GCSE MARKING SCHEME

SUMMER 2024

GCSE
SCIENCE (DOUBLE AWARD)
UNIT 5: CHEMISTRY 2

3430U50-1 AND 3430UE0-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCSE SCIENCE (DOUBLE AWARD) UNIT 5 – CHEMISTRY 2

SUMMER 2024 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

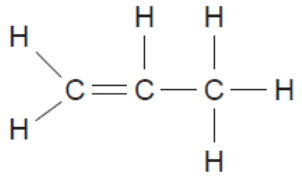
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	I	boiled	1			1		
			II	condense	1			1		
			III	fractions	1			1		
			IV	boiling points	1			1		
		(ii)	I	bitumen accept naphtha			1	1		
			II	naphtha and kerosene **both** needed			1	1		
	(b)	(i)		96		1		1	1	
		(ii)		84 / 84.2 / 84.21 ecf possible from incorrect mass of carbon atoms		1		1	1	

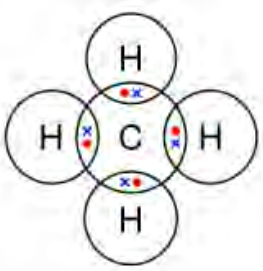
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		   award (2) for **all** three correct award (1) for any **one** correct do not credit if multiple lines from any photograph		2		2		
		(ii)		electrical fire	1			1		
				Question 1 total	**5**	**4**	**2**	**11**	**2**	**0**

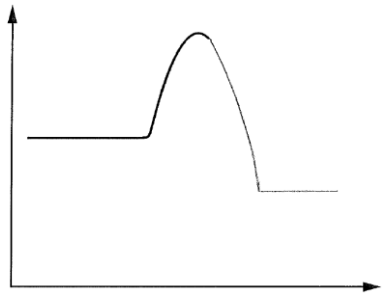
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		copper(II) chloride (1) accept copper chloride / $CuCl_2$ cathode (1) electrolysis (1)	3			3		3
		(ii)		$CuCl_2$		1		1		
		(iii)		$Cu - 2e^- \rightarrow Cu^{2+}$ ☐ $Cu + 2e^- \rightarrow Cu^{2+}$ ☐ $Cu^{2+} + 2e^- \rightarrow Cu$ ✓ $Cu^{2+} - 2e^- \rightarrow Cu$ ☐		1		1		
	(b)	(i)		to release the oxygen gas from the aluminium oxide ☐ to allow the aluminium ions and oxide ions to move ✓ to allow the aluminium to leave the cell ☐ to speed up the process ☐	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		$2\,Al_2O_3 \longrightarrow \boxed{4}\,Al + 3\,O_2$		1		1	1	
		(iii)		landfill sites ☐ power stations ✓ limestone quarries ☐ oil refineries ☐ coastal ports ✓ coal mines ☐ award (1) for each correct answer deduct (1) for each additional tick if more than two ticks	2			2		

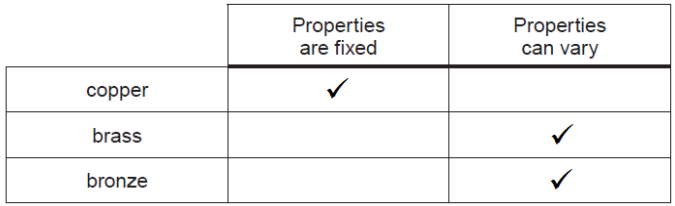
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			award (1) each for any **two** of following • low density • does not corrode • ductile neutral answers malleable / durable / does not tarnish / weather resistant do not accept strong / high melting point / unreactive	2			2		
				Question 2 total	**8**	**3**	**0**	**11**	**1**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			award (1) for each correct answer name ⇨ ethane molecular formula ⇨ C_4H_8 structural formula ⇨ 		3		3		
	(b)	(i)		colourless	1			1		1
		(ii)	I	**Y**		1		1		
			II	award (1) for any of following it contains bromine / Br it contains hydrogen, carbon and bromine / H, C and Br hydrocarbons contain hydrogen and carbon only / H and C only it doesn't contain hydrogen and carbon only / H and C only		1		1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			 accept shared electrons drawn on lines or in overlap		1		1		
				Question 3 total	**1**	**6**	**0**	**7**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		15		1		1	1	1
		(ii)		both reactions **and** reason needed **A** and **B** temperature increases / they get hotter / positive temperature change neutral answer – energy / heat given out		1		1		1
	(b)			 energy of products must be lower than energy of reactants accept without the horizontal line for products accept with energy of products on x-axis	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			$2Al + \boxed{3} ZnCl_2 \longrightarrow 2 AlCl_3 + 3Zn$ award (1) for product award (1) for balancing zinc atoms (**even if aluminium chloride formula is incorrect**)		2		2		
				Question 4 total	**1**	**4**	**0**	**5**	**1**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			 award (2) for all three correct award (1) for any two correct			2	2		
	(b)			copper, bronze and brass are all metal alloys ☐ copper and bronze are both metal alloys ☐ copper and brass are both metal alloys ☐ bronze and brass are both metal alloys ☑			1	1		
	(c)			**B**			1	1		

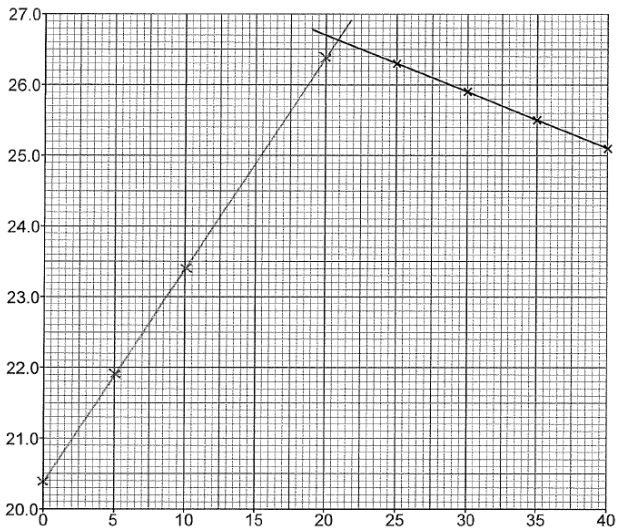
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			no – must give reason brass and bronze are used in electrical industry / electrical contacts / have uses that depend on conducting electricity brass and bronze contain metals and therefore conduct electricity brass and bronze have delocalised electrons (and therefore conduct electricity) accept reference to only one of brass / bronze neutral answers brass and bronze are metals brass and bronze conduct electricity			1	1		
				Question 5 total	**0**	**0**	**5**	**5**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** • smart materials have properties that change with a change in their surroundings • these changes are reversible / temporary thermochromic pigments • change colour with changing temperature • uses include thermometers, cups, baby bottles and mood rings photochromic pigments • change colour with changing light (UV) • uses include lenses in sunglasses, windows and fashion jewellery and clothing hydrogels (polymer gels) • absorb many times their weight in water / expand in water • uses include nappies, watering beads and magic snow	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5-6 marks Good description of the properties; uses of all three smart materials *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 of some of the properties; some uses *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** Properties or uses of one or two smart materials *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	**6**	**0**	**0**	**6**	**0**	**0**

COMMON QUESTIONS

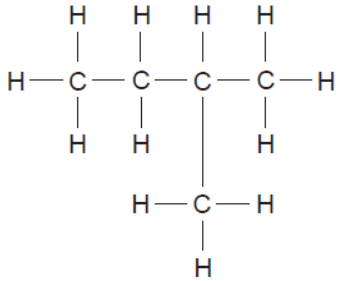
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7/1	(a)	(i)		sulfuric acid accept H_2SO_4		1		1		1
		(ii)	I	fizzing / bubbling / effervescence neutral answer – temperature change / colour change	1			1		1
			II	award (1) for any indication of the acid being used up e.g. to use up (all) the (sulfuric) **acid** to neutralise (all) the (sulfuric) **acid** so that no **acid** is left do not accept – to use up all the reactants	1			1		1
		(iii)		filter (the mixture) / filtration (1) award (1) for any indication of evaporation or steps taken for evaporation to happen e.g. evaporate (solution) heat / boil (solution) leave (solution) in a warm place / on window sill leave (solution) for a day / until next lesson neutral answer – leave / leave to form crystals	2			2		2
		(iv)		$ZnSO_4$		1		1		

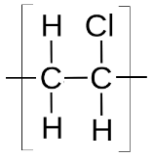
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		 award (2) for **all** four points plotted correctly – tolerance ±½ square award (1) for any **two** correct points award (1) for straight line		3		3	3	3
		(ii)	I	24.9 accept correct value from graph		1		1	1	
			II	accept any value in the range 20.5 – 21.0 accept correct value from graph			1	1	1	

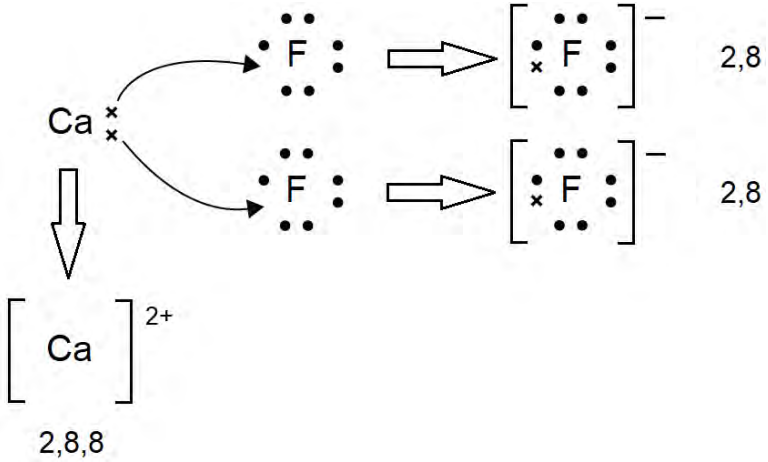
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		award (1) for each correct answer use a beaker instead of a flask ☐ repeat the method ☐ add the acid in smaller intervals ☐ wrap cotton wool around the flask ✓ use a larger flask ☐ place a lid on the flask ✓			2	2		2
	(c)			award (2) for either of following sodium hydroxide is twice as concentrated (as hydrochloric acid) hydrochloric acid is half as concentrated (as sodium hydroxide) award (1) for either of following sodium hydroxide is more concentrated (than hydrochloric acid) hydrochloric acid is less concentrated (than sodium hydroxide) accept reference to strength instead of concentration			2	2		2
				Question 7/1 total	**4**	**6**	**5**	**15**	**5**	**12**

HIGHER TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			$CO_2 + C \rightarrow 2CO$ award (1) for both reactants award (1) for product **and** balancing	2			2		
	(b)	(i)		$\boxed{2}\ Fe_2O_3 + 3C \longrightarrow \boxed{4}\ Fe + \boxed{3}\ CO_2$		1		1		
		(ii)		iron oxide is reduced ⇨ it loses oxygen (1) neutral answer – iron is reduced ⇨ it loses oxygen carbon is oxidised ⇨ it gains oxygen (1) if no other credit award (1) for generic description or for identifying which reactants are oxidised and reduced • oxidation is gaining oxygen, reduction is losing oxygen • iron oxide is reduced (to form iron) and carbon is oxidised (to form carbon dioxide) • oxygen goes from iron oxide to carbon reference to electrons is neutral		2		2		
	(c)	(i)		decomposition	1			1		1
		(ii)		$CaSiO_3$	1			1		
				Question 2 total	**4**	**3**	**0**	**7**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		**A**, **D** and **F** **all** needed			1	1		
		(ii)		4			1	1		
		(iii)		**A**		1		1		
		(iv)		 accept any correct representation of 2-methylbutane			1	1		
		(v)		add (orange) bromine water / bromine (1) award (1) for any of following • it is decolourised by **D only** • it goes from orange / brown to colourless **in D only** • it is decolourised by **D** but not **C** • it goes from orange / brown to colourless in **D** but not **C** neutral answer – reference to 'clear'		2		2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			double bond splits / opens / breaks (1) the (vinyl chloride) molecules join / link together / form chains (1) accept 'they join together'  (1) neutral answer – reference to heat / catalyst	3			3		
	(c)			award (1) for any **two** of following • does not rust / corrode • flexible / easy to shape • lightweight / low density neutral answers weather resistant doesn't need to be painted reference to cost do not accept low melting point doesn't conduct electricity / heat	1			1		
				Question 3 total	**4**	**3**	**3**	**10**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			 award (1) for <u>transfer of electrons</u> from calcium atom to two fluorine atoms award (1) for electronic structure and charge of calcium ion award (1) for electronic structure and charge of **one** fluoride ion award second/third mark if both electronic structures given (no/incorrect charges) or both charges given (no/incorrect electronic structures) accept diagrams with all electron shells shown		3		3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			award (1) for either of following • the charges of the ions in calcium oxide are greater (than the charges of the ions in potassium chloride) • Ca^{2+} / calcium / O^{2-} / oxide ions have greater charges (than the K^+ / potassium / Cl^- / chloride ions) [must compare **size** of charges] award (1) for any of following • (this results in) greater attraction between the ions • (this results in) stronger bonds between the ions • (this means that) more energy is needed to separate the ions/break the bonds between the ions accept converse answers		2		2		
	(c)			award (1) each for any **two** of following • each carbon atom in diamond bonds to 4 others **whereas** in graphite, each carbon atom bonds to 3 others • graphite has layers **but** diamond doesn't / diamond has a tetrahedral structure **but** graphite doesn't • graphite has free electrons (between layers) **whereas** diamond doesn't • graphite has weak bonds between the layers **whereas** diamond has no weak bonds if no other credit award (1) for two partially met marking points	2			2		
				Question 4 total	**2**	**5**	**0**	**7**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		award (1) for any of following copper(II) ions are blue copper(II) ions / Cu^{2+} are formed copper(II) nitrate is formed a copper(II) salt/solution is formed award (1) for any of following copper atoms lose electrons / are oxidised $Cu \rightarrow Cu^{2+} + 2e^-$ $Cu - 2e^- \rightarrow Cu^{2+}$ copper displaces the silver copper is more reactive than silver	2			2		
		(ii)		$\boxed{2}\ AgNO_3 + Cu \longrightarrow Cu(NO_3)_2 + \boxed{2}\ Ag$ award (1) for product award (1) for balancing **only if product correct**		2		2	1	
	(b)	(i)		$Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(aq)$ ☐ $Ag^+(s) + Cl^-(s) \longrightarrow AgCl(s)$ ☐ $Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$ ✓ $Ag^+(s) + Cl^-(s) \longrightarrow AgCl(aq)$ ☐	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		yellow	1			1		1
				Question 5 total	**4**	**2**	**0**	**6**	**1**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		phytomining uses lower grade ores than bioleaching ☐ bioleaching conserves supplies of the lowest grade metal ores ☐ phytomining conserves supplies of high-grade metal ores ✓ bioleaching uses high-grade metal ores ☐ phytomining uses the lowest grade metal ores ☐			1	1		
		(ii)		yes – plants and bacteria are both living things / living organisms must give reason			1	1		
		(iii)		award (1) for any of following • insufficient land (available to grow plants) • land is used for other things e.g. food crops • unsuitable climate (to grow plants) e.g. not sunny enough / lack of water / too hot accept any sensible answer			1	1		
		(iv)		award (1) for either of following bacteria extract (the copper) at a low rate bacterial growth is slow / have to wait for the bacteria to grow			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			iron is more reactive than copper (1) iron can displace copper / can reduce copper ions from the solution / (1) accept a correct equation for the second mark only e.g. $Fe + CuSO_4 \rightarrow Cu + FeSO_4$ neutral answers – reference to supply or cost		2		2		2
	(c)			ratio of Cu : O atoms ⇨ $\frac{2.54}{63.5} : \frac{0.32}{16}$ (1) 0.04 : 0.02 (1) 2:1 ratio ⇨ Cu_2O (1) award (1) for correct answer with no working ecf possible award (2) for CuO_2 with working – incorrect division of mass and A_r		3		3	3	
				Question 6 total	**0**	**5**	**4**	**9**	**3**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Indicative content** • crude oil is a complex mixture of hydrocarbon compounds with a range of boiling points • the useful products from fractional distillation are called fractions • crude oil is boiled / vaporised / evaporated before it enters the fractionating column • fractions condense at different heights inside the column because they have different boiling points • the higher the boiling point, the lower down it condenses • boiling points are linked to the length of the carbon chain – the longer the chain, the higher the boiling point • compounds in the same fraction have similar boiling points	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5-6 marks Detailed explanation including reference to changes of state and the link between chain length and boiling point of fractions *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 with some reference to changes of state, chain length and boiling point of fractions *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** Some knowledge of changes of state, chain length or boiling point of fractions *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	5	4	2	**11**	**2**	**0**
2	8	3	0	**11**	**1**	**3**
3	1	6	0	**7**	**0**	**1**
4	1	4	0	**5**	**1**	**1**
5	0	0	5	**5**	**0**	**0**
6	6	0	0	**6**	**0**	**0**
7	4	6	5	**15**	**5**	**10**
TOTAL	**25**	**23**	**12**	**60**	**9**	**15**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	6	5	**15**	**5**	**10**
2	4	3	0	**7**	**0**	**1**
3	4	3	3	**10**	**0**	**2**
4	2	5	0	**7**	**0**	**0**
5	4	2	0	**6**	**1**	**1**
6	0	5	4	**9**	**3**	**2**
7	6	0	0	**6**	**0**	**0**
TOTAL	**24**	**24**	**12**	**60**	**9**	**16**