Cambridge IGCSE™

COMBINED SCIENCE	**0653/42**
Paper 4 Theory (Extended)	**May/June 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 May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **12** printed pages.

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.

Question	Answer	Marks
1(a)(i)	label to aorta on healthy heart ;	1
1(a)(ii)	blood flowing, backwards / into (left) atrium ;	1
1(a)(iii)	*any two from:* stress ; smoking ; genetic predisposition ; age ; gender ; AVP ;	2
1(b)(i)	$\dfrac{80}{60} \times 100$; 133.33333 ; 133 ;	3
1(b)(ii)	*any three from:* heart rate decreases ; less energy required / less muscular contraction ; less oxygen needs to be transported to muscles ; (due to) decreased respiration (rate) ; AVP ;	3

Question	Answer	Marks
2(a)(i)	volumes of solid and liquid do not change and gas volume decreases / changes ; solid and liquid particles are close together and gas particles are (far) apart ; the idea that solid / liquid particles cannot be pushed closer together and gas particles can be pushed closer together ;	**3**
2(a)(ii)	(volume increases because) particles move / become further apart ; particles gain (kinetic) energy / particles move faster ;	**2**
2(b)(i)	36–39 (°C) (any value in this range) ;	**1**
2(b)(ii)	above 45 (°C) ;	**1**
2(c)	(chemical / burning) new chemicals are formed / (physical / state change / melting) same substances present / ORA ;	**1**

Question	Answer	Marks
3(a)	(**S** =) 340 (N) **AND** no vertical movement, (so forces must be equal and opposite) ;	**1**
3(b)(i)	kinetic ; kinetic ;	**2**
3(b)(ii)	$W = F \times d$ *(in any form)* / = 225 × 0.30 ; 67.5 (J) ;	**2**
3(b)(iii)	power = work done ÷ time **OR** change in energy ÷ time **OR** = 67.5 ÷ 1.2 ; 56 (W) ;	**2**

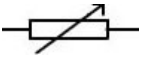| Question	Answer	Marks
4(a)	<table><thead><tr><th>letter</th><th>name of part</th><th>function</th></tr></thead><tbody><tr><td>(A)</td><td>anther / stamen</td><td>produce, pollen / male gamete</td></tr><tr><td>(D)</td><td>ovary</td><td>(produce ovules)</td></tr><tr><td>C</td><td>(stigma)</td><td>receives pollen / AW</td></tr></tbody></table> ;;;	3
4(b)	similarity – fusion of nuclei ; difference – pollen used instead of sperm / takes place in ovary not oviduct ;	2
4(c)	acts as a barrier against, toxins / poisons ; *then any two from:* provides nutrients ; provides oxygen ; removes waste products ;	3

Question	Answer	Marks
5(a)	*any two from:* brass is, stronger ; brass is, harder / more hardwearing ; brass does not corrode (as easily) ; ORA	**2**
5(b)(i)	percentage of copper (56) plus zinc (37), is 93 / is less than 100 / 7% unaccounted for ;	**1**
5(b)(ii)	atoms of zinc should be larger than copper ; too many Cu atoms / too few Zn atoms / percentage of zinc needs to be higher ;	**2**
5(c)(i)	because copper forms on the rod ;	**1**
5(c)(ii)	because copper ions are used up / less copper ions left ;	**1**
5(c)(iii)	orange rod and colourless solution ; no reaction ; because zinc is more reactive (than copper) ;	**3**

Question	Answer	Marks
6(a)	(gamma radiation) | | ultraviolet ; | (visible light) | | micro-waves ; | (radio waves)	2
6(b)	burns / DNA damage / (skin) cancer ;	1
6(c)	satellite television / (mobile) telephones ;	1
6(d)	transverse ; equal to ;	2
6(e)(i)	$v = f\lambda$ *(in any form)* / ($f =$) $3 \times 10^8 \div 3.5 \times 10^{-7}$; $= 8.6 \times 10^{14}$; Hz ;	3
6(e)(ii)	$P = VI$ or $I = P \div V$ **OR** $450 \div 230$; *and either:* current in each lamp = $150 \div 230$ / 0.652(174) ; (total currect = $3 \times 0.652(174)$) = 1.96 / 2.0 (A) ; **OR** (total power supply needed = 3×150) 450 (W) ; (total current = 450 / 230 =) 1.96 / 2.0 (A) ;	3

Question	Answer	Marks
7(a)(i)	mouse ;	**1**
7(a)(ii)	*any two from:* energy lost between trophic levels ; named example of energy loss ; so not enough energy to sustain more levels ;	**2**
7(b)(i)	palisade mesophyll cells – photosynthesis ; spongy mesophyll cells – gas exchange ;	**2**
7(b)(ii)	magnesium needed to synthesise chlorophyll / (less Mg means) plant becomes pale / yellow or less growth ; chlorophyll is needed for photosynthesis ;	**2**
7(c)	kill bacteria ; provide (acidic) pH for enzymes ;	**2**

Question	Answer	Marks
8(a)(i)	(activation energy of) reaction 2 is higher because the difference in energy of reactants and energy of the peak is greater / ORA ;	1
8(a)(ii)	more collisions have the activation energy / frequency of successful collisions increases ;	1
8(b)	reaction 1 **AND** because it is exothermic / energy is given out ;	1
8(c)	<table><thead><tr><th></th><th>bonds are being broken</th><th>bonds are being formed</th><th>energy is being taken in</th><th>energy is being given out</th><th></th></tr></thead><tbody><tr><td>arrow **A**</td><td>✓</td><td></td><td>✓</td><td></td><td>;</td></tr><tr><td>arrow **B**</td><td></td><td>✓</td><td></td><td>✓</td><td>;</td></tr></tbody></table>	2
8(d)(i)	4 ;	1
8(d)(ii)	*Any two from:* contains (only) carbon and hydrogen ; **all** single bonds / saturated ; has the same general formula ;	2

Question	Answer	Marks
9(a)	**A** AND **C** ;	1
9(b)(i)	;	1
9(b)(ii)	$E = IVt$ *(in any form)* or 300 (s) ; $5 \times 12 \times 5 \times 60$ / 18 000 (J) ; 18 (kJ) ;	3
9(b)(iii)	8 (V) ;	1
9(b)(iv)	(to) thermal energy ; due to resistance (in the circuit) ;	2