Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **May/June 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 May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

© UCLES 2022

[Turn over

PUBLISHED

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.

© UCLES 2022

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.

© UCLES 2022

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

© UCLES 2022

Question	Answer	Marks	Guidance
1(a)(i)	Fungus / Fungi **;**	**1**	
1(a)(ii)	aerobic respiration **;**	**1**	
1(b)	*any two from:* ref. to specificity (of enyme) **;** shape of active site is complementary to, substrate / sucrose **;** for, substrate / sucrose, to bind / fit, enzyme / sucrase / active site **;**	**2**	
1(c)	*total of six from:* *max. four for description:* 1 sucrase / enzyme, is active between pH2 and pH12 **;** 2 activity, increases and decreases / reaches a peak **;** 3 peak / maximum or 100% activity, at pH 6 **;** 4 steeper increase between pH 5–6 / steeper decrease in activity between pH 9–10 **;** 5 minimum / 10%, activity at pH 12 **;** 6 more activity in, acidic conditions / low pH, than, alkaline conditions / high pH **;** *explanation:* 7 (change in) pH affects the shape of, sucrase / active site / enzyme **;** 8 at pH 6, most enzyme-substrate complexes form / AW **;** 9 at, low / high / extremes of, pH, enzyme is (partially) denatured **;** 10 ref to substrate molecules can no longer bind with enzyme (at low / high / extreme pH, so activity decreases) **;** 11 AVP **;**	**6**	

Question	Answer	Marks	Guidance
2(a)(i)	left ventricle **;**	**1**	
2(a)(ii)	*total of three from:* vena cava **;** *max. two from:* has valves **;** wide, lumen / AW **;** thin wall **;** (wall) lined by single layer of cells **;** (wall) contains muscle (fibres) **;** (wall) contains elastic (fibres) **;**	**3**	
2(a)(iii)	semilunar valve **;** prevents backflow of blood (correctly described) / ensures that blood flows in one direction **;**	**2**	
2(b)(i)	shading in any part of the pulmonary vein only **;**	**1**	
2(b)(ii)	*any two from:* heart has, two / left and right, sides / AW **;** blood must flow through the heart twice in one (complete) circuit / AW (of the body) **;** pulmonary and systemic circuits / circuits from heart to lungs and from heart to rest of body **;**	**2**	

© UCLES 2022

Question	Answer	Marks	Guidance
2(b)(iii)	*any four from:* **1** oxygenated and deoxygenated blood, are kept separate / do not mix / separated by septum **;** **2** ensures efficient supply of oxygen (to, body / AW) **;** **3** ensures efficient supply of (named) nutrients (to, body / AW) **;** **4** low(er) pressure in, pulmonary, artery / circuit / AW **;** **5** to prevents damage to (capillaries in the) lungs **;** **6** allows more time for gas exchange **;** **7** allows high(er) pressure (in body) **;** **8** to ensure efficient, blood supply to (rest of) body **;** **9** to allow filtration in kidneys (for excretion) **;** **10** to allow / maintain, a high, metabolic rate / rate of respiration **;** **11** AVP **;**	**4**	e.g., larger diffusion gradient between capillaries and respiring tissues

Question	Answer	Marks	Guidance
3(a)	**J** – liver **;** **K** – gall bladder **;** **L** – duodenum / small intestine **;**	**3**	
3(b)	*hormones:* insulin **;** glucagon **;** *enzymes:* amylase **/** carbohydrase **;** trypsin / protease **;** lipase **;**	**5**	*enzymes and hormones can be in any order in each column*

Question	Answer	Marks	Guidance
3(c)	*any three from:* active transport **;** against a concentration gradient / from low concentration to high concentration **;** protein changes shape to move (chloride) ions **;** uses energy **;** AVP **;**	**3**	e.g., ref. to carrier proteins
3(d)	*any three from:* *idea of* presence of chloride ions (in duct) decreases water potential **;** (water moves by) <u>osmosis</u> **;** down water potential gradient / from high water potential to low water potential **;** (movement of water) through partially permeable membrane **;**	**3**	
3(e)(i)	parents of 5 and 7 / parents of people with cystic fibrosis / 2 and 3, do not have cystic fibrosis **;** parents / 2 and 3 must be, heterozygous / carriers (of the mutant allele) **;**	**2**	

© UCLES 2022

Question	Answer	Marks	Guidance
3(e)(ii)	1 correct parental genotype **aa ;** 2 correct parental genotype **Aa ;** 3 correct gametes from the parental genotypes **;** 4 correct offspring genotypes from their gametes / parental genotypes (in any order) **;** 5 correct offspring phenotypes **and** correct probability **;**	**5**	*MP1 and MP2 parents may be either way round but following rows must match* **ecf** from MP1 and MP2 **ecf** from MP3 **ecf** from MP4 **expected answer:** *parental genotypes* **aa** × **Aa** *gametes* **a a** + **A a** *offspring genotypes* **Aa (Aa)** **aa (aa)** *offspring phenotypes* without cystic fibrosis / with cystic fibrosis *probability* 50% / 1 in 2 / 0.5

Question	Answer	Marks	Guidance
4(a)	*any five from:* 1 protein, broken down / digested / decomposed, to amino acids **;** 2 by decomposers / fungi / bacteria in terms (in context of breakdown of manure / protein) **;** 3 ref to use of proteases **;** 4 deamination (of amino acids / proteins) / described **;** 5 production of, ammonia / ammonium ions / NH_3 / NH_4^+ **;** 6 ammonium (ions), converted to, nitrite / nitrate (ions) / NO_3^-/ NO_2^-**;** 7 ref. to, nitrification / nitrifying bacteria **;** 8 AVP **;** e.g., nitrite to nitrate ions	**5**	*points must be given in a correct context*
4(b)(i)	*any one from:* farmers, do not have to add (nitrogen) fertiliser / use less fertiliser **;** *idea of* increased yield / more profit per hectare **;** (snap beans / beans / plants) grow, faster / better **;**	**1**	
4(b)(ii)	63 (%) **;;;**	**3**	MP1 correct readings from graph: 96 **and** 156 MP2 correct answer calculated MP3 answer correctly rounded to two significant figures ecf MP2 and MP3 from wrong readings / calculation
4(b)(iii)	*any four from:* 1 breakdown / decomposition, of manure / AW **;** 2 increase in (availability of named), ions (in streams/rivers) **;** 3 (increased) growth of, (named) plants / producers / algae **;** 4 increased competition for, light / AW **;** 5 no photosynthesis causing death of, producers / plants / algae **;** 6 increase in, (number of) bacteria / decomposers **;** 7 respiration (by decomposers) reduces (dissolved) oxygen (leads to death of fish) **;**	**4**	

Question	Answer	Marks	Guidance
5(a)	*Widdringtonia* ;	**1**	
5(b)	*any three from:* 1 no roots, to absorb water / bind soil / hold soil together ; 2 *idea of:* no canopy / AW, to protect (soil) from rainfall ; 3 increase in run off / AW ; 4 ref. to soil erosion ; 5 loss of, mineral content / ions / nutrients / AW, in the soil ; 6 flooding (in the valleys) ; 7 landslides / mudslides ; 8 ref. to visual pollution / dead tree stumps / bare ground / AW ; 9 loss of biodiversity / disruption of food chains / disruption of food webs / (species) extinction ; 10 AVP ;	**3**	
5(c)	food source(s) ; nesting / breeding, sites ; shelter / shade / protection from predators ; leaf litter for decomposers ; ref. to nutrient cycling ; (named) resources for humans ; AVP ;	**2**	
5(d)	*any two from:* ref. to genetic, diversity / variation ; *importance of genetic diversity:* plants (grown from seeds) may be adapted to changes in the environment ; plants (grown from seeds) may be resistant to, diseases / pests ; (seeds collected) may not, be viable / germinate ; (seeds collected) may, be diseased / have parasites / AW ; (seeds collected) may have harmful, alleles / mutations ; AVP ; e.g., increase in fitness	**2**	

© UCLES 2022

Question	Answer	Marks	Guidance
6(a)	**P** – testis **;** **S** – zygote **;** **Q** – meiosis **;** **R** – fertilisation **;** **T** – mitosis **;** **U** – implantation **;**	**6**	
6(b)(i)	*idea of* maintenance of the same number of chromosomes (from generation to generation) / so (diploid) number of chromosomes does not double at fertilisation (described) **;**	**1**	
6(b)(ii)	to prevent more than one sperm fertilising the egg / stops other sperm entering **;**	**1**	
6(c)	1 diffusion / exchange **;** 2 amino / fatty **;** 3&4 **;;** *max. two from:* glucose (named) vitamins (named) minerals / ions / salts glycerol fatty acids amino acids 5 passive **;** 6 antigens **;** 7 pathogen / (micro)organism **;**	**7**	**A** fatty acids or amino acids only once, i.e. MP2 OR MP3/4

© UCLES 2022