



Cambridge IGCSE™

COMBINED SCIENCE

0653/43

Paper 4 Theory (Extended)

October/November 2023

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 October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **12** 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 descriptors 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.

Mark scheme abbreviations

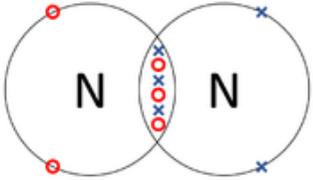
;	separates marking points
/	separates alternative responses for the same marking point
ecf	error carried forward
AVP	any valid point
ORA	or reverse argument
AW	alternative wording
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
()	the word / phrase in brackets is not required but sets the context

Question	Answer	Marks
1(a)(i)	A rib ; B diaphragm ;	2
1(a)(ii)	produce mucus ; (mucus) traps, pathogens / particulates ;	2
1(b)(i)	(student) 2 ;	1
1(b)(ii)	$73 \div 4 / 18.25$; 18 ;	2
1(b)(iii)	(increased) respiration ; (idea that respiration) produces carbon dioxide ; increase in carbon dioxide (concentration) in the <u>blood</u> (causes increase in breathing rate) ;	3

Question	Answer	Marks
2(a)(i)	<i>hydrogen</i> H ⁺ AND decreases ; <i>hydroxide</i> water ; <i>sodium</i> Na ⁺ AND stays the same ;	3
2(a)(ii)	(each) chloride ion loses (one) electron ; chlorine atoms (form) ; two atoms join together to form a molecule (of chlorine gas) ;	3
2(b)(i)	conducts electricity / inert / unreactive ;	1
2(b)(ii)	<i>any two from:</i> high melting point ; high density ; forms coloured compounds ; acts as a catalyst ; AVP ;	2

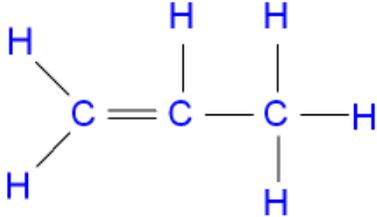
Question	Answer	Marks
3(a)(i)	radiation ;	1
3(a)(ii)	turns to steam / vaporises / boils ;	1
3(a)(iii)	unit conversion, $1800 \text{ dm}^3 = 1.8 \text{ m}^3$; evidence of, $\rho = \frac{m}{V} / 1000 \times 1.8$; 1800 (kg) ;	3
3(b)(i)	evidence of, $W = mg / 140\,000 \div 10$; 14 000 (kg) ;	2
3(b)(ii)	evidence of, $p = \frac{F}{A} / 140\,000 \div 0.56$; 250 000 ; Pa OR N / m ² ;	3

Question	Answer	Marks
4(a)(i)	gall bladder labelled ;	1
4(a)(ii)	amylase ; (simpler) sugars ;	2
4(a)(iii)	<i>any two from:</i> diffuses ; through, cell membrane / capillary wall ; (dissolves) into the plasma ;	2
4(b)(i)	10 (°C) ;	1
4(b)(ii)	enzyme is <u>denatured</u> ; <u>active site</u> changes shape ; substrate no longer fits (into active site) ;	3

Question	Answer	Marks
5(a)(i)	1.2 (%) ;	1
5(a)(ii)	oxygen ;	1
5(b)	in Group VIII AND period 3 ; in VIII because 8 electrons in outer shell ; period 3 because 3 shells ;	3
5(c)	4 ; it has a double bond / 2 electrons in each bond / 2 pairs of electrons are shared / oxygen shares 2 electrons and carbon shares 2 electrons ;	2
5(d)	 <p>bonding electrons correct ; non-bonding electrons correct ;</p>	2

Question	Answer	Marks
6(a)(i)	2.0 (cm) ;	1
6(a)(ii)	evidence of, $F = kx / 1.5 \div 2.0$; 0.75 (N / cm) ;	2
6(a)(iii)	elastic (potential) / strain ;	1
6(b)(i)	period correctly shown AND labelled ; amplitude correctly shown AND labelled ;	2
6(b)(ii)	evidence of, $KE = \frac{1}{2} m v^2 / \frac{1}{2} \times 0.15 \times 0.012^2$; 1.1×10^{-5} (J) ;	2
6(b)(iii)	correct and idea that, all the stored (elastic) energy is transferred to kinetic energy (assuming no, friction / air resistance) / energy is conserved ; OR incorrect and idea that, some energy is transferred to surroundings / work is done against, friction / air resistance ;	1

Question	Answer	Marks
7(a)(i)	support ; transport (of, water / minerals) ;	2
7(a)(ii)	large surface (area) ;	1
7(b)(i)	chemical ; photosynthesis ;	2
7(b)(ii)	<i>any three from:</i> due to eutrophication ; increase in growth of producers / plants on surface (of pond B) ; (increased) decomposition of producers (after death) ; (increased aerobic) respiration by decomposers ; (aerobic respiration/decomposers) uses up the oxygen (in pond B) ; AVP ;	3

Question	Answer	Marks
8(a)(i)	C_nH_{2n+2} ;	1
8(a)(ii)	C_2H_4 ; butane ; C_8H_{18} ;	3
8(b)(i)	hydrocarbon because it contains hydrogen and carbon only ; saturated because, it contains only single bonds / no double (carbon-carbon) bond ;	2
8(b)(ii)	 <p>The diagram shows the structural formula of propene. It consists of three carbon atoms. The first carbon atom is on the left and is double-bonded to the second carbon atom. The first carbon atom is also bonded to two hydrogen atoms (one above and one below). The second carbon atom is double-bonded to the first and single-bonded to the third. The second carbon atom is also bonded to one hydrogen atom (above). The third carbon atom is single-bonded to the second and single-bonded to one hydrogen atom (to the right). The third carbon atom is also bonded to two hydrogen atoms (one above and one below).</p>	2

Question	Answer	Marks							
9(a)(i)	<table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;">(X-rays)</td> <td style="width: 15%;">ultraviolet ;</td> <td style="width: 15%;">visible light ;</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;">(radio waves)</td> </tr> </table>		(X-rays)	ultraviolet ;	visible light ;			(radio waves)	2
	(X-rays)	ultraviolet ;	visible light ;			(radio waves)			
9(a)(ii)	burn (to skin) / damage to eyes / blindness ;	1							
9(a)(iii)	evidence of, $P = IV / 3.0 \div 3.7 ;$ 0.81 (A) ;	2							
9(b)	evidence of, $R = R_1 \times R_2 \div (R_1 + R_2) / \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$, for R1 and R2 ; use of series addition of resistors for R3 to result for R1 and R2 ; values for R1 and R2 of 10 and 15 AND R3 = 22 ;	3							