Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 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 May/June 2021 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	<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 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.

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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>central <u>and</u> peripheral (nervous system) ;</td><td>1</td><td></td></tr>
<tr><td>1(b)(i)</td><td>motor ;</td><td>1</td><td></td></tr>
<tr><td>1(b)(ii)</td><td>
<table>
<tr><th>part of the eye</th><th>function</th><th>letter in Fig. 1.1</th></tr>
<tr><td>suspensory ligament</td><td>• controls / changes, shape / size, thickness, of lens
• ref. to accommodation / focusing
• attachment of <u>lens</u> to <u>ciliary muscles</u></td><td>G</td></tr>
<tr><td>circular muscles / iris</td><td>contracts in response to a bright light</td><td>E</td></tr>
<tr><td>cornea</td><td>refracts / bends, light</td><td>D</td></tr>
<tr><td>fovea</td><td>contains a high density of cones for colour vision</td><td>J</td></tr>
</table>
;;;;</td><td>4</td><td>one mark per row</td></tr>
<tr><td>1(c)(i)</td><td>(ciliary muscles) contract / conduction of (nerve) impulses ;</td><td>1</td><td></td></tr>
<tr><td>1(c)(ii)</td><td><u>haemoglobin</u> ;</td><td>1</td><td></td></tr>
<tr><td>1(c)(iii)</td><td>any two from:
diffusion (across cell membranes) ;
down concentration gradient / AW ;
passive process / (use of) kinetic energy / random movement of molecules ;
through a thin capillary wall ;</td><td>2</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
1(d)(i)	*any two from:* hairs in the nose ; skin ; AVP ;	**2**	
1(d)(ii)	phagocytes ;	**1**	
1(d)(iii)	(different) pathogens / antigens, have different / unique shapes ; pathogens have antigens ; lymphocytes, produce (specific) antibodies ; antibodies are, complementary / specific to, antigens ; antibodies, mark / destroy, pathogens ; ref. to memory cells ;	**3**	
1(e)	arthropods ;	**1**	

Question	Answer	Marks	Guidance
2(a)	(dietary) fibre **/** carbohydrate / starch / (named) sugar / vitamin C ;	**1**	
2(b)(i)	external ears / pinnae ; fur ;	**2**	

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Question	Answer	Marks	Guidance
2(b)(ii)	*any five from:* *for (giant panda closer to red panda):* same diet / herbivores / AW **;** terrestrial / similar, ecosystems / habitats **;** fur markings described **;** ear position **;** *against:* shorter (branch) distance between giant panda and polar bear (than to red panda) **;** fewer, DNA (base sequence) / gene, differences between giant panda and polar bear (than to red panda) **;** (red panda) first appeared, 40±3 million rather than 20±3 million, years ago (giant and polar) **;** more time for, mutations / evolution (for red panda) **;** common, ancestor / branch / relationship, 20±3 million, (giant and polar), than 47±3 million years ago (red) **;** DNA data is likely to be more, accurate / quantitative / not subjective **;**	**5**	
2(b)(iii)	anatomy **/** ability to produce fertile offspring **/** AVP **;**	**1**	

Question	Answer	Marks	Guidance
3(a)(i)	**E** **A** **B** **D** **C** **;**	**1**	Accept **A** **E** **B** **D** **C**
3(a)(ii)	FSH **;**	**1**	
3(a)(iii)	*any two from:* (menstruating females need more) iron **;** ORA (iron is needed for) haemoglobin / red blood cells / transport of oxygen / to prevent (iron-deficiency) anaemia **;**	**2**	

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Question	Answer	Marks	Guidance
3(b)	**1** sperm / male gametes are, deposited in, **S** / vagina OR travel through, **R** / cervix **;** **2** egg / sperm / gametes, travel, to **P** / oviduct **;** **3** enzymes (from acrosome / sperm) digest jelly coat (around egg) **;** **4** fertilisation OR fusion of <u>nuclei</u>, of sperm / male gamete, and of female gamete / egg (cell) **;** **5** formation of <u>diploid</u> zygote **;** **6** zygote / embryo, travels, down **P** / oviduct OR zygote / embryo, travels to, **T /** uterus **;** **7** mitosis / cell division / growth / develop (zygote / embryo / fetus) **;** **8** ball of cells / embryo, implants in, **T** / uterus **;** **9** **U** / placenta / **V** / umbilical cord (between mother, and fetus) **;** **10** delivery / diffusion, of (named) resource / excretion of (named) waste, via **U /** placenta / **V** / umbilical cord **;** **11** AVP **;** e.g. • named sperm adaptation for swimming e.g. mitochondria • **Q** / ovary / **U /** placenta, releases progesterone (to maintain lining) • *ref to* (cell) specialization / complexity, of fetus / (named) organs (in fetus)	**6**	

Question	Answer	Marks	Guidance
4(a)(i)	habitat destruction / named example **;** removing (too many) of a plant species **;** (named) pollutants (of plants) **;** additional named pollutant (of plant) **;** introduced species / disrupted food chains **;** disease **;** AVP **;** e.g. extinction of other species / fewer, pollinators / (named) pesticides killing pollinators / reduced genetic diversity / stated impact of GM crops / war	**3**	

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Question	Answer	Marks	Guidance
4(a)(ii)	*any four from:* more carbon dioxide (is being released / in the atmosphere) ; (carbon dioxide is produced by) burning / use of, fossil fuels ; deforestation (leads to more carbon dioxide in atmosphere) ; more methane (is being released / in the atmosphere) ; (methane is produced by) farming ; (methane produced by) landfill ; increased / increasing human population ; enhanced greenhouse effect ; (greenhouse / named) gases trap, heat / (infra-red) radiation ; AVP ;	**4**	
4(b)(i)	*any three from:* ensure (genetic) variation / AW ; represent many environments where the plant grows / able to survive (in a changing environment) / AW ; more chance of cross-fertilisation ; not enough seeds in any one population ; increases chances of successful germination ; AVP ;	**3**	
4(b)(ii)	mutations (of DNA) / genetic change / change (base sequence of) DNA ;	**1**	
4(b)(iii)	*any two from:* low (kinetic) energy ; for enzymes ; low rate of (effective) collisions / AW ; slow diffusion (of oxygen) ;	**2**	
4(c)(i)	*any three from:* water ; oxygen ; suitable / optimum, temperature ; AVP ;	**3**	

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Question	Answer	Marks	Guidance
4(c)(ii)	obtain (named) resources from, larger / deeper, area ; so that they have enough roots to survive (the reintroduction process) ; ref. to large(r) surface area ; more root hair (cells) ; for (more) water <u>and</u> (named) minerals / ions / salts, uptake ; anchorage / described ; so that not pulled out (when animals grazing / wind etc) ; reduced soil erosion ; AVP ; e.g. named use of, water / mineral ion	**4**	
4(c)(iii)	lag ;	**1**	**A** death (phase)

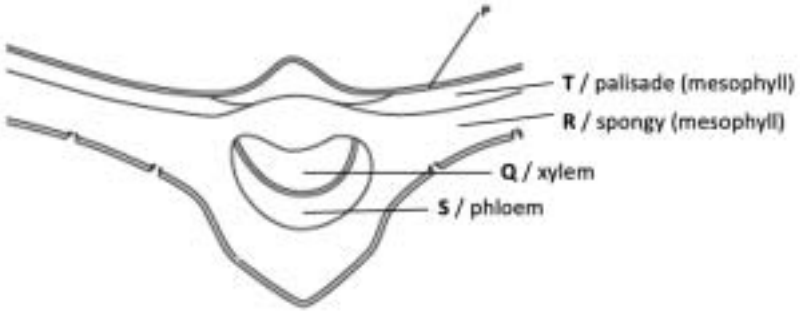
Question	Answer	Marks	Guidance
5(a)	<u>helix</u> ; one / the same / equal / identical / maintained / constant ; <u>identical</u> ;	**3**	
5(b)(i)	0.003 (mm) ;;	**2**	MP1 correct reading from graph i.e. 3 (μm) MP2 correct conversion, ecf from wrong readings in MP1
5(b)(ii)	*any two from:* there are some (before division) cells that are less than 6μm ; the smallest that divide are 4.5±1μm in length ; some cells are less than 3μm after division (assuming equal division) ;	**2**	units must be stated at least once
5(c)(i)	*any two from:* (cut using) <u>restrict</u>ion enzyme ; to form sticky ends ; plasmid cut with <u>same</u> enzyme (as new gene) ; to form <u>complementary</u> (sticky) ends ;	**2**	

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Question	Answer	Marks	Guidance
5(c)(ii)	*any two from:* rapid rate of reproduction **;** no ethical considerations **;** share same genetic code as other organisms **;** ability to make complex molecules **;** AVP **;** do not take up much space / cheap to maintain cultures	**2**	

Question	Answer	Marks	Guidance
6(a)(i)	*prediction:* set, **A /** in bag, will lose less, mass (than set **B**) **;** *explanation*: because high(er) humidity (in **A**) **;** less steep diffusion gradient / AW (in **A**) **;** less transpiration (in **A**) **;**	**3**	ORA throughout
6(a)(ii)	*any three from:* water evaporates **;** from (surface of) mesophyll / into air spaces **;** water vapour, diffuses / described **;** through stomata (out of leaf) / AW **;**	**3**	
6(a)(iii)	balance / scale / AW **;** stop-clock / timer / AW **;**	**2**	

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Question	Answer	Marks	Guidance
6(b)	 ;;	**4**	*max 2 for diagram* 4 correct labels on the diagram = 2 marks 2 or 3 correct labels = 1 mark 1 correct label = 0 marks

letter	description	name of tissue
P	a protective transparent layer that allows light to reach inner tissues	upper epidermis
Q	conducts water from the stem	xylem
R	contains many interconnected air spaces	spongy mesophyll
S	transports sucrose and amino acids	phloem
T	traps the most light energy to synthesise carbohydrates	palisade mesophyll

;;

max 2 for table
4 correctly named tissues = 2 marks
2 or 3 correct tissues = 1 mark
1 correct tissue = 0 marks

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