Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/43**

Paper 4 Theory (Extended) **May/June 2022**

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.

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This document consists of **11** printed pages.

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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)(i)	bacteria **;**	**1**	
1(a)(ii)	antibiotic **;**	**1**	
1(b)(i)	*any two from:* nucleus **;** mitochondria **;** (r)ER **;** vacuole **;** AVP **;**	**2**	e.g., hyphae / structure of cell wall
1(b)(ii)	*Penicillium* **;**	**1**	
1(b)(iii)	*any two from:* glucose **;** ammonia / amino acids **;** (named mineral) salts **/** ions **;;** water **;**	**2**	
1(b)(iv)	stops the growth of microorganisms / AW **;**	**1**	**A** prevent contamination
1(b)(v)	*any two from:* release of, waste gas / carbon dioxide **;** (carbon dioxide / gas) is produced during fermentation / respiration **;** to prevent fermenter exploding / to reduce pressure **;** carbon dioxide is toxic (to fungus if it builds up) **;**	**2**	

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Question	Answer	Marks	Guidance
1(b)(vi)	*any four from:* 1 (step 4) is reproduction (of **A** before adding to fermenter) **;** 2 (step 5) inoculation in a fermenter / AW **;** 3 (step 6) exponential growth (of organism **A** in fermenter) **;** 4 sampling to check when penicillin is ready ; 5 penicillin is, a byproduct of maximum growth / a toxin / fermentation **;** 6 (step 7) cells / product / penicillin, are removed ; 7 (step 8) purification / filtering / described ; 8 idea of packaging of penicillin ; 9 AVP **;**	**4**	**A** idea of adapting to environment **A** drying / AW e.g., batch cultures (described) / limited resources / stationary phase triggers production of penicillin

Question	Answer	Marks	Guidance
2(a)(i)	carbon **and** oxygen **and** hydrogen **;** nitrogen **;**	**2**	
2(a)(ii)	binds to / releases / transports / AW, oxygen **;**	**1**	
2(b)	*any two from:* (it is) sickle-shaped / not biconcave **;** rigid / inflexible **;** get stuck in / block, blood vessels / capillaries **;** reference to (increased) clotting **;**	**2**	

Question	Answer	Marks	Guidance
2(c)	*parental phenotypes* unaffected / sickle trait / (sickle) carrier / AW × unaffected / sickle trait / (sickle) carrier **;** *parental genotypes* $Hb^A\ Hb^S$ × $Hb^A\ Hb^S$ **;** *gametes* Hb^A, Hb^S + Hb^A, Hb^S **;** *offspring genotypes* Hb^AHb^A Hb^AHb^S (Hb^AHb^S) Hb^SHb^S **;** *probability* 0.25 / 25% / ¼ **;**	**5**	**ecf** for subsequent rows
2(d)(i)	*any five from:* **1** **A** has, almost no / low(est), Hb^S (allele) frequency / AW, but medium births **;** **2** **B** has high(est) births and high(est) Hb^S (allele) frequency / AW **;** **3** **C** has low(est) number of births and low / medium Hb^S (allele) frequency / AW **;** **4** **B** supports the statement / **A** does not support the statement / no link between births and allele frequency / AW **;** **5** data is estimated not actual **;** **6** maps have different level of detail **;** **7** *ref. to effect of* population density ; **8** AVP **;**	**5**	
2(d)(ii)	look at, DNA base sequence / amino acid sequence / AW **;**	**1**	
2(e)	*any four from:* mutations are found in the DNA **;** asexual reproduction offspring are, genetically identical to / clones of, the parent / AW **;** (so) any existing mutations (in parent DNA) will be inherited / AW **;** sexual reproduction (usually) involves two parents **;** mutation will only be in one of the parents **;** mutation will only be in some of the gametes **;** meiosis does not result in genetically identical cells **;**	**4**	

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Question	Answer	Marks	Guidance
3(a)	*any three from:* lowers pH / acidifies soil **;** (acidified soil) causes leaching **;** burn / corrode / damage , leaves **;** affects ability of roots to absorb mineral ions **;** consequence of named mineral ion deficiency described **;** AVP **;**	**3**	e.g., described root damage / reduced ability to take up water
3(b)	*any four from:* species become endangered / extinct **;** because there is a loss of habitat **;** knock on negative effect to, other organisms / food chains **;** (increases) soil erosion / nutrient leaching **;** causes flooding **;** (increases) landslides ; *idea of* change in the pattern of rainfall ; less photosynthesis **;** increase (atmospheric) carbon dioxide / less carbon dioxide removed **;**	**4**	
3(c)	*any two from:* adapted to a different pH **;** moist / permeable, skin **;** large surface to volume ratio **;** may have gills which are, fragile / thin / AW **;** lays (unshelled) eggs in water **;** part of the life cycle / larval stages, only exist in water **;**	**2**	
3(d)	*any three from:* scrubbers / flue gas desulfurisation, in power stations / chimneys **;** reduce use of coal-fired power stations **;** use alternative / renewable, energy sources **;** catalytic converters **;** low sulfur fuel / AW **;** recycling / reusing / reducing, plastic / less plastic waste burnt **;** AVP **;**	**3**	e.g., electric cars / carpool / public transport

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4(a)</td><td>
<table>
<tr><th>number from Fig. 4.1</th><th>name of the organ</th><th>letter or letters of all the processes that occur in the organ</th></tr>
<tr><td>1</td><td>mouth</td><td>I, C, M</td></tr>
<tr><td>2</td><td>stomach</td><td>C, M (A)</td></tr>
<tr><td>3</td><td>duodenum</td><td>A, C (M)</td></tr>
<tr><td>4</td><td>ileum</td><td>A, C</td></tr>
<tr><td>5</td><td>colon</td><td>A</td></tr>
<tr><td>6</td><td>anus</td><td>E</td></tr>
</table>
;;;;;;</td><td>6</td><td>one mark for each correct row</td></tr>
<tr><td>4(b)</td><td>any six from:
1 P is a lacteal ;
2 (lacteals) absorb, fats / fatty acids / glycerol / (named) fat soluble vitamin ;
3 T / lymphatic vessel, returns lymph / fats, to blood / to circulatory system ;
4 Q / epithelial cell, has microvilli ;
5 (microvilli / villi) increase the surface area for absorption ;
6 Q is one cell thick for short diffusion distance / fast diffusion
7 Q is site of breakdown of maltose to glucose ;
8 glucose uptake by active transport ;
9 R / capillary, for absorption of, amino acids / glucose / salts / water / products of digestion / soluble nutrients ;
10 R has thin walls / R is one cell thick ;
11 blood flowing to maintain concentration gradient / AW ;
12 transports absorbed nutrients to, S / venule / vein ;</td><td>6</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
5(a)(i)	carbon dioxide is needed for photosynthesis **;** (atmospheric) carbon dioxide concentration is a limiting factor / AW **;** glucose is, a product of photosynthesis / needed for growth **;**	**3**	
5(a)(ii)	(named fossil fuel) burners **/** carbon dioxide gas cylinders **/** AVP **;**	**1**	
5(a)(iii)	diffusion / high concentration to low concentration **;** through stomata / ref. to guard cells **;**	**2**	
5(b)(i)	65(%) **;;**	**2**	MP1 correct calculation e.g. (651 – 394) ÷ 394 = 65.228 to any number of significant figures MP2 correct rounding to two significant figures **ecf** MP2 from incorrect MP1
5(b)(ii)	sodium **;**	**1**	
5(b)(iii)	*any three from:* enzymes are involved (in, photosynthesis / respiration) **;** (too much heat) can, denature enzyme / change shape of active site **;** correct ref. to, transpiration / described / water vapour loss **;** (more likely to) wilt **;** decrease in yield / death **;** AVP **;**	**3**	

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Question	Answer	Marks	Guidance
6(a)	*any one from* two cotyledons ; (leaves have) branching / network / AW, veins ; broad leaves ; (multiples of) five petals ; petioles ;	**1**	
6(b)	(made of) protein / biological ; catalyst / described ;	**2**	
6(c)(i)	pectinase ;	**1**	
6(c)(ii)	45 minutes ;	**1**	
6(c)(iii)	(vitamin) C / ascorbic acid ;	**1**	
6(d)(i)	genetic, engineering / modification ;	**1**	
6(d)(ii)	*any three from:* reduced natural biodiversity ; insect-resistant plants negatively affect pollinators ; cross-pollinate into wild populations ; (GM seeds are) expensive / AW ; seeds need to be bought each season ; ethical concerns of consumers ; AVP ;	**3**	

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