Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 80

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.

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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.

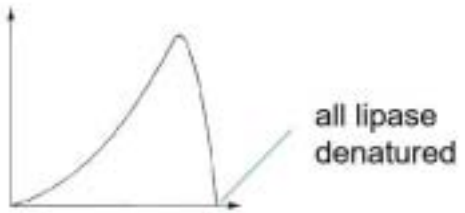
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6	Calculation specific guidance Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'. For questions in which the number of significant figures 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.

Mark scheme abbreviations

- **;** separates marking points
- **/** alternative responses for the same marking point
- **R** reject the response
- **A** accept the response
- **I** ignore the response
- **ecf** error carried forward
- AVP any valid point
- **ora** or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- ( ) the word / phrase in brackets is not required but sets the context

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Question	Answer	Marks	Guidance
1(a)	**K ;** **C ;** **K ;** **H ;** **H ;**	**5**	
1(b)(i)	*any four from:* pH decreases / (solution) becomes acidic **;** (pH changes because) fatty acids are produced **;** lipase, digests / breaks down, fat **;** fatty acids, produced / AW, faster in test-tube **C** than **B ;** bile, emulsifies fats / converts large particles of fat to small particles **;** bile increases the surface area (for lipase action) **;**	**4**	
1(b)(ii)	compare with tubes **B** and **C** to assess effect of lipase and / or bile **;** shows that bile, does not (chemically) digest fats / does not make solution acidic **;** shows that, lipase / enzyme, is required (for breakdown of fats in milk) **;**	**2**	**A** control (experiment)
1(c)	line drawn showing that decrease after optimum is steeper than increase **;** ***MP1*** *- line does not have to start at the origin or end at the x-axis* label line to point where line meets the *x*-axis **and** label indicating that all the lipase is denatured / AW **;** ***MP2 –*** *line must meet the x-axis*	**2**	
1(d)	*any three from:* ref to specificity **;** (only) substrate for lipase is fat (molecules) **;** shape of active site is, not complementary to protein / complementary to fat **;** protein cannot, fit into / bind to, active site / lipase / enzyme **;** enzyme-substrate complexes cannot be formed **;**	**3**	

Question	Answer	Marks	Guidance
2(a)(i)	–13.28 (%) **;;;**	**3**	MP1 for correct selection of data from Table 2.1 = 1.11 – 1.28 ***or*** (–)0.17 MP2 correct calculation (–0.17 ***or*** 1.11 – 1.28 / 1.28) × 100 ***or*** –13.28125 MP3 answer rounded correctly to two decimal places with a minus sign
2(a)(ii)	*any five from:* potato (cube) in 0.8 (mol dm^{-3} solution) loses greater (percentage) mass / **ora ;** movement of water out / loss of water, is cause of mass loss **;** water moves from an area of high water potential to an area of low water potential / AW **;** water potential of 0.8 (mol dm^{-3} solution) is lower than the water potential of the 0.6 (mol dm^{-3} solution) **;** greater / steeper, water potential gradient in 0.8 (mol dm^{-3}) than in 0.6 (mm dm^{-3}) **;** (relatively) <u>more water</u> leaves the potato (cube) in 0.8 (mol dm^{-3} solution) **;**	**5**	
2(a)(iii)	*any two from:* (cell is) swollen / large(r) / big(ger) / wide(r) / AW **;** (cell is) turgid **;** vacuole is, swollen / large(r) / big(ger) / wide(r) / AW **;** cell wall bulges / AW **;** cell membrane / cytoplasm / cell contents, presses on cell wall / AW **;**	**2**	
2(b)	*any three from:* uses energy (from respiration / mitochondria) **;** (transport / movement is) against a concentration gradient / AW **;** involves movement of, sugars / ions / substance(s) other than water / AW **;** involves protein <u>carriers</u> **;**	**3**	
2(c)	root hair (cells) **;**	**1**	

Question	Answer	Marks	Guidance
2(d)	(leaves are) yellow / (leaves show) chlorosis ; magnesium required for making chlorophyll ;	**2**	

Question	Answer	Marks	Guidance
3(a)(i)	produce / secrete, mucus ; traps / catches / AW, pathogens / bacteria / particulates / AW ; AVP ; e.g., water in mucus moistens surface in, nose / airways	**2**	
3(a)(ii)	*any two from:* ciliated / has cilia / has hair-like cilia ; move / sweep / waft / AW, mucus (with pathogens / AW) ; AVP ;	**2**	e.g., many mitochondria to provide energy for movement of cilia
3(a)(iii)	bronchi / bronchioles / AVP ;	**1**	e.g., nose / pharynx / throat / oviduct / uterus / cervix / ear / testes
3(b)	feature: diaphragm; action: contracts / lowers / flattens ; feature: external intercostal muscles; action: contract ; feature: pressure in the th**ora**x; action: decreases / AW ; feature: ribs; action: move, up / out ; feature: volume of the th**ora**x; action: increases / AW ;	**5**	
3(c)	carbon dioxide / water vapour ;	**1**	

Question	Answer	Marks	Guidance
3(d)	*any two from:* large (surface) area **;** thin (surface) / one cell thick / short diffusion distance **;** good blood supply / AW **;** AVP **;**	**2**	e.g., moist / ref. to surfactant
3(e)	alveoli **;**	**1**	

Question	Answer	Marks	Guidance
4(a)	*any six from:* LIGHT (B and C as light intensity increases) the rate (of photosynthesis) increases and remains constant / AW **;** rates (of photosynthesis) are the same at low(est) light intensities **;** light provides <u>energy</u> (for photosynthesis) **;** where the line rises / initially, light intensity is, limiting / the limiting factor **;** line(s) / rate, levels off where light intensity is **not** limiting **;** in **B** light intensity becomes limiting at higher light intensity than **C** / **ora** **;** CARBON DIOXIDE *Idea that* line C levels off, at a lower rate (of photosynthesis) / lower light intensity **;** carbon dioxide (concentration) is, lower for **C** / 0.04% vs 0.4% **;** carbon dioxide is, reactant / substrate / raw material / needed, for photosynthesis **;** in **C** carbon dioxide is a limiting factor at a lower light intensity / in **B** carbon dioxide is a limiting factor at a higher light intensity **;** TEMPERATURE *idea that* temperature is limiting for **B** at high light intensities **;**	**6**	**I** if C given as well (as no evidence for C)

Question	Answer	Marks	Guidance
4(b)	O_2 ;	1	
4(c)	*any four from:* (glucose) used, in respiration / to provide energy / to release energy / as an energy store ; (glucose) converted to / stored as, starch ; (glucose) converted to sucrose ; sucrose for, translocation / transport (in the phloem) / sent to sink(s) ; (glucose / fructose / sucrose) in nectar ; (nectar) to attract, insects / pollinators ; (glucose / fructose / sucrose) in fruits (to attract animals) ; (glucose) converted to cellulose ; cellulose to build cell walls ; lignin for cell walls ; used to make, amino acids / fatty acids ; AVP ;	4	e.g., used to make chlorophyll / (DNA/RNA) bases

Question	Answer	Marks	Guidance
5(a)(i)	**X** – nucleus ; **Y** – mRNA ; **Z** – ribosome ;	3	
5(a)(ii)	sequence / order, of bases in, mRNA / DNA / gene ;	1	
5(a)(iii)	(the sequence of amino acids) determines the shape of the, protein / receptor ; complementary / specific, shape is required for the receptor molecule to, bind / attach / fit, to neurotransmitter ;	2	
5(b)	not all genes are, expressed / switched on / activated / AW ; cells only produce the (specific) proteins they need / AW ;	2	
5(c)	*either* an alternative form of a gene ;	1	

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Question	Answer	Marks	Guidance
5(d)	humans choose, specific feature(s) / desired features ; humans choose, individuals / offspring, to reproduce ; selection not influenced by environment / humans manipulate environment ; decreases (genetic) variation / decreases size of gene pool ; faster / shorter ; for economic / aesthetic, reasons ; no / less, evolution ; AVP ;	**3**	e.g. decrease in fitness
5(e)	*any two from:* meiosis ; random mating / cross pollination / crossbreeding ; random fertilisation ; AVP ;;	**2**	e.g., immigration

Question	Answer	Marks	Guidance
6(a)	*gap1:* 7.07 (to) *gap 2:* 6.55 ; (enough) *gap 3:* oxygen / oxygenated blood *gap 4:* (an) oxygen (debt) ; *gap 5:* any time between 31 and 32 (minutes) ; *gap 6:* blood(stream) / (blood) plasma ; *gap 7:* liver ; *gap 8:* heart / pulse ;	**6**	
6(b)(i)	$(C_6H_{12}O_6) \rightarrow 2C_2H_5OH + 2CO_2$;;	**2**	MP1 for formulae MP2 for balancing
6(b)(ii)	cell wall / (large) vacuole / plasmid(s) ;	**1**	

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