UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5082375369

BIOLOGY **9700/51**

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.

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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

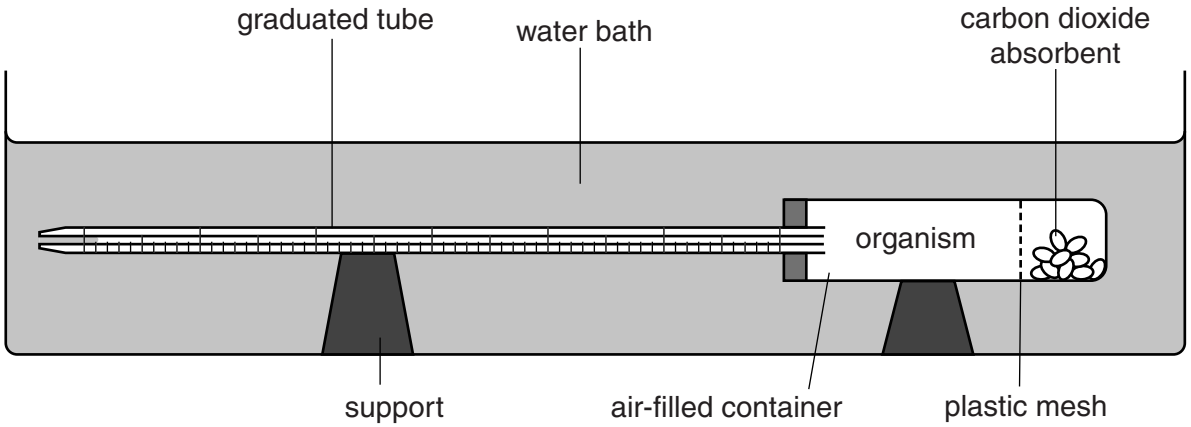


Fig. 1.1

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 .....

.....

dependent variable .....

.....[2]

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(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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.....[2]

(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]

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(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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[Total: 20]

For Examiner's Use

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.

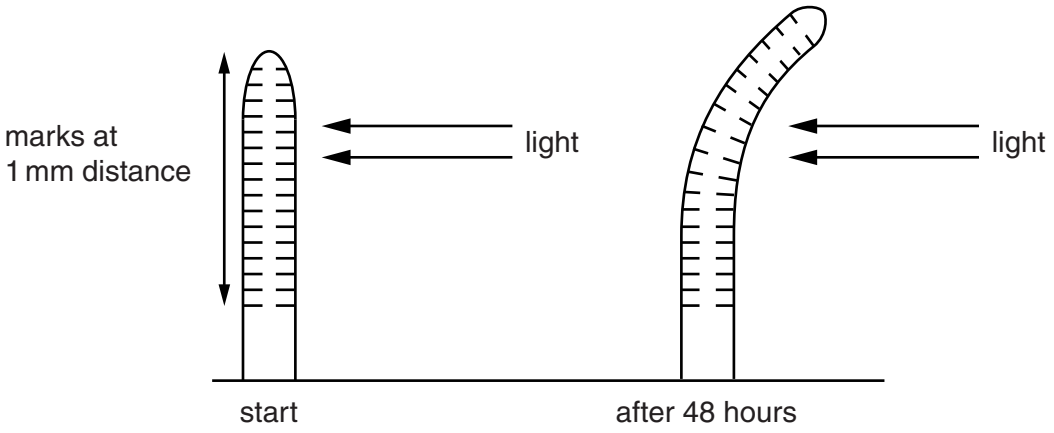


Fig. 2.1

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.

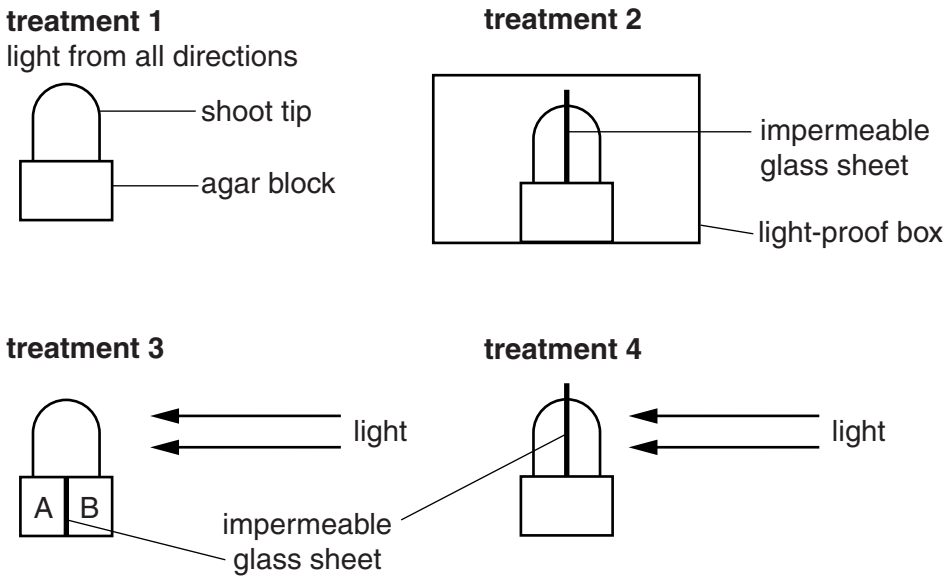


Fig. 2.2

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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.....[3]

(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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.....[2]

(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

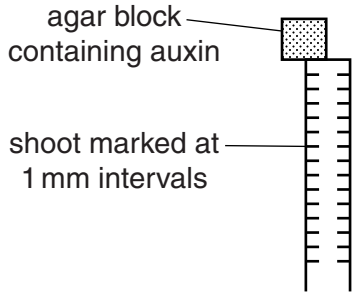


Fig. 2.3

(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.

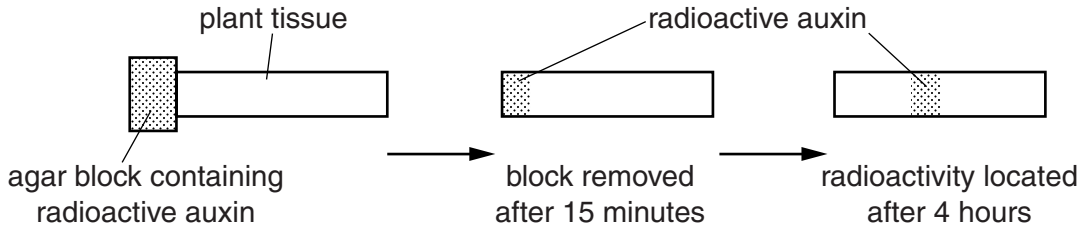


Fig. 2.4

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]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0161477939

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.

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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.

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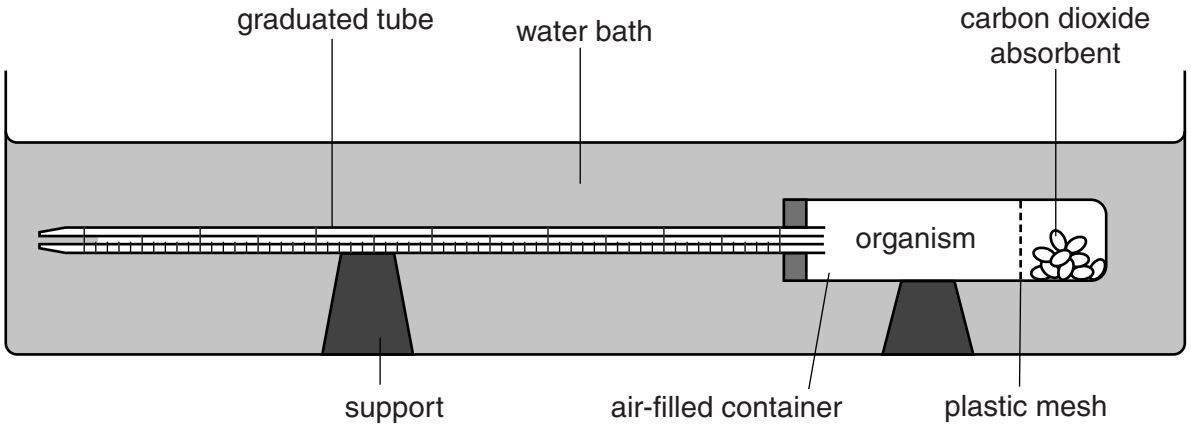


Fig. 1.1

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

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

independent variable .....

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Explain how this rate of respiration was calculated.

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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

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(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?

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[Total: 20]

For Examiner's Use

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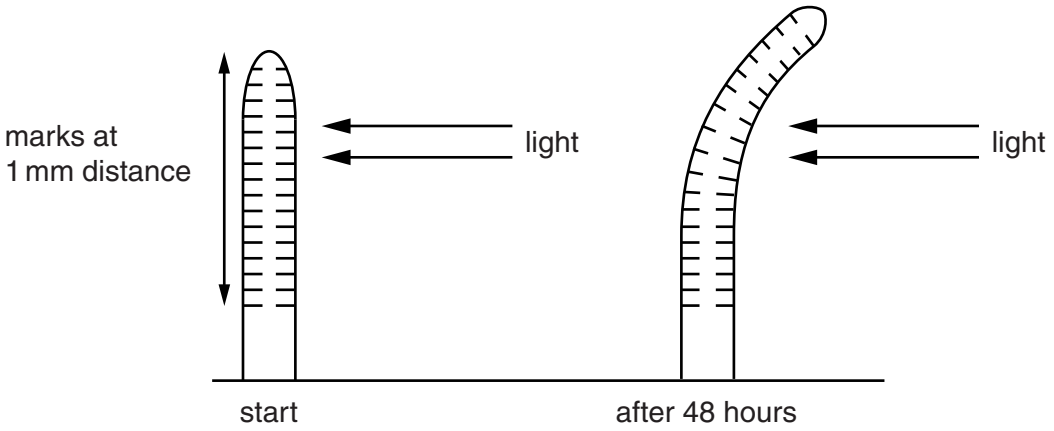


Fig. 2.1

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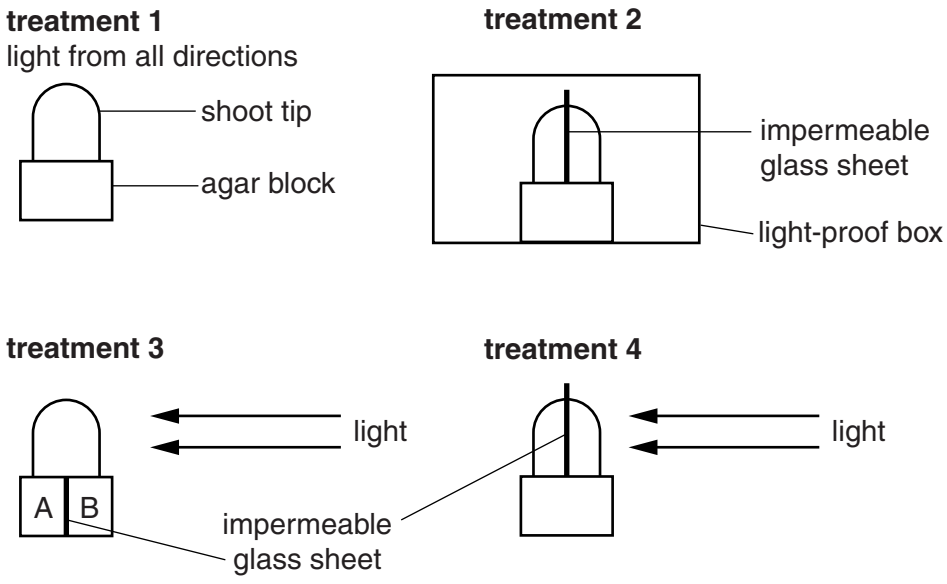


Fig. 2.2

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Table 2.1 shows the results of the investigation.

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(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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.....[2]

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

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.....[1]

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For Examiner's Use

Space for diagram

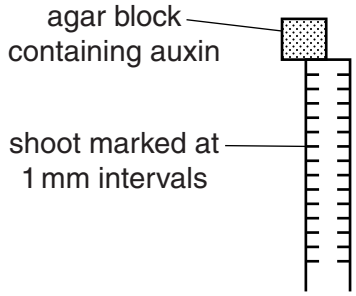


Fig. 2.3

(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.

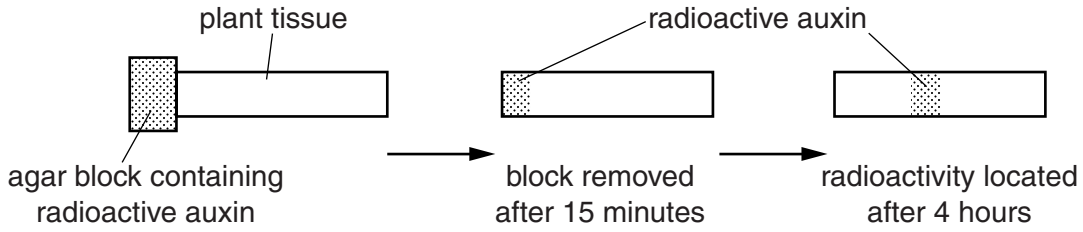


Fig. 2.4

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.

.....

.....[1]

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

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.....[1]

[Total: 10]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1531396002

BIOLOGY **9700/53**

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

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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[Turn over

1 **(a)** Fig. 1.1 shows a simple respirometer that can be used to measure the rate of respiration by measuring oxygen uptake.

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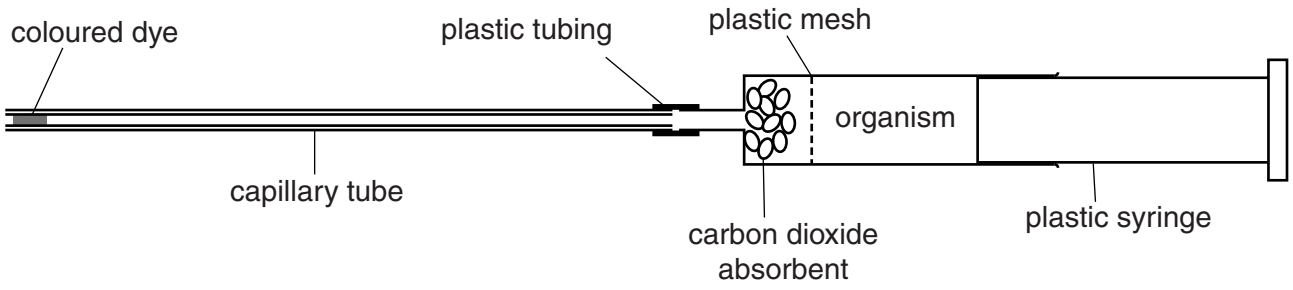


Fig. 1.1

A student used this apparatus to test the hypothesis:

The rate of respiration will double for every 10°C rise in temperature.

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

independent variable.....

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dependent variable.....

..... [2]

(ii) Sketch a graph to show the expected results **if the student's hypothesis is correct**.

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(iii) Describe how the student could use the apparatus in Fig. 1.1 to test this hypothesis using germinating seeds.

For Examiner's Use

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

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For Examiner's Use

(b) The student calculated the rate of respiration as volume of oxygen taken up per unit mass of the germinating seeds.

Explain how this rate of respiration was calculated.

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(c) Outline how the student could use the apparatus in Fig. 1.1 to find the optimum temperature for respiration in the germinating seeds.

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(d) In a different investigation the student measured the effect of external temperature on the oxygen uptake of a small mammal.

Careful attention was paid to the welfare of the mammal during the investigation.

Table 1.1 shows the results of this investigation.

Table 1.1

environmental temperature / °C	oxygen uptake / arbitrary units				
	trial 1	trial 2	trial 3	trial 4	mean
5	52	36	48	45	45.3
10	42	32	35	36	36.3
15	35	25	29	24	28.3
20	28	15	17	22	20.5
25	17	10	11	9	11.8
30	14	11	13	10	12.0
35	12	10	11	11	11.0

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(i) State why the student decided that the results from trial 1 were anomalous.

For Examiner's Use

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.....[1]

(ii) Suggest a reason for the cause of these anomalous results in trial 1.

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(iii) Suggest an explanation for the higher rates of oxygen uptake of the small mammal at the low temperatures.

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[Total: 21]

For Examiner's Use

2 **(a)** In plants the growth regulator, auxin, is synthesised in the stem tip and moves away from the tip. The movement of auxin through plant tissues was investigated using bean seedlings as shown in Fig. 2.1.

The following procedure was used.

- Stems were cut into 60 mm lengths.
- Agar blocks containing radioactive auxin were placed on the apical surfaces of two groups of stem lengths.
- The basal ends of the stem lengths were placed on agar blocks without any auxin to provide support.

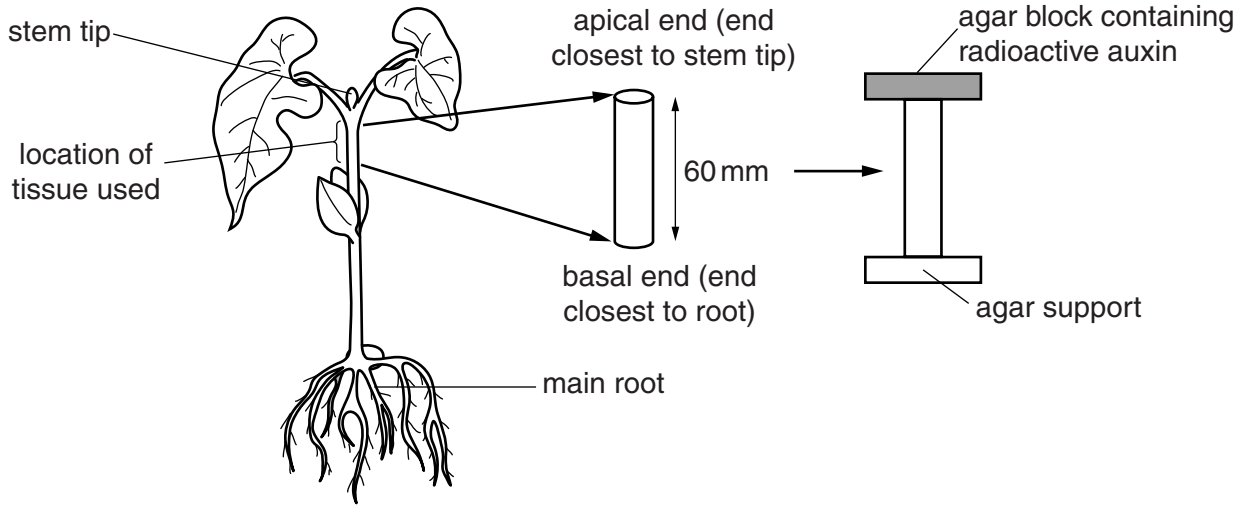


Fig. 2.1

- After 10 minutes the agar blocks at the apical ends were removed.
- One group of stem lengths was placed in air and the other group in an atmosphere of nitrogen.
- Both groups were left in light for 30 minutes after removing the agar blocks.
- The position of the radioactivity was located.

Fig. 2.2 shows the results of the investigation.

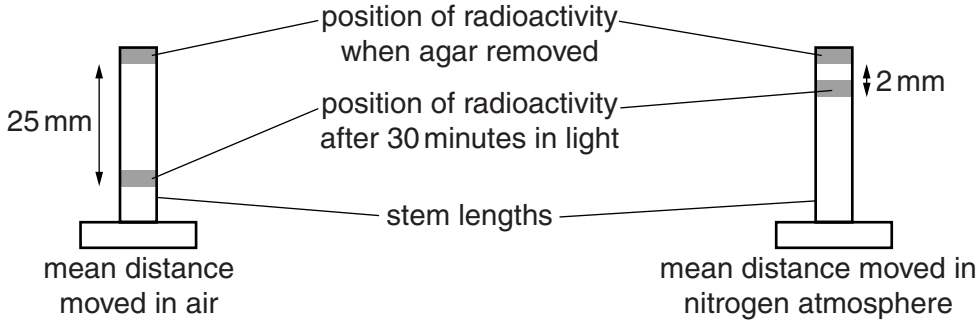


Fig. 2.2

(i) Identify one variable that should be standardised during this investigation.

.....[1]

(ii) Suggest **one** conclusion that can be made from these results.

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.....[1]

For Examiner's Use

(iii) Calculate the rate in mm h^{-1} of movement of auxin in air.

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.....[1]

(b) A similar investigation was carried out to test the hypothesis:

The rate of movement of auxin will be faster in plants grown in the light than plants grown in the dark.

Table 2.1 shows the results of this investigation.

Table 2.1

plants grown in light										**plants grown in the dark**									
sample number										sample number									
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
rate of movement mm h^{-1}																			
56	61	66	52	50	68	76	51	55	64	45	52	42	35	55	38	32	37	45	51
mean ± standard deviation *(s)* = 59.9 ± 8.5										mean ± standard deviation *(s)* = 43.2 ± 7.7									

(i) State **two** pieces of evidence from Table 2.1 that support the hypothesis.

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.....[2]

(ii) A *t*-test was carried out to see if the difference in the rates of movement of auxin in plants grown in the light and plants grown in the dark was significant.

Suggest a null hypothesis for this statistical test.

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(iii) Explain how the student should use the value for *t* to find out if the difference in the rates of movement of auxin is significant.

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[Total: 9]

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