Version 2.0

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.

Set and published by the Assessment and Qualifications Alliance.

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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 Λ 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 and 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 *must* 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; *Note: Observed values from own data (15 to 25-year-olds). Expected values from supplied data (over 50-year-olds/previous generation)*	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	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;
	See comments for guidance
		2	If the calculated test statistic **is greate**r 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	2.84:1;	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**	