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CAMBRIDGE
International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **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.

This document consists of **17** printed pages.

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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	‘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.

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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
	incorrect or 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
	point has been noted, but no credit has been given or blank page seen
	correct awarding one mark from marking point or marking group 1. similar numbered ticks are used for marking point or marking groups 2, 3, 4 etc.

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Annotation	Meaning
	pages are linked together
	used to highlight part of the response
	used to highlight parts of an extended response
	used to highlight parts of an extended response
	Point already given
	Maximum mark reached
	Key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
	Maximum number of marks for a marking point has been awarded.

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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

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Question	Answer	Marks	Guidance
1(a)(i)	0.45 ;	1	
1(a)(ii)	**1** (as windspeed increases the rate of transpiration) increases / there is a positive correlation / AW ; **2** not a linear relationship / greater increase in (transpiration) rate at higher wind speeds / AW ;	2	**A** (rate of) water uptake for transpiration **I** linear in MP1 **A** exponential / not linear / AW in MP2
1(a)(iii)	*any one from:* not all of the water (taken up by the plant) is lost through transpiration ; (named) use of water by a plant ;	1	MP2 e.g. photosynthesis / turgidity / enzyme reactions / solvent MP2 **R** used in respiration MP2 **A** released from respiration
1(a)(iv)	*any two from:* **1** temperature ; **2** humidity ; **3** AVP ;; e.g. • light intensity • soil moisture / AW • carbon dioxide, concentration / level	2	MP1 **A** heat MP2 **A** moisture (in air)
1(b)	*any four from:* **1** transpiration pull ; **2** water moves up the xylem ; **3** there is a column of water molecules (in the xylem) ; **4** water molecules are held together by forces of attraction between them / AW ; **5** loss of water from leaf (cells) lowers water potential at the top of the plant / in the leaf / AW ; **6** (this) pulls on / creates tension, on water molecules (in xylem) ; **7** water evaporates / water vapour moves, from the, surfaces / cell walls, of mesophyll cells OR water evaporates into air spaces in the mesophyll ; **8** loss of water (vapour) by diffusion, through stomata (out of leaf) ;	4	MP2 **A** water moves from root to leaf MP4 **A** cohesion between water molecules

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Question	Answer	Marks	Guidance
2(a)	**1** produced as rapidly as it is used **;** **2** (idea that it) does not run out **;**	**2**	MP1 **A** it is renewable MP1 **I** regrown / reused / recycled
2(b)	*any three from:* **1** plants / producers / phytoplankton / algae (use light) to photosynthesise **;** **2** light <u>energy</u> is converted to, chemical energy / glucose **;** **3** more, plants / producers / food / (chemical) energy / biomass (for the fish) **;** **4** (so more / faster) production of new cells / (named) tissues (in fish) **;** **5** **AVP ;**	**3**	MP4 **A** fish can reproduce (more) e.g. (photosynthesis produces) oxygen for <u>aerobic</u> respiration (of fish) / less competition (between tilapia) for food
2(c)(i)	<u>nitrate</u> **;**	**1**	**A** ammonium (ions)
2(c)(ii)	(needed for,) growth / repair (tissues) / **AVP ;**	**1**	**A** making, muscle / enzymes / antibodies / hormones / new cells / named protein **I** ref. to energy **R** repair cells
2(c)(iii)	eutrophication **;**	**1**	**I** algal bloom
2(d)	*any four from:* **1** holes should be large **; ora** **2** small / young / non-target / AW, fish escape **OR** only, large / old / target, fish are caught **;** **3** small / young / escaped, fish are able to, grow (to adults) / reach sexual maturity / reach breeding age **; ora** **4** (small / young / escaped fish) can reproduce **; ora** **5** (results in) larger / maintains, populations / number, of a fish (species) (in the wild) **; ora**	**4**	MP1 **I** nets are large MP5 **A** more young fish produced to replace older ones that are caught

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Question	Answer	Marks	Guidance
2(e)	*any six from:* **1** climate change / global warming / (enhanced) greenhouse effect **;** **2** (climate change / changed environment / less genetic variation) means that species less able to adapt / evolve (fast enough) **;** **3,4** named example of habitat destruction **;;** **5** (habitat destruction / pollution) causes a lack of (named) / more competition for, resources (necessary for survival) **;** **6** hunting (by humans)**;** **7** overharvesting **;** **8,9** named examples of pollutants **;;** **10** (hunting / overharvesting / pollution / habitat destruction / climate change / competition for resources) causes a decrease in, the <u>population</u> size / number of <u>a species</u> **;** **11** (decreased population size results in) less genetic variation (within the species) **;** **12** (decreased population size results in) reduced reproduction / harder to find a mate **;** **13** introduced / invasive / alien, species OR new predator **;** **14** causes (too much) competition with (local) species (for resources) **;** **15** disruption of, food chain / web OR description **;** **16** example of consequence of disrupted ecosystem **;** **17** disease that kills, whole / most of a, population (before the population can recover) / AW **;** **18** **AVP** **;**	**6**	MP1 **A** (increased) (named) greenhouse gas emissions MP3 **A** <u>habitat,</u> destruction / loss MP3 / 4 examples: urbanisation / deforestation / mining / land clearing / monocultures / intensive livestock farming / natural disasters that would destroy habitat (e.g. flooding, drought / fires ...) MP8 **A** <u>pollution</u> MP8 / 9 examples: pesticide / (non-biodegradable) plastics / poison / excess fertiliser / (untreated) sewage (water) / oil spill / nuclear radiation etc. MP8 / 9 **I** (named) greenhouse gases MP11 **A** reduced, gene pool / inbreeding / genetic diversity MP15 **I** disruption of ecosystem unqualified MP16 examples – fewer pollinators resulting in less reproduction of plant MP17 **A** 'all / many, individuals' for 'whole / most of a, population'

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Question	Answer	Marks	Guidance
2(f)	*any five from:* **1** ref. to (female given) fertility drugs / LH **and** FSH / drugs for ovulation / drugs for egg production (AI or IVF) **;** **2** ref. to screening / selecting / quality checking, sperm (AI / IVF) / embryos (IVF) / eggs (IVF) **;** **3** freeze, semen / sperm (AI or IVF) / embryos (IVF) / eggs (IVF) OR use sperm bank (AI) OR use sperm (AI or IVF) or eggs (IVF) or embryos (IVF) collected, far away / long ago **;** *artificial insemination* **4** semen / sperm / male gamete, collected / extracted **;** **5** semen / sperm / male gamete, inserted into, <u>vagina</u> / <u>uterus</u> / (near) <u>cervix</u> / <u>oviduct</u> **;** **6** ref. to (sperm insertion) at the time, of fertility / ovulation **;** *in vitro fertilsation* **7** gametes / eggs **and** sperm, collected / extracted **;** **8** fertilisation / described, occurs, outside the body / in a dish / in a laboratory / AW **;** **9** <u>embryo</u> inserted in <u>uterus</u> **;** **10 AVP ;**	**5**	MP2 **R** screening of sperm **and** eggs for AI MP3 **A** gametes for eggs **and** sperm MP4 **R** extract / collect of sperm **and** eggs MP8 **A** egg <u>nucleus</u> and sperm <u>nucleus</u> fuse / join / combine, outside the body / AW MP8 **A** inject / insert, sperm into egg e.g. use of surrogate mother (IVF) / many embryos can be inserted at the same time (IVF) / gametes selected from different populations / AW, to improve genetic variation

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><th>name</th><th>letter from Figure 3.1</th><th>function</th></tr>
<tr><td><u>sperm duct</u></td><td>E</td><td>transports / AW, sperm (from testis / to, urethra)</td></tr>
<tr><td>prostate gland</td><td>D</td><td>produces / secretes, seminal / nutrient-rich / alkaline, fluid (for sperm cells to use)</td></tr>
<tr><td>scrotum</td><td>F</td><td>holds / contains / protects / AW, the <u>testes</u> (outside the body)</td></tr>
<tr><td>ure<u>thra</u></td><td>G</td><td>tube for urine and semen to pass through</td></tr>
<tr><td>penis</td><td>H</td><td>delivers / passes / AW, sperm / semen, into the <u>vagina</u> OR for <u>urination</u> OR <u>removal</u> / <u>excretion</u> of urine OR <u>urine</u> released out the body</td></tr>
</table>
;;;;;
</td><td>5</td><td>one mark per correct row

MP1 I transports, seminal fluid / semen
MP1 R transports urine and sperm

MP2 I produces semen (fluid)
MP2 A stops urine release during sperm release

MP3 A allows, sperm / testes, to be cool(er)
MP3 I regulate / maintain, temperature</td></tr>
</table>

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Question	Answer	Marks	Guidance
3(b)	*any four from:* **1** (**J**) produce sperm / male gametes **;** **2** for sexual reproduction **;** **3** to halve the number of chromosomes / produce haploid (daughter / sperm) cells **OR** reduction division **;** **4** so that sperm can fertilise an, egg (cell) / female gamete **;** **5** (zygote / fertilised egg / offspring) is diploid / has two sets of chromosomes **;** **6** allows genetic variation (between sperm / in offspring, to occur) **;** **7** (sperm) determines the sex of the offspring / maintains a 50:50 ratio between the sexes in a population **;**	**4**	MP3 **A** 46 to 23 chromosomes MP4 **A** sperm nucleus can, fuse / join / combine, with egg nucleus MP5 **A** maintains diploid number, from one generation to the next / AW MP6 **A** creates genetically different (daughter) cells MP7 **A** sperm will have either an X or a Y chromosome

Question	Answer	Marks	Guidance
4(a)	carbon **and** hydrogen **and** oxygen (in any order) **;**	**1**	
4(b)(i)	(urea) **Q ;** (pepsin) **L ;**	**2**	
4(b)(ii)	**1** glucagon **;** *any two from:* **2** (stimulates) the breakdown / conversion / AW, of glycogen to glucose **;** **3** in liver (cells) **;** **4** prevents glucose uptake (into liver cells) **;**	**3**	MP1 **I** adrenaline / insulin MP2 **ecf** if glucagon and glycogen are switched with each other MP3 **I** muscle
4(b)(iii)	adrenaline **;**	**1**	**A** glucagon as **ecf** if it was not given in **Q4(b)(ii)**

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Question	Answer	Marks	Guidance
4(c)	*any three from:* *without diabetes* **1** (blood glucose concentration) is always lower **; ora** **2** (blood glucose concentration) increases more slowly / increases by a smaller concentration / AW **; ora** **3** (blood glucose concentration) decreases / returns to initial concentration, faster **; ora** **4** comparative data quote **;**	**3**	MP1 **A** (blood glucose concentration) is lower, at start / AW MP3 **A** (blood glucose concentration) returned to initial concentration in 5 or 5.5 or 6 hours (with) and 2.5 hours without MP4 units must be stated at least once for both variables
4(d)	*any three from:* **1** insulin, injection / therapy / patch / pump **;** **2** monitoring <u>blood</u> glucose / regular <u>blood</u> glucose tests **;** **3** counting / monitoring, (named) carbohydrates (in diet) **;** **4** matching, food / carbohydrate, intake to activity **;** **5** keeping a healthy weight **;** **6** pancreas transplant OR islet / beta / stem, cell, transplant **;** **7** **AVP ;**	**3**	MP1 **I** insulin unqualified MP1 or MP2 **A** artificial pancreas / closed loop system MP3 **A** limit alcohol intake **OR** restrict, carbohydrate / sugar, content (of diet) MP7 e.g. immunotherapy **OR** regular exercise **OR** consuming, sugar /glucose, if blood glucose is low

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Question	Answer	Marks	Guidance
5(a)	*any six from:* **1** ref to <u>osmosis</u> **;** **2** water moves across a partially / AW, permeable membrane **;** **3** concentration of salt solution in **A** is lower than in **B ; ora** **4** water moved into cells in **A ;** **5** volume of, vacuole / cell sap / cytoplasm, increased in **A ;** **6** (lighter colour) because the vacuole / cell sap / cytoplasm takes up more space / is less concentrated / AW **; ora** **7** because (salt) solution **A** has a high<u>er</u> water <u>potential</u> than cells / (salt) solution **A** is <u>hypotonic</u> (compared with cells) / (salt) solution **A** has a low<u>er</u> <u>concentration</u> (of salt) than in the cells **; ora** *in solution **A***: **8** cell, membrane / contents / sap / water / cytoplasm, pushes on cell wall OR turgor <u>pressure</u>, has increased / is high **;** **9** cell wall prevents cells from bursting / AW **;** *in solution **B***: **10** cell membrane / cytoplasm, comes away from the cell wall / turgor <u>pressure</u> has decreased **;**	**6**	MP2 **A** semi / selectively, permeable membrane MP4 **ora**: water moved out of <u>cells</u> in **B** MP5 **ora**: volume / size of, vacuole / cell sap / cytoplasm, decreased in **B** MP6 **ora**: (darker colour of cell sap) because the vacuole / cell sap / cytoplasm, take up less space / is more concentrated / AW **;** MP7 **ora**: because (salt) solution **B** has a low<u>er</u> water <u>potential</u> than cells / (salt) solution **B** is <u>hypertonic</u> (compared with cells) / salt solution **B** has a high<u>er</u> <u>concentration</u> (of salt) than in the cells **Alternative approach for MP4 to MP7:** no net movement of water / water did not move in or out of cells in **A ;** volume of, vacuole / cell sap / cytoplasm, stayed the same in **A ;** (lighter colour) because the vacuole / cell sap / cytoplasm, takes up more space / / is less concentrated / AW **;** because salt solution **A** has the same water <u>potential</u> than cells / salt solution **A** is <u>isotonic</u> (compared with cells) / salt solution **A** has the same <u>concentration of salt</u> than in the cells **;** MP7 **I** water concentration
5(b)(i)	*any three from:* **1** produce (new) cells **;** **2** (for) growth / increase in length (of root) **;** **3** repair of (damaged) tissues **;** **4** replacement of cells **;** **5** <u>asexual</u> reproduction **;**	**3**	MP2 **I** <u>cell elongation</u> MP4 **I** repair cells MP5 **A** production of tubers

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Question	Answer	Marks	Guidance
5(b)(ii)	to produce, unspecialised / genetically identical / undifferentiated, cells **OR** to produce / form, (daughter) cells that (can then become) specialise / named specialised cell in a root **;**	**1**	**A** make more stem cells **A** to <u>produce</u>, root hair cells / root cortex cells / phloem / xylem
5(b)(iii)	<u>chlorophyll</u> **;**	**1**	**I** chloro<u>plast</u>
5(b)(iv)	*any three from:* **1** by <u>active transport</u> **;** **2** (mineral ions absorbed) across / through, a <u>cell</u> membrane **;** **3** into root hair (cells) **;** **4** (mineral ions absorbed by active transport) from a low(er) concentration to high(er) concentration OR against the concentration gradient **;** **5** (active transport uses) energy (from respiration) / ATP **;** **6** (active transport uses) <u>protein</u>, carriers / pumps / channels / molecules, (in the cell membrane) **;** **7** <u>diffusion</u> (of mineral ions) if they are in a higher concentration, outside cells / in soil **;**	**3**	MP7 **I** diffusion unqualified

Question	Answer	Marks	Guidance
6(a)(i)	**Q** atrioventricular valve **;** **R** semilunar valve **;** **S** <u>left</u> ventricle	**3**	
6(a)(ii)	**T** **;**	**1**	
6(a)(iii)	<u>vena cava</u> **;**	**1**	
6(a)(iv)	lung(s) **;**	**1**	
6(b)	<u>coronary</u> (artery) **;**	**1**	

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Question	Answer	Marks	Guidance
6(c)	**1** twice / two (times) ; **2** double ; **3** high(er) ; **4** (aerobic) respiration ;	**4**	**A** more / increase

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