CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

**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.

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|---|---|
| 1 | |
| 2 | |
| **Total** | |

This document consists of **7** printed pages and **1** blank page.

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**[Turn over**

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

graduated capillary tube to measure water movement

syringe used to push water into capillary
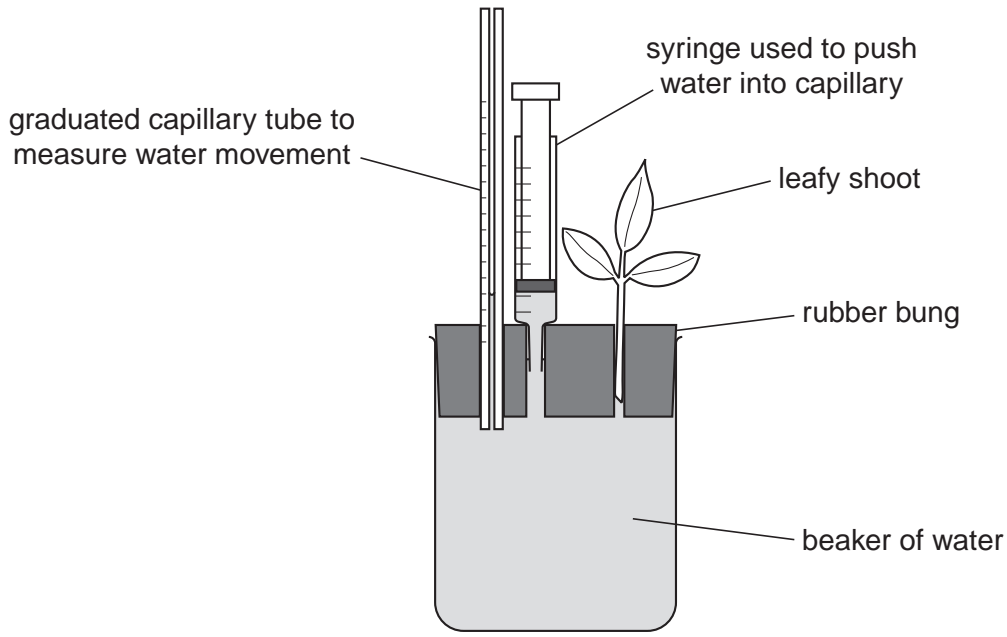
leafy shoot

rubber bung

beaker of water

**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).

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

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

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

[2]

**(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.

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**(d)** In a further investigation the student measured the loss in mass of each type of leaf.
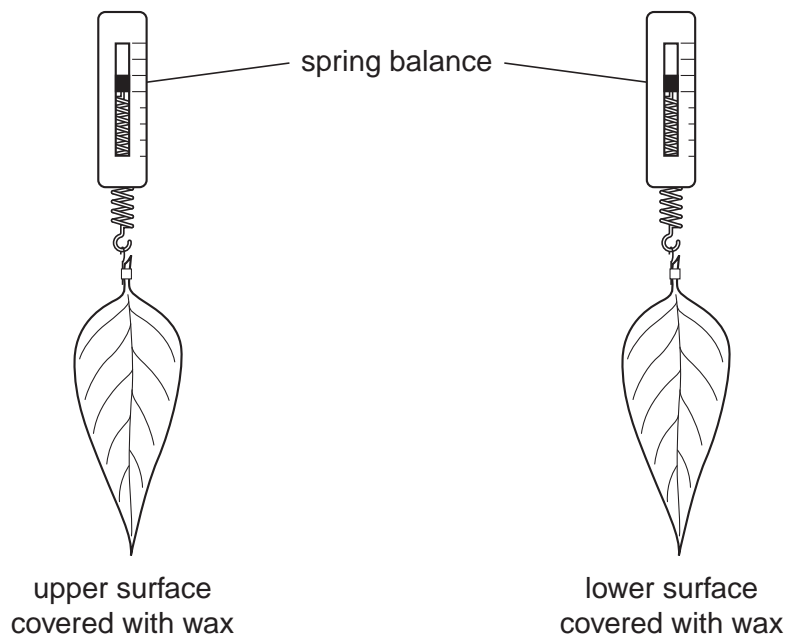
Fig. 1.2 shows the experimental set-up.



upper surface
covered with wax

lower surface
covered with wax

**Fig. 1.2**

Table 1.1 shows the results of this investigation.

**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.

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**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.

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

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**(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.

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