Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/41**

Paper 4 Theory (Extended) **October/November 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.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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.

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.

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

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(a)(i)</td><td>reptiles and amphibians ;</td><td>1</td><td></td></tr>
<tr><td>1(a)(ii)</td><td>one mark per row:
<table><tr><th>feature</th><th>fish</th><th>mammals</th><th>birds</th></tr><tr><td>organ involved in gas exchange</td><td>gills</td><td>lungs</td><td>lungs</td></tr><tr><td>circulatory system</td><td>single</td><td>double</td><td>double</td></tr><tr><td>body covering</td><td>scales</td><td>fur</td><td>feathers</td></tr><tr><td>presence of external ears (pinnae)</td><td>no</td><td>yes</td><td>no</td></tr></table>; ; ; ;</td><td>3</td><td></td></tr>
<tr><td>1(b)(i)</td><td>(net) movement of particles, from a region of their higher concentration to a region of their lower concentration / down a concentration gradient ;
as a result of their <u>random</u> movement ;</td><td>2</td><td></td></tr>
<tr><td>1(b)(ii)</td><td>any one from:
large surface (area) / AW ;
thin ;</td><td>1</td><td></td></tr>
<tr><td>1(c)(i)</td><td>nitrate (ions) / sewage / fertilisers / AVP ;</td><td>1</td><td></td></tr>
<tr><td>1(c)(ii)</td><td>15 °C – 8.9 ± 0.1 (mg per dm^3) and 25 °C – 7.3 ± 0.1 (mg per dm^3) ;

2.35 ± 0.05 (μm) and 1.95 ± 0.05 (μm) ;

(–)0.4 (in μm) ;</td><td>3</td><td>ecf from readings in MP1 for MP2 and MP3</td></tr>
</table>

Question	Answer	Marks	Guidance
2(a)	selection of suitable letter and case for alleles, e.g. R and r ; *parental phenotypes: red fruit x red fruit* parental genotypes: Rr ; x Rr ; gametes: R r x R r ; offspring genotypes: (1)RR and (2)Rr and (1)rr ; expected ratio: 3 (red fruit) : 1 (yellow fruit) ;	**6**	
2(b)	(perform a) test cross ;	**1**	
2(c)(i)	*any two from:* ref. to photosynthesis ; transfers light <u>energy</u> into chemical energy ; to make, carbohydrates / glucose / starch / AW ;	**2**	
2(c)(ii)	magnesium ;	**1**	
2(c)(iii)	*any three from:* **1** chlorophyll concentration decreases in both ; **2** lycopene concentration increases in both ; **3** (lycopene) increases from zero (in unripe fruit) ; **4** ref to lycopene change being much larger than chlorophyll change / AW ; **5** comparative data quote to support observations (with units used at least once) ; **6** AVP ;	**3**	
2(d)(i)	DNA ;	**1**	

Question	Answer	Marks	Guidance
2(d)(ii)	*any two from:* cross-breeding with wild populations of plants **;** expensive **;** (named) unknown long-term effects (on the environment / populations) **;** ethical considerations with manipulating 'nature' **;** AVP **;**	**2**	

Question	Answer	Marks	Guidance
3(a)(i)	*any three from:* protease / trypsin / pepsin **;** chemical) digestion **;** (protein) digested to amino acids **;** insoluble to soluble molecules **;**	**3**	
3(a)(ii)	*any four from:* enzymes have, a specific shape / complementary shape to substrate **;** correct ref. to active site **;** 30°C is optimum temperature **;** above 50 °C (these) enzymes denature **;** ref. to active site changing (shape) **;** (below 30 °C,) less kinetic energy / lower frequency of effective collisions (between substrate and enzyme) **; ora**	**4**	

Question	Answer	Marks	Guidance
3(b)	*any four from:* emulsification ; increased surface area of fat (globules) ; faster, digestion / breakdown (of fat) ; by lipase / to fatty acids and glycerol ; neutralises, (stomach) acid / chyme / gastric juice ; alters / increases, pH for (pancreatic / intestinal) enzymes / AW ; denatures, pepsin / stomach, enzymes ; AVP ;	**4**	

Question	Answer	Marks	Guidance
4(a)	bacteria ;	**1**	
4(b)(i)	*any one from:* weakened / dead / AW, bacteria / pathogen ; antigen(s) (of the pathogen) ; AVP ;	**1**	
4(b)(ii)	*any three from:* *idea that* the immune response takes time to occur ; lymphocytes release antibodies ; ref. to (lymphocytes) produce specific antibodies to the (cholera) antigens / AW ; memory cells (form) ; long-term immunity ;	**3**	
4(b)(iii)	*idea that* they did not have (active) immunity / memory cells before the start of the study / AW ;	**1**	

Question	Answer	Marks	Guidance
4(b)(iv)	*any two from:* more, pathogens / diarrhoea / fever, in non-vaccinated group **; ora** some vaccinated people did get symptoms so vaccine not 100% effective **; ora** comparative data quote between vaccinated and not vaccinated **;** AVP **;**	**2**	
4(c)(i)	*any four from:* cholera / pathogen, releases toxin **;** (toxin) causes (more) chloride released (into small intestine) **;** lowering water potential (in lumen) **;** ref. to, osmosis / movement of water (into the lumen) **;** (diarrhoea is) loss of watery faeces **;** loss of salts / loss of minerals / dehydration **;**	**4**	
4(c)(ii)	*any two from:* oral rehydration therapy **;** drink mixture of, sugar / nutrients and, salt / ions **;** replace lost, water / fluids **;** AVP **;**	**2**	

Question	Answer	Marks	Guidance
5(a)	*any four from:* valves in, heart / (main) veins **;** correct sequence, of open / closing, of valves **;** prevention of backflow / description **;** semi-lunar valves **;** atrioventricular valves **;** heart, pumping / contracting **;** AVP **;**	**4**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5(b)</td><td>one mark per row:

<table>
<tr><th>function</th><th>type of blood vessel</th><th>letter on Fig. 5.1</th></tr>
<tr><td>regulates blood flow by constricting and dilating</td><td>arteriole
/ artery</td><td>P
N</td></tr>
<tr><td>collects blood from a network of the narrowest blood vessels</td><td>venule</td><td>K</td></tr>
<tr><td>withstands the highest blood pressure</td><td>artery</td><td>N</td></tr>
<tr><td>allows the transfer of substances to and from tissue fluid</td><td>capillary</td><td>J</td></tr>
<tr><td>transports blood towards the heart</td><td>vein
/ venule</td><td>M
K</td></tr>
<tr><td>redirects blood under the surface of the skin</td><td>shunt vessel</td><td>L</td></tr>
</table>
; ; ; ; ; ;</td><td>6</td><td></td></tr>
<tr><td>5(c)</td><td><u>renal artery</u> ;
<u>coronary artery</u> ;</td><td>2</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
5(d)	*any four from:* stent **;** (small) mesh / gauze, tube inserted in artery **;** opens / supports, (narrow / weak) artery **;** (balloon) angioplasty / dilatation **;** (tube / catheter with) balloon inserted into artery **;** inflate balloon to widen artery **;** by-pass **;** (another / shunt) blood vessel, joined to / grafted to / replaces, artery **;** AVP **;** e.g. aspirin / warfarin / ref to treatment of clots	**4**	**A** blood vessel for artery throughout

Question	Answer	Marks	Guidance
6(a)	*any three from:* loss of biodiversity / AW **;** habitat destruction **;** damage to, food chains / food webs **;** soil erosion **;** by, water / wind **;** infertility of soil **;** competition for resources **;** ref to pollution **;** AVP **;;** e.g. desertification / flooding / diseases or pests spreading to wild-varieties / migration (of species)	**3**	
6(b)	*any two from:* more / number / amount (of), fruits / seeds / kernels **;** size of, fruits / seeds / kernels **;** ref. to colour (of, fruits / seeds / kernels / cobs) **;** length / size / width, of cobs **;** ref. to arrangement of, fruits / seeds / kernels **;**	**2**	
6(c)(i)	to prevent (natural) pollination / AW **;**	**1**	

Question	Answer	Marks	Guidance
6(c)(ii)	*any two from:* aerobic respiration ; for energy ; for growth ;	**2**	
6(c)(iii)	the plants may be heterozygous ; recessive traits only visible if plants are homozygous ;	**1**	
6(c)(iv)	*any two from:* reduce variation (in a population) / create uniformity ; become more homozygous ; to, improve / maintain, the desirable feature ; produce more seeds ; AVP ; e.g. ensure trait continues on subsequent generations / to ensure no other alleles are present / does not result in unforeseen effects	**2**	
6(c)(v)	mutation(s) ;	**1**	