CAMBRIDGE
International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/42**

Paper 4 Theory (Extended) **February/March 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 February/March 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.

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
cao	correct answer only
owtte	or words to that effect

Question	Answer	Marks
1(a)(i)	hawk / snake ;	**1**
1(a)(ii)	*any **two** from:* rabbits would have no food / rabbits would decrease in number ; mice would have more food / mice would increase in number ; grasshoppers would eat more corn (rather than grass) ; hawks would eat more mice ; mice would decrease in number because more eaten by hawks ; AVP ;	**2**
1(b)	*any **two** from:* monitoring species ; protecting habitat ; education (qualified) ; (captive) breeding programs ; AVP ;	**2**
1(c)(i)	amylase ; reducing ;	**2**
1(c)(ii)	*any **one** from:* molecules are too large to pass through ileum wall or capillary wall / molecules are too large to pass into blood ; (starch)molecules are too, large / complex to be absorbed / only small / simple, molecules can be absorbed ; (starch) molecules cannot be absorbed because they are insoluble / only soluble molecules can be absorbed ;	**1**

Question	Answer	Marks
2(a)(i)	(left) atrium ; valve ;	**2**
2(a)(ii)	thick (muscular) wall / elastic wall ; the idea of allowing or withstanding the transport of blood at high pressure ; OR narrow lumen ; to maintain high blood pressure ;	**2**
2(b)(i)	heart rate increases (from 3 min) ;	**1**
2(b)(ii)	133 – 64 / 69 ; $\frac{133-64}{64} \times 100$ / 107.8(125) / 108 ;	**2**
2(b)(iii)	*any **three** from:* the person has stopped running / owtte ; muscle contraction decreases ; less energy / oxygen required ; reduction in respiration rate ;	**3**
2(c)	white blood cells ;	**1**

Question	Answer	Marks
3(a)(i)	guard (cell) ;	**1**
3(a)(ii)	photosynthesis ;	**1**

Question	Answer	Marks
3(b)	*any **three** from:* uptake of mineral ions is by <u>active transport</u> ; energy required for, active transport / uptake of mineral ions ; respiration releases energy ; (mitochondria are) site of (aerobic) respiration ;	**3**
3(c)	potential ; turgor ; plasmolysed ;	**3**

Question	Answer	Marks
4(a)(i)	sodium: reacts violently / produces effervescence / bubbles / melts / moves around surface / becomes smaller / yellow flame ; copper: does not react with water / no reaction / no change ;	**2**
4(a)(ii)	(most) copper compounds are coloured (and (most) sodium compounds are colourless / white) ;	**1**
4 (a)(iii)	CuO ; NaC*l* ;	**2**
4(b)	*any **two** from:* malleable ; ductile ; (good) conductors of heat ; (good) conductors of electricity ;	**2**
4(c)(i)	shows **different** atoms / atoms of different sizes / arrangement of atoms is not regular ;	**1**
4(c)(ii)	alloy is, harder / stronger / more hardwearing / more durable / ora ;	**1**

Question	Answer	Marks
5(a)(i)	(l) shows it is a liquid / the state symbol shows it is a liquid ;	**1**
5(a)(ii)	oxidation **and** reduction happen (simultaneously) / iron is reduced and aluminium is oxidised ; iron (oxide) loses oxygen **and** aluminium gains oxygen ;	**2**
5(a)(iii)	Fe ; Al^{3+} ;	**2**
5(b)	shows oxidation number / state (of iron) (which is +3) ;	**1**
5(c)	shape of diagram: hump with products lower than reactants ; activation energy labelled ; energy change of reaction correctly labelled ;	**3**

Question	Answer	Marks
6(a)(i)	addition ;	**1**
6(a)(ii)	C_2H_4 ;	**1**
6(b)	cracking ;	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(c)</td><td>
<table>
<tr><th></th><th>true for alkanes only</th><th>true for alkenes only</th><th>true for both</th></tr>
<tr><td>A bond between two carbon atoms has four shared electrons.</td><td></td><td>✓</td><td></td></tr>
<tr><td>The group of compounds have the same general formula.</td><td></td><td></td><td>✓</td></tr>
<tr><td>Complete combustion gives carbon dioxide and water.</td><td></td><td></td><td>✓</td></tr>
<tr><td>Adding aqueous bromine gives a colourless solution.</td><td></td><td>✓</td><td></td></tr>
</table>
;;;

all four correct = 3 marks
three correct = 2 marks
two correct = 1 mark
</td><td>3</td></tr>
<tr><td>6(d)(i)</td><td>acid ;</td><td>1</td></tr>
<tr><td>6(d)(ii)</td><td>nickel ;</td><td>1</td></tr>
</table>

Question	Answer	Marks
7(a)(i)	(moving with) constant speed ;	**1**
7(a)(ii)	$a = \Delta v \div \Delta t$ / 0.12 ÷ 1.5 ; 0.080 (m/s^2) ; negative sign ;	**3**

Question	Answer	Marks
7(a)(iii)	use of area under the graph ; correct calculation shown, (½ × 0.12 × 1.5) + (0.12 × 1.5) + (½ × 0.12 × 1.5) (= 0.36) / or equivalent ;	**2**
7(b)	unit conversion of g to kg / 0.13 seen ; $\Delta E_P = mg\Delta h$ / 0.13 × 9.8 × 0.36 ; = 0.46 (J) ;	**3**

Question	Answer	Marks
8(a)	blue / indigo / violet ;	**1**
8(b)	speed of radio waves stated as 3.0×10^8 m / s ; recognition that radio signal travels down and back (i.e. divide time or distance by 2) ; $v = s \div t$ / $3.0 \times 10^8 \times 1.65 \times 10^{-6}$; 495 (m) ;	**4**
8(c)(i)	volume ;	**1**
8(c)(ii)	***three*** *from:* mp1 idea that force = P × A / higher pressure causes higher force (on bottom) ; mp2 reference to force / pressure, created by collisions between particles and wall ; mp3 (when piston moves / volume decreases) the number of wall particle collisions increases / frequency of wall particle collisions increases ; mp4 (if mp3 is awarded) (reason for more collisions / higher collision rate) the idea that particle concentration increases / idea of more particles in smaller volume / particles are closer together ;	**3**

Question	Answer	Marks
9(a)(i)	nuclear fusion ; chemical ;	**2**
9(a)(ii)	total power received by solar cells = 1800 × 12 / 21600 W ; efficiency = useful power output ÷ total power input × 100 / 3900 ÷ 21600 × 100 ; 18 (%) ;	**3**
9(b)(i)	heater ;	**1**
9(b)(ii)	4.8 (V) ;	**1**
9(b)(iii)	evidence for use of $R = V \div I$ / 4.8 ÷ 0.015 ; 320 (Ω) ;	**2**