GCSE MARKING SCHEME

SUMMER 2023

GCSE
SCIENCE (DOUBLE AWARD) - UNIT 5

3430U50-1 AND 3430UE0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2023 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCSE SCIENCE (DOUBLE AWARD) UNIT 5 – CHEMISTRY 2

SUMMER 2023 MARK SCHEME

GENERAL INSTRUCTIONS

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

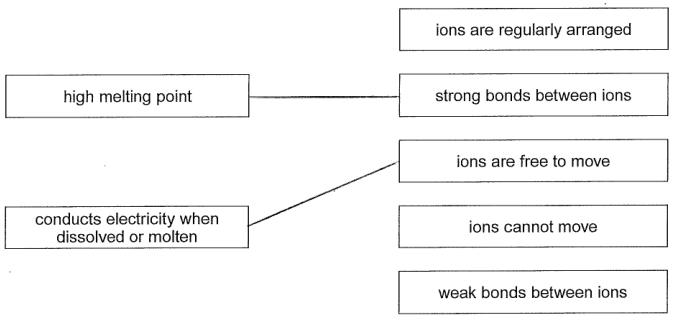
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

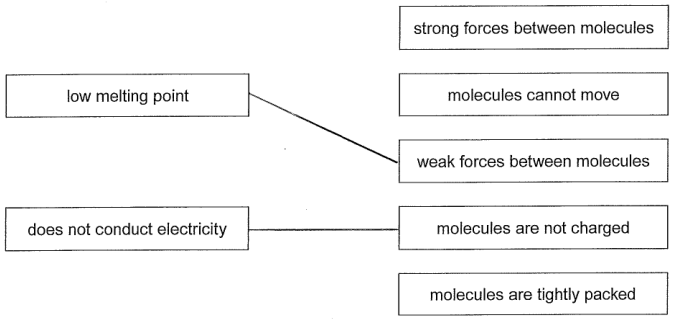
Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

FOUNDATION TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	I	hydrogel	1			1		
			II	photochromic (pigment)	1			1		
		(ii)		heat it ✓ add water place it in sunlight	1			1		
	(b)	(i)		 award (1) for each correct line do not credit if more than one line drawn from either property	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		 award (1) for each correct line do not credit if more than one line drawn from either property	2			2		
	(c)			hard (1) over (1)	2			2		
				Question 1 total	**9**	**0**	**0**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			limestone (1) (hot) air (1)	2			2		
	(b)			$Fe_2O_3 + 3CO \rightarrow 2\ Fe + 3CO_2$		1		1		
	(c)			40 + 28 + 16 ☐ 40 + 40 + 40 + 28 + 28 + 28 + 16 + 16 + 16 ☐ 40 + 28 + 16 + 16 + 16 ☑ 40 + 16 + 16 + 16 ☐ 40 + 28 + 28 + 28 + 16 + 16 + 16 ☐		1		1		
	(d)			46.9 (2) if answer incorrect award (1) for any of following $\frac{820}{1750}$ 0.46857147 / 0.5 / 46.857147 / 46.86 / 46.8 / 46 / 47		2		2	2	
				Question 2 total	**2**	**4**	**0**	**6**	**2**	**0**

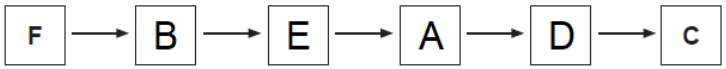
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		same concentration / strength (1) same temperature (1) neutral answer - reference to volume or amount of acid	2			2		2
		(ii)		**B** **A** **D** **C** order correct (1) award (1) for any of following the more reactive (the metal) the more bubbles / fizzing the less reactive (the metal) the less bubbles / fizzing the most reactive (metal) has the most bubbles / fizzing the least reactive (metal) has the least bubbles / fizzing accept reference to **B** having the <u>most</u> bubbles or **C** having <u>no bubbles</u> / the <u>least</u> bubbles if correct order given		2		2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		thermometer is not in the acid / solution / in the air (1) award (1) for any of following will not measure the <u>temperature</u> of the reaction mixture / acid / solution will measure the <u>temperature</u> of the air will not get a <u>temperature</u> rise / change <u>temperature</u> will be lower than expected <u>temperature</u> recording will be incorrect neutral answers unreliable / inaccurate results thermometer gives wrong reading different temperature			2	2		2
		(ii)	I	metal **D** test **2** **both** needed accept correct answer circled in table		1		1		1
			II	23 accept 22 / 24 accept correct answer written in table		1		1	1	1
			III	accept any value in the range 14.1 to 21.9 accept any range that falls within this range e.g. 15-21			1	1	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		$Mg + \boxed{2}\ HCl \longrightarrow MgCl_2 + H_2$ award (1) for formula award (1) for balancing only if formula is correct		2		2		
		(ii)		magnesium nitrate accept $Mg(NO_3)_2$		1		1		
				Question 3 total	**2**	**7**	**3**	**12**	**2**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			the *s*-block, *p*-block and *d*-block ✓ the *s*-block and *p*-block only the *s*-block only the *d*-block and *p*-block only the *p*-block only	1			1		
	(b)			titanium / Ti			1	1	1	
	(c)			the Group 1 metals and transition metals all have a +1 oxidation state the transition metals all have a +3 oxidation state ✓ the Group 1 metals all have a +1 oxidation state ✓ iron and lithium have the same oxidation states the Group 1 metals and transition metals all have a +4 oxidation state award (1) for each correct tick if more than two ticks award (1) for two correct and one incorrect award (0) for one correct and two incorrect			2	2		

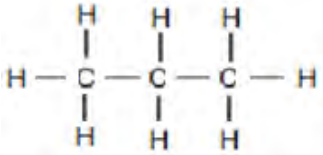
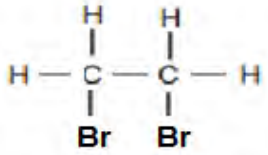
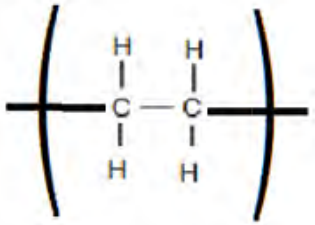
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			agree – award (1) for either of following • if the compound is coloured it must be a transition • metal the transition metals have coloured compounds (whereas the Group 1 metals do not) accept 'Group 1 metal compounds are white' assume that coloured means not white disagree – award (1) for any of following • titanium has a white compound but is not a Group 1 metal • titanium <u>also</u> has a white compound • just because the compound is white does not mean it is in Group 1 neutral answer – some of the transition metal compounds are white			2	2		
				Question 4 total	**1**	**0**	**5**	**6**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		 award (2) for all stages in correct order award (1) for stage **B** in correct place	2			2		2
		(ii)		**E** (1) likely to overshoot the end-point / add too much acid / go past the point of neutralisation / miss colour change (1)	2			2		2
	(b)	(i)		sulfuric acid accept H_2SO_4		1		1		
		(ii)		K_2SO_4		1		1		
				Question 5 total	**4**	**2**	**0**	**6**	**0**	**4**

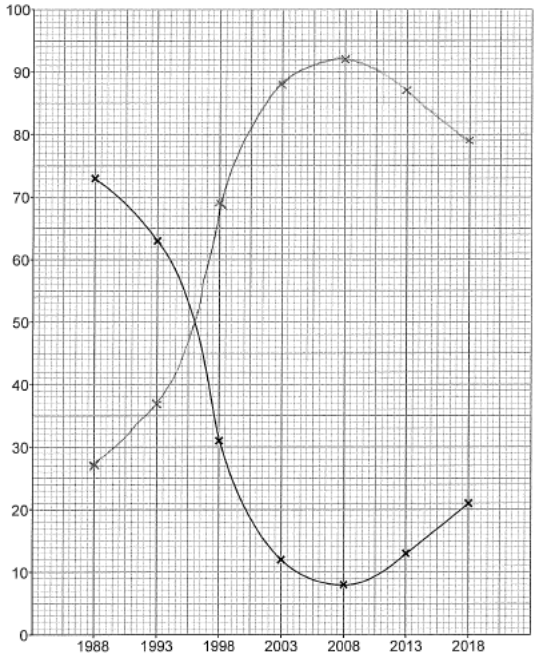
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** **AO1** • use of aluminium in aircraft / overhead power cables / saucepans / window frames • use of copper in electrical wires / saucepans / coins / jewellery • use of titanium in replacement joints / helicopter rotor blades / car parts **AO2** • uses of the metals linked to the properties in the table e.g. ➢ aluminium used in aircraft because of low density and good resistance to corrosion ➢ copper used in saucepans because of high melting point and good thermal conductivity ➢ titanium used in replacement joints because of low density and good resistance to corrosion **5-6 marks** At least one use for each of the metals linked to two properties from the table; no reference made to other properties e.g. strength (AO3 marks) *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.*	2	2	2	6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				3-4 marks One use for two of the metals linked to at least one property from the table *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** One use for two of the metals without links to properties from the table *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or answer worthy or any credit.*						
				Question 6 total	**2**	**2**	**2**	**6**	**0**	**0**

COMMON QUESTIONS

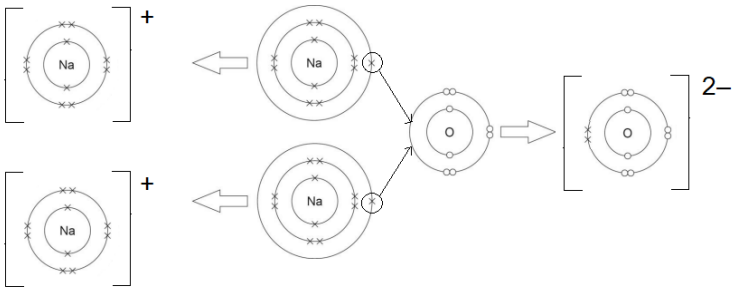
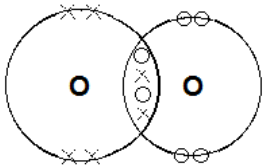
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7/1	(a)	(i)		**D** and **E** **both** needed, either order		1		1		
		(ii)		propene	1			1		
		(iii)			1			1		
	(b)	(i)		 (1)  (1)		2		2		
		(ii)		decolourises / goes colourless neutral answers – goes clear / changes colour	1			1		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		(addition) polymerisation	1			1		
	(c)	(i)		0.15 (2) if answer incorrect award (1) for any of following $\frac{12}{100} \times 1.25$ 0.0125 × 12 15 / 150000		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		 award (2) for **all** points plotted correctly – tolerance ±1 square award (1) for any **four** correct points award (1) for curved line do not accept - point to point line		3		3	3	

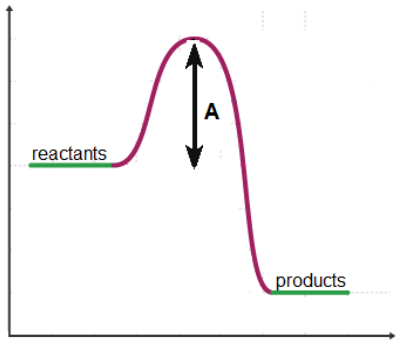
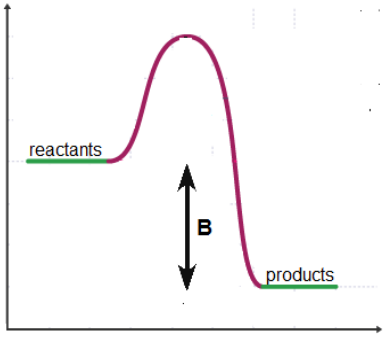
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)	I	1996 accept 1995 / 1997 accept range 1995-1996 / 1996-1997		1		1		1
			II	2 : 8 **1 : 4** 4 : 1 8 : 2 20 : 80			1	1	1	
		(iv)		award (1) for any of following actions people **use** bag for life / alternative bags people **reuse** bags supermarkets **charge** for bags / **stop giving** free plastic bags government **introduced** a charge people have **become more aware** of issues to do with plastic waste people **want to reduce** amount of plastic going to landfill / incineration people **want to reduce** the amount of plastic pollution / microsplastics			1	1		
				Question 7/1 total	**4**	**9**	**2**	**15**	**6**	**2**

HIGHER TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		 outer shell electron of both sodium atoms shown going to the outer shell of the oxygen atom (1) correct charges on **both** sodium ions <u>and</u> the oxide ion (1)		2		2		
		(ii)		 award (2) for correct diagram with **two** shared pairs of electrons in the overlap <u>and</u> correct octet for both atoms if incorrect award (1) for overlapping oxygen atoms with **two** shared pairs in the overlap		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	I	graphite – (because it has) free/mobile/delocalised electrons (between the layers)	1			1		
			II	graphite – (because) the layers can slide over each other	1			1		
		(ii)		nanotubes / graphene / fullerene / buckminsterfullerene accept 'bucky ball'	1			1		
				Question 2 total	**3**	**4**	**0**	**7**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		498 (3) if answer incorrect award credit for each correct step (2 × C—C) + (8 × C—H) / 4000 / 696 + 3304 (1) (5 × O=O) = 6490 – 4000 / 2490 (1) O=O = $\frac{2490}{5}$ = 498 (1) ecf possible		3		3	3	
		(ii)		2052 kJ taken in ☐ 15032 kJ taken in ☐ 15032 kJ given out ☐ 2052 kJ given out ☑			1	1	1	
	(b)			70 / 69.8 / 69.84 do not accept 69.9	1			1	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		 **must** be unambiguously labelled	1			1		
		(ii)		 **must** be unambiguously labelled	1			1		
				Question 3 total	**3**	**3**	**1**	**7**	**5**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			burns and produces heat / acts as a fuel (1) forms carbon monoxide (1) carbon monoxide reduces the iron oxide / is a reducing agent (1) award last marking point for coke as a reducing agent if no reference to carbon monoxide	3			3		
	(b)	(i)		100g of $CaCO_3$ can produce 56g of CaO (1) 8g $CaCO_3$ can produce $\frac{56}{12.5}$ g of CaO or 4.48g of CaO (1) award (1) for any of following 4.48 to one decimal place is 4.5 therefore Charlie is correct 4.48 to one decimal place is 4.5 4.48 therefore Charlie is correct do not accept 4.5 and Charlie with **no working** alternative methods 0.08 mol $CaCO_3$ (1) 0.08 × 56 = 4.48g CaO (1) award (1) for any of following 4.48 to one decimal place is 4.5 therefore Charlie is correct 4.48 to one decimal place is 4.5 4.48 therefore Charlie is correct			3	3	3	3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				'trial and error' methods working backwards from any of the values given e.g. $\frac{4.4 \times 100}{56}$ = 7.86 $\frac{4.5 \times 100}{56}$ = 8.04 closest to 8.0g therefore Charlie $\frac{5.0 \times 100}{56}$ = 8.93 $\frac{100}{8}$ = 12.5 12.5 × 4.4 = 55 12.5 × 4.5 = 56.3 closest to 56 therefore Charlie 12.5 × 5.0 = 62.5						
		(ii)		$CaSiO_3$		1		1		
	(c)			$\boxed{4}\ Fe + 3O_2 \longrightarrow \boxed{2}\ Fe_2O_3$ award (1) for formula award (1) for balancing only if formula is correct		2		2		
				Question 4 total	**3**	**3**	**3**	**9**	**3**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		award (1) **each** for **A** and **B** **A** copper(II) nitrate / copper nitrate / $Cu(NO_3)_2$ **B** carbon dioxide / CO_2 award (1) for **both C** and **D** **C** zinc nitrate / $Zn(NO_3)_2$ **D** copper	3			3		3
		(ii)		$Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$ award (1) **each** for formulae of <u>products</u> award (1) for balancing only if all formulae are correct		3		3		
		(iii)		displacement	1			1		1
	(b)	(i)		$H^+ + Cl^- \longrightarrow HCl$ ☐ $Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_4$ ✓ $Ba^{2+} + S^{2-} + 4O^{2-} \longrightarrow BaSO_4$ ☐ $2H^+ + 2Cl^- \longrightarrow 2HCl$ ☐ $Ba^{2-} + SO_4^{2+} \longrightarrow BaSO_4$ ☐			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)	I	flame test – (apple) green (flame)	1			1		1
			II	silver nitrate (solution) – white **precipitate**	1			1		1
				Question 5 total	**6**	**3**	**1**	**10**	**0**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			they are macromolecules ☐ they are unsaturated ✓ they contain hydrophilic groups ☐ they are polymers ☐			1	1		
	(b)			ability to swell and shrink, depending on their surroundings			1	1		
	(c)			12440 (2) if answer incorrect award (1) for 4.389 – 0.035 = 4.354		2		2	2	
	(d)			award (1) for **either** of following • the higher the temperature, the more the diameter increases (over time) • the higher the temperature, the higher the rate of increase in diameter / the more quickly the diameter increases at 40°C the size of the bead stops increasing / reaches maximum after 8 hours (1)			2	2		
				Question 6 total	**0**	**2**	**4**	**6**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Indicative content** • ions are free to move because aluminium oxide is molten • ions travel to the oppositely charged electrodes because opposite charges attract / Al^{3+} ions go to the cathode / O^{2-} ions go to the anode • reduction is gain of electrons, oxidation is loss of electrons at the cathode – reduction • $Al^{3+} + 3e^- \rightarrow Al$ • aluminium ions gain 3 electrons to form aluminium atoms at the anode – oxidation • $2O^{2-} \rightarrow O_2 + 4e^-$ • two oxide ions lose 2 electrons each to form two oxygen atoms • these pair up to form oxygen molecules **5-6 marks** Good explanation of the movement of ions towards both electrodes and of reduction and oxidation of both ions in terms of gain/loss of electrons; attempt at electrode equations *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.*	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				3-4 marks Attempt at explanation of the movement of ions and of reduction and oxidation in terms of gain/loss of electrons *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** Simple description of the movement of ions during the process; knowledge of reduction or oxidation in terms of gain/loss of electrons *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
				Question 7 total	**6**	**0**	**0**	**6**	**0**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	9	0	0	9	0	0
2	2	4	0	6	2	0
3	2	7	3	12	2	8
4	1	0	5	6	1	0
5	4	2	0	6	0	4
6	2	2	2	6	0	0
7	4	9	2	15	6	2
TOTAL	24	24	12	60	11	14

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	9	2	15	6	2
2	3	4	0	7	0	0
3	3	3	1	7	5	0
4	3	3	3	9	3	3
5	6	3	1	10	0	6
6	0	2	4	6	2	0
7	6	0	0	6	0	0
TOTAL	25	24	11	60	16	11