



# Cambridge International AS & A Level

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**BIOLOGY**

**9700/05**

Paper 5 Planning, Analysis and Evaluation

**For examination from 2022**

MARK SCHEME

Maximum Mark: 30

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**Specimen**

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This document has **10** pages. Blank pages are indicated.

**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> (see examples below)</p> <p>For questions that require <b>n</b> responses (e.g. State <b>two</b> reasons ...):</p> <ul style="list-style-type: none"> <li>• The response should be read as continuous prose, even when numbered answer spaces are provided</li> <li>• Any response marked <i>ignore</i> in the mark scheme should not count towards <b>n</b></li> <li>• Incorrect responses should not be awarded credit but will still count towards <b>n</b></li> <li>• Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should <b>not</b> 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</li> <li>• Non-contradictory responses after the first <b>n</b> responses may be ignored even if they include incorrect science.</li> </ul>

6	<p><u>Calculation specific guidance</u></p> <p>Correct answers to calculations should be given full credit even if there is no working or incorrect working, <b>unless</b> the question states 'show your working'.</p> <p>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.</p> <p>For answers given in standard form, (e.g. <math>a \times 10^n</math>) in which the convention of restricting the value of the coefficient (<math>a</math>) 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.</p> <p>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.</p>
7	<p><u>Guidance for chemical equations</u></p> <p>Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.</p> <p>State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.</p>

Mark scheme abbreviations:

; separates marking points  
 / separates alternatives within a marking point  
**R** reject  
**I** ignore mark as if this material was not present  
**A** accept (a less than ideal answer which should be marked)  
**COND** indicates mark is conditional on previous marking point  
**OWTTE** or words to that effect (accept other ways of expressing the same idea)  
**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 awarded  
**ECF** credit a correct statement that follows a previous wrong answer  
**MP** marking point (with relevant number)  
**( )** the word / phrase in brackets is not required, but sets the context  
**ORA** or reverse argument

**Examples of how to apply the list rule**

State three reasons ... [3]

**A**

1. Correct	✓	<b>2</b>
2. Correct	✓	
3. Wrong	✗	

**B (4 responses)**

1. Correct, Correct	✓, ✓	<b>3</b>
2. Correct	✓	
3. Wrong	ignore	

**C (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct, Wrong	✓, ✗	
3. Correct	ignore	

**D (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct, CON (of 2.)	✗, (discount 2)	
3. Correct	✓	

**E (4 responses)**

1. Correct	✓	<b>3</b>
2. Correct	✓	
3. Correct, Wrong	✓	

**F (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct	✓	
3. Correct CON (of 3.)	✗ (discount 3)	

**G (5 responses)**

1. Correct	✓	<b>3</b>
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

**H (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct	✗	
3. CON (of 2.) Correct	(discount 2) ✓	

**I (4 responses)**

1. Correct	✓	<b>2</b>
2. Correct	✗	
3. Correct CON (of 2.)	✓ (discount 2)	

Question	Answer	Marks
1(a)(i)	type(s) of enzyme / endoprotease or exoprotease ;	1
1(a)(ii)	temperature + pH + time intervals between samples ;	1
1(a)(iii)	<p><i>method must match the related variable</i></p> <p><i>any two from:</i></p> <p><i>temperature – use a water-bath / incubator ;</i></p> <p><i>pH – use a (named) buffer ;</i></p> <p><i>time intervals – use a stop-clock / stop-watch / timer / AW ;</i></p>	2
1(a)(iv)	<p><i>idea of:</i></p> <p>two (successive) chromatograms give the same results</p> <p><b>or</b></p> <p>no more change in, results / chromatograms / spots ;</p>	1

Question	Answer	Marks
(1)(b)	<p>accept marks from a labelled diagram</p> <p>any <b>eight</b> from:</p> <p>max 7 from marking points 1–12</p> <ol style="list-style-type: none"> <li>1 ref. to drawing <b>or</b> using, a base line / line of origin ; <b>R</b> if using pen or ink to draw base line</li> <li>2 ref. to suitable method of applying sample to give a small spot (on the chromatography paper) ;</li> <li>3 <i>idea</i> of chromatograms using hydrolysed extracts of <b>both</b> enzymes ;</li> <li>4 ref. to same number of applications applied to origin ;</li> <li>5 <i>idea</i> of concentrating the extract ; e.g. by drying between adding spots <b>or</b> concentrating the extract by evaporation before use</li> <li>6 ref. to placing in solvent so that the level of solvent is below the, origin line / sample ;</li> <li>7 ref. to covering to, prevent evaporation / maintain a saturated environment ;</li> <li>8 ref. to running <b>all</b> chromatograms for same time <b>or</b> ref. to running <b>all</b> chromatograms until same distance moved by solvent front ; <b>R</b> if allow to run off the end</li> <li>9 ref. to drying before spraying with dye ;</li> <li>10 <i>idea</i> of running at least 3 chromatograms for each enzyme ;</li> <li>11 ref. to taking mean of distances travelled by each spot <b>or</b> taking mean of <math>R_f</math> values ;</li> </ol>	8

Question	Answer	Marks
1(b)	<p>12 any <b>one</b> from:</p> <p>ref. to flammable solvents <b>and</b> no naked flames ;</p> <p>ref. to flammable solvent or toxic, solvent / dye, <b>and</b> safe disposal ;</p> <p>ref. to allergy to, dyes / solvents, <b>and</b> wear gloves ;</p> <p>ref. to harmful / toxic / irritant / corrosive solvent or dye <b>and</b> wear gloves / mask / eye protection / use fume cupboard / keep covered ;</p> <p><b>I</b> chemicals unqualified</p> <p>13 ref. to, observe / count, the number of, products / spots, (for each enzyme) <b>or</b> measurement of the distance moved by each, product / spot, (for each enzyme) ;</p> <p>14 comparison between chromatograms of the different proteases ;</p>	
1(c)	<p><i>must state whether supported or not with the reason allow yes / no, true / false, does / does not, as alternative words for supported / not supported</i></p> <p>1 not supported, because different numbers of bonds are cut so cannot compare the enzymes ; ORA</p> <p>2 not supported, because some products will be dipeptides (and tripeptides) ;</p> <p>3 supported, because the endoprotease gives the exoprotease more 'ends' to work on <b>or</b> not supported because there will be, more / different, dipeptides since endoprotease created new 'ends' ;</p>	<b>3</b>
1(d)(i)	<p>ring around the 3rd spot from the left on <b>both</b> chromatograms ;</p> <p><b>I</b> any circles on the electrophoretograms</p> <p><b>R</b> if extra spots ringed</p>	<b>1</b>



Question	Answer	Marks
1(d)(ii)	<i>idea that the sickle cell, peptide / fragment / amino acid, has moved, a different distance / further, (compared to the normal peptide) / ORA</i> <b>or</b> <i>idea that the (sickle cell), peptide / fragment / amino acid, has a different, charge / solubility, (compared to the normal peptide) ;</i>	<b>1</b>
<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	<i>dependent variable: number of chromosomes in the cells of the embryo ;</i>	<b>1</b>
2(a)(ii)	<i>idea of the species / source of pollen on the stigma ;</i>	<b>1</b>
2(b)	<i>accept marks from a fully annotated diagram</i> <i>any three from:</i> 1 from cross <b>A × B</b> the chromosome number is half of the chromosome number of each parent ; 2 (due to) fusion of gametes with 6 chromosomes and gametes with 10 chromosomes / half the number of chromosomes compared to the parents ; 3 <i>idea that, gametes / pollen, are produced by meiosis ;</i> 4 from cross <b>A × C</b> the chromosome number is double the expected hybrid number ; 5 <i>idea that mitosis (of the zygote / embryo) has not occurred correctly so chromosomes have stayed together in one cell (so number has doubled)</i> <b>or</b> meiosis has not occurred correctly so chromosomes have stayed together in one cell (so number has doubled in gametes) ;	<b>3</b>
2(c)(i)	<b>A × B: a variable number (between 0 and 16) / any number in the range from 0–16</b> <b>and</b> <b>A × C: 13 ;</b>	<b>1</b>

Question	Answer	Marks
2(c)(ii)	<p><i>any one from:</i></p> <p>(gametes) will not have complete set of chromosomes ;</p> <p>pollen of hybrid <b>A</b> × <b>B</b> has variable number of chromosomes ;</p> <p>pollen (from <b>A</b> × <b>B</b>) that fertilised another plant would have a, different / random, number of chromosomes ;</p> <p>pollen with, different / random, chromosomes may not be able to, grow / fertilise, the female gamete ;</p>	1
2(d)(i)	<p>mean = 46 ;</p> <p>mode = 48 <b>and</b> median = 46 ;</p>	2
2(d)(ii)	<p><i>any one from:</i></p> <p>continuous / normal, distribution ;</p> <p>standard deviations are similar ;</p> <p>size of the two samples is fewer than 30 ;</p>	1
2(d)(iii)	<p>there is no difference in the percentage germination of grains from, cross <b>A</b> × <b>B</b> and cross <b>A</b> × <b>C</b> / the two crosses ;</p>	1
2(d)(iv)	<p><i>idea of</i> subtracting two from total number of samples since there are two sets of data to compare ;</p> <p><b>A</b> as a formula</p> <p><math>(11 - 1) + (11 - 1) / 22 - 2 (= 20)</math></p>	1