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Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

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.

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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)	Plants **;**	**1**	
1(b)	190 (µm) **;**	**1**	
1(c)	**G** **F** **B** **D** **C** **A** **E** **;;;;;**	**5**	all 7 correct = 5 marks 5 or 6 correct = 4 marks 3 or 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark
1(d)	*any three from:* **1** phytoplankton are, producers / first trophic level / autotrophs **;** **2** converts (sun)light (energy) into chemical energy **;** **3** provide / source of, (named) food for, primary consumers / herbivores / second trophic level **;** **4** make <u>energy</u> available to, (all) other trophic levels / (rest of) food web / food chain **;** **5** ref to conversion of (water and) carbon dioxide to glucose **;** AVP **;** e.g. release / AW, nutrients when decompose	**3**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2(a)</td><td>one mark per row

<table>
<tr><th>enzyme</th><th>organ that secretes the enzyme</th><th>number identifying the organ on Fig. 2.1</th><th>substrate</th><th>product or products</th></tr>
<tr><td>amylase</td><td>salivary gland(s)</td><td>1</td><td><u>starch</u></td><td><u>maltose</u></td></tr>
<tr><td>pepsin / protease</td><td>stomach / gastric gland</td><td>3</td><td>protein</td><td>amino acid(s)</td></tr>
<tr><td>lipase</td><td>pancreas</td><td>4</td><td>fat / lipid / oil</td><td>fatty acids <u>and</u> glycerol</td></tr>
<tr><td>maltase</td><td>small intestine / duodenum / ileum</td><td>5</td><td><u>maltose</u></td><td>glucose</td></tr>
</table>
;
;
;
;</td><td>4</td><td>A pepsinogen
A (poly)peptides / peptones

A epithelium of small intestine</td></tr>
<tr><td>2(b)</td><td>any three from:
1 ref to hydrochloric acid in the stomach ;
2 kills, bacteria / pathogens (in food) ;
3 denatures enzymes in, bacteria / (harmful) microorganisms (in food) ;
4 provides, acid / suitable / low / optimum / best, pH for, pepsin / protease / (digestive) enzymes ;
5 AVP ; e.g. activation of pepsinogen</td><td>3</td><td></td></tr>
<tr><td>2(c)</td><td>(re)absorbs, water / ions / vitamins ;
AVP ; e.g. fermentation of indigestible (food) matter by bacteria</td><td>1</td><td>A solidifying undigested waste</td></tr>
</table>

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Question	Answer	Marks	Guidance
2(d)	*any six from:* **1** mechanical / physical, digestion / breakdown **;** **2** (decrease particle size) increase surface area (of food for chemical digestion) **;** **3** for (named) enzyme (activity) **;** **4** any further detail of enzyme activity **;** **5** chewing / crushing / grinding / AW, in the mouth / by teeth **;** **A** mastication **6** incisor / canine, (teeth) for cutting food / AW **;** **7** (pre)molar (teeth), crush food / AW **;** **8** mixing of saliva with food / formation of bolus of food for swallowing **;** **9** churning action / formation of chyme / AW, of stomach (3) **;** **10** ref to action of muscles in the stomach (wall) **;** **11** emulsification by bile **;** **12** occurs in, small intestine / duodenum / ileum (5) **;** **13** *described as* bile (salts) break(s) fat globules into smaller pieces / large fat droplets into small(er) droplets / AW **;**	**6**	

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Question	Answer	Marks	Guidance
3(a)(i)	three body regions / head and thorax and abdomen / AW **;** three pairs of (jointed) legs / six legs **;**	**2**	
3(a)(ii)	*any two from:* **1** spray / use, insecticide / pesticide / chemical to kill (aphids) **;** **2** grow crop in, glasshouse / protected environment **;** **3** use crops that are resistant (to insects / aphids) **;** **4** ref. to crops that have been produced by, selective breeding / genetic engineering **;** **5** biological control / any example **;** **6** avoid monoculture / plant a variety of crops / crop rotation **;** **7** 7 AVP **;**	**2**	MP5 e.g. predators / parasites / sterile males MP7 e.g. pheromone / hormone, traps e.g. surveillance
3(a)(iii)	*any two from:* (upper) epidermis **;** xylem **;** palisade (mesophyll / layer) **;** spongy (mesophyll / layer) **;**	**2**	
3(b)(i)	252 **;**	**1**	
3(b)(ii)	*any three from:* **1** (carbon dioxide / ^{14}C) enters (leaf), through stoma(ta) / by diffusion **;** **2** ref to photosynthesis **;** **3** is used to make, glucose / (simple) sugar **;** **4** *idea of* photosynthesis is catalysed by enzyme(s) **;** **5** reaction(s) occur in chloroplasts **;** **6** glucose / (simple) sugars, converted to sucrose **;**	**3**	

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Question	Answer	Marks	Guidance
3(c)(i)	*any two from:* buds / root (tips) / tubers / storage organs / flowers / fruits / seeds / young *or* growing leaves / shoot (tips) / nectaries **;;**	**2**	**A** any parts of a flower
3(c)(ii)	*any three from:* **1** sucrose is converted to glucose **;** **2** (sucrose / glucose / sugars) respired / provide energy **;** **3** *any plant process that requires energy* e.g. growth / reproduction / flowering / active transport / absorption of ions / cell division / mitosis / metabolism / fruit formation **;** **4** stored as, sucrose / starch **;** **5** used to make cellulose (for cell walls) **;** **6** converted to amino acids (used to make proteins) **;** **7** AVP **;** e.g. used to make nectar	**3**	**A** converted to starch

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Question	Answer	Marks	Guidance
4(a)(i)	$C_6H_{12}O_6$ **;** $\longrightarrow 2C_2H_5OH + 2CO_2$ **;**	**2**	
4(a)(ii)	*any three from:* **1** uses wastes (from farming / forestry) **;** **2** *idea that* reduces use of, fossil fuels / oil / petrol / non-renewable fuel **;** **3** less (pollution / damage to environment by) mining / drilling **;** **4** to conserve, fossil fuels / non-renewables, for the future **;** **5** *idea that* plants grown for biomass is an example of a sustainable resource **;** ***6*** carbon neutral / no *or* small carbon footprint **;** **7** does not contribute to, (enhanced) greenhouse effect / global warming **;** **8** less (net) air pollution / no acid rain **;** **9** AVP **;**	**3**	e.g. less methane, produced / released
4(a)(iii)	*disadvantages - any two from:* **1** land could be used for food production **;** **2** loss of habitats **;** **3** loss of, species diversity / biodiversity / AW **;** **4** loss of genetic diversity **;** **5** uses land that could be used for, nature reserves / conservation **;** **6** plants (grown in monocultures) are susceptible to, pests / disease **;** **7** loss of soil nutrients / soil degradation / soil erosion / soil exhaustion / AW **;** **8** need (high inputs of), herbicides / pesticides / water / fertiliser **;**	**2**	

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Question	Answer	Marks	Guidance
4(b)(i)	*any three from:* **1** concentrations of xylose and ethanoic acid decrease, concentration of ethanol increases **;** **2** steep / AW, decrease of, xylose and ethanoic acid until 62 hours **;** **3** steepest change is between 6 to 12 hours **;** **4** increase in ethanol concentration to 44 g dm^{-3} **;** **5** small change in concentration(s), after / from, 62 hours **;** **6** xylose reaches, 1 g dm^{-3} / almost zero, at 90 hours / at the end *or* ethanoic acid reaches 0.25 g dm^{-3}, at 90 hours / at the end **;**	**3**	MP2 **A** the substrates MP3 **A** for xylose, ethanoic acid or ethanol MP5 **A** plateau between 62 and 90 hours MP5 **A** for xylose, ethanoic acid or ethanol
4(b)(ii)	*one from:* (s)lower rate of increase of ethanol / less ethanol (in same time) **;** take longer to reach same concentration of ethanol **;** line(s) / gradient(s) (on graph), less steep **;**	**1**	

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Question	Answer	Marks	Guidance
5(a)(i)	all of the populations of different species in an ecosystem **;**	**1**	
5(a)(ii)	natural selection **;** environment **;**	**2**	**A** mutation
5(b)(i)	*these descriptions refer to the changes in 2013, but accept **ora** for 1969* **A** *Meyer's goshawk* - range extends, downwards / to lower altitude **;** **B** *Mackinlay's cuckoo-dove* - range extends, upwards / to higher altitude **;** **C** *Island thrush* - range does not extend downwards as much / AW **;** **D** *Island leaf warbler* - no / little, change in range **;**	**4**	*accept limits of the ranges instead of descriptions if units (m) used at least once* **A** range is larger **A** range is (much) smaller **;**

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Question	Answer	Marks	Guidance
5(b)(ii)	*any three from:* **1** decrease in population(s) (of island thrush) **;** **2** ref to competition (between species at higher altitude) **;** **3** ref to, increase in population(s) / extension of range of Mackinlay's cuckoo-dove **;** **4** *idea that* there is competition with other species for, breeding / nesting, sites (at higher altitudes) **;** **5** habitat loss / deforestation / increased human activity / tourism **;** **6** disease **;** **7** predation **;** **8** loss of food source **;** **9** climate change / global warming / enhanced greenhouse effect **;** **10** (increased) hunting (at lower altitudes) **;** **11** (increased) pollution (at lower altitudes) **;** **12** introduction of, alien / new / exotic, species **;** **13** AVP **;**	**3**	**I** natural disasters / AW MP1 **A** 'not breeding' MP9 **A** examples – fire / flood / drought e.g. species trapped at lower altitudes for, pets / medicines
5(c)	*any three from:* difficulty finding a mate **;** inbreeding **;** reduced fitness **;** decrease in genetic variation (within each population) / loss of alleles **;** increase in, genetic / inherited, diseases **;** more vulnerable to (pathogenic / infectious) disease (spreading) **;** unable / less able, to adapt to change in environment **;** at increased risk of extinction (as populations are so small) **;** e.g. by natural catastrophes / introduced species / AW **;** rarity linked to, egg stealing / poaching **;** AVP **;**	**3**	

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Question	Answer	Marks	Guidance
6(a)(i)	**Q** – heart / ventricle / cardiac muscle **;** **T** – renal vein **;** **W** – vena cava **;** **X** – pulmonary artery **;**	**4**	
6(a)(ii)	**V –** septum **;** separates / prevents mixing of, oxygenated and deoxygenated blood **;**	**2**	
6(a)(iii)	blood passes through heart once in a complete circulation (of the body) **;**	**1**	**A** in one circuit of the body
6(a)(iv)	*any three from:* **1** efficient / AW, supply of, blood / oxygen / nutrients (to, body / AW) **;** **2** efficient / AW, removal of, carbon dioxide / urea / wastes (from body / AW) **;** **3** low(er) pressure in, pulmonary, artery / circuit / AW **;** **4** to prevents damage to (capillaries in the) lungs **;** **5** allows more time for gas exchange **;** **6** allows high(er) pressure (in body) **;** **7** to allow efficient, filtration in kidneys (for excretion) **;** **8** to allow / maintain, a high, metabolic rate / rate of respiration **;** **9** AVP **;**	**3**	MP8 **A** allows a high(er) body temperature / maintains body temperature MP9 e.g. larger / steeper, diffusion gradient between capillaries and respiring tissues OR allows large body size
6(b)(i)	<u>coronary arteries</u> **;**	**1**	
6(b)(ii)	*any one from:* *drug treatment:* aspirin / AVP **;** *surgery:* stents / angioplasty / (heart) bypass (operation) **;**	**1**	

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Question	Answer	Marks	Guidance
6(c)(i)	alveoli / alveolus **;**	**1**	
6(c)(ii)	glomeruli / glomerulus / nephron(s) **;**	**1**	**A** Bowman's capsule / cortex
6(c)(iii)	<u>assimilation</u> **;**	**1**	**R** absorption
6(c)(iv)	deamination **;**	**1**	
6(c)(v)	ovary **;**	**1**	

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