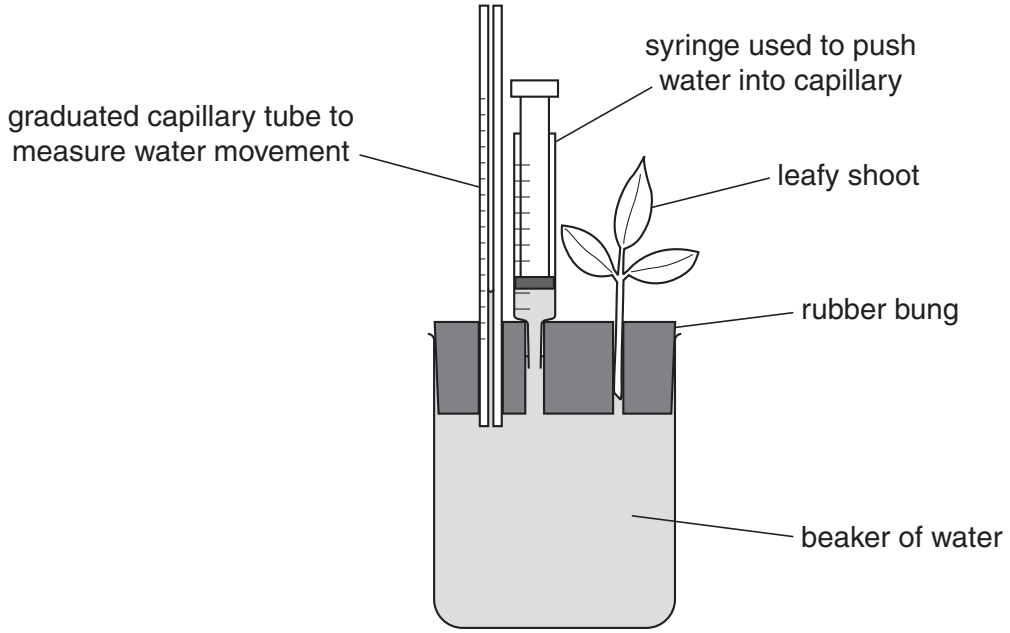


Fig. 1.1

(a) (i) Suggest a hypothesis the student could test about the transpiration of a mesophyte (a plant adapted to a moist environment) and a xerophyte (a plant adapted to a dry environment).

.....

..... [1]

(ii) Using this potometer, outline a procedure that the student could use to test this hypothesis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

© UCLES 2010

For Examiner's Use

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [8]

(iii) The capillary tube measures the distance moved by the water. Explain how the actual volume of water lost can be calculated.

.....

.....

..... [2]

(b) Sketch a graph to predict the expected results of the investigation.

[2]

For Examiner's Use

(c) (i) The student then measured the surface area of the leaves by tracing the outline on a grid and counting the number of squares covered by the leaves. This area was doubled.

Mesophyte:
surface area of leaves = 36 cm^2
water loss in 30 minutes = 0.018 cm^3

Calculate the rate of water loss in $cm^3\,m^{-2}\,min^{-1}$.

Show all the steps in your calculation.

[3]

(ii) State a statistical test that the student could use to find out if the difference in water loss between the two types of leaf is significant. State a reason for your choice.

.....

..... [2]

(d) In a further investigation the student measured the loss in mass of each type of leaf.

Fig. 1.2 shows the experimental set-up.

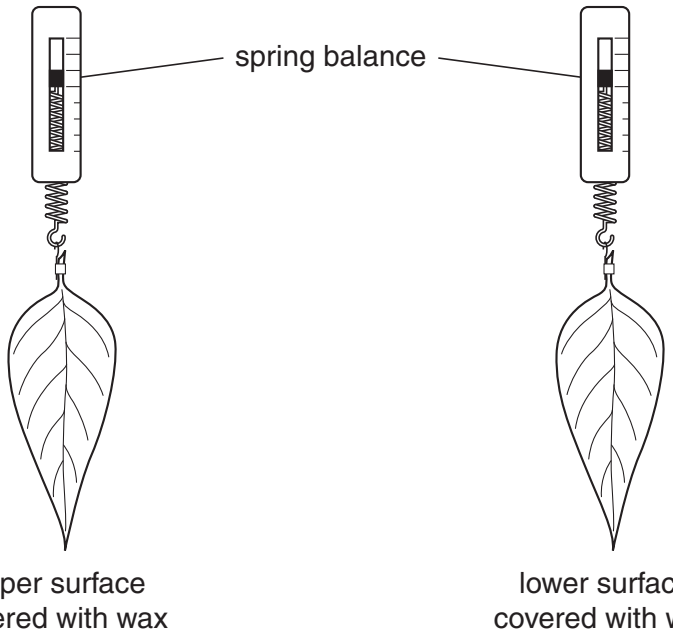


Fig. 1.2

© UCLES 2010

Table 1.1 shows the results of this investigation.

For Examiner's Use

Table 1.1

day	loss in mass / g per day			
	upper side covered		lower side covered	
	mesophyte	xerophyte	mesophyte	xerophyte
1	4.25	0.55	1.15	0.05
2	3.20	0.35	1.00	0.05
3	1.55	0.20	0.75	0.00
4	0.50	0.10	0.95	0.05
5	0.05	0.04	1.00	0.00
total loss in mass / g	9.55	1.24	4.85	0.15

State three conclusions that can be drawn from these results.

1. .....

.....

2. .....

.....

3. .....

..... [3]

[Total: 21]

For Examiner's Use

2 The effects of the concentration of two amino acids was tested on the growth of fibroblast cells from mice. The following procedure was used:

- a culture of 2000–3000 cells was added to a growth medium containing all the required nutrients other than the amino acids being tested
- a total of ten cultures were used for each concentration of amino acid
- the cells in the culture were fed every two days with fresh amino acid solution
- after 6 days five cell samples from each of the cultures were counted
- the proportional increase in cell number was calculated for each culture.

Table 2.1 shows the results of this investigation.

Table 2.1

	mean proportional increase in cell number									
	concentration of amino acid added / mmol dm^{-3}									
	0.0	0.1	0.2	0.5	1.0	2.5	5.0	10.0	20.0	40.0
glutamine	0.5	1.0	5.2	7.6	8.7	6.3	1.2	1.3	0.0	0.0
glutamic acid	0.4	0.2	0.1	0.3	0.4	0.4	0.4	0.6	0.8	0.3

(a) State two variables that should be controlled in this investigation. For each, suggest a method by which it might be controlled.

1. .....

.....

.....

.....

2. .....

.....

.....

..... [4]

(b) Explain how the proportional increase in cell number is calculated.

.....

..... [1]

© UCLES 2010

(c) The hypothesis tested was

Growth of fibroblasts is stimulated by glutamine and inhibited by glutamic acid.

Assess how far the results support the hypothesis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 9]

For Examiner's Use

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2010

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2101163070

BIOLOGY **9700/53**

Paper 5 Planning, Analysis and Evaluation **May/June 2010**

1 hour 15 minutes

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.

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 **7** printed pages and **1** blank page.

© UCLES 2010

1 Fig. 1.1 shows one type of potometer used by a student to investigate transpiration.

For Examiner's Use

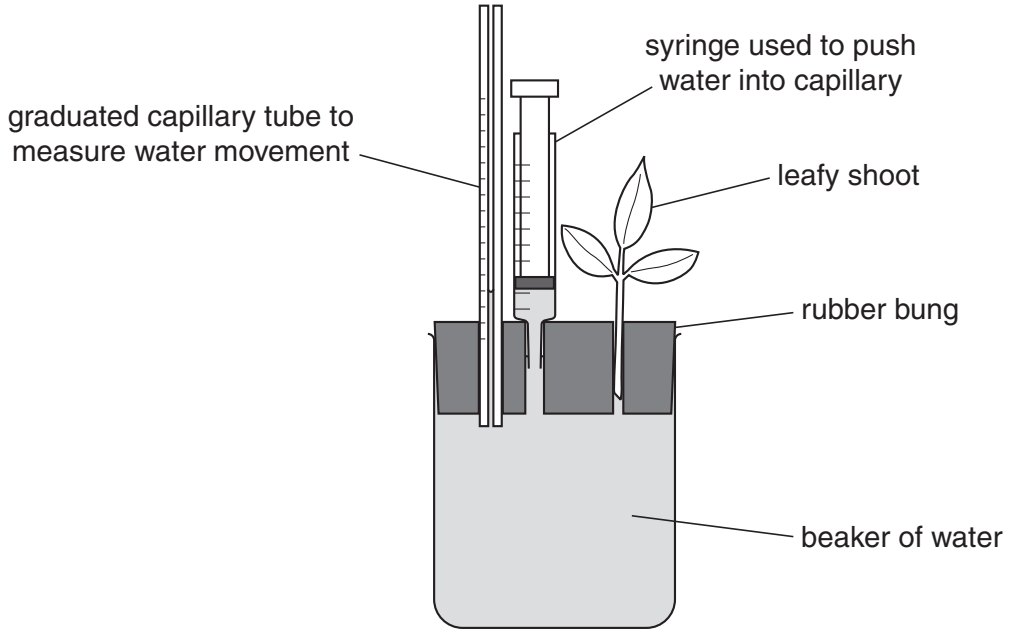


Fig. 1.1

(a) (i) Suggest a hypothesis the student could test about the transpiration of a mesophyte (a plant adapted to a moist environment) and a xerophyte (a plant adapted to a dry environment).

.....

..... [1]

(ii) Using this potometer, outline a procedure that the student could use to test this hypothesis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

© UCLES 2010

For Examiner's Use

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [8]

(iii) The capillary tube measures the distance moved by the water. Explain how the actual volume of water lost can be calculated.

.....

.....

..... [2]

(b) Sketch a graph to predict the expected results of the investigation.

[2]

For Examiner's Use

(c) (i) The student then measured the surface area of the leaves by tracing the outline on a grid and counting the number of squares covered by the leaves. This area was doubled.

Mesophyte:
surface area of leaves = 36 cm^2
water loss in 30 minutes = 0.018 cm^3

Calculate the rate of water loss in $cm^3\,m^{-2}\,min^{-1}$.

Show all the steps in your calculation.

[3]

(ii) State a statistical test that the student could use to find out if the difference in water loss between the two types of leaf is significant. State a reason for your choice.

.....

..... [2]

(d) In a further investigation the student measured the loss in mass of each type of leaf.

Fig. 1.2 shows the experimental set-up.

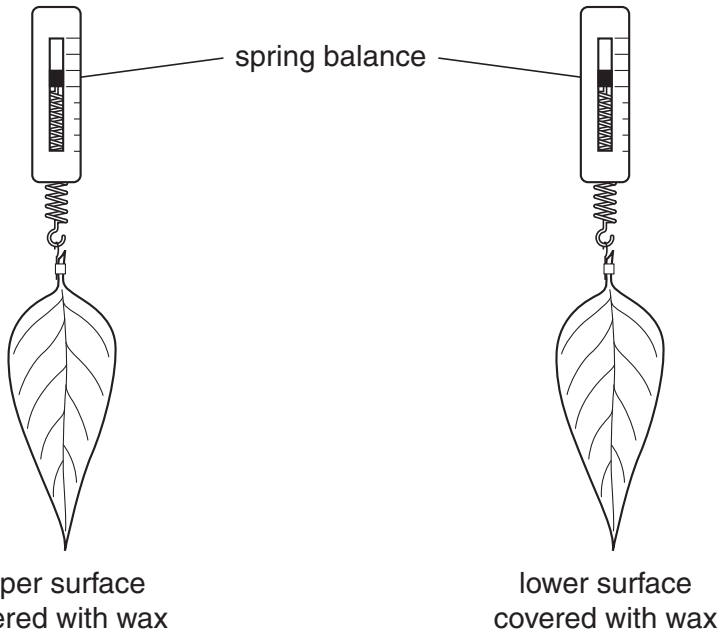


Fig. 1.2

© UCLES 2010

Table 1.1 shows the results of this investigation.

For Examiner's Use

Table 1.1

day	loss in mass / g per day			
	upper side covered		lower side covered	
	mesophyte	xerophyte	mesophyte	xerophyte
1	4.25	0.55	1.15	0.05
2	3.20	0.35	1.00	0.05
3	1.55	0.20	0.75	0.00
4	0.50	0.10	0.95	0.05
5	0.05	0.04	1.00	0.00
total loss in mass / g	9.55	1.24	4.85	0.15

State three conclusions that can be drawn from these results.

1. .....

.....

2. .....

.....

3. .....

..... [3]

[Total: 21]

For Examiner's Use

2 The effects of the concentration of two amino acids was tested on the growth of fibroblast cells from mice. The following procedure was used:

- a culture of 2000–3000 cells was added to a growth medium containing all the required nutrients other than the amino acids being tested
- a total of ten cultures were used for each concentration of amino acid
- the cells in the culture were fed every two days with fresh amino acid solution
- after 6 days five cell samples from each of the cultures were counted
- the proportional increase in cell number was calculated for each culture.

Table 2.1 shows the results of this investigation.

Table 2.1

	mean proportional increase in cell number									
	concentration of amino acid added / mmol dm^{-3}									
	0.0	0.1	0.2	0.5	1.0	2.5	5.0	10.0	20.0	40.0
glutamine	0.5	1.0	5.2	7.6	8.7	6.3	1.2	1.3	0.0	0.0
glutamic acid	0.4	0.2	0.1	0.3	0.4	0.4	0.4	0.6	0.8	0.3

(a) State two variables that should be controlled in this investigation. For each, suggest a method by which it might be controlled.

1. .....

.....

.....

.....

2. .....

.....

.....

..... [4]

(b) Explain how the proportional increase in cell number is calculated.

.....

..... [1]

© UCLES 2010

(c) The hypothesis tested was

Growth of fibroblasts is stimulated by glutamine and inhibited by glutamic acid.

Assess how far the results support the hypothesis.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 9]

For Examiner's Use

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2010