

Cambridge IGCSE™

CO-ORDINATED SCIENCES**0654/43**

Paper 4 Theory (Extended)

May/June 2025

MARK SCHEME

Maximum Mark: 120

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.

This document consists of **19** printed pages.

PUBLISHED**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 '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.

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

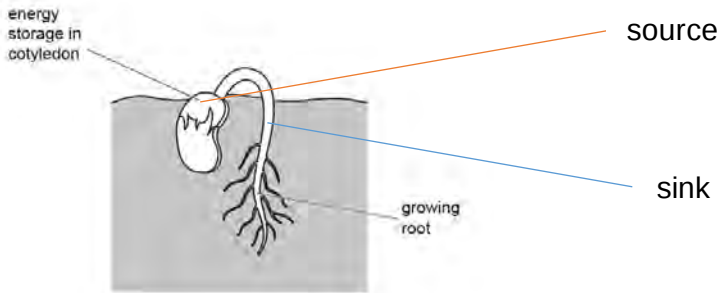
Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
	benefit of the doubt given
	follow through
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied.
	response is too vague or there is insufficient detail in response
	error carried forward applied
	information missing or insufficient for credit
	unclear response
	incorrect or insufficient point ignored while marking the rest of the response

Annotation	Meaning
	incorrect point or mark not awarded
	two statements are linked
	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
	blank page

Question	Answer	Marks
1(a)	X on right hand side of circulatory system;	1
1(b)	any three from: blood circulated more quickly (in mammalian system); high blood pressure (around body); low blood pressure to lungs ; more effective delivery of oxygen / nutrients (in mammalian system); oxygenated and deoxygenated blood kept separate;	3
1(c)(i)	to allow movement of substances in and out of blood;	1
1(c)(ii)	large surface area / good ventilation (with water);	1
1(d)(i)	$127\,750 / 1.278 \times 10^5$ (platelets per mm^3);	1
1(d)(ii)	(platelets) below healthy range; AND any 2 from less clotting; (more) entry of pathogens into wound; increased blood loss;	3

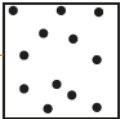
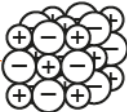
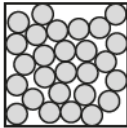
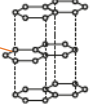
Question	Answer	Marks
2(a)(i)	any three from: increased respiration; increased energy requirement; increased muscle contraction; (muscles) need more oxygen / glucose; increase in carbon dioxide concentration (detected by brain); blood pumped faster;	3
2(a)(ii)	any three from: (blood temperature) detected by brain; (increase in) sweat; vasodilation / widening of arterioles; increased blood flow to capillaries / skin surface ; relaxation of hair muscles / hair lies flat;	3
2(b)(i)	a substance/chemical taken into the body; that, affects/modifies/changes, chemical reactions;	2
2(b)(ii)	balanced diet / less stress / stop smoking;	1

Question	Answer		Marks								
3(a)	C; G;		2								
3(b)	<table><tr><th>feature</th><th>function</th></tr><tr><td>flagellum</td><td>produces swimming / movement;</td></tr><tr><td>mitochondria</td><td>release energy (for swimming);</td></tr><tr><td>acrosome;</td><td>contains enzymes to digest the jelly coat on the egg</td></tr></table>	feature	function	flagellum	produces swimming / movement;	mitochondria	release energy (for swimming);	acrosome;	contains enzymes to digest the jelly coat on the egg		3
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3(c)(i)	(length of) DNA which contains, genetic information / genes;		1								
3(c)(ii)	haploid;		1								
3(d)(i)	antibiotics; mutation;		2								
3(d)(ii)	reducing number of sexual partners / abstaining (from sex); using condoms / preventing transfer of bodily fluids during sex; AVP;;		2								

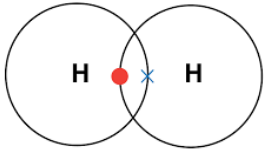
Question	Answer	Marks
4(a)	 source label to the cotyledons; sink label to the roots;	2
4(b)	any three from starch (in seeds) is energy store; starch is a large molecule (so cannot be transported); amylase breaks down starch to (simple reducing) sugars; (sugars) used in respiration; energy needed (for growth of plant);	3
4(c)(i)	two comparative differences;;	2
4(c)(ii)	enzyme is denatured; active site no longer complementary to substrate / starch;	2
4(c)(iii)	idea that in cells / small intestine, pH value stays the same but outside cells it, varies / changes;	1

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Question	Answer	Marks
5(a)	(impure because) idea that there is more than one spot;	1
5(b)	A and B;	1
5(c)	$R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$ $0.80 = 2.8 \div \text{distance travelled by solvent}$ distance travelled by the solvent = $2.8 \div 0.80$; 3.5 (cm);	2
5(d)	separation idea that particles in a liquid are slightly further apart than in a solid (but still touching) / ORA; motion idea that particles in a liquid move faster (than in a solid) / ORA / idea that particles move randomly in a liquid but vibrate (about a fixed position in a solid);	2

Question	Answer	Marks
5(e)	The substance is a gas.  The substance is an ionic solid.  The substance is a solid metal.  The substance is a giant covalent solid.   1111	4

Question	Answer	Marks
6(a)	MgO;	1
6(b)	basic; (because) magnesium is a metal;	2
6(c)	2.8.2;	1
6(d)	similarity same number / amount of protons / same atomic number / all have an atomic number of 12; difference different number / amount of neutrons / different mass number ;	2
6(e)	M_r of $\text{MgSO}_4 = 26 + 32 + (4 \times 16) = 122$; $\text{mol} = \text{mass} \div M_r / 3.05 \div 122$; $= 0.025$;	3
6(f)	idea that (pure) water has a boiling point of 100°C ;	1

Question	Answer	Marks
7(a)(i)	A;	1
7(a)(ii)	A;	1
7(a)(iii)	C;	1
7(a)(iv)	D;	1
7(b)	$\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$ correct formulae; correct balancing;	2
7(c)	moles of $\text{C}_4\text{H}_8 = \frac{11.2}{56} = 0.2$; moles of $\text{H}_2 = \frac{0.6}{2} = 0.3$; ($\text{C}_4\text{H}_8$ is limiting because) 0.2 mol is less than the 0.3 mol of H_2;	3
7(d)	 ;	1

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Question	Answer	Marks
8(a)	(reaction that) transfers / releases thermal energy to the surroundings;	1
8(b)(i)	34 (kJ/mol);	1
8(b)(ii)	36 (kJ/mol); –;	2
8(c)	decreases / AW;	1
8(d)	<i>any three from:</i> molecules have higher (average) kinetic energy / molecules are moving faster; more molecules / collisions with (energy greater than or equal to) activation energy; more successful collisions;	3
8(e)	NaCl (aq) H ₂ O (l) CO ₂ (g);;	2

Question	Answer	Marks
9(a)(i)	weight; gravitational field strength;	2
9(a)(ii)	speed / distance travelled per unit time; in a given direction;	2
9(b)	evidence of $a = \Delta v / \Delta t$ or gradient or $5.4 / 12$; $0.45 \text{ (m/s}^2\text{)}$;	2
9(c)(i)	$(-)3.6$;	1
9(c)(ii)	evidence of $E = 0.5mv^2 / \frac{1}{2} mv^2$ or $470\,000 = 0.5 m 28^2$; 1200 (kg) ;	2

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Question	Answer	Marks
10(a)	expansion; from a single point high density / high temperature;	2
10(b)	red super giant; supernova; black hole;	3
10(c)(i)	the Sun;	1
10(c)(ii)	speed decreases (as radius increases);	1
10(d)	In either order: alpha because count rate decreases with paper; gamma because count rate decreases with lead / count rate above background after aluminium;	2

Question	Answer	Marks
11(a)	wavelength correct; amplitude correct;	2
11(b)	evidence of $v = f\lambda$ or $v = 0.5 \times 0.078$; 0.039 (m/s);	2
11(c)(i)	any 2 from ray parallel to principal axis and refracted through focal point; straight ray from top of object through centre of lens; ray through principal focus and refracted parallel of the principal axis; AND inverted image with arrow in correct location;	3
11(c)(ii)	any two from: upright; magnified; virtual;	2
11(d)	rises in daytime and falls in nighttime; day: energy in (to Earth) > energy out (from Earth); night: energy in (to Earth) > energy out (from Earth);	3

Question	Answer	Marks
12(a)(i)	(electrical) work done / energy transferred (by a source); moving a unit charge around a complete/whole circuit ;	2
12(a)(ii)	0.75; V;	2
12(a)(iii)	7.6 (Ω);	1
12(b)	delocalised electrons; (electrons) move / flow; from negative potential to positive potential;	3
12(c)(i)	multiplied by 4;	1
12(c)(ii)	10 (Ω);	1