CAMBRIDGE
International Education

Cambridge O Level

BIOLOGY **5090/22**

Paper 2 Theory **May/June 2026**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

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General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

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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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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.

Annotations

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

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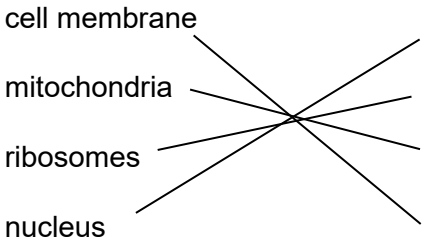
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Annotation	Meaning
SEEN	point has been noted but no credit has been given or blank page seen
	correct idea but not specific enough
	used to highlight parts of an extended response
	key point attempted / working towards marking point
Ruler	allows lengths 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.

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Question	Answer	Marks	Guidance
1(a)(i)	(an animal) with a backbone ;	**1**	**A** spine / vertebral column / vertebrae **I** spinal cord / endoskeleton
1(a)(ii)	birds ;	**1**	accept answers in either order **A** Aves
	amphibians ;	**1**	**I** named species of birds / amphibians
1(b)	scaly skin ; rubbery / leathery eggs ; cold blooded ;	**1**	**A** (skin with) scales **A** soft shelled / flexible / amniotic eggs **A** poikilothermic, ectothermic

Question	Answer	Marks	Guidance
2(a)(i)		**3**	all correct = three marks two or three correct = 2 marks one correct = 1 mark
2(a)(ii)	chloroplast ; (cellulose) cell wall ; (sap) vacuole ; **Max 2**	**2**	**I** chlorophyll **A** cytoplasm / endoplasmic reticulum

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Question	Answer	Marks	Guidance
2(b)	50 (μm) ;;;	**3**	45 / 900 or 0.05 (mm) = 1 marks 0.05 (mm) × 1000 = 2 marks **OR** 45 × 1000 or 45000 (μm) = 1 mark 45 000 / 900 = 2 marks If no other marks awarded then for 1 mark: Answer × 1000

Question	Answer	Marks	Guidance
3(a)	X = palisade mesophyll (cell) ;	**1**	**A** palisade (cell)
	Y= guard (cell) ;	**1**	**I** stomata
3(b)	(large surface area) allows **more / maximum** light to be absorbed / **more / maximum** gas exchange / diffusion of gases ;	**1**	**A** correctly named gases
	(thin) for diffusion of gases / carbon dioxide in / oxygen out	**1**	**A** short distance for gas exchange/carbon dioxide in/oxygen out
3(c)	transpiration pull ; water vapour lost from leaf / stomata ; water (molecules) held together by forces of attraction ; water moves in continuous column ; (transports water) in the xylem (from roots / to leaves) ; **Max 3**	**3**	**A** transpiration **A** water evaporates / water vapour diffuses out of leaf/stomata **A** cohesion/adhesion of water (molecules) **R** water moves by active transport **R** phloem

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Question	Answer	Marks	Guidance
3(d)(i)	softens the faeces / forms the bulk in faeces / shortens the time waste spends in body / prevents/helps constipation / helps peristalsis / regular bowel movements / decreases bowel cancer ;	1	**A** healthy gut microbiome / weight management / manage cholesterol / blood sugar levels **A** ora **I** digestion / excretion
3(d)(ii)	scurvy ;	1	

Question	Answer	Marks	Guidance
4(a)(i)	large (internal) surface area ;	1	**A** increases (internal) surface area
4(a)(ii)	glycerol and fatty acids ;	1	**R** fats / lipids
4(a)(iii)	hepatic portal vein ;	1	**I** HPV
4(b)	reduces (internal) surface area ; less / few nutrients absorbed ; (fewer) amino acids / proteins for growth ;	3	**A** less named correct nutrient **A** reduces surface area for absorption of nutrients = 2 marks **R** less protein / lipids / starch absorbed **R** no nutrients absorbed fewer amino acids absorbed for growth = 2 marks
4(c)(i)	bacterium ;	1	

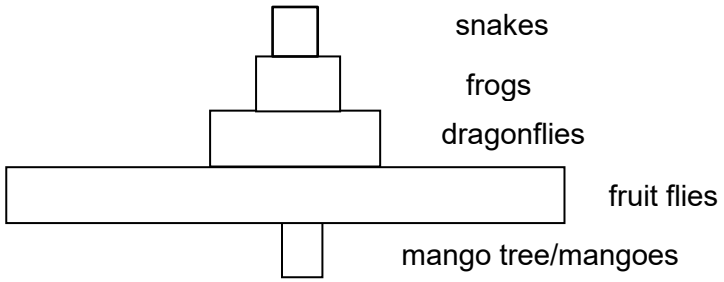
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Question	Answer	Marks	Guidance
4(c)(ii)	clean water supply ; good personal hygiene ; waste disposal / sewage treatment ; hygienic food preparation ; **Max 2**	**2**	**A** purify / distil / filter / boil / chlorination of water **A** washing hands after the toilet **A** cook / separate raw and cooked food / sterilise surfaces / wash hands/food **A** vaccination Only award hygiene / sanitation unqualified once if neither MP2 and 4 not awarded
4(c)(iii)	(chloride) ions lower the water potential (in the gut) ; water moves out of cells **or** water moves into the gut ; (water moves) down the water potential gradient ;	**3**	**A** (chloride) ions make the gut hypertonic **I** water moves out of the blood **A** (water moves) from high to low water potential **I** (water moves) down the concentration gradient

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Question	Answer	Marks	Guidance
5(a)(i)	correctly drawing the boxes ; labelling them correctly ;  	**2**	mango tree box should be smaller than the fruit flies box. All subsequent boxes form a pyramid (i.e. getting smaller in size) **R** 6 trophic levels with mango & mango tree
5(a)(ii)	producer ;	**1**	**A** primary producer
5(a)(iii)	trophic (level) ;	**1**	**R** tropic
5(a)(iv)	energy lost to environment / surrounding **or** energy transfer is inefficient (at each trophic level) ; not enough energy available to the higher levels **AW** ; **Max 2**	**2**	**A** energy lost as heat / respiration / defaecation / excretion / movement **R** growth **A** only 10–20% of energy is passed on / 80–90% lost (at each trophic level)

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Question	Answer	Marks	Guidance
5(b)(i)	increase oxygen (levels) ;	1	
	warmer conditions / increase in temperature ;	1	**R** high temperature / heat **A** hotter climate **A** more water / moisture / humidity **I** humid / moist **I** pH
5(b)(ii)	(bacteria) feed / breakdown / digest / hydrolysis (of dead / organic material) ; (bacteria) release (digestive) enzymes (onto the dead/organic material) ; saprophytic / saprotrophic / saprobiotic ; (bacteria) absorb the nutrients ; (bacteria use the nutrients/glucose) for respiration ; role in recycling nutrients ; **Max 2**	2	**I** decay / decompose **A** extracellular digestion = 2 marks **A** obtain nutrients **A** correct named example

Question	Answer	Marks	Guidance
6(a)	W = (hair) erector muscle ;	1	
	Y = sweat gland ;	1	
6(b)(i)	hypothalamus ;	1	**A** thermoregulatory centre
6(b)(ii)	vasodilation ; Z/arterioles dilate ; more blood reaches X / capillaries / surface of the skin ; X / capillaries are close to the surface of the skin ; Heat is lost (from the blood) ; **Max 3**	3	 **R** X / capillaries dilate **R** capillaries move closer to the skin surface **I** Z / arterioles close to the surface of the skin **A** increases radiation / conduction from skin **I** keep warm / releases energy unqualified **I** heat loss due to sweating

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Question	Answer	Marks	Guidance
6(c)	(shivering is) rapid AW **+** contractions of muscles ;	**1**	**A** sudden / uncontrollable / continuous contraction of muscles
	releases heat ;	**1**	**A** produces heat / thermal energy

Question	Answer	Marks	Guidance
7(a)	(a mutation) is a change in the base / nucleotide sequence (of DNA / gene) ; (sequence of bases in a gene) determines the sequence of amino acids ; (DNA / gene) codes for (specific wavy hair) protein / polypeptide ; (different sequences of amino acids) change in the protein shape / structure ;	**4**	**A** changes sequence of amino acids **R** codes for production of amino acids / amino acids code for proteins **A** contains instructions for proteins / controls protein production
7(b)	an alternative form of a / the same gene ;	**1**	**A** variation / form of a / the same gene **R** alternative form of genes
7(c)(i)	<table><tr><td></td><td>b</td><td>b</td></tr><tr><td>B</td><td>Bb</td><td>Bb</td></tr><tr><td>b</td><td>bb</td><td>bb</td></tr></table> correctly identifying the gametes ; correct cross / offspring ; probability = 50% or 0.5 or ½ or 1 in 2 or 1:1 ;	**3**	If gametes genotype are wrong = 0 marks If gametes are wrongly placed in punnet square mp2 and 3 can still be awarded **A** 2 in 4

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Question	Answer	Marks	Guidance
7(c)(ii)	random fertilisation (of gametes) ; only a small number of offspring / small sample size ; **Max 2**	**2**	**A** random fusion of gametes **A** ora

Question	Answer	Marks	Guidance
8(a)(i)	plasmid ;	**1**	
8(a)(ii)	3 (1) 2 5 4 ;;;	**3**	3 before 2 one mark 2 before 5 one mark 5 before 4 one mark
8(b)(i)	reduced use / cost of insecticides / pesticides ;	**1**	**I** cost unqualified
	increased / higher / maximum crop yields/production ;	**1**	**I** grow more crops
8(b)(ii)	could cause allergies **or** toxic (poisonous)/harm/side effects to humans ; kill pollinators ; genes **+** spread / cross pollination to wild plants ; effect on ecosystem / disrupts food chains / webs ; **Max 2**	**2**	 **A** kill helpful insects **A** named pollinator **A** loss of biodiversity **I** reference to reduced genetic variation / susceptible to disease

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Question	Answer	Marks	Guidance
9(a)	rapid ;	**1**	**A** quick / fast / sudden / immediate
	and automatic response (to a stimulus) ;	**1**	**A** involuntary / unconscious / instinct action **I** brain
9(b)	1 stimulus / wasp detected **+** by the retina / (photo) receptor / rods / cones **or** (photo)receptor / rods / cones **+** in the retina ; 2 nerve/electrical impulse ; 3 (nerve/electrical impulse) passes through optic / sensory neurone ; 4 (optic / sensory nerve sends impulse) to relay neurone (in CNS) ; 5 (impulse sent from relay neurone / CNS) through motor neurone ; 6 (from motor neurone) to the effector / (eyelid) muscles ; 7 (eyelid muscles) which contract (to close the eye / response) ; **Max 6**	**6**	**I** eye **I** signal / messages **I** brain / spinal cord / coordinator **R** consciousness involved
9(c)	(neurotransmitter molecules) diffuse across the gap ; (neurotransmitters) bind with receptor (proteins / molecules) ; cause an impulse to be stimulated in the (next) neurone ;	**3**	

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