CAMBRIDGE
International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/41**

Paper 4 Theory (Extended) **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.

Annotations

Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
	information missing or insufficient for credit
	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
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied
	response is too vague or there is insufficient detail in response
	incorrect point or mark not awarded

Annotation	Meaning
SEEN	point has been noted, but no credit has been given or blank page seen
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
BP	blank page
	unclear response
LNK	two statements are linked
FT	follow through
IR	irrelevant material that does not answer the question

Question	Answer	Marks
1(a)(i)	lipase ;	1
1(a)(ii)	glycerol ;	1
1(b)(i)	increases ;	1
1(b)(ii)	130 **and** 370 ; $\frac{240 \times 100}{130}$ **OR** ((370 ÷ 130) × 100) − 100 ; 185 (%) ;	3
1(c)	active transport is against a **concentration gradient and** diffusion is down a **concentration gradient** **OR** active transport is movement from a low to high **concentration and** diffusion is movement from high to low **concentration** / AW ; *then any **one** from:* active transport requires energy / diffusion does not require energy ; both transport (food) molecules across a cell membrane ;	2

Question	Answer	Marks
2(a)(i)	anther ;	1
2(a)(ii)	pollen is transferred (by wind) ; (pollen moves) from anther to stigma ;	2
2(b)	enzyme denatures ; active site changes **shape** ; active site no longer complementary to substrate / substrate no longer fits active site ;	3

Question	Answer	Marks
2(c)(i)	(tube **A**) **light not needed for germination** (so indicator turns yellow) ; (tube **C**) water is required for **germination** (so indicator stays red) ;	**2**
2(c)(ii)	respiration ; oxygen ; $C_6H_{12}O_6$;	**3**

Question	Answer	Marks
3(a)(i)	plasmid labelled ;	**1**
3(a)(ii)	*any **two** from:* cell wall ; ribosomes ; cell membrane ; cytoplasm ;	**2**
3(b)(i)	*idea that* it helps prevent antibiotic resistance **in bacteria** ; *idea that* antibiotic becomes less effective (due to over use) / owtte ;	**2**
3(b)(ii)	(defence against a pathogen by) production of antibodies ;	**1**
3(c)(i)	decomposer ;	**1**
3(c)(ii)	*any **one** from:* hygienic food preparation ; personal hygiene / good hygiene ; clean water supply ; waste disposal ; AVP, e.g. vaccination ;	**1**

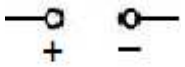
Question	Answer	Marks
4(a)	evaporation ; freezing ;	**2**
4(b)	(changing arrangement) from regular / fixed, to irregular / random ; (changing movement) from (particle) vibration to idea of , moving / sliding over each / move more freely ;	**2**
4(c)(i)	chromium / nickel / carbon ;	**1**
4(c)(ii)	different sized atoms ; (layers/atoms) can no longer slide over each other (in an alloy) / owtte;	**2**
4(d)	(Fe_2O_3) loses oxygen ;	**1**

Question	Answer	Marks
5(a)(i)	red-brown ;	**1**
5(a)(ii)	*melting point:* from −100 to +24 (°C) inclusive ; *physical state*: solid ;	**2**
5(b)(i)	displacement ;	**1**
5(b)(ii)	chlorine + potassium bromide → potassium chloride + bromine ;	**1**
5(b)(iii)	(chlorine is) less reactive than fluorine ;	**1**
5(c)	$3I_2 + 2Fe \rightarrow 2FeI_3$;	**1**
5(d)(i)	addition ;	**1**
5(d)(ii)	orange / orange brown *to* colourless ;	**1**

Question	Answer	Marks
6(a)	add **excess** copper oxide (to the acid) ; filter (to remove the excess copper oxide) ; evaporate (some) **water** ; filter **crystals** / separate **crystals** / method of drying **crystals** slowly (e.g. warm oven / between filter paper / leave in an open space) ;	**4**
6(b)	sodium with 8 crosses in outer shell ; chloride with 7 dots and 1 cross in outer shell ; (1)+ and (1)– charges ;	**3**
6(c)	(giant) lattice / regular ; (ions are) alternating ;	**2**

Question	Answer	Marks
7(a)(i)	chemical ;	**1**
7(a)(ii)	(efficiency =) $\frac{\textbf{useful (energy) output}}{\textbf{total (energy) input}}$; ($\times$ 100%)	**1**
7(b)	$a = \Delta v \div \Delta t$ / 18 ÷ 4.0 ; 4.5 (= ~5 m / s^2)_;	**2**
7(c)	$F = ma$ / 2000 $\times$ 4.5 ; 9000 ; N ;	**3**
7(d)	$E_K = \frac{1}{2} mv^2$ / ½ $\times$ 2000 $\times$ (23^2 – 5.0^2) / 529 000 or 25 000 (evidence of use of formula) ; 504 000 (J) ;	**2**

Question	Answer	Marks
8(a)(i)	tyre **A** *(no mark)* same force (on both tyres due to shared weight of motorcycle) ; (over) smaller area (so greater pressure on road) / ORA ;	**2**
8(a)(ii)	moving particles colliding with, tyre / wall / owtte ; (particle / they) create / exert, a force **and** reference to area ;	**2**
8(b)(i)	radio waves ;	**1**
8(b)(ii)	3.0×10^8 (m / s) ;	**1**
8(b)(iii)	$v = f\lambda$ / $3.0 \times 10^8 \div 3.5 \times 10^8$; 0.86 (m) ;	**2**

Question	Answer	Marks
9(a)(i)	 **AND** current **only** flows in one direction in LED / current only able to flow in this direction through LED ;	**1**
9(a)(ii)	current in motor = 6.6 – 0.30 = 6.3 A ; $R = V \div I$ / 9.0 ÷ 6.3 ; 1.4 (Ω) ;	**3**
9(b)(i)	generator ;	**1**
9(b)(ii)	work ; charge ;	**2**
9(c)(i)	$v = 2\pi r \div T$ *(in any form)* / $2 \times \pi \times 15\,000 \div 17$; 5500 or 5.5×10^3 (s) ;	**2**
9(c)(ii)	13.8 billion years ;	**1**