Cambridge Assessment International Education

Cambridge O Level

BIOLOGY **5090/21**

Paper 2 Theory **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.

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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 schemes will use these abbreviations:

; separates marking points
/ alternatives
() contents of brackets are not required but should be implied
R reject
A accept (for answers correctly cued by the question, or guidance for examiners)
Ig ignore (for incorrect but irrelevant responses)
AW alternative wording (where responses vary more than usual)
AVP alternative valid point (where a greater than usual variety of responses is expected)
ORA or reverse argument
underline actual word underlined must be used by candidate
+ statements on both sides of the **+** are needed for that mark

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Question	Answer	Marks	Guidance
1(a)(i)	cell wall or large / central / sap **+** vacuole **;**	**1**	
1(a)(ii)	*any four from:* dissolved in water **;** through the cell wall **;** carriers in membrane **;** through the cell / partially permeable **AW +** membrane **;** by active transport / diffusion **;** correct reference to concentration gradient **;** using energy (for active transport) **;** from (aerobic) respiration (for active transport) **;**	**4**	
1(b)	yellowing / chlorosis / reduced growth / cannot photosynthesise / make glucose / starch / sugar / carbohydrate **;** deficiency of chlorophyll **;**	**2**	

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Question	Answer	Marks	Guidance
2(a)(i)	lens ;	**1**	
2(a)(ii)	*any two from:* transparent / spherical / curved sides ; allows light to pass through / to focus / refract light ; **or** flexible / elastic / can change shape **AW** ; accommodation / focus objects ;	**2**	1 mark for structural feature and 1 mark for function
2(a)(iii)	retina ;	**1**	
2(b)(i)	macula / yellow spot / fovea ;	**1**	
2(b)(ii)	*any four from:* bring glucose / amino acids / minerals / vitamins ; for energy / repair of cells ; bring oxygen ; for (aerobic) respiration ; take urea / carbon dioxide away ; diffusion ; capillaries / veins / arteries mentioned in correct context ; bring white blood cells ; to fight infection ;	**4**	

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Question	Answer	Marks	Guidance
2(c)	*any four from:* retina / rods detect extra light (intensity) **;** impulse **+** to CNS / brain **;** via optic nerve / sensory neurone **;** back to eye / iris / effector / muscle **+** motor neurone **;** radial muscles relax **;** circular muscles contract **;** iris becomes bigger / elongates **;** reflex arc **;**	**4**	
2(d)(i)	parental genotypes = Aa **+** Aa **;** gametes a and A **;** offspring genotypes AA, Aa, Aa and aa **;** correctly linked phenotypes: AA & Aa = produce melanin, aa don't produce melanin **;**	**4**	
2(d)(ii)	25% / ¼ / 0.25 / I in 4 / 1:3 **;**	**1**	

Question	Answer	Marks	Guidance
3(a)(i)	photosynthesis / autotrophic / making own organic nutrients ;	**1**	
3(a)(ii)	flow / transfer **+** energy / food ;	**1**	
3(b)	*any four from:* *biomass* tree has large mass so long rectangle / correct reference to relative masses at two trophic levels ; biomass declines as trophic level increases ; *numbers* there is only one tree so a short rectangle for numbers / correct reference to relative numbers at two trophic levels ; *both or either* after producer both pyramids in shape ; energy is lost (to the environment) ; as heat / thermal energy ; from respiration ;	**4**	
3(c)	*any two from:* large / colourful **+** <u>petals</u> / <u>sepals</u> ; nectaries / nectar ; scent ; anthers / stigma **+** inside petals / short / sticky stigma ; markings / nectar guides / petals modified with insect landing site ; pollen rough / sticky ;	**2**	
3(d)	<u>meiosis</u> ;	**1**	

Question	Answer	Marks	Guidance
4(a)	*clockwise from top:* oesophagus / gullet **;** duodenum / small intestine **;** gall bladder **;**	**3**	 **R** ileum
4(b)	*any three from:* digestion / break down food or protein / protein to polypeptides / protein to amino acids **;** (mechanical) muscle / contractions / movement **+** make food particles smaller / chyme **;** (chemical) enzymes / proteases / pepsin **+** proteins **;** hydrochloric acid **+** optimum pH **AW ;** hydrochloric acid **+** destroy microbes / defence against microbes **;** mucus **+** protects lining / lubrication **;**	**3**	
4(c)	pancreas **;** control of blood glucose concentration / level **or** produces / releases **+** insulin / glucagon **;**	**2**	

Question	Answer	Marks	Guidance
5(a)	*any four from:* named bone(s) **+** location **;** antagonistic muscles **;** biceps contract **;** become shorter / radius or ulna is moved towards humerus **;** triceps relax **;** hinge joint **;**	**4**	
5(b)	*any four from:* no leaching / run-off into water / water pollution **;** so insecticides not ingested by aquatic insects **;** no bioaccumulation **AW ;** (so fertilisers) don't cause algal bloom / eutrophication **;** eutrophication detail e.g. decomposition of algae / lack of oxygen / increase in bacteria **;** pollinators / insects that eat pests can still function **;** increase biodiversity **;** greater variety of food sources for consumers **;** if artificial fertilisers replaced with organic then soil structure maintained **AW ;**	**4**	

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Question	Answer	Marks	Guidance
6(a)	*any five from:* heating / pasteurisation at start of process or after fermentation ; denaturation of milk protein / kill unwanted bacteria ; starter culture / bacteria ; *Lactobacillus (bulgaricus)* / *Streptococcus (thermophiles)* ; fermentation / anaerobic respiration ; warm temperature ; lactose / milk sugar ; lactic acid produced ; decreases pH ; coagulation / thickening ;	**5**	
6(b)	*any five from:* *(yoghurt contributes to a balanced diet)* carbohydrates for energy ; proteins for growth / repair ; water for chemical reactions / cytoplasm / transport ; fats for energy / insulation ; calcium for bones / prevent rickets ; *(yoghurt is not suitable on its own)* no **+** fibre **+** so poor bowel health / constipation ; no **+** iron ; no **+** vitamin C or other named vitamin ;	**5**	

Question	Answer	Marks	Guidance
7(a)	*any seven from:* transported in blood / plasma **;** dissolved **;** hepatic vein to vena cava / heart **;** renal artery (to kidney) **;** to kidney **;** urea removed / filtered **+** from blood **;** part of urine **;** ureter (to bladder) **;** bladder **;** (bladder to) urethra **;**	**7**	
7(b)	*any three from:* cycling / replenishing nitrogen **;** used / converted by nitrifying bacteria / nitrogen fixing bacteria **;** form **+** nitrates **;** nitrates **+** taken up by plants **;** production of proteins / amino acids **;** increased soil fertility (for crops) / plants grow faster / bigger / **AW** **;** animals / herbivores obtain protein / nitrogen from plants **;**	**3**	

Question	Answer	Marks	Guidance
8(a)	*any five from:* photosynthesis ; in leaves / green parts of plants / in mesophyll / chloroplasts / using chlorophyll ; using light <u>energy</u> ; water **+** soil / irrigation / roots / root hair cells ; carbon dioxide **+** air / through stomata ; produce glucose / $C_6H_{12}O_6$; starch ; magnesium **+** from soil **+** to make chlorophyll ;	**5**	
8(b)	*any five from:* greater demand for food ; not enough land available for farming ; land being used for e.g. building / biofuels / deforestation ; increase in greenhouse gases ; (leads to) climate change ; droughts / floods / salinisation **AW** ; lack of nutrients in soils monoculture / overcrowding **AW** ;	**5**	
9(a)	*any five from:* contraction of diaphragm ; diaphragm flattens / moves down ; bones of rib cage pulled upwards / outwards ; external intercostal muscles contract / internal relax ; pressure decreases / volume increases ; air passes through nose / trachea / windpipe / larynx ; through bronchi / bronchioles ;	**5**	

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Question	Answer	Marks	Guidance
9(b)	*any three from (effect on person):* bronchi narrowed / blocked by mucus **;** need to cough **+** remove **;** pain (from coughing) **;** increase in bacteria / microorganisms **;** harder for oxygen to reach alveoli / reduced gaseous exchange **;** reduced <u>aerobic</u> respiration **;** ability to exercise reduced **;** feel tired / lethargic **;** *any two from (avoiding the condition):* avoid smoking / avoid breathing in smoke **;** avoid particulate air pollution / use of mask **;** avoid places with lots of vehicles **;**	**5**	

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