Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/43**

Paper 4 Theory (Extended) **October/November 2023**

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

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.

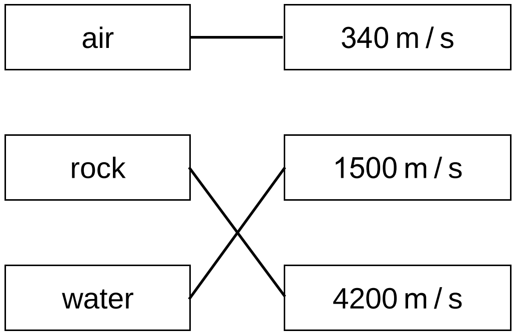
Science-Specific Marking Principles

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.

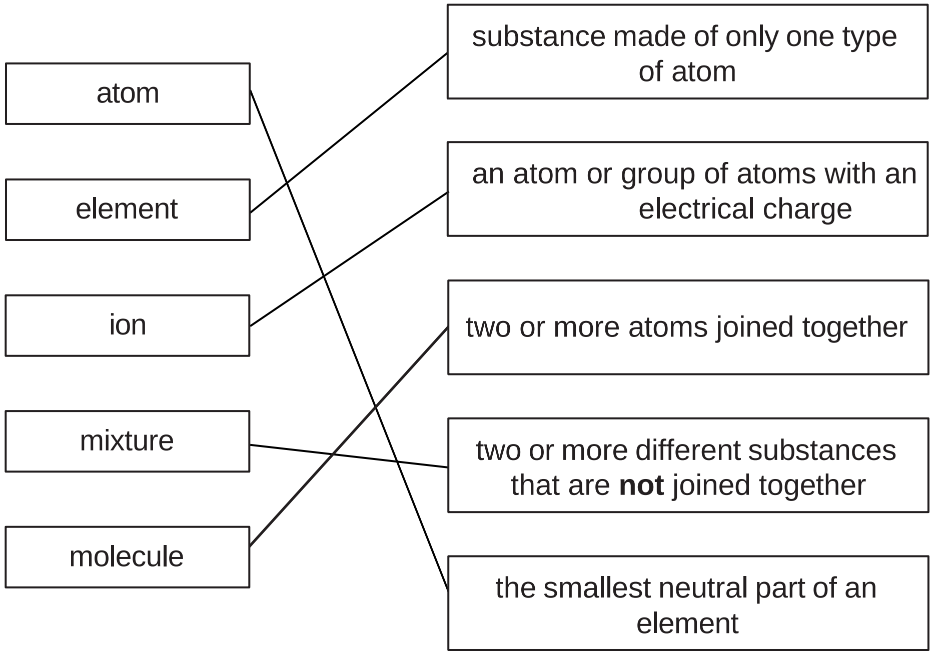
6	<u>Calculation specific guidance</u> Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'. For questions in which the number of significant figures required is not stated, credit should be awarded 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	<u>Guidance for chemical equations</u> 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.

Question	Answer	Marks
1(a)(i)	blockage ;	**1**
1(a)(ii)	stop smoking ; do more exercise ;	**2**
1(a)(iii)	age ;	**1**
1(b)(i)	thick wall ; to <u>withstand</u> high blood pressure ; elastic / muscular, wall ; able to stretch and recoil / <u>maintain</u> (high) blood pressure ;	**4**
1(b)(ii)	<u>double</u> (circulatory system) ;	**1**

Question	Answer	Marks
2(a)	low density ✓ ;	**1**
2(b)	(aluminium) forms an oxide layer / reacts with oxygen / forms a layer of aluminium oxide ; idea that the (oxide) layer adheres to the surface of the aluminium ;	**2**
2(c)	explanation about alloy linking *any three from*: added atoms are different size / atoms or ions in an alloy are different sizes / irregular arrangement ; layers / particles cannot easily slide over each other ; more energy is needed to cause slippage of the layers / owtte ; idea that alloy is stronger ;	**3**
2(d)	zinc is more reactive than iron / ORA ; idea that zinc corrodes or oxidises or reacts instead of the iron ;	**2**
2(e)	**metal –** sodium / calcium / magnesium ; **explanation** idea that the chosen metal is more reactive than carbon ; idea that metal cannot be displaced from its ore by (heating with) carbon ;	**3**

Question	Answer	Marks
3(a)(i)	(*t* =) *d* / *v* or 1000 / 25 000 ; (*in any form*) (*t* =) 0.04 (s) ;	**2**
3(a)(ii)	0–3 s / initially constant speed ; then slows down / decelerates / negative acceleration / non-constant deceleration ; (at 7 s) it stops / hits the ground **/** speed becomes 0 ;	**3**
3(b)	(density =) mass / volume or 1720 / 200 (*in any form*) ; 8.6(0) (g / cm^3) ;	**2**
3(c)(i)	compressions and rarefactions ;	**1**
3(c)(ii)	 all correct ;	**1**

Question	Answer	Marks
4(a)	nitrate ; growth ; photosynthesise ; decompose ; aerobic respiration ; eutrophication ;	**6**
4(b)(i)	mitosis ;	**1**
4(b)(ii)	*any two from*: creates <u>genetically</u> identical offspring / clones ; only one parent required ; does not involve, gametes / fertilisation ;	**2**
4(b)(iii)	gametes / egg / sperm ;	**1**

Question	Answer	Marks
5(a)	 one mark for each additional correct line ;;;;	**4**
5(b)(i)	<u>molecular</u> mass of ammonia is less (than hydrogen chloride) / ORA ; ammonia particles diffuse / move faster (than hydrogen chloride particles / molecules) / ORA ;	**2**
5(b)(ii)	M_r of $NH_3 = 17$; moles of $NH_3 = 5.1 \div 17 = 0.3$ volume of $NH_3 = 0.3 \times 24 = 7.2(0)\ dm^3$;	**3**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)(i)</td><td>convection ;</td><td>1</td></tr>
<tr><td>6(a)(ii)</td><td>air (at the top) is cooled and its density increases ;
the cooled air falls ;
warm(er) air has lower density and moves upwards ;</td><td>3</td></tr>
<tr><td>6(b)</td><td><table><tr><td>temperature</td><td>volume</td><td>pressure</td></tr><tr><td>increases</td><td>kept constant</td><td>increases</td></tr><tr><td>remains constant</td><td>increases</td><td>decreases</td></tr></table>
both correct ;</td><td>1</td></tr>
<tr><td>6(c)</td><td>any two from:
decrease the current in the coil ;
use fewer turns on the coil ;
use a weaker magnet / magnetic field ;</td><td>2</td></tr>
</table>

Question	Answer	Marks
7(a)(i)	**A –** (upper) epidermis ; **B –** palisade (mesophyll) ;	**2**
7(a)(ii)	large air spaces / spongy mesophyll cells loosely packed ; for increased <u>diffusion</u> of gases or larger surface area for <u>diffusion</u> ;	**2**
7(a)(iii)	guard (cell) identified with the correct name identifying correct cell ; correct name ;	**2**
7(b)	*any three from:* glucose used for respiration ; storage as starch ; cellulose for cell walls ; sucrose for transport ; used in synthesis of (named) biological molecules ; AVP ;	**3**

Question	Answer	Marks
8(a)	gain ; anions ; lose ;	**3**
8(b)	anode – oxygen / O_2 ; cathode – copper / Cu ;	**2**
8(c)	$Al^{3+} + 3e^{-} \rightarrow Al$;	**2**
9(a)(i)	reduces by 2 reduces by 2 reduces by 4 ;; one or two correct - 1 mark three correct - 2 marks	**2**
9(a)(ii)	12.5% of Te remaining ; 3 half-lives ; ($4.63 \times 3 =$) 13.89 or 13.9 (s) ;	**3**
9(b)(i)	(advantage) doesn't produce CO_2 / contribute to global warming / climate change / AVP ; (disadvantage) doesn't work at night / need large area / AVP ;	**2**
9(b)(ii)	black absorbs the most / is a good absorber of light / radiation ;	**1**
9(b)(iii)	(power input =) $1.5 \times 0.5 \times 1400$ / 0.75×1400 / 1050 (W) ; (power output =) power input $\times$ efficiency / 100 / 1050×0.16 ; (power output =) 168 (W) ; **or** $1400 \times 0.16 = 224$; 224×0.75 ; 168 (W) ;	**3**

Question	Answer	Marks
10(a)(i)	1050(± 10) **and** 1900(±10) ; (((1900–1050) / 1050) × 100) = 81 (%) ;	**2**
10(a)(ii)	*any three from*: increase in blood glucose concentration detected by pancreas ; insulin released (by pancreas) ; conversion of glucose to glycogen ; glycogen stored in liver ;	**3**
10(b)	<u>glucagon</u> ;	**1**
10(c)	mechanical digestion ; assimilation ; absorption ;	**3**
10(d)(i)	villus ;	**1**
10(d)(ii)	lacteal ; fat / lipid <u>absorption</u> ;	**2**

Question	Answer	Marks
11(a)(i)	any value between 0 and 6.9 ;	**1**
11(a)(ii)	proton donor / owtte ;	**1**
11(b)(i)	magnesium + hydrochloric acid → magnesium chloride + hydrogen ;	**1**
11(b)(ii)	using powdered magnesium instead of magnesium ribbon ✓ ;	**1**
11(b)(iii)	line starting at origin, but steeper than original ; levels off at same point ;	**2**
11(b)(iv)	any three from: molecules have higher (average)(kinetic) energy / molecules are moving faster ; more molecules with activation energy ; frequency of collision (of molecules) is higher / more collisions per second ; more successful collisions ;	**3**
11(c)	moles of $HCl = 0.5 \times \frac{40}{1000} = 0.02$; moles of Mg $= \frac{0.1}{24} = 0.004(166667)$; (from equation) 1 mol of Mg reacts with 2 mol of HCl ; so $(2 \times 0.004) = 0.008$ mol of HCl are needed but there is more than this ;	**4**

Question	Answer	Marks
12(a)(i)	(Q =) It / 0.24 × 60 ; (*in any form*) (Q =) 14(.4) ; coulombs / C ;	**3**
12(a)(ii)	(effect) reading increases ; (explanation) the resistance (of the LDR) decreases ;	**2**
12(a)(iii)	(f =) speed / wavelength **or** $3 \times 10^8 / 7.5 \times 10^{-7}$; (*in any form*) use of 3×10^8 (m / s) ; (f =) 4.0×10^{14} (Hz) ;	**3**
12(b)	potential difference / p.d. (across the LDR) ;	**1**
12(c)	use of $I_pV_p = I_sV_s$; $V_p = 4.2 / 10.5\ V_s / 0.4\ V_s$; (N_s =) N_pV_s / V_p / 360/0.4 / 360 × 2.5 ; (*in any form*) (N_s =) 900 ; **or** use of $I_pN_p = I_sN_s$; $N_s = I_pN_p / I_s$; (10.5 × 360) / 4.2 ; = 900 ;	**4**