Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/04**

Paper 4 Theory (Extended) **For examination from 2025**

MARK SCHEME

Maximum Mark: 80

Specimen

This document has **10** 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 descriptions 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 descriptions for the question
- the specific skills defined in the mark scheme or in the generic level descriptions 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 descriptions.

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 descriptions 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	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.

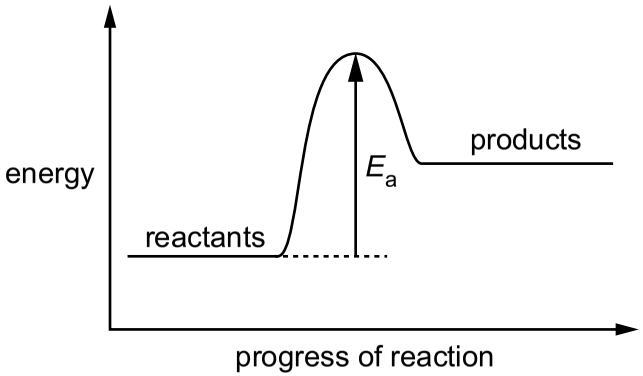
mark scheme abbreviations

;	separates marking points
/	alternative responses for the same marking point
A	accept (a less than ideal answer which should be marked correct)
I	ignore (mark as if this material was not present)
ecf	error carried forward
AVP	alternative valid point
ORA	or reverse argument
owtte	or words to that effect
AW	alternative wording (where responses vary more than usual)
AND	both responses required for the mark
OR	alternative responses for the same marking point
underline	actual word given must be used by candidate (grammatical variants excepted)
( )	the word / phrase in brackets is not required but sets the context
max	indicates the maximum number of marks

Question	Answer	Marks	Guidance
1(a)	any **two** from: pathogens spread diseases ; idea of good personal hygiene ; stops the spread of pathogens ;	**2**	**A** named pathogen **A** removes pathogens from hands **A** stops pathogens getting on to food
1(b)(i)	any **two** from: initial vaccination – fewer antibodies produced ; initial vaccination – number of antibodies increases more slowly ; initial vaccination – antibodies decrease to a lower number (after the peak) ; initial vaccination – number of antibodies decreases more rapidly (after the peak) ;	**2**	**ORA**
1(b)(ii)	phagocytosis ☐ assimilation ☐ active immunity ✓ ; transmissible disease ☐	**1**	
1(c)	help form a clot ; idea that blood clot, seals wound / prevents entry of pathogens ;	**2**	**I** produces antibodies
1(d)(i)	coronary ;	**1**	
1(d)(ii)	red blood cell(s) ;	**1**	

Question	Answer	Marks	Guidance
2(a)(i)	sucrose **AND** amino acids ;	**1**	more than **two** circled = 0 marks
2(a)(ii)	support ;	**1**	
2(b)	$6CO_2 + 6H_2O \rightarrow$; $C_6H_{12}O_6 + 6O_2$;	**2**	**A** reactants any order **A** products any order **I** anything written over the arrow
2(c)	test-tube **A** high concentration of carbon dioxide because: carbon dioxide produced in respiration ; no photosynthesis / light is needed for photosynthesis ; test-tube **C** low concentration of carbon dioxide because: carbon dioxide used in photosynthesis ; rate of photosynthesis is higher than rate of respiration ;	**4**	
2(d)	reduces biodiversity because: any **two** from: less food available for consumers ; some species become extinct ; removes habitat / shelter ;	**2**	

Question	Answer	Marks	Guidance
3(a)(i)	egestion ;	**1**	
3(a)(ii)	pancreas ; lipase ; fatty acids **AND** glycerol ;	**3**	 **A** either order
3(b)(i)	stomach contents, are acidic / have a lower pH ; active site changes shape ; substrate no longer fits into the active site / substrate no longer complementary to the active site / enzyme-substrate complex no longer forms ;	**3**	
3(b)(ii)	bell-shaped curve with optimum pH 1–3 ;	**1**	

Question	Answer	Marks	Guidance
4(a)(i)	the minimum energy that colliding particles must have to react ;	**1**	
4(a)(ii)	arrow to show E_a ;  	**1**	
4(b)	temperature decreases **AND** reaction is endothermic / takes in thermal energy / the products have more energy than the reactants ;	**1**	
4(c)(i)	carbon dioxide ; water ;	**2**	

Question	Answer	Marks	Guidance
4(c)(ii)	frequency of collisions increases ; more particles have kinetic energy greater than the activation energy / collisions are more energetic / more collisions are successful ;	**2**	

Question	Answer	Marks	Guidance
5(a)(i)	both have high electrical conductivity ;	**1**	
5(a)(ii)	aluminium, has low density / is light in weight / is lightweight ;	**1**	
5(a)(iii)	some copper compounds are toxic ;	**1**	**A** aluminium is preferred because it does not corrode
5(b)(i)	mixture of a metal with (one or more) other elements ;	**1**	
5(b)(ii)	steel contains particles of different sizes ; which stop layers of atoms from sliding over each other ;	**2**	
5(b)(iii)	stainless steel is, hard / resistant to rusting ;	**1**	**A** stainless steel does not corrode
5(c)	<table><tr><th>metal</th><th>heating with carbon</th><th>electrolysis</th></tr><tr><td>aluminium</td><td></td><td>✓</td></tr><tr><td>copper</td><td>✓</td><td></td></tr><tr><td>iron</td><td>✓</td><td></td></tr></table> any two correct ; all three correct ;	**2**	

Question	Answer	Marks	Guidance
6(a)	carbon monoxide **AND** carbon particulates by incomplete combustion ; carbon dioxide by complete combustion ;	**2**	**A** max 1 for identification of combustion alone
6(b)	$CO_2(g)$ **AND** CO(g) ; C(s) **AND** $C_8H_{18}(l)$;	**2**	
6(c)(i)	idea that, the double bonds are not between two carbon atoms ;	**1**	
6(c)(ii)	any **two** from: reduce deforestation ; decrease the use of fossil fuels ; increase the use of, renewable energy / wind / solar ;	**2**	**A** reduce livestock farming **A** other examples of suitable energy sources e.g. hydrogen
6(d)(i)	$2CO + 2NO \rightarrow 2CO_2 + N_2$	**1**	
6(d)(ii)	acid rain ; because oxides of nitrogen are removed ;	**2**	**A** NO for oxides of nitrogen

Question	Answer	Marks	Guidance
7(a)(i)	40 (s) ;	**1**	
7(a)(ii)	**X** marked on graph line at any point between 100 s and 120 s ;	**1**	
7(a)(iii)	use of, graph data between 40 s and 100 s / speed 1.5 m / s ; distance = speed × time / use of graph to calculate area / 1.5 × 60 ; 90 (m) ;	**3**	in that order
7(b)	$\Delta E_p = mgh$ / 55 × 9.8 × 0.15 ; 81 ; J / joules ;	**3**	**A** formula in any form **A** 80.9 / 80.85

Question	Answer	Marks	Guidance
8(a)(i)	infrared ;	**1**	
8(a)(ii)	absorbed **AND** greater than **AND** emitted ;	**1**	in that order
8(b)(i)	sound ;	**1**	
8(b)(ii)	transverse waves: direction of vibration at right angles to direction of propagation ; longitudinal waves: direction of vibration parallel to direction of propagation ;	**2**	
8(c)	conversion of days to hours / 365.25 × 24 / 8766 hours ; orbital speed $v = \frac{2\pi r}{T} / \frac{2\pi \times 1.51 \times 10^8}{8766}$; 1.08×10^5 (km / h) ;	**3**	**A** formula in any form
8(d)(i)	red giant ;	**1**	
8(d)(ii)	(the Sun) does not have enough <u>mass</u> / Sun is a small <u>mass</u> star / (only) very large <u>mass</u> stars become black holes ;	**1**	

Question	Answer	Marks	Guidance
9(a)(i)	(5.4 + 3.5 =) 8.9 (Ω) ;	**1**	
9(a)(ii)	(**S** =) 0.2 (A) ; (**U** =) 2.5 (A) ;	**2**	
9(a)(iii)	LED / light-emitting diode ;	**1**	
9(b)(i)	chemical ; kinetic ;	**2**	in that order
9(b)(ii)	useful power output = $\frac{\text{energy}}{\text{time}} / \frac{32}{10}$; efficiency = $\frac{\text{useful power output}}{\text{total power input}} \times 100\% / \frac{3.2}{3.6} \times 100$; 88.9% ;	**3**	**A** alternative approach of converting input power to energy, then using energy efficiency formula **A** formula in any form calculation shown with final answer to at least 3 significant figures