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CAMBRIDGE
International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/41**

Paper 4 Theory (Extended) **May/June 2026**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

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General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

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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.

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Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
	information missing or insufficient for credit
	incorrect or insufficient point ignored while marking the rest of the response
	contradiction in response, mark not awarded
	benefit of the doubt given
	error carried forward applied
	response is too vague or there is insufficient detail in response
	incorrect point or mark not awarded
	point has been noted, but no credit has been given or blank page seen

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Annotation	Meaning
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
	blank page
	unclear response
	two statements are linked
	follow through
	irrelevant material that does not answer the question

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Question	Answer	Marks	Guidance
1(a)(i)	**E** ; **C** ; **B** ;	**3**	
1(a)(ii)	M1 starch ; M2 simple / reducing sugars ;	**2**	M1 **DO NOT ACCEPT** carbohydrate / glycogen M2 **ALLOW** glucose / maltose **DO NOT ACCEPT** sucrose and unqualified 'sugar'
1(b)(i)	35 (°C) ;	**1**	**ALLOW** ± 1.0 °C
1(b)(ii)	*any **three** from:* M1 enzyme activity increases ; M2 increase in **kinetic** energy ; M3 increased **frequency** of (effective) collisions ; M4 more enzyme-substrate complexes form ;	**3**	 M2 **ALLOW** moves faster M4 **ALLOW** idea of rate of formation of enzyme-substrate complexes increases (1) as result of increased effective collisions (1)

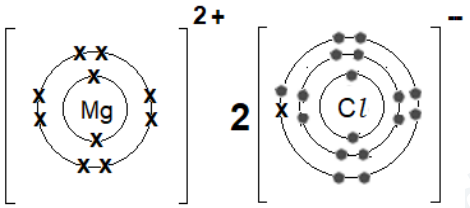
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Question	Answer	Marks	Guidance
2(a)(i)	M1 (119.56 – 115.23) / 4.33 ; M2 (4.33 ÷ 20 =) 0.22 (g per minute) ;	**2**	correct answer no working = 2 marks M2 **ALLOW** 0.2165 / 0.2 **ALLOW** ecf from M1 to M2 for incorrect change in mass
2(a)(ii)	increased temperature ;	**1**	**ALLOW** decreased humidity **IGNORE** unqualified 'temperature' **ALLOW** high temperature / hot weather
2(b)	hair ; xylem ; (spongy) mesophyll ;	**3**	**ALLOW** root hair **ALLOW** palisade mesophyll
2(c)(i)	$6CO_2 + 6H_2O$; → $C_6H_{12}O_6 + 6O_2$;	**2**	**DO NOT ALLOW** ambiguous formulae e.g. Co^2 / H_{20} / $_6CO_2$ on impression - penalise poor formulae presentation only once **IGNORE** names of substances
2(c)(ii)	palisade (mesophyll) ;	**1**	
3(a)	M1 **both** cause an increase (in concentration) of antibodies / greater increase in response to pathogen / smaller increase in response to vaccination ; M2 (concentration of) antibodies increases quicker in response to (infection by) pathogen / ora ; M3 (concentration of) antibodies remains higher for longer after (infection by) pathogen / ora ;	**3**	M1 **ALLOW** pathogen - higher (change) OR vaccination - lower (change) At least one answer **must** be comparative or max 2 M3 **ALLOW** decreases slower 'remains constant at the end'

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Question	Answer	Marks	Guidance
3(b)	M1 bacterial infections are treated with **antibiotics** ; M2 prevent/limit the development of (antibiotic) resistant **bacteria** ; M3 Effectiveness is reduced by presence of resistant bacteria / over use / not completing the course of treatment ;	**3**	**IGNORE** references to bacteria becoming immune / releasing antibodies or antigens M2 **DO NOT ACCEPT** antibiotic resistance of the *body* **ALLOW** named resistant bacteria, e.g. MRSA M3 **ALLOW** idea that overuse may reduce the effectiveness of the drug used to treat bacterial infection **IGNORE** efficient as AW for effective **ALLOW** (overuse) may harm / destroy useful / healthy bacteria
3(c)(i)	*any **one** from:* (increased) exercise ; stop smoking ; reduce stress ; AVP ;	**1**	**IGNORE** diet including refs to alcohol **IGNORE** changes to genetics / sex / age **ACCEPT** just 'exercise' **E.g.** use of statins / beta blockers
3(c)(ii)	*any **two** from:* provides vitamins ; provides minerals ; provides fibre ; AVP ;	**2**	 **ALLOW** named vitamin **ALLOW** (correct) named mineral **ALLOW** roughage **IGNORE** nutrients E.g. Avoids scurvy / constipation / rickets

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Question	Answer	Marks	Guidance
4(a)(i)	inert / unreactive ; conducts **electricity** ;	**2**	**ALLOW** high melting point **IGNORE** things like solid / insoluble **IGNORE** unqualified *conductor*
4(a)(ii)	magnesium / Mg ;	**1**	**DO NOT ACCEPT** ref to ions
4(a)(iii)	no mobile ions ;	**1**	**IGNORE** refs to being in a lattice / no delocalised electrons
4(b)	M1 the energy is used to **break** the bonds / forces (between particles) ; M2 (particles) gain kinetic energy **OR** (overcome forces) between oppositely charged ions ;	**2**	M1 **IGNORE** refs to molecules M2 **ALLOW** particles move faster **IGNORE** refs to molecules
4(c)	magnesium with 8 crosses in outer shell ; chloride with 7 dots and 1 cross in outer shell ; 2+ and 1– ;	**3**	**ACCEPT** correct numbers of electrons whether dots and/or crosses /  **IGNORE** inner shells **ACCEPT** +2 and **–1**

Question	Answer	Marks	Guidance
5(a)	from red to yellow ;	1	**DO NOT ACCEPT** orange
5(b)	$CaO + 2HCl \rightarrow CaCl_2 + H_2O$ reactants and products ; balanced (dependent on correct formulae) ;	2	**ALLOW** multiples / fractions **IGNORE** state symbols Max 1 for ambiguous formulae e.g. Co^2 / H_{20} / $_6CO_2$ / Cao / $CaCl_2$ / Ca (on impression)
5(c)	M1 more (reactant / acid) particles per unit volume ; M2 frequency of (successful) collisions increases ;	2	M1 and M2 marked independently M2 **ALLOW** number of (successful) collisions increases per unit time M2 **ALLOW** higher chance of (successful) collisions M2 **ALLOW** collisions happen more often / increased rate of collisions M2 **IGNORE** references to energy changes M2 **IGNORE** more successful collisions / proportion of successful collisions increases

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Question	Answer	Marks	Guidance
5(d)	M1 exothermic profile: reactants and products labelled **and** reactants higher than products **and** a maximum shown ; M2 activation E_a label: activation energy shown as a line or upward arrow and labelled E_a / activation energy, from energy level of reactants to the energy maximum ; M3 energy change mark one downward arrow labelled **Y** and energy change starting from energy level of reactants and finishing at energy level of products ;	**3**	**DO NOT ACCEPT** M1 if on an endothermic profile **ALLOW** both terms 'reactants' and 'products' OR formulae from **5(b)** allowing ecf M2 **ALLOW** double headed arrow for E_a M2 **IGNORE** downward arrow for E_a **ALLOW** ecf from **5(b)** for reactants and products M3 **ALLOW** 'energy change' label for **Y** M3 **DO NOT ALLOW** double headed or upward arrow for **Y** **ACCEPT** max 2 for fully correct endothermic reaction profile. –1 mark for each additional error
6(a)	*any **two** from:* M1 same general formula ; M2 trend in physical properties ; M3 similar chemical properties ;	**2**	M1 **ALLOW** difference of CH_2 between consecutive members **DO NOT ALLOW** same chemical formula **ACCEPT** same functional group as an extra marking point M2 **ALLOW** trend in stated physical property limited to m.pt. b.pt. viscosity M3 **DO NOT ALLOW** *same* chemical properties
6(b)	addition ;	**1**	**ACCEPT** additional

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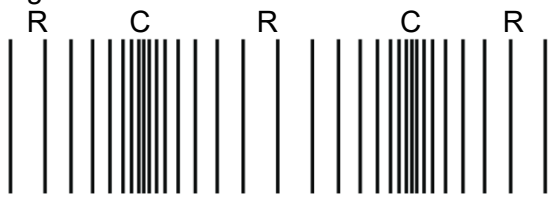
Question	Answer	Marks	Guidance
6(c)(i)	nickel ;	1	**ALLOW** Ni AVP Pt Pd Rh Ru but NOT elemental iron **IGNORE** unqualified a transition metal
6(c)(ii)	ethane ;	1	**IGNORE** alkane **ALLOW** C_2H_6
6(d)	*max [4] for any two pairs: effect dependent on pollutant* carbon dioxide ; causes global warming / causes climate change ; carbon monoxide ; toxic ; sulfur dioxide ; causes acid rain ; nitrogen oxides ; causes acid rain / respiratory problems ; particulates ; respiratory problems / cancer ;	4	No ecf from incorrect pollutant **IGNORE** suffocation **ALLOW** enhanced / increased greenhouse effect **ALLOW** formulae for pollutants **ALLOW** sulfur oxide but **not** SO **IGNORE** sulfuric acid For nitrogen oxides **ALLOW** photochemical smog / low level ozone **ALLOW** named respiratory issues e.g. asthma **ALLOW** smog for particulates

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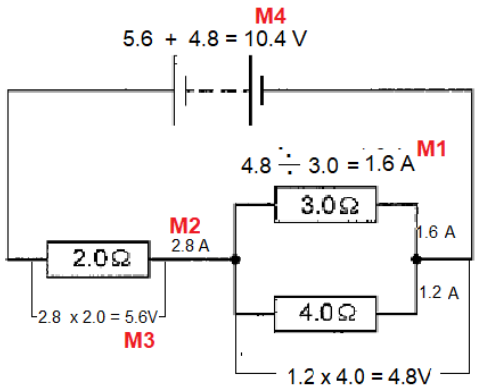
Question	Answer	Marks	Guidance
7(a)(i)	constant speed ;	1	**ALLOW** uniform / steady / constant 40 m/s **ACCEPT** velocity
7(a)(ii)	M1 5 min to 300 s ; M2 (Δv =) 0.10 × 300 or 0.1 × 5 × 60 ;	2	M1 **AWARD** 1 mark if 300 or 5 × 60 seen **ACCEPT** M2 in any form
7(a)(iii)	M1 Calculations showing distance = area under graph ; e.g. ½ × 300 × 30 or 4500 **OR** ½ x 5 × 30 or 75 **OR** 300 × 10 or 3000 **OR** 5 × 10; or 50 M2 both correct areas / distances :4500 and 3000 seen OR 75 and 50 ; 7500 (m) ;	3	**ALLOW** area of trapezium (10 + 40) / 2) × 300 **ALLOW M1 (300 × 10) + ½ (300 × 30)** **ALLOW M1** use of area of trapezium i.e. $\frac{1}{2}(40+10)\times 300 = 7500$ = 3 marks **ALLOW** M1 and M2 for 125 seen (unconverted time so max2) **ACCEPT** use of higher level equations, e.g. $s = ut + ½\ at^2$
7(b)(i)	resultant force 510 000 – 440 000 OR 70 000 (N) ; $F = ma$ or 70 000 ÷ 1.25 ; 56 000 (kg) ;	3	**ALLOW** 440 000 ÷ 1.25 = 352 000 for 2 marks **ACCEPT** equation in any form **ACCEPT** 510 000 ÷ 1.25 for 1 mark **ACCEPT** 408 000 (kg) for 2 marks
7(b)(ii)	$(v =)\frac{2\pi r}{T}$ (R is radius of orbit and T is orbital period) ;	1	**ALLOW** equation in words e.g. orbital speed = (2 × pi × radius of orbit) ÷ orbital period ;

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Question	Answer	Marks	Guidance
8(a)	M1 pressure increases ; M2 **kinetic** energy of particles increases / particles move faster ; M3 particles collide with container walls more frequently / with more force ;	**3**	**DO NOT ALLOW** particles move further apart (constant vol) **ALLOW** collide harder
8(b)(i)	one compression labelled **C** AND one rarefaction labelled **R** ;	**1**	e.g.  **ALLOW** more than one of each labelled if correct
8(b)(ii)	longitudinal ;	**1**	
8(c)	$v = f\lambda$ / 9000×0.11 ; $v = 990$ (m / s) ; (state of matter) gas AND (explanation) speed is slower in a gas (than in a liquid) ;	**3**	**ALLOW** air **ALLOW** ecf from $9000 \div 0.11 = 81\,818$ (no mark) and then solid because faster in solids for 1 mark **ALLOW** alternative valid approach comparing wavelengths = 3 max

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Question	Answer	Marks	Guidance
9(a)	charge ;	**1**	
9(b)(i)	1.2 × 4.0 seen (= 4.8 (V)) ;	**1**	
9(b)(ii)	4.8 V ;	**1**	
9(b)(iii)	M1 current in 3 ohm resistor I_3 = (4.8 ÷ 3.0 =) **1.6 (A)** ; M2 current in 2 ohm resistor (total current in circuit) I_2 = (1.2 + 1.6 =) **2.8 (A)** ; (M2 also gains M1) M3 voltage across 2 ohm resistor V_2 = (2.8 × 2.0 =) **5.6 V** ; (M3 also gains M1 and M2) M4 sum of voltages across all resistors (e.m.f. = 4.8 + 5.6 =) **10.4 V** ;  	**4**	Error in **9(b)(ii)** → ECF error in I_3 I_2 and V_2 Alternative methods: Combined resistance of 3 and 4 ohm resistors $R_{parallel}$ = 1.7 or 12 / 7 seen (Alt M1) Total resistance R_{tot} = 3.7 / 1.7 +2 / 12/7 +2 seen (Alt M2) Current through 2 ohm resistor I_{tot} = 2.8 (Alt M3) (from current split between 3 and 4 ohm resistors 4 to 3 ohms so current ratio 3 : 4 so 1.2 + 1.6) Emf = 2.8 × 3.7 = 10.36 = 10.4 (Alt M4) allow an ecf for their total current × their total resistance even if numerically incorrect **OR** emf Sum of parallel resistors = 1.7 (Alt M1) V across 2Ω resistor = $\frac{4.8 \times 2}{1.7}$ = 5.6 V (Alt M2) Total voltage = 4.8 + 5.6 (Alt M3) = 10.4 V (Alt M4)
9(c)	$\frac{1}{R_T} = \frac{1}{R_A} + \frac{1}{R_B}$ / $\frac{1}{15} = \frac{1}{20} + \frac{1}{R_B}$; **R_B** = 60 (Ω) ;	**2**	**ACCEPT** equation in any form e.g. may be seen as: $R_T = \frac{R_A R_B}{R_A + R_B}$

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