Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

Biology **9700/52**

Paper 52 Planning, Analysis and Evaluation **February/March 2023**

Maximum Mark: 30

PRE-STANDARDISATION MARK SCHEME

Cambridge Assessment International Education – 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 (see examples below) 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.

Examples of how to apply the list rule

State **three** reasons … [3]

A	1. Correct	✓	**2**
	2. Correct	✓	
	3. Wrong	×	
B	1. Correct, Correct	✓, ✓	**3**
(4 responses)	2. Correct	✓	
	3. Wrong	ignore	
C	1. Correct	✓	**2**
(4 responses)	2. Correct, Wrong	✓, ×	
	3. Correct	ignore	
D	1. Correct	✓	**2**
(4 responses)	2. Correct, CON (of 2.)	×, (discount 2)	
	3. Correct	✓	

E	1. Correct	✓	**3**
(4 responses)	2. Correct	✓	
	3. Correct, Wrong	✓	

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

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

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

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

Question	Answer	Marks	Guidance
1(a)(i)	*any **one** from:* ref. to correct, colour / wavelength, of light **;** use (colorimeter tube) of distilled water / use a blank (colorimeter tube), to zero colorimeter **;** AVP **;**	1M	**A** stated wavelength of about 600 nm **A** use coloured filter (should be, red / orange) **R** blue filter *STM to discuss colours and wavelengths to accept see mark scheme for 9700/52 Nov 2022* **A** water / deionised water / distilled water **A** use a blank, to set absorbance to 0 **A** use clear sides of colorimeter tube to face light **A** fill cuvette to arrow / mark
1(a)(ii)	1 5 stated concentrations **and** units **;** 2 (reasonably) evenly spaced **;** 3 method for dilution shown for **at least** 2 intermediates **;**	3M	**ignore prompt lines when marking** **A** as a table showing volumes and concentrations with units (cm^3 and %) if **serial** dilution, **max 1** – mp 1 1 from 2.0% downwards can include 2.0% and 0.0% **A** units mentioned once 2 award in context of number of concentrations i.e. not bunched and spread between 2.0% and 0.0% 3 **A** e.g. 'take e.g. 5 cm^3 of glucose solution and add water to make up to 20 cm^3 do **not** accept anything for the diluent other than (deionised / distilled / pure) water

Question	Answer	Marks	Guidance
1(a)(iii)	correct axis labels **and** orientation **;** appropriate shaped line **;**	2P	*x*-axis: glucose concentration **and** *y*-axis: absorbance **ignore** units negative correlation (absorbance decreases as glucose concentration increases) **A** curve or line **ECF** from incorrect orientation of axes
1(b)(i)	glucose concentration (of potato) **;**	1P	**A** absorbance(s)
1(b)(ii)	*any **six** from:* 1 ref. to, same / stated, potatoes (used for investigation) **;** 2 ref. to, same / stated, storage conditions (of potatoes) **;** 3 additional stated storage condition (of potatoes) **;** 4 ref. to appropriate range of storage times (of potatoes) **;** 5 ref. to, same / stated, volume of potato juice (for glucose assay) **;** **continued on next page**	1P 5M	1 e.g. variety, growing conditions, harvesting time **I** same species of potato 2 e.g. cold temperature, dark, dry / low humidity + *STM to discuss sensible storage conditions to 3 accept* two marks for **either**: same storage conditions and example of stated storage condition **or** two stated storage conditions 4 minimum 5 storage times *STM to discuss sensible storage times to acc (weeks / months?)* 5 volumes chosen must be sensible and fit into test-tube

Question	Answer	Marks	Guidance
1(b)(ii) continued	6 at each storage time, measure / note / record, absorbance (of potato juice used in glucose assay) **or** at each storage time carry out glucose assay **;**		
	7 use at least three measurements for each storage time **and** calculate a mean **;**		7 **A** use 3 different potatoes for each storage time / do 3 replicates using potato juice made from 1 potato *STM to discuss*
	8 safety comment with hazard **and** precaution **;**		8 e.g. Benedict's reagent + irritant + gloves / eye protection hot water bath + burns / scalds + use tongs / eye protection potato + allergy + gloves knife + injury + cut away from hand **R** no risk **I** low risk
	9 AVP **;**		9 e.g. carry out glucose assay in same way as for standard glucose solutions use standardised variables and same colorimeter for all assays
1(c)	*any **two** from:* 1 as gamma radiation dose increases, volatile nitrogen compounds decrease, significantly **;** 2 *idea that* no change in percentage glucose, therefore decrease in acrylamide, is not due to glucose / must be due to asparagine **;** 3 *idea that* (decrease in volatile nitrogen compounds) indicates decrease in asparagine so less acrylamide is made (in the Maillard reaction) **;**	2C	

Question	Answer	Marks	Guidance
1(d)(i)	(–)61 (%) **;** working **;** 100 × (1768 – 4551) / 4551 **or** 100 × 2783 / 4551	2D	apply rounding rule (science-specific marking principle 6) **I** sign (positive or negative)
1(d)(ii)	*supports (max **2**):* 1 *idea that*, gamma radiation **and** hot water treatment / treatment 2, decreases the acrylamide concentration of potato blocks more than, gamma radiation only / treatment 1 **;** 2 *idea that*, 95% confidence intervals / 95% CI / error bars, (for treatment 1 **and** treatment 2) do not overlap (at all doses of radiation) suggesting treatment with radiation and hot water is significantly better than treatment with radiation alone **;** 3 hot water treatment and, highest / 150 J kg^{-1}, gamma radiation dose gives lowest acrylamide concentration (of potato blocks) **;** *does **not** support (max **2**):* 4 *idea that* hot water treatment alone decreases acrylamide concentration (of potato blocks) **;** 5 *idea that*, 95% confidence intervals / 95% CI / error bars, (for treatment 2 overlap at all gamma radiation doses) suggesting that decrease in acrylamide due to hot water treatment **and** gamma radiation is not significant (compared to hot water treatment alone) **;** 6 *idea that* hot water treatment alone might be safer than γ-radiation **;** 7 ref. to only one variety of potato investigated **;** 8 AVP **;**	1D 2E	**A** throughout: treatment 1 = gamma / γ radiation only treatment 2 = gamma / γ radiation and hot water potato chips for potato blocks 4 **A** hot water treatment alone = treatment 2 at 0 J kg^{-1} gamma radiation dose 8 **A** no statistical test carried out (since not shown on question paper)

Question	Answer	Marks	Guidance
2(a)(i)	distance from, GM rice plants **and** direction from GM rice plants **;**	1P	**A** distance pollen carried *STM to consider whether 'GM' must be included*
2(a)(ii)	apply herbicide to young plants **;** count the number of young plants that survive **;**	2M	**I** analysis of, nucleic acids / DNA / mRNA / microarrays / etc. (young plants that survive contain the gene for herbicide resistance)
2(a)(iii)	*any **two** from:* 1 as distance (from GM rice plants) increases, percentage gene flow decreases / pollen dispersal decreases **;** **ora** 2 percentage gene flow / distance of pollen dispersal, is higher in direction of (normal) wind / NW direction (than other directions) **;** **ora** 3 pollen cannot disperse further than 10 m / no gene flow at 10 m (or further) **;**	1D 1C	1 *STM to consider acceptability of reference to negative correlation* **A** in context of NW or other areas combined
2(b)(i)	0.036 **;**	1D	apply rounding rule (science-specific marking principle 6) 0.03625

Question	Answer	Marks	Guidance
2(b)(ii)	*any **three** from:* 1 critical value (for $p = 0.05$) = 2.145 **or** critical value (for $p = 0.01$) = 2.977 **;** 2 value for t / 9.043 / calculated value, is greater than critical value **;** 3 null hypothesis is rejected **;** 4 there is a <u>significant</u> difference (between percentage gene flow from GM rice plants to weedy rice plants and percentage gene flow from weedy rice plants to GM rice plants) **;**	2D 1C	1 **A** indication of values on Table 2.2 4 **A** there is less than a 5% probability that the difference is due to chance **R** correlation / relationship, instead of difference *STM to consider if association instead of difference is **R** or **I*** **A** there is no significant difference as **ECF** from marking point 3
2(b)(iii)	*any **one** from:* *reasons to do with limitations of study:* investigation only carried out once **;** investigation only on, wind-pollinated crop / one crop species / (GM and weedy) rice / one non-crop species **;** investigation only investigated, one / two, gene(s) **;** investigation in one geographical area only **;** investigation only in, experimental trials / without herbicide use **;** no assessment of significance of consequences **;** no long-term data / no data over several generations **;** *reasons to do with results of study:* gene flow from GM plants to wild plants was shown to occur **;** even a low gene flow will transfer (herbicide-resistant) genes (from GM plants) to, weeds/ wild plants **;** wild plants to which genes are transferred (from GM plants) may have selective advantage **;**	1E	