GCSE MARKING SCHEME

SUMMER 2022

GCSE
CHEMISTRY – UNIT 1
3410U10-1 AND 3410UA0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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.

WJEC GCSE CHEMISTRY

UNIT 1 – CHEMICAL SUBSTANCES, REACTIONS AND ESSENTIAL RESOURCES

SUMMER 2022 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

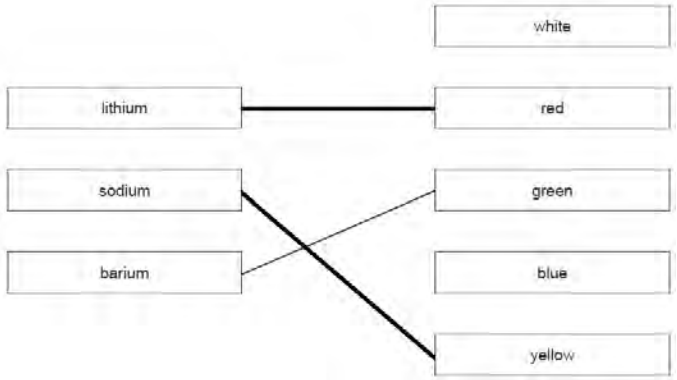
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide 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.

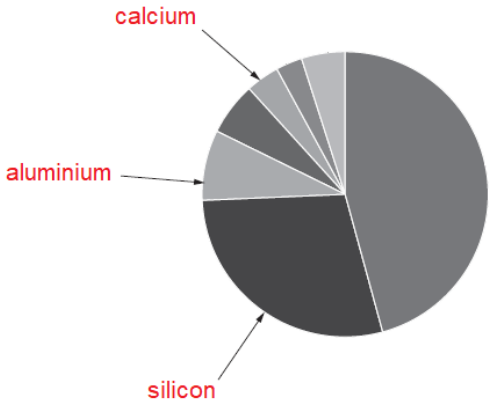
cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

Foundation Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		<table><tr><th>Substance</th><th>Formula</th><th>Element</th><th>Compound</th></tr><tr><td>potassium hydroxide</td><td>KOH</td><td></td><td>✓</td></tr><tr><td>hydrogen</td><td>H_2</td><td>✓</td><td></td></tr></table> award (1) for each correct tick		2		2		
		(ii)		fizzing (1) potassium floats (1)	2			2		2
	(b)			4 accept any method of identifying correct answer		1		1	1	
	(c)			 award (1) for each correct line	2			2		2
				Question 1 total	**4**	**3**	**0**	**7**	**1**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			sulfur dioxide, SO_2 **B** (1) ethene, C_2H_4 **A** (1)		2		2		
	(b)			carbon dioxide neutral answer – CO_2		1		1		
				Question 2 total	**0**	**3**	**0**	**3**	**0**	**0**

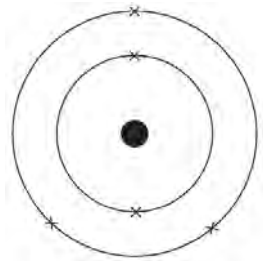
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			7		1		1		
	(b)			Cl_2		1		1		
	(c)	(i)		glowed less brightly than iodine ☐ glowed less brightly than chlorine ✓ glowed more brightly than chlorine ☐		1		1		1
		(ii)	I	$FeBr_3$		1		1		
			II	iron bromide ignore any bracketed numbers		1		1		
	(d)			to disinfect skin before surgery ✓ to make coloured fireworks ☐ to sterilise swimming pools ☐ to fill party balloons ☐	1			1		
				Question 3 total	**1**	**5**	**0**	**6**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		 award (2) for all correct award (1) for 1 or 2 correct			2	2		
		(ii)		$\frac{\mathbf{1}}{\mathbf{4}}$			1	1	1	
		(iii)		most metals have higher melting points than gold ☐ most metals are magnetic ☐ most metals are more reactive than gold ☑ most metals are radioactive ☐	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		plates move apart / separate (1) magma / molten rock moves upwards (1) cools / solidifies / crystallises / hardens (1) references to new land / igneous rock / volcanoes are neutral	3			3		
		(ii)		constructive	1			1		
				Question 4 total	**5**	**0**	**3**	**8**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		**D <u>B E A</u> C**			1	1		1
		(ii)		magnesium	1			1		
		(iii)		<table><tr><td>volume of soap solution</td><td>✓</td></tr><tr><td>type of water</td><td></td></tr><tr><td>type of soap solution</td><td>✓</td></tr><tr><td>volume of water</td><td>✓</td></tr><tr><td>height of lather</td><td></td></tr><tr><td>width of test tube</td><td>✓</td></tr></table> award (2) for all 4 correct with no other ticks award (1) for any 2 or 3 deduct (1) per incorrect box ticked			2	2		2
	(b)	(i)		54°C no tolerance		1		1	1	
		(ii)		solubility of both increases as the temperature increases (1) award (1) for any of following (solubility of) copper(II) sulfate increases much more (than that of sodium chloride) (solubility of) sodium chloride increases much less (than that of copper(II) sulfate) (solubility of) copper(II) sulfate increases a lot and that of sodium chloride increases only slightly comparison needed		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		290 g (2) if incorrect award (1) for either of following 29 g (correct reading from graph) any value multiplied by 10		2		2	2	
	(c)	(i)		1		1		1		
		(ii)		174 (2) if incorrect award (1) for either of following (39 × 2) + 32 + (4 × 16) 2 K + 1 S + 4 O		2		2	2	
				Question 5 total	**1**	**8**	**3**	**12**	**5**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		atomic number ⇨ 5 (1) mass number ⇨ 11 (1)		2		2		
		(ii)		 accept 2,3 as a written alternative		1		1		
		(iii)		equal numbers of protons and electrons (1) protons are positive and electrons are negative / protons and electrons have opposite charges (1) neutral answers any reference to neutrons charges cancel out	2			2		
	(b)	(i)		nitrogen accept N / N_2		1		1		
		(ii)		5 electrons in <u>outer</u> shell / orbit		1		1		
		(iii)		2 (electron) shells / orbits		1		1		
				Question 6 total	**2**	**6**	**0**	**8**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			award (2) for 6 correct points (tolerance ±½ square) award (1) for any 4 or 5 correct points award (1) for straight line through points does not need to be drawn to origin		2 1		3	3	
	(b)			award (2) for high-level quantitative description • as the concentration doubles, the volume of gas doubles • concentration and volume of gas are directly proportional award (1) for lower-level description • as the concentration increases, the volume of gas increases • concentration and volume are proportional • concentration and volume are directly correlated • concentration and volume have a linear relationship			2	2		2
	(c)			more (1) collide (1) gas (1)	2	1		3		1
	(d)			award (1) each for any **two** of following • increase temperature / warm / heat / hotter • increase surface area (of chalk) / smaller pieces / cut chalk up / powder chalk [do not accept smaller surface area] • (add) catalyst (1) award (1) for 'change' surface area <u>and</u> temperature with no reference to 'increase' if no other mark awarded			2	2		2
				Question 7 total	**2**	**3**	**5**	**10**	**3**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8				**Indicative content** • carbon dioxide level in the atmosphere increases • this traps more heat in the atmosphere • the Earth's temperature is rising • melting polar ice / glaciers leads to increased sea levels and flooding • extreme weather such as hotter summers / colder winters / more hurricanes • habitat changes are caused by changes in climate	6			6		
				5-6 marks Global warming clearly explained including the idea of increase in carbon dioxide trapping more heat; two consequences described *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.* **3-4 marks** Global warming explained with link between carbon dioxide and increase in temperature; reference to two consequences *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** Reference to increasing temperature; reference to one consequence *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 8 total	**6**	**0**	**0**	**6**	**0**	**0**

Common questions

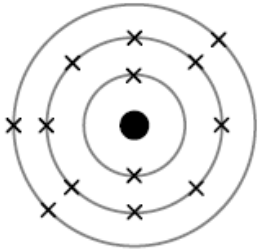
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/1	(a)	(i)	I	(thermal) decomposition	1			1		1
			II	$CaCO_3 \rightarrow CaO + CO_2$ award (1) for reactant award (1) for products ignore any attempt at balancing		2		2		1
		(ii)		water	1			1		
	(b)			award (1) for any of following making cement / concrete / plaster making iron / steel road building in statues neutral answers – building / building houses / buildings	1			1		
				Question 9/1 total	**3**	**2**	**0**	**5**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10/2	(a)			**C** (1) award (1) for any of following $\frac{9}{15}$ = 0.6 both **B** and **C** have R_f of 0.6 both **B** and **C** have a dot at 9 cm it is the highest dot (in **C**) (1)			3	3	1	3
	(b)			more soluble pigments move further up / more soluble pigments move faster (2) pigments have different solubilities (1) neutral answer – different R_f values	2			2		2
	(c)			**B** (1) award (1) for any of following one of its dot has not moved / is still on the line one of its dots has R_f = 0 pigment needs to be soluble to move up the paper			2	2		2
	(d)			62 (2) if incorrect award (1) for 36 or $\frac{12}{58}$		2		2	2	
				Question 10/2 total	**2**	**2**	**5**	**9**	**3**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11/3	(a)			(surface of the) Earth cooled / temperature decreased (1) (water vapour) condensed to form rivers/lakes/oceans (1) award (1) each for any two of following (carbon dioxide used in) photosynthesis / plants evolved (carbon dioxide) locked in fossil fuels / rocks / shells dissolved/absorbed in oceans	4			4		
	(b)			nitrogen ⇨ 78% (1) accept 79 / 80 oxygen ⇨ 21% (1) accept 20	2			2		
				Question 11/3 total	**6**	**0**	**0**	**6**	**0**	**0**

Higher Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		award (1) for sensible scale on y-axis e.g. 1 small square ≡ 5 g award (2) for 6 correct points (tolerance ±½ square) award (1) for any 4 or 5 correct points award (1) for curve of best fit		3	1	4	4	
		(ii)		308 g (3) accept any answer between 287 and 338 (based on ±½ square tolerance for two readings from graph) if incorrect award (2) for 169 – 46 = 123 g accept any answer between 115 and 135 (based on ±½ square tolerance for two readings from graph) award (1) for 46 g read from graph (±½ square tolerance)		3		3	3	
	(b)			ethanol and water have different boiling points / ethanol has a lower boiling point than water / water has a higher boiling point than ethanol (1) award (1) for either of following on heating, ethanol will evaporate first and go into the condenser on heating, ethanol will evaporate at lower temperature and go into the condenser	2			2		2
				Question 4 total	**2**	**6**	**1**	**9**	**7**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			 accept electrons shown as dots accept diagram with nucleus missing		1		1		
	(b)	(i)		**B** and **D** (1) must be correct to access second mark award (1) for either of following they have same number of protons but different number of neutrons they have same atomic number but different mass number ignore reference to electrons	1	1		2		
		(ii)		**A** and **F** (1) must be correct to access second mark award (1) for any of following they have different numbers of protons and electrons **A** has more electrons than protons and **F** has more protons than electrons neutral answer - they are $\mathbf{A}^-$ and $\mathbf{F}^+$ do not award the mark if there is any suggestion that the number of neutrons is relevant	1	1		2		
				Question 5 total	**2**	**3**	**0**	**5**	**0**	**0**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>6</td><td>(a)</td><td>(i)</td><td></td><td>
<table>
<tr><th>Compound</th><th>Flame test colour</th><th>Symbol of ion</th><th>Observation on adding silver nitrate solution</th><th>Symbol of ion</th></tr>
<tr><td>S</td><td>brick red</td><td>Ca^{2+}</td><td>yellow precipitate</td><td>I^-</td></tr>
<tr><td>T</td><td>apple green</td><td>Ba^{2+}</td><td>white precipitate</td><td>Cl^-</td></tr>
</table>

award (1) mark for each correct answer

do not accept ions with missing (or incorrect) charges but penalise once only e.g.
award (2) if all three ions identified but no charges given
award (1) if two ions identified but no charges given</td><td>4</td><td></td><td></td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>award (1) for any of following

the yellow would hide the white precipitate
it would look (pale) yellow (like iodide) / cream (like bromide)
there would be a mixture of two precipitates
it would not be possible to distinguish between the colours</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

award (1) for ions
award (1) for product formula
award (1) for state symbols – can only be awarded if ions and product are correct</td><td></td><td>3</td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 6 total</td><td>4</td><td>3</td><td>1</td><td>8</td><td>0</td><td>5</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			**4**			1	1	1	
	(b)			**Y** (1) award (1) for either of following volume of gas produced / rate of reaction increases with temperature then decreases it works best / has an optimum temperature at around 40°C enzymes are denatured at 40°C / at higher temperatures (1) neutral answers – broken down / damaged / killed	1		2	3		
	(c)			**C**			1	1		
				Question 7 total	**1**	**0**	**4**	**5**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			**A** is permanent hard water (1) it is not softened by boiling (only by ion exchange) / boiling has no effect on the volume of soap needed (1) **B** contains both temporary and permanent hard water (1) as it is partly softened by boiling <u>and</u> further softened by ion exchange / less soap needed after boiling and less again after ion exchange (1)	2		2	4		4
	(b)			$Na_2CO_3 + MgCl_2 \rightarrow 2NaCl + MgCO_3$ award (1) for reactants award (1) for products award (1) for balancing - can only be awarded if reactants and products are correct accept multiples of correct balancing ignore state symbols		3		3		
				Question 8 total	**2**	**3**	**2**	**7**	**0**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			**Indicative content** • lithium fizzes and moves around the surface of the water • sodium moves faster on the surface, fizzes more and melts into a ball • potassium reacts more vigorously again, melts into a ball and ignites producing a lilac flame • reactions more vigorous on moving down the group • outer electron is lost during the reaction • lost more easily on moving down the group because it is further away from the nucleus / attraction between the nucleus and the outer electron decreases	6			6		3

5-6 marks
Detailed description of reactions; explanation of relative ease of loss of outer electron
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.

3-4 marks
Basic description of reactions; reference to loss of outer electron
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
Basic description of some reactions
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				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		18.8 g (3) if answer incorrect credit each correct step in one of two possible methods (ecf possible throughout) method 1 n(K) = $\frac{15.6}{39}$ = 0.4 mol (1) n(K_2O) = $\frac{0.4}{2}$ = 0.2 mol (1) mass K_2O = 0.2 × 94 = 18.8 g (1) method 2 M_r(K_2O) = 94 / mass of 156 (for K)(1) (156 g K produces) 188 g K_2O (1) 15.6 g K produces 18.8 g K_2O (1)		3		3	3	
		(ii)		3.0 × 10^{22} (2) accept 3 × 10^{22} if answer incorrect award 1 mark for 0.30 × 10^{23}		2		2	2	
				Question 9 total	**6**	**5**	**0**	**11**	**5**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		**C** (1) reactivity of halogens decreases down the table / chlorine is the most reactive/ iodine is the least reactive (1) award (1) for any of following chlorine displaces bromine and iodine iodine does not displace bromine or chlorine chlorine reacts with sodium bromide and sodium iodide iodine does not react with sodium bromide or sodium iodide	2		1	3		3
		(ii)		$Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ award (1) for reactants award (1) for products award (1) for balancing - can only be awarded if reactants and products are correct ignore state symbols accept ionic equation $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$				3		
	(b)			$n(Fe) = \frac{7}{56} = 0.125$ (1) $n(Br) = \frac{30}{80} = 0.375$ (1) ratio 1:3 therefore $FeBr_3$ (1) **working must be shown**		3		3	2	
				Question 10 total	**2**	**6**	**1**	**9**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	(a)			1.52 cm^3 / s (2) accept 1.5 if incorrect award (1) for either of following (58 – 20) and (30 – 5) 38 and 25 ecf possible if one value read incorrectly from graph		2		2	2	
	(b)	(i)		line steeper than original line (1) line finishing at 90 cm^3 (1)			2	2		2
		(ii)		award (1) each for any two of following • greater surface area at the start • more collisions per unit time / more frequent collisions • produces 50% more gas as mass is 50% more • carbonate is the limiting factor / reaction stops when carbonate is used up	2			2		
				Question 11 total	**2**	**2**	**2**	**6**	**2**	**2**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	3	0	7	1	4
2	0	3	0	3	0	0
3	1	5	0	6	0	1
4	5	0	3	8	1	0
5	1	8	3	12	5	3
6	2	6	0	8	0	0
7	2	3	5	10	3	5
8	6	0	0	6	0	0
9	3	2	0	5	0	2
10	2	2	5	9	3	7
11	6	0	0	6	0	0
TOTAL	32	32	16	80	13	22

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	2	0	5	0	2
2	2	2	5	9	3	7
3	6	0	0	6	0	0
4	2	6	1	9	7	2
5	2	3	0	5	0	0
6	4	3	1	8	0	5
7	1	0	4	5	1	0
8	2	3	2	7	0	4
9	6	5	0	11	5	3
10	2	6	1	9	2	3
11	2	2	2	6	2	2
TOTAL	32	32	16	80	20	28