Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/43**

Paper 4 Theory (Extended) **May/June 2021**

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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This document consists of **12** printed pages.

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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	<u>'List rule' guidance</u> 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	<u>Calculation specific guidance</u> 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	<u>Guidance for chemical equations</u> 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.

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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>water ;</td><td>1</td><td></td></tr>
<tr><td>1(a)(ii)</td><td>
<table>
<tr><th>nutrient</th><th>elements</th><th>enzyme</th><th>products of digestion / products absorbed into blood</th></tr>
<tr><td>protein</td><td>C, H, O, N (S) AND</td><td>protease / pepsin / trypsin</td><td>amino acids ;</td></tr>
<tr><td>fat</td><td>C, H, O ;</td><td>lipase</td><td>fatty acids AND glycerol ;</td></tr>
<tr><td>lactose (milk sugar)</td><td>C, H, O</td><td>lactase ;</td><td>galactose and glucose (simple sugars)</td></tr>
</table>
</td><td>4</td><td>elements for protein and fat for 1 mark
enzyme and products for protein for 1 mark
enzyme and products for fat for 1 mark
enzyme for lactose for 1 mark</td></tr>
<tr><td>1(b)(i)</td><td>any three from:
needed for (growth / development / strengthening of) bones ;
needed for (growth / development / strengthening of) teeth ;
prevents rickets ;
AVP ;</td><td>3</td><td></td></tr>
<tr><td>1(b)(ii)</td><td>any two from:
required to make haemoglobin / red blood cells ;
for transport of oxygen ;
prevents (iron-deficiency) anaemia ;
AVP ;</td><td>2</td><td></td></tr>
<tr><td>1(c)(i)</td><td>disease is caused by a <u>pathogen</u> ;
(pathogen is) passed from one host to another ;</td><td>2</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
1(c)(ii)	*any four from:* rubella is caused by a virus **;** (virus) can cross the placenta **;** (virus) can affect embryo / fetus **;** can cause serious, disease / damage / death, to baby / offspring **;** vaccination stimulates, long-lasting / active, immunity (in the mother) **;** (immunity gained) before they become pregnant **;** AVP **;**	**4**	
1(c)(iii)	not enough protein (in the diet) **;** adequate energy (in the diet) **;** inadequate diet after breast feeding finishes / AW **;**	**2**	

Question	Answer	Marks	Guidance
2(a)(i)	mRNA / messenger RNA **;**	**1**	
2(a)(ii)	ribosome **;**	**1**	
2(a)(iii)	*any three from:* molecule **A** / mRNA, is a copy of the gene (for insulin) **;** transfers instructions from, DNA / nucleus, to, cytoplasm / ribosome / **B** **;** passes through **B** **;** sequence of bases determines the order of amino acids **;**	**3**	
2(b)	insulin is a hormone **;** stimulates liver (cells and muscle cells) **;** to, absorb / take up, glucose / sugar, from the blood **;** across cell membranes **;** stimulates production of <u>glycogen</u> (in cells) / AW **;** reduces concentration of, glucose / sugar, in the blood **;** homeostasis **;** AVP **;**	**4**	

Question	Answer	Marks	Guidance
2(c)	*any two from:* glucagon / hormone ; amylase ; trypsin / protease ; lipase ; AVP ;;	**2**	

Question	Answer	Marks	Guidance
3(a)(i)	*any four from:* (photosynthesis involves) enzymes / AW ; increase in temperature increases rate (of photosynthesis) / ora ; increases kinetic energy of molecules ; increases effective collisions between enzyme and substrate molecules / ora ; reaction will have an optimum temperature ; high temperature denatures enzymes ; increases rate of diffusion ; increased uptake of carbon dioxide molecules into leaf ;	**4**	
3(a)(ii)	*any three from:* air becomes very dry ; ref. to increasing the diffusion gradient for water vapour ; from the air spaces in the leaf into the air surrounding the leaf ; increases rate of transpiration ; stomata close ; carbon dioxide cannot enter ;	**3**	
3(a)(iii)	record the difference (in concentration of carbon dioxide) (between air in and air out / between chamber 1 and 3 / before and after) ; divide by, the time / 15 min ;	**2**	
3(b)(i)	*CO_2 uptake:* 136 ; *CO_2 release:* 20 ;	**2**	

Question	Answer	Marks	Guidance
3(b)(ii)	*any two from:* carbon dioxide produced in respiration **;** plants respire all the time **;** carbon dioxide released in the dark is produced by respiration **;** carbon dioxide released by cells is used in photosynthesis **;**	**2**	
3(b)(iii)	*any one from:* leaves have different surface areas **;** so, valid / AW, comparisons can be made **;**	**1**	

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Question	Answer	Marks	Guidance
3(c)	*any six from:* **1** glasshouses can maintain, optimum / AW, conditions for photosynthesis **;** **2** ref. to limiting factors for, photosynthesis / growth **;** **3** to increase yield / continuous production / production independent of seasons **;** *ref. to control of light* **4** (can, achieve / maintain) optimum, light / light intensity / wavelength **;** **5** light duration / use artificial lights (and timers / light sensors) **;** *ref. to control of temperature* **6** (can, achieve / maintain) optimum temperature **;** **7** heater / cooling / idea of ventilation **;** *ref. to control of carbon dioxide* **8** (can use) carbon dioxide enrichment / high carbon dioxide concentration **;** **9** burn (named) fuels / pump in carbon dioxide **;** *ref. to control of water and nutrients* **10** water supply / humidity **;** **11** nutrients / minerals **;** **12** irrigation / fertigation / misting / hydroponics / described **;** *ref. to control of pests and weeds* **13** pest control **;** **14** any type described **;** e.g. biological control / chemical control **15** herbicides not required **;** *additional points* **16** computer control / automation (described) **;** **17** efficient use of land / use brownfield sites / local food near markets **;** **18** reduction in pollution by, fertilisers / pesticides **;** **19** control of pollinators for selective breeding **;**	**6**	

Question	Answer	Marks	Guidance
4(a)	*any five from:* **1** habitat loss / deforestation **;** **2** large mammals need large amounts of space **;** **3** (named example of) climate change **;** e.g. desertification *use of land for* **4** land developed for agriculture **;** **5** land developed for, housing / transport / factories / AW **;** **6** land used for extraction of (named) material(s) **;** **7** competing with humans for space **;** **8** idea that populations are isolated **;** **9** hunt / trophies / high value / poaching **;** **10** laws are not enforced to protect from hunting **;** **11** lack of education **;** **12** poisoning / pollution **;** **13** need a large quantity of food / lack of food sources / starvation **;** **14** slow reproduction rate / hard to breed in captivity **;** **15** AVP **;**	**5**	
4(b)(i)	*any two from:* inbreeding / AW **;** reduce (genetic) variation **;** (reduced variation) less able to respond to, environmental changes / disease **;** increase in homozygosity / described in terms of alleles **;** increase chance of genetic disease(s) / birth defects **;** any example **;** e.g. lameness increase chance of infertility **;**	**2**	

Question	Answer	Marks	Guidance
4(b)(ii)	*any three from:* **1** collect semen / sperm *(implied by context)* **;** **2** freeze semen / sperm, / use sperm bank / use sperm collected, far away/ long ago **;** **3** selecting / washing / screening, of sperm / AW **;** **4** use hormones for (super)ovulation **;** **5** determine when female is about to ovulate **;** **6** insert, semen / sperm, into female (vagina / uterus) **;**	**3**	
5(a)	diaphragm / external intercostal muscles **;** trachea / bronchus **;** internal intercostal muscles **;** alveolus / alveoli **;**	**4**	
5(b)	*any four from:* **1** (rate and depth of breathing) increase when carbon dioxide concentration increases **;** **2** depth of breathing levels off at 9–10 minutes while rate of breathing still going up **;** **3** larger increase in rate of breathing than the depth of breathing **;** **4** both rate and depth of breathing decrease when the carbon dioxide concentration decreases **;** **5** rate and depth of breathing decrease below zero (percentage change) **;** **6** rate of breathing does not / depth of breathing starts to, return to zero (percentage change)**;** **7** use of comparative figures for rate of breathing **;** **8** use of comparative figures for depth of breathing **;**	**4**	
5(c)	respiration **;** mitochondria **;** brain **;** excreted / AW **;** toxic / poisonous / waste / acid(ic) **;**	**5**	

Question	Answer	Marks	Guidance
6(a)	<table><tr><td></td><td>I^A</td><td>I^O</td></tr><tr><td>I^B</td><td>I^AI^B</td><td>I^BI^O</td></tr><tr><td>I^O</td><td>I^AI^O</td><td>I^OI^O</td></tr></table> ;; *phenotypes of the children:* **AB**, **B**, **A**, **O** ; *probability…blood group O:* 0.25 / 25% / 1 in 4 ;	**4**	one mark for four correct gametes in Punnett square one mark for four correct offspring genotypes in Punnett square
6(b)	both / two, alleles are expressed in, heterozygote / phenotype / AW ; ref. to, blood group **AB** / I^AI^B ;	**2**	
6c)	*any two from:* phenotype is determined only by a gene ; no effect of environment on phenotype ; only, four / limited number of, phenotypes / (blood) groups / categories ; no intermediates between categories ;	**2**	