Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/43**

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

Cambridge International is publishing the mark schemes for the October/November 2022 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.

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>reflex ;</td><td>1</td><td></td></tr>
<tr><td>1(a)(ii)</td><td>
<table>
<tr><th>function</th><th>name of structure</th><th>letter in Fig. 1.1</th></tr>
<tr><td>cell that transmits impulse from the receptor to the central nervous system</td><td>sensory neurone</td><td>J</td></tr>
<tr><td>changes the, volume / (air) pressure, in the thorax / AW</td><td>diaphragm</td><td>N</td></tr>
<tr><td>coordinates / controls / communicates / regulates / AW, body functions / responses / reflexes
or
connects, neurones / brain / CNS, and (named part of) body / PNS / neurones</td><td>spinal cord / CNS</td><td>M</td></tr>
<tr><td>transmits / sends, impulses (in, CNS / M)
or
connects neurones</td><td>relay / AW, neurone</td><td>K</td></tr>
<tr><td>contains cilia to move mucus out of the airway</td><td>trachea</td><td>P</td></tr>
</table>
;;;;;</td><td>5</td><td>one mark per row</td></tr>
</table>

Question	Answer	Marks	Guidance
1(b)(i)	*any two labels to correct structure on Fig.1.2:* nucleus **;** cell membrane **;** cytoplasm **;** AVP **;** e.g. cell body / axon / dendrite	**2**	
1(b)(ii)	**X** drawn at any tip of left-hand side of the motor neurone **;**	**1**	
1(b)(iii)	*any two from:* **1** axons / long, to transmit (impulse), over (long) distance / fast / direct connection **;** **2** (many) branches to connect to, other / relay, neurones / cells / effector / muscle **;** **3** mitochondria to (release energy), for, transmission of impulse / protein synthesis / active transport / making or releasing (neuro)transmitters **;** **4** vesicles to, carry / hold / release, chemicals / (neuro)transmitters (into synapse) **;** **5** receptor (molecules), to ensure unidirectional transmission / to allow signal to be received by next neurone **;** **6** AVP **;**	**2**	MP6 e.g. dendrites have large surface area for many receptors
1(c)	*any three from:* *nerve communication is:* **1** faster / **ora ;** **2** shorter-lasting / **ora ;** **3** specific / one, target / location **;** **4** electrical (and chemical) **; A** uses impulses **5** conducted through cells / uses neurones / uses nerves / uses CNS **;** **6** AVP **;**	**3**	*hormonal communication is:* MP3 widespread / can have multiple target organs MP4 chemical (only) MP5 (travels through) blood / plasma / circulatory system ***or*** released from, glands / endocrine system MP6 e.g. can be voluntary

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2(a)(i)</td><td>any two from:
bile ;
(hydrochloric) acid ;
mucus / water / saliva ;
AVP ;</td><td>2</td><td></td></tr>
<tr><td>2(a)(ii)</td><td>
<table>
<tr><th>name of enzyme</th><th>organ where enzyme is secreted</th><th>organ where the enzyme acts</th><th>products of digestion involving this enzyme</th></tr>
<tr><td>amylase</td><td>salivary glands</td><td>mouth / buccal cavity</td><td><u>simple(r) sugars</u> / maltose / glucose</td></tr>
<tr><td>pepsin</td><td>stomach / gastric glands</td><td>stomach</td><td>amino acids</td></tr>
<tr><td>lipase</td><td>pancreas</td><td>small intestine / duodenum / ileum</td><td>fatty acids and glycerol</td></tr>
<tr><td>maltase</td><td>small intestine</td><td>epithelial lining of the small intestine</td><td>glucose</td></tr>
</table>
;;;;</td><td>4</td><td>one mark for each correct row</td></tr>
</table>

Question	Answer	Marks	Guidance
2(b)	*any six from:* **1** 39 ± 2 °C is optimum temperature / AW **;** **2** highest activity is 2500 U per mg (protein) **;** **3** steep(er) decrease in activity after optimum / **ora ;** **4** no activity after 62 °C ± 2 **;** **5** (increased) temperature causes increased kinetic energy / **ora ;** **6** increased frequency of (effective) collisions / **ora ;** **7** forming enzyme-substrate complexes / **ora ;** **8** denaturation occurs (at any temperatures above optimum temperature) **;** **9** active site changes shape **;** **10** no longer, fit into substrate / complementary (to substrate) **;** **11** *idea that* both enzyme and substrate are proteins and may change **;**	**6**	*each unit must be stated at least once* ecf on wrong or no units
2(c)(i)	*any two from:* lactose is found in milk **;** lactase breaks down lactose **;** (young) babies are dependent on, lactose / milk (for their nutrition) / AW **;**	**2**	
2(c)(ii)	(loss of) watery faeces / AW **;**	**1**	
2(c)(iii)	*any three from:* (cholera bacterium) release toxins **;** causes chloride ions (to be secreted from the body) **;** (chloride ions) in small intestine / duodenum / ileum **;** *ref to* osmotic movement / lowers water potential (in gut) **;** water moves into gut ***or*** more water remains, in intestines / gut **;**	**3**	

Question	Answer	Marks	Guidance
3(a)(i)	7.6 billion / 7 600 000 000 / 7.6×10^9 **;**	**1**	
3(a)(ii)	0.3(%) **;;**	**2**	MP1 correct calculation MP2 correct rounding to 0.3(%) ecf if wrong values used in the calculation
3(b)(i)	*any three from:* (named crop) disease **;** war **;** drought / AW **;** flooding **/** AW **;** unequal distribution of food / AW **;** (widespread) poverty **;** AVP **;**	**3**	MP7 e.g. plagues of crop pests
3(b)(ii)	*any four from:* **1** one named chemical (other than fertilisers) used in farming **;** *pesticides / insecticides / herbicides:* **2** kill / harm, non-target species (in natural environment) **;** **3** example of specific impact from harm of non-target species **;** **4** loss of biodiversity / disrupt food chains **;** **5** bioaccumulation / bioconcentration / biomagnification **;** **6** ref to resistant organisms ***or*** super, bugs / weeds **;** **7** pollute / destroy / AW, non-target / named, area / habitat **;** **8** (antibiotics cause) antibiotic-resistance **;** **9** AVP **;**	**4**	MP1 examples: herbicides / 2,4 D / weedkillers / pesticides / insecticides / antibiotics / plant growth regulators / (animal) hormones MP3 e.g. loss of pollination (by bees) MP5 **A** descriptions MP9 changes / increases, the pH of soil
3(b)(iii)	a single crop in production / AW **;**	**1**	
3(b)(iv)	genetic, engineering / modification **;**	**1**	

Question	Answer	Marks	Guidance
4(a)(i)	(positive) phototropism **;**	1	
4(a)(ii)	*any two from:* (plants have) cell walls **;** pressure of water pressing against cell wall / ref. to turgor **;** ref. to xylem (offering support) **;** AVP **;**	**2**	MP4 e.g. ref. to lignin
4(b)	label to xylem shown on Fig. 4.2 **;**	**1**	
4(c)	*any three from:* **1** translocation **;** **2** transport of, sucrose / amino acids / sugars **;** **3** (transports nutrients) from (named) source to (named) sink **;** **4** AVP **;**	**3**	MP4 e.g. transport can occur in both directions some organs can be both a source and / or a sink at different times
4(d)	*strip of stalk:* **1** **B** **;** *explanation, max two from:* **2** shows greater degree of, bending / shrivelling / AW **;** **3** because more water moves out (of the cells in the inner surface of the scape) **;** **4** (water moves) from high water potential to, lowest water potential / lower water potential **;**	**3**	MP4 **A** (cells become) plasmolysed / flaccid / less turgid

Question	Answer	Marks	Guidance
5(a)(i)	(some) protoctists / algae **;**	**1**	**A** (cyano)bacteria / (phyto)plankton
5(a)(ii)	15 **;** mg **;**	**2**	(3.0)×5 **A** 0.015 g for 2 marks
5(a)(iii)	*any one from:* (organisms) too small / difficult, to count **;** AVP **;**	**1**	e.g. easier to measure (in outdoor environment) / there are microorganisms that do not have chlorophyll / (more) accurate / time-efficient
5(a)(iv)	(day) 8 **;**	**1**	
5(a)(v)	*any two from:* to absorb / receive, (enough) light (energy) **;** (light) is necessary for photosynthesis **;** (for the organisms) to make sugars / starch / to convert light (energy) into chemical energy **;**	**2**	MP3 **A** because they are producers / for growth (of organisms)
5(b)(i)	*any one from:* nitrate **/** NO_3^- **;** AVP **;**	**1**	e.g. magnesium
5(b)(ii)	*any three from:* **1** eutrophication **;** **2** increase in, decomposition / number of (named) decomposers **;** **3** decomposers respire aerobically **;** **4** decomposition causes a reduction in (dissolved) oxygen **;** **5** (reduced oxygen) causes death of fish / (named aquatic) animals / AW **;** **6** (death of producers means) less food for consumers / loss of biodiversity / knock on effect further along food chain **;**	**3**	MP4 **I** because there is less photosynthesis

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5(c)</td><td>any five from:
1 screening / removal of, large pieces of waste ;
2 flocculation / coagulation / clump suspended particles / AW ;
3 settling of, (insoluble) particles ;
4 digestion / decomposition by, (aerobic) bacteria / fungi / decomposers / microorganisms ;
5 (with) aeration (tank) / trickle filter / <u>activated</u> sludge ;
6 sludge treated with <u>anaerobic</u> decomposers / <u>anaerobic</u> digestion ;
7 (water) treated with, chlorine / ozone / UV (light) ;
8 distillation / collection of water from evaporator ;</td><td>5</td><td>MP3 A ref to sedimentation / (use of) settlement tank
MP5 A with oxygen / description of a trickle filter
MP7 A reverse osmosis / disinfect
MP8 A use of carbon / charcoal, filters</td></tr>
<tr><td>6(a)(i)</td><td><table>
<tr><td>go to 2</td><td></td></tr>
<tr><td>go to 4</td><td></td></tr>
<tr><td>go to 3</td><td></td></tr>
<tr><td>Pyrus communis</td><td>D</td></tr>
<tr><td>Prunus domestica</td><td>A</td></tr>
<tr><td>Prunus salicina</td><td>B</td></tr>
<tr><td>go to 5</td><td></td></tr>
<tr><td>Punica granatum</td><td>E</td></tr>
<tr><td>Prunus amygdalus</td><td>C</td></tr>
<tr><td>Olea europaea</td><td>F</td></tr>
</table>;;;;</td><td>4</td><td>6 correct = 4 marks
4 or 5 correct = 3 marks
2 or 3 correct = 2 marks
1 correct = 1 mark</td></tr>
</table>

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Question	Answer	Marks	Guidance
6(a)(ii)	*any four from:* nectary / nectar **;** sticky / spiky / AW, pollen **;** sticky stigma **;** stigmas / style / carpel, within flower / AW **;** anthers / stamens, within flower / AW **;** colourful petals **;** AVP **;**	**4**	MP7 e.g. nectar guides (on petals) / robust stigma / robust style / landing site
6(b)	*features of flowering plants* *any one from:* pollen **;** ovule(s) **;** (named part of) seed **;** fruit **;** leaves **;** aerial stems **;** AVP **;**	1	*accept parts of a fern for **ora*** **A** ferns have, spores / fronds / underground stems
6(c)	pectinase **;**	1	

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