Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 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 October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level 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.

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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)	haemoglobin **;**	**1**	
1(b)	platelets **;**	**1**	
1(c)(i)	9.3 **;;;**	**3**	MP1 selection of correct values from table MP2 correct calculation to any number of significant figures MP3 correct rounding to two significant figures
1(c)(ii)	*any three from:* (salt) solution has a lower water potential than the (red blood) cells/ ora **;** (diameter decreases because) water leaves the (red blood) cells by osmosis **;** water travels, from higher water potential to lower water potential / down a water potential gradient **;** across the, cell / partially permeable, membrane **;**	**3**	
1(c)(iii)	*any one from:* water potential (of red blood cells) is the same (as the salt solution) / AW **;** no, net / overall, movement of water (across membrane / in or out of cell) **;**	**1**	
1(d)	(red blood cells) do not have a (rigid) cell wall / ora **;**	**1**	
1(e)	*any two from:* transport (of ions / sucrose / AW) / translocation **;** as a reactant / (used in) photosynthesis **;** as a solvent / substances dissolve in it **;** medium for, chemical / enzyme / metabolic, reactions **;** support / (maintaining) turgidity (of cells) / (maintaining) turgor pressure / prevent wilting **;** AVP **;**	**2**	e.g. cooling / temperature regulation / germination / elongation of cells (in growth)

Question	Answer	Marks	Guidance
2(a)	an inherited (structural) feature **;** that helps an organism to, survive / reproduce (in its environment) **;**	**2**	
2(b)(i)	**A** – palisade mesophyll **;** **B** – spongy mesophyll **;** **C** – <u>air</u> spaces **;**	**3**	
2(b)(ii)	*any three from:* many (air spaces) / large (air spaces) **;** reduces density (of the leaf) **;** allowing it to float / be on water / be near surface of water **;** (so) accessible, to light / carbon dioxide / gas exchange / AW, for photosynthesis **;**	3	
2(c)(i)	*total of five from:* *comparison - max three from:* 1 tomato has <u>more</u> stomata on its lower epidermis than its upper epidermis **;** 2 water lily has, stomata **only** on upper epidermis / **no** stomata on lower epidermis **;** 3 water lily has more stomata on upper epidermis than tomato **;** ORA 4 water lily has more stomata (per mm^2) than tomato **;** ORA 5 any use of comparative manipulated figures from table including unit (at least once in the answer) **;** *explanation:* 6 (tomato has most stomata on lower epidermis) so not facing the sun **;** *7 idea that* tomato needs to reduce, water loss / transpiration / evaporation **;** 8 water lily (floats on water so) only upper surface is exposed to air **;** 9 (water lily has large number of stomata) as water does not need to be conserved **;**	**5**	
2(c)(ii)	guard (cells) **;**	**1**	

Question	Answer	Marks	Guidance
3(a)	**X** – vesicle (membrane) **;** **Y** – synapse / synaptic gap **;**	**2**	
3(b)	*any five from:* movement is, impaired / slower / non-existent **;** slower reflexes / AW **;** fewer vesicles **;** fewer neurotransmitters in, vesicles / **X ;** fewer neurotransmitters, released (when an impulse arrives) **;** fewer neurotransmitters <u>diffuse</u> across the, synapse / gap / cleft **;** fewer neurotransmitters bind to receptor proteins **;** fewer / no, impulses (in the, postsynaptic / second / next, neurone) **;** AVP **;**	**5**	
3(c)	*any two from:* more rapid **;** short-lived effect **;** localised / AW **;** transmission of (electrical) impulses **;** (transmission is through) neurones / nerve cells **;**	**2**	**A** ora for hormonal control throughout, i.e.: slower (some may have) long-lasting effect widespread / AW hormones are chemicals transmission through the, blood / circulatory, system
3(d)(i)	*any two from:* sequence of bases in, gene / DNA / mRNA, determines sequence of amino acids **;** sequence of amino acids determines shape of receptor proteins **;**	**2**	
3(d)(ii)	move / carry, (named) molecules / ions, across membrane(s) / into *or* out of cells **;** by active transport / using energy from respiration **;** movement against concentration gradient / from low to high concentration **;**	**2**	

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Question	Answer	Marks	Guidance
4(a)	40 (°C) **;**	**1**	
4(b)	*any six from:* *before 40 °C* 1 increasing temperature increases the kinetic energy (of reactants / molecules) **;** 2 increasing the, frequency / rate, of (effective) collisions **;** 3 more enzyme-substrate complexes are formed **;** 4 releasing more, oxygen / glucose / products **;** 5 temperature is the limiting factor **;** *at 40 °C* 6 (optimum temperature) maximum number of, enzyme-substrate complexes / collisions**;** *after 40 °C* 7 increasing temperature changes the shape of active site(s) (of enzyme(s)) **;** 8 ref. to denaturation **;** 9 substrate, no longer complementary (to active sites) / can no longer fit into active sites **;** 10 fewer / no, enzyme-substrate complexes are formed **;** 11 fewer / no, products are released **;** 12 AVP **;**	**6**	e.g. stomata close (as high rate of transpiration) so no CO_2 enters
4(c)	*any two from:* carbon dioxide is a limiting factor / so that carbon dioxide is **not** a limiting factor / AW **;** so that temperature is the only, variable / limiting factor **;** to ensure that the effects are caused (only) by temperature **;**	**2**	
4(d)	*any one from:* (some is) used, for (aerobic) respiration / to react with glucose **;** some remains in air spaces **;**	**1**	

Question	Answer	Marks	Guidance
4(e)	*any two from:* absorbs / traps / captures, light **;** transfers / converts, light energy into chemical energy **;** for the synthesis of, glucose / carbohydrates **;**	**2**	

Question	Answer	Marks	Guidance
5(a)	*any two from:* single circulation / blood flows through the heart once on one circuit of the body **;** ref. to, one atrium and one ventricle / two chambers in the heart **;** no septum in the heart **;** only deoxygenated blood / no separation of oxygenated and deoxygenated blood, in the heart **;** blood is under less pressure **;**	**2**	*assume answer is about fish unless mammal stated* **A** no separate systemic and pulmonary circuits *if answered for mammals:* MP1 double circulation / blood flows twice through the heart in one circuit of the body **A** systemic and pulmonary circuits MP2 two atria and two ventricles / four chambers MP3 heart has a septum MP4 oxygenated and deoxygenated are separated MP5 blood pressure is higher

Question	Answer	Marks	Guidance
5(b)	*any three from:* 1 prevents mixing of oxygenated and deoxygenated blood **;** 2 blood able to flow at high pressure (to the body) **;** 3 efficient / fast, supply of, blood / glucose / oxygen / nutrients **;** 4 efficient / fast, removal of, waste / carbon dioxide / urea / lactic acid **;** 5 allows efficient filtration in kidneys (for excretion) **;** 6 to allow / maintain, a high, metabolic rate / rate of respiration **;** 7 lower pressure, in pulmonary circuit / to lungs **;** 8 to prevent damage to, delicate tissue / capillaries, in lungs **;** 9 allows more time for gas exchange **;** 10 AVP **;**	**3**	e.g. larger diffusion gradient between capillaries and respiring tissues / allows large body size
5(c)(i)	**C ;** **A ;** **D ;** **B ;**	**4**	
5(c)(ii)	hepatic portal vein **;**	**1**	
5(d)	*any four from:* 1 deamination / removal of nitrogen-containing part of amino acids **;** 2 removing excess amino acids (from blood regulating concentration of amino acids (in blood)) **;** 3 forming urea **;** 4 urea, released / diffuses, into blood (to travel to kidney) **;** 5 breakdown / respiration / oxidation, of lactic acid **;** 6&7 AVP **;**	**4**	e.g. breakdown of, alcohol / hormones / drugs / toxins

Question	Answer	Marks	Guidance
6(a)	oestrogen **;** progesterone **;**	**2**	

Question	Answer	Marks	Guidance
6(b)	placenta **;**	**1**	
6(c)(i)	6 / six **;** lymphocytes **;** 56 / fifty-six **;** 3 / three **;**	**4**	
6(c)(ii)	*any two from:* 1 breastfeeding supplies antibodies before the baby starts making (enough of its) own **;** 2 provides the baby with <u>passive immunity</u> **;** 3 protection against / immunity from, infection / (named) pathogens / (named) diseases **;** *4 idea that* it provides all the nutrients required by the baby **;** 5 forms a bond (between mother and baby) **;** 6 (stated) health benefit for mothers **;** 7 milk at, the right temperature / body temperature **;** 8 no need to prepare milk / sterilisation not required **;** 9 AVP **;**	**2**	e.g. free / provides bacteria for gut / (may) reduce chances of asthma *or* allergies *or* autoimmune diseases
6(c)(iii)	*any two from:* passive immunity / antibodies from mother, during pregnancy / before birth / across the placenta **;** vaccination *or* giving antigen(s) by, injection / mouth **;** injection of antibodies **;** (active immunity) following infection (by a pathogen) **;**	**2**	

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Question	Answer	Marks	Guidance
6(d)	*any three from:* each (named) pathogen has antigens (on surface) **;** ref. to specificity **;** (shape) is complementary **;** antibodies bind to antigens **;** antibodies, mark pathogens for destruction / destroy pathogens **;**	**3**	
6(e)	carbon, hydrogen, oxygen **;**	**1**	

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