CAMBRIDGE
International Education

Cambridge IGCSE™

BIOLOGY **0610/41**

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)	active transport **;**	**1**	**A** facilitated diffusion / active uptake
1(b)(i)	as surface area (to volume ratio) decreases, the time taken (for the cube to turn completely red / for the acid to move through the cube) increases / **ora ;** correct ref. to diffusion **;** *idea that* (smaller surface area / bigger cube) there is a greater distance for acid (particles) to move through, (to reach the centre) / **ora ;**	**3**	less surface area reduces the rate of diffusion = MP1 and MP2 **A** largest ratio / largest surface area, is the fastest **R** osmosis for MP2 e.g. acid moves through the cube by diffusion
1(b)(ii)	*any three from:* the time taken for (all) cubes to turn red decreases **;** increasing temperature increases the kinetic energy (of the particles / AW) **;** increasing (the rate of) diffusion **;** *idea that* the same relationship between time and surface area : volume ratio still applies **;**	**3**	**A** faster time for cubes to turn red

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Question	Answer	Marks	Guidance
1(c)	*any six from:* **1** ref. to <u>osmosis</u> **;** **2** water moves (into / out of cells), across / through, a partially / AW, permeable membrane **;** *cells in the highly concentrated salt solution* **3** *idea that* cells have a higher water potential than the salt solution / **ora ;** **4** cells / vacuole / cell sap / cytoplasm, decreases in volume / turgor <u>pressure</u> decreases **;** **5** become, flaccid / plasmolysed **OR** cell membrane, pulls away / AW, from cell wall **;** *cells in distilled water* **6** *idea that* cells have a lower water potential than distilled water / **ora ;** **7** cells / vacuole / cell sap / cytoplasm, increase in volume / turgor <u>pressure</u> increases **;** **8** become turgid / cell contents push against cell wall **;**	**6**	**A** tissue for cells throughout **A** low / lack of / no, turgor pressure **I** cell shrinks **A** turgor pressure is high / has turgor pressure **R** cells bursting / lysis for MP8 **A** cell membrane pushes against cell wall

Question	Answer	Marks	Guidance
2(a)(i)	*amylase* - mouth / small intestine **;** *pepsin* – stomach **;**	**2**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2(a)(ii)</td><td>1 test-tube 1 turns red and test-tube 2, stays blue / does not change ;

plus any four from:

test-tube 1
2 amylase breaks down starch into (named) reducing sugar ;

3 (shape of the) <u>active site</u> of amylase is complementary to starch ;
4 enzyme-substrate complexes are formed ;

test-tube 2
5 pepsin does not break down starch / pepsin breaks down proteins ;

6 (shape of the) <u>active site</u> of pepsin is not complementary to starch ;

7 no enzyme-substrate complexes are formed ;</td><td>5</td><td>A green / brown / orange / yellow for red
A substrate for starch throughout
A digest for break down throughout
I converts / turns for break down

A simple sugar / glucose / maltose for named reducing sugar
R sucrose for MP2

A active site or enzyme, fits / binds to for ESC formation for MP4 and MP7

I pepsin does not change / has no effect on starch
A active site of pepsin is only complementary to protein</td></tr>
<tr><td>2(b)</td><td>carbon and hydrogen and oxygen ;</td><td>1</td><td>all three required for the mark
A in any order A symbols CHO
R molecules e.g. H_2, O_2
R additional substances</td></tr>
<tr><td>2(c)</td><td><table><tr><th>large molecule</th><th>small molecules</th></tr><tr><td>glycogen</td><td>glucose</td></tr><tr><td>cellulose</td><td>glucose</td></tr><tr><td>protein</td><td>amino acids</td></tr><tr><td>fats / oils</td><td>fatty acids and glycerol</td></tr></table>;;</td><td>2</td><td>one mark for each correct column
R additional incorrect molecules

A maltose for glucose
I disaccharides / simple sugars / hexoses

A polypeptides

A lipids / triglycerides for fat</td></tr>
</table>

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Question	Answer	Marks	Guidance
2(d)	in assimilation nutrients are, taken up / used, by cells **;** in absorption nutrients are moved from the intestines to the blood **;**	**2**	**I** food / substances / materials, for nutrients **A** molecules / digested food / food molecules / products of digestion / nutritional compounds / minerals, for nutrients **A** duodenum / ileum / villi, for small intestine
3(a)(i)	*any five from:* **1** ref. to translocation **;** **2** carbon dioxide (containing ^{14}C) is <u>taken into</u> the leaf (by diffusion) **;** **3** correct ref. to photosynthesis, occurring / described **;** **4** sucrose / glucose / amino acids, contains, the radioactive carbon / ^{14}C **;** **5** glucose converted to sucrose **;** **6** sucrose / amino acids / radioactive carbon / ^{14}C , is transported in the phloem **;** **7** (sucrose / amino acids / radioactive carbon / ^{14}C) transported / AW, to the root **OR** not, transported / AW, to the top of stem **;** **8** leaf acts as a source and roots act as a sink **;**	**5**	**A** carbon dioxide absorbed by leaf **A** ^{14}C in carbon dioxide / radioactive carbon dioxide, is used to make glucose **R** substances being transported in the phloem **AND** xylem **I** glucose / sugars / minerals / ions / nutrients, being transported **R** radioactive carbon taken in through the soil for MP7 **A** not transported to upper part of plant

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Question	Answer	Marks	Guidance
3(a)(ii)	acts as a control ; *plus* to show where (sucrose / amino acids / radioactive carbon / ^{14}C) is found when phloem is intact ; **OR** to see if the effect is due to ringing ; **OR** to compare with the effect of ringing ;	**2**	**I** just 'to compare with plant A' **A** to show that movement occurs when phloem is intact **R** movement of water through phloem **A** to show the effect without ringing
3(b)	reduces (rate of transpiration) ; (because there are) fewer <u>stomata</u> / water is lost through <u>stomata</u> ;	**2**	**A** water (vapour) diffuses through stomata
3(c)	no effect (on the rate of transpiration) ; (transpiration) occurs through xylem / xylem transports water ;	**2**	**A** remains the same **I** does not affect it much **I** xylem not removed unqualified (in the question stem)
3(d)	vascular bundles ;	**1**	**A** veins / midrib
3(e)	xylem ;	**1**	

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Question	Answer	Marks	Guidance
4(a)	*any three from:* **1** *idea that* heart rate increases at the start of the race **and** decreases after the race **;** **2** the heart rate, before the race / between 0 and 1 minute, is 40 bpm **;** **3** heart rate increases to 180 bpm (between 1 and 2 minutes) **;** **4** heart rate remains, at 180 bpm / constant / plateaus, for 2 minutes / between 2 and 4 minutes / until the end of the race **;** **5** heart rate decreases to, 40 bpm / resting / initial value, at 7 minutes / 3 minutes after the race finishes **;** **6** there is a more, rapid / AW, increase in heart rate than decrease **;**	**3**	once you have seen units once you can apply to the rest of the response **A** resting / initial / at the start, heart rate is 40 bpm **I** lowest / normal / regular, heart rate is 40 bpm **A** increases by 140 bpm / heart rate reaches 180 bpm from 40 bpm **I** maximum / peak, heart rate is 180 bpm **A** stable for constant **A** heart rate increases steeply and decreases gradually
4(b)(i)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ **;;**	**2**	MP1 for products MP2 for reactants **R** word equation / photosynthesis equation max 1 if = used instead of an arrow **I** +, ATP / energy, as a product
4(b)(ii)	(aerobic respiration increases) to release energy **;** for muscle contraction **;**	**2**	**R** produces / forms / makes, energy **A** produces ATP / supplies or provides energy **A** (aerobic respiration increases) as energy is needed
4(b)(iii)	mitochondria **;**	**1**	**A** mitochondrion

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Question	Answer	Marks	Guidance
4(c)	*any four from:* **1** correct ref. to oxygen debt **;** **2** anaerobic respiration occurs **;** **3** production / build-up / AW, of lactic acid in, muscles / blood **;** **4** transport of, lactic acid / oxygen, (in the blood) to the liver **;** **5** lactic acid is, broken down using oxygen / oxidised / aerobically respired **;**	**4**	
4(d)	*any two from:* increase in blood glucose concentration **;** increase in breathing, rate / depth **;** **AVP ;**	**2**	**A** increase in breakdown of glycogen to glucose / stimulates release of glucagon / high blood glucose concentration e.g. (named) airways widen / diversion of blood flow (to muscles)
4(e)	*any two from:* have valves, to prevent backflow of blood / AW **;** have a large lumen, to provide less resistance to blood flow / allow large volumes of blood to flow / to carry blood at low pressure **;** have thin walls so blood is, moved by / AW, (contraction of), surrounding / AW, muscles **;**	**2**	both structure and explanation required for the mark **A** big / wide for large **A** large lumen, to allow more blood to flow / maintain low (blood) pressure / reduce (blood) pressure / for low pressure (blood) **R** contraction of muscular walls **R** thin cell walls **A** skeletal muscles for surrounding muscles

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Question	Answer	Marks	Guidance
5(a)(i)	(a group of) organisms that can reproduce ; (to produce) fertile offspring ;	2	
5(a)(ii)	*any three from:* **1** increased, biodiversity / species diversity / AW ; **2** increased (chance of), pollination / fertilisation ; **3** *idea of* (better) maintenance of, food chains / food webs ; **4** less risk of species becoming, endangered / extinct ; **5** reduction in, pesticide / insecticide, use ; **6** improve soil fertility ; **7** **AVP** ;	3	**I** genetic variation **A** increased pollinator species number / increased diversity of pollinators or plants **I** more pollinators / data quotes / increased variation of pollinators **A** increased chance of / more efficient, reproduction or pollination **I** faster pollination **A** more food, chains / webs **A** less disruption of food chains e.g. increase in habitat variety / number of habitats **I** prevent habitat loss
5(b)(i)	stigma ; offspring ; generations ; artificial selection / selective breeding ;	4	
5(b)(ii)	reduces competition (with weeds) / kills weeds / stop weeds growing ;	1	**A** examples of reduction in competition **R** pests for weeds

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Question	Answer	Marks	Guidance
5(c)	*any four from:* **1** ref. to photosynthesis **;** **2** carbon dioxide is a greenhouse gas **;** **3** carbon dioxide accumulates in / less carbon dioxide removed from, the atmosphere **;** **4** carbon dioxide, absorbs / traps / reemits, (thermal or infrared) radiation / heat **;** **5** leading to, enhanced greenhouse effect / global warming **;** **6** release of carbon dioxide from, (felled) decaying / burnt, trees **;** **7** less transpiration **;**	**4**	**A** trees are a carbon sink / trees fix carbon / carbon fixation **A** carbon dioxide increases / remains, in the atmosphere **A** thermal energy / IR **A** release of carbon dioxide from decomposition **A** disruption to water cycle

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Question	Answer	Marks	Guidance
6(a)	**E ;** **B ;** **D ;**	**3**	**R** each additional letter
6(b)(i)	4.0 (%) **;;;**	**3**	MP1 evidence of correct selection of data and calculation of difference i.e. 306.4 – 294.2 / 12.2 MP2 correct percentage decrease calculation to any number of decimal places i.e. (12.2 ÷ 306.4) × 100 = 3.981723238 etc. MP3 correct rounding to one decimal place **A** two decimal places **ecf** from previous step 4.0(%) with no working = 3 marks
6(b)(ii)	temperature of blood **;** detected / monitored, by brain **;**	**2**	**A** detected by, receptors in brain / hypothalamus **I** detected by thermoreceptors, unqualified / in the skin **I** signals being sent to brain
6(b)(iii)	*any three from:* ref. to vasoconstriction **;** arterioles, constrict / become narrower **;** less blood flows to (skin) surface capillaries **;** **AVP ;**	**3**	arterioles vasoconstrict = MP1 and MP2 **R** contract **R** capillaries / blood vessels move for MP3
6(c)	blood glucose concentration / **AVP ;**	**1**	

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