

Cambridge IGCSE™

CO-ORDINATED SCIENCES (DOUBLE AWARD)**0654/42**

Paper 4 Extended Theory

February/March 2026**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 February/March 2026 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **16** 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)	Any two from: movement ; sensitivity ; growth ; excretion ; respiration ; nutrition ;	2
1(b)(i)	D ; C ;	2
1(b)(ii)	gland blood / plasma target ; ;	2
1(b)(iii)	Any two from: <u>enzymes</u> (in acrosome) to digest the, outer layer of the egg / egg membrane ; flagellum to, swim / move, <u>to the egg</u> ; haploid nucleus to restore nucleus to diploid ; mitochondria to provide energy for, swimming / movement ; AVP ;	2
1(c)	fusion of nuclei ; of a pollen (grain) and ovule ;	2

Question	Answer	Marks																								
2(a)(i)	(similarity) : (net) movement (of particles / molecules) from high concentration to low concentration ; (difference): osmosis is movement of (only) water / osmosis (always) occurs across a partially permeable membrane / osmosis involves water potentials / ora ;	2																								
2(a)(ii)	Any two from : (the movement of particles) through a cell membrane ; from a region of lower concentration to a region of higher concentration / against a concentration gradient ; using energy (from respiration) ; AVP ;	2																								
2(b)	<table><tr><td></td><td>aerobic respiration only</td><td>anaerobic respiration only</td><td>both aerobic and anaerobic respiration</td></tr><tr><td>produces carbon dioxide</td><td>✓</td><td></td><td></td></tr><tr><td>produces water</td><td>✓</td><td></td><td></td></tr><tr><td>releases energy</td><td></td><td></td><td>✓</td></tr><tr><td>uses glucose</td><td></td><td></td><td>✓</td></tr><tr><td>uses oxygen</td><td>✓</td><td></td><td></td></tr></table> ; ; ; ;		aerobic respiration only	anaerobic respiration only	both aerobic and anaerobic respiration	produces carbon dioxide	✓			produces water	✓			releases energy			✓	uses glucose			✓	uses oxygen	✓			4
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uses glucose			✓																							
uses oxygen	✓																									

Question	Answer	Marks
2(c)	Any three from : (continuation of) fast heart rate to transport, lactic acid / oxygen, (by the blood) ; (continuation) of, deeper / faster, breathing to supply (more) oxygen ; lactic acid broken down in the liver ; lactic acid broken down by aerobic respiration ;	3

Question	Answer	Marks
3(a)	carbon, hydrogen, oxygen, nitrogen ;	1
3(b)(i)	small intestine; pancreas ;	2
3(b)(ii)	simple / reducing, sugars ;	1
3(b)(iii)	(test :) iodine (solution) ; (starting colour) orange-brown AND (final colour) blue-black ;	2
3(c)	Any three from : (as temperature increases) rate of reaction increases ; (enzyme / substrate) has more <u>kinetic</u> energy ; increase in frequency of collisions / more enzyme-substrate complexes formed ;	3
3(d)	<u>pH</u> , low / acidic ; enzyme / amylase, denatured OR <u>active site</u> no longer complementary to substrate / <u>active site</u> changes shape ;	2

Question	Answer	Marks
4(a)(i)	ecosystem ;	1
4(a)(ii)	Sun ;	1
4(b)(i)	oak tree → aphid → ladybird → blackbird (→ hawk) ; ;	2
4(b)(ii)	Any two from : aphid caterpillar beetle snail ; ;	2
4(c)	energy is lost (between each trophic levels) / not enough energy (for fifth trophic level) ; named example of energy lost ;	2

Question	Answer	Marks
5(a)(i)	dissolves (in a solvent) ;	1
5(a)(ii)	Any two from: (the brown ink) contains the blue colour contains the yellow colour contains the red colour does not contain the green colour contains four colours contains an unknown colour does not contain any insoluble colour ; ;	2

Question	Answer	Marks
5(a)(iii)	$R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$ OR $0.48 = 3.6 \div \text{distance travelled by solvent ;}$ distance travelled by solvent = $3.6 \div 0.48 ;$ 7.5 (cm) ;	3
5(b)	78 (%) ;	1
5(c)	mass of $\text{NH}_4\text{NO}_3 = 7\,360 \text{ g ;}$ moles of $\text{NH}_4\text{NO}_3 = 7\,360 \div 80 ;$ = 92 ;	3

Question	Answer	Marks
6(a)	(temperature) increases ;	1
6(b)(i)	B ;	1
6(b)(ii)	C ;	1
6(c)	more particles <u>per unit volume</u> ; frequency of collisions (of molecules) is higher / more collisions per second / more, successful / effective, collisions ;	2
6(d)	M_r of $\text{MgSO}_4 = 120 ;$ $\frac{24 \times 31}{120} = 6.2 \text{ (g) ;}$	2

Question	Answer	Marks
6(e)	(oxidised) Mg / magnesium ; (reduced) Cu ²⁺ / copper <u>ions</u> ; oxidation is loss of electrons and reduction is gain of electrons ;	3

Question	Answer	Marks
7(a)	(unsaturated) contains a double (carbon-carbon) (covalent) bond ; (hydrocarbon) contains hydrogen and carbon ; only / AW ;	3
7(b)	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \quad \square_n$ ☐ $\begin{array}{c} \text{H} \quad \text{CH}_3 \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \quad \square_n$ ☒ $\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array} \quad \square_n$ ☐ ;	1
7(c)	stage 1 – fractional distillation ; stage 2 – cracking ; stage 3 – polymerisation ;	3

Question	Answer	Marks
7(d)	ratio of O ₂ : CO ₂ = 3 : 2 ; volume of O ₂ needed = $\frac{1.80 \times 3}{2} = 2.7 \text{ dm}^3$; volume of O ₂ unreacted = 6.4 – 2.7 = 3.7 dm ³ ; = 3 700 cm ³ ;	4

Question	Answer	Marks
8(a)	reduction ; blast furnace ; bauxite ; electrolysis ;	3
8(b)	Fe ₂ O ₃ ;	1
8(c)	brown ;	1
8(d)(i)	zinc stops water reaching the iron ; zinc stops oxygen reaching the iron ;	2
8(d)(ii)	zinc is more reactive than iron (so corrodes instead of iron) / ORA ; zinc loses electrons more readily than iron / ORA ;	2

Question	Answer	Marks
9(a)(i)	100 °C ;	1
9(a)(ii)	more energetic particles ; escape from the surface ;	2
9(a)(iii)	increases rate (of evaporation) ; particles have higher <u>kinetic</u> energy ;	2
9(b)(i)	conduction and convection ; radiation ;	2
9(b)(ii)	Any three from: ref to convection ; glass is a poor conductor ; water near flame becomes less dense and rises ; colder water sinks (to ice cube) ;	3

Question	Answer	Marks
10(a)(i)	(particles) vibrate / oscillate ; perpendicular / at right angles, to direction of, wave travel / energy transfer / wave propagation ;	2
10(a)(ii)	electromagnetic / water / (seismic) S waves ;	1
10(b)(i)	spreading (out) ;	1
10(b)(ii)	(diffraction) increases ;	1
10(c)	$n = \sin i / \sin r$ or $\sin 60 / \sin 41$; 1.32 ;	2

Question	Answer	Marks
10(d)	normal drawn and labelled ; ray in water with angle of incidence and angle of reflection equal (by eye) ; at least one arrow on ray, correct angles of incidence and reflection labelled;	3

Question	Answer	Marks
11(a)(i)	$Q = It$ or $1.2 \times (1 \times) 60$; 72 ; C ;	3
11(a)(ii)	in d.c. current is in (only) one direction ; in a.c. current <u>changes</u> direction ;	2
11(b)	(if there is a fault which causes a) live wire to touch the metal case ; the current will flow through the earth wire creating a low-resistance path / large current in earth wire ; causing fuse to blow / the circuit breaker to trip ;	3
11(c)(i)	concentric circles (getting further apart with greater distance) ; at least one anticlockwise arrow with no contradictory arrows ;	2
11(c)(ii)	(to the) right ;	1

Question	Answer	Marks
12(a)(i)	geothermal ; tidal ;	2
12(a)(ii)	the joining of nuclei (together) ;	1

Question	Answer	Marks
12(b)	Any two from: the Universe expanded from a single point of high, density / temperature ; the Universe is still expanding ; the Universe is approximately 13.8 billion years old ;	2
12(c)	$F_1 d_1 = F_2 d_2$ or $5.2 \times 0.5 = F \times 0.40$; $F = 6.5 \text{ (N)}$; $F = kx$ or $6.5 = 27 x$; $x = 0.24 \text{ (m)}$;	4