CAMBRIDGE
International Education

Cambridge O Level

BIOLOGY **5090/22**

Paper 2 Theory **May/June 2025**

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 2025 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 descriptions 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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
	information missing or insufficient for credit
	allow or accept
	insufficient point ignored while marking the rest of the response
	contradiction in response, mark not awarded
	benefit of the doubt given
	error carried forward applied
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied
	point has been noted but no credit has been given or blank page seen

Annotation	Meaning
	correct idea but not specific enough
	used to highlight parts of an extended response
	key point attempted / working towards marking point
Ruler	allows lengths to be measured
Protractor	allows angles to be measured
Multi-line Overlay	overlays graphs
	correct, awarding one mark from marking point 1.
	correct, awarding one mark from marking point 2, similar numbered ticks are used for marking point 3, 4, 5 etc.

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
max	indicates the maximum number of marks that can be given
mp	marking point

Question	Answer	Marks	Guidance
1(a)	warm ; water ; oxygen ;	**3**	
1(b)	1 water absorbed / goes in ; 2 seed increases + in size / volume ; 3 enzymes become active AW; 4 digestion / hydrolysis / breakdown of starch / protein / lipids ; 5 respiration ; 6 testa / seed coat / seed wall softens / splits AW ; 7 radicle / root + grows (out) ; **max 5**	**5**	
1(c)(i)	embryo ;	**1**	
1(c)(ii)	X / plumule /shoot + negative gravitropism / grows against gravity ; Y / radicle / root + positive gravitropism / grows towards gravity ;	**2**	

Question	Answer	Marks	Guidance
2(a)(i)	minerals ; vitamins ; fibre ; water ; **max 3**	**3**	
2(a)(ii)	energy / energy store ; electrical insulation in neurones ; (thermal) insulation ; mechanical protection; components of cell membranes ; **max 2**	**2**	
2(b)(i)	60 / 59.8 / 59.81 ;;	**2**	
2(b)(ii)	15 / 15.3 / 15.33 ;;	**2**	
2(c)	fewer energy transfers involved when eating plants ORA ; energy is lost to environment / energy transfers not 100% efficient ORA ; example of loss ; **max 2**	**2**	
2(d)	less deforestation / more land/habitat available for wildlife ; more biodiversity / less monoculture ; less extinction ; reduced pollution + from insecticides / herbicides / fertilisers ; less erosion / loss of soil ; less flooding ; less methane production + reduced AW global warming / climate change ; **max 3**	**3**	

Question	Answer	Marks	Guidance
3(a)(i)	A: ribosome ;	1	
	B: plasmid ;	1	
3(a)(ii)	cytoplasm ; cell membrane ; DNA / RNA / genetic material / chromosome ; **max 2**	2	
3(a)(iii)	antigens / proteins ; on surface AW of bacteria ORA ; recognised as foreign ORA ; antibody specific to the antigen ; **max 3**	3	
3(b)(i)	antibiotic, moves / diffuses into the agar / bacteria ;	1	
3(b)(ii)	antibiotic 1: only effective against strain L;	1	
	antibiotic 5: is effective against all four strains ;	1	
3(c)(i)	N	1	
3(c)(ii)	1 variation in population ; 2 N has greatest resistance ; 3 best adapted (to environment) ; 4 they (are more likely to) survive ; 5 they (are more likely to) reproduce ; 6 beneficial alleles passed to next generation / offspring ; 7 natural selection ; **max 5**	5	

Question	Answer	Marks	Guidance
4(a)(i)	(X) goblet ; produces / secretes mucus ; (mucus) traps bacteria / pathogens / dust / particles ;	**3**	
4(a)(ii)	(Y) ciliated ; moves mucus away from lungs AW ;	**2**	
4(b)(i)	1 lower volume of air / oxygen into lungs / alveoli ; 2 reduced oxygen into blood ; 3 decrease in oxygen reaching cells / tissues / muscles ; 4 aerobic respiration limited / less ; 5 (more) anaerobic respiration ; 6 reduced ability to exercise / do activities ; **max 3**	**3**	
4(b)(ii)	increased blood pressure ; artery constriction ; atherosclerosis ; increased clotting tendency ; increased heart rate ; **max 1**	**1**	

Question	Answer	Marks	Guidance
5(a)(i)	fungi / fungus **+** *Rhizomucor*	**1**	
5(a)(ii)	cell wall made of chitin ; heterotrophic / saprotrophic / saprophytic ; filamentous / hyphae / mycelium ; eukaryotic; **max 2**	**2**	

Question	Answer	Marks	Guidance
5(a)(iii)	fungi/bacteria / *Rhizomucor pusillus* + decomposition / decomposers ; respiration ; heat / energy released ; vegetation layer insulating AW ;	**4**	
5(b)(i)	(pH) 2 / 3 + denatured ; active site of enzyme deformed / changed shape ; substrate no longer fits the active site ; optimum (pH) at 4.5 ; substrate and active site complementary AW ; ES complexes form ; starts to denature above 4.5 ; **max 4**	**4**	
5(b)(ii)	line with optimum activity at pH 4.5 + drawn above the original ;	**1**	
5(b)(iii)	fruit juice production ;	**1**	

Question	Answer	Marks	Guidance
6(a)(i)	(P) chromosome	**1**	
6(a)(ii)	(Q) nucleotide	**1**	
6(a)(iii)	C	**1**	
6(b)	(DNA) codes for proteins / polypeptides ; order of bases / base sequence ; determines sequence of amino acids; example protein;	**4**	

Question	Answer	Marks	Guidance
7(a)	1 large surface area + maximum light absorption ; 2 stomata + gaseous exchange / carbon dioxide in / oxygen out ; 3 thin + diffusion of gases / carbon dioxide in / oxygen out ; 4 air spaces / spongy mesophyll + diffusion of gases / gaseous exchange ; 5 chloroplasts / chlorophyll + absorb light ; 6 chloroplasts / chorophyll + most dense in palisade (mesophyll) ; 7 palisade in upper leaf + receive most light ; 8 xylem (vessels) + bring water (from soil) ; 9 epidermal cells no chloroplasts / transparent + light reaches cells ; **max 6**	**6**	
7(b)	***necessary (max 2):*** 1 provides (leaves with) water for photosynthesis ; 2 transports minerals / ions from roots / to leaves ; 3 provides plant cells with support / turgidity / turgor ; 4 cools the leaf / plant ; ***problem (max 2):*** 5 too much water is lost (through stomata / leaf) ; 6 (water loss) leads to wilting / death ; 7 plants may close stomata to prevent transpiration, which slows down photosynthesis ; **max 4**	**4**	