Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **February/March 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 February/March 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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Question	Answer	Marks	Guidance
1(a)(i)	alveoli / alveolus ;	1	
1(a)(ii)	*any two from:* large surface area ; thin surface / short diffusion distance ; good blood supply ; good ventilation (with air) ; AVP ;	2	
1(b)(i)	correct label line with the label **X** to the external intercostal muscle ;	1	
1(b)(ii)	*name* cartilage ; *function* support / prevent collapse / allows movement of air ;	2	
1(b)(iii)	increases in volume ; decreases in pressure ;	2	
1(c)(i)	**B** oxygen ; **C** carbon dioxide ; **D** water vapour ;	3	
1(c)(ii)	ref. to (aerobic) respiration ; **B** / oxygen, is a reactant of respiration / diffuses across alveoli / into cells or blood ; **C** / carbon dioxide, is a product of respiration / diffuses across alveoli / out of cells or blood ;	3	

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Question	Answer	Marks	Guidance
2(a)	*sperm (max. four from):* **1** presence of acrosome (containing enzymes) **;** **2** *idea of* enzymes, digest / breakdown, egg membrane / jelly coat **;** **3** many mitochondria **;** **4** for respiration / to release energy (for swimming) **;** **5** flagellum / streamlined shape **;** **6** for, swimming / movement / locomotion **;** *egg:* **7** energy / (named) nutrient, stores **;** **8** energy / (named) nutrients for, development of embryo / mitosis / cell division **;** **9** jelly coat **;** **10** (hardens) to prevent other sperm from entering (after fertilisation) **;** *both:* **11** haploid (nuclei) / half the normal number of chromosomes **or** 23 chromosomes in, sperm / egg **;** **12** gametes are haploid so, correct number of chromosomes in / 46 chromosomes in / diploid, zygote **;**	**6**	
2(b)(i)	*any three from:* sample of, semen / sperm, collected / donated **;** sperm, washed / concentrated **;** (semen / sperm) inserted into vagina / uterus / near cervix **;** ref. to (sperm insertion) at the time of fertility **;** ref. to fertility drugs **;**	**3**	

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Question	Answer	Marks	Guidance
2(b)(ii)	*any two from:* gametes collected from both parents / eggs harvested or collected **;** fertilisation occurs, outside the body / in a dish / not in oviduct **;** fertilisation can occur by injecting sperm into the egg **;** embryo inserted **;** more invasive / surgical procedure (in reference to egg collection) **;** AVP **;**	**2**	e.g. screening of embryos
2(b)(iii)	*any four from:* **1** treatments are expensive **;** **2** *idea that* there are questions over who will fund treatments **;** **3** risk of multiple, births / children / pregnancies **;** **4** poor success rates **;** **5** ref to emotional stress / ref to not knowing heritage **;** **6** ethical / religious / cultural, issues, with fertility treatment process **;** **7** allows people who have lost their partners to have children **;** **8** allows people undergoing cancer treatment to have children **;** **9** lower chance of genetic diseases if embryos screened **;** **10** allows infertile people to have children **;** **11** allows older people to have children **;** **12** spare embryos can be used for, medical research / treatments / stem cells **;** **13** AVP **;**	**4**	**e.g** screening for features in embryos

Question	Answer	Marks	Guidance
3(a)(i)	*any five from:* **1** as temperature increases the mass (of leaves) decreases / AW **;** **2** by (increased) transpiration **;** **3** evaporation increases **;** **4** from surface of the mesophyll cells **;** **5** due to increased (kinetic) energy of water molecules **;** **6** diffusion of water vapour increases **;** **7** through stomata **;**	**5**	
3(a)(ii)	humidity / AVP **;**	**1**	e.g. windspeed
3(b)(i)	xylem **;**	**1**	
3(b)(ii)	*any three from:* **1** hollow / no cell contents, to reduce resistance / allow efficient flow **;** **2** no end walls, to reduce resistance / allow efficient flow **;** **3** large cross-sectional area / wide, to allow transport of large volume of water **;** **4** lignin to, prevent collapse / provide support / provide strength **;** **5** waterproof to prevent water loss **;** **6** AVP **;**	**3**	e.g. bordered pits for lateral fluid transport
3(c)	*any three from:* into the root hair (cell) **;** by active transport **;** against a concentration gradient / AW **;** using energy **;** using carrier proteins (in the cell membrane) **;** (also / initially) by diffusion **;**	**3**	

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Question	Answer	Marks	Guidance
4(a)(i)	*similarities max two from:* (presence of) cell wall ; (presence of) cell membrane ; (presence of) DNA / genetic material ; (presence of) ribosomes ; (presence of) cytoplasm ; *differences max two from:* no plasmids ; no flagella ; no capsule ; no loop of DNA ; presence of chloroplasts ; presence of mitochondria ; presence of nucleus ; presence of large vacuole ; AVP ;	**4**	
4(a)(ii)	*any three from:* bacteria releases a toxin ; causing chloride ion, secretion / AW, (into small intestine) ; reducing water potential (in the gut) ; ref. to osmosis / osmotic movement ; water moves, into gut / into intestine / out of cells / AW ;	**3**	
4(b)(i)	largest clear area / has prevented most growth / killed the most bacteria / AVP ;	**1**	e.g. bacteria has no resistance (to antibiotic **E**)

Question	Answer	Marks	Guidance
4(b)(ii)	*any four from:* **1** ref. to natural selection **;** **2** ref. to mutation **;** **3** bacteria without resistance die / bacteria with resistance survive **;** **4** (resistant / surviving, bacteria) multiply **;** **5** passing their, alleles / genes, (for resistance) on to their offspring **;** **6** AVP **;**	**4**	e.g. ref. antibiotics destroy bacterial cell walls **/** resistance passed through plasmids
4(b)(iii)	only take antibiotics when needed **/** complete the course of treatment / restrict the use of antibiotic **B ;**	**1**	

Question	Answer	Marks	Guidance
5(a)	hair / fur **;** external ears / pinnae **;**	**2**	
5(b)(i)	247 **;;;**	**3**	MP1 correct readings from graph of 75 and 260 MP2 correct calculation (185÷75) × 100 = 246.66 MP3 correct rounding to 3 significant figures **ecf** MP2 and MP3
5(b)(ii)	*any three from:* overall decrease in numbers / ref to increase then decrease **;** in 1980 there are 15 rhinoceros **;** (numbers of rhinoceros) increase to 32 in 2003 **;** (numbers of rhinoceros) decrease to 2 in 2020 **;** data manipulation **;** correct comparison of difference in rate of, increase / decrease **;**	**3**	

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Question	Answer	Marks	Guidance
5(c)	*any three from:* providing, habitats / protected areas / AW **;** (laws to) prevent / limit, hunting / poaching **;** education / AW **;** (captive) breeding programmes / use of AI **;** AVP **;;;**	**3**	e.g. reintroduction programmes / legislation
5(d)	*any three from:* **1** inbreeding **;** **2** lack of genetic diversity **;** **3** increased risk of genetic diseases / mutation **;** **4** reduced ability to survive changes in the environment **;** **5** increased risk of extinction **;** **6** only small population, sex unknown / difficult to locate each other / too old to breed **;** **7** **AVP** **;**	**3**	

Question	Answer	Marks	Guidance
6(a)	<table><tr><th>name of enzyme</th><th>function</th><th>site of action</th></tr><tr><td>pepsin</td><td>breaks down protein to, amino acids / (poly)peptides</td><td>stomach</td></tr><tr><td>trypsin</td><td>breaks down protein / polypeptides, to amino acids / peptides</td><td>small intestine</td></tr><tr><td>maltase</td><td>breaks down maltose to glucose</td><td>intestinal epithelium / small intestine</td></tr></table> ;;;	**3**	one mark for each correct row
6(b)(i)	**A** gene / allele **;** **C** ribosome **;**	**2**	
6(b)(ii)	mRNA / a copy of the, gene or **A ;** moves out of, the nucleus (to the cytoplasm) **;**	**2**	
6(b)(iii)	the sequence of bases in, mRNA / DNA / gene **;**	**1**	
6(c)	ref. to specificity **;** (shape of) active site and substrate must be <u>complementary</u> **;** to enable, enzyme and substrate to bind / enzyme-substrate complexes to be formed **;**	**3**	

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