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Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/41**

Paper 4 **October/November 2022**

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 2022 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 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.

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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.

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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
underline	actual word given must be used by candidate (grammatical variants accepted)
( )	the word / phrase in brackets is not required but sets the context

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Question	Answer	Marks
1(a)(i)	(right) atrium ;	**1**
1(a)(ii)	vena cava ;	**1**
1(a)(iii)	*any two from:* blood passes through the heart twice (in one circuit of the body) ; the idea that one circulation is to lungs ; the idea that one circulation is to the body (tissues) ;	**2**
1(b)(i)	80 ÷ 97 / 0.824742268 ; 0.82 ;	**2**
1(b)(ii)	(incidence of) coronary heart disease increases with increased waist-to-hip ratio ;	**1**
1(b)(iii)	high fat diet / obesity ; causes blockage of coronary artery ;	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>hydrogen test lighted splint AND positive result pops ;
chlorine test (damp) litmus paper AND positive result bleaches ;</td><td>2</td></tr>
<tr><td>2(b)(i)</td><td>2NaCl (aq) AND $2H_2O$ (l) AND 2NaOH (aq) ;</td><td>1</td></tr>
<tr><td>2(b)(ii)</td><td>sodium hydroxide ;</td><td>1</td></tr>
<tr><td>2(c)</td><td>
<table>
<tr><th>statement</th><th>true</th><th>false</th></tr>
<tr><td>OH^- ions are attracted to the cathode.</td><td></td><td>✓</td></tr>
<tr><td>H^+ ions gain electrons at the negative electrode.</td><td>✓</td><td></td></tr>
<tr><td>H^+ ions come from the water in the solution.</td><td>✓</td><td></td></tr>
<tr><td>Hydrogen gas is made when OH^- ions lose electrons.</td><td></td><td>✓</td></tr>
</table>
two or three correct ;
all four correct ;
</td><td>2</td></tr>
<tr><td>2(d)</td><td>colour red ;
pH answer in range 1–3 ;</td><td>2</td></tr>
</table>

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Question	Answer	Marks
3(a)	Q, S ; P, R ;	**2**
3(b)(i)	1 200 000 (N) ;	**1**
3(b)(ii)	evidence of, $p = F \div A$ / 1 200 000 ÷ 0.125 ; 9 600 000 ; Pa OR N / m^2 ;	**3**
3(b)(iii)	evidence of, $W = F d$ / $1.2 \times 10^6 \times 1500$; 1.8×10^9 / 1 800 000 000 (J) ;	**2**
3(b)(iv)	evidence of, $KE = ½ m v^2$ / $½ \times 120\,000 \times 80^2$; 3.8(4) $\times 10^8$ / 380 000 000 (J) ;	**2**
3(b)(v)	(work done against) friction / air resistance ;	**1**

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Question	Answer	Marks
4(a)(i)	(simple) sugar ;	**1**
4(a)(ii)	starch is broken down more quickly as temperature increases / activity of amylase increases as temperature increases ; increase in kinetic energy (of particles) / (particles) move faster ; increased frequency of collisions / increased number of successful collisions ;	**3**
4(a)(iii)	idea that, amylase is specific (to starch) ; protein molecules will not fit into active site / (shape of) active site not complementary to protein (shape) / (shape of) active site is complementary to starch (shape) ;	**2**
4(b)(i)	*any two from:* combustion ; respiration ; decomposition ; AVP ;	**2**
4(b)(ii)	fossilisation ;	**1**
4(c)	(snake is a) secondary consumer when it eats the insect ; tertiary consumer when it eats the toad ;	**2**

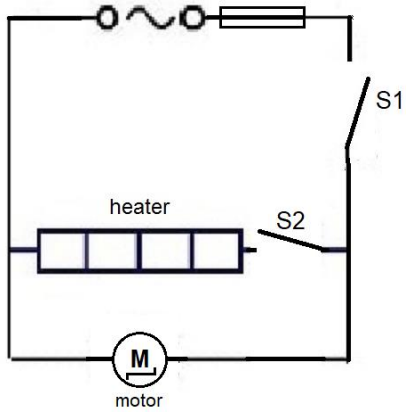
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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>C ;</td><td>1</td></tr>
<tr><td>5(b)</td><td>
<table>
<tr><th></th><th>bonds break</th><th>bonds form</th><th>energy is taken in</th><th>energy is given out</th></tr>
<tr><td>arrow A</td><td>✓</td><td></td><td>✓</td><td></td></tr>
<tr><td>arrow B</td><td></td><td>✓</td><td></td><td>✓</td></tr>
</table>
two or three correct ;
all four correct ;
</td><td>2</td></tr>
<tr><td>5(c)(i)</td><td>similarity both produce, water / water vapour ;
difference alkanes / hydrocarbons / diesel, also produce carbon dioxide ;</td><td>2</td></tr>
<tr><td>5(c)(ii)</td><td>(carbon dioxide emissions cause)
an <u>enhanced</u> greenhouse effect / contribute to climate change ;</td><td>1</td></tr>
<tr><td>5(c)(iii)</td><td>hydrogen is a gas AND diesel is a liquid ;
hydrogen, takes up more space / needs to be stored under pressure ;</td><td>2</td></tr>
</table>

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Question	Answer	Marks
6(a)(i)	evidence of, power = current × voltage ; fan current = 60 ÷ 240 = 0.25 A / heater current = 2300 ÷ 240 = 9.58 A ; current in fuse = 0.25 + 9.58 = 9.83 A ; OR evidence of, power = current × voltage ; total power drawn = 2300 + 60 / 2360 W ; current in fuse = 2360 ÷ 240 = 9.83 A ;	**3**
6(a)(ii)	comparison of fuse rating with operating current, e.g. rating is, higher than / too close to, operating current ; appropriate matching conclusion, e.g. so fuse, does not blow / may blow, under normal operation ;	**2**
6(b)	 switch S1 in main circuit ; switch S2 in heater branch ;	**2**

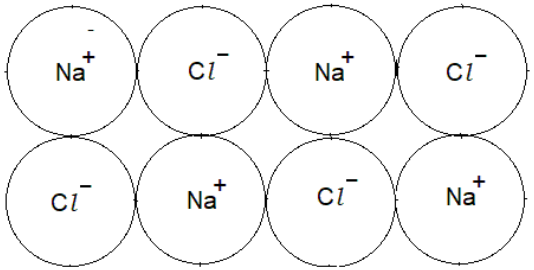
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Question	Answer	Marks
7(a)(i)	either ovary labelled ;	**1**
7(a)(ii)	toxins ; excretory ;	**2**
7(b)	idea that, fetus needs (some of the) vitamin D ; vitamin D needed, for bone (development) / to prevent rickets ;	**2**
7(c)	*nicotine* addictive ; *tar* prevents cilia working / causes (lung) cancer ;	**2**

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Question	Answer	Marks
8(a)	*any two metals from*: sodium, magnesium, aluminium ; *any two non-metals from*: silicon, phosphorus, sulfur, chlorine, argon ;	**2**
8(b)	idea of achieving a full outer shell (for stability) ; sodium atom has one outer electron and chlorine atom has seven ; sodium atom loses one electron and chlorine atom gains one electron ;	**3**
8(c)(i)	 alternating arrangement as shown ;	**1**
8(c)(ii)	*any two from:* ions, have opposite charges / are positive and negative ; strong attraction (between ions) ; so high energy needed to break bonds ;	**2**
8(c)(iii)	potassium / rubidium / caesium / francium ;	**1**
8(c)(iv)	fluorine ;	**1**

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Question	Answer	Marks
9(a)(i)	<table><tr><td></td><td>X-rays</td><td>ultraviolet</td><td></td><td></td><td>microwaves ;</td><td></td></tr></table>	**1**
9(a)(ii)	*volume* large(r) <u>amplitude</u> ; *pitch* high(er) <u>frequency</u> ;	**2**
9(b)	transverse / named example ; longitudinal / named example ;	**2**
9(c)(i)	3.0×10^8 / 300 000 000 (m / s) ;	**1**
9(c)(ii)	evidence of, speed = distance ÷ time / 150 000 000 000 ÷ 300 000 000 ; 500 (s) (= 8 min 20 s) ;	**2**
9(c)(iii)	a shiny white surface is a, poor <u>absorber</u> / (good) <u>reflector</u> (of radiation) ;	**1**

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