Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

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.

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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)	it is made of (named) tissues (in a leaf) **;** (tissues), working together / for a specific (named) function(s) **;**	**2**	
1(b)	*ref* to photosynthesis **;** **B** is the palisade (mesophyll / tissue / layer / cells) and **C** contains spongy (mesophyll / tissue / layer / cells) / vascular bundles / xylem / phloem **;** *any three from:* ***layer B*** cells are, tightly / vertically, packed *or* columnar *or* few cross walls **;** (cells / layer) positioned (immediately) below, layer **A** / the upper epidermis **;** to (maximise) light (energy) reaching, cells / chloroplasts / layer **;** *ref* to many chloroplasts / lots of chlorophyll **;** (large) vacuole keeps the chloroplasts towards the sides of cells **;** *any three from:* ***layer C*** cells are loosely packed / layer contains (interconnecting) air spaces (between cells) **;** (mesophyll / air spaces) to allow, gas exchange / diffusion of (named) gases **;** (mesophyll / air spaces) to allow evaporation (of water) from cell surfaces (into air spaces) **;** (xylem) has, thick / lignified / waterproofed / pitted, cell wall **;** (xylem) (long) continuous tube / no cytoplasm / hollow *or* no end / cross, walls **;** (xylem) to allow transport of, water / mineral ions **;** (phloem) to allow, translocation / transport of, sucrose / sugar / amino acids **;**	**6**	**MP1 A** transpiration
1(c)(i)	guard (cell) **;**	**1**	
1(c)(ii)	gas exchange (described) / (regulation of) transpiration / AW **;**	**1**	

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Question	Answer	Marks	Guidance
1(c)(iii)	reduce water loss (through transpiration) ; *ref* to preventing wilting ;	**1**	
1(d)	*any three from:* stomata will take longer to close / reduces (stomatal) closure / reduces (stomatal) response ; reduced, water vapour / concentration / diffusion, gradient (between the air spaces and the outside) ; so the (guard) cells do not lose water (as, quickly / much as the first experiment) ; the (guard) cells, stay / become, turgid *or* (guard) cells take longer to become flaccid ;	**3**	

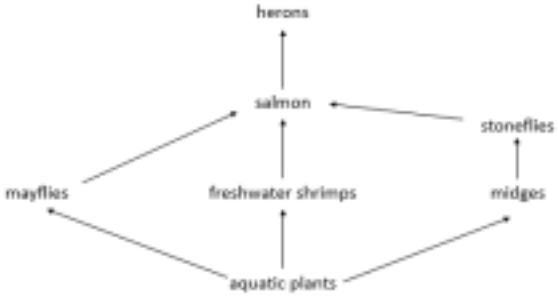
Question	Answer	Marks	Guidance
2(a)	circle one pair of the inward pointing horizontal sections opposite each other ;	**1**	
2(b)	21(%) ;	**1**	
2(c)(i)	gene ;	**1**	
2(c)(ii)	*any five from:* ribosomes make, proteins / polypeptides ; mRNA is copied from, gene / DNA ; DNA stays in the nucleus / mRNA is made in nucleus / mRNA leaves nucleus / mRNA moves to cytoplasm ; mRNA passes through ribosome / AW ; ribosome, assembles amino acids / translates mRNA (into a protein) / AW ; (protein synthesis) uses energy ; order of amino acids determined by base sequence of, mRNA / DNA / gene ;	**5**	

Question	Answer	Marks	Guidance
2(c)(iii)	*any two from:* carriers **;** receptor(s) (proteins) **;** maltase / enzyme **;** AVP **;**	**2**	

Question	Answer	Marks	Guidance
3(a)(i)	correct readings from graph **;** –44 (%) **;;**	**3**	MP1 correct readings from graph (180 and 100) MP2 correct answer to any number of significant figures i.e. -44.4 recurring MP3 correct rounding to two significant figures ecf from previous step
3(a)(ii)	*any three from:* daily doses / use (of erythromycin), peak, 1989 / at 2.8 doses per 1000 people **;** (bacterial) infections (resistant to erythromycin) peak, in 1993 / at 180 bacterial infections per 1000 people **;** no record of resistant infections, until 1991 / from 1983 to 1989 / first 6 years **;** delay (of 4 years) between peak of doses and peak of (resistant) infections **;**	**3**	

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Question	Answer	Marks	Guidance
3(a)(iii)	*any two from:* fewer doses of erythromycin used **;** development of new, antibiotics / treatments / vaccines **;** any example that would cause a reduced usage of antibiotics **;;** more, awareness / education about, overuse of antibiotics / antibiotic resistance **;** improved, detection / screening (of pathogens to avoid spread) **;** *ref* to improved, cleanliness / hygiene *or* more people vaccinated / population has reached herd immunity **;** isolating infected individuals **;**	**2**	MP3 examples**:** • only giving antibiotics when essential • do not use antibiotics for viral infections
3(a)(iv)	*any five from:* *ref* to (random) mutations occur (in some of the bacteria) **;** (genetic) variation (in ability of bacteria to survive antibiotic treatment) **;** bacteria with (antibiotic) resistance, survive / reproduce **; ora** pass on resistant, gene / allele (to offspring / other bacteria) **;** increase in frequency of resistant, allele / gene (in the population) **;** *ref* to natural selection / become (better) adapted (for the new environment) **;** AVP **;**	**5**	e.g. gene (for resistance) transferred to other bacteria in a plasmid
3(b)(i)	*any two from:* cell wall **;** circular DNA **;** DNA is, free in cytoplasm / not in a nucleus **;** cell membrane **;** cytoplasm **;** ribosomes **;** unicellular **/** single-celled (organisms) **;** asexual reproduction **;**	**2**	
3(b)(ii)	movement / swimming / AW **;**	**1**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4(a)(i)</td><td>aquatic plants → midges → stoneflies → salmon → herons ;
aquatic plants → mayflies → salmon → herons ;
aquatic plants → freshwater shrimps → salmon → herons ;
all arrows drawn correct way from food to feeder <u>and</u> no additional wrong links <u>and</u> drawn as a food web ;</td><td>4</td><td>
</td></tr>
<tr><td>4(a)(ii)</td><td><table>
<tr><td>name of trophic level</td><td>organism in Fig. 4.1</td></tr>
<tr><td>producer</td><td>aquatic plants</td></tr>
<tr><td>primary consumer</td><td>mayflies / midges / (freshwater) shrimps and</td></tr>
<tr><td>secondary consumer</td><td>salmon / stoneflies ;</td></tr>
<tr><td>tertiary consumer and</td><td>salmon / herons ;</td></tr>
<tr><td>quaternary consumer and</td><td>herons ;</td></tr>
</table></td><td>3</td><td>MP1 one correct organism in primary <u>and</u> one correct organism in secondary consumer rows
MP2 tertiary consumer <u>and</u> one correct tertiary consumer organism
MP3 quaternary consumer <u>and</u> one correct quaternary consumer organism</td></tr>
<tr><td>4(a)(iii)</td><td>any three from:
primary consumers (tissues) contain <u>chemical</u> energy ;
energy is transferred to, secondary consumers / predator (from primary consumers / prey, that are eaten) ; ora
(named) food particles (of primary consumer) are digested (to make energy / glucose, available for respiration) ;
energy (released) is used for, growth / to make, more / new / larger, cells / mitosis ;
energy is used for, protein synthesis / reproduction / assimilation / storage as fat / storage as glycogen ;</td><td>3</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
4(a)(iv)	*any three from:* fewer herons (as less, food / salmon) **;** more, mayflies / stoneflies / (freshwater) shrimps (as less salmon to eat them) **;** fewer midges (as more stoneflies) **;** fewer / more, no change in, aquatic plants (as more, mayflies / freshwater shrimps / fewer midges, feeding on them) **;**	**3**	
4(b)	(organism) that gets its <u>energy</u>, from dead / waste organic, material **;**	**1**	
4(c)	*any four from:* as fewer <u>trophic</u> levels / plants are at a lower <u>trophic</u> level (than salmon / livestock) **; ora** *idea that* energy transfer along food chain is inefficient **;** (energy lost in) respiration / heat / (named) metabolic process **/** movement / muscle contraction **;** *ref* to (more) material that is lost as, faeces / egested / inedible / not digestible (in longer food chains) **;** (energy lost in) excretion / urine **;**	**4**	

Question	Answer	Marks	Guidance
5(a)	mitochondrion **;** (aerobic) respiration **;**	**2**	**A** release energy **A** cytoplasm for MP1 with correct function for MP2 i.e. allows / location of, (biochemical / metabolic) reactions / cell processes **ecf** MP2 from incorrect structure in MP1
5(b)	<u>length</u> of the (cell structure), in image / picture / photomicrograph / diagram <u>and</u> magnification **;**	**1**	

Question	Answer	Marks	Guidance
5(c)	0.75 (μm) **;**	**1**	**A** 7.5 x 10^{-1}

Question	Answer	Marks	Guidance
6(a)(i)	*either* (all) roots have grown, downwards / with gravity (no matter which way they were facing at the start) *or* roots show positive, gravitropism / geotropism and *either* (all) shoots have grown, upwards / in opposite direction to gravity (no matter which way they were facing at the start) *or* shoots show negative, gravitropism / geotropism **;**	**1**	
6(a)(ii)	gravitropism **;**	**1**	
6(a)(iii)	*any five from:* (auxin) made in / released from, (shoot) tip **;** (auxin) moves by diffusion **;** (auxin) stimulates cell elongation **;** *in **B** / Petri dish 1:* (auxin) has a higher concentration of auxin on the lower surface (of the shoot) **; ora** (auxin stimulates cell) elongation more on lower side of the shoot **;** **ora** shoot grows away from the pull of gravity / AW **;** *in **E** / Petri dish 2:* (auxin is) equally distributed (in the shoot) **;** (auxin stimulates cell) elongation equally on, both / all, sides of the shoot **;** (shoots grow neither up or down / shoot grows straight) because the effect of gravity is, constantly changing / countered by rotating (the Petri dish)	**5**	

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Question	Answer	Marks	Guidance
6(b)(i)	example of an appropriate environment condition ;	**1**	e.g., temperature
6(b)(ii)	*any two from:* (oxygen) aerobic respiration ; (water) used in (named) cell process ; (water) is a solvent / AW ; (water) used for turgor ; AVP ;	**2**	

Question	Answer	Marks	Guidance
7	soluble ; stomach ; hydrochloric acid ; (named) microorganisms / pathogens ; pancreas / small intestine ; alkaline ; bile / bile salts ; emulsification ;	**8**	