GCSE MARKING SCHEME

SUMMER 2024

GCSE
CHEMISTRY – UNIT 2

3410U20-1 AND 3410UB0-1

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 CHEMISTRY UNIT 2

CHEMICAL BONDING, APPLICATION OF CHEMICAL REACTIONS AND ORGANIC CHEMISTRY

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

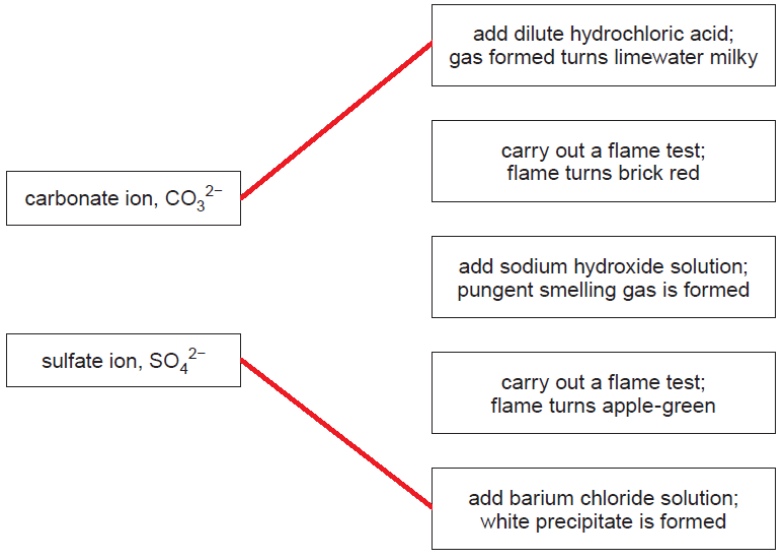
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	I	**B**	1			1		1
			II	**A**	1			1		1
		(ii)		hydrogen	1			1		1
		(iii)		$MgCl_2$ ✓ Mg_2Cl $MgCl$ Mg_2Cl_2		1		1		
	(b)			sulfuric acid (1) sodium nitrate (1)		2		2		
				Question 1 total	**3**	**3**	**0**	**6**	**0**	**3**

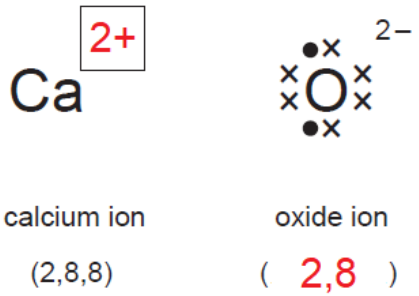
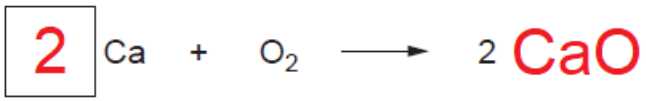
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		electrolysis (1) opposite (1) liquid (1)	3			3		
		(ii)		$2Al_2O_3 \longrightarrow$ **4** $Al + 3O_2$		1		1	1	
	(b)			low density ✓ resists corrosion ✓ good thermal conductor ☐ non-toxic ☐ shiny ☐ award (1) for each correct answer	2			2		
				Question 2 total	**5**	**1**	**0**	**6**	**1**	**0**

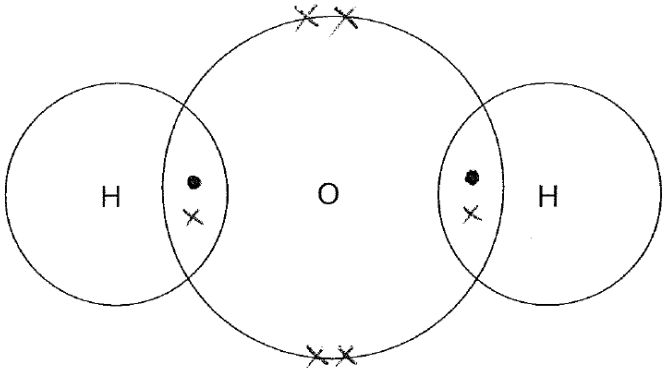
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		award (1) for correct order zinc / Zn copper / Cu silver / Ag			1	1		
		(ii)		ZnO (1) Cu (1) ignore any attempt at balancing		2		2		
	(b)	(i)		s	1			1		1
		(ii)		insoluble		1		1		
				Question 3 total	**1**	**3**	**1**	**5**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		award (2) for all three points plotted correctly (±½ square) award (1) for any one point plotted correctly award (1) for smooth curve of best fit		3		3	3	3
		(ii)	I	4.0 °C			1	1	1	1
			II	decreases	1			1		1
			III	21.0 °C			1	1		
		(iii)		put bubble wrap around the cup ☐ put a lid on the polystyrene cup ☐ use a cup made from copper ✓			1	1		1
	(b)			84 (2) if answer incorrect award (1) for either of following 23 + 1 + 12 + 48 Na + H + C + (3 × O)		2		2	2	
				Question 4 total	**1**	**5**	**3**	**9**	**6**	**6**

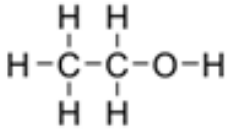
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			<table><tr><th></th><th>True or false?</th></tr><tr><td>Both processes use a catalyst that is a metallic element</td><td>false</td></tr><tr><td>Both processes are carried out at the same temperature and pressure</td><td>false</td></tr><tr><td>Both processes are reversible reactions</td><td>true</td></tr><tr><td>Both processes use air as a raw material</td><td>true</td></tr></table> award (3) for all four correct award (2) for any three correct award (1) for any two correct	3			3		
	(b)	(i)		award (1) for any of following 6 × 391 $\frac{2346}{6}$ $\frac{2346}{391}$ = 6		1		1	1	
		(ii)	I	exothermic	1			1		1
			II	93 / –93		1		1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			 award (1) for each correct line	2			2		2
				Question 5 total	**6**	**2**	**0**	**8**	**1**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		 award (1) for charge award (1) for electronic structure		2		2		
		(ii)		 award (1) for product award (1) for balancing **only if product correct**		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			 award (1) for two shared pairs award (1) for oxygen octet accept shared electrons drawn on lines or in overlap award (1) if diagram wholly correct except using all dots or crosses		2		2		
				Question 6 total	**0**	**6**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		increases			1	1		
		(ii)		petrol			1	1		
		(iii)		15			1	1		
	(b)	(i)		C_3H_8		1		1		
		(ii)		**B**	1			1		
		(iii)		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		
		(iv)		**B**		1		1		
	(c)	(i)		3			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		 accept if the —O—H bond shown as —OH	1			1		
		(iii)		81 (2) if answer incorrect award (1) for 81000 / 810 / 8100 / 0.81 ecf possible only from incorrect conversion of units		2		2	2	
				Question 7 total	**3**	**4**	**4**	**11**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			**Indicative content** the fire triangle states that heat, fuel and air/oxygen are needed for a fire to burn removing one factor extinguishes a fire **method A** – water cools / removes heat **method B** – beating removes air / oxygen **method C** – cutting a fire break removes fuel **5-6 marks** Full understanding of fire triangle and how all three fires are extinguished *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 understanding of fire triangle and how some of the fires are extinguished *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 knowledge of fire triangle *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.*	3	3		6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		wet chemical			1	1		
		(ii)		dry powder			1	1		
		(iii)		 chip pan fire ☐  burning plug and socket ☐  burning butane cylinder ☐  burning waste cardboard ✓			1	1		
				Question 8 total	**3**	**3**	**3**	**9**	**0**	**0**

COMMON QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/1	(a)			zinc			1	1		
	(b)			The higher the metal in the reactivity series, the greater the energy given out ✓ The lower the metal in the reactivity series, the greater the energy given out The energy given out is not related to the metal's position in the reactivity series			1	1		
	(c)			$Fe + NiSO_4 \longrightarrow FeSO_4 + Ni$ award (1) for each product		2		2		
	(d)			displacement accept redox neutral answer – reduction	1			1		
	(e)			7400 (2) award (1) for 7434 / 7430 no ecf possible		2		2	2	2
				Question 9/1 total	**1**	**4**	**2**	**7**	**2**	**2**

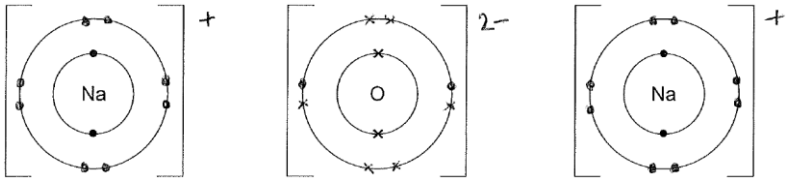
<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>10/2</td><td>(a)</td><td>(i)</td><td></td><td>glowing splint (in the tube) – it relights</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>20</td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>
<table>
<tr><th rowspan="2">Electrolyte</th><th colspan="2">Ions present in the electrolyte</th><th colspan="2">Observations</th></tr>
<tr><th>Positive ion(s)</th><th>Negative ions(s)</th><th>At the negative (–) electrode</th><th>At the positive (+) electrode</th></tr>
<tr><td>molten lead(II) bromide</td><td>Pb^{2+}</td><td>Br^-</td><td>grey metal A formed</td><td>orange gas formed</td></tr>
<tr><td>aqueous copper(II) chloride</td><td>Cu^{2+} and H^+</td><td>Cl^- and OH^-</td><td>brown metal formed</td><td>green-yellow gas B formed</td></tr>
<tr><td>aqueous compound C</td><td>Zn^{2+} and H^+</td><td>I^- and OH^-</td><td>grey metal formed</td><td>brown solution formed</td></tr>
</table>
award (1) for each correct ion</td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>metal A lead / Pb (1)
do not accept Pb^{2+}

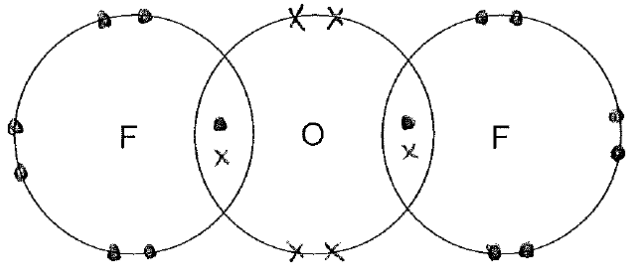
gas B chlorine / Cl_2 (1)
do not accept chloride / Cl^-

compound C zinc iodide / ZnI_2 (1)
accept ZnI</td><td></td><td></td><td>3</td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 10/2 total</td><td>3</td><td>1</td><td>3</td><td>7</td><td>0</td><td>7</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11/3	(a)			carbon accept C	1			1		
	(b)			covalent ignore reference to giant / simple	1			1		
	(c)			award (1) for each correct property and (1) for related use soft ⇨ pencils / lubricant conducts electricity ⇨ electrodes / in batteries	4			4		
				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 8 dots in outer shell of **both** sodium ions award (1) for 6 crosses and 2 dots in outer shell of oxide ion do not accept if extra electrons drawn in inner shell award (1) for + charge on sodium ions **and** 2– charge on oxide ion accept if + charge shown on only one sodium ion		3		3		
		(ii)		$4Na + O_2 \rightarrow \boxed{2}\ Na_2O$ award (1) for product award (1) for balancing **only if product correct**		2		2	1	

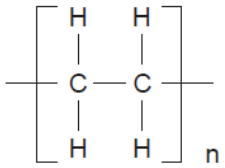
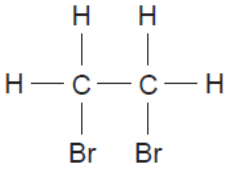
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		 award (1) for two shared pairs award (1) for three octets accept shared electrons drawn on lines or in overlap award (1) if diagram wholly correct except using all dots or crosses		2		2		
		(ii)		bonds within the molecules are strong ☐ bonds within the molecules are weak ☐ bonds between the molecules are strong ☐ bonds between the molecules are weak ☑	1			1		
				Question 4 total	**1**	**7**	**0**	**8**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		award (1) for each correct formula **A** H_2 **B** HCl **C** $PbCl_2$		3		3		
		(ii)		**C**	1			1		1
	(b)	(i)		neutralisation	1			1		
		(ii)	I	12.4		1		1		1
			II	19.0		1		1		1
			III	the acid and the alkali have the same concentration ☐ the acid has a lower concentration than the alkali ☐ the concentration of the acid is half of the concentration of the alkali ☐ the acid has a higher concentration than the alkali ☑			1	1		1

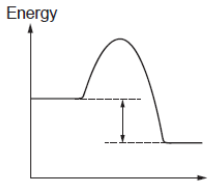
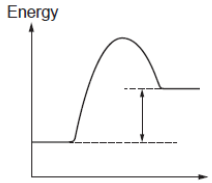
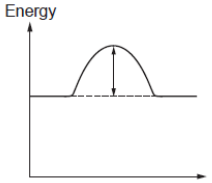
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		award (1) for any of following • Eleanor knew the exact pH (at any point) • pH sensor gives an accurate / precise pH (at any point) • Freddie only knew an approximate pH value (at any point) • universal indicator only gives an approximate pH value • universal indicator does not give accurate / precise pH values • universal indicator does not give a colour for pH 2.5 / 4.5 / 6.5 etc • not possible to judge when one colour becomes another e.g. when orange becomes red accept any sensible answer neutral answers no room for human error more reliable			1	1		1
				Question 5 total	**2**	**5**	**2**	**9**	**0**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			reversible reaction accept either of following • reaction can go both ways • products (of the reaction) can react to form (the original) reactants	1			1		
	(b)			vanadium(V) oxide / vanadium oxide accept V_2O_5 neutral answer – VO	1			1		
	(c)			step 1 (sulfur trioxide) added to / dissolved in **concentrated** sulfuric acid (to form oleum) (1) accept $SO_3 + \textbf{conc}\ H_2SO_4 \rightarrow H_2S_2O_7$ (ignore incorrect formula for oleum) step 2 add product of first reaction to water / product is diluted (to form sulfuric acid) (1) accept $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$ (ignore incorrect formula for oleum)	2			2		

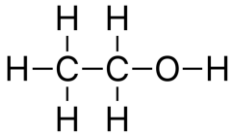
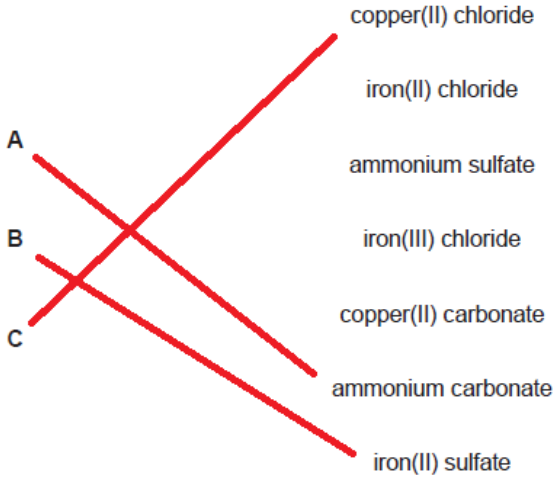
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			award (2) for all five points plotted correctly (±1 square) award (1) for any three points plotted correctly award (1) for smooth curve of best fit		2	1	3	3	
	(e)			decreases		1		1		
	(f)			400 to 515-525 ^{o}C ecf possible from line based on incorrectly plotted points			1	1	1	
				Question 6 total	**4**	**3**	**2**	**9**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		C_nH_{2n}	1			1		
		(ii)	I		1			1		
			II		1			1		
			III	addition neutral answer – additional	1			1		
		(iii)		$C_2H_4 + 3O_2 \rightarrow$ 2 CO_2 + 2 H_2O award (1) for product award (1) for balancing **only if product correct**		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(b)	(i)		612 + (4 × 412) + 436 (= 2696) (2) if answer incorrect award (1) for clear indication of the number of each type of bond e.g. C=C + [4 × (C—H)] + H—H award (1) when one error made in identifying the number of each type of bond e.g. 612 + 412 + 436 / 1460 612 + (4 × 412) / 2260		2		2	2	
		(ii)		348 (2) if answer incorrect award (1) for either of following 6 × 412 2472		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(b)	(iii)		 ✓  		1		1		
	(c)			but-1-ene **C** but-2-ene **A** 2-methylpropene **B** award (2) for all three correct award (1) for any one correct	2			2		
				Question 7 total	**6**	**7**	**0**	**13**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		80% bioethanol : 20% petrol ☐ 20% bioethanol : 20% petrol ☐ 20% bioethanol : 80% petrol ☑			1	1		
		(ii)		the energy value decreases ☑ the density decreases ☐ the flash point decreases ☐			1	1		
		(iii)		award (1) for any sensible answer e.g. • fermentation releases carbon dioxide • building factories releases carbon dioxide • transporting bioethanol releases carbon dioxide • burning forests releases carbon dioxide • deforestation decreases the amount of carbon dioxide removed from the atmosphere link to carbon dioxide is essential			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(b)	(i)				1		1		
		(ii)	I	magnesium ethanoate		1		1		
			II	$Mg(CH_3COO)_2$	1			1		
	(c)						3	3		3
				Question 8 total	**1**	**2**	**6**	**9**	**0**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			**Indicative content** • both ions are free to move in molten state • Al^{3+} ions attracted to negative electrode / move towards negative electrode because opposite charges attract • Al^{3+} ions gain three electrons forming aluminium (atoms) • Al^{3+} ions are reduced • $Al^{3+} + 3e^- \rightarrow Al$ • O^{2-} ions attracted to positive electrode / move towards positive electrode because opposite charges attract • O^{2-} ions lose two electrons forming oxygen (atoms) • two O^{2-} ions lose (four) electrons forming oxygen (molecules) • O^{2-} ions are oxidised • $2O^{2-} - 4e^- \rightarrow O_2$ **5-6 marks** Clear understanding of movement of ions and gain/loss of electrons; good attempt at 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 Some understanding of movement of ions and 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** Basic knowledge of ions moving to electrodes of opposite charge or ions gaining/losing 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.*						
	(b)			award (1) for factor and (1) for relevant explanation e.g. coastal location (1) ⇨ to import ore / bauxite / aluminium oxide (1) near a power station (1) ⇨ process uses huge amounts of electricity (1) do not credit more than one factor	2			2		
				Question 9 total	**8**	**0**	**0**	**8**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)			0.125 mol (2) if answer incorrect award (1) for any of following 0.25 125 125000 rearranging equation ⇨ n = concentration × volume		1	1	2	2	
	(b)			24 g (2) if answer incorrect award (1) for citric acid M_r of 192 ecf possible from incorrect M_r value ecf possible from part (a)		2		2	2	
				Question 10 total	**0**	**3**	**1**	**4**	**4**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

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

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	1	4	2	**7**	**2**	**2**
2	3	1	3	**7**	**0**	**7**
3	6	0	0	**6**	**0**	**0**
4	1	7	0	**8**	**1**	**0**
5	2	5	2	**9**	**0**	**5**
6	4	3	2	**9**	**4**	**0**
7	6	7	0	**13**	**4**	**0**
8	1	2	6	**9**	**0**	**3**
9	8	0	0	**8**	**0**	**0**
10	0	3	1	**4**	**4**	**0**
TOTAL	**32**	**32**	**16**	**80**	**15**	**17**