Cambridge Assessment International Education

Cambridge Pre-U

BIOLOGY **9790/02**

Paper 2 Data Analysis and Planning **October/November 2020**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 ‘List rule’ guidance

For questions that require ***n*** responses (e.g. State **two** reasons …):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks	Guidance
1(a)	arrow(s) from matrix through ETC into inter-membrane space ; arrow into matrix from inter-membrane space through ATP synthase ;	**2**	
1(b)(i)	*oligomycin* (blocks ATP synthase) no proton flow through ATP synthase so maintains proton gradient / stays steep ; backing-up of chain so ETC stops moving e^- ; no flow of e^- so no H^+ moved across inner mitochondrial membrane ; no e^- to combine with H^+ and O_2 to form water ; *FCCP* (opens ion channels) leaking of protons out of inter-membrane space decreases the proton gradient / H^+ moves into matrix / cytoplasm ; ETC attempts to maintain proton gradient ; increased flow of e^- down ETC ; H^+ combines with e^- + oxygen to form water ; *AA+rotenone* (blocks ETC) no electrons supplied at start of ETC therefore no electron flow to create a proton gradient ; (so no e- flow) so no e- to react with oxygen ;	**6**	
1(b)(ii)	other uses of oxygen in cell / reference to other oxidation reactions ;	**1**	**A** oxidation of lactic acid
1(b)(iii)	56 – 30 = 26 ; ± 1 unit	**1**	
1(c)	any two from: cancer cells divide faster ; therefore need more energy / cancer cells more metabolically active / higher rate of aerobic respiration ; more vulnerable to reduced aerobic respiration than non-cancer cells ;	**2**	

Question	Answer	Marks	Guidance
1(d)(i)	(32 – 6) = 26 ; ± 1 unit (26 ÷ 6) × 100 = 433(%) ;	**2**	 ecf
1(d)(ii)	1 rotenone has a large effect on cell death ; **A** vs **B** 2 adding H2S decreases effect of rotenone ; 3 little effect of increasing H2S **C D E F** ; 4 ref to figures 0.1 vs 100 uM H2S / comparing treatments C and F ; 5 comment on error bars / overlap / significance **A** vs others ; 6 comment on error bars / overlap / significance **C** vs **F** ;	**3**	
1(d)(iii)	As a control / to compare number of cells dying with no rotenone ;	**1**	

Question	Answer	Marks	Guidance
2(a)(i)	suitable explanation for owl population change ; e.g. more owls as more pika stay the same as bears eat pika instead of foxes fewer owls as less pika as more pika are eaten by bears (instead of bears eating foxes)	**1**	
2(a)(ii)	any two from: other species not included / may be other producers / consumers ; ref to migratory species ; no idea of population sizes / biomass ; no idea of energy transfer ; ref to seasonal variation ;	**2**	
2(a)(iii)	species that has disproportionate effect on ecosystem ;	**1**	

Question	Answer	Marks	Guidance
2(a)(iv)	any two from: 1 large numbers / reproduce rapidly ; 2 feeds on grasses which provide food for local livestock ; 3 has economic impact on farming ; 4 negative impact of burrowing ; 5 AVP ; e.g. disease vector	**2**	
2(b)(i)	labelled axes with units ; (pika density per 100 m^2 and total biomass kg m^{-2}) scale suitable for grid ; (plots cover at least 50%) all plots correct ; curve of best fit ;	**4**	
2(b)(ii)	correlation test / Spearman Rank / Pearson ;	**1**	
2(b)(iii)	increased aeration of the soil / more droppings so increased soil fertility ; greater plant growth ; AVP ;; e.g. / removal of competing species	**2**	
2(b)(iv)	any four from: 1 capture and count a sample ; 2 ref. to suitable marking method ; 3 release and leaving for a time period ; 4 recapture and count marked and unmarked ; 5 use Lincoln index / correct description ; 6 reference to known area ;	**4**	

Question	Answer	Marks	Guidance
3	*defining the problem* *Some points may be taken from a diagram or a flow or sequence diagram* 1 biological hypothesis / prediction ; • higher concentrations of lactose will cause more enzyme to be produced / greater gene expression / yellow to be formed more quickly ORA 2 theory to support prediction ; • lactose switches on gene • gene expressed and enzyme produced 3 dependent variable identified ; • time taken to colour change to yellow / intensity of colour after set time 4 independent variable identified ; • concentration of lactose 5 6 control variables identified ;; (at least two for each mp) • ONPG concentration / volume • strain of bacteria • end-point for yellow colour / time • incubation temperature • volume of lactose • number / density of bacteria • pH • concentration / volume toluene 7 8 control identified ;; • no lactose / no bacteria • use of β-galactosidase solution	**25**	

Question	Answer	Marks	Guidance
3	9 risk assessment ; • ref to sterile technique • alcohol near naked flame • safe disposal of tubes and plates / autoclave • safe use of toluene *methods* 10 Dilution method ; • Serial or standard dilution described 11 Suitable range ; • At least five concentrations 12 Reference to labelling items ; 13 (Sterile) technique described ; • Disinfecting work area / washing hands • Transfer techniques described • Flaming • Use of broth 14 Method of controlling temperature ; • Use of thermostatically controlled incubator 15 Mixing of lactose + bacteria ; 16 Stated time for incubation to induce expression ; 17 Addition of toluene to bacteria; 18 Addition of ONPG ; 19 Mixing / stirring ;		

Question	Answer	Marks	Guidance
	20 Description of how measured ; • time taken • to reach end point • OR compare colour at set time 21 Use of enzyme to determine endpoint ; 22 Describe use of colorimeter or colour standard ; 23 Replicates ; • repeat each concentration at least two times more *Analysis* 24 Suitable table shown / described ; 25 Calculation of means (of replicates) ; 26 Calculation of SD ; 27 Use of suitable statistical test ; • test of correlation between lactose concentration and time taken to colour change 28 Correct description of statistical test analysis ; 29 Suitable graph described ; • scatter graph for correlation AVP		