Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/43**

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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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 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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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(a)(i)</td><td>
<table>
<tr><th>structure in Fig. 1.1.</th><th>name</th><th>function</th></tr>
<tr><td>A</td><td>stigma</td><td>trap / stick to / AW, pollen</td></tr>
<tr><td>B</td><td>petal</td><td>attracts, insects / pollinators OR protects reproductive organs</td></tr>
<tr><td>F</td><td>sepal</td><td>protect (flower) bud</td></tr>
</table>
;;;
</td><td>3</td><td>one mark per correct row</td></tr>
<tr><td>1(a)(ii)</td><td>filament and anther ;</td><td>1</td><td>either order</td></tr>
<tr><td>1(b)(i)</td><td>any five from:
self-pollination occurs in the same, plant / flower ;
pollen (grain) transferred from, anther / C, to, stigma / A (on same plant / flower) ;
pollen <u>grain</u> grows into a pollen <u>tube</u> ;
pollen / male, <u>nucleus</u> travels down the pollen <u>tube</u> ;
(pollen) tube grows / pollen nucleus or male nucleus moves, through the, style / G / ovary ;
pollen (tube / grain) releases enzymes ;
pollen tube, grows / pollen nucleus or male nucleus moves, through the micropyle / (in)to the, <u>ovule</u> / E ;
pollen / male, <u>nucleus</u> fuses with, female / ovule, <u>nucleus</u> ;
correct description of haploid to diploid ;
zygote is formed ;
fertilisation / described, occurs in the, <u>ovary</u> / <u>ovule</u> / E ;
AVP ;</td><td>5</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
1(b)(ii)	*any four from:* *advantages of self-pollination* 1 more (chance of successful) pollination / fertilisation **;** 2 less pollen wasted **;** 3 less / no, need for, (named) pollinators / (named) pollinating agents **;** 4 (pollination / fertilisation) can (still) occur in plants that become isolated (as occurs within same plant) **;** 5 advantage to, farmers / plants, in maintaining (named) selected varieties / limiting variation (from one generation to the next) **;** *disadvantages of self-pollination* 6 less, variation / (genetic) diversity **;** 7 limited ability to, adapt / evolve, more slowly to (named) change in environment **;** 8 more chance of, genetic / inherited, disease **;** 9 fewer individuals survive (new infectious) diseases **;** 10 more competition between plants (as have similar adaptations) **;** 11 AVP **;**	**4**	*Assume answers are about self-pollination unless stated otherwise* **ora** throughout MP4 **A** one, plant / parent, only needed MP7 **A** fewer individuals likely to survive (named) changes in environment MP8 **A** ref. to inbreeding / increased risk of harmful recessive alleles being passed on

Question	Answer	Marks	Guidance
2(a)	**J** – (upper) epidermis (cell) **;** (translucent / transparent / thin / flat / no chloroplasts) to allow passage of light, through / to palisade (cells) / leaf / AW **;** **K** – xylem (vessel) **;** continuous tube / no cytoplasm / no (named) cell contents / hollow / no end walls / no cross walls / pits, to allow transport of, water / mineral ions (to leaf) **OR** lignin, to prevent collapse of water column / support the leaf to maximise light absorption / AW **;**	**4**	
2(b)	limiting factor **;** 6 / six **;** source **;** (sun)light **;** chemical **;** water vapour **;** chlorophyll **;**	**7**	**A** reactant / substrate / raw material

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(a)(i)</td><td>
<table>
<tr><th>component</th><th>percentage in inspired air</th><th>percentage in expired air</th></tr>
<tr><td>carbon dioxide</td><td>0.04 ; A 0.03–0.08</td><td>4 ; A 3–6</td></tr>
<tr><td>oxygen</td><td>21 ; A 19.5–23</td><td>16 ; A 13.5–18</td></tr>
</table>
</td><td>2</td><td>MP1 for 2 correct numbers
MP2 for 4 correct numbers</td></tr>
<tr><td>3(a)(ii)</td><td>any one from:
trapped in nose hairs ;
trapped in mucus ;</td><td>1</td><td></td></tr>
<tr><td>3(b)(i)</td><td>any three from:
allows delivery of named useful substances (to tissues) / removal of named waste ;
thin (capillary) wall / wall is one cell thick ;
small lumen / AW ;
short diffusion distance / close contact ;
slows down blood flow (to maximise time for diffusion) ;
gaps between (capillary) cells ;
AVP ;</td><td>3</td><td></td></tr>
<tr><td>3(b)(ii)</td><td>red blood cells ;</td><td>1</td><td></td></tr>
<tr><td>3(b)(iii)</td><td>pulmonary artery ;</td><td>1</td><td></td></tr>
<tr><td>3(b)(iv)</td><td>trachea ;

prevents airway collapse / keeps airway open / AW ;</td><td>2</td><td>function must match location
A bronchus / bronchi / bronchioles / sternum / ribs / larynx / nose
A allows, flexibility / movement
A protects vocal cords / prevents food from entering the lungs</td></tr>
<tr><td>3(c)(i)</td><td>12 / 13 (breaths per minute) ;</td><td>1</td><td>A 13.3 or 10.9</td></tr>
</table>

Question	Answer	Marks	Guidance
3(c)(ii)	2.5–2.6 (dm^3) **;**	**1**	
3(c)(iii)	*any four from:* 1 more oxygen needed, for (aerobic) respiration / to release energy **;** 2 (exercise uses) muscles (which need more energy) **;** 3 ref. to muscle contraction **;** 4 (exercise causes an) increased carbon dioxide concentration / lower pH, in the blood **;** 5 (change in carbon dioxide / pH) detected by the brain **;** 6 brain sends impulses to the, diaphragm / intercostal muscles (to stimulate, faster / larger, contractions) **;** 7 to remove more carbon dioxide **;** 8 ref. to adrenaline release (during exercise increasing breathing rate) **;**	**4**	

Question	Answer	Marks	Guidance
4(a)	homeostasis **;** negative feedback **;**	**2**	
4(b)(i)	**L** - sweat gland **;** **O** - receptor(s) **;** **J** - (hair) erector muscle **;**	**3**	

Question	Answer	Marks	Guidance
4(b)(ii)	*any six from:* 1 (temperature / thermo) receptor / sensory neurone / **O**, detects, stimulus / decrease (in temperature) / external temperature **;** 2 (nerve) impulse sent along sensory neurone to, brain / hypothalamus **;** 3 impulses from the brain, travel along motor neurone / cause response **;** 4 (hair) erector muscles / **J**, contract OR hairs / **K**, stand up **;** 5 (hairs) trap layer of air as insulation **;** 6 fatty tissue / **M**, acts as insulation **;** 7 (skeletal) muscles contract and relax fast / shivering, to release heat / gain warmth / keep warm **;** 8 (constriction of) **N** / arteriole **;** 9 ref. to (arterioles / blood vessels / vaso)constriction **;** 10 (vasoconstriction) decreases blood flow to the surface **;** 11 sweat gland / **L**, reduces / stops, production of sweat **;** 12 (decreased blood flow / less sweat) decreases heat loss (from skin) **;** 13 AVP **;**	**6**	e.g. described behavioural change
4(c)(i)	pancreas **;**	**1**	
4(c)(ii)	*any one from:* (stimulates) the breakdown of glycogen (to glucose) **;** increases (blood) glucose (concentration) **;**	**1**	

Question	Answer	Marks	Guidance
5(a)	*any two from:* cell membrane **;** cytoplasm **;** ribosomes **;** DNA **;**	**2**	

Question	Answer	Marks	Guidance
5(b)	*any three from:* 1 rapid reproduction rate / AW **;** 2 reproduce asexually / offspring are genetically identical **;** 3 small / do not need much space **;** 4 simple requirements to, grow / keep / AW **;** 5 ability to make complex molecules **;** 6 few / no, ethical concerns **;** 7 presence of plasmids **;** 8 same, genetic code / type of DNA / AW, as other organisms **;** 9 AVP **;**	**3**	e.g. great, variety / diversity, of bacteria that are (or could be) useful in biotechnology / haploid
5(c)(i)	**X** placed in lag phase **;**	**1**	between 0–8 hours
5(c)(ii)	**Y** placed in stationary phase **;**	**1**	between 18–24 hours
5(c)(iii)	12 (hours) **;**	**1**	
5(c)(iv)	*any three from:* 1 death phase OR death rate above birth rate OR (bacterial population) is decreasing **;** 2 limited / lack, of (named) resources / nutrients / space **;** 3 <u>increased</u> competition (for resources / nutrients / space) **;** 4 build-up / high concentration, of (named) waste / toxins **;** 5 build-up of pressure / increase in temperature (above optimum) **;** 6 appropriate use / description, of data **;**	**3**	

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Question	Answer	Marks	Guidance
5(c)(v)	*any three from:* 1 sufficient kinetic energy (at optimum temperature) **;** 2 for many collisions between enzyme and substrate / many enzyme-substrate complexes form **;** 3 to maximise, rate of reaction / enzyme activity (at optimum temperature) **;** 4 to prevent, enzymes / active site, from denaturing (at higher temperatures) **;** 5 so that the active site does not change shape (at optimum temperature) **;** 6 active site fits / is complementary to, substrate / reactants (at optimum temperature) **;**	**3**	
5(c)(vi)	*any one from:* (amino acids are used) to make, proteins / enzymes / nucleic acids / AW **;** quicker / efficient, absorption **;** amino acids are, soluble / dissolved **;**	**1**	

Question	Answer	Marks	Guidance
6(a)	(process) resulting from natural selection **;** (populations) becoming better suited to their environment **;** over many generations **;**	**3**	

Question	Answer	Marks	Guidance
6(b)	*total of four from:* *feature:* spines / needles / thorns / spikes / AW **;** *explanation:* reduced surface area for, transpiration / water loss **or** defence against, herbivores / animals killing plant / AW **;** *feature:* fleshy / thick / wide / swollen / AW, stem / stalk / trunk **;** *explanation:* store water **;** *feature:* corrugated / AW, stem / stalk / trunk **;** *explanation:* increased shading / increased surface area for photosynthesis (of stem) / reduces, evaporation / transpiration **;**	**4**	*two correct features with two matching explanations*
6(c)(i)	33 600 (stomata) **;**	**1**	(8 cm^2 = 800 mm^2, 800 × 42)
6(c)(ii)	*any two from:* 1 lower (leaf) surfaces are, cooler / in the shade / more sheltered from wind / AW **;** 2 lower (leaf) surfaces have (more) stomata to reduce, transpiration / water loss **;** 3 few(er) stomata in xerophytes to reduce, transpiration / water loss **;** 4 xerophytes, exchange gases / photosynthesise / respire, more slowly / less (because of a lack of water / they are slow growing / in an extreme environment / exposed to high light intensities) **;**	**2**	*ora throughout*

Question	Answer	Marks	Guidance
6(d)	*any two from:* to maintain / increase, biodiversity / genetic diversity **;** reduce extinction **;** to ensure stability of, food chains / food webs **/** interdependence of organisms **;** to protect vulnerable, ecosystems **;** to maintain, nutrient cycling / soil structure / climate stability **;** to provide (named) resources **;;** AVP **;**	**2**	e.g. economics reasons such as ecotourism / aesthetic reasons / ethical duty or moral responsibility / future research / carbon sinks

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