

AQA A-LEVEL BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT 6 OLD SPECIFICATION PAPERS

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For Teacher's Use	
Section	Mark
PSA	
Stage 1 Skills	
Stage 2 Skills	
Section A	
Section B	
TOTAL (max 50)	



General Certificate of Education
Advanced Level Examination
June 2014

Biology

BI06T/P14/test

Unit 6T A2 Investigative Skills Assignment

Written Test

For submission by 15 May 2014

For this paper you must have: - the task sheet, your results and your calculations - a ruler with millimetre measurements - a calculator.	Time allowed 1 hour 15 minutes
Instructions - Use black ink or black ball-point pen. - Fill in the boxes at the top of this page. - Answer all questions. - You must answer the 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 37. - You are expected to use a calculator where appropriate. - You will be marked on your ability to: - use good English - organise information clearly - use scientific terminology accurately.

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Section A

These questions relate to your investigation of reaction times.

Use the Task Sheet, your results and your calculations to answer the questions.

Answer **all** questions in the spaces provided.

- 6** You asked the first person to place an arm on the work surface with only the wrist and hand over the edge (step 1).
Suggest **one** reason for this.

[1 mark]

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- 7** Before dropping the measuring stick, you held it in a vertical position (step 3).
Why was it important to hold it in a vertical position before dropping it?

[1 mark]

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- 8** You were told to read out instructions (step 4). Why was it important to read out the same instructions each time?

[1 mark]

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- 9** It was important to vary the release time (steps 5 and 7). Explain why. **[2 marks]**

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- 10** You were told to keep the temperature of the ice-water bath at about 5 °C (step 8). Give **two** other variables that you did control. **[2 marks]**

1

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2

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- 11** Other than standardising the method, suggest why you were told to use only the results from **Trial 3** (Question 1). **[1 mark]**

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Turn over ►

12

In your investigation, you were not told to match people for any factor.

Table 3 shows some factors that could be used to match people in this investigation. Complete **Table 3** by giving an explanation of why people should be matched for each factor.

[4 marks]

Table 3

Factor	Explanation of why people should be matched for this factor
People are the same age	
People belong to the same ethnic group	
People have the same body size	
People have the same intake of caffeine	

13

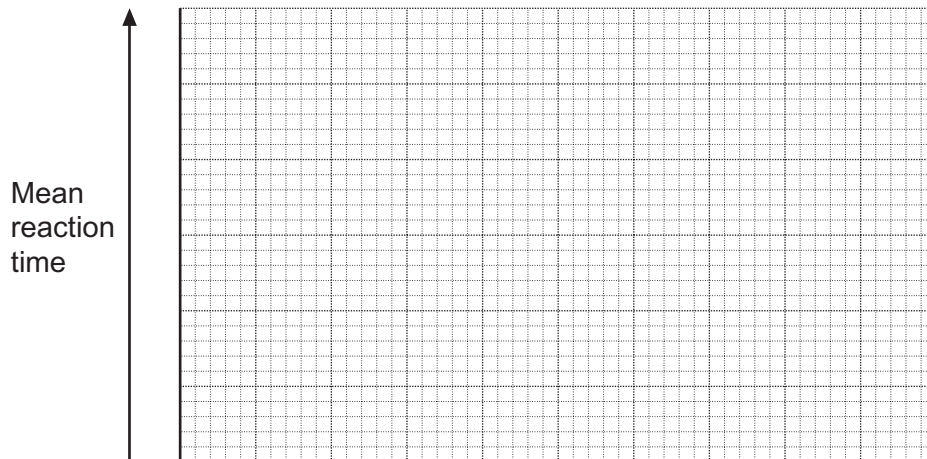
The people caught the measuring stick as quickly as they could after you let go of it. This was **not** a simple reflex action. Explain why.

[2 marks]

- 14** Another student used the same method as you to investigate the effect of age on reaction times. He tested the reaction times of six groups of people aged 20, 30, 40, 50, 65 and 75 years of age. For each age group, he determined the mean reaction time. He found that mean reaction times slowly increased up to 50 years of age and then quickly increased.

- 14 (a)** Complete the graph to show how his data would appear.

[4 marks]



- 14 (b)** The student also calculated the standard deviations of the mean reaction times. He found these standard deviations increased with the age of the group. What did this show about reaction time?

[1 mark]

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Resource Sheet**Resource A**

The body loses heat quickly in cold water. A researcher investigated the effect of length of time in a bath of ice-cold water on the reaction times of 20 healthy people aged between 21 and 23 years of age.

She measured each person's reaction time after being left in ice-cold water for 15, 30 or 45 seconds. She also recorded each person's reaction time before being placed in the ice-cold water (0 seconds).

Table 4 shows her results.

Table 4

Length of time in bath of ice-cold water / seconds	Mean reaction time / seconds	Standard error
0	0.395	0.0124
15	0.301	0.0105
30	0.297	0.0212
45	0.326	0.0183

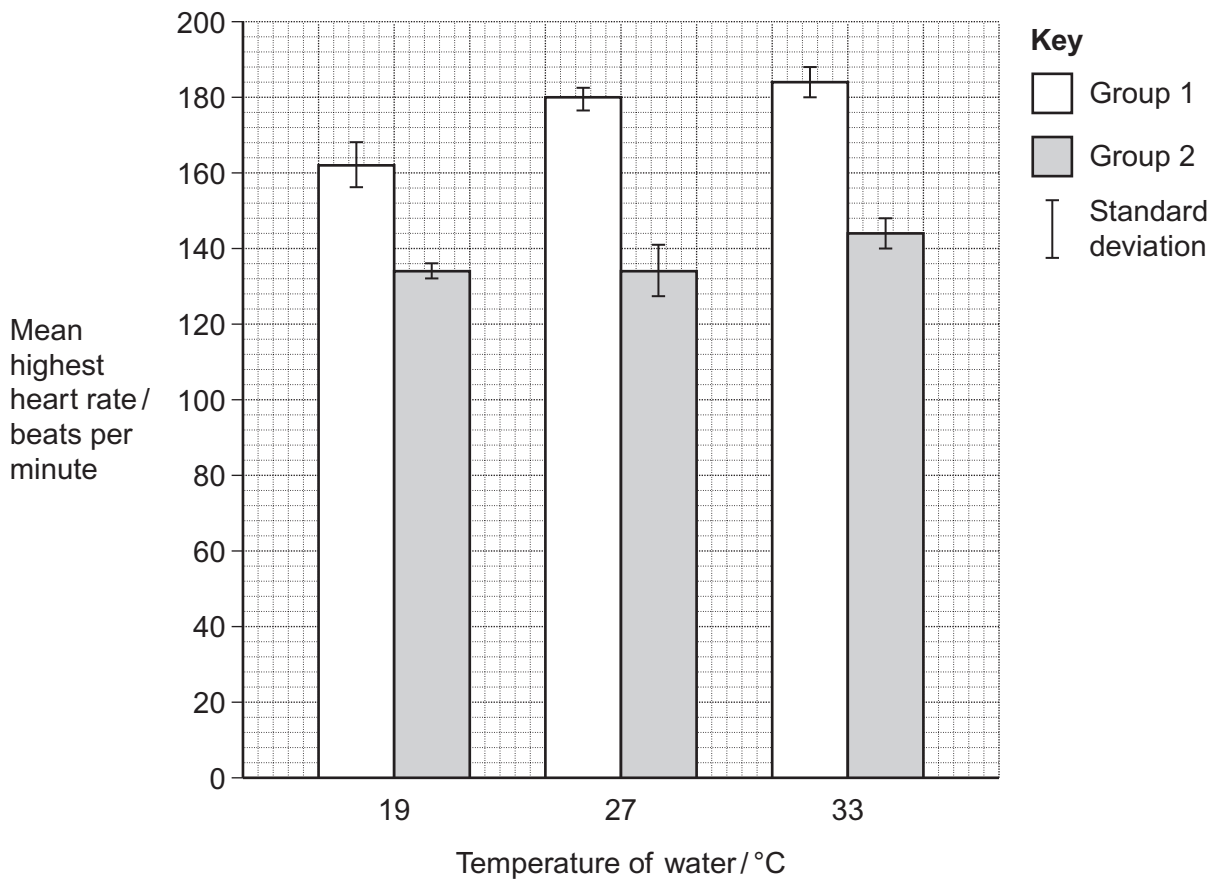
Resource B

Scientists investigated the effects of water temperature on the heart rate of swimmers. Two groups of volunteers were asked to repeat the same swim at three different temperatures.

- **Group 1** volunteers were asked to swim 100 m as quickly as they could.
- **Group 2** volunteers were asked to swim continuously for 30 minutes.

The scientists recorded the highest heart rate for each swimmer during each swim. Their mean results are shown in **Figure 2**.

Figure 2



Turn over ►

Section B

Use the information in the **Resource Sheet** and your own knowledge to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 15 to 19**.

- 15** The stimulus of putting the body in ice-cold water leads to responses in the body that reduce heat loss from the surface of the skin. Describe how. **[3 marks]**

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[Extra space]

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- 16 (a)** One reason that reaction time is slower when body temperature falls is because nerve impulse conduction is slower. Explain how a lower temperature leads to slower nerve impulse conduction. **[2 marks]**

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- 16 (b)** Other than temperature, give **two** factors that affect the speed of nerve impulse conduction. **[2 marks]**

1

2

- 17** Suggest the conditions that the researcher used when obtaining her data for 0 seconds. **[1 mark]**

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- 18** Explain how the researcher could use her **raw** data to find **[2 marks]**

18 (a) the mode

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18 (b) the range

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- 19** A student reading the researcher's report concluded that the difference between the results for 30 seconds and 45 seconds was significant. Do you agree with his conclusion? Explain your answer. **[3 marks]**

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[Extra space]

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Turn over for the next question

Turn over ►

Use **Resource B** to answer **Questions 20** and **21**.

20 Give **one** conclusion that can be made from the scientists' investigation.

[1 mark]

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21 After reading the scientists' report, a member of a swimming club stated that "the report shows that swimming flat out is better for you than swimming for a length of time." Evaluate this statement.

[4 marks]

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[Extra space]

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END OF QUESTIONS

A-level Biology

Investigative and Practical Skills in A2 Biology - BI06T/P14
Final Marking Guidelines

Specification 2410
June 2014

Version: 0.1 Final Marking Guidelines

Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

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Guidance for teachers marking Biology ISAs

These are the final **Marking Guidelines**, which provide guidance on the marking of the ISA.

General principles

In general, you are looking for evidence that the student knows and understands the point required by the Marking Guidelines.

It is important to mark what the student has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used
For example anaphase, the term must appear
For example and, both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a student's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed
- Additional instructions are shown in the comments column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example, 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a student will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the student has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a $\wedge$ symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the student's response in the order in which they appear in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the student contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the student gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents students from gaining full marks from a list of right and wrong answers.

Example:

Name two substances that are produced in photosynthesis.

(2 marks)

Answer	Marks	Comment
Oxygen, glucose	2	Both correct
Oxygen, carbon dioxide	1	One correct, one incorrect
Carbon dioxide, oxygen, glucose	1	Carbon dioxide is clearly incorrect and cancels one of the marks
Oxygen, glucose, water	2	Regard water as a neutral point. It is not worth a mark but it is not incorrect

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the comments column in the Marking Guidelines to show that misspellings must not be credited.

BIO6T/P14 TASK

Before you mark any work, please make sure that you have read **Guidance for teachers marking Biology ISAs** on pages 3 to 5 of these Marking Guidelines.

Stage 1

The tables of raw data collected during implementation are required for moderation and **must** be attached to the ISA test.

The following criteria should be used to mark the results of the students' calculations:

Question	Marking Guidance	Mark	Comments
1	Correct calculation of all 10 reaction times;	1	Do not award mark if less than 10 values <i>or</i> Trial 3 values not used <i>or</i> reaction times given to fewer or more than 3 decimal places
Total		1	

Stage 2 – Assessment of statistical analysis

Question	Marking Guidance	Mark	Comments
2	Null hypothesis clearly stated; eg temperature/exposure to cold has no effect on <u>reaction time</u> eg there is no difference in <u>reaction time</u> before and after exposure to cold	1	Allow other expressions of the hypothesis but there must be a reference to reaction time
3(a)	Standard error / 95% confidence limits;	1	
3(b)	Valid explanation for choice of statistical test; eg looking for differences between <u>mean</u> values (of samples)	1	Do not credit if the wrong test is chosen Do not award unless there is a reference to 'mean'
4	Test statistic calculated accurately;	1	Working must be shown. Do not penalise lack of evidence for standard deviation calculation Accept student's correct calculation of the test statistic from their data even if the wrong test has been chosen
5	1. Correct interpretation of statistical test result in terms of acceptance or rejection of null hypothesis; 2. Interpretation involves appropriate reference to the <u>probability</u> of the results being due to <u>chance</u> ; <i>See comments for guidance</i>	2	Neither mark is possible if a calculation has not been completed 1. Allow correct interpretation of calculated test statistic even if the calculation or the choice of test is incorrect 2. Do not credit suggestion that probability is 0.05% or 5 Guidance for SE: If no overlap , then probability is less than 0.05/5% that (differences in) results are due to chance; reject the null hypothesis.

			If overlap , then probability is greater than 0.05/5% that (differences in) results are due to chance; accept the null hypothesis.
Total		6	

The Candidate Results Sheet: Stage 2 is required for moderation and must be attached to the ISA test.

BIO6T/P14 Written Test
Section A

Question	Marking Guidance	Mark	Comments
6	No movement of arm / no grabbing (of stick) / only hand/fingers move;	1	Reject ideas about discomfort or tiring
7	Easier to catch / falls between (index) finger and thumb / not touching finger and thumb (until caught) / dropped at same angle (each time);	1	Reject references to gravity or amount of scale covered up
8	Can compare results of different people / standardised method;	1	‘Compare/comparison’ alone is insufficient. ‘Standardised’ could be expressed (simply) as “everybody does the same thing” Reject suggestion of ‘so method understood’
9	1. (Person) cannot learn/cannot anticipate release / has to wait for release / don't know when it is going to be released; 2. Learning/anticipation would change reaction time/distance stick fell/speed of catching stick; 3. Only react when seeing stick fall/seeing movement of stick;	2 max	2. Need idea of reaction time/distance fell being different (than otherwise) Reject ‘results’ will not be the same
10	1. Position of arm/hand and wrist (relative to work surface); 2. Starting distance/7 cm between thumb and index finger; 3. Starting position of stick (between thumb and index finger/at 0); 4. The point to read off on the stick once caught; 5. Time/1 minute for immersion (of hand); 6. (Each person uses) same hand throughout/in all 6 trials; 7. Reading of instructions each time; 8. One named environmental factor, eg temperature of room, level of light; 9. Time/angle of release of stick / use of same stick;	2 max	Reject any other suggestions 4. This was a personal decision to make so position must be stated eg top/bottom of finger(s) (in all trials) 6. Eg only right hand used

11	More representative (of reaction time) / gives a more reliable reaction time / fell shortest distance / quickest reaction / first two trials are (like) practice / get improvement with 'practice';	1	Reject idea that Trial(s) 1 or 2 are anomalous Reject any ideas that relate to the experimenter
12	1. Age changes reaction time/muscle movements/eyesight/(muscle/nervous) coordination; 2. Similar <u>genetic</u> make up / similar alleles; 3. Same length neurones / same length nerve pathway(s) / same distance for nerve impulses to travel / same (degree of) insulation; 4. Reference to effect on synapses/synaptic transmission/reaction times;	4	Accept converse for marking point 1, marking point 2 and marking point 3 1. Accept named age-associated medical condition that may affect reactions 2. Reject 'same alleles'. Reject same/similar genes'. Accept 'same gene pool' 3. Last alternative needs the idea of insulation (of hands or neurones) and not just 'same amount of fat' 4. It is sufficient to recognise that synapses/reaction times are affected in some way. Ignore suggestions of what the effect may be 4. Accept 'caffeine is a stimulant'
13	1. Involves conscious thought / brain is used / does not start with skin receptors; 2. Not just spinal cord involved; 3. (Reaction is) not automatic / not innate / not inborn / is learned; 4. (Reaction) is not protective / does not prevent damage;	2 max	Accept converse statements Ignore references to speed or number of neurones involved 2. This needs stating for credit 3. Accept 'not autonomic'

14(a)	<i>Relating to trend</i> 1. Gradual increase and then steep increase; 2. Steep increase begins at 50 (years); <i>Relating to Graph</i> 3. Linear scale shown on <i>x</i>-axis and <i>x</i>-axis labelled as 'age/age group' with units given as 'years'; 4. Line drawn only between 20 and 75 years with no extrapolation;	4	1. Credit for overall trend. This point is not dependent on showing values on the <i>x</i>-axis 2. Reject this point if no values are shown on <i>x</i>-axis 3. All three aspects required. Check particularly where the position of 65 and 75 would occur within the chosen scale or are shown on the chosen scale. Ignore any values that might be shown on <i>y</i>-axis 4. Ignore points – they do not have to be shown Note: where a bar chart is shown in error, marking points 1 and 2 are still available
14(b)	More variation/more spread (about mean);	1	Reject answers in the context of 'range'
	Total marks for section A	19	

BIO6T/P14 Written Test
Section B

Question	Marking Guidance	Mark	Comments
15	1. Reference to <u>receptors</u> (for temperature detection); 2. Reference to hypothalamus/autonomic nervous system; 3. Reference to nerve/electrical impulses (to or from hypothalamus/ANS); 4. Reference to effectors in <u>wall of arterioles</u> / reference to muscles in <u>wall of arterioles</u> / reference to sweat glands; 5. Vasoconstriction (of arterioles) / stop sweating;	3 max	All points should only be awarded if they are in the correct context 1. Receptors could be in skin or blood system 2. Ignore 'thermoregulatory centre' 3. Credit once only. Accept 'action potentials' 4. Reject 'signals' or 'messages' 5. Question requires mechanisms to reduce heat loss and not generate heat. Ignore reference to hair 'movements'. Reject shivering/increase in metabolic rate/reference to skeletal muscles 5. Accept appropriate reference to shunt vessels. Reject where wrong blood vessels are constricted
16(a)	1. Slower <u>diffusion</u> ; 2. (Of) ions/ Na^+ / K^+ ;	2	1. Accept description of diffusion eg 'movement <i>down</i> concentration gradient' but concept of slower is required 2. Reference to ions is required. Reject other named ions, eg calcium ions Ignore references to synaptic transmission or rates of respiration
16(b)	1. Myelination / saltatory conduction; 2. Axon diameter;	2	1. Accept reference to presence of nodes of Ranvier

17	Keep everything the same but not in bath / at room temperature / same clothing as for immersion / sitting in empty bath / sitting in water at room temperature;	1	Accept 'normal' or 'comfortable' as equivalent to room temperature Ignore reference to body temperature
18(a)	(Find) the most common result/time / the result/time that occurs the most;	1	
18(b)	Highest and lowest result/time;	1	Accept 'difference between highest and lowest results/times'
19	1. (Which is based on) <u>mean</u> of 20 people/large (enough) sample; 2. (But) SE bars/confidence limits overlap; 3. Reference to 0.297 ± 0.0424 / 0.326 ± 0.0366 / confidence limits = $2 \times \text{SE}$; 4. (So) difference is not significant;	3 max	1. This point is possible for students that suggest the difference <i>is</i> significant 2. This point applies whether $1 \times \text{SE}$ or $2 \times \text{SE}$ is used 3. This point rewards knowledge of use of $2 \times \text{SE}$ (as per Students' Statistics Sheet) 4. This point is only awarded after marking point 2 or marking point 3 has been given
20	1. People swimming 100 m/group1 had higher heart rates than people swimming for 30 minutes/group 2; 2. (Trend is) as temperature increases heart rate increases for swimming 100 m/group 1; 3. No trend for swimming for 30 minutes/group 2; 4. (SD values show that) each set of results has little variation;	1 max	Four approaches but only 1 mark available

21	1. Assumes that an increased HR is beneficial (whatever the temperature of the water); 2. (But) haven't measured the 'benefits' to health / increased heart rate may not be 'better'; 3. No definition of better/flat out / better/flat out is subjective/based on opinion; 4. Only know the highest heart rate / time at highest heart rate not known; 5. Swimmers only tested once / only a short-term effect (on heart rate) / long-term effects are not known; 6. Distance covered in 30 minutes not known/might vary / time to complete 100 m not known/might vary / swimming ability might vary (among volunteers/between groups); 7. Groups may not be representative (of population);	4 max	
Total marks for Section B		18	

Centre Number						Candidate Number					
Surname						Other Names					
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For Teacher's Use	
Section	Mark
PSA	
Stage 1 Skills	
Stage 2 Skills	
Section A	
Section B	
TOTAL (max 50)	



General Certificate of Education
Advanced Level Examination
June 2013

Biology

BIO6T/P13/test

Unit 6T A2 Investigative Skills Assignment

Written Test

For submission by 15 May 2013

For this paper you must have: - the task sheet, your results and your calculations - a ruler with millimetre measurements - a calculator.	Time allowed 1 hour 15 minutes
Instructions - Use black ink or black ball-point pen. - Fill in the boxes at the top of this page. - Answer all questions. - You must answer the questions in the space 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. - You are expected to use a calculator where appropriate. - The maximum mark for this paper is 36. - You will be marked on your ability to: - use good English - organise information clearly - use scientific terminology accurately.

Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page. Yes ☐ No ☐

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Signature of teacher Date

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Section A

These questions relate to your investigation of human variation.

Use the Task Sheet and your results to answer the questions.

Answer **all** questions in the spaces provided.

- 7** You investigated characteristics with phenotypes produced by dominant and recessive alleles. What is meant by *phenotype*?

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(1 mark)

- 8** Other than for age, there was no matching of the subjects in this investigation.
Give **one** reason why it was not necessary to match the subjects in this investigation.

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(1 mark)

- 9** You investigated whether the frequency of certain human characteristics remained the same from one generation to the next.

Suggest **two** reasons why the Hardy-Weinberg principle may **not** apply to human populations.

1

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2

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(2 marks)

You measured your own hand spans (steps 1 and 2) and wrist circumferences (steps 3 and 4). Another student, who carried out a similar investigation, measured the hand spans and wrist circumferences of a group of people. His results are shown in **Figure 1**.

Figure 1

Person	Hand span / mm	Wrist circumference / mm
1	224	171
2	232	192
3	235	195
4	216	168
5	220	170
6	244	193
7	248	199
8	238	194
9	229	180

10

In this investigation, the student did have to match the people.
Give **two** features he should have matched people for when investigating hand span.
For each feature, explain why it should be matched.

Feature 1

Explanation

.....

.....

Feature 2

Explanation

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(4 marks)

11

Use his data for **hand span** to identify:

11 (a) the median

11 (b) the range.

(2 marks)

Turn over ►

- 12** He concluded that wrist circumference was **not** determined by a single gene.

Use his data to suggest why he came to this conclusion.

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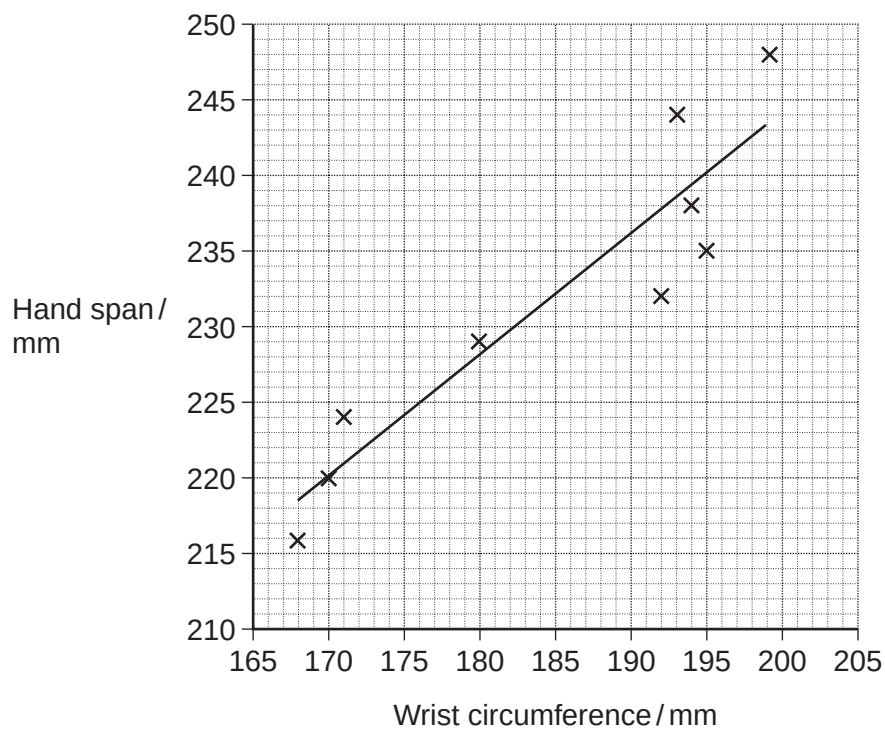
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(2 marks)

- 13** The student wondered whether wrist circumference could be used to predict hand span and plotted the scatter diagram shown in **Figure 2**.

Figure 2



- 13 (a)** Explain why he plotted his data as a scatter diagram.

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(1 mark)

- 13 (b)** He concluded that there was a strong positive correlation between wrist circumference and hand span.

Explain why he came to this conclusion.

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(2 marks)

- 13 (c)** Which statistical test should he use to see if the correlation between a person's wrist circumference and their hand span is significant or not?

.....

(1 mark)

- 13 (d)** When he carried out the statistical test on his data he obtained a value of $P < 0.05$.

How should he interpret this value?

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(2 marks)

Resource Sheet**Resource A**

Researchers investigated some characteristics of people from different parts of England. In the north of England they selected 200 people and recorded their phenotypes for three different characteristics.

Their results are shown in **Figure 3**.

Figure 3

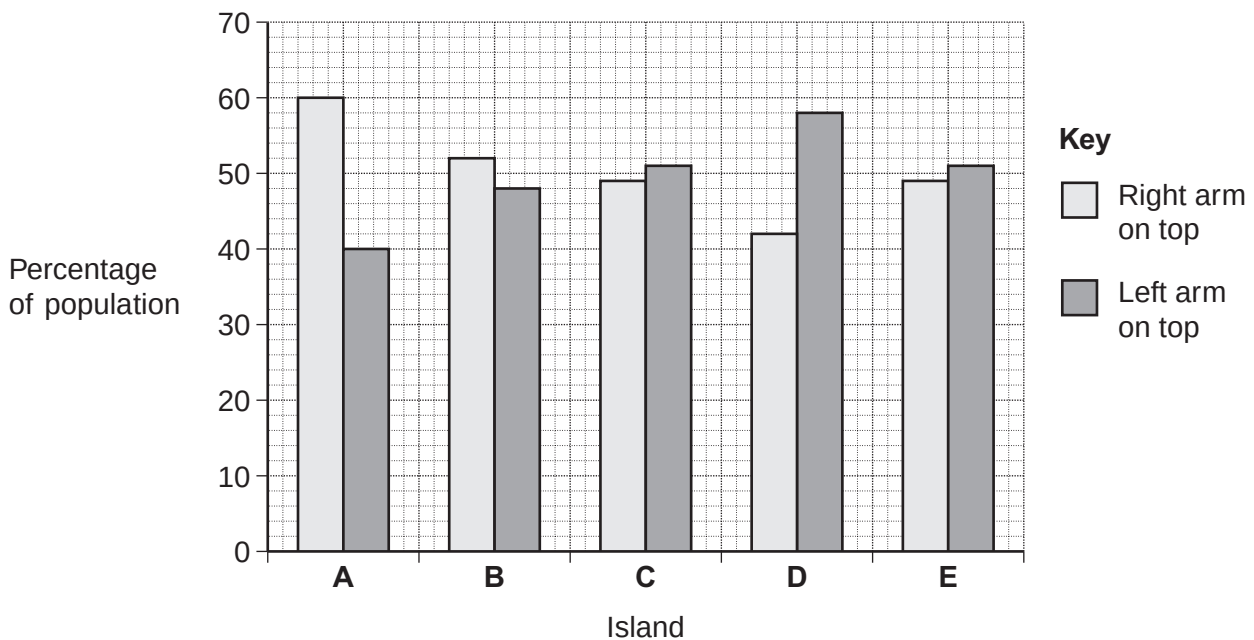
Phenotype produced by dominant allele	Number of people	Phenotype produced by recessive allele	Number of people
Tongue roller	131	Non-tongue roller	58
Right-handed	182	Left-handed	14
Straight thumb	142	Hitch-hiker thumb	50

Resource B

When most people fold their arms, they either always have their left arm on top, **L**, or always have their right arm on top, **R**. A geneticist investigated this characteristic on five small islands, **A**, **B**, **C**, **D** and **E**.

Her results are shown in **Figure 4**.

Figure 4



On one of the islands she recorded the arm-folding characteristics of parents and their children.

These results are shown in **Figure 5**.

Figure 5

Arm-folding of parents	Arm-folding of the children / %	
	Right arm on top, R	Left arm on top, L
R and R	41	59
R and L	45	55
L and L	44	56

The geneticist concluded that arm-folding is not determined by a single gene with a dominant allele and a recessive allele.

Turn over ►

Section B

Use the information in the **Resource Sheet** to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer Questions **14** to **16**.

- 14** Calculate the ratio of straight thumb to hitch-hiker thumb in this study.

Ratio = ...
(1 mark)

- 15** The numbers for the tongue rolling and thumb characteristics do not add up to 200.
For each characteristic suggest **one** reason why the numbers do **not** add up to 200.

Tongue rolling

.....

.....

Thumb

.....

.....

(2 marks)

- 16** One student looked at the researchers' results and concluded that 91% of people in the UK are right-handed.
Do you agree with this conclusion? Give reasons for your answer.

.....

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(2 marks)

Use **Resource B** to answer Questions 17 to 19.

17 The geneticist investigated arm-folding on five small islands.

17 (a) Use information from **Figure 4** to describe the results she obtained.

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(2 marks)

17 (b) Suggest advantages of using island populations in this investigation.

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(2 marks)

Turn over for the next question

Turn over ►

- 18** The geneticist concluded that arm-folding is **not** determined by a single gene with a dominant allele and a recessive allele.

Use information from **Figure 5** to explain why she reached this conclusion.

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(3 marks)

(Extra space)

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- 19** In another study, the geneticist investigated arm-folding in genetically identical twins. Data from this study supported her conclusion from the island study.

Suggest the evidence she found that supported her conclusion.

.....

.....

.....

(1 mark)

20 The Hardy-Weinberg equation is

$$p^2 + 2pq + q^2 = 1$$

The Hardy-Weinberg equation can be used to estimate the frequency of a recessive allele in a population. Haemochromatosis is a condition caused by a recessive allele. In one country, 1 in every 400 people was found to have haemochromatosis.

Describe how you would use the Hardy-Weinberg equation to calculate the frequency of people who are healthy but carriers (heterozygotes) of the allele for haemochromatosis.

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(3 marks)

(Extra space)

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21 Health Authorities often make use of estimates of the frequency of harmful alleles.

Suggest and explain **one** advantage to Health Authorities of using these estimates.

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(2 marks)

END OF QUESTIONS

There are no questions on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

General Certificate of Education (A-level)
June 2013

Biology

BIO6T/P13

(Specification 2410)

Unit 6T: Investigative Skills Assignment

Final

Marking Guidelines

Mark schemes are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

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Guidance for teachers marking Biology ISAs

Final Marking Guidelines must be used to mark students' work.

General principles

In general, you are looking for evidence that the student knows and understands the point required by the Marking Guidelines.

It is important to mark what the student has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used
For example anaphase, the term must appear
For example and, both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a student's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed
- Additional instructions are shown in the comments column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example, 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a student will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the student has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a $\wedge$ symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the student's response in the order in which they appear in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the student contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the student gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents students from gaining full marks from a list of right and wrong answers.

Example:

Name two substances that are produced in photosynthesis. (2 marks)

Answer	Marks	Comment
Oxygen, glucose	2	Both correct
Oxygen, carbon dioxide	1	One correct, one incorrect
Carbon dioxide, oxygen, glucose	1	Carbon dioxide is clearly incorrect and cancels one of the marks
Oxygen, glucose, water	2	Regard water as a neutral point. It is not worth a mark but it is not incorrect

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the comments column in the Marking Guidelines to show that misspellings must not be credited.

BIO6T/P13 TASK

Before you mark any work, please make sure that you have read ***Guidance for teachers marking Biology ISAs*** on pages 3 and 4 of these Marking Guidelines.

Stage 1

The tables of raw data collected during implementation are required for moderation and **must** be attached to the ISA test.

The following criteria should be used to mark the students' results:

Question	Marking Guidance	Mark	Comments
1	Table 1 and Table 2 completed <u>and</u> correct numbers in boxes 1 to 4 in Table 3 (own data);	1	All 4 boxes should be correct
2	Correct numbers in boxes 1 to 4 in Table 5 (for over 50-year-olds);	1	All 4 should be correct and <i>must</i> be for the same two characteristics as own data
Total		2	

Stage 2 – Assessment of statistical analysis

Question	Marking Guidance	Mark	Comments
3	Null hypothesis clearly stated; e.g. There will be no difference between the observed and expected number of people with the two characteristics	1	Accept other appropriate ways of expressing the null hypothesis, e.g. the number of people with characteristics A and B will be the same for both age groups
4(a)	Chi-squared;	1	
4(b)	Valid explanation for choice of statistical test; e.g. comparing frequencies of people in categories	1	Accept 'comparing numbers' (in the context of this investigation) Do not credit if wrong test is chosen
5	Test statistic calculated accurately; <i>Note: Observed values from own data (15 to 25-year-olds). Expected values from supplied data (over 50-year-olds/previous generation)</i>	1	Working must be shown Accept student's correct calculation even if the test is not appropriate and/or phenotype numbers are incorrect, but observed and expected numbers must relate to the same two characteristics
6	- Correct interpretation of statistical test in terms of acceptance or rejection of null hypothesis; - Interpretation involves appropriate reference to the probability of the results being due to chance; <i>See comments for guidance</i>	2	If the calculated test statistic is greater than the critical value (7.82) then probability is less than 0.05/5% that (differences in) results are due to chance; reject the null hypothesis; If the calculated test statistic is less than the critical value (7.82) then probability is greater than 0.05/5% that (differences in) results are due to chance; accept the null hypothesis;
Total		6	

The Candidate Results Sheet: Stage 2 is required for moderation and must be attached to the ISA test.

BIO6T/P13 Section A

Question	Marking Guidance	Mark	Comments
7	How gene/allele is expressed / physical appearance of characteristic;	1	Accept 'it is what you see' as the minimum requirement
8	Everybody has these characteristics;	1	Could be expressed as not specific to ethnic groups/sexes/not sex-linked
9	1. Mutations are present / mutations occur (in humans); 2. People migrate / genes flow into a population / genes are lost from a population; 3. Mating is not random / people choose partners; 4. Generations overlap / generations are not discrete; 5. (Natural) selection / change in allele frequencies;	2 max	2. Accept immigration/emigration, 'gene flow' or 'genetic drift' 3. Idea of mate selected by 'looks' etc. 4. Idea of 'marriages' between different age groups
10	1. Age; 2. Reference to different stage of growth/maturity; 3. Sex; 4. Females are (usually) smaller / have different hormone effects; 5. Same ethnic group; 6. Reference to different body shape/size; 7. Same hand; 8. Greater flexibility with use / stretch with use;	4 max	Principle: max 2 features, max 2 explanations for named feature 2. Accept body or bone growth 3. Accept gender 4. Accept correct named hormones 7. e.g. all use right hand 8. Credit different ways of expressing this idea
11(a)	232;	1	
11(b)	216 – 248;	1	Accept 32 (difference between top and bottom values)

12	1. No categories; 2. No dominant form/phenotype / no recessive form/phenotype; 3. (Wrist circumference/data shows) normal distribution; 4. Measurements of wrists/sizes of wrist <u>continuous</u> /not <u>discontinuous</u> ;	2 max	1. Accept no discrete types No dominant (or recessive) categories meets points 1 and 2 4. Knowledge of specific terms required to credit this point (as a further qualification of point 1)
13(a)	Both variables are continuous / two dependent variables / to see if there is a correlation;	1	Variables can be named. Accept other valid explanation for use of scatter diagram e.g. data/measurements are in pairs. Reject reference to scattered data
13(b)	1. As wrist circumference increases so does hand span; 2. Points are close to the line (of best fit);	2	2. Accept converse e.g. no/few outliers/anomalies
13(c)	Spearman's / Spearman rank / Rank correlation;	1	
13(d)	1. <u>Correlation</u> not due to chance / there is a <u>correlation</u> ; 2. Null hypothesis rejected; 3. (Because) <u>probability</u> is less than 0.05/5%; 4. Results of test would be obtained by chance less than 5% of the time;	2 max	1. Must refer to correlation 3. Reject 0.05% or 5 Probability must be stated and not 'p'
Total marks for Section A		18	

BIO6T/P13 Section B

Question	Marking Guidance	Mark	Comments
14	<u>2.84</u> :1;	1	Accept '2.84 to 1' or (just) 2.84 Do not accept 1:2.84 or 142:50
15	1. Some embarrassed / some not willing to show tongue / cannot tell; 2. Could not decide whether thumb was straight or not / thumb bending is judgemental/subjective;	2	
16	1. (No) - should be 92.9% / should be calculated from 182 out of 196 / should not be calculated from 182 out of 200; 2. (Yes) – assumes 4 out of 200 use either hand; 3. (But) sample may not be representative; 4. Small sample size / only sampled 200;	2 max	Allow either no or yes approach but no mark awarded for no or yes on its own 2. Accept ambidextrous 3. This could be expressed in other ways e.g. only based on one part of the country / might not be the same in different parts of the UK / might not be representative of UK
17(a)	1. No overall pattern / pattern (of right or left most common) is not the same for all islands; 2. For (B) C and E there is little difference; 3. Large differences on A and D and opposite ways (to each other);	2 max	1. Allow expression in other ways e.g. three islands show left on top is more common 3. Need both aspects but allow other expressions of 'opposite ways'
17(b)	1. Can record all individuals on (small) islands; 2. (So) no/less sampling error; 3. (Maybe) different rates of mutation / different selection pressures / different environmental conditions; 4. Inbreeding / breeding with close relatives (more likely); 5. (Little) gene flow / (more chance of) genetic drift;	2 max	5. Accept reference to either of these ideas for this point

18	1. If R is recessive, R × R parents cannot produce L offspring; 2. If L is recessive, L × L parents cannot produce R offspring; 3. R × R and L × L parents produce both types of offspring;	3	Accept use of genetic diagrams to illustrate points 1 and 2 Accept right arm on top as R etc. 3. Need reference to two parent crosses for this mark
19	Both L and R in a set of twins / (some) twins show different arm-folding;	1	
20	1. Use 1 in 400 to find frequency of homozygous recessive/q^2 OR 1 in 400 gives frequency of 0.0025; 2. Find square root of q^2 / find square root of 0.0025; 3. Use of $p + q = 1.0$ / determine frequency of both alleles/both p and q / find $p = 0.95$ and $q = 0.05$; 4. Use of $2pq$ to find carriers/heterozygotes;	3 max	Note - convention has recessive allele as q and dominant allele as p but allow reversal (since outcome is the same) as long as this is consistent throughout The question requires a description but credit working where correct as alternative since this shows the stages
21	1. Have an idea of number of people that will have disease / know if number of carriers has changed; 2. (Because) expect little/no change in frequency from one generation to the next; 3. Medical facilities/funds (can be) in place;	2 max	1. Accept reference to specific disease e.g. cystic fibrosis 3. Accept any appropriate example of 'medical facility' e.g. gene therapy/hospital places/research etc.
Total marks for Section B		18	

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 Examiner's Use	
Total EMPA mark	
Examiner's Initials	
Section	Mark
Task 1	
Task 2	
Section A	
Section B	
TOTAL EMPA MARK	



General Certificate of Education
Advanced Level Examination
June 2012

Biology

BIO6X

Unit 6X A2 Externally Marked Practical Assignment Written Test

For submission by 15 May 2012

For this paper you must have: - the Task Sheet 2, including your results and statistical calculations - a ruler with millimetre measurements - a calculator.	Time allowed 1 hour 15 minutes
Instructions: - Use black ink or black ball-point pen. - Fill in the boxes at the top of this page. - Answer all questions. - You must answer the questions in the space 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 34. - You will be marked on your ability to: - organise information clearly - use scientific terminology accurately.

Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes ☐ No ☐

Teacher Declaration:

I confirm that the candidate has met the requirements of the practical skills verification (PSV) in accordance with the instructions and criteria in section 3.8 of the specification.

Practical Skills Verification	Yes ☐
--------------------------------------	-------------------------------------

Signature of teacher Date

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Section A

These questions are about your investigation of the effect of the height at which parsnip seeds are released on the distance they travel.

Use your copy of Task Sheet 2 and the results of your statistical analysis to answer them.

Answer **all** questions in the spaces provided.

- 5** In **Task 2** you were told to standardise the way in which you released the parsnip seeds. Describe how you did this.

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(2 marks)

- 6** You used a plumb line in your investigation. Explain why using a plumb line would allow you to get reliable measurements.

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(1 mark)

- 7** In your investigation, wind speed was a confounding variable.
Would using a large number of seeds help to minimise the effect of wind speed?
Explain your answer.

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(2 marks)

8 A student suggested that it would be better to release all 20 seeds together.

8 (a) Suggest **one** advantage of releasing the seeds together.

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(1 mark)

8 (b) Suggest **one** disadvantage of releasing the seeds together.

.....

.....

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(1 mark)

9 Hogweed is a common plant found on roadsides. Hogweed seeds are very similar to parsnip seeds. Suggest **two** ways in which passing vehicles may assist the dispersal of hogweed seeds.

1

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2

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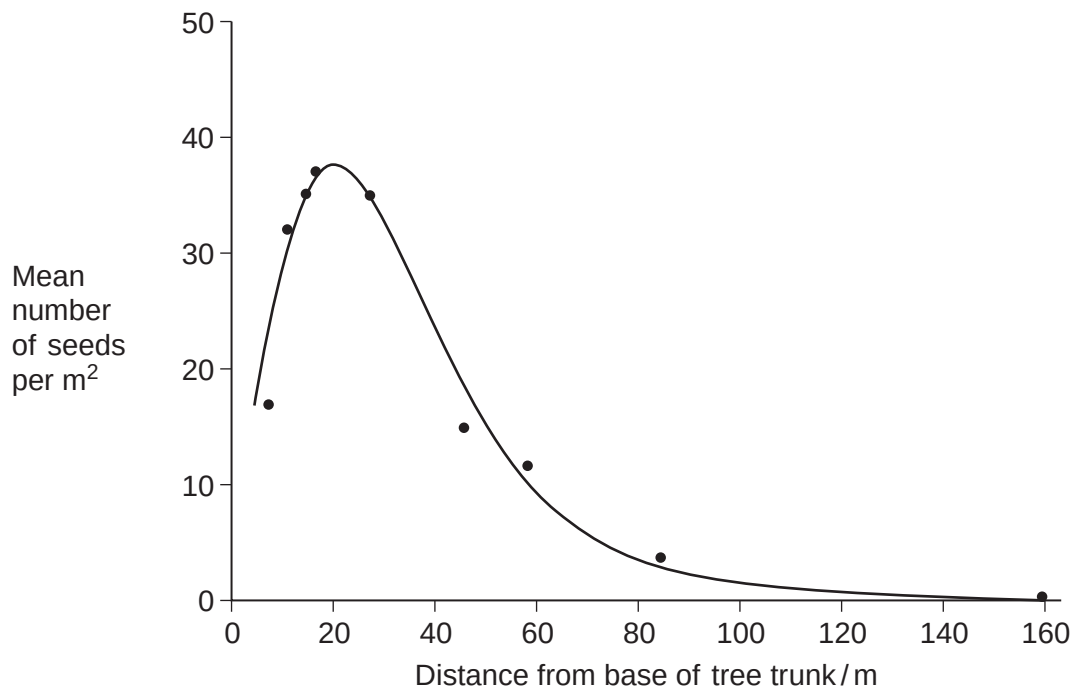
(2 marks)

Turn over for the next question

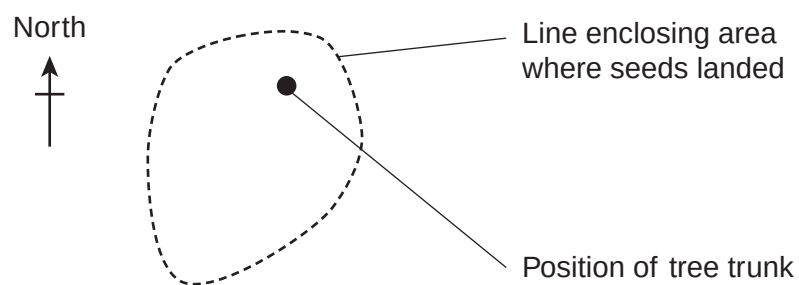
Resource Sheet

Resource A

A 75 m tall tree released very large numbers of small seeds. Ecologists used quadrats along a transect to measure the number of these seeds at different distances from the tree. Their results are shown on the graph.



The seeds of this tree are dispersed by wind. The diagram shows the pattern of seed dispersal from this tree.



Resource B

Agricultural scientists divided a field into a number of different plots. They planted soya bean seeds in these plots at different sowing densities. The diagram shows how these plots were arranged. The numbers show the sowing densities in seeds per m². The plots containing seeds sown at a density of 250 seeds per m² have been shaded.

250	500	1000	15	25	50	100
15	25	50	100	250	500	1000
25	50	100	250	500	1000	15
50	100	250	500	1000	15	25
1000	15	25	50	100	250	500
500	1000	15	25	50	100	250
100	250	500	1000	15	25	50

The scientists recorded the number of soya bean plants growing in each plot at different times after the start of the investigation. Their results are shown in the table.

Number of seeds planted per m ²	Mean number of plants surviving per m ² after			
	22 days	39 days	61 days	93 days
15	15	15	15	15
25	24	24	24	23
50	47	46	46	41
100	98	96	96	87
250	246	242	204	196
500	492	486	313	124
1000	987	788	276	95

Turn over ►

Section B

Use the information in the **Resource Sheet** and your own knowledge to answer the questions.

Answer **all** questions in the spaces provided.

Use **Resource A** to answer **Questions 10 to 12**.

- 10** Describe how the ecologists could have used quadrats and a transect to obtain the data from which the graph was drawn.

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(2 marks)

- 11** Look at the diagram showing the pattern of seed dispersal from this tree.

- 11 (a)** Suggest an explanation for the shape of the line enclosing the area where the seeds landed.

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(2 marks)

- 11 (b)** The line enclosing the area where the seeds landed would be different for trees of this species that were of a different height. Suggest why.

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(2 marks)

12 In an ecological succession, trees that are pioneer species often have smaller seeds than those that are part of a climax community.

12 (a) The species of tree in this investigation is adapted to colonising areas that have been cleared of vegetation. Use information from **Resource A** to explain how.

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(2 marks)

12 (b) The seeds produced by this species of tree did **not** grow successfully in a climax community. Suggest why.

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(2 marks)

Use **Resource B** to answer **Questions 13 to 15**.

13 (a) In terms of rows and columns, describe how the plots containing seeds sown at a density of 250 m² were arranged.

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(1 mark)

13 (b) Explain the advantage of arranging the plots in this way.

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(2 marks)

Turn over ►

- 14** The scientists would have treated the plots in the same way. Suggest **two** ways in which the scientists would have treated the plots to ensure that confounding variables would **not** affect the results.

1

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2

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(2 marks)

- 15 (a)** Describe the results of this investigation.

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(3 marks)

(Extra space)

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- 15 (b)** Explain the results when 1000 seeds were planted per m².

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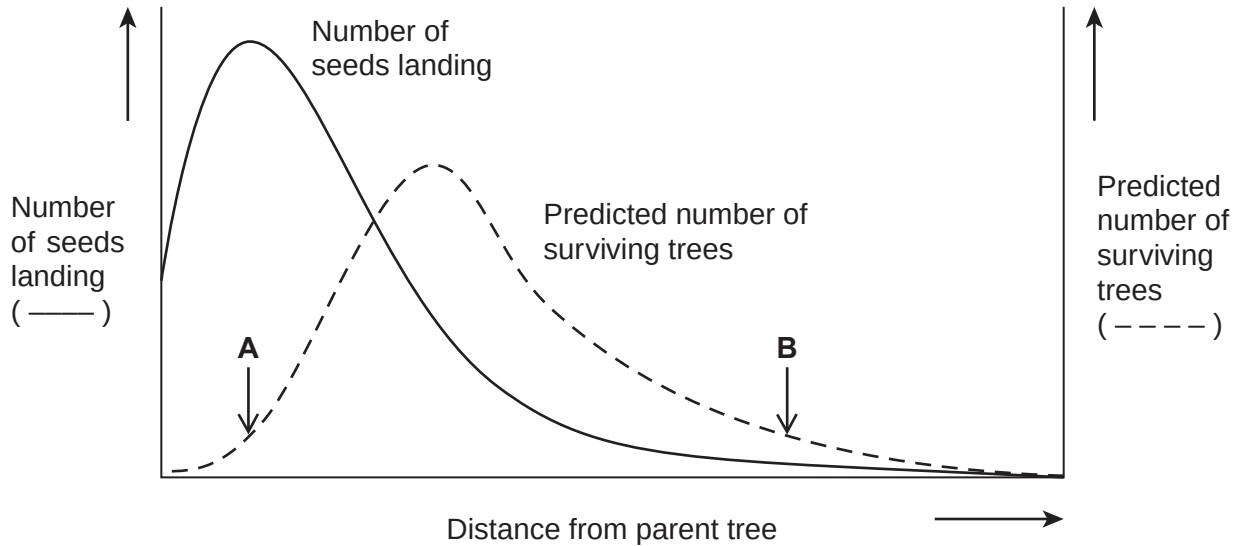
.....

(2 marks)

Use **Resources A** and **B** and your own knowledge to answer Question 16.

- 16** A scientist measured the number of seeds landing at different distances from a parent tree. He then produced a theoretical model. He used this model to predict how the number of new trees that grew from the seeds and survived varied with distance from the parent tree. The scales used for the two vertical axes are different.

The predictions from this model are summarised in the graph.



- 16 (a)** Explain why the model predicts a low number of surviving trees at point **A**

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(Extra space) (3 marks)

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Turn over ►

16 (b) Explain why the model predicts a low number of surviving trees at point **B**.

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(2 marks)

25

END OF QUESTIONS

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General Certificate of Education (A-level)
June 2012

Biology

BIO6X

(Specification 2410)

**Unit 6X: Externally Marked Practical
Assignment**

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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BIO6X 2012: TASK 1

Question	Marking guidance	Mark	Comments
Table	No marks awarded		
1(a)	Allow any method that does not involve any element of conscious choice;	1	E.g. number and select numbers from a 'hat' Do not accept methods such as measure every other seed 'Use random number generator' insufficient must be a table/calculator for example
1(b)	Selector influenced (by some feature)/selector makes conscious choice;	1	No marks awarded for using the words random and bias as these are given in the question
2(a)	Principle that magnification is apparent size divided by real size; 4.0 – 4.2;;	2	E.g. Measured size of scale divided by scale size itself
2(b)	Two marks for correct answer in range 5.7 – 6.5;; One mark for incorrect answer in which incorrect measured length of seed has been divided by magnification / measured length of seed has been compared to given scale;	2	Two marks can be awarded if error in the magnification calculation is carried forward
3(a)	(Involves lengths of) all the seeds/shows spread (of all lengths);	1	Do not accept answers using 'range'
3(b)	1. Large standard deviation means greater variation (in seed length/size); 2. Greater variation in distance (from the parent plant) / more spread out; 3. Description of why seed size/mass affects distance travelled;	3	Allow 'range' as equivalent to variation in this instance 3. suggestion must be reasonable
Total		10	

BIO6X 2012: TASK 2

Question	Marking guidance	Mark	Comments
4(a)	Clear statement of null hypothesis. E.g. height has no effect on distance travelled;	1	
4(b)	Standard error (and 95% confidence limits);	1	
4(c)	Comparing means;	1	
4(d)	Test statistic calculated correctly;	1	Allow wrong stats test calculated correctly
4(e)	<u>If Overlap:</u> 1 Probability greater than 0.05 / 5% that (differences in) results are due to chance; 2 Accept null hypothesis; <i>OR If no overlap</i> 1 Probability less than 0.05 / 5% that (differences in) results are due to chance; 2 Reject null hypothesis;	2	Use student's value of test statistic even if it has been calculated incorrectly 1 Must refer to both probability and chance 2. Reject 'hypothesis is true/false'
Total		6	

BIO6X 2012: WRITTEN TEST

Section A

Question	Marking guidance	Mark	Comments
5	2 marks Method fixes height dropped and orientation of seeds, would be repeatable;; 1 mark Method fixes either height dropped or orientation and would be repeatable; 0 marks Method may fix either height dropped or orientation, but unlikely to be repeatable	2 max	
6	Allows horizontal distance to be measured accurately;	1	
7	(Yes) 1. Seeds exposed to wide range of wind speeds; 2. Would cancel out in the average; (No) 3. Will affect those dropped from higher more; 4. Longer time for wind to have effect/wind more noticeable higher from floor;	2 max	Ignore references to anomalies
8(a)	Minimises the effect of factors/named factor other than height;	1	Accept "that's how they are released naturally by plant" Do not accept 'quicker'
8(b)	May interfere with each other; Will not all be released in the same position/same orientation;	max 1	

9	1. Stick to/land on tyres/radiator/vehicle; 2. Draft/turbulence;	2	
Total		9	

BIO6X 2012: WRITTEN TEST**Section B**

Question	Marking guidance	Mark	Comments
10	1. Quadrats placed at intervals along transect; 2. Number of seeds counted per quadrat to calculate seeds per m ² ;	2	
11(a)	1. Wind from North East; 2. Seeds blown further;	2	1. Accept blowing to South West
11(b)	1. Seeds have different distances to fall / seeds have different times in air; 2. Blown by wind a different amount; 3. (Candidates investigation) shows that seeds travel further when dropped from higher;	2 max	3. Supported by reference to candidate's investigation
12(a)	1. Produces large number of seeds / produces seeds blown by wind; 2. Greater probability (of colonising);	2	2. Accept greater chance
12(b)	1. Small size; 2. Too little food in seed to become established; 3. Not enough light for photosynthesis;	2 max	
13(a)	Each treatment occurs in each row <u>and</u> each column;	1	Ignore references to random

13(b)	1. Different environments or different variables in the field/in different plots; 2. Variables change across rows / down columns / from one side to another; 3. Minimises/removes the effect of variables;	2 max	
14	Standardising any two relevant factors, for example: 1. Water; 2. Fertiliser/manure/ soil nutrient; 3. Weed killer; 4. Soil pH;	2 max	To gain credit here, factor must be something that the scientists could do and must relate to field conditions Reject answers such as keep light/carbon dioxide/temperature constant
15(a)	1. Survival falls as time increases; 2. Survival falls as sowing density increases; 3. Up to 15/25 seeds per m ² all survive/above 250 seeds per m ² survival falls rapidly;	3	
15(b)	1. Intraspecific competition/ competition between bean/soya plants; 2. For water/nutrients/light; 3. Greater as plants grow/increase in size;	2 max	
16(a)	1. Competition; 2. (From) parent tree; 3. (From) large number of seeds; 4. For light/nutrients/water;	3 max	
16(b)	1. Few seeds/young plants; 2. Interspecific competition/unsuitable conditions means not all survive;	2	
Total		25	

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
PSA	
Stage 2 Skills	
Section A	
Section B	
TOTAL (max 50)	



General Certificate of Education
Advanced Level Examination
June 2011

Biology

BIO6T/P11/test

Unit 6T A2 Investigative Skills Assignment

For submission by 15 May 2011

For this paper you must have: - the task sheet, your results and your calculations - a ruler with millimetre measurement - a calculator.	Time allowed 1 hour 15 minutes
Instructions: - Use black ink or black ball-point pen. - Fill in the boxes at the top of this page. - Answer all questions. - You must answer the questions in the space 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 38. - You will be marked on your ability to: - use good English - organise information clearly - use scientific terminology accurately.
Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page. 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

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Section A

These questions relate to your investigation of the effect of ammonium hydroxide on the time taken for chloroplasts to decolourise DCPIP.

Use the task sheet and your results to answer the questions.

Answer **all** questions in the spaces provided.

- 5 (a)** You were told **not** to put the leaf midrib or leaf stalk in the blender (Step 2). Suggest why.

.....

 (1 mark)

- 5 (b)** What was the purpose of using a blender?

.....

 (1 mark)

- 6** The isolation medium was cold and was also isotonic with the spinach tissue.

- 6 (a)** Explain why it was important that the isolation medium was cold.

.....

 (3 marks)

Extra space

- 6 (b)** Explain why it was important that the isolation medium was isotonic with the spinach tissue.

.....

.....

.....

.....

(2 marks)

- 7** There are large pieces of tissue and other organelles in your chloroplast suspension. Describe how you could isolate the chloroplasts from the other components in the suspension.

.....

.....

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.....

.....

(3 marks)

Extra space

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.....

Turn over for the next question

Turn over ►

8 You were told to wrap tube **A** in aluminium foil (step 8). Explain why.

.....

.....

(1 mark)

9 Tube **B** was a control experiment (step 8). Explain how the results in this tube acted as a control experiment.

.....

.....

.....

.....

.....

(2 marks)

10 In your investigation, the colour change in DCPIP was caused by the transfer of electrons from chlorophyll. Name the part of a chloroplast where this transfer of electrons takes place.

.....

(1 mark)

11 DCPIP is decolourised more slowly when ammonium hydroxide is added. Use your knowledge of the light-dependent reaction to suggest a reason why.

.....

.....

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.....

.....

(2 marks)

12 Some weed killers are substances that accept electrons during photosynthesis.

12 (a) Suggest how these substances kill weeds.

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.....

.....

.....

.....

(2 marks)

12 (b) Suggest **one** disadvantage of using these weed killers on weeds growing in a crop.
Explain your answer.

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.....

.....

.....

.....

(2 marks)

Resource Sheet**Resource A**

The Harvest Index is the percentage of dry biomass that is harvested and used.

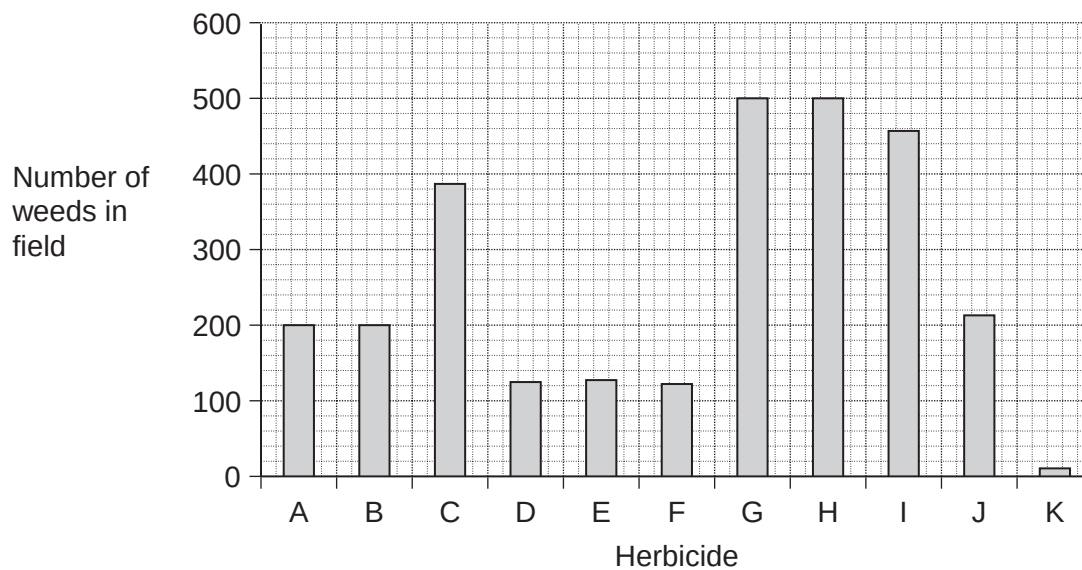
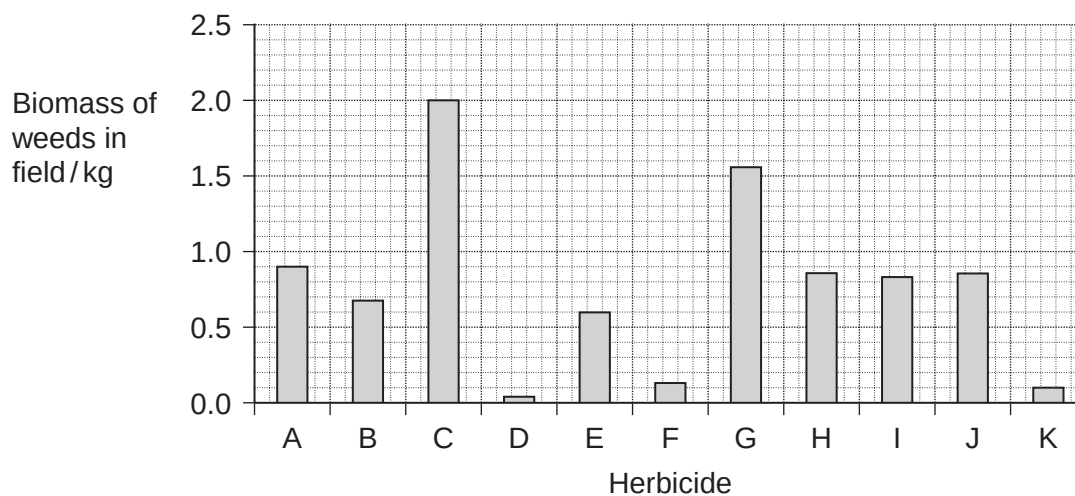
Barley is a cereal. It is grown for its grain. Researchers collected data to calculate the Harvest Index of barley growing in a small field. They obtained their measurements from quadrats at different places in the field. Their results are shown in **Figure 1**.

Figure 1

Quadrat number	Dry biomass of barley plants / g m⁻²	Dry biomass of barley grain harvested / g m⁻²
1	80	42
2	75	37
3	82	41
4	93	39

Resource B

Herbicides are substances that kill weeds. Three farmers wanted to know which herbicide to use to control weeds in fields of barley. They chose eleven fields of barley and used a different herbicide in each field. Four weeks later they collected, counted and weighed the weeds in each field. Their results are shown in **Figure 2** and **Figure 3**.

Figure 2**Figure 3****Turn over ►**

Section B

Use the information in the **Resource Sheet** to answer the questions.

Answer **all** questions in the spaces provided.

Use the information provided in **Resource A** to answer Questions **13** to **16**.

- 13** Use the data for quadrat number **4** in **Figure 1** to calculate the Harvest Index for barley. Show your working.

Harvest Index = ...
(2 marks)

- 14** Plant breeders are trying to produce barley plants with shorter stems. Explain how this would increase the Harvest Index.

.....
.....
(1 mark)

- 15** The values for the biomass of the barley plants are different in each quadrat. Suggest an explanation for this difference.

.....
.....
.....
.....
.....
(2 marks)

- 16** The researchers measured the dry biomass of the barley plants and the barley grain. What is the advantage of using dry biomass for these measurements?

.....
.....
.....
.....
.....
(2 marks)

Turn over ►

Use the information provided in **Resource B** to answer Questions 17 to 20.

- 17** Describe the difference in biomass of **each** of the weed plants in fields treated with herbicides **G** and **H**. Explain how you arrived at your answer.

.....

.....

.....

.....

.....

(2 marks)

- 18** The farmers decided that **K** would be the best herbicide to use. Explain why herbicide **K** would give a higher crop yield.

.....

.....

.....

.....

.....

(2 marks)

- 19** The farmers carried out their investigation during the summer. Suggest **one** advantage and **one** disadvantage of carrying out this investigation during the summer.

Advantage

.....

Disadvantage

.....

(2 marks)

Turn over ►

20

One of the farmers told a local newspaper reporter of their findings. The newspaper published an article with the following headline: "Local farmers show scientists the way to bigger crop yields." Was this headline justified? Explain your answer.

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(5 marks)

Extra space

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END OF QUESTIONS

18

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



General Certificate of Education

Biology

Unit 6T A2 Investigative Skills Assignment

BIO6T/P11/MG

Final

Marking Guidelines

2011 examination – June series

Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

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Guidance for teachers marking Biology ISAs

Final Marking Guidelines must be used to mark candidates' work

General principles

In general, you are looking for evidence that the candidate knows and understands the point required by the Marking Guidelines.

It is important to mark what the candidate has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used
For example anaphase, the term must appear
For example and, both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a candidate's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed.
- Additional instructions are shown in the final column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a candidate will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the

The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the candidate has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a **A** symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the candidate's response in the order in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the candidate contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the candidate gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents candidates from gaining full marks from a list of right and wrong answers.

Name **two** substances that are produced in photosynthesis.

(2 marks)

Answer	Marks	Comment
Oxygen, glucose	2	Both correct
Oxygen, carbon dioxide	1	One correct, one incorrect
Carbon dioxide, oxygen, glucose	1	Carbon dioxide is clearly incorrect and cancels one of the marks
Oxygen, glucose, water	2	Regard water as a neutral point. It is not worth a mark but it is not incorrect

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the final column in the Marking Guidelines to show that misspellings must not be credited.

Stage 2 (NB no marks are awarded for Stage 1 at A2)

Question	Marking Guidance	Mark	Comments
1	Clear statement of null hypothesis;	1	e.g. ammonium hydroxide has no effect on the time taken for colour change
2 (a)	Standard error (and 95% confidence limits);	1	
2 (b)	Compare two means;	1	Do not credit if wrong test is chosen
3	Test statistic calculated accurately;	1	Accept candidate's accurate calculation even if the test is not appropriate. If working not shown, calculation must be checked against raw data.
4	1 Correct interpretation of statistical test in terms of acceptance or rejection of null hypothesis; 2 Interpretation involves appropriate reference to the probability of the results being due to chance;	2	Use candidate's value from chosen test, even if it is incorrect Probability and chance must be used in the correct context
Total		6	

The table of raw data and the Stage 2 sheet is required for moderation and must be attached to the ISA test.

ISA test Section A

Question	Marking Guidance	Mark	Comments
5 (a)	Few/no chloroplasts present / tough material so will not be cut up (by blender);	1	
5 (b)	Break open <u>cells</u> / break <u>cell</u> walls / allow release of chloroplasts;	1	
6 (a)	EITHER 1 Slows/stops enzyme activity; 2 Enzymes released during blending; 3 Chloroplasts not damaged/still function/photosynthesis continues; OR: 4 Blending produces friction/releases heat; 5 (Heat) changes the tertiary structure (of enzymes) / denatures enzymes; 6 Chloroplasts not damaged / still function / photosynthesis continues;	3	Do not credit references to microorganisms/bacteria/decay Allow answers via <i>one</i> route only
6 (b)	1 Same water potential (as plant tissue) / no osmosis/no water movement in/no water movement out; 2 Chloroplasts/organelles do not burst / chloroplasts do not shrivel / chloroplasts are not damaged;	2	Accept 'no osmosis in or out' Accept 'no water movement in or out' Answer to second point must follow from first Reject cells do not burst
7	1 Filter/centrifuge; 2 At low speed then high speed / centrifuge again at higher speed / filter then centrifuge; 3 Collect pellet/sediment;	3	Marking principles are: 1. Filtering or centrifuging 2. Carrying out procedure twice at different speeds 3. Pellet is required

Question	Marking Guidance	Mark	Comments
8	Prevent entry of light/keep in the dark / to slow release of electrons from chlorophyll / because release of electrons / photosynthesis only occurs in the light /to stop photosynthesis;	1	
9	1 Shows that colour change in x / colour does not change in B ; 2 (Colour change) not due to isolation medium; 3 (Colour change) is due to chloroplasts / chlorophyll;	2 max	Accept shows that mitochondria do not affect result.
10	Chloroplast membrane;	1	Accept grana or thylakoids
11	1 Ammonium hydroxide has stopped/slowed transfer of electrons; 2 Along electron transport chain/to DCPIP; OR 3 Ammonium hydroxide accepts electrons; 4 Does not pass along electron transport chain / to DCPIP; OR 5 Ammonium hydroxide affects pH; 6 pH affects proteins in electron transport chain;	2	Accept equivalent terms for electron transport chain Do not accept 'from chlorophyll'. This is insufficient Reject enzymes.
12 (a)	1 Stop/slow light-dependent reaction; 2 Stop/less production of reduced NADP/ATP; 3 <u>Light-independent</u> reaction slowed/stopped / photosynthesis slower/not completed;	2 max	Must refer to reduced NADP or alternatives for <u>reduced</u> NADP Slows or stops light-dependent reaction and light-independent reaction gain 2 marks
12 (b)	1 (Substance in weed killer) absorbed by crop; 2 Reduce growth/yield of crop / weed killer not selective; 3 Toxic effects on other wild life/when crop eaten; 4 Slows/stops respiration;	2 max	1 Idea of uptake 2 Idea of effect of uptake e.g. builds up in food chain and toxic / poisonous/harmful to other organisms
	Total	20	

Section B

Question	Marking Guidance	Mark	Comments
13	Two marks for correct answer, 41.9 / 42 ;; One mark for incorrect answer of 0.42;	2	
14	Increases proportion of crop that is used / greater proportion is grain / reduces proportion of crop that is not used / is not grain;	1	
15	1 Quadrats from different parts of field; 1 Biotic / abiotic factors / named biotic /abiotic factor different;	2	
16	1 Water (in plants and grain); 2 Varies;	2	
17	1 Greater when treated with herbicide G ; 2 Same number but total biomass larger;	2	Can be shown by figures
18	1 Fewer weeds left; 2 Fewer weeds to produce seeds; 3 Less contamination of crop (by weeds); 4 Fewer weeds to separate from crop; 5 Less competition (between crop and weeds);	2 max	

Question	Marking Guidance	Mark	Comments
19	Advantage 1 Weeds growing fast / photosynthesising fast so effect will be seen / will have large effect; Disadvantage 2 No information about winter / other seasons / weeds not growing fast / could kill (beneficial) insects / crop may be harvested before effects noticeable;	2	One mark for advantage and one mark for disadvantage
20	Limitations of investigation 1. No control/untreated field; 2. Amount of herbicide may be different; 3. May be differences between fields; Eg soil Nutrients/fertiliser added Type of weed Microclimates 4. May be different number of weeds (at start); Limitations of results 5. No replicates/one set of data; 6. Field size may vary/not specified; Scientific Research 7. Scientific research/example of scientific research has led to greater yield;	5 max	When marking please number the marking points e.g. ⁵ ✓ means a mark award for point 5
Total		18	

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Teacher's Use	
	Mark
Stage 1 Skills	
Stage 2 Skills	
Section A	
Section B	
TOTAL ISA Mark	



General Certificate of Education
Advanced Level Examination
June 2010

Biology

BIO6T/P10/test

Unit 6T A2 Investigative Skills Assignment

Written Test

For submission by 15 May 2010

For this paper you must have:

- the task sheet, your results and your calculations
- a ruler with millimetre measurement.
- a calculator.

Time allowed

- 1 hour 15 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the 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 37.
- You will be marked on your ability to:
 - use good English
 - organise information clearly
 - use scientific terminology accurately.

Signature of Teacher marking the ISA Date

Section A

These questions relate to your investigation into the effect of light intensity on the rate of photosynthesis.

Use the task sheet, your results and your calculations to answer these questions.

Answer **all** questions in the spaces provided.

- 6** In this investigation you found the rate of bubbling. Explain why the rate of bubbling can be used as a measure of the rate of photosynthesis.
-
-
-
-
-
-
- (2 marks)
- 7** Heat from the lamp causes small temperature rises during this investigation.
- 7 (a)** Describe and explain how these temperature rises might have affected the data you collected.
-
-
-
-
- (2 marks)
- 7 (b)** Suggest **one** way by which you could reduce these temperature rises.
-
-
- (1 mark)

- 8 A solution of sodium hydrogencarbonate was used in this investigation. Suggest why.

.....

.....

(1 mark)

- 9 After setting up the apparatus, you were told to leave your plant for 5 minutes before making any measurements. Explain why you were told to leave your plant.

.....

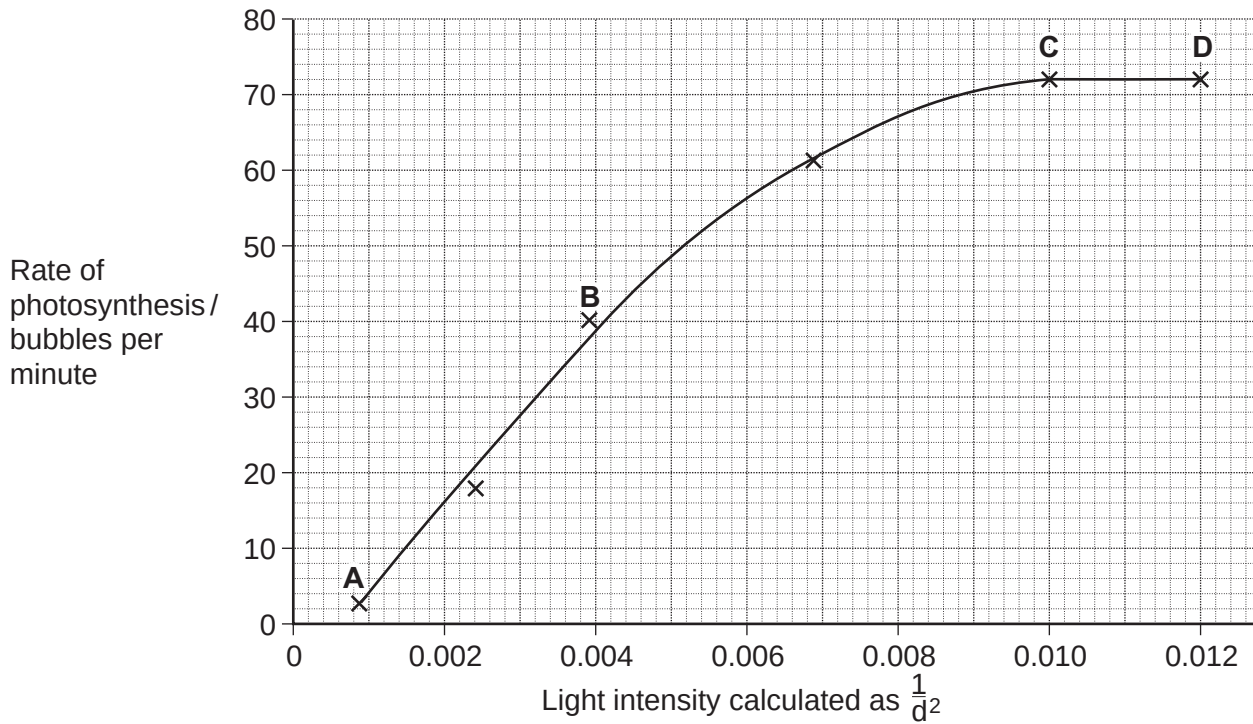
.....

(1 mark)

Turn over for the next question

Turn over ►

- 10** A student who carried out a similar investigation plotted a graph of his results.



- 10 (a)** Explain the shape of the curve between points **A** and **B**.

.....

.....

.....

.....

.....

.....

(2 marks)

- 10 (b)** Explain the shape of the curve between points **C** and **D**.

.....

.....

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.....

.....

.....

(2 marks)

11

Give **two** assumptions which have to be made in using the rate of bubbling as a measure of the rate of photosynthesis.

1.....

.....

2.....

.....

(2 marks)

13

Turn over for the next question

Turn over ►

Resource Sheet

Introduction

Resource A – D relate to a single investigation.

Scientists investigated the effect of supplying extra carbon dioxide on the yield of tomatoes growing in a glasshouse. They compared the mean yield of tomatoes from 1995 to 1997 when no extra carbon dioxide was supplied with the mean yield of tomatoes from 1998 to 2000 when extra carbon dioxide was supplied.

Resource A

Tomato plants were grown in two glasshouses, each with an area of 2000 m². **Figure 1** shows the mean number of hours of sunshine per month during fruit production.

Figure 1

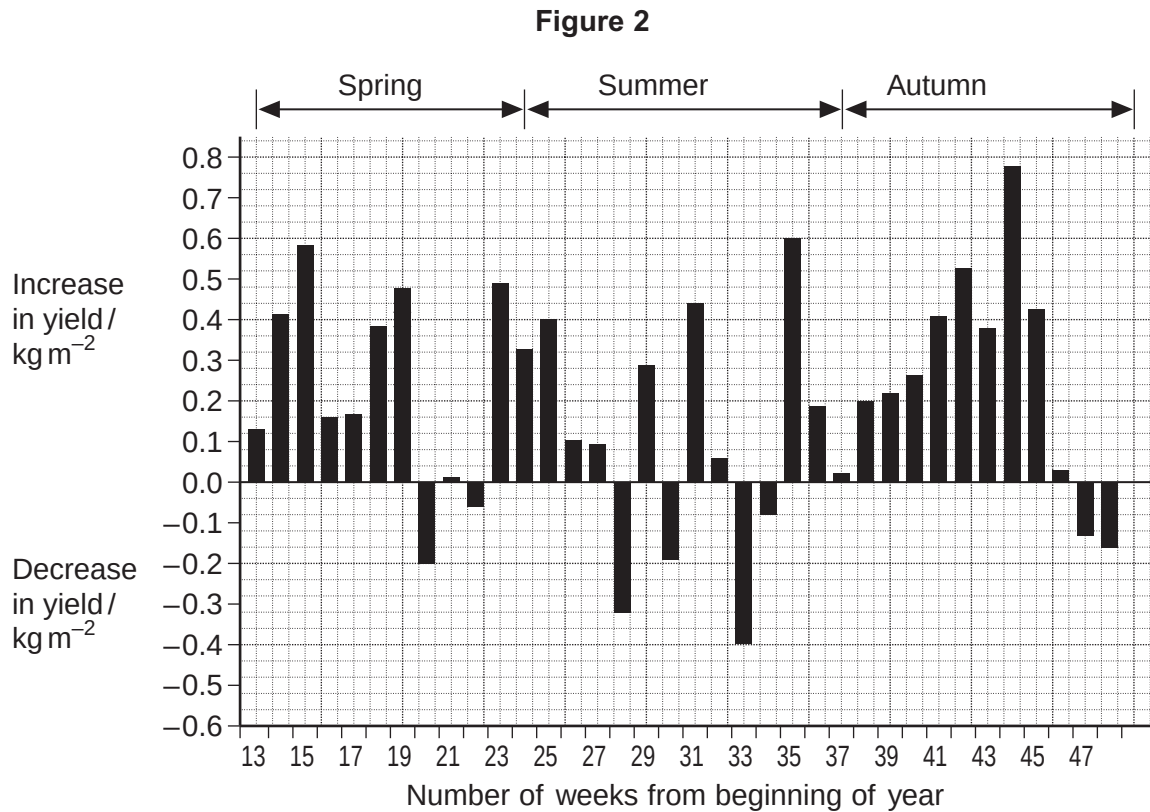
	1995 – 1997 (no extra carbon dioxide)	1998 – 2000 (extra carbon dioxide)
Mean number of hours of sunshine per month	148.91	147.00

- The scientists used heating to maintain the temperature inside the glasshouses above 18 °C. They opened the windows to keep the temperature below 30 °C.
- From 1998 to 2000 they maintained the carbon dioxide concentration between 0.06 % and 0.08 % when the windows were closed and between 0.04 % and 0.05 % when the windows were open.
- The carbon dioxide concentration in the air outside the glasshouse was 0.04 %.

Resource B

Figure 2 shows the mean difference between the yield of tomatoes with extra carbon dioxide and the yield with no extra carbon dioxide for each week during the harvesting period.

If the yield is greater when extra carbon dioxide is supplied, the difference in yield is shown as an increase. If the yield is lower when extra carbon dioxide is supplied, the difference is shown as a decrease.



The Resource Sheet continues on the next page.

Turn over ►

Resource C

Figure 3 shows the relationship between the time when the tomatoes were harvested and the yield.

Figure 3

Number of weeks from beginning of year	Mean yield per week with extra carbon dioxide / kg m ⁻²	Mean yield per week without extra carbon dioxide / kg m ⁻²
13 – 19	1.25	0.83
20 – 25	1.62	1.47
26 – 48	1.23	1.06

The commercial price for tomatoes varies with the time of year. The highest price is paid for tomatoes between weeks 13 and 19. The lowest price is paid between weeks 26 and 48.

Resource D

Whiteflies are an important insect pest of tomatoes. The adults can fly from plant to plant. Their young do not have wings. The adults and young feed on the plant sap and introduce viruses into the tomato plants. Feeding and the introduction of viruses both reduce the yield of tomatoes. The scientists controlled the number of whitefly in the glasshouses by releasing parasitic wasps. The wasps lay their eggs in the young of the whitefly. The wasp eggs hatch and feed on the young whitefly, killing them.

Section B

Use the information in the **Resource Sheet** and the Students' Statistics Sheet in your Task Sheet to answer the questions.

Answer **all** questions in the spaces provided.

- 12** The scientists monitored the number of hours of sunshine per month. Explain why they monitored the number of hours of sunshine.

.....

.....

.....

.....

.....

.....

(2 marks)

- 13** The temperature, the use of fertiliser and the number of insect pests were controlled during this investigation. Name **one** other factor which should have been controlled during the investigation. Explain why variation in this factor would affect yield.

Factor

Explanation

.....

(2 marks)

- 14 (a)** An increase in carbon dioxide concentration affected the yield of tomatoes in week 35. Use **Figure 2** to describe how.

.....

.....

(1 mark)

- 14 (b)** There was a decrease in yield when extra carbon dioxide was supplied during some weeks of the year. Use information from **Resource A** to suggest why.

.....

.....

(1 mark)

Turn over ►

- 15** Using **Figure 3**, calculate the percentage increase in yield when extra carbon dioxide was added for weeks 13 to 19. Show your working.

Percentage increase
(2 marks)

- 16** Additional information is required for tomato growers to decide whether it is economically profitable to add extra carbon dioxide to produce very early tomatoes. Give **two** pieces of information that the growers would require.

1
.....
2
.....
(2 marks)

- 17** Adding extra carbon dioxide during the summer (weeks 24 – 36) is unlikely to be profitable. Use data from the resource sheet explain why.

.....
.....
.....
.....
(2 marks)

- 18** The control experiment in this investigation was when data were collected with no extra carbon dioxide added. Some scientists said this control experiment was not satisfactory. Explain how you could improve the control experiment.

.....
.....
.....
.....
(2 marks)

- 19 (a)** Scientists used parasitic wasps to control the numbers of whitefly in the glasshouses. What term is used to describe this method of pest control?

.....
(1 mark)

- 19 (b)** The scientists estimated the number of whitefly in each glasshouse by using yellow sticky traps hanging from the plants. The whitefly are attracted to the yellow colour and stick to the glue on the trap.

Suggest why it was important for the scientists to have an estimate of the number of whitefly in these glasshouses.

.....
.....
.....
.....
(2 marks)

- 19 (c)** Suggest why the use of sticky traps may **not** give an accurate measure of the total number of whiteflies in a glasshouse.

.....
.....
(1 mark)

- 19 (d)** Give **one** disadvantage of using a natural parasite, such as this wasp, rather than using chemical control.

.....
.....
(1 mark)

Turn over ►

Design an investigation to test the hypothesis that whitefly are attracted to a yellow sticky trap more than to a red sticky trap.

[illegible]

Extra space

24



General Certificate of Education

Biology

Unit 6T A2 Investigative Skills Assignment

BIO6T/P10/MG

Marking Guidelines

2010 examination – June series

Marking Guidelines are prepared by the Principal Moderator and considered, together with the relevant questions, by a panel of subject teachers.

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Guidance for teachers marking Biology ISAs

General principles

In general, you are looking for evidence that the candidate knows and understands the point required by the Marking Guidelines.

It is important to mark what the candidate has written, not to assume what may have been intended. It is also important to make sure that a valid point is in the correct context. Individual words or phrases where the overall answer does not apply to the question asked should not be credited.

Conventions

The following conventions are used in the Marking Guidelines.

- A semicolon (;) separates each marking point
- An oblique stroke (/) separates alternatives within a marking point
- Underlining of a word or phrase means that the term must be used
For example anaphase, the term must appear
For example and, both items must be present for a mark
- Brackets are used to indicate contexts for which a marking point is valid. This context may be implied by a candidate's answer
- 'Accept' and 'reject' show answers which should be allowed or not allowed.
- Additional instructions are shown in the final column
- 'Max' refers to the maximum mark that can be awarded for a particular question or part question.

The Marking Guidelines show the minimum acceptable answer(s) for each marking point. A better, more detailed, or more advanced answer should always be accepted, provided that it covers the same key point.

Marking Guidelines cannot give every possible alternative wording - equivalent phrasing of answers should be accepted. For example 'the water potential is higher in the cells' is equivalent to 'the water potential is less negative in the cells'. It is, however, important to be sure that the minimum requirement of the Marking Guidelines is met and that the point is made unambiguously.

Converse answers are normally acceptable, unless the wording of the question rules this out. For example, 'the water potential is lower in the solution' is an acceptable converse of 'the water potential is higher in the cell'.

Very occasionally, a candidate will give a biologically correct answer that is not covered in the Marking Guidelines. If it is equivalent in standard to the Marking Guideline answers, it should be credited. In this case, write the word 'valid'.

All marking points are awarded independently, unless a link between points is specified in the Marking Guidelines.

The mechanics of marking

Always mark in red ink. Make sure that some red ink appears on every page on which the candidate has written.

For each mark awarded, put a tick close to the marking point. In all cases, a tick should equal one mark and the total number of ticks should match the mark totals in the margins. The total mark for each part answer should be written in the right hand margin.

Put a cross against incorrect points. It is helpful to indicate omissions of key words or incomplete answers with a **Δ** symbol, and to highlight irrelevancies or contradictions by underlining. It is also helpful to write brief comments to explain the reason for awarding or withholding a mark when the answer does not obviously match the Marking Guidelines.

When marking answers with many marking points, the points will be numbered. The points do not have to appear in the candidate's response in the order in the Marking Guidelines. The appropriate number must be placed alongside the tick. This helps to clarify where a specific point has been awarded and makes moderation much easier. It also helps to avoid awarding the same point twice.

Disqualifiers A correct point should be disqualified when the candidate contradicts it in the same answer. Indicate this on the script by 'dq'. If a tick has already been placed against a valid point, ensure that it is clearly deleted. Note that there is no penalty for incorrect points which are not contradictory, or for surplus or neutral information.

The list rule When a question asks for a specific number of points, and the candidate gives more, the general rule is that any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers. This prevents candidates from gaining full marks from a list of right and wrong answers.

Answer	Marks	Comment
Oxygen, glucose	2	Both correct
Oxygen, carbon dioxide	1	One correct, one incorrect
Carbon dioxide, oxygen, glucose	1	Carbon dioxide is clearly incorrect and cancels one of the marks
Oxygen, glucose, water	2	Regard water as a neutral point. It is not worth a mark but it is not incorrect

Two or more correct points on the same answer line should be credited.

'Neutral' points, i.e. ones which are not creditworthy but not actually incorrect, should not negate a correct answer.

Spelling Reasonably close phonetic spellings should be credited. However, any misspelling of technical terms which can easily be confused, such as intermediate between 'mitosis' and 'meiosis', should result in the relevant marking point being withheld. Terms like this will be indicated in the final column in the Marking Guidelines to show that misspellings must not be credited.

Stage 2 (NB no marks are awarded for the table, Stage 1 at A2)

Question	Marking Guidance	Mark	Comments
1	Correct calculations of the reciprocal distance squared;	1	
2	Clear statement of null hypothesis e.g. there is no relationship / correlation between light intensity and rate of photosynthesis;	1	
3 (a)	Spearman Rank;	1	
3 (b)	Rate of photosynthesis measured at a number of light intensities and this test determines if there is an association/correlation between them;	1	
4	Test statistic calculated correctly;	1	Accept candidate's correct calculation even if test is not appropriate
5	Compares the test statistic with the critical value at $P = 0.05/5\%$ level of probability; Correct statement concerning acceptance or rejection of null hypothesis;	2	Use candidate's value of test statistic even if it is incorrect
Total		7	

Section A

Question	Part	Marking Guidance	Mark	Comments
6		Bubbles contain oxygen from photosynthesis/oxygen is a product of photosynthesis/oxygen is a product of photolysis; Higher rate of photosynthesis results in more bubbles being released;	2	
7	a	More bubbles released; Because increase in rate of photosynthesis/lower solubility of oxygen/thermal expansion of gas/(photosynthetic) enzymes work faster;	2	
7	b	Use of water-filled transparent container/sheet of glass/(clear) plastic/heat shield between plant and lamp; Use of LED/low voltage bulb/halogen bulb/bulb which does not give off heat; Use of larger test tube/volume of water;	1 max	
8		Provides carbon dioxide/source of carbon for photosynthesis; So carbon dioxide not limiting;	1 max	Accept 'to act as a buffer/maintain pH'
9		Time needed for rate to adjust to new light intensity / oxygen released from previous light intensity still present;	1	
10	a	Rate limited by light intensity; Because rate of photosynthesis increases as light intensity increases; Increase in light intensity results in greater activation of chlorophyll / more electrons released; So more photolysis / greater dissociation of water producing oxygen;	2 max	
10	b	Light intensity not limiting; Another factor is limiting; Carbon dioxide concentration/temperature/chlorophyll concentration limiting;	2 max	If described in terms of 'not enough' rather than 'limiting' max 1

Section A – continued

Question	Part	Marking Guidance	Mark	Comments
11		Bubbles are the same size; Bubbles are oxygen/constant proportion of oxygen; A constant proportion of oxygen produced is released /oxygen produced does not dissolve/oxygen produced is not used in respiration/rate of respiration constant; Bubbles do not stick to glass/apparatus;	2 max	
Total marks for Section A			13	

Section B

Question	Part	Marking Guidance	Mark	Comments
12		To see if a difference in hours of sunshine was present/because it is necessary to monitor factors which cannot be controlled; So that they could eliminate this factor from affecting the yield (with/without extra carbon dioxide); Duration of light influences length of time for photosynthesis/temperature in glasshouse; Higher photosynthesis results in higher yield/more carbohydrates/sugars/proteins produced;	2 max	
13		Named factor; Explanation of why the factor is important; E.g. Density of planting; Competition for named resource; or Same variety of tomato; Yield will vary with different varieties/with different genotypes; or Water (application); Water needed for expansion of fruit/maintain leaf turgidity/maintain stomatal opening/replace water lost in transpiration/water used in photosynthesis;	2	For named resource accept 'nutrient' but not 'food'
14	a	Yield increases by 0.6 kg m^{-2} (when extra carbon dioxide present);	1	
14	b	Temperature/light intensity so could be lower in these weeks (as temperature / light intensity not fully controlled / monitored) (over period 1998 – 2000);	1	

Section B – continued

Question	Part	Marking Guidance	Mark	Comments
15		Two marks for correct answer of 50.6 %;; One mark for incorrect answer in which candidate has shown clearly that calculation based on an increase / 0.42 and original mass / 0.83	2	
16		Cost of supplying carbon dioxide; Price of (very early) tomatoes;	2	
17		Lowest price paid for tomatoes; Some carbon dioxide lost as windows open in summer; Little/no mean increase in yield in summer;	2 max	
18		Grow with extra carbon dioxide in one glasshouse and without carbon dioxide in other glasshouse at same time; So all environmental conditions/light and temperature same for experiment and control;	2	
19	a	Biological control;	1	
19	b	When/whether to start release of the parasitic wasps; How many parasitic wasps to release; To monitor effectiveness of method; Threshold population size beyond which they cause severe crop loss;	2 max	
19	c	Only catch flying whitefly / whitefly may not be evenly distributedj / don't know what proportion of whitefly are caught;	1	Accept converse e.g. will not catch crawling young
19	d	Control not immediate; Always some pest present/pest not eliminated;	1 max	

Section B – continued

Question	Part	Marking Guidance	Mark	Comments
20		Traps with same surface area/stickiness/height above ground; Same climatic conditions e.g. same wind speed, same temperature, same day; Left for same length of time/stated length of time given; Large number of traps; Count number of whitefly trapped on both colours; Determine if there is a significant difference using a statistical test;	5 max	Any two relevant factors for two marks Do not allow 'weather' If number stated this must be at least 10 Allow 'many', do not allow 'several'
Total marks for Section B			24	