Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

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.

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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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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(a)</td><td>10 (μm) ;</td><td>1</td><td></td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><th>function</th><th>structure</th><th>letter in Fig. 1.1</th></tr>
<tr><td>storage of DNA / controls (named) activity of cell / produces RNA / makes ribosomes</td><td>nucleus</td><td>C</td></tr>
<tr><td>photosynthesis / absorb light / AW</td><td>chloroplast</td><td>E</td></tr>
<tr><td>aerobic respiration</td><td>mitochondrion / mitochondria</td><td>D</td></tr>
<tr><td>contains cell sap and stores water</td><td>vacuole</td><td>B</td></tr>
<tr><td>supports (the cell) / resists turgor pressure / prevents bursting / AW</td><td>cell wall</td><td>A</td></tr>
</table>
;
;
;
;
;
</td><td>5</td><td>one mark per correct row</td></tr>
<tr><td>1(c)(i)</td><td>diffusion ;</td><td>1</td><td></td></tr>
<tr><td>1(c)(ii)</td><td>(enters through) stoma(ta) / between guard cells ;
(moves through) interconnecting / intercellular / air, spaces ;</td><td>2</td><td></td></tr>
<tr><td>1(d)(i)</td><td>limiting factor ;</td><td>1</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
1(d)(ii)	(low / no) light intensity / (extreme air) temperature / (low / no) water (availability) / (incorrect) (wavelength of light / (short) day length **;**	**1**	
1(e)	*any two from:* 1 reduces, extraction / conserves, (named) fossil / non-renewable, fuels **;** 2 (temporarily) removes, carbon dioxide / greenhouse gases (from atmosphere) / does not add more, carbon dioxide / greenhouse gas (to the atmosphere) / *idea that the process is* carbon neutral **;** 3 does not cause / prevents a further increase in, enhanced greenhouse effect **;** 4 does not cause / prevents further increase in global warming / prevents further climate change **;** 5 it is a sustainable process / uses renewable fuel source / described **;** 6 AVP **;** e.g. described example of less environmental impact caused by use of non-renewable (fossil) fuels **;**	**2**	

Question	Answer	Marks	Guidance
2(a)(i)	glomerulus **;**	**1**	
2(a)(ii)	*any one from:* (vessel **Q**) is a (renal) artery / blood has not passed through any capillaries **;** blood (in **Q**) comes (straight) from, the heart / an artery / aorta **;** (vessel **Q**) is narrow(er than **R**) **;** (vessel **Q**) has thick / elastic, walls **;** for (ultra)filtration **;**	**1**	**A** it is an arteriole
2(a)(iii)	increase surface area **;** for faster / more, (re)absorption (of glucose / amino acids / minerals / ions / salts / water / vitamins / nutrients / (other relevant) substances) **;**	**2**	

Question	Answer	Marks	Guidance
2(b)	*any six from:* 1 no protein in, region 1 / (Bowman's / renal) capsule / protein only in, **P** / blood / plasma **;** 2 all glucose / salts / urea, is filtered out, of **P** / blood plasma / into region 1 / (Bowman's / renal) capsule **;** 3 (re)absorption of, <u>all</u> glucose, by region 3 / loop of Henle / in tubule / in region 2 / after region 1 **; ora** 4 (re)absorption of, some salts, by / at, region 3 / by loop of Henle / in tubule / in region 2 / after region 1 **;** 5 urea concentration is, increased / higher in, region 3 / loop of Henle **;** 6 *idea that* size of the substance determines what is <u>filter</u>ed **;** 7 glucose / salts / urea, filtered out of blood / plasma OR proteins, stay in blood / plasma / not filtered out, of blood / plasma **;** 8 active transport, of glucose / salts (from tubule / back into blood / back into plasma) **;** 9 movement of, glucose / salts, against a concentration gradient / through proteins (in membranes) **;** 10 (active transport) uses energy from, respiration / mitochondria **;** 11 (most) water (re)absorbed by osmosis (in region 3 / loop of Henle) **;** 12 urea concentration increases as a result of reabsorption of water **;** 13 urea / excess salt, is, an excretory substance / waste product (of metabolism) / toxic **;** 14 urine contains salts <u>and</u> urea **;**	**6**	
2(c)(i)	homeostasis **;**	**1**	
2(c)(ii)	*any three from:* 1 (blood) glucose concentration, is low / decreases **;** 2 (causing) glucagon, secretion / production **;** 3 glucagon, released from / produced in, pancreas **;** 4 (glucagon stimulates) breakdown of glycogen / release of glucose (into the blood) **;** 5 from liver / muscle **;** 6 (blood) glucose concentration, goes (back) up / returns to normal / stays within limits **;**	**3**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(a)(i)</td><td>refraction ;</td><td>1</td><td></td></tr>
<tr><td>3(a)(ii)</td><td>any three from:
ciliary muscles contract ;
tension in suspensory ligaments decreases ;
lens becomes more convex ;
causing more refraction ;</td><td>3</td><td></td></tr>
<tr><td>3(b)(i)</td><td>any four from:
rods / cones, are light receptors OR detect / respond / sensitive, to light ;

rods:
sensitive to / function in, light of low intensity OR used for night vision ;
provide black and white vision ;

cones:
sensitive to light of high intensity ;
ref. to three different types of cone ;
provide colour vision ;
AVP ;</td><td>4</td><td></td></tr>
<tr><td>3(b)(ii)</td><td><table><tr><th rowspan="2">receptor</th><th colspan="3">distribution across the retina</th></tr><tr><th>peripheral retina</th><th>blind spot</th><th>fovea</th></tr><tr><td>rods</td><td>many</td><td>none</td><td>none / few</td></tr><tr><td>cones</td><td>few</td><td>none</td><td>many</td></tr></table>; ; ;</td><td>3</td><td>one mark for each correct column</td></tr>
<tr><td>3(c)(i)</td><td>only males, are colour-blind / colour-blindness is more common in males / no females are colour-blind / person 1 and 2 had two male colour-blind children (but no female colour-blind children) ;</td><td>1</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
3(c)(ii)	X^AX^a **;;**	**2**	MP1 correct sex chromosomes MP2 correct alleles
3(c)(iii)	1 correct genotype for person **3**, i.e. $(X)^A(X)^a$ **;** 2 correct genotype for person **4**, i.e. X^AY **;** 3 correct gametes from the parental genotypes **;** 4 correct offspring genotypes from their gametes / parental genotypes (in any order) **;** 5 correct offspring correct probability **;**	**5**	MP3 **ecf** from MP1 and MP2 MP4 **ecf** from MP3 MP5 **ecf** from their offspring genotype **expected answer:** *genotype* (person **3**) X^AX^a × (person **4**) X^AY *gametes* X^A, X^a + X^A, Y *offspring genotypes* X^AX^A, X^AX^a, X^AY, X^aY *offspring phenotypes* female with normal colour vision female with normal colour vision male with normal colour vision male with colour blindness) *probability* 0.25 / 25% / 1 in 4 / ¼

Question	Answer	Marks	Guidance
4(a)	**N** – protein coat **;** **O** – genetic, material / DNA / RNA **;**	**2**	

Question	Answer	Marks	Guidance
4(b)(i)	–87(%) **;;;**	**3**	Use **ecf** from each previous step throughout MP1: both correct readings from graph 760 and 100 MP2: correct answer calculated MP3: correct rounding to two significant figures
4(b)(ii)	*any two from:* (overall) decrease in number (of lymphocytes during the 84 months) **;** rapid decrease from 10 months and then, less steep / (eventually) levels off **;** suitable description from graph **;**	**2**	
4(b)(iii)	*any four from:* fewer antibodies (produced by lymphocytes) **;** decrease in immunity / inefficient immune system **;** fewer memory cells **;** any role of antibodies or lymphocytes (that will be impacted by fewer lymphocytes) **;** develop AIDS **;** example of (secondary) infection / disease / pathogen that may result from reduced number of lymphocytes **;**	**4**	
4(b)(iv)	viruses are, acellular / non-living / do not have (named) cell structure **;** antibiotics target (named) cell structures / (named) process **;**	**2**	**A** antibiotics do not affect viruses / antibiotic only affect, cells / bacteria

Question	Answer	Marks	Guidance
5(a)(i)	**X** – larynx **;** **Y** – trachea **;** **Z** – bronchus **;**	**3**	
5(a)(ii)	cartilage **;**	**1**	
5(b)	*any four from:* **1** external intercostal muscles contract (and internal intercostal muscles relax) **;** **2** lifts ribs, upwards / outwards**;** **3** diaphragm, contracts / flattens**;** **4** volume of, thorax, increases **;** **5** pressure in, thorax, decreases **;** **6** causing air to flow, down a pressure gradient / into the lungs / lungs inflate **;** **7** equalising pressure between atmosphere and lungs **;**	**4**	
5(c)	alveoli / alveolus **;**	**1**	

Question	Answer	Marks	Guidance
6(a)	community / communities **;** environment(s) **;**	**2**	
6(b)(i)	4 **;**	**1**	
6(b)(ii)	(reef) shark **;**	**1**	
6(b)(iii)	4 **;**	**1**	
6(b)(iv)	no arrows pointing to phytoplankton / AW **;**	**1**	

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Question	Answer	Marks	Guidance
6(b)(v)	*any three from:* 1 *idea that* energy transfer along a food chain is inefficient **;** 2 **and** 3 named examples of causes of inefficient energy flow between trophic levels **;;** 4 energy to, decomposers / decomposer food chain(s) **;** 5 limited / not enough, energy to support another trophic level **;**	**3**	
6(c)	*any three from:* 1 named threat **;** 2 **and** 3 detail of how it is a threat to aquatic ecosystems **;;** 4 another named threat **;** 5 detail of how it is a threat to aquatic ecosystems **;**	**3**	*examples of named threats:* (micro)plastics / litter / sewage / fertilisers / effluent / (named) introduced / alien species / escaped farmed fish / genetically modified fish / (over)fishing / hunting / cyanide fishing / bomb fishing / (named) chemical / nuclear, pollutants / (named) development in sea / coast / (named) development in sea / coast / shipping / (named) tourism *examples of detail of threat:* habitat destruction / toxic to (aquatic) organisms / chokes / strangles / traps / blocks digestive systems (of aquatic animals) / accumulates in an organism / passes down a food chain / eutrophication / algal bloom / feminisation of fish / acidification of water / sedimentation in water

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