Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/42**

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	<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	<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.

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)	stigma(s) ; wind ;	**2**
1(a)(ii)	idea that air sacs, increase the time in the air / increase air resistance / increase surface area / provide a sail effect / reduce density ;	**1**
1(b)	*any two from:* sexual reproduction ORA, (usually) requires two parents (not one) ; requires, fertilisation / fusion, of (nuclei) of gametes ; produces offspring that are not genetically identical ; leads to a zygote forming ;	**2**
1(c)(i)	sperm duct ; cervix ;	**2**
1(c)(ii)	*any two from:* have a flagellum ; contain enzymes ; AVP;	**2**

Question	Answer	Marks
2(a)(i)	hydrochloric (acid) ;	**1**
2(a)(ii)	water ;	**1**
2(a)(iii)	add excess MgO / add MgO until no more dissolves ; filter (to remove excess MgO) ; evaporate (some) water / heat to remove (some) water / heat to saturation point / heat to crystallisation point ;	**3**
2(b)(i)	temperature greater than 0 °C and below 20 °C ;	**1**
2(b)(ii)	because, heat / (thermal) energy, is released ;	**1**
2(b)(iii)	idea that Mg and K are in different groups OR have different numbers of electrons in their outer shells OR different valences OR they form ions with different charges ;	**1**

Question	Answer	Marks
3(a)(i)	50 (s) ;	**1**
3(a)(ii)	**X** anywhere on the horizontal line of the graph ;	**1**
3(a)(iii)	evidence of, use of area under graph / ½ × 100 × 12 ; 600 (m) ;	**2**
3(b)(i)	evidence of, $W = mg$ / 2500 × 10 OR 25 000 ; any value greater than 25 000 (N) ; a resultant force is needed ;	**3**
3(b)(ii)	evidence of, change in GPE = $mg\Delta h$ / 2500 × 10 × 0.95 ; 24 000 (J) ;	**2**
3(c)	(the truck needs the) energy in fuel / energy transfer from fuel ; work done against friction OR energy is transferred to thermal energy (of surroundings) ;	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)(i)</td><td>
<table>
<tr><th>organism</th><th>carnivore</th><th>primary consumer</th><th>occupies trophic level 3</th></tr>
<tr><td>blackbird</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>caterpillar</td><td></td><td>✓</td><td></td></tr>
<tr><td>hawk</td><td>✓</td><td></td><td></td></tr>
<tr><td>thrush</td><td>✓</td><td></td><td>✓</td></tr>
</table>
carnivore column ;
primary consumer column ;
trophic level 3 column ;
</td><td>3</td></tr>
<tr><td>4(a)(ii)</td><td>
any three from:

hawk is trophic level 4 / idea that next level is trophic level 5 ;
not enough energy (to support another level) ;
energy lost between each trophic level OR only a percentage of energy is transferred between trophic levels ;
example of energy loss ;
</td><td>3</td></tr>
<tr><td>4(b)(i)</td><td>greater number of trees in the young forest area ;</td><td>1</td></tr>
<tr><td>4(b)(ii)</td><td>red oak ;</td><td>1</td></tr>
<tr><td>4(c)</td><td>
glucose converted to starch / glucose is stored as starch ;

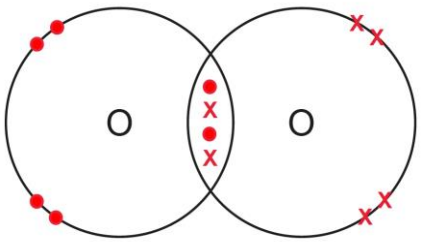
plus any three from:

(light energy is) transferred to chemical energy ;
by chlorophyll ;
(takes place in) chloroplasts ;
used in photosynthesis ;
used to synthesise carbohydrates / glucose ;
AVP ;
</td><td>4</td></tr>
</table>

Question	Answer	Marks
5(a)(i)	magnesium AND it is the most reactive or atoms lose electrons most readily ;	**1**
5(a)(ii)	copper AND copper does not displace hydrogen (from the acid) ;	**1**
5(a)(iii)	any value greater than 0 AND less than 30 ; reactivity of iron is between copper and zinc ;	**2**
5(b)(i)	(volume of gas produced) increases ; more frequent collisions more successful collisions OR particles move faster / particles have more kinetic energy ; more particles (have more than minimum) with activation energy ;	**3**
5(b)(ii)	*pH at start:* 1–3 AND *pH at end*: 7 ; (acid is fully neutralised) because magnesium is in excess OR the acid is used up;	**2**

Question	Answer	Marks
6(a)(i)	 all six emerging rays correctly linked back to principal focus at lamp ;	**1**
6(a)(ii)	0.6 (m) ;	**1**
6(b)(i)	unit conversion cm to m ; evidence of, $v = f\lambda$ / 330 ÷ 0.75 ; 440 (Hz) ;	**3**
6(b)(ii)	(loud means) large amplitude ; requires a lot of energy (from a powerful diesel engine) ;	**2**
6(c)	<table><tr><td></td><td></td><td></td><td>(visible light)</td><td>(infrared)</td><td></td><td>radio waves ;</td></tr></table>	**1**

Question	Answer	Marks
7(a)	thick (muscular) wall ; to withstand pressure ; OR small lumen ; to maintain pressure ; OR elastic fibres ; to allow stretch and recoil ;	**2**
7(b)(i)	less blood passes through ; reference to transport of oxygen in blood ;	**2**
7(b)(ii)	*any two from:* smoking ; genetic predisposition ; age ; gender / sex ; diet ; stress ; AVP ;	**2**

Question	Answer	Marks
8(a)(i)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$;	1
8(a)(ii)	*reducing agent* carbon monoxide ; *reason* it takes oxygen from iron (oxide) OR it reduces iron oxide (to iron) ;	2
8(b)(i)	*any two from:* oil acts as a barrier ; stops contact of iron with, air / oxygen ; stops contact of iron with water ;	2
8(b)(ii)	painting / coating / AVP ;	1
8(c)(i)	Group VI AND has 6 electrons in the outer shell / same number of electrons in outer shell as the group number ;	1
8(c)(ii)	 bonding electrons correct ; non-bonding electrons correct ;	2

Question	Answer	Marks
9(a)	evidence of, $P = IV$ / 18 × 240 ; 4300 ; W / watt(s) ;	**3**
9(b)(i)	parallel ; different currents so two separate branches / series circuit must have same current everywhere / 18 A is split into 12 A and 6 A ;	**2**
9(b)(ii)	cables to floodlight **G** are twice as long ; *R* is proportional to length / *R* increases with length / *R* (of the cables / in the branch) is doubled ; idea that *R* is inversely proportional to I / use of $V = IR$ (in any form) (so the current is halved) ;	**3**