



Cambridge International AS & A Level

BIOLOGY

9700/52

Paper 5 Planning, Analysis and Evaluation

May/June 2023

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.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

PUBLISHED**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	<p><u>'List rule' guidance</u></p> <p>For questions that require <i>n</i> responses (e.g. State two reasons ...):</p> <ul style="list-style-type: none">• The response should be read as continuous prose, even when numbered answer spaces are provided.• Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>.• Incorrect responses should not be awarded credit but will still count towards <i>n</i>.• 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 <i>n</i> 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.

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)	

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)
<u>underline</u>	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)	1 part enzyme extract/polyphenol oxidase with 9 parts of water / buffer ;	1
1(b)(i)	pH ;	1
1(b)(ii)	<p><i>any one from:</i></p> <p>1 temperature of, solutions / tubes ;</p> <p>2 wavelength of, light / (light) filter (of 470 nm) ;</p> <p>3 concentration of enzyme / polyphenol oxidase ;</p> <p>4 total length of time /time reading interval ;</p>	1
1(c)(i)	<p>1 figures from printed line at or below 0.26 au and 30 s or figures from correct tangent ;</p> <p>2 correct calculation / 0.0083 to 0.0089 / 8.3×10^{-3} to 8.9×10^{-3} ;</p>	2
1(c)(ii)	sketched line below printed line starting at origin and constantly increasing to 180 s ;	1

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Question	Answer	Marks
1(d)	1 state at least 5 dilutions (0.0–0.2%) of dopamine hydrochloride solution / substrate ; 2 describe a correct method to making at least 2 dilutions ; 3 add tubes to a water bath / incubator, at a, set / constant temperature (10–40 °C) ; 4 enzyme and substrate / (all) solutions equilibrated separately ; 5 state 2 different variables that are kept constant (volumes of enzyme and substrate or mixture / pH / filter or wavelength) ; 6 set to zero / calibrate, colorimeter using a, blank / water, at the start / between each reading ; 7 mix substrate and (buffered) enzyme and immediately add (colorimeter tube) to colorimeter ; or mix substrate and (buffered) enzyme and immediately start timing ; 8 measure absorbance at set time intervals (for set time) ; or record time at which red colour (first) appears ; 9 3 replicates / 2 repeats for same / one concentration and calculate a mean or 2 repeats, of experiment / each concentration, and calculate the means ; 10 calculate / find / work out rate (of reaction) ;	7

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Question	Answer	Marks													
1(d)	<p>11 named hazard and risk and precaution ;</p> <table border="1" data-bbox="398 284 1288 715"> <thead> <tr> <th data-bbox="398 284 672 347">Hazard</th> <th data-bbox="672 284 936 347">Risk</th> <th data-bbox="936 284 1288 347">Precaution</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 347 672 483">dopamine hydrochloride</td> <td data-bbox="672 347 936 483">Toxic</td> <td data-bbox="936 347 1288 483">don't drink don't pour down the sink wear gloves</td> </tr> <tr> <td data-bbox="398 483 672 547"></td> <td data-bbox="672 483 936 547">Irritant / allergy</td> <td data-bbox="936 483 1288 715" rowspan="3">wear gloves / goggles / mask/ PPE</td> </tr> <tr> <td data-bbox="398 547 672 651">polyphenol oxidase / enzyme</td> <td data-bbox="672 547 936 651">Irritant / allergy</td> </tr> <tr> <td data-bbox="398 651 672 715">buffer</td> <td data-bbox="672 651 936 715">Irritant / allergy</td> </tr> </tbody> </table> <p>12 use water/boiled enzyme instead of enzyme as the control ;</p>	Hazard	Risk	Precaution	dopamine hydrochloride	Toxic	don't drink don't pour down the sink wear gloves		Irritant / allergy	wear gloves / goggles / mask/ PPE	polyphenol oxidase / enzyme	Irritant / allergy	buffer	Irritant / allergy	
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Question	Answer	Marks
1(e)	<p>1 enzyme: from different (plant) sources / only from plants / enzyme not used from bananas ;</p> <p>2 sources of information: maybe out of date / maybe unreliable / not comparable ;</p> <p>3 variables: 2 variables not controlled / not standardised / no information (temperatures, pH, timings, volumes, concentrations) ;</p> <p>4 stats: no statistical test / analysis ;</p> <p>5 substrate: no information, on what substrate was used / whether tested on bananas or other fruits ;</p> <p>6 inhibitor: do not know type of inhibition (competitive v. non-competitive) ;</p> <p>7 anti-browning agents: <i>idea that</i> other anti-browning agents maybe more or less effective / may impact differently ;</p> <p>8 anti-browning agents should be tested on all sources of enzyme / each only tested on one source of enzyme / may act differently on other sources of enzyme ;</p> <p>9 validity: 2 independent variables ;</p>	2
1(f)	sketched line (starts at origin) levels out showing lower V_{max} ;	1P

Question	Answer	Marks
2(a)(i)	<p>any two from:</p> <p>type /species of tree / type of bark ;</p> <p>height (of grid) above ground ;</p> <p>side / aspect of tree ;</p> <p>age / size of tree ;</p> <p>AVP grid placed horizontally / orientated as diamond shape ;</p>	2

Question	Answer			Marks																					
2(a)(ii)	<table border="1"> <thead> <tr> <th colspan="2" data-bbox="654 213 1267 277">Hazard and risk – 1 mark ;</th> <th data-bbox="1267 213 1621 277">Precaution – 1 mark ;</th> </tr> </thead> <tbody> <tr> <td data-bbox="654 277 866 413">Trees / plants / leaves / bark / pollen</td> <td data-bbox="866 277 1267 413">scratches / allergy / irritation toxins</td> <td data-bbox="1267 277 1621 413">suitable PPE / medication don't ingest</td> </tr> <tr> <td data-bbox="654 413 866 549">Animals /Animal waste</td> <td data-bbox="866 413 1267 549">dangerous / allergy / bites / to xoplasmosis</td> <td data-bbox="1267 413 1621 549">medication / work in a group / travel with an expert /suitable PPE</td> </tr> <tr> <td data-bbox="654 549 866 644">Fungi / Lichen</td> <td data-bbox="866 549 1267 644">irritation / allergic reaction toxic / poisonous</td> <td data-bbox="1267 549 1621 644">suitable PPE do not ingest</td> </tr> <tr> <td data-bbox="654 644 866 740">Inhaling fungal spores</td> <td data-bbox="866 644 1267 740">(lung) infection</td> <td data-bbox="1267 644 1621 740">wear a mask</td> </tr> <tr> <td data-bbox="654 740 866 876">Traffic</td> <td data-bbox="866 740 1267 876">collision / fumes / air pollution</td> <td data-bbox="1267 740 1621 876">cone off the road / hi vis vest / look + listen / suitable PPE</td> </tr> <tr> <td data-bbox="654 876 866 1043">Woods / holes /trip hazards</td> <td data-bbox="866 876 1267 1043">Injury from trips / falling / falling branches / getting lost / hypodermic needles</td> <td data-bbox="1267 876 1621 1043">look where you're stepping / hard hat / don't climb trees / GPS / map</td> </tr> </tbody> </table>			Hazard and risk – 1 mark ;		Precaution – 1 mark ;	Trees / plants / leaves / bark / pollen	scratches / allergy / irritation toxins	suitable PPE / medication don't ingest	Animals /Animal waste	dangerous / allergy / bites / to xoplasmosis	medication / work in a group / travel with an expert /suitable PPE	Fungi / Lichen	irritation / allergic reaction toxic / poisonous	suitable PPE do not ingest	Inhaling fungal spores	(lung) infection	wear a mask	Traffic	collision / fumes / air pollution	cone off the road / hi vis vest / look + listen / suitable PPE	Woods / holes /trip hazards	Injury from trips / falling / falling branches / getting lost / hypodermic needles	look where you're stepping / hard hat / don't climb trees / GPS / map	2
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2(b)	<p>1 39 / 90 ($\times 100$) ;</p> <p>2 43 / 43.3 (%) ;</p>			2																					
2(c)(i)	D = 2 and D ² = 4 ;			1																					

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Question	Answer	Marks
2(c)(ii)	0.760 / 0.759 ; ; If answer is incorrect allow 1 mark for evidence of correct calculation 238.5 / 990 or 0.241	2
2(c)(iii)	<u>strong</u> (correlation) ; <u>positive</u> (correlation) ; (showing that) as distance from road increases, cover / abundance of lichen increases / ora ;	3
2(c)(iv)	use critical values (of r_s), at $p= 0.05$ or less ; if calculated r_s is greater than critical r_s value (correlation) is not due to chance or if calculated value of r_s is less than the critical r_s value (correlation) is due to chance ;	2