Controlled Assessment – Biology ISA BU 3.x
Transpiration (Specimen)

Candidates' Notes

This ISA relates to Biology Unit 3: Section B3.2.3 Transport systems in plants

Area of investigation

B3.2.3a: Flowering plants have separate transport systems:

- xylem tissue transports water and minerals from the roots to the stem and leaves
- phloem tissue carries dissolved sugars from the leaves to the rest of the plant, including the growing regions and the storage organs.

Task

You will be given the opportunity to:

- plan an investigation about one factor that may affect the rate of transpiration.

You will be shown a basic technique to use, but you will have to decide on things such as:

- the range of the independent variable
- the interval of the independent variable
- the number of repeats
- the equipment you are going to use
- how you are going to do the experiment.

You will also be required to:

- make a risk assessment
- make a prediction about the outcome of your investigation
- research the results obtained by other people.

Controlled Assessment – Biology ISA BU 3.x
Transpiration (Specimen)
For use from May 20xx to April 20xx

Teachers' Notes

This ISA relates to Biology Unit 3: Section B3.2.3 Transport systems in plants

Area of investigation

B3.2.3a: Flowering plants have separate transport systems:

- xylem tissue transports water and minerals from the roots to the stem and leaves
- phloem tissue carries dissolved sugars from the leaves to the rest of the plant, including the growing regions and the storage organs.

Method

Candidates should be given the opportunity to make a prediction and use their own risk assessment to carry out an **investigation on the effect of a factor on the rate of transpiration**.

A simple method would involve attaching a short piece of rubber tubing, in turn attached to capillary tubing, to a freshly cut woody stem (such as privet), under water (so that the tubing is water-filled). When the stem and capillary tubing are supported in air a meniscus (air – water interface) moves up the capillary tube. Suitable factors to be investigated could be temperature, humidity, wind, leaf removal or the comparison between different species (eg holly v. privet). It is only necessary to investigate the effect of one of these factors (in comparison with an experimental control).

Teachers should make an assessment of the appropriate equipment available in the centre for the particular candidate group and their abilities. Teachers should make available a list of appropriate equipment to the candidates during the research period.

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

Candidates should develop hypotheses and plan practical ways to test them including:

- risk assessment, managing risks when carrying out practical work
- collecting, processing, analysing and interpreting primary and secondary data, including the use of appropriate technology to draw evidence-based conclusions
- reviewing methodology to assess fitness for purpose, and review predictions in light of outcomes.

Stage 1 – Planning

The teacher should lead a discussion group with the candidates in order to outline the technique that is to be used. This might include demonstrating the technique and illustrating the variety of equipment that is available.

Candidates should be shown the technique that is to be used. It is also important that the candidates themselves have hands on experience of the technique. Candidates should then be left to decide for themselves factors such as the independent variable to be investigated, the range, interval and number of repeat readings that they should take.

At the end of this Stage 1 planning session, candidates should be given Section 1 of the CAU and should work on their own, under controlled conditions, to answer this.

Section 1 will require them to write a plan, make a prediction, formulate a hypothesis, produce a risk assessment, and draw a blank table ready for their results. The table may be drawn on the final page of Section 1 or may be drawn on a separate sheet of paper and then stapled to the ISA paper. If a candidate chooses to use a computer to draw the blank table, this must be done under the direct supervision of the teacher and must be stored in a secure area of the network to which no other candidate has access.

Stage 2 – Practical Work
For this part of the investigation candidates may work individually or in groups.

The teacher should complete an Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.

The suggested method described above could be used, but this should not preclude centres from making adaptations to suit their own needs.

Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude candidates from making their own decisions.

Each candidate must contribute to the collection of data. Each candidate should be given a blank table in which to record their data. This could be a photocopy of the table produced by the candidate in Stage 1 or it could be a table produced by the teacher.

Once the candidates have completed their investigation, their results should be made available to others in their group for research purposes.

The candidate should use the results of others (possibly in their class) to research and analyse the validity of their results.

Stage 3 – The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Candidates should be given back their table of results, 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. This may be done on a separate occasion, or it may be combined with the completion of Sections 2 and 3 of the ISA. It is advised that candidates should use paper and pencil for this activity.

If a candidate chooses to use a computer, this must be done under the direct supervision of the teacher and must be stored in a secure area of the network to which no other candidate has access.

Stage 4 – Analysing results
For this part of the investigation candidates must work individually under direct supervision.

Candidates should be given Sections 2 and 3 of the ISA and should be given back their own table of results, the researched results and their own chart or graph. The marks for each candidate's table and graph/chart should have been recorded by the teacher 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. Candidate's work must not be annotated with additional information, either by the teacher or the candidate, which would give them an unfair advantage during the ISA eg the use of the terms independent/dependent variable

Section 2 will require them to analyse their own results, draw a conclusion and ask them to match their achieved results to their original prediction/hypothesis.

Section 3 will require them to analyse secondary data drawn from the same topic area as their original investigation.

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 (/16)	
Section 2 (/16)	
Section 3 (/13)	
TOTAL (max 45)	

AQA General Certificate of Secondary Education
June 20xx

Biology (Specimen)

Controlled Assessment ISA BU3.x Transpiration Section 1

For submission on 7 May 20xx

Time allowed up to 45 minutes

You will need no other materials.
You may use a calculator.

Instructions

- Use black ink or black ball-point pen
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** in the space provided. You may use extra paper.
- 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 16.
- The maximum mark for the Controlled Assessment Unit is 45
- 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 this candidate take part in the practical activity?	**YES / NO**

Teacher Declaration:
I 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 ……

SECTION 1

The task is to do an investigation on Transpiration.
Your teacher will have given you information about the equipment available to you to perform your investigation.

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

Describe how you are going to do your investigation.

You should include:
- the equipment that you are going to use
- how you will use the equipment
- the measurements that you are going to make
- how you will make it a fair test.

You may include a labelled diagram.

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(6 marks)

2 Think about the possible hazards in your investigation.

2 (a) Describe **two** hazards that you think may be present in your investigation.

1 .....

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2 .....

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(2 marks)

2 (b) Explain how you are going to reduce the risks from the hazards that you have described.

1 .....

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2 .....

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(2 marks)

3 Make a prediction about what you think will happen in your investigation.

3 (a) I think that:

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(2 marks)

3 (b) I think this will happen because: (this is your hypothesis)

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.....

(2 marks)

Turn over for the next question

4 You will need a table for your results.

Design a table that will contain all the data that you are going to record during your investigation.

You may draw your table in the space below, or you may draw it on a separate sheet of paper and staple it to this booklet. If you use a word processor to draw your blank table, you should print it and attach it here.

(2 marks)

16

END OF SECTION 1

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 (/16)	
Section 2 (/16)	
Section 3 (/13)	
TOTAL (max 45)	

AQA General Certificate of Secondary Education

June 20xx

Biology (Specimen)

Controlled Assessment ISA BU3.x Transpiration Sections 2 and 3

For submission on 7 May 20xx

Time allowed 45 minutes

For this paper you must have:
- results tables and charts or graphs from your own investigation.

You may use a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 2** and **Section 3** in the spaces provided.
- 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 29.
- The maximum mark for the Controlled Assessment Unit is 45
- 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 this candidate take part in the practical activity?	**YES / NO**

Teacher Declaration:
I 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 ……

Section 2

These questions are about the investigation that you did on Transpiration.

1 (a) What were the variables that you were investigating?

I was trying to find out if changing..... (this is the

independent variable) had any effect on ..... (this is the dependent variable).

(1 mark)

1 (b) You researched the results obtained by other people in your group or by your teacher.

Were your results similar to those of others or different?

Draw a ring around your answer. **Similar / Different**

Describe the ways in which they were similar or different.

.....

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(1 mark)

1 (c) (i) What conclusion can you make from your investigation about a link between your independent and your dependant variable?

To help you to answer this question you should consider the results that you obtained and the information that you gained from your research into other people's results.

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(3 marks)

1 (c) (ii) Does the link that you have described match the prediction that you made before you started your investigation?

Use information from your results to explain how this prediction does or does not fit your results.

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(3 marks)

2 If you could repeat your investigation, what changes would you make to your method?

Explain your answer.

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(4 marks)

3 Make sure that your results tables, and charts or graphs are handed in with this paper. You will be awarded up to 4 marks for your chart or graph.

(4 marks)

Turn over for the next question

16

Section 3

These questions are about an investigation that some scientists did which may be similar to your own.

Many people keep indoor plants. The leaves of the plants can become dusty.
Removing the dust may damage the leaves.
A company produces a chemical that can be sprayed onto leaves to stop dust sticking to them.

4 At very high concentrations the chemical is toxic.

Which hazard label should be used on containers of the concentrated chemical?

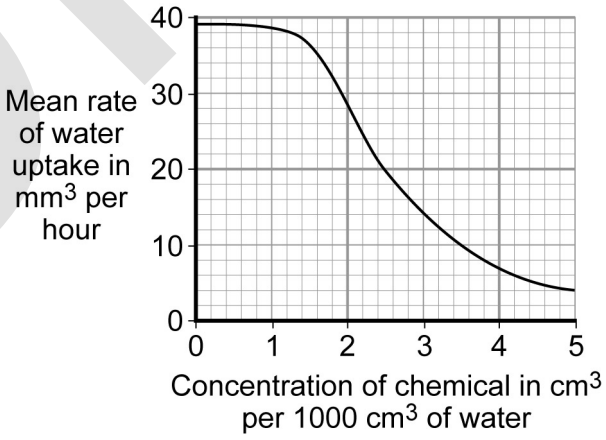
Draw a ring around **one** answer.

(1 mark)

5 At low concentrations the chemical is not harmful.
The scientists are concerned that spraying the chemical onto leaves at low concentrations, may reduce the speed that plants take up water, killing the plants.
The scientists investigate the effect of using different concentrations of the chemical on the speed that plants take up water.

Graph 1 shows the scientists' results.

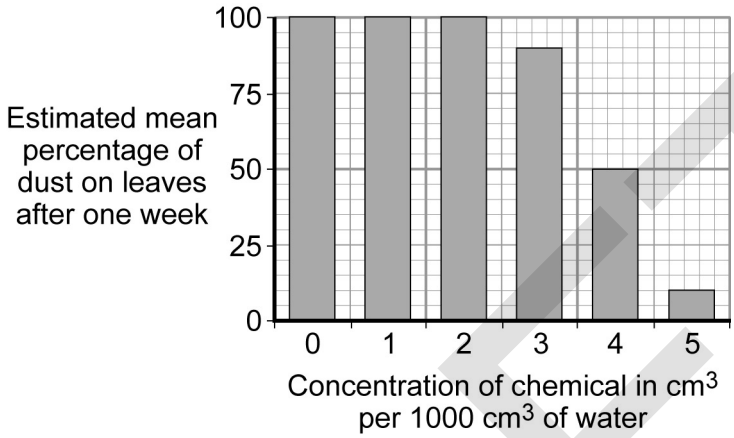
Graph 1



In a second investigation, the scientists estimated the amount of dust on leaves after one week, when they used different concentrations of the chemical.

Graph 2 shows these results.

Graph 2



5 (a) Suggest how the scientists created a scale to 'estimate the percentage of dust on leaves'.

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(2 marks)

5 (b) The scientists used the graphs from the two investigations to think about the best concentration of the chemical to use.

5 (b) (i) Give **one** advantage and **one** disadvantage of using a concentration of 1 cm^3 per 1000 cm^3 of water.

Advantage .....

.....

Disadvantage .....

.....

(2 marks)

5 (b) (ii) Which concentration do you think would be the best to use?

Use information from both graphs.

Tick (✓) **one** box.

2 cm^3 per 1000 cm^3 of water ☐

3 cm^3 per 1000 cm^3 of water ☐

4 cm^3 per 1000 cm^3 of water ☐

5 cm^3 per 1000 cm^3 of water ☐

(1 mark)

5 (b) (iii) Explain your answer.

.....

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(1 mark)

6 Before the new chemical is sold in shops it must be tested by the National Standards Testing Laboratory. The National Standards Testing Laboratory is an independent laboratory.

6 (a) Why is it helpful to the **company** to have the product tested by an independent laboratory?

Suggest **one** reason.

.....

(1 mark)

6 (b) Why is it helpful to the **public** to have the product tested by an independent laboratory?

Suggest **one** reason.

.....

(1 mark)

7 The scientists at the National Standards Testing Laboratory tested the effect of the chemical 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	37	22	2.5
1	34	22	2.5
2	31	20	2.3
3	28	14	2.4
4	25	12	2.5
5	22	10	2.4

7 (a) Which type of plant do you think the company scientists used in their investigations?

Use information in the **table** and **Graph 1**.
Draw a ring around **one** answer.

fig **rubber** **cactus**

Give a reason for your answer.

.....

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(1 mark)

7 (b) The scientists at the National Standards Testing Laboratory did five tests on each plant and calculated mean values.

7 (b) (i) How would the scientists calculate the mean values?

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(2 marks)

7 (b) (ii) What is the advantage of doing each test five times instead of just once?

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(1 mark)

END OF QUESTIONS

There are no questions printed on this page

GCSE Science – Controlled Assessment ISA – Marking Guidelines

Biology ISA Transpiration (Specimen)

For use from 1 May 20xx to 30 April 20xx

Please mark in red ink, and use one tick for one mark. 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**, **Section 2**, **Section 3** and the **total mark** on the front cover of the answer booklet and fasten them together with the results table(s) and the graphical work.

The teacher must sign and date the front cover of the ISA.

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

Section 1

1 Plan	Marks
There is a clear and detailed scientific description of how the investigation should be carried out. Control variables are clearly identified, with details of how they will be monitored or controlled, so that the method gives valid results. Equipment is clearly described and appropriate. There is an appropriate and logical sequence of events. A range of appropriate and relevant specialist terms are used accurately. The response shows very few errors in spelling, punctuation and grammar.	**6**
There is a clear description of how the investigation should be carried out. Control variables are clearly identified so that the method gives valid results. Equipment is clearly described. Logical sequence of events is shown. Relevant and appropriate specials terms are used. The response shows few errors in spelling, punctuation and grammar.	**5**
There is a description of how the investigation should be done so that valid results can be collected. At least one control variable is identified. Most of the equipment required is described. A sequence of events is shown. Some errors in spelling punctuation and grammar.	**4**
The method is poorly described, but the meaning is clear. The method is such that some meaningful results can be collected. Some of the required equipment is mentioned. Some events have been described. Some errors in spelling punctuation and grammar.	**3**
The method described is weak and but shows some understanding of the sequence of an investigation. The equipment is mentioned but not always appropriate. There are many errors in spelling punctuation and grammar.	**2**
The method described is weak and shows very little understanding of the sequence of an investigation. The equipment is mentioned but not always appropriate. There are many errors in spelling punctuation and grammar.	**1**
No relevant content.	**0**

2 Risk Assessment Read the candidate's whole answer to both parts and mark both parts together.	Marks
2 (a) Hazards	
Two relevant hazards identified, **1** mark each.	**2**
2 (b) Risk reduction	
Appropriate suggestion for risk reduction, matched to the hazards identified, **1** mark each.	**2**

3 Prediction / hypothesis (Mark parts (a) and (b) together)	Marks
The prediction is coherent and uses a range of appropriate and relevant specialist terms. The hypothesis shows a clear understanding of the scientific process of transpiration.	**4**
The prediction is clear and uses some relevant and specialist terms. The hypothesis shows a basic understanding of transpiration.	**3**
The prediction is poorly constructed but shows some understanding, and uses some relevant terms. The hypothesis shows some understanding of transpiration, but is often muddled.	**2**
The prediction is poor, with few relevant scientific terms used The hypothesis shows little understanding of transpiration.	**1**
No relevant content.	**0**

4 Table		Marks
Correct headings and units all correct for all measured variables.		**2**
Table with incomplete headings or units for the measured variables = **1** mark.	As a 'rule of thumb', add up the total number of headings and units that should be present, then: • all present and correct = **2** marks • some missing, but at least half present and correct = **1** mark • fewer than half present and correct = **0** marks. eg all headings present = **1** eg all units present = **1**	
	Section 1 max marks	**16**

Section 2

1 Variables and conclusion			Marks
1 (a)	Independent variable and dependent variable both correctly stated		**1**
1 (b)	Any one similarity or difference described	eg my results didn't show a pattern but everyone else found that as x increased, *y* increased	**1**
1 (c) (i)	The candidate correctly concludes whether or not there is a relationship between the variables investigated. There is a clear and detailed scientific description of the relationship between the variables used in the investigation. This conclusion is supported by reference to the research into the results of others.		**3**
	The candidate correctly concludes whether or not there is a link between the variables investigated, but does not make clear what this relationship is. This conclusion is supported by reference to the research into the results of others.		**2**
	The candidate correctly concludes whether or not there is a link between the variables investigated, but does not make clear what this relationship is. There is little or no reference to the research into the results of others.		**1**
	No relevant content		**0**
1 (c) (ii)	The review of the prediction is appropriate and valid and correctly states, with reason(s) why the prediction is or is not supported.		**3**
	The review of the prediction is appropriate and valid and correctly states whether or not the prediction is or is not supported, but fails to explain clearly the reason for this.		**2**
	There is a review of the prediction which is appropriate but there is little clarity and detail.		**1**
	No relevant content		**0**

2 Further work	Marks
Identifies appropriate improvement(s) with reference to own results and the results of others. Clear explanation of the reason for the improvement(s) based on scientific understanding.	**4**
Identifies appropriate improvement(s) with some reference to own results and/or the results of others, but the reasons for the suggested improvements may not be fully explained.	**3**
Some indication of appropriate improvement(s) is indicated but there is a lack of clarity and detail, with little reference to own results.	**2**
Improvements are poorly defined but there is an attempt to describe what should be done. The answers are weak and generally lack scientific understanding.	**1**
No relevant content	**0**

3 Graph or chart		Marks
• 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. It may not always be necessary to show the origin.	**1**
• Y axis: suitable scales chosen and labelled with quantity and units.		**1**
• Points or bars plotted correctly to within ± 1 mm.	Allow one plotting error out of each 5 points plotted.	**1**
• Suitable line drawn on graph or bars correctly labelled on bar chart.	Allow error carried forward from incorrect points. If wrong type of graph / chart, maximum **3** marks. If the independent variable is: • *continuous,* should draw a *best fit line graph.* **Note** If no line possible because there is no correlation, candidates should state this on the graph to gain the mark. • *categoric,* should draw a *bar chart*.	**1**
	Section 2 max marks	**16**

Section 3

Question	Answer	Additional Guidance	Marks
4	Ring drawn around second diagram (skull)		**1**
5 (a)	Take dustiest leaf as 100% Take leaf with no dust as 0%	Ignore references to dividing the difference into parts	**1** **1**
5 (b) (i)	*Advantage*: does not affect water uptake (much) *Disadvantage*: Has no effect on dustiness of leaves		**1** **1**
5 (b) (ii)	4 cm^3 per 1000 cm^3 of water		**1**
5 (b) (iii)	Removes a lot of dust **and** does not cause too much water loss	**Both** parts required	**1**
6 (a)	Unbiased / to check their results		**1**
6 (b)	Safety / not toxic / not harmful		**1**
7 (a)	Rubber Graph would be same shape	**Both** 'rubber' and the explanation are required for the mark Accept a description of the pattern shown by the graph / data	**1**
7 (b) (i)	Discard anomalous results Add (others) divide by five		**1** **1**
7 (b) (ii)	Any **one** from: • improves reliability • allows anomalies to be identified / eliminated		**1**
		Section 3 max marks	**13**
			Controlled Assessment Total 45 marks