Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/43**

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)	<table><tr><th>feature</th><th>active transport</th><th>diffusion</th></tr><tr><td>movement of particles always occurs across a cell membrane</td><td>✓ ;</td><td></td></tr><tr><td>molecules moving during gas exchange</td><td></td><td>✓ ;</td></tr><tr><td>rate of movement of particles is higher when the concentration gradient is larger</td><td></td><td>✓ ;</td></tr><tr><td>requires energy from respiration</td><td>✓ ;</td><td></td></tr></table>	**4**	one mark per correct row **R** each additional tick
1(b)	*any three from:* for ion, uptake / absorption **;** ion concentration lower in the soil than in the root (cell) / AW **;** movement against the concentration gradient **/** AW **;** creates a water potential gradient / AW **;** named example of ion e.g. nitrate / magnesium **;**	**3**	

Question	Answer	Marks	Guidance
2(a)	mesophyll **;** diffuses **;**	**2**	
2(b)	*any three from:* transpiration pull **;** (draws up) a column of water **;** held together by forces of attraction between water molecules **;** (xylem forms) a continuous (empty) tube **;** loss of water from leaf reduces, water potential / hydrostatic pressure **;** AVP **;**	**3**	e.g. adhesion between water molecules and, wall of xylem / AW

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Question	Answer	Marks	Guidance
2(c)(i)	*describe (max three from):* as wind speed increases the rate of transpiration increases (in both light and dark) / **ora ;** (the rate of) transpiration is higher in the light (than the dark) / **ora ;** the rate of increase in transpiration rate is higher in the light than the dark **/ ora ;** ref change of gradient at wind speeds above 4 m per s (to 10 m per s) **;** comparative correct data quote including units **;** *explain:* (transpiration rate) increases because the water vapour is removed from outside the leaf faster / AW / **ora ;** maintaining the concentration gradient for diffusion **;** (in the light) (more) stomata are open / stomata are open wider / **ora ;** to allow, gas exchange / carbon dioxide to diffuse in / oxygen to diffuse out, for photosynthesis **;** energy from light increases the, kinetic energy of the water molecules / rate of evaporation of water **;**	**4**	
2(c)(ii)	line drawn increasing with wind speed but below the light line **;**	**1**	must start below 2 g per hr **A** below the dark line

Question	Answer	Marks	Guidance
2(c)(iii)	*any four from:* *prediction:* lower rate of / less, transpiration (in the light) **;** at all wind speeds **;** little change in the dark **;** *explanation - max three from:* less water absorbed by the roots **;** water moves from the cells **;** by osmosis **;** (guard) cells, lose their turgidity / become flaccid **;** (in the light) stomata close **;** plant / leaves / tree, wilts **;** (little change in dark because) stomata already closed **;**	**4**	

Question	Answer	Marks	Guidance
3(a)	**X** drawn on septum **;**	**1**	
3(b)	*any two from:* left ventricle / thicker wall / **B**, contains more muscular tissue **;** left ventricle / thicker wall / **B**, can contract with more force **;** left ventricle / thicker wall / **B** , pumps blood at high(er) pressure **;** left ventricle / thicker wall / **B**, pumps blood a long(er) distance **;**	**2**	**A** ora for each point **A** left ventricle / thicker wall / **B**, pumps to whole body while, right ventricle / thinner wall / **C**, pumps to lungs only

Question	Answer	Marks	Guidance
3(c)	*(the red blood cell moves)* carried in the (flowing) blood **;** from the vena cava / **A**, into the right atrium **;** from the right atrium to the right ventricle as the right atrium, contracts / pumps **;** out of the right ventricle into the pulmonary artery as the right ventricle contracts **;** through the lungs / pulmonary circulation / into the pulmonary veins **;** from pulmonary vein to the left atrium **;** from the left atrium to the left ventricle as the left atrium contracts **;** out of the left ventricle into the aorta as the left ventricle contracts **;** (correct atria to correct ventricle) through the atrioventricular valve / atrioventricular valves close to prevent backflow **;** (correct ventricle to (correct) artery) through the semilunar valve / semilunar valves close to prevent backflow **;**	**6**	
3(d)(i)	ECG / (measuring) pulse rate / listening to valves closing **;**	**1**	**A** fitbit / fitness tracker / smartwatch **A** description of taking pulse
3(d)(ii)	–48.9(%) **;;;**	**3**	MP1 correct readings from graph of 180 and 92 MP2 correct answer calculated as a negative value to any number of significant figures (92 – 180)/180 MP3 correct rounding to three significant figures **ecf** from previous step
3(d)(iii)	*any three from:* to increase blood flow to muscles **;** to provide more oxygen for (aerobic) respiration **;** to provide more glucose for respiration **;** to provide / release, more energy for contraction **;** to remove (excess) CO_2 produced **;** to transport / remove, lactic acid (to liver / from muscle) **;** to remove heat from muscles **/** ref to maintain constant internal body temperature **;**	**3**	**R** produce energy

Question	Answer	Marks	Guidance
4(a)(i)	deamination **;** in the liver **;** the removal of the nitrogen-containing part **;** of excess amino acids **;**	**3**	
4(a)(ii)	plasma **;**	**1**	
4(a)(iii)	urea is, toxic / harmful / poison(ous) / a toxin **;**	**1**	
4(a)(iv)	renal vein **;**	**1**	
4(b)	*any four from:* the glomerulus / **K**, is where the blood is filtered **;** water / glucose / urea / ions, move into, nephron / **L** **;** the nephron / **L**, reabsorbs <u>all</u> glucose **;** the nephron / **L**, reabsorbs some of the, water / ions **;** into, the blood / **M** / capillary **;** urine flows through **N** **;** urine contains urea and excess water and excess <u>ions</u> **;** AVP **;**	**4**	e.g. correct ref to, active transport / diffusion / selective reabsorption
4(c)	formation of, amino acids / proteins, for growth **;**	**1**	
4(d)	*any two from:* apply, less / suitable, amount **;** do not apply before rain / AW **;** do not apply too frequently **;** do not apply right next to the lake **;** do not apply onto bare soil **;** (i.e. before crops are planted) apply only when crops are actively growing **;** AVP **;**	**2**	

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Question	Answer	Marks	Guidance
5(a)	*any three from:* maintains pregnancy **;** prevents the menstrual cycle continuing during pregnancy / prevents menstruation **;** maintains the (thickness of) lining of the uterus **;** inhibits contraction of the muscular wall of the uterus **;** prevents secretion of, FSH / LH **;** prevents, more follicles developing **/** ovulation **;** AVP **;**	**3**	
5(b)(i)	*any two from:* oxygen / glucose / amino acids / named nutrient molecule / ions / water / (named) hormone / antibodies **;;**	**2**	
5b(ii)	large surface area **;** short diffusion distance **;** concentration gradient is maintained / good blood supply **;**	**3**	
5(c)	*gametes:* mother's gametes **d d and** father's gametes **D d ;** *offspring genotypes*: **Dd**, **Dd**, **dd** and **dd ;** *probability*: 0.5 / 50% / ½ / 1 in 2 **;**	**3**	**ecf** from previous step **D** | **d** **d** | **Dd** | **dd** **d** | **Dd** | **dd**

Question	Answer	Marks	Guidance
6(a)(i)	1950s **;**	**1**	**A** 1950 to,1959 / 1960

Question	Answer	Marks	Guidance
6(a)(ii)	*any three from:* pollution ; climate change ; land for housing / crop plantation / livestock / agriculture ;; logging for, firewood / paper / timber / charcoal / fuel ; for mining / extracting raw materials ; AVP ;	**3**	e.g. forest fires
6(b)(i)	0.2156 (g) ;	**1**	A 0.21 / 0.22 / 0.216
6(b)(ii)	*any two from:* seeds are, small / AW ; seeds are easy to collect / AW ; some plants produce many seeds ; seeds can, be dormant / have low metabolism / AW ; seeds do not need (much) maintenance / AW ;	**2**	
6(b)(iii)	*any five from:* maintaining / increasing biodiversity ; reduce (plant) extinction ; preventing loss of animal species that depend on plant species ; (moral) responsibility to save other species ; protect / maintain, (vulnerable / AW) ecosystems ; by supporting recycling of nutrients ; by supporting flow of energy in, food chains / food webs ; possible fuels ; possible genes ; possible drug sources ; possible crop plants / selective breeding ; allows for future research ; AVP ;;	**5**	e.g. prevent flooding / protect livelihood / ecotourism / named conservation project and advantage

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7(a)</td><td>nitrogen ;</td><td>1</td><td></td></tr>
<tr><td>7(b)</td><td>
<table>
<tr><td>large biological molecule</td><td>products of the breakdown of the large biological molecule</td><td>enzyme that catalyses the breakdown of the large biological molecule</td><td>organ that produces the enzyme</td></tr>
<tr><td>oil</td><td>fatty acids and glycerol</td><td>lipase</td><td>pancreas</td></tr>
<tr><td>glycogen</td><td>glucose</td><td>glycogen phosphorylase</td><td>liver</td></tr>
<tr><td>starch</td><td>maltose</td><td>amylase</td><td>salivary gland / pancreas</td></tr>
<tr><td>protein</td><td>amino acid</td><td>pepsin / protease</td><td>stomach</td></tr>
</table>
;;;;</td><td>4</td><td>one mark per correct row</td></tr>
<tr><td>7(c)</td><td>any two from:
insulin ;
<u>glu</u>cagon ;
adrenaline ;</td><td>2</td><td></td></tr>
</table>

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