Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/53**

Paper 5 Planning, Analysis and Evaluation **October/November 2021**

MARK SCHEME

Maximum Mark: 30

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.

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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.

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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.

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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.

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Examples of how to apply the list rule
State **three** reasons…. [3]

A

1. Correct	✓	**2**
2. Correct	✓	
3. Wrong	×	

B (4 responses)

1. Correct, Correct	✓, ✓	**3**
2. Correct	✓	
3. Wrong	ignore	

C (4 responses)

1. Correct	✓	**2**
2. Correct, Wrong	✓, ×	
3. Correct	ignore	

D (4 responses)

1. Correct	✓	**2**
2. Correct, CON (of 2.)	×, (discount 2)	
3. Correct	✓	

E (4 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct, Wrong	✓	

F (4 responses)

1. Correct	✓	**2**
2. Correct	✓	
3. Correct CON (of 3.)	× (discount 3)	

G (5 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

H (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. CON (of 2.) Correct	(discount 2) ✓	

I (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. Correct CON (of 2.)	✓ (discount 2)	

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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Question	Answer	Marks
1(a)(i)	*independent variable* temperature **;** *dependent variable* volume of carbon dioxide / time to collect stated or fixed volume of CO_2 **;**	**2**
1(a)(ii)	*idea that:* ensures glucose and yeast are, uniformly distributed / homogeneously mixed / evenly mixed / completely mixed / AW **;**	**1**
1(a)(iii)	*any **seven** from:* 1 use a minimum of five different temperatures **;** 2 state a suitable range of identified temperatures **;** 3 *idea of* same / constant / stated / standardised / known, volume of, yeast-glucose / mixture (in the test-tube) **;** 4 method of maintaining a, constant / stated, temperature **;** 5 leave mixture to equilibrate to (each) temperature **;** 6 leave for, set time / stated time, **and** measure volume (of carbon dioxide) **or** time how long to collect same volume (of carbon dioxide) from (each) sample **;** 7 use a control using, killed yeast / water replacing yeast **;** 8 *ref. to* a minimum of, two repeats / three replicates (for each temperature), **and** calculating means **;** 9 *idea of* repeat investigation with narrower range of temperatures (around that which seems the one giving maximum rate) **;** 10 low risk **;** 'medium risk' needs hazard **and** risk **and** precaution. **A** yeast + allergy/irritant + gloves / mask / goggles /PPE 11 AVP e.g. maintaining a constant pH and using a buffer **;**	**7**

Question	Answer	Marks
1(a)(iv)	1 horizontal axis labelled temperature / ^{o}C **and** vertical axis labelled volume of carbon dioxide / cm^3 / mm^3 **;** 2 curve starts low, reaches a maximum and then decreases **;**	**2**
1(b)	1 flask 2 (provides the evidence) as in *C. tropicalis* there is lower CO_2 (production / volume / AW) **;** 2 (for flask 2, *C. tropicalis* compared to *S. cerevisiae)* 65% v 93% (after 30 minutes) CO_2 as % of maximum **or** manipulated figure i.e. 28% different **;** 3 *idea that*: when transferred from conditions with oxygen to conditions with no oxygen yeasts have to use fermentation / anaerobic respiration but *C. tropicalis* does so at a much slower rate (as no Crabtree effect) thus less CO_2 produced **ora ;**	**3**

Question	Answer	Marks
2(a)	*idea of* no (clear), relationship / trend **;** **or** as latitude increases, (bird) species diversity / numbers of (bird) species, (slightly) decreases / (might) show a downward trend **;**	**1**
2(b)(i)	*any **three** from:* 1 data (for latitude and number of species) is, paired / linked **;** 2 number of bird species and latitude / (i.e. the data points) within samples are independent of each other **;** 3 the <u>data,</u> is ordinal / is interval / is discrete / can be ranked **;** 4 (scatter) graph / Fig. 2.2, suggests a, (decreasing) relationship / correlation **;** 5 there are, 17 (paired) observations / more than 5 (paired) observations **;** 6 *idea that* bird species selected randomly / AW **;**	**3**
2(b)(ii)	*idea that* there is no, correlation / relationship, between latitude and the number of (bird) species **;**	**1**
2(b)(iii)	*any **four** from:* 1 critical value (for p = 0.05%) = 0.485 ***or*** critical value for p = 0.01% = 0.615 **;** 2 value for r_s / calculated value, is < than critical value **;** 3 null hypothesis is accepted **;** 4 there is no <u>significant</u> correlation (between latitude and number of bird species) **;** 5 there is a (weak) negative correlation (between latitude and number of bird species as shown by the negative value for r_s) **;**	**4**

Question	Answer	Marks
2(c)	*any **three** from* *all marking points are ideas that:* *limitations of the data* 1 **only** used counts of bird species (may not apply to all species) **;** 2 do not know the, number of individuals of each species / relative abundance of each species / species evenness **;** *limitations of sampling* *birds* 3 hard to identify some (bird) species / miss some (bird) species / some (bird) species look similar / miss birds that fly away / birds migrate / only resident birds or species counted / qualified ref to volunteers / AW ; *latitudes sampled* 4 nothing above 40N / nothing before 37N / need wider range of latitudes / AW **;** 5 no data on latitudes south of the equator **;** sampling sites 6 not random / only sampled in certain locations / sample locations do not cover the whole of the peninsula **/** many near the coast **/** locations may not be representative of the peninsula / only 17 sites / sampling sites do not extend beyond the peninsular / AW **;** habitats 7 no information on habitats (at locations) / not all location may be equally suited for birds / different habitats have different conditions / AW **;** timings 8 only sampled, on one day / in one year **/** sampled in, winter / one season **; ora**	**3**

Question	Answer	Marks
2(d)	*any **three** from:* 1 catch birds within area and count total captured **and** mark **and** release them **;** 2 detail e.g. *idea of:* marking technique not, harmful / too obvious e.g. *idea of:* giving time for populations to mix before second sample taken – days or weeks not more **;** 3 catch second sample **and** count total number of birds **and** number of marked birds **;** 4 *ref. to* Lincoln / Petersen, index **;**	**3**