CAMBRIDGE
International Education

Cambridge IGCSE™

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 2024**

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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PUBLISHED

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 descriptions 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)	**L ;** **N ;** **M ;**	**3**	
1(a)(ii)	circle drawn around a vascular bundle **;**	**1**	
1(a)(iii)	sucrose **;** amino acids **;**	**2**	
1(b)	*any three from:* thick walls **;** containing lignin **;** (lignin for) support (of vessel / tube) / AW **;** no cell contents **;** cells joined end to end / forming long continuous tube / no cross-walls **;** to transport water **;** AVP **;**	**3**	e.g. narrow diameter to prevent water column 'breaking' / pits for side-ways movement of water / pits to by-pass a blockage
1(c)	*any four from:* (water enters) root hair cells, by osmosis **;** through the (root) cortex (cells) **;** to xylem (in the root) **;** a column of water molecules moves up (the stem in xylem) / AW **;** water molecules are held together by forces of attraction (between the molecules) / ref. to cohesion **;** (water) diffuses / moves, out (of xylem in the leaf) into mesophyll cells **;** (water) evaporates (from surface of mesophyll cells) into the air spaces **;**	**4**	

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Question	Answer	Marks	Guidance
1(d)	*any two from:* needed to make amino acids **;** (amino acids) to make proteins **;** (proteins) for growth **;**	**2**	

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Question	Answer	Marks	Guidance
2(a)(i)	(–)59(%) **;**	**3**	MP1 correct readings from graph (3900 and 1600) MP2 correct calculation and answer to any number of significant figures MP3 correct rounding to two significant figures ecf from previous step
2(a)(ii)	*any four from:* abstain from sexual contact **;** condoms / femidom **;** testing / screening **;** contact tracing **;** education (about, risks / how it is transmitted / prevention) **;** use of antibiotics **;** no sharing of needles **;** using screened blood for transfusions **;** vaccination **;** AVP **;**	**4**	
2(b)(i)	ovary **;**	**1**	
2(b)(ii)	*any three from:* secondary sexual characteristics **;** start of, the menstrual cycle / AW **;** hips widen **;** growth of breasts **;** growth of, pubic / body, hair **;** AVP **;**	**3**	
2(c)	antibiotics **;** natural **;** sequence **;** alleles **;** ionising **;** meiosis **;**	**6**	

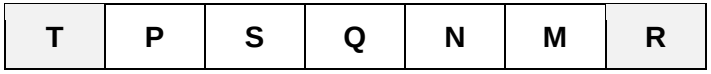
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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(a)(i)</td><td>prokaryote ;</td><td>1</td><td></td></tr>
<tr><td>3(a)(ii)</td><td>
<table>
<tr><th>name</th><th>function or use</th><th>letter from Fig. 3.1</th></tr>
<tr><td>flagellum</td><td>movement / AW</td><td>B</td></tr>
<tr><td>cell membrane</td><td>controls what goes in and out (of the cell)</td><td>G</td></tr>
<tr><td>ribosome</td><td>protein synthesis</td><td>D</td></tr>
<tr><td>cell wall</td><td>prevents (cell) bursting / provides support</td><td>A</td></tr>
<tr><td>plasmid</td><td>used in genetic modification</td><td>C</td></tr>
</table>
;;;;;</td><td>5</td><td>one mark for each correct row</td></tr>
<tr><td>3(b)</td><td>drinking contaminated water / AW ;</td><td>1</td><td></td></tr>
<tr><td>3(c)</td><td>any four from:
1 cholera / bacterium / pathogen, produces a toxin ;
2 (toxin) causes secretion of chloride ions ;
3 into lumen / small intestine ;
4 (loss of ions) increases / AW, water potential within cell ; ora
5 water moves out of cells / blood ;
6 down water potential gradient / from high to low water potential ;
7 (out) by osmosis / through the partially permeable membranes ;
8 (causing) diarrhoea / watery faeces / AW ;
9 resulting in loss of water (from the body) ;</td><td>4</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
3(d)	*any six from* **1** *ref. to* active / long-term, immunity **;** **2** vaccine contains weakened / dead / AW, bacteria / pathogen **;** **3** *ref. to* antigens of pathogen **;** **4** (antigen) stimulates an immune response **;** **5** lymphocytes make antibodies **;** **6** antibodies bind to, antigen **;** **7** *ref. to*, specificity / complementary (shape to antigen / pathogen) **;** **8** *ref. to* forming memory cells **;** **9** *ref. to* mass vaccination (programmes) **;** **10** person to person transmission interrupted / AW **;** **11** AVP **;**	**6**	

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Question	Answer	Marks	Guidance
4(a)	*first gap:* central **and** *second gap:* peripheral **;**	**1**	both needed for the mark
4(b)(i)	 **;;**	**2**	MP1 for **P** first and **M** at the end MP2 for **S**, **Q**, **N** in that order but in *any* position in relation to **P** and **M**
4(b)(ii)	*any two from:* touch **;** temperature **;** AVP **;**	**2**	e.g. pressure / pain
4(b)(iii)	circular / radial, muscle **;**	**1**	**A** iris
4(c)	*total of five from:* **1** only the first neurone releases neurotransmitters **;** ***2*** only the second neurone has (complementary) receptors **;** *max four from:* **3** *ref. to* neurotransmitter (molecules) **;** **4** (neurotransmitter is released) from vesicles **;** **5** into the synaptic gap **;** **6** the junction between the neurones is the synapse **;** **7** (neurotransmitter molecules) diffuse (across the gap) **;** **8** *ref. to* receptors are complementary in shape (to neurotransmitter) **;** **9** (neurotransmitter molecules) bind with receptors (on the next neurone) **;** **10** impulse is then stimulated (in the next neurone) **;**	**5**	
5(a)	*any two from:* parent 2, is homozygous recessive / has two alleles (for red-green colour blindness) **;** only parent 2 can provide the X chromosome for male children **;** males only have one X chromosome and they only need one recessive allele (to be red-green colour blind) **;** red-green colour blindness is a sex-linked characteristic **;**	**2**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5(b)</td><td>
parental genotypes: parent 3 X^bY and parent 4 X^BX^b ;

gametes: X^b , Y/0/- and X^B, X^b ;

<table>
<tr><td>offspring genotypes</td><td>X^BX^b,</td><td>X^BY</td><td>X^bX^b</td><td>X^bY</td></tr>
<tr><td>offspring phenotypes</td><td>normal (colour vision) female</td><td>normal (colour vision) male</td><td>colour-blind female</td><td>colour-blind male</td></tr>
</table>
;
;

probability: 0.5 / 50% ;
</td><td>5</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
6(a)	fungus / fungi **;**	**1**	**A** *Penicillium*
6(b)	**X**: lag (phase) **Y**: log (phase) / exponential (phase) **Z**: stationary (phase)	**3**	
6(c)(i)	organisms need oxygen **;** for (aerobic) respiration **;**	**2**	
6(c)(ii)	*any three from:* respiration, produces heat **;** *ref. to* enzymes (in organisms) **;** (enzymes are) denatured by excess heat **;** to keep (the fermenter) at the optimum (temperature) **;** for maximum yield of product **;** ora AVP **;**	**3**	e.g. so that the microorganisms are not killed
6(c)(iii)	*any two from:* *ref. to* mixing / stirring **;** ensure even / uniform, distribution of, oxygen / air / nutrients / fungi **;** ensure even / uniform, temperature / pH, (in all parts of the fermenter) **;**	**2**	
6(c)(iv)	*any two from:* insulin **;** mycoprotein **;** AVP **;**	**2**	

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