Mark Scheme (Results)

Summer 2018

Pearson Edexcel International Advanced Level in Biology (WBI06)
Practical Biology and Investigative Skills

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.

- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.

- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.

- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
• an idea of the types of response expected
• how individual marks are to be awarded
• the total mark for each question
• examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
• write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
• select and use a form and style of writing appropriate to purpose and to complex subject matter
• organise information clearly and coherently, using specialist vocabulary when appropriate.
Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Additional Guidance	Mark
1(a)	1. dependent variable identified as the ventilation rate / eq ;	1. ACCEPT movements / contractions of abdomen per unit time IGNORE respiration rate and oxygen consumption	
	2. two suitable temperatures stated (in range 0 to 50 °C) ;		
	3. description of how to obtain quantitative results for ventilation rate ;	3. e.g. count number of abdominal movements / contractions in stated time	
	4. description of how temperature is controlled ;	4. e.g. thermostatically controlled waterbath / incubator / air conditioned room / Bunsen burner and thermometer	
	5. {same/stated} time for exposure to each temperature to acclimatise / eq ;		
	6. repeats (at each temperature) and calculate a mean ;	6. ACCEPT repeats for reliability	
	7. control of locust ;	7. e.g. same size / mass / sex / age / species	**(5)**

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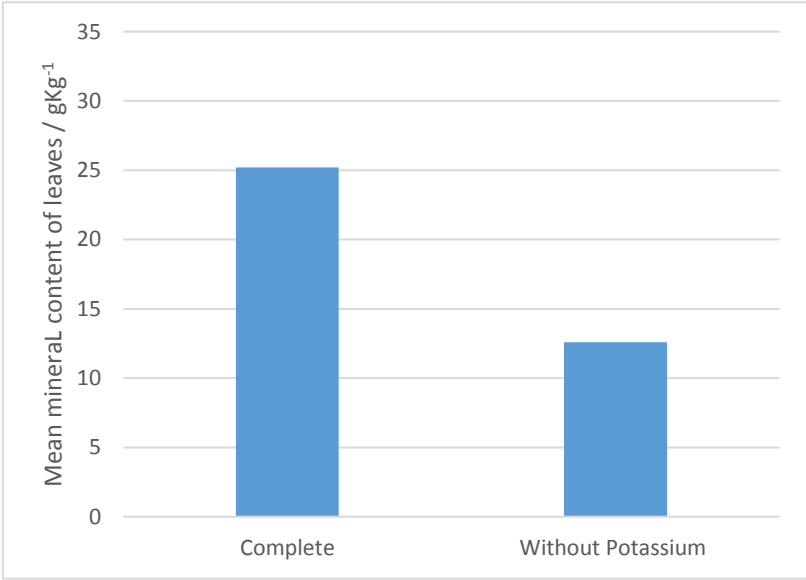| Question Number	Answer	Additional Guidance	Mark
1(b)(i)	1. oxygen concentration ; 2. carbon dioxide concentration ; 3. humidity ; 4. light {intensity / wavelength} ;	If one biotic factor named then a max of one mark If two biotic factors named then a max of zero marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. variable with suitable control method described ; 2. results are not valid / description of expected effect on the dependent variable ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)		ACCEPT converse statements for lower temperature	
	1. more oxygen demand at higher temperatures / eq ;	1. ACCEPT increased need to remove carbon dioxide / more carbon dioxide produced	
	2. enzyme mediated reactions are faster / eq ;	2. ACCEPT increased collisions between substrate and enzyme	
	3. {more (aerobic) respiration / increased metabolic rate};		
	4. more {ATP / energy} from respiration (required for muscle contraction) ;		**(3)**

Total for question 1 = 12

Question Number	Answer	Additional Guidance	Mark
2(a)	1. there will be no significant difference ; 2. between the mineral content of the leaves of plants grown with and without potassium ions / eq ;	ACCEPT the difference between the mineral content of the leaves of plants grown with and without potassium ions is not significant for MP1 and 2	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)	1. suitable table format with correct headings and units ; 2. all raw data correctly entered ; 3. correct means ;	**Example of table:** | Mineral content of dry leaves / g kg⁻¹	
Complete fertiliser	Fertiliser without potassium ions
24.3	8.9
33.1	9.6
26.7	10.3
30.6	10.5
32.0	7.4
28.4	18.2
20.5	13.9
24.8	14.2
19.9	15.2
29.9	7.4
23.5	17.2
20.3	13.8
19.6	16.7
19.8	15.8
24.6	9.9
Mean = 25.2	Mean = 12.6		**(3)**

Example of table:

Mineral content of dry leaves / g kg^{-1}	
Complete fertiliser	Fertiliser without potassium ions
24.3	8.9
33.1	9.6
26.7	10.3
30.6	10.5
32.0	7.4
28.4	18.2
20.5	13.9
24.8	14.2
19.9	15.2
29.9	7.4
23.5	17.2
20.3	13.8
19.6	16.7
19.8	15.8
24.6	9.9
Mean = 25.2	Mean = 12.6

Question Number	Answer	Additional Guidance	Mark
2(c)	1. y axis correctly labelled with units and bars labelled ; 2. mean data plotted correctly as two bars ; 3. range bars plotted correctly ;	ALLOW ECF from 2b for mp 1 and 2 1. y axis must start at zero and be linear **Example of graph** Range bars 33.1 – 19.6 18.2 – 7.4	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(d)	1. critical value identified as 2.05 ;	1. ACCEPT 2.37 / 2.76	
	2. the calculated value (8.19) is more than the critical value ;	2. 8.19 > 2.05 gains mark point 1 and 2	
	3. therefore reject the null hypothesis ;		
	4. there is a significant difference between the mineral content of the two samples / eq ;		
	5. comment on the variability of the data ;	5. ACCEPT the range / error bars are large / do not overlap	(4)

Question Number	Answer	Additional Guidance	Mark
2(e)	1. named variable(s) will be difficult to control (in a field) / eq ;	1. IGNORE age / genetic variability	
	2. the mineral content of the soil will vary / eq ;	2. IGNORE nutrients	
	3. effect of a named biotic factor on mineral content explained ;	3. ACCEPT effect on growth eg. herbivores might eat the plant and reduce growth	
	4. effect of a named abiotic factor on mineral content explained;	4. ACCEPT effect on growth eg. change in light intensity / change in pH would affect ability to absorb minerals	(4)

Total for question 2 = 16

Question Number	Answer	Additional Guidance	Mark
3(a)	1. risk of infection of humans by {bacteria / fungi} / eq ;		
	2. risk of allergies / eq ;		
	3. risk of {toxins / poisons / irritants} from plants / eq ;		
	4. other sensible risk ;	4. e.g. risk of electrocution from the water bath / burns or scalds / being cut when using a knife	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)	1. practise the method to see if it works ;		
	2. find suitable range of temperature / eq ;		
	3. find a suitable growth medium (for seedlings) / eq ;		
	4. find an appropriate measurement of growth ;	4. ACCEPT measurement / calculation of rate of growth	
	5. find the time taken for a measurable change in growth / eq ;		
	6. identify {other / named} abiotic variable that needs to be taken into account ;	6. eg find the best light intensity / pH / light wavelength for growth	(3)

Question Number	Answer	Additional Guidance	Mark
3(c)	**Max. 8 marks** from this section. Two marks are reserved for QWC. 1. control of the source of the plant material ; 2. stated suitable time period for growth to occur ; 3. dependent variable defined as {rate of growth / cm per week / eq} ; 4. at least 2 different stated temperatures / eq ; 5. description of method of controlling temperature ; 6. and 7. variables that could alter growth ;; 8. and 9. description of how these variables are controlled ;; 10. repeats at each temperature ;	1. eg. seeds from the same packet 2. minimum 5 days 4. ACCEPT stated temperatures between 0 - 40 °C 5. ACCEPT growth chamber / air conditioned room / incubator	**(10)**

Level	Mark	Descriptor
Level 1	**0**	The account is very disorganised and is very difficult to follow. Scientific vocabulary is very limited with many spelling and grammatical errors.
Level 2	**1**	There is some disorganisation in the account which is not always in the correct sequence. Some relevant scientific vocabulary is used. The account is not always in continuous prose and there are grammatical errors and some important spelling mistakes.
Level 3	**2**	The account is well organised with no undue repetition and a correct sequence. There is good use of scientific vocabulary in the context of the investigation described. The account is written in continuous prose which is grammatically sound with no major spelling errors.

Question Number	Answer	Additional Guidance	Mark
3(d)	1. table with headings and suitable units, including space for raw data ;		
	2. means calculated from repeats ;	2. ACCEPT column in table / axis label on graph	
	3. suitable graph format with labelled axes ;	3. bar graph if 2 temperatures used or {scatter / line} graph if range of temperatures used	
	4. use of a named appropriate statistical test ;	4. ACCEPT t-test / Mann-Whitney U test if only 2 temperatures or (Pearson's) correlation coefficient or Spearman's rank for range of temperatures	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(e)	1. difficult to control {all variables / or a named variable} affecting the growth of the seedling / affecting the results;		
	2. idea of difficulty of measuring growth ;		
	3. possible infection of the plants with {bacteria / fungi / virus} / eq ;	3. ACCEPT microbes / microorganisms	**(3)**

Total for question 3 = 22