CAMBRIDGE
International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **February/March 2024**

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 descriptions 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.

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)(i)	substance that increases the rate of a reaction **;** not (permanently) changed by the reaction / not used up in the reaction **;**	**2**	
1(a)(ii)	carbon **and** hydrogen **and** oxygen **;** nitrogen **;**	**2**	
1(b)	*any six from:* **1** activity, is 0 / stops, at pH 3.8 **and** pH 10.2 **OR** enzyme active between pH 3.8 – pH 10.2 **;** **2** *idea that* enzyme is denatured at, low / high / extremes of, pH **;** **3** active site changes shape **;** **4** active site / enzyme, no longer complementary to substrate **;** **5** fewer / no, substrate molecules bind to enzyme or active site / fewer or no enzyme-substrate complexes form **;** **6** steep increase between pH 5-6 / steep decrease between pH 8–9 **;** **7** activity peaks at pH 7 / optimum pH is 7 **;** **8** *idea of* increase in (rate of) effective collisions to pH 7 / decrease in (rate of) effective collisions after pH 7 **;** **9** *idea of* most enzyme-substrate complexes form at pH 7 **OR** most substrate binding to enzymes / active sites, at pH 7 **;**	**6**	
1(c)(i)	fats / oils **;** fatty acids **and** glycerol **;**	**2**	**A** products in either order
1(c)(ii)	*any three from:* *ref to* bile **;** bile, produced by the liver / released from the gall bladder **;** alkaline mixture **;** neutralises, gastric juices / stomach acid / HC*l* **;**	**3**	

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Question	Answer	Marks	Guidance
2(a)(i)	**R** drawn on the right ventricle **;**	**1**	
2(a)(ii)	**A** atrioventricular valve **;** **B** semilunar valve **;**	**2**	
2(a)(iii)	(left) ventricle **;** (rest of the) body / AW **;**	**2**	
2(b)	hole in septum / left atrium joined to right atrium / AW **;** oxygenated blood mixes with deoxygenated blood **;** *idea of* less oxygen, transported / supplied (to the respiring tissues) **;**	**3**	
2(c)(i)	*any four from:* **1** percentage of energy released from aerobic respiration increases and then remains constant **;** **2** energy from aerobic respiration plateaus at 80% at 100 s **;** **3** percentage of energy released from anaerobic respiration increases, decreases and then remains constant **;** **4** energy from anaerobic respiration peaks at 80% at 20 s **;** **5** energy from anaerobic respiration plateaus at 20% at 100 s **;** **6** energy from aerobic respiration increases gradually **and** (energy from) anaerobic respiration increases rapidly **;** **7** energy from aerobic and anaerobic respiration both reach 50% at 60 s **;**	**4**	
2(c)(ii)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ **;;**	**2**	
2(c)(iii)	lactic acid **;**	**1**	

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Question	Answer	Marks	Guidance
3(a)(i)	gravitropism **;**	**1**	
3(a)(ii)	*any three from:* **1** *ref to* auxin **;** **2** diffuses from shoot tip **;** **3** accumulates on lower side **;** **4** stimulates cell elongation **;**	**3**	
3(b)	*any two from:* (water needed for) photosynthesis **;** medium for, chemical / enzyme / metabolic, reactions **;** for support / AW **;** as a solvent **;** for transport **;** germination **;** AVP **;**	**2**	
3(c)	177.78 (%) **;;;**	**3**	use ecf from each previous step throughout MP1: correct values selected from graph MP2: correct percentage increase calculation MP3: correct rounding of answer expressed to two decimal places

Question	Answer	Marks	Guidance
4(a)	**R** oestrogen **;** **S** LH **;**	**2**	
4(b)	*ovulation* 12 / 13 / 14 / 15 / 16 **;** *menstruation* 1 – 8 **;**	**2**	

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Question	Answer	Marks	Guidance
4(c)	*description* concentration of progesterone increases and remains / is, high **;** *reason* to thicken or maintain uterus lining / prevent ovulation or menstruation **;** **OR** progesterone is produced by the placenta **;**	**2**	1 mark for description and 1 mark for reason
4(d)	*during a menstrual cycle* – ovary **;** *during pregnancy* – ovary / placenta **;**	**2**	
4(e)	*any one from:* stimulates ovaries to release of oestrogen **;** stimulates eggs to, mature / develop (in the ovary) **;**	**1**	

Question	Answer	Marks	Guidance
5(a)(i)	*any two from:* large petals **;** petals form a landing platform **;** spotted pattern (to attract insects) **;** anthers / stigma, inside petals / flower **/** ora **;**	**2**	

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Question	Answer	Marks	Guidance
5(a)(ii)	*any four from:* *advantages* **1** increased variation **;** **2** increased ability to adapt to, changing / new, environment **;** **3** makes the population less susceptible to a, disease / pest / AW **;** **4** genetic disease less likely **;** **5** *idea of* seed dispersal means there is less competition **;** **6** less risk of, endangerment / extinction **;** *disadvantages* **7** requires two, parents / plants / gametes **;** **8** requires, (named) pollinators **;** **9** takes longer / is slower **;** **10** *idea that* the increased genetic variation means that some plants might be less adapted to the environment **;** **11** ref to more energy required **;**	**4**	max 3 marks from advantages or disadvantages
5(b)(i)	301 **;** cm^2 **;**	**2**	
5(b)(ii)	plants in Europe have a greater leaf area than those in North America **;**	**1**	**A** ecf from **(b)(i)**
5(b)(iii)	*any five from:* **1** *ref to* mutation **;** **2** natural selection **;** **3** competition for, light / resources, (by many offspring) **;** **4** plants with a larger leaf area, have a survival advantage / are better adapted **;** **5** larger leaves, are better for photosynthesis / absorb more light **;** **6** plants with larger leaves reproduce and pass on alleles for larger leaf area **;** **7** this occurs over many generations until larger leaves are common in population **;**	**5**	

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Question	Answer	Marks	Guidance
6(a)(i)	*any two from:* phytoplankton, are producers / they photosynthesise **;** carbon dioxide used, for photosynthesis / to produce carbohydrates **;**	**2**	
6(a)(ii)	decomposer **;**	**1**	
6(a)(iii)	*any two from:* respiration **;** combustion **;** decomposition / decay **;** AVP **;**	**2**	
6(a)(iv)	*any three from:* **1** carbon dioxide, is a greenhouse gas **;** **2** global warming / climate change / enhanced greenhouse effect **;** **3,4** named effect of climate change **;;** **5** AVP **;**	**3**	
6(b)(i)	middle layer of pyramid labelled **;**	**1**	
6(b)(ii)	energy is lost between each trophic level **;** named example of energy loss **;** *idea of* insufficient energy, to support / reaches, more than five trophic levels **;**	**3**	
6(b)(iii)	*any two from:* shows actual energy transfer **;** time is taken into account **;** more accurate **;**	**2**	
6(c)(i)	produced as rapidly as it is used **;** *idea that* it does not run out / AW **;**	**2**	

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Question	Answer	Marks	Guidance
6(c)(ii)	*method/way* *any one from:* closed seasons **;** protected areas **;** quotas **;** education **;** smaller nets **;** larger mesh size **;** monitoring / legislation **;** *explanation* allows fish to breed / prevents overfishing **;**	**2**	1 mark for method/way and 1 mark for explanation

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