GCSE MARKING SCHEME

SUMMER 2023

GCSE
CHEMISTRY - UNIT 1

3410U10-1
3410UA0-1

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 CHEMISTRY UNIT 1: CHEMICAL SUBSTANCES, REACTIONS AND ESSENTIAL RESOURCES

SUMMER 2023 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

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 statement.

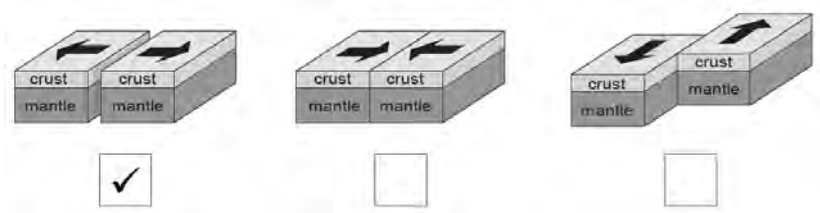
Marking abbreviations

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

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		distillation (1) chromatography (1)	2			2		2
		(ii)		**A** (1) **B** (1) **D** (1)		3		3		3
	(b)			The solid stays the same ☐ A gas is formed ✓ A temperature change occurs ✓ The mass of the beaker and contents stay the same ☐	2			2		2
				Question 1 total	**4**	**3**	**0**	**7**	**0**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			true (1) true (1) false (1) false (1)	2	2		4		
	(b)			70 (2) if incorrect award (1) for any clear indication of correct number of atoms of each element e.g. (2 × B) + (3 × O) / 2(11) + 3(16)		2		2	2	
	(c)			**A**		1		1		
	(d)			MgF_2		1		1		
				Question 2 total	**2**	**6**	**0**	**8**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		**B**			1	1		
		(ii)		20		1		1	1	
		(iii)		**Z**		1		1		
	(b)	(i)			1			1		
		(ii)		magma (1) convection currents (1)	2			2		
	(c)			4			1	1		
				Question 3 total	**3**	**2**	**2**	**7**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			$Mg + HCl \longrightarrow MgCl_2 + H$ ☐ $Mg + 2HCl \longrightarrow MgCl_2 + 2H$ ☐ $Mg + 2HCl \longrightarrow MgCl_2 + H_2$ ✓		1		1		
	(b)	(i)		award (2) for all points plotted correctly – tolerance ±1 square award (1) for any three points plotted correctly award (1) for (smooth) curve drawn through points judgement by eye ecf possible from incorrectly plotted points		3		3	3	
		(ii)		decreases increases			2	2		
		(iii)		more (1) a greater (1)	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Increasing the temperature of the acid ✓ Using a lump of magnesium ☐ Using a different apparatus ☐ Using magnesium powder ✓ Decreasing the temperature of the acid ☐			2	2		2
				Question 4 total	**2**	**4**	**4**	**10**	**3**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		award (1) for each correct product CaO CO_2 ignore any attempt at balancing		2		2		
		(ii)		$Ca(OH)_2$		1		1		
	(b)			**Indicative content** **Economic benefits** • employment / local jobs • building material e.g. roads / houses • raw material e.g. blast furnace / glass / concrete / cement • improved road system **Environmental drawbacks** • noise e.g. blasting / traffic • dust from blasts / dust from lorries • landscape destruction • habitat destruction	6			6		

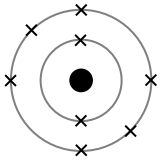
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5-6 marks Good description of benefits and drawbacks *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3-4 marks** Description including reference to some benefits and drawbacks *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 benefit / drawback identified *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 5 total	**6**	**3**	**0**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		award (1) for correct order zinc carbonate — accept zinc / Zn copper(II) carbonate — accept copper / Cu lead carbonate — accept lead / Pb			1	1		1
		(ii)		Sodium carbonate only decomposes a small amount on heating ☐ Sodium carbonate is very unstable ☐ Sodium carbonate does not decompose on heating ✓ Sodium carbonate decomposes too quickly ☐			1	1		1
		(iii)		70 (2) if incorrect award (1) for $\frac{3.5}{5.0}$ / 0.7		2		2	2	
		(iv)		Cu^{2+}		1		1		
	(b)			yellow / orange / yellow-orange	1			1		1
				Question 6 total	**1**	**3**	**2**	**6**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		Helium is a gas ☐ Helium is the second most common element in the Universe ☐ Helium is less dense than air ✓ Helium is colourless ☐			1	1		
		(ii)		The Earth's atmosphere contains more helium than argon ☐ The Earth's atmosphere contains more xenon than helium ☐ The Earth's atmosphere contains more helium than krypton ✓		1		1	1	
		(iii)		There isn't much helium in the Earth's atmosphere ☐ Scientists say helium shouldn't be used to fill balloons ☐ Helium is a finite resource ✓			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		Only helium gas can leak away into space ☐ Helium and neon gases can leak away into space ✓ Only argon can leak away into space ☐ All inert gases can leak away into space ☐			1	1	1	
	(b)			All Group 0 elements have 2 electrons in their inner shell ☐ All Group 0 elements have 8 electrons in their outer shell ☐ All Group 0 elements have full outer shells ✓ All Group 0 elements have some full shells ☐	1			1		
				Question 7 total	**1**	**1**	**3**	**5**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			**B** **C** **A** award (2) for all three correct award (1) for any one correct			2	2		2
	(b)			award (1) for disadvantage relating to soap / scum • forms scum with soap • wastes soap / doesn't lather with soap award (1) for disadvantage relating to limescale • forms limescale in kettles / boilers • furs pipes • furring of kettles • reduces efficiency of kettles / boilers neutral answers – blocks pipes / bad taste			2	2		
	(c)	(i)		award (1) for either of following • at 35°C the solubility is 66 g (in 100 g of water) / • 66 g dissolves at 35°C		1		1	1	1
		(ii)		26 (2) if incorrect award (1) for either of following • solubility 79 read from graph • 53 subtracted from value read from graph to get corresponding answer		2		2	2	2
		(iii)		40 accept value in the range 39-41		1		1	1	1
				Question 8 total	**0**	**4**	**4**	**8**	**4**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/1	(a)			**A** (1) **B** (1) **F** (1) **D** (1)	 1 1 	1 1		4		
	(b)					1		1		
	(c)	(i)		number of protons 15 number of neutrons 20 number of electrons 19	3			3		
		(ii)		isotopes	1			1		
				Question 9/1 total	**6**	**3**	**0**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10/2	(a)	(i)		award (1) for any of following • they have same number of electrons in their outer shell • they have 1 electron in their outer shell • they lose 1 electron when reacting	1			1		
		(ii)		density			1	1		
	(b)	(i)		stored in oil / liquid paraffin do not accept paraffin	1			1		1
		(ii)		sodium hydroxide / NaOH (1) hydrogen / H_2 (1)	2			2		
		(iii)		lithium / Li	1			1		
		(iv)		NaF		1		1		
	(c)	(i)		61 (2) if incorrect award (1) for any of following figures in method or as final answer 114 0.61 / 0.606 10.1 / 10		2		2	2	
		(ii)		mass medication / medical treatment without permission / no choice neutral answers any health problem not needed because it's in toothpaste	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		toothpaste accept mouthwash neutral answers dental products fluoride supplements	1			1		
				Question 10/2 total	**7**	**3**	**1**	**11**	**2**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	I	evaporation / boiling condensation	2			2		2
			II	distillation neutral answer – desalination	1			1		1
		(ii)		• water (front) travels up paper / is absorbed (1) award (1) for any of following • more soluble dye travels further up paper • dyes travel (up paper) at different speeds • dyes travel different distances • dyes have different R_f values neutral answer – dyes have different solubilities		2		2		2
	(b)	(i)		14			1	1		
		(ii)		38°C (3) if answer is incorrect award (1) each for any of following solubility at 55°C = 94 g 94 – 36 = 58 g ecf possible			3	3	3	
				Question 3 total	**3**	**2**	**4**	**9**	**3**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		decomposition	1			1		
		(ii)		award (1) for each of following • steam formed / spits / fizzing / bubbles / effervescence • (chip) expands / puffsup / cracks open / breaks up / crumbles neutral answers gas given off exothermic	2			2		2
		(iii)		reactant CaO product $Ca(OH)_2$ both needed for (1) ignore any attempt at balancing		1		1		
	(b)	(i)		0.040 (2) if incorrect award (1) for $\frac{2.96}{74}$ in method		2		2	2	
		(ii)		calcium hydroxide is an alkali / a base / has pH 11 (1) accept pH values from 8-14 neutralises acid in soil (1) accept removes acidity from soil / cancels out acid in soil / raises pH of soil	2			2		2
				Question 4 total	**5**	**3**	**0**	**8**	**2**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			Na_2CO_3		1		1		
	(b)			1:2		1		1	1	
	(c)			**3** (1) must have correct number to access second mark award (1) for any of following • limescale is calcium carbonate • no calcium carbonate is formed • no calcium **ions** • removes the ions that form limescale / sodium ions don't form limescale • only sodium hydrogencarbonate is formed • sodium hydrogencarbonate is soluble • nothing insoluble is formed	2			2		
	(d)			calcium sulfate ✓ potassium sulfate magnesium hydrogencarbonate sodium sulfate	1			1		1
				Question 5 total	**3**	**2**	**0**	**5**	**1**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			**Indicative content** amount of water vapour decreased as Earth cooled, water vapour condensed and oceans formed amount of carbon dioxide decreased evolution of green plants, photosynthesis, CO_2 taken in by plants / algae evolution of marine animals / CO_2 locked in limestone / chalk / carbonates rock remains of marine organisms / (land) plants locked into fossil fuels amount of oxygen increased evolution of green plants, photosynthesis, O_2 released by plants **5-6 marks** Good explanation of changes for all three gases *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 explanation of changes referring to photosynthesis and condensation of water vapour *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 changes in percentage of gases *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	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		No significant impact on the overall level of carbon dioxide ✓ A significant increase in the level of carbon dioxide A significant decrease in the level of carbon dioxide			1	1		
		(ii)		Mean atmospheric temperature decreases ✓ Mean atmospheric temperature increases No effect on the mean atmospheric temperature			1	1		
		(iii)		Solar radiation decreases because it is reflected by sulfur dioxide ✓ Solar radiation increases because it is absorbed by carbon dioxide Solar radiation increases because it is absorbed by carbon dioxide and sulfur dioxide Solar radiation decreases because it reacts with sulfur dioxide forming sulfuric acid			1	1		
				Question 6 total	**6**	**0**	**3**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			award (1) for either of following • prevents acid (-spray) escaping • only allows carbon dioxide to escape			1	1		1
	(b)			take the mass (after 10 s) away from 107.75 / the original mass			1	1		1
	(c)			0.0082 / 8.2×10^{-3} (3) **must** be to 2 sig figs if incorrect award (1) each for either of following appropriate **change** in mass e.g. 0.44 – 0.30 / 0.14 corresponding **change** in time e.g. 30 – 13 / 17 ecf possible from error in graph reading but must have calculated a change in mass and change in time		3		3	3	
	(d)	(i)		award (2) for all points plotted correctly – tolerance ±½ square award (1) for any four points plotted correctly award (1) for (smooth) curve drawn through points ecf possible from incorrectly plotted points		3		3	3	
		(ii)		acid has lower concentration (1) so fewer particles present (in the same volume) (1) lower chance of successful collisions / lower frequency of successful collisions / fewer successful collisions (per second) (1)	2		1	3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			curve to the left of and above graph **A** starting from (0,0) and to a maximum height of 0.88 – tolerance ±½ square			1	1		
				Question 7 total	**2**	**6**	**4**	**12**	**6**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		increases			1	1		
		(ii)		outer shell gets further away (from the nucleus) / there are more shells (1) there is lower attraction for an (incoming) electron / it is harder to gain an electron (1)	2			2		
	(b)			Cl_2 + 2NaBr → Br_2 + 2NaCl award (1) each for formulae Cl_2 NaCl award (1) for balancing only if both formulae are correct		3		3		
	(c)	(i)		3.20		1		1	1	
		(ii)		$\frac{1.27}{63.5}$ $\frac{3.20}{80}$ (1) 0.02 : 0.04 ⇨ 1: 2 ⇨ $CuBr_2$ (1) working **must** be shown ecf possible alternative method percentage composition of **both** elements		2		2	2	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				$\frac{1.27}{4.47}$ × 100 = 28% $\frac{3.20}{4.47}$ × 100 = 72% (1) for 100 g of compound $\frac{28}{63.5}$ $\frac{72}{80}$ 0.44 : 0.90 ⇨ 1:2 ⇨ $CuBr_2$ (1) ecf possible						
				Question 8 total	**2**	**6**	**1**	**9**	**3**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		potassium / K^+ bromide / Br^- do not accept bromine calcium / Ca^{2+} iodide / I^- do not accept iodine award (3) for all four ions correct award (2) for any two correct award (1) for any one correct			3	3		3
		(ii)		$BaCl_2$		1		1		
	(b)			$Na^+(aq) + NO_3^-(aq) \longrightarrow AgCl(s)$ ☐ $Ag^+(aq) + NO_3^-(aq) + Na^+(aq) + Cl^-(aq) \longrightarrow NaNO_3(s) + AgCl(s)$ ☐ $Ag^+(aq) + NO_3^-(aq) \longrightarrow AgNO_3(s)$ ☐ $Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$ ✓ $Ag^+(aq) + Cl^-(aq) \longrightarrow NaNO_3(s)$ ☐		1		1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			from the equation 552 g of Ag_2CO_3 gives 432 g of Ag (1) 1 g of Ag_2CO_3 gives $\frac{432}{552}$ g of Ag (1) 13.8 g of Ag_2CO_3 $\frac{432}{552} \times 13.8$ g of Ag = 10.8 g (1) ecf possible alternative method moles of Ag_2CO_3 = $\frac{13.8}{276}$ = 0.05 mol (1) 2 mol of of Ag_2CO_3 gives 4 mol of Ag therefore 0.10 mol of Ag produced (1) mass of Ag = n × M_r = 0.10 × 108 = 10.8 g (1) ecf possible second alternative method (applying conservation of mass) percentage of Ag in Ag_2CO_3 = $\frac{216}{276}$ × 100 = 78.3% (1) mass of Ag on left-hand side = $\frac{78.3}{100}$ × 13.8 = 10.8 g (1) so 10.8 g of Ag formed (1) ecf possible		3		3	3	
				Question 9 total	**0**	**5**	**3**	**8**	**3**	**3**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	3	0	**7**	0	7
2	2	6	0	**8**	2	0
3	3	2	2	**7**	1	0
4	2	4	4	**10**	3	2
5	6	3	0	**9**	0	0
6	1	3	2	**6**	2	3
7	1	1	3	**5**	2	0
8	0	4	4	**8**	4	6
9	6	3	0	**9**	0	0
10	7	3	1	**11**	2	1
Total	**32**	**32**	**16**	**80**	**16**	**19**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	3	0	**9**	0	0
2	7	3	1	**11**	2	1
3	3	2	4	**9**	3	5
4	5	3	0	**8**	2	4
5	3	2	0	**5**	1	1
6	6	0	3	**9**	0	0
7	2	6	4	**12**	6	2
8	2	6	1	**9**	3	2
9	0	5	3	**8**	3	3
Total	**34**	**30**	**16**	**80**	**20**	**18**