UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**BIOLOGY** **9700/52**

Paper 5 Planning, Analysis and Evaluation **October/November 2013**

**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 ink.
You may use a 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 **all** questions.

Electronic calculators may be used.

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.

**1** A student used the respirometer shown in Fig. 1.1 to compare the rate of respiration in:

- germinating seeds
- insect larvae
- single celled green algae living in water.

For Examiner's Use

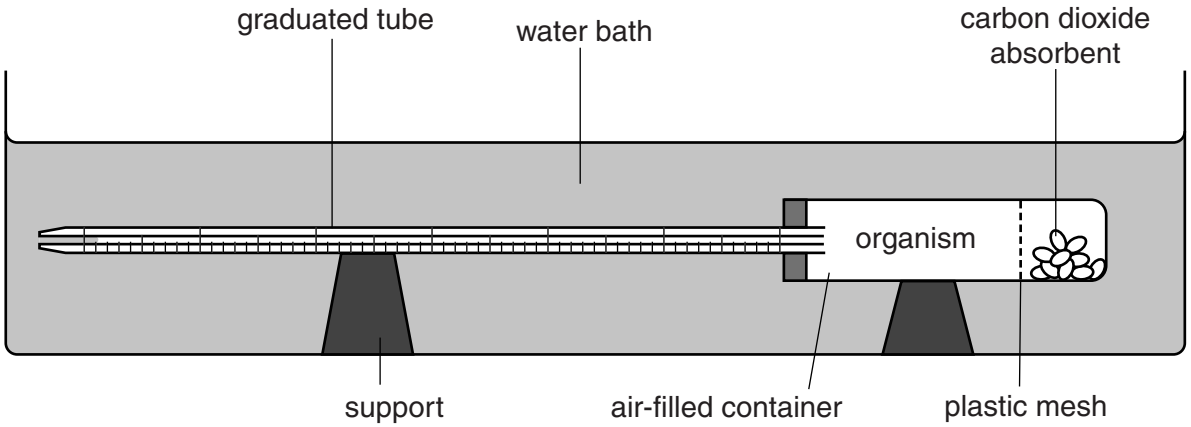


**Fig. 1.1**

After putting the germinating seeds into the air-filled container and attaching the graduated tube, the respirometer was lowered into a water bath. The seeds respired using oxygen and water moved into the graduated tube. The procedure was repeated for the other two organisms.

**(a) (i)** Suggest a hypothesis about the respiration of the different organisms that the student could test using this apparatus.

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.....[1]

**(ii)** Identify the independent and dependent variables in this investigation.

*independent variable* .....

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*dependent variable* .....

.....[2]

**(iii)** Describe a method, using the respirometer in Fig. 1.1, that the student could use to compare the rates of respiration of germinating seeds, insect larvae and a single celled green algae living in water.

*For Examiner's Use*

Your method should be detailed enough for another person to use.

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**(b)** The student calculated the rate of respiration as oxygen used per unit mass of the organisms.

Explain how this rate of respiration was calculated.

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.....[3]

**(c)** The student determined the respiratory quotient (RQ) for each of the organisms. To do this the student needed to measure the rate of carbon dioxide production.

Outline how the student should use the respirometer to find the rate of carbon dioxide production.

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**(d)** Table 1.1 shows the student's results.

**Table 1.1**

| | mean volume of oxygen used per unit mass per unit time | mean volume of carbon dioxide produced per unit mass per unit time | RQ |
|---|---|---|---|
| germinating seeds | 0.74 | 0.53 | 0.72 |
| insect larvae | 1.23 | 0.98 | |
| single-celled green algae | 0.35 | 0.34 | |

**(i)** Complete Table 1.1 by writing in the RQ values for the insect larvae and the single celled green algae. [1]

**(ii)** With reference to the RQ values in Table 1.1, what conclusions can be drawn about the type of substrate respired by each of the organisms tested?

*For Examiner's Use*

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.....[3]

[Total: 20]

**2** The shoot of a plant seedling was exposed to light from one direction for 48 hours. Fig. 2.1 shows the effect on the growth of this shoot.

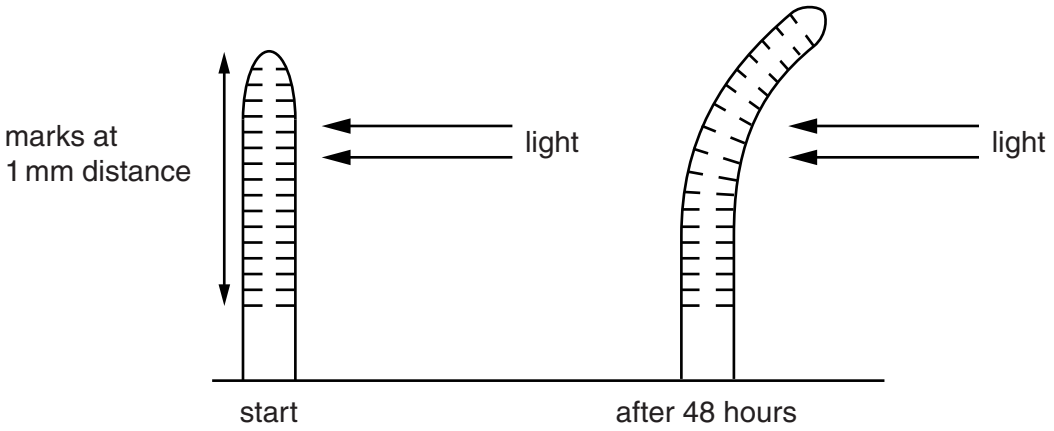


**Fig. 2.1**

There are two hypotheses about how this growth response may be controlled.

**Hypothesis A** Auxin is broken down by light on the side of the shoot closest to the light.

**Hypothesis B** Auxin moves from the side of the shoot closest to the light to the shaded side.

In an investigation to test these two hypotheses, the tips of 24 shoots were removed and divided into 4 groups of 6 shoot tips.

Fig. 2.2 shows the different treatments used for each of the groups.

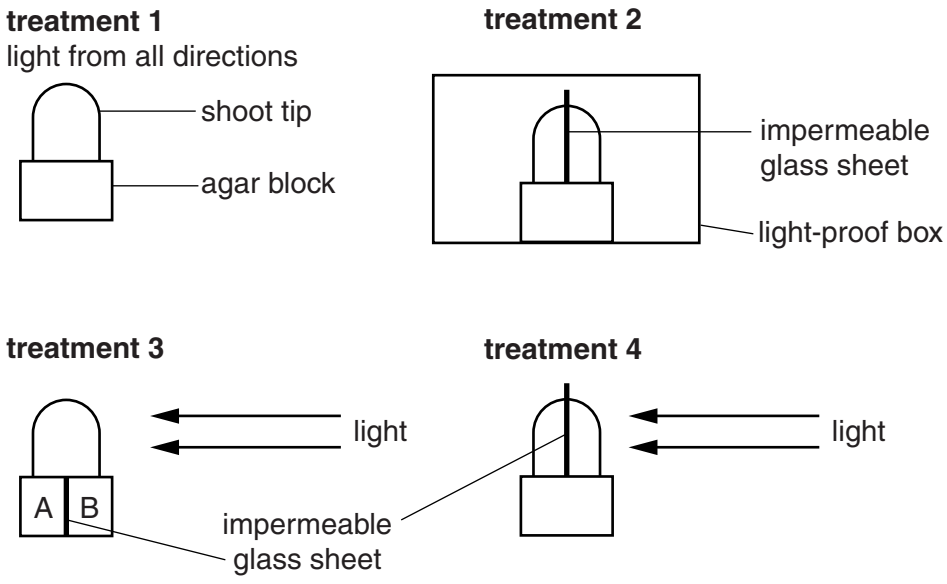


**Fig. 2.2**

Auxin diffused into the agar blocks and the concentration was measured after 4 hours of each treatment.

Table 2.1 shows the results of the investigation.

For Examiner's Use

**Table 2.1**

| treatment | 1 | 2 | 3A | 3B | 4 |
|---|---|---|---|---|---|
| mean auxin concentration ± *s* / arbitrary units | 26.1 ± 0.5 | 25.5 ± 0.2 | 17.9 ± 0.3 | 8.5 ± 0.3 | 25.8 ± 0.2 |

**(a)** State the evidence in Table 2.1 that supports hypothesis **B**.

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**(b)** **(i)** State what the standard deviations (*s*) in Table 2.1 show about the reliability of the estimate of the mean of the measurements of auxin concentration.

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**(ii)** Suggest **one** way in which the reliability of the results could be improved.

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In a further investigation the shoot tip was removed from a number of seedlings. The tips were replaced by an agar block containing auxin as shown in Fig. 2.3.

*For Examiner's Use*

*Space for diagram*

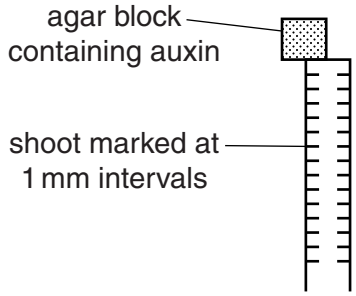


**Fig. 2.3**

**(c)** Using the information in Fig. 2.1 and Table 2.1 sketch a diagram to show how the shoot would grow after treatment.

Use the space next to Fig. 2.3 for your diagram. [2]

**(d)** The movement of auxin through the plant was measured using radioactive auxin.

Fig. 2.4 shows the main steps in the procedure.

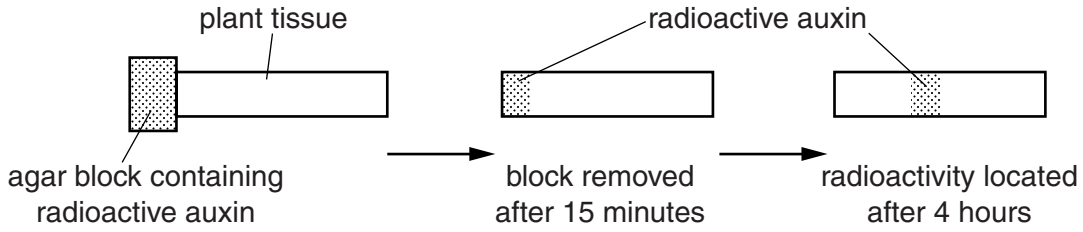


**Fig. 2.4**

Two sets of 20 samples of plant tissue were treated as shown in Fig. 2.4. Both sets were kept in air, one set in the light, the other set in complete darkness.

A *t*-test was used to find out if the difference in the rate of movement in light and the rate of movement in complete darkness was significant.

**(i)** Suggest a null hypothesis for this statistical test.

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**(ii)** Calculate the number of degrees of freedom that should be used for the *t*-test in this investigation.

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[Total: 10]