Controlled Assessment
Further Additional Science ISA BU3.x
Transpiration (Specimen)

For moderation in May 20xx

Teachers' Notes

This ISA relates to Biology Unit 3: **B3.2.3 Transport systems in plants**
B3.1.3 Exchange systems in plants

Topic of investigation

Section B3.2.3a The movement of water from the roots through the xylem and out of the leaves is called the transpiration stream.

Section B3.1.3d Plants mainly lose water vapour from their leaves. Most of the loss of water vapour takes place through the stomata.

Overview

Candidates should:

- develop hypotheses and plan practical ways to test them
- make risk assessments and manage risks when carrying out practical work
- collect, process, analyse and interpret primary and secondary data, including the use of appropriate technology to draw evidence-based conclusions
- review methodology to assess fitness for purpose, and review predictions in the light of outcomes.

Candidates should be told to investigate a factor that may affect the rate at which a plant loses water through its leaves.

The teacher should describe the context in which the investigation is set. Examples of suitable contexts could include consideration of leaf adaptations to avoid excessive water loss, or agricultural scientists calculating how much water must be provided to maximise crop yields.

Candidates need to develop their **own** hypothesis. They should research **two** possible methods to investigate it, and develop a detailed plan for **one** of these methods.

Candidates will need to decide which variables need to be controlled in order to investigate the hypothesis and research a method that could be used, with particular reference to hazards and risk assessment.

Candidates will be required, in Section 1 of the ISA, to provide a full plan of the method that they have chosen to use and to explain briefly why they chose this method, rather than the other one.

Once the candidates have researched and written up their own plan in the first part of the ISA, they should carry out their investigation providing that this is valid, workable, safe and manageable in the laboratory.

Risk Assessment

It is the responsibility of the centre to ensure that a risk assessment is carried out.

Stage 1 – Planning (Limited control)
Teachers should provide the candidates with a Candidate Research Notes form.
For Further Science, teachers should instruct the candidates to write their hypothesis and the chosen context on their Candidate Research Notes.

Candidates should be given the opportunity to plan an investigation to test the hypothesis. The investigation should be set in a context by the centre. Examples of suitable contexts could include consideration of leaf adaptations to avoid excessive water loss, or agricultural scientists calculating how much water must be provided to maximise crop yields. Whichever context is chosen, the teacher must take care to present it in such a way that it does not limit the candidates' choice of method for the investigation.

Teachers should instruct the candidates to write their hypothesis and the chosen context on their Candidate Research Notes.

Candidates should then independently research an appropriate plan to test the hypothesis and decide for themselves factors such as the range, interval and number of repeat readings that they should take, and the variables that need to be controlled. They should use at least **two** sources for this research.

They will need to undertake independent research to identify **two** methods that could be used. During this time they may make up to **one** A4 side of their own Candidate Research Notes for use during Section 1 and Section 2 of the ISA.

For their research, candidates may use technology such as the Internet or CD-ROMs, textbooks or any other appropriate sources of information. Candidates should also research how the results of the investigation might be useful in the specified context.

There is no set time allocation for this research, but it is anticipated that it should take no longer than 3 hours of work. This research may be done in the laboratory or elsewhere.

The teacher should check and sign the Candidate Research Notes before allowing the candidate to use them during the completion of Section 1 of the ISA. These must be checked to ensure they do not include plagiarised text, detailed planning grids or a pre-prepared draft. The candidate may use these notes while completing Section 1 and Section 2 of the ISA. When the candidate has completed Section 2, the Candidate Research Notes should be stapled to the ISA.

Stage 2 – Reporting on the planning research (High control)
For this stage, candidates must work individually under direct supervision.

After the Stage 1 planning session, candidates should be given Section 1 of the ISA and should work on their own, under controlled conditions, to answer it. Candidates will need their Candidate Research Notes in the formal assessment.

Section 1 will require candidates to:

- state and explain their hypothesis
- consider the variables (independent, dependent and control) that they will need to manage during the investigation
- report on their research into how to test their hypothesis
- write a detailed plan of their chosen method
- identify possible hazards and write down how the risks may be minimised
- explain why they chose one method rather than an alternative method they researched
- draw a blank table suitable for the results of the method they have planned.

Candidates may choose to use technology to draw the table, eg a computer spreadsheet.
This must be done under the direct supervision of the teacher, and may be done at any convenient time between the planning session in Stage 1 and the completion of Section 1 of the ISA.

While answering Section 1 of the ISA, candidates must **not** be allowed to use notes, textbooks, the Internet or any other source of help apart from their own Candidate Research Notes.

Stage 3 – Practical work (Limited control)
For this part of the investigation candidates may work individually or in groups.

Candidates may work in groups to carry out their plans, but each candidate must contribute to the collection of data.

Candidates may use appropriate technology during the practical work, eg data loggers or sensors.

If the candidate is going to carry out his or her own plan, then the teacher may photocopy the plan from Section 1 of that candidate's ISA. This photocopy may then be given to the candidate to use during the practical session.

If the teacher deems that the plan produced by the candidate is invalid, unworkable, unsafe, unmanageable, or for any other reason unsuitable, then the teacher may provide a method. An example of a suitable method is attached to these notes.

Candidates may use their own blank table for the results providing that this has already been marked by the teacher.

Alternatively, the teacher may provide a blank table for the results:

- if the table produced by the candidate is inadequate - in which case the candidate would not be able to score full marks for producing a table
- if the candidate carries out an investigation from a method provided by the teacher, or the teacher prefers that the candidates use a particular format - in which case the candidate would be able to score full marks for producing their own table.

Stage 4 – Processing primary data (High control)
For this part of the investigation candidates must work individually under direct supervision.

Candidates should be given back their table of results, or a table containing the pooled results of the class, and asked to display these on a bar chart or line graph. Candidates must decide for themselves which format is the more appropriate for any particular investigation. Candidates may use appropriate technology to do this, eg a graph-drawing program on a computer.

If a candidate chooses to use a computer, this must be done under the direct supervision of the teacher and must be printed straight away.

Candidates should not be allowed to take their results and chart or graph away: the teacher must collect them at the end of the lesson and mark them before Stage 5.

Stage 5 – Analysing results (High control)
For this part of the investigation candidates must work individually under direct supervision.

AQA will provide a Secondary Data Sheet.

Candidates should be given Section 2 of the ISA and should also be given:

- their own table of results
- their own chart or graph
- the Secondary Data Sheet supplied by AQA
- their own Candidate Research Notes.

The teacher should have recorded the marks for each candidate's table and graph/chart before these are given back. This will ensure that a candidate cannot gain an unfair advantage by making any alterations to them at this stage.

Any candidate who does not take an active part in the practical work cannot score any marks for Section 2 of the ISA.

Section 2 will require candidates to:

- analyse their own results
- draw a conclusion
- match their achieved results to their hypothesis
- evaluate the method of collection and the quality of the resulting data
- analyse further secondary data drawn from the same topic area as their original investigation
- relate their findings to the context set in the ISA.

Additional Guidance

Full details are given on the method sheet.

Further Additional Science

BU3.x: Transpiration (Specimen)

This method could be used to investigate the following hypothesis:

The rate at which leaves loses water depends on the wind speed.

You will need to prepare a table for the results.

Equipment

25 large sized leaves, eg European lime or sycamore

Fan or hair dryer with a cold setting

Balance measuring to 0.01 g

Two retort stands, bosses and clamps

Metre rule

Stop clock

Scissors

Strong cotton thread

String

Method

1. Take five leaves and use the balance to measure their total mass.
2. Tie a small length of cotton thread (approximately 10 cm) around the petiole (stalk) of each leaf.
3. Tie a piece of string between two clamps fixed to retort stands.
4. Attach the leaves to the string by tying the cotton thread.
5. Place the fan 50 cm away from the leaves and switch it on for 5 minutes.
6. Remove the leaves from the string, remove the cotton thread and measure the total mass of the leaves again.
7. Take five fresh leaves and repeat steps 1 to 6 for different distances between the fan and the leaves, measuring the distance each time.

Centre Number						Candidate Number				
Surname						Other Names				

Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

Candidate Declaration. I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

Candidate Signature		Date	

For Teacher's Use	
Section	Mark
Section 1 (/20)	
Section 2 (/30)	
TOTAL (max 50)	

AQA

General Certificate of Secondary Education
June 20xx

Further Additional Science (Specimen)

Controlled Assessment ISA BU3.x Transpiration Section 1
For moderation in May 20xx

For this paper you must have:
- your Candidate Research Notes
- a pencil and a ruler.

You may use a calculator.

Time allowed
- 45 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 20.
- The maximum mark for the Controlled Assessment is 50.
- You are reminded of the need for good English and clear presentation in your answers.

Details of additional assistance (if any). Has the candidate received any help or information from anyone other than the subject teacher(s) in the production of this work? If the answer is yes, give the details below or on a separate page.

Yes ☐ No ☐

Teacher Declaration:
I can confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

As part of AQA's commitment to assist students, AQA may make your CA available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your CA is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns, please contact AQA.

To see how AQA complies with the Data Protection Act 1988, please see our Privacy Statement at aqa.org.uk

1 Write down your hypothesis.

Explain why you made this hypothesis.

Hypothesis .....

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Explanation .....

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(3 marks)

2 Think about the research you did to find out how to test your hypothesis.

Identify **two** sources you used for your research.

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Which of these sources was more useful?

Why was this source better than the other source?

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(3 marks)

3 *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

From the research you have done, describe in detail how you are going to do your investigation.

You should include:

- the equipment you plan to use
- how you will use the equipment
- the measurements you are going to make
- how you will make the investigation a fair test
- a risk assessment.

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Continue your answer on the next page

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(9 marks)

4 In your research, you will have found other methods you could have used.

Outline **one other** method you could have used.

Explain why you decided **not** to use this method.

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(3 marks)

5 Make sure you hand in your Candidate Research Notes and your blank table for the results with this paper.

You will be awarded up to two marks for your table.

(2 marks)

20

END OF QUESTIONS

Centre Number						Candidate Number				
Surname						Other Names				

Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

Candidate Declaration. I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

Candidate Signature		Date	

For Teacher's Use	
Section	Mark
Section 1 (/20)	
Section 2 (/30)	
TOTAL (max 50)	

General Certificate of Secondary Education
June 20xx

Further Additional Science (Specimen)

Controlled Assessment ISA BU3.x Transpiration Section 2
For moderation in May 20xx

For this paper you must have:
- results tables and chart or graph from your own investigation
- a set of results obtained by other people
- your Candidate Research Notes
- the Secondary Data Sheet
- a pencil and a ruler.

You may use a calculator.

Time allowed
- 50 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 30.
- The maximum mark for the Controlled Assessment is 50.
- You are reminded of the need for good English and clear presentation in your answers.

Details of additional assistance (if any). Has the candidate received any help or information from anyone other than the subject teacher(s) in the production of this work? If the answer is yes, give the details below or on a separate page.

Yes ☐ No ☐

Did the candidate take an active part in the practical?

Yes ☐ No ☐

Teacher Declaration:
I can confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

As part of AQA's commitment to assist students, AQA may make your CA available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your CA is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns, please contact AQA.

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1 (a) (i) Do your results support the hypothesis you investigated?

You should use any pattern you can see in your results to support your answer. You should include examples from your results.

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(3 marks)

1 (a) (ii) Did you get any anomalous results?

Explain your answer.

Your explanation should include examples from your results.

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(3 marks)

1 (b) Describe in detail how you could use repeated readings to obtain more accurate results.

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(3 marks)

1 (c) What was the independent variable in the investigation you did?

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What was the range of the independent variable?

The range was from ..... to ..... .

Explain why this was or was not a suitable range.

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(3 marks)

1 (d) Most investigations contain errors or uncertainties.

What do you think was the cause of the largest error or uncertainty in your investigation?

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What could you do to reduce the size of this error or uncertainty if you were to repeat the investigation?

Explain your answer.

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(3 marks)

2 You have been given a Secondary Data Sheet that provides results from similar investigations.

2 (a) Draw a sketch graph of the results in Case Study **1**.

The graph should show how the total mass lost from the leaves varies with the distance from the fan.

(2 marks)

2 (b) A company makes a chemical that can be sprayed onto plants to stop dust sticking to the leaves. The company is concerned that the chemical might affect the health of plants.

The company's hypothesis is:

'The rate of water uptake by a plant is affected by the concentration of the chemical sprayed onto the leaves.'

2 (b) (i) Look at Case Studies **2**, **3** and **4**.

Explain whether or not the results in Case Studies **2**, **3** and **4** support this hypothesis.

To gain full marks, your explanation should include appropriate examples from the results in Case Studies **2**, **3** and **4**.

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(3 marks)

2 (b) (ii) The company decides to use a concentration of 40 cm^3 per 1000 cm^3 of water for its chemical spray.

Evaluate the company's decision to use a concentration of 40 cm^3 per 1000 cm^3 of water, and suggest further work the company's scientists should do.

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(3 marks)

3 How could the results from your investigation be useful in the context you have researched?

You may use information from your Candidate Research Notes to help you to answer this question.

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(3 marks)

4 Make sure you hand in your Candidate Research Notes, results tables and chart or graph with this paper.

You will be awarded up to four marks for your chart or graph. *(4 marks)*

30

END OF QUESTIONS

Further Additional Science
BU3.x Transpiration (Specimen)

Case Study 1

Students investigated the effect of wind speed on water lost by sycamore leaves. They placed five leaves at different distances in front of a fan and measured the total mass lost by the leaves after 5 minutes.

Here are the results.

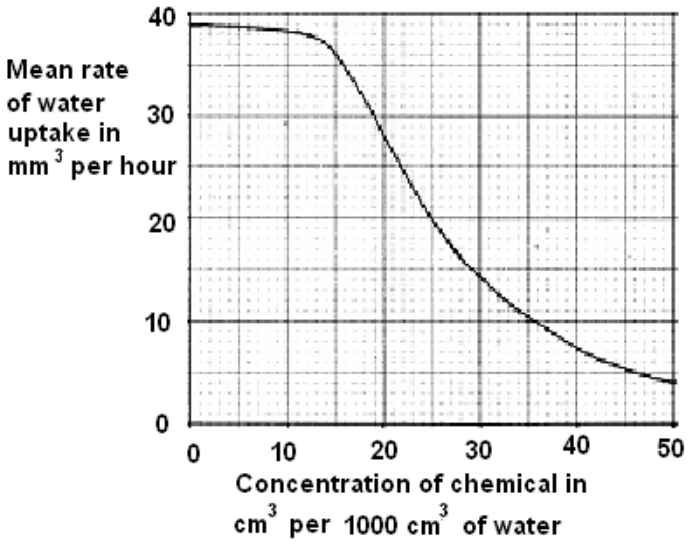
Distance from fan in centimetres	Total mass lost in grams
50	1.02
60	0.83
70	0.65
80	0.45

Case Study 2

A company makes a chemical that can be sprayed onto plants to stop dust sticking to the leaves.

The company scientists think that spraying the chemical onto the leaves may reduce the rate that plants take up water. The scientists investigated the effect of using different concentrations of the chemical on the rate that a geranium plant takes up water.

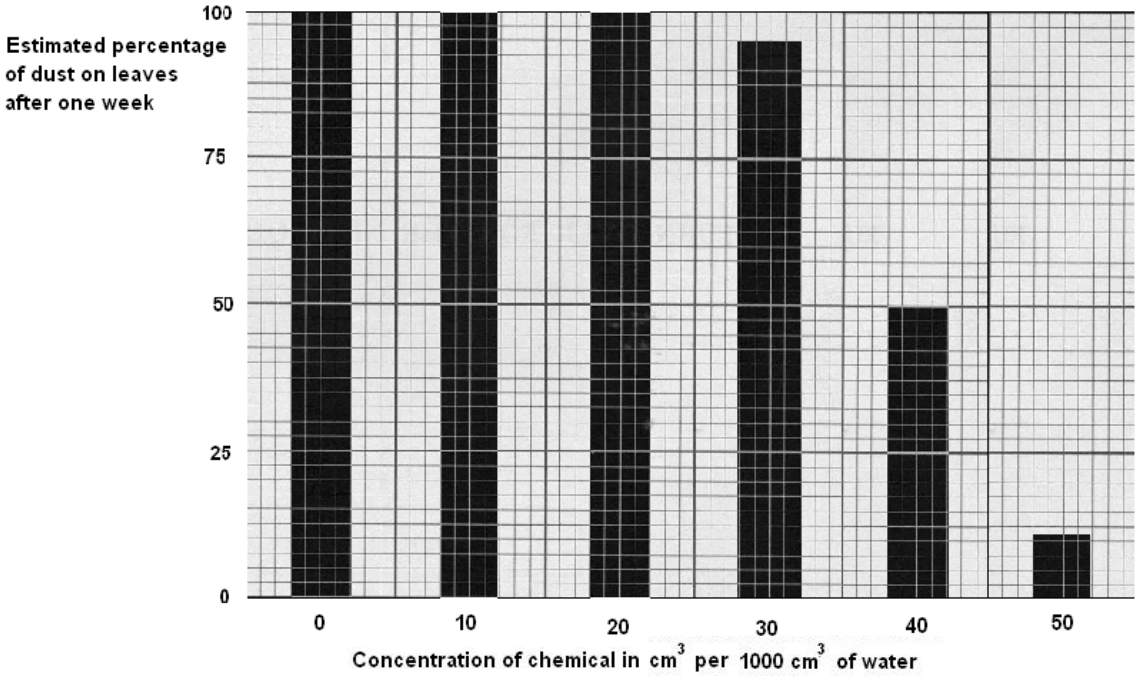
The graph shows the scientists' results.



Case Study 3

In a second investigation, the company scientists used the same chemical from Case Study 2 to investigate how the concentration affects the amount of dust on geranium leaves after one week.

The bar chart shows their results.



Case Study 4

The company scientists tested the effect of the chemical from Case Studies 2 and 3 on water uptake for three types of plant, **fig**, **rubber** and **cactus**.

The results are shown in the table.

Concentration of chemical in cm^3 per 1000 cm^3 of water	**Mean rate of water uptake by plant in mm^3 per hour**		
	Fig plant	**Rubber plant**	**Cactus plant**
0	40	24	1.1
10	35	20	1.2
20	31	17	1.1
30	28	14	1.0
40	26	14	1.1
50	25	14	1.3

GCSE Further Additional Science – Controlled Assessment ISA – Marking Guidelines

Further Additional Science ISA – BU3.x Transpiration (Specimen)

For moderation in May 20xx

Please mark in red ink. Each part of each question must show some red ink to indicate that it has been seen. Subtotals for each part of each question should be written in the right-hand margin.

Enter the marks for **Section 1** and **Section 2** and the **total mark** on the front cover of the answer booklet for Section 1. Fasten both sections together with the results table(s) and the graphical work and the Candidate's Research Notes.

The teacher must sign and date the front covers of Section 1 and Section 2 of the ISA.

The papers must be kept in a secure place and must **not** be returned to the candidates.

These Marking Guidelines are necessarily generic. Additional guidance on how to relate these generic Marking Guidelines to particular investigations is given below the generic section.

Read through the whole of the candidate's answer and use the Marking Guidelines below to arrive at a 'best fit' mark.

The layout on the ISA has been designed to help the candidate to structure an answer, but it does not matter if the candidate has written part of the answer in what you consider to be the wrong section of a question.

Section 1

	0 marks	1 mark	2 marks	3 marks
Q. No. 1	No creditworthy response.	There is a hypothesis that, by implication, identifies the independent and dependent variables, but there is no explanation.	There is a hypothesis that, by implication, identifies the independent and dependent variables, however, the explanation for this hypothesis is unclear.	There is a hypothesis that, by implication, identifies the independent and dependent variables. The hypothesis is explained clearly.
Additional Guidance	*An example of a hypothesis could be: "I think that if I increase the wind speed, the leaves will lose more water in a given time."* *An example of an unclear explanation could be: "I think this because things dry out when it's windy."* *An example of a clear explanation could be: "When the wind speed increases the rate of evaporation of water through the stomata increases."*			

Section 1				
Q. No. 2	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	Two relevant sources are identified. **or** One relevant source is identified and the usefulness of the source commented on.	Two relevant sources are identified. The usefulness of **one** of the sources is commented on.	Two relevant sources are identified. The usefulness of **both** sources is explained and a comparison made.
Additional Guidance	*An identified source is referred to by title and author or for websites at least the name of the web site should be quoted.* *Any identified source should be capable of being accessed by the moderator.* *A clear comment on only one of the sources may be sufficient to gain 3 marks if the answer implies a comment on the other source.* *If candidates have taken part in peer discussion as part of their research, simply stating this is not sufficient to qualify for quoting a source. Similarly, reference to their own notes or exercise book alone is insufficient.*			

<table>
<tr><th colspan="5">Section 1</th></tr>
<tr><td rowspan="3">Q. No.
3</td><td colspan="4">In this question candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.
Candidates will be required to use good English, organise information clearly and use specialist vocabulary where appropriate. In order to attain a mark within a certain level, both the science and the quality of written communication must be considered.
Read through the whole of the candidate’s answer and use the Marking Guidelines below to arrive at a ‘best fit’ mark, as candidates may meet some criteria but not others in a mark range.</td></tr>
<tr><td>0 marks</td><td>1, 2 or 3 marks</td><td>4, 5 or 6 marks</td><td>7, 8 or 9 marks</td></tr>
<tr><td>No creditworthy response.</td><td>Some of the necessary equipment is stated.
The method described is weak but shows some understanding of the sequence of an investigation.
The measurements to be made are stated.
An appropriate hazard is identified, but the corresponding risk assessment and control measure is weak or absent.
The answer is poorly organised, with almost no specialist terms and little or no detail given.
The answer shows very weak spelling, punctuation and grammar.</td><td>Most of the necessary equipment is stated.
The method described will enable valid results to be collected.
The measurements to be made are stated and at least one control variable is given.
Any significant hazards are identified, together with a corresponding control measure but the risk assessment is weak or absent.
The answer has some structure and organisation, use of specialist terms has been attempted but not always correctly, and some detail is given.
The answer shows reasonable spelling, punctuation and grammar although there may still be some errors.</td><td>Most of the necessary equipment is stated.
The method described will enable valid results to be collected.
The measurements to be made are stated and the significant control variables are clearly identified, with details of how they will be monitored or controlled.
Any significant hazards are identified, together with an assessment of the associated risks and corresponding control measures.
The answer is coherent and written in an organised, logical sequence, containing a range of relevant specialist terms used correctly.
The answer shows almost faultless spelling, punctuation and grammar.</td></tr>
<tr><td>Additional Guidance</td><td colspan="4">Typical hazards with associated control measure might include: “There’s a possibility of fingers becoming trapped by a fan blade, so make sure the fan has a cover.”
It may be possible to credit a clearly labelled diagram for some of the marks.</td></tr>
</table>

Section 1				
Q. No. 4	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	An alternative method is outlined briefly although some of the necessary steps may not be clear.	An alternative method is outlined briefly. A simple suggestion is given as to why this alternative method would not have been as good as the one chosen.	An alternative method is outlined briefly. An explanation is given as to why this alternative method would not have been as good as the one chosen.
Additional Guidance	*A simple suggestion might be that the alternative method would take too long.* *An explanation might be that manipulation or measurement of the variables would be difficult with the apparatus available.*			

Table for the Results			
Q. No. 5	**0 marks**	**1 mark**	**2 marks**
	No table or a table with incomplete headings or units for the measured variables. Fewer than half of the required elements are present.	A table with incomplete headings or units for the measured variables. At least half of the required elements should be present.	Correct headings and units present for all measured variables.
Additional Guidance	*The table should be able to accommodate all the variables that the candidate is going to measure or record during the investigation.* *There is no need for the candidate to include columns for repeats, means or derived values.*		

Section 2				
Q. No. 1 (a) (i)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	A valid statement is made about whether or not the results support the hypothesis.	A valid statement is made about whether or not the results support the hypothesis. The answer includes either a reference to a pattern **or** some examples from the results.	A valid statement is made about whether or not the results support the hypothesis. The answer includes a reference to a pattern **and** some examples from the results.
Additional Guidance	*The candidate's statement(s) must match the candidate's own results.* *An example of a pattern might be: "The greater the wind speed, the more water is lost from the leaves."* *An example of results quoted in support might be: "When the fan was at a distance of 50 cm, the water lost from the leaves in 5 minutes was 0.06 g, and when the fan was at distance of 100 cm the water lost decreased to 0.02 g."*			
Q. No. 1 (a) (ii)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	There is a correct statement as to whether or not there are any anomalous results.	There is a correct statement as to whether or not there are any anomalous results and a statement or implication that anomalous results are ones that do not fit the pattern.	There is a correct statement as to whether or not there are any anomalous results and a statement or implication that anomalous results are ones that do not fit the pattern. Some examples from the results are given to support this, eg by specifying results that are considered to be anomalous or by referring to the fact that, eg all results are very close to a line of best fit.
Additional Guidance	*N.B. the candidate's response must match the candidate's own results.*			

Section 2				
Q. No. 1 (b)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	A statement is made that a mean should be calculated.	A statement is made that a mean should be calculated, by adding the results together and dividing by the number of values.	A statement is made that a mean should be calculated, by adding the results together and dividing by the number of values. A statement is made that **either** anomalous results are discarded before calculating a mean **or** a graph is plotted and a best fit line is drawn ignoring anomalous points.
Additional Guidance	*Accept the term 'average' as an alternative to 'mean'.*			
Q. No. 1 (c)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	Correctly states the independent variable.	Correctly states the independent variable. Correctly states the range of the independent variable.	Correctly states the independent variable. Correctly states the range of the independent variable. Explains whether or not the range is suitable.
Additional Guidance	*Look at the candidate's table of results in order to confirm the suitability of the range. The explanation should convey that the candidate understands the term range. Range may be given as lowest to highest, highest to lowest, or the difference between them. Correct units should appear at least once.* *If the dependent variable is given instead of the independent variable, a maximum of 1 mark may be given for the correct range of the dependent variable.*			

Section 2				
Q. No. 1 (d)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	Identifies a suitable error or uncertainty.	Identifies a suitable error or uncertainty. Suggests a way of reducing the error or uncertainty identified.	Identifies a suitable error or uncertainty. Suggests a way of reducing the error or uncertainty identified. Explains how the way suggested will reduce the error or uncertainty.
Additional Guidance	*A possible source of error in the investigation might be that the leaves move in the wind and so are different distances from the fan.* *A way to reduce the error might be to use a different method of holding the leaves, eg attaching the petioles to a metre rule using modelling clay.* *An explanation might be that this method of attaching the leaves prevents excessive movement and so the distance is kept constant.*			
Q. No. 2 (a)	**0 marks**	**1 mark**	**2 marks**	
	No creditworthy response.	Both axes labelled with the variables (ignore any units given).	Both axes labelled with the variables (ignore any units given) and an appropriate line drawn.	
Additional Guidance	*Accept axes drawn either way round (ie it doesn't matter which axis the mass lost is on).* *The line should be (approximately) straight and should slope from top left to bottom right.* *No values need to be shown on either axis.*			

Section 2				
Q. No. 2 (b) (i)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	A simple correct statement is made about **at least two** of the Case Studies **2**, **3** and **4** as to whether or not they support the hypothesis.	Simple correct statements are made about Case Studies **2, 3** and **4,** supported by a more detailed explanation of **one** of Case Studies **2** and **4**.	Simple correct statements are made about Case Studies **2**, **3** and **4**, supported by a more detailed explanation of **both** Case Studies **2** and **4**.
Additional Guidance	*An example of a simple correct statement for Case Study **2** is: "As the concentration increases the water uptake decreases."* *An example of a simple correct statement for Case Study **3** is: "The scientists are investigating how the concentration of the chemical affects the percentage of dust on the leaves, not the rate of water uptake."* *An example of a simple correct statement for Case Study **4** is: "As the concentration increases the water uptake decreases for fig and rubber, but not for cactus."* *A more detailed explanation for Case Study **2** could be: "As the concentration of the chemical increases the rate of water uptake decreases but there is not much difference until the concentration is greater than 15 cm^3 per 1000 cm^3 of water."* *A more detailed explanation for Case Study **4** could be: "For rubber the rate of water uptake does not decrease beyond a concentration of 30 cm^3 per 1000 cm^3 of water, but for fig it is still decreasing at a concentration of 50 cm^3 per 1000 cm^3 of water."*			
Q. No. 2 (b) (ii)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	An advantage or disadvantage is given.	An advantage and disadvantage is given.	An advantage and disadvantage is given, and appropriate further work is suggested.
Additional Guidance	*An example of an advantage is: "This concentration reduces the amount of dust on the leaves by a half."* *An example of a disadvantage is: "This concentration reduces the water uptake and so the plants might die."* *An example of appropriate further work might relate to the need for finding an optimum concentration that reduces the amount of dust but does not affect the health of the plant, trying further species of plant (Case Studies 2 and 3 only relate to geranium) or testing the chemical for harmful effects.*			

Section 2				
Q. No. 3	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response.	Results from the investigation or an idea from the research has been related to the context.	Results from the investigation or an idea from the research has been related to the context. There is a **simple** explanation of how the results or idea can be applied and used in the context.	Results from the investigation or an idea from the research has been related to the context. There is a **detailed** explanation of how the results or idea can be applied and used in the context.
Additional Guidance	*A simple explanation could be that plants will wilt/die in adversely windy or hot conditions.* *A detailed explanation could be that calculating transpiration rates is useful for determining how much water is required to maximise crop yields.*			

Graph or chart			
Q. No. 4	**Answer**	**Additional Guidance**	**Mark**
	X axis: suitable scales chosen and labelled with quantity and units.	Scale should be such that the plots occupy at least one third of each axis. Accept axes reversed.	**1**
	Y axis: suitable scales chosen and labelled with quantity and units.	It may not always be necessary to show the origin.	**1**
	Points or bars plotted correctly to within ± 1 mm.	Allow one plotting error out of each 5 points/bars plotted. Allow error carried forward from incorrect points.	**1**
	Suitable line drawn on graph or bars correctly labelled on bar chart.	If wrong type of graph / chart, maximum **3** marks. If the independent variable is: • categoric, should draw a bar chart. • continuous, should draw a best fit line. **N.B.** If no line possible because there is no correlation, candidates should state this on the graph to gain the mark.	**1**